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Date Growers' Institute

APRIL 25, 1942

HELD IN

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MORNING SESSION

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THE RELATION OF LEAF AREA TO ALTERNATE BEARING IN THE DEGLET NOOR PALM*

By Forrest Mathez and Donald E. Bliss, University of California Citrus Experiment Station, Riverside, California

Alternate bearing is one of the important cultural and economic problems that confront every date grower. Yearly fluctuations in the number and size of fruit spathes are sufficiently pronounced to be reflected in the yields of many date gardens.

The relation of alternate bearing to overloading of the palm has been clearly demonstrated by Nixon and others (6, 7, 9, 10). These writers have suggested that alternate bearing may be controlled by adjusting the fruit load according to the size and vigor of the palm. Swingle (13, 14), Nixon (11), and Aldrich and Young (1) have indicated that there is also a direct relation between the green-leaf area of a palm and its capacity to produce sugar. For the last twenty-five years there has been, among date growers and scientists, a growing conviction that the yield and quality of the date crop depends to a considerable extent on the ability of the grower to balance the fruit load of his palms with their ability to produce. Some growers have apparently accomplished this by a method of trial and error, but no one has interpreted the theories of alternate bearing quantitatively, in simple terms whereby a grower may easily solve his own problem.

Since 1937, when palms in the Coachella Valley of California were severely injured by freezing, the date crops in this region have shown a marked tendency toward alternate bearing. This has been the case with the palms in the plots of the Arkell fertilizer experiment (12), which was organized in 1935 to study the effect of different soil fertilizers on the yield and quality of Deglet Noor dates. Fruit-thinning in these plots had been done on a percentage basis, as recommended by Nixon (6), but without special regard for leaf area. The freeze of 1937 killed or injured all the exposed leaves and reduced the total green-leaf area of the palms 80 or 90 per cent. On the advice of Roy W. Nixon,** the number of fruit bunches was arbitrarily reduced to four per palm. In 1938, spathes were produced by 59 of the 63 experimental palms, while many other palms in the border rows, which had been thinned less drastically in 1937, were entirely nonfruitful. In 1939, because of the large number of spathes and the apparently rapid recovery of the experimental palms, 80 per cent of the fruit bunches and 45 per cent of the fruits on these bunches were retained. Unfortunately, because of this method of thinning, many of the palms were overloaded, and the fruit was consequently small. In 1940, the number of spathes that appeared on these palms was again reduced. Of the 63 palms, only 8 produced 15 or more spathes each; 44 produced 12 to 14 spathes each; and 11 produced less than 12 spathes each.

At this point a significant change was made in the method of calculating the desired number of fruits on a palm. Nixon (11) had concluded that to obtain a proper balance between number of leaves and quantity of fruit, an average of 7.5 leaves per fruit bunch was desirable. Because of the large variation in the size of the fruit bunches, we decided, however, to retain a certain number of fruits for each green leaf on the palm. On the basis of previous experience, this number was arbitrarily placed at 125 (4). This calculation of fruit load per leaf involved the practical difficulty of counting the leaves on many tall palms. While we were confronting this problem, Leonhardt Swingle recalled an earlier observation by Mason (3), namely, that there are 13 nearly vertical ranks of leaf bases on the trunk of a date palm. This observation was verified and was used as the basis for a quick and accurate method of counting leaves. A photoelectric method of determining leaf area then made it possible to estimate rather accurately the total leaf area of a date palm.

Records of fruit-thinning in the palms of the Arkell fertilizer plots showed that the incidence of alternate bearing was associated with palms of small leaf area. Although the fruits of all the palms had been thinned in the same manner and on a percentage basis, only those palms with large tops produced enough flowers every year to give 125 fruits per leaf. The fruit crops on palms with smaller tops continued to fluctuate, and only in alternate years were there enough spathes produced to give 125 fruits per leaf. These differences in the experimental palms indicated that the total leaf area, not the number of leaves, was of fundamental importance in calculating fruit load and in controlling alternate bearing.

It is the purpose of this paper to report certain preliminary findings that may be of value to growers who are interested in obtaining maximum yields of fruit without alternate bearing.

*Paper No. 458, University of California Citrus Experiment Station, Riverside, California.

**Roy W. Nixon, Associate Horticulturist, U. S. Department of Agriculture, Indio, California.

METHODS

Since some knowledge of the arrangement of leaf bases on the trunk of the Deglet Noor date palm is necessary in order to apply the method of leaf-counting suggested in this paper, this information is included here. Methods employed in measuring leaf area and in thinning fruit bunches are described briefly.

Counting the leaves. — When the leaves are stripped from a palm, it is found that the base of each leaf extends outward on either side of the blade to form an unbroken band or sheath of fiber about the trunk. The leaf bases with their sheathes are attached to the trunk, one above another. So crowded are these leaf bases on the trunk that there is much overlapping, as in the case of paper cups that are telescoped together. In somewhat the same way that the cups in such a stack can be numbered by counting the exposed rims, the leaves on a palm can be numbered by counting the sheathes. Suppose that a certain leaf at the bottom of the trunk is designated as no. 1. When the base of this leaf is removed, that of leaf no. 2 is exposed. By continuing this process and numbering the leaves consecutively, not only will the number of leaves be known, but also the order in which they developed.

If, while stripping the leaves from a Deglet Noor palm, the positions of the thickened petioles (called "leaf bases" in this paper) are noted, a remarkable discovery is made, namely, that there is a definite symmetry in the arrangement of the leaf bases, which, when understood, can be used in counting the leaves. Palms are said to be either right handed or left handed, according to the slope of certain lines in the pattern of the leaf bases. In a right-handed palm (fig. 1), every fifth leaf base, counted from any leaf base and in the order of leaf development, is found to be located in the same one of 5 rows which wind about the trunk to the right in upward spirals. In figure I, bases of leaves nos. 2, 7, 12, 17, 22, and of leaves nos. 57, 62, 67, 72, and 77, constitute the visible portions of one of these spirals, which will be called "series of 5." Similarly, every eighth leaf base is located in the same one of 8 rows which wind about the trunk to the left in upward spirals. In figure I, bases of leaves nos. 4, 12, 20, 28, and 36 belong to one of these spirals, which will be called "series of eight." Finally, every thirteenth leaf base on a Deglet Noor palm lies in the same one of 13 nearly vertical rows, which on a right-handed palm incline slightly toward the right. In figure 1, bases of leaves nos. 7, 20, 33, 46, 59, 72, and 85 comprise one of these nearly vertical rows, which will be called "series of 13."

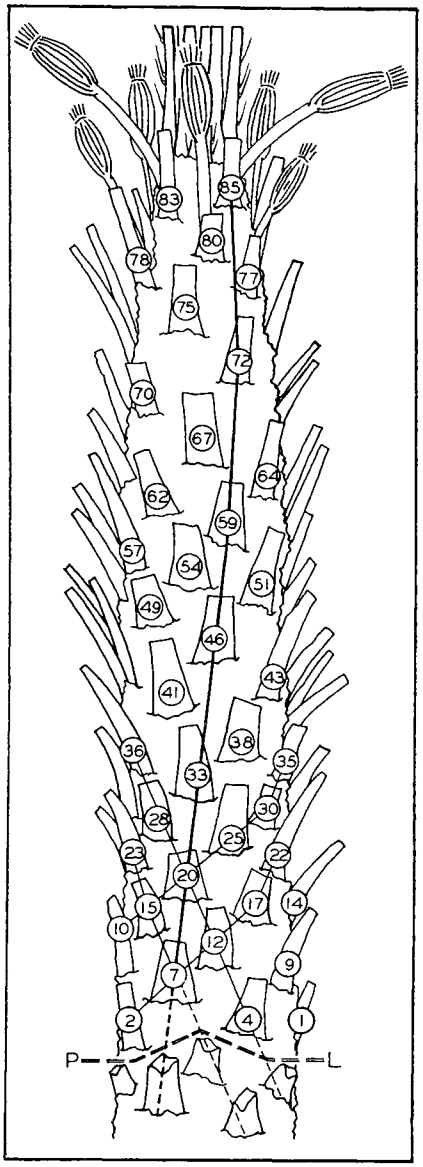

Fig. 1. — Diagram showing the arrangement of leaf bases on the trunk of a right-handed Deglet Noor date palm. Ninety-one mature green leaves were retained on this palm after the leaves below the pruning line, P-L, had been removed. The three principal series in the pattern of the leaf bases are illustrated: (a) a series of 5 (leaves nos. 2, 7, 12, 17, 22, etc.), in upward spiral to the right; (b) a series of 8 (leaves nos. 4, 12, 20, 28, 36, etc.), in upward spiral to the left; and (c) a series of 13 (leaves nos. 7, 20, 33, 46, 59, 72, 85, etc.) in a nearly vertical row. On every Deglet Noor date palm there are 5 series of 5, 8 series of 8, and 13 series of 13. The pattern on left-handed palms is similar but reversed.

The arrangement of leaves on a left-handed palm is similar to that on a right-handed palm, except that the pattern is reversed. This relation is comparable to that of the fingers on the left and right hands: the fingers are arranged similarly, but their order is reversed.

After one has recognized the three principal series that form the pattern of leaf bases on the trunk of a palm, it is comparatively easy to count the number of leaves. A satisfactory method of estimating the number of fully developed leaves on a Deglet Noor palm is to count the number of leaves in any series of 13 and then multiply this number by 13, the total number of vertical rows on the tree. In figure 1, for example, by counting the number of leaves in the series of 13 beginning with leaf no. 7 (in this case, 7 leaves) and multiplying this number by 13, the number of fully developed leaves on this palm may be determined as 91. If other series of 13 on this palm had only 6 leaves, the total number would lie between 78 and 91. If greater accuracy is desired, it is best to count the number of leaves in each of four series of 13, located on four different sides of the palm. The average number of leaves in these series is then multiplied by 13.

With practice, the estimation of leaves becomes comparatively rapid and accurate. The number of leaves on 40 palms can be estimated in about an hour, and each estimate should be within 5 per cent of the correct number. When estimating the number of leaves for the purpose of calculating the number of fruits to retain after thinning, the count should be made after all spathes have emerged. All green leaves should be included, up to the one which stands in front of the highest spathe (fig. 1, leaf 85). To estimate the number of leaves to retain at time of leaf-pruning, merely count the number of leaves in any series of 13 and retain the desired number of leaves in every series of 13.

Measuring Leaf Area.—When the number of mature leaves has been determined, the next step is the determination of the area of an average-sized leaf. In this study, the measurements were made by means of an Aminco Area Determi-

TABLE 1

Relation of Green-Leaf Area to Alternate Fruit-Bearing in Mature Deglet Noor Date Palms*

Palm size and no.	Year	Number of green leaves			Leaf area, in sq. ft.			Number of spathes emerged	Number of fruit bunches retained	Number of fruits				
		Mature		Immature§	Avg. leaf	Total				Desired (125 per leaf)¶	Retained after thinning		Per 100 sq. ft. of leaf area	
		Mar. to May†	Sept. 1‡			Mar. to May†	Sept. 1‡				Per palm	Per bunch, range	Mar. to May†	Sept. 1‡
Large:														
No. 1	1939	...	..	..	.....	.....	.....	15	11	13,843	13,843	1,500 - 1,680	...	...
	1940	86	..	15	.....	.....	.....	14	13	12,625	12,213	420 - 1,364	...	...
	1941	110	95	10	47.09	5,651	4,944	18	13	15,000	15,234	1,020 - 1,225	270	308
	1942	...	..	..	.....	.....	.....	15	..	.....	.....	.....	...	...
No. 2	1939	...	..	..	.....	.....	.....	13	10	11,916	11,916	980 - 1,800	...	...
	1940	91	..	15	.....	.....	.....	16	11	13,250	13,263	925 - 1,386	...	...
	1941	105	93	10	.....	.....	.....	18	12	14,375	14,485	1,120 - 1,225	...	...
	1942	...	..	..	.....	.....	.....	15	..	.....	.....	.....	...	...
Medium:														
No. 3	1939	...	..	..	.....	.....	.....	13	9	10,791	10,791	945 - 1,680	...	...
	1940	75	..	15	.....	.....	.....	13	12	11,250	10,664	384 - 1,400	...	...
	1941	97	92	10	43.10	4,612	4,396	19	13	13,375	13,667	720 - 1,225	296	311
	1942	...	..	..	.....	.....	.....	13	..	.....	.....	.....	...	...
No. 4	1939	...	..	..	.....	.....	.....	14	12	13,187	13,187	700 - 1,560	...	...
	1940	79	..	15	.....	.....	.....	14	12	11,750	9,937	450 - 1,161	...	...
	1941	92	85	10	45.45	4,636	4,318	16	12	12,750	12,182	700 - 1,200	276	297
	1942	...	..	..	.....	.....	.....	14	..	.....	.....	.....	...	...
Small:														
No. 5	1939	...	..	..	.....	.....	.....	14	10	10,675	10,675	594 - 1,482	...	...
	1940	70	..	15	.....	.....	.....	10	10	10,625	8,052	384 - 1,025	...	...
	1941	85	72	10	42.87	4,073	3,515	16	11	11,875	12,035	840 - 1,225	295	342
	1942	...	..	..	.....	.....	.....	9	..	.....	.....	.....	...	...
No. 6	1939	...	..	..	.....	.....	.....	14	11	11,958	11,958	800 - 1,575	...	...
	1940	68	..	15	.....	.....	.....	6	6	10,375	3,156	300 - 768	...	...
	1941	83	78	10	.....	.....	.....	15	11	11,625	11,584	780 - 1,260	...	...
	1942	...	..	..	.....	.....	.....	8	..	.....	.....	.....	...	...

*Palms were planted in 1929. †Fruit-thinning period. ‡After pruning. §Value estimated in terms of mature leaves. ¶Except in 1939, when the fruits were thinned on a percentage basis, the percentage of fruits retained ranging from 35.7 to 38.5 per palm.

nator,*** a photoelectric instrument which had been adapted from the basic work of Gerdel and Salter (2) and Mitchell (5). The average area of 4 representative leaves was multiplied by the number of mature leaves to give the approximate total leaf area of a palm.

Fruit-Thinning.—The fruit on the experimental trees has, for the most part, been thinned according to standard practice for the Deglet Noor variety. The ends of the fruit strands have been cut off at time of pollination, and strands at the center of the bunch have later been removed entirely. In the early years of the experiment, when the number of fruits was reduced to about 45 per cent of the original number, more than 2,000 fruits were sometimes retained on the very large bunches. These bunches were too large and heavy. Considerable fruit was lost because of broken fruit stalks, shrivel, and fallen fruit. Since 1940, the maximum number of fruits per bunch has been limited to 1,400, and best results have been obtained from bunches with about 1,200 fruits. Bunches with less than 800 fruits, after thinning, are considered undesirable.

***See catalog 41 (p. 105) of the American Instrument Company, Silver Spring, Maryland, for further description of the 7-345 Aminco Area Determinator (115 volts, 50-60 cycles a-c), used in this study with voltage regulator with output of 115 volts.

RESULTS

Since 1940, the palms in the Arkell fertilizer plots have been thinned on the basis of 125 fruits for each mature green leaf. From the records it is possible to classify the 63 experimental palms into three groups, as follows: (a) large palms which produce an ample number of strong spathes and have no tendency toward alternate bearing; (b) medium-sized palms which develop just enough spathes to supply the desired number of fruits but show little or no alternate bearing; and (c) small palms which do not produce sufficient fruits on alternate years to avoid alternate bearing. Six palms have been selected for the purpose of illustrating these three groups, and their records, since 1939, are shown in table 1. The first group is illustrated by palms 1 and 2, the second by palms 3 and 4, and the third by palms 5 and 6.

During the fruit-thinning period from March to May, 1941, the number of mature green leaves on these palms, below the highest fruit bunch, ranged from 110 to 83 (table 1); while on September 1, 1941, after the summer pruning, the range was from 95 to 72. The area of the immature leaves in the heart growth was estimated to be equivalent to that of 10 average-sized mature leaves. The average surface area per leaf, in 1941, ranged from 47.09 sq. ft. on palm 1 to 42.87 sq. ft. on palm 5. The total leaf area per palm, from March to May, 1941, ranged from 5,651 sq. ft. on palm 1 to 4,073 sq. ft. on palm 5. After pruning the leaves in the late summer to make room for the fruit bunches, the total leaf area of these palms was reduced to a range of 4,944 to 3,515 sq. ft. The data show that the wide range in total leaf area was due both to the difference in the number of leaves and to the difference in the area of an average leaf.

The number of spathes which emerged each year, from 1939 to 1942, inclusive (table 1), gives a rough measure of the tendency in each palm toward alternate bearing. This tendency is also apparent if one compares the number of fruits desired (125 for each mature

green leaf or its equivalent) with the number of fruits retained after thinning. In palms 1 and 2, approximately the same number of fruits were retained as were desired. Palms 3 and 4 were slightly deficient in 1940, but palms 5 and 6 were markedly deficient in that year. Whereas the fruit bunches on the larger palms were mostly of the desired size, many small bunches of poor quality had to be retained on the smaller palms in order to supply the desired number of fruits. The percentage of fruits retained after thinning in 1939 ranged from 35.7 to 38.5. Such percentages were not obtained for succeeding years because the method of calculation was changed.

The number of fruits per 100 sq. ft. of leaf area is shown in table 1 for the crop of 1941, both for the period of fruit-thinning (March to May) and also for September 1, after the summer leaf-pruning. At the time of fruit-thinning, palm 1 had 270 fruits per 100 sq. ft. of leaf area, while palm 5 had 295 fruits; on September 1, these values for the two palms were 308 and 342 fruits, respectively. Palm 1 showed no tendency toward alternate bearing; palm 5 was definitely affected. Palms 3 and 4 gave results of intermediate degree and could be classified as showing a little or no tendency toward alternate bearing.

DISCUSSION

The question which may arise immediately in the mind of the grower is, "How can I apply this principle to my own garden when I have no means of measuring leaf area?" This is a question which cannot be answered satisfactorily without additional information and study. In the data from the Arkell fertilizer plots, there are certain facts and tendencies, however, that suggest a partial solution to this problem.

In the first place, Deglet Noor palms equal in size and vigor to those in the Arkell fertilizer plots might be expected to have a similar capacity for fruit production. Palms with greater leaf area should produce more fruits; palms with smaller leaf area should produce less. It is known from preliminary studies that the area of the average leaf on a young fruit-bearing palm is comparatively small, or about half that of the average leaf on a mature palm. There is also a marked increase in the number of green leaves as a palm grows older. Practical experience with the Deglet Noor variety indicates that 91 mature green leaves are about the maximum number that can be retained on any palm through the harvest season, a larger number of leaves interfering too much with the fruit. Before that time, and especially during the spring and early summer months, it seems desirable to retain as many green leaves as possible.

The number of green leaves that an unpruned palm will carry depends on such factors as the age, health, and nutrition of the palm. Under ordinary conditions the grower usually prunes a leaf that has turned brown at the tips of the leaflets. Very vigorous palms (such as palms 1 and 2, table 1) will carry from 104 to 115 green leaves after all brown, decadent leaves have been removed. Where the maximum number of leaves at harvest time is set at 91, most of the leaves, on large palms, are pruned off before the tips turn brown. Less vigorous palms (such as palms 3 and 4, table 1) will carry 91 to 103 green leaves after all brown leaves have been removed; and weak palms (such as palms 5 and 6, table 1) will carry only 78 to 90 leaves. Palms with fewer leaves are not sufficiently developed to be considered here. Because of differences in the palms of these groups in average leaf area, it is thought that the most vigorous palms can carry 125 fruits per green leaf, the less vigorous palms can carry about 118 fruits per leaf, and the weak palms can carry about 100 fruits per leaf.

It now seems probable that a healthy Deglet Noor palm with 91 to 103 mature green leaves (average leaf area, 44.3 sq. ft.) at the time of fruit-thinning, is capable of bearing 118 fruits per leaf without danger of alternate bearing. On the basis of 101 leaves (91 mature leaves, as in figure 1, plus immature leaves, considered equivalent to 10 average mature leaves), such a palm would carry 11,918 fruits or 11 bunches of 1,084 fruits each. If, at the time of thinning, 50 fruits are allowed for the production of 1 pound of mature fruit, this palm should mature 238 pounds of dates. The actual tonnage of fruit delivered at the packing-house would depend, of course, on the amount of spoilage and the efficiency of the fruit pickers.

Under the proposed system, the operation of leaf-pruning assumes as much importance as that of fruit-thinning. Since the yield of fruit depends directly on the amount of green-leaf area, it is important to retain every green leaf until it begins to die back or until it interferes with fruit production. For summer leaf-pruning, it is suggested that the operator count down 7 leaves in a series of 13 and then prune off the leaves which come below this level (fig. 1, line P-L). By this method of leaf-pruning, the grower will retain at least 91 green leaves on the palm.

SUMMARY

The incidence of alternate bearing in Deglet Noor palms is related to the ratio between the number of fruits and the green-leaf area of the palm. The data indicate that a healthy Deglet Noor palm having 104 to 115 mature green leaves with an average area of 47.1 sq. ft. at the time of fruit-thinning, is capable of bearing 125 fruits per leaf without danger of alternate bearing; a palm with 91 to 103 leaves (44.3 sq. ft. average area) is capable of bearing 118 fruits per leaf; and a palm with 78 to 90 leaves (42.9 sq. ft. average area) is capable of bearing 100 fruits per leaf. A quick and accurate method for counting the leaves on a Deglet Noor date palm is described. The importance of retaining a sufficient number of green leaves on a bearing palm is stressed.

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SOME EFFECTS OF SOIL MOISTURE DEFICIENCY UPON DEGLET NOOR FRUIT

By W. W. Aldrich, U. S. Date Garden, Indio, California

Irrigation every 10 to 20 days during the warmer months is the usual practice in date growing, but nevertheless in many date plantings the size and quality of the fruit on some palms are limited by deficiency in soil moisture. Frequently this deficiency occurs just below layers of dense silt or clay, which prevent adequate downward movement of irrigation water. Of the commercial practices affecting fruit size or quality, adequate irrigation ranks next in importance to thorough pollination and to careful fruit thinning in relation to the size of the fruit bunch and to the amount of green leaf area. To help date growers determine whether soil moisture is limiting the size and quality of their fruit, the following discussion, based upon four years' study of date irrigation, is presented.

To determine the effects of soil moisture deficiency at different times during the summer upon fruit size and quality, irrigations were omitted in experimental plots for periods of from 5 to 6 weeks, and the fruit and leaf growth carefully compared with than of adjacent, regularly-irrigated palms. The cooperation of H. L. Cavanagh and of Kenneth Peck has made it possible to determine the effects of soil moisture deficiency upon vigorous, well-cared-for palms normally producing high quality fruit. The detailed data were obtained with the assistance of Carl L. Crawford and of Dewey C. Moore. To illustrate typical results, fruit growth and rate of leaf elongation in two plots at the Cavanagh Garden in 1940 are presented in simplified form in figure 1.

Normal Fruit Development With Regular Irrigation

In the lower part of figure 1, the continuous line, beginning at 0 at the time of pollination and rising steeply during June and July, shows the normal growth in fresh weight of Deglet Noor fruit with regular irrigation. The final fruit thinning and pulling down of bunches was done early in May, while the fruit was still smaller than a pea. Most rapid growth of fruit occurred in June, with somewhat less rapid growth in July. The period of fruit susceptibility to checking began about June 10, and ended about August 5, when the fruit color was changing from light green to pink. Maximum fresh weight was reached by the middle of August, after the fruit had developed the full pink, khalal color. In 1940 fruit ripening was earlier than usual, with the first picking in this garden on September 20.

The heavy continuous line, beginning May 1, and not rising steeply until August, shows the normal increase in total dry weight per fruit with regular irrigation. G. L. Rygg, at the U. S. Date Garden, has shown that the rapid increase in dry weight of Deglet Noor fruit in August is due almost entirely to the accumulation of sucrose (cane sugar) in the fruit.

Soil Moisture Deficiency in June in Relation to Fruit Size and Blacknose

The light broken line, marked by open triangles, indicates the retarded fresh weight growth of fruit as a result of soil moisture deficiency during June. This soil moisture deficiency was caused by omitting irrigations from May 13 to July 4. Before May 13 and after July 4, irrigations were the same as for "regularly - irrigated" palms. Note that by June 12, 30 days after the last irrigation, the fresh weight per fruit was less than that of "regularly-irrigated" palms. By July 3, the soil moisture deficiency had resulted in 18 per cent smaller fruit. Following the thorough irrigation on July 4, the fruit growth more or less paralleled that of the "regularly-irrigated" palms but did not catch up with it. The diagonally-hatched area between the solid line and the broken line marked by open triangles shows the reduction in fruit fresh weight resulting from the soil moisture deficiency in June.

The dry weight per fruit, indicated by heavy broken line marked by solid triangles, was slightly reduced by the soil moisture deficiency in June, but was reduced only about half as much as the fresh weight. However, during the latter part of the summer some effect of the June deficiency in soil moisture caused the dry weight increase to be appreciably retarded as compared with the fruit on the "regularly-irrigated" palms. This is shown in figure 1 by the widening of the diagonally-hatched area between the heavy continuous and heavy broken lines marked by solid triangles during September. Ripening of the fruit on the palms with soil moisture deficiency in June began 10 to 14 days earlier than that on "regularly-irrigated" palms.

During the period of fruit susceptibility to checking (from about June 10 to about August 5), several cloudy nights, when the relative humidity of the air in the date gardens was as high as 70 to 80 per cent, resulted in considerable checking. However, on the palms with soil moisture deficiency in June, fewer fruits checked than on the "regularly-irrigated" palms. Blacknose, which developed on 30 per cent of the fruits on the "regularly-irrigated" palms as a result of severe checking, developed on only 2 per cent of the fruits of the palms with soil moisture deficiency in June.

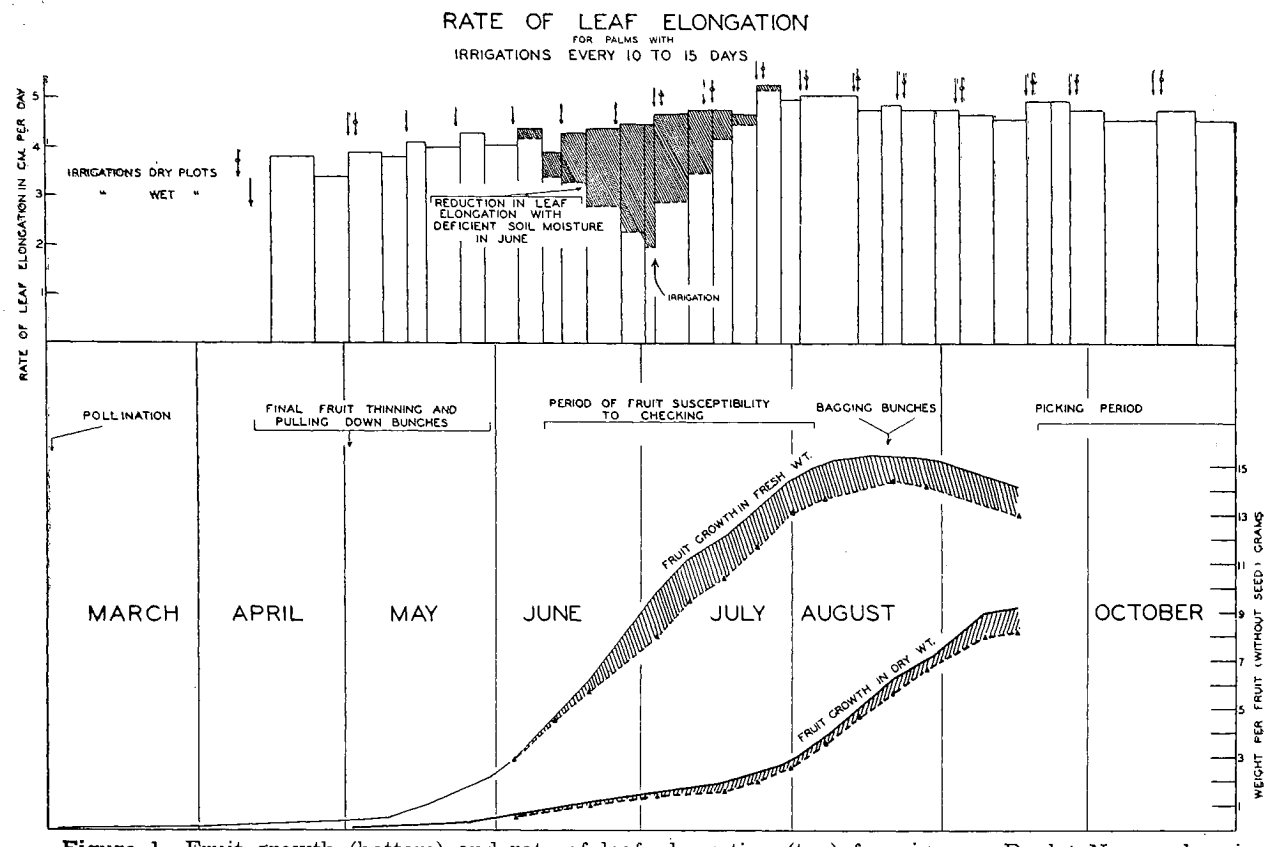

Figure 1—Fruit growth (bottom) and rate of leaf elongation (top) for vigorous Deglet Noor palms in 1940.

Fruit Growth—The reduction in fruit growth **in fresh weight** as a result of soil moisture deficiency in June is shown by the extent of the diagonally-hatched area between the light continuous line and light broken line marked by open triangles.

The reduction in fruit growth **in dry weight** as a result of soil moisture deficiency in June is shown by the diagonally-hatched area between the heavy continuous line and the heavy broken line marked by solid triangles.

Leaf Growth—The height of each block indicates the average rate of leaf elongation during a period indicated by the width of the block. The arrows pointing downward indicate the times of irrigation. When omission of irrigations in one plot resulted in soil moisture deficiency, the rate of leaf elongation was reduced (to the extent indicated by the diagonally-hatched area) at the same time that fruit growth was first reduced.

Thus soil moisture deficiency in June had by September resulted in:

1. Reduced fresh and dry weight of fruit.
2. 10 to 14 days earlier beginning of ripening.
3. Fewer fruits developing blacknose.

Soil moisture deficiency in July affected the fruit in much the same manner as soil moisture deficiency in June.

In six series of experimental plots during the past four years, soil moisture deficiency in either June or July, following the omission of irrigations for 5 to 6 weeks, resulted in reductions in final fresh weight per fruit of 6 to 17 per cent below that of "regularly-irrigated" palms. These reductions in fresh weight per fruit represent a reduction in total yield per palm.

The use of soil moisture deficiency in June or July to minimize the occurrence of checking or blacknose is not recommended, because in a year with a small amount of blacknose the reduction in fruit size, and therefore in yield, might exceed any benefit from reduction in blacknose.

Soil Moisture Deficiency in Late Summer in Relation to Fruit Size

Since Deglet Noor fruits have usually reached full size by the middle of August, soil moisture deficiency after that would not be expected to affect fruit growth. However, the normal decrease in water content of fruit during August and Setember is greater when soil moisture is deficient at that time. In these experiments in the Cavanagh Garden in 1940, the soil moisture deficiency in late summer was sufficintly prolonged to reduce final weight per fruit (and therefore yield) as much as did soil moisture deficiency in June.

The dry weight per fruit was, in the case of these vigorous palms, reduced only very slightly by soil moisture deficiency in late summer.

Since this late summer deficiency in soil moisture occurred after the period of fruit susceptibility to checking, it did not affect the checking or blacknose.

Soil Moisture Deficiency in Relation to Quality of Fruit

In the experimental results thus far obtained, the effects of soil moisture deficiency in June, in July, or in late August and September upon the amount and severity of fruit shrivel have not been consistent. In general, soil moisture deficiency for one period of three to four weeks during the summer **slightly** reduced the percentage of the crop in the "fancy" or better grades and **slightly** increased the percentage of the crop in the "standard" or "dry" grades. At present

the most reasonable explanation is that the quality of the fruit is greatly influenced by the reserve carbohydrates stored in the palm trunk at the beginning of summer. If palms have been adecuately irrigated and allowed to have an adequate leaf area for a number of years, the carbohydrate reserves may be sufficiently great to produce high quality fruit in spite of a short period of soil moisture deficiency. On the other hand, if palms have for years frequently suffered from soil moisture deficiency or carried too heavy crops in proportion to their leaf area, the carbohydrate reserves may have become insufficient to produce high quality fruit, particularly if soil moisture becomes deficient for even a short period during the development of the fruit.

Reduced Leaf Elongation Associated with Soil Moisture Deficiency

Following the preliminary work by Pillsbury (summarized in California Bulletin 649), the rate of leaf elongation has been studied in relation to soil moisture deficiency. When the soil moisture in any portion of the rooting zone of the palm has become depleted to the extent that fruit growth has been reduced, the rate of leaf elongation has become less than that for adequately irrigated palms. The greater the deficiency of soil moisture for fruit growth, the greater has been the reduction in rate of leaf elongation. This is illustrated in the block diagram at the top of figure 1.

The height of each block indicates the average rate of leaf elongation for that period. The width of each block indicates the period between the measurements from which the rate was calculated. The day of each application of irrigation water to each of the two plots is shown by small arrows pointing downward. It is evident that from May through October the rate of leaf elongation of the "regularly-irrigated" palms varied between 4 and 5 centimeters per day. When soil moisture deficiency in June resulted in slower growth of fruit, the rate of leaf elongation for these palms was also slower, as indicated by the diagonally-hatched area. By July 4, the rate of leaf elongation for the palms with soil moisture deficiency was reduced about 50 per cent below that of "regularly-irrigated" palms. Following the irrigation of the palms in soil with moisture deficiency, the rate of leaf elongation increased but did not come up to that of "regularly-irrigated palms" for nearly 4 weeks.

When and Where Soil Moisture Deficiency Might Occur

Observations during the past four years indicate that in general a deficiency in soil moisture sufficient to reduce rate of leaf elongation or fruit growth often occurs in commercial date gardens:

1. During the first warm periods of April and May, before the summer schedule of frequent irrigations has been started.
2. In September and October, when picking operations disrupt the irrigation schedule.
3. Where a winter cover crop is not turned under by early in April or where a heavy growth of weeds is allowed to develop at any time during the summer.
4. Where the soil is a coarse sand, and has a relatively small water holding capacity.
5. Where during the summer the amount of irrigation water applied is less than 6 acre-inches every two weeks. (Six acre-inches is the equivalent of 50 miner's inches flowing to one acre for 6 hours).
6. Where the slope of the irrigation run is so great that the water flows quickly to the end of the row and is turned off before penetration all the way along the row is adequate.
7. Where a layer of dense silt or clay, usually 3 or 4 feet below the surface, prevents downward penetration of irrigation water (most common cause of soil moisture deficiency).

How to Determine if Soil Moisture is Deficient

The most simple and practical method to determine if soil moisture is deficient is to examine the soil, particularly that from a depth of four, five and six feet below the surface. In most date gardens the current irrigation practice generally keeps the top three feet of soil sufficiently moist, but frequently fails to result in adequate water penetration to fourth, fifth and sixth foot depths. If during the period from April to October the soil at these lower depths looks and feels dry, soil moisture is likely to be deficient for maximum growth of fruit. To facilitate examination of soil at the fourth, fifth or sixth foot depths a soil tube or auger is very helpful.

Theoretically soil moisture becomes deficient for a palm when the moisture content of the soil in contact with the roots is depleted to a value called the "first permanent wilting percentage" for that soil. However, the great variability in soil texture in most date gardens, the variability in root distribution, the time and equipment necessary to obtain soil samples and precisely determine percentage of soil moisture, and the great difficulty encountered in accurately determining the "first permanent wilting percentage" for each type of soil, all combine to make the accurate measurement of soil moisture percentages an impractical method for determining when soil moisture is deficient in a date planting. However, the fact that rate of leaf elongation slows down when soil moisture becomes deficient for maximum fruit growth gives a basis for a fairly simple method of using the palm behavior as an index of soil moisture deficiency.

The rate of elongation of an emerging leaf is determined by measuring the vertical distance that the leaf has extended during a period of several days. To avoid climbing the palm for each measurement, the upper end of a flexible wire (No. 21, soft, copper wire has been used) is looped around the mid-rib, with the loop pulled down tightly against the next pinnae below. The point of attachment to the mid-rib should be as low on the leaf as possible. The wire is then extended down the trunk, with a nail attached to the lower end. Another nail driven into a leaf base near the ground serves as a reference point. Where the wire extends out of the cluster of young leaves, interfering pinnae and spines are cut away, to avoid rough projections that might eventually hook the wire. To keep the wire clear of the bases of older leaves on the crown, it is passed through a screw-eye in the edge of a convenient leaf base.

At the start, the distance from the end of the nail on the wire to the head of the nail in the trunk is measured and recorded. Several days later the distance is again measured and recorded. The change of days between measurements, is in distance, divided by the number the rate of elongation per day. At each measurement the wire is pulled down firmly, to remove any slack. If the wire tends to spring upward when the tension by the hand is released, a pinna or spine is probably pulling the wire out of original

alignment, and such interference has to be removed. When the leaf has extended vertically about three and a half feet (which occurs during a period of three to four weeks), the upper end of the wire should be moved to a lower position on the mid-rib or to a more recently emerged leaf. Since at any given time all emerging leaves elongate at about the same rate, any recently emerged leaf gives a reliable index for that palm. Leaf elongation occurs entirely at night; so leaves can be measured at any time during the day. For ease in measurements a steel extension tape graduated in tenths of a centimeter has been used.

Such measurement every 3 or 4 days of an emerging leaf on each of several palms in a problem area will, after 10 to 14 days, indicate the average rate of leaf elongation for that particular area. If during the summer the rate of leaf elongation for any Deglet Noor palm is less than 4 centimeters (about 1.6 inches) per day, a deficiency in soil moisture for that palm is probable. If the rate of leaf elongation is above 4 centimeters per day, the only way to determine if soil moisture is adequate is to irrigate three or four palms very thoroughly (at least the equivalent of 6 miner's inches of water for one hour for each palm) and frequently (every 10 days); then measure their rate of leaf elongation, and compare that with the leaf elongation of nearby palms with the usual irrigation. If the thoroughly and frequently irrigated palms show a more rapid leaf elongation than the palms with the usual irrigation, soil moisture deficiency for the palms receiving the usual irrigation should be suspected.

Summary

Deficiency in soil moisture at any time during the summer reduces the fresh weight of each fruit, and so reduces the total yield per palm. The extent of such reduction in fruit weight is dependent upon the proportion of soil in the rooting zone that is deficient in moisture, and the length of the period during which such deficiency continues.

Soil moisture deficiency in June or July results in 10 to 14 days earlier beginning of ripening.

Soil moisture deficiency in June or July reduces the susceptibility of Deglet Noor fruit to checking and blacknose.

Soil moisture deficiency may slightly reduce the percentage of "fancy" or better grades and increase the percentage of "drys;" but in general improper bunch thinning rather than soil moisture deficiency has the more pronounced effect upon grade.

Systematic measurement of the rate of elongation of emerging leaves can be used to determine when soil moisture is deficient.

FACTORS AFFECTING SUGAR SPOTTING IN DATES

By G. L. Rygg, Assistant Physiologist, Bureau of Plant Industry, United States Department of Agriculture (1)

Sugar spotting in dates is characterized by the formation of spots immediately beneath the skin and within the flesh of the fruit. These spots vary from very minute size to about one-eighth inch in diameter, and are granular in consistency; they are light in color and if the color of the fruit is dark the spots are conspicuous by contrast.

While sugar spotting does not make dates inedible, it admittedly detracts from the appearance and hence the marketability of the fruit. Consequently, any practice in the handling of susceptible varieties which will reduce, retard, or eliminate the appearance of this blemish is of economic importance. Sugar spotting apparently can affect all date varieties of the invert sugar type provided the conditions are such as to favor its development. There may be varietal differences with regard to the rate of development, severity of spotting, and conditions most conducive to the development of sugar spotting.

At the present time in the Southwest sugar spotting is thought of largely as being associated with cold storage. That it is not limited to dates in cold storage, however, is found by referring to Mason's description of the Saidy variety (2) in which he refers to a "slow granulation of the sugar content" in Egyptian dates which presumably were not held in cold storage. Christie (3) reported that dates were badly sugar spotted after 18 months at "ordinary temperatures" and Barger (4) stated that Khadrawy dates sugar spotted severely at 70°F.

Factors which affect the formation of sugar spots include the moisture content of the fruit and the storage temperature, and possibly others. In 1934 Barger (4) reported results which justified the conclusion that sugar spotting could be retarded or prevented by lowering the moisture content of the fruit. On the other hand, in 1933 Hilgeman and Smith (5) showed that sugar spotting was prevented if moist dates were prevented from losing moisture. It thus appears that in one investigation sugar spotting was reduced by lowering the moisture content of the fruit and in the other investigation spotting was increased by lowering the moisture content. It has been the purpose of the present investigation to find whether or not it is possible to reconcile these apparently conflicting results. It was noticed that Barger was working in the lower range of moisture content, or from 12 percent to about the middle twenties, whereas Hilgeman and Smith worked mostly in the higher range or from the middle twenties to 47 per cent moisture content. Since sugar spotting was found to be most severe at the upper part of Barger's range and at the lower part of Hilgeman and Smith's range, it seemed that perhaps spotting was most severe at the middle of the entire range and decreased as the moisture content of the fruit was raised or lowered from the region of greatest susceptibility. With this in mind some samples of dates were stored at various moisture contents intended to extend from that giving low susceptibility due to a relatively low moisture content to that giving a low susceptibility due to a relatively high moisture content and to pass through the highly susceptible region of moderate moisture. The varieties used in 1940 included Saidy, Khadrawy, Barhee, and Hayany. The condition of that year's fruit after being stored 1 year at about 25°F. is given in table 1.

The evidence obtained on the 1940 crop as to the possibility of preventing the development of sugar spot-

TABLE 1

The relation between moisture content and severity of sugar spotting in date. 1941 season.

Variety	Percent moisture	Severity of spotting	Variety	Percent moisture	Severity of spotting
Barhee	33	X	Khadrawy	30	XXX
	31	XXXX		25	XXXX
	29	XXXX		24	XXX
	28	XXXX		21	X
	28	XXXX		20	X
	28	XXXX		19	X
	27	XXXX		19	O
	27	XXXX			
	26	XXXX	Saidy	23	XXX
	25	XXX		19	O
	25	XXXX	Hayany	38	O
	24	XXXX		19	O
	22	XX			
	20	X			
	20	X			

All samples were stored 1 year at about 25°F. in nearly moisture proof containers. O indicates no spotting; X, slight spotting; XX, moderate spotting; XXX, severe spotting; XXXX. very severe spotting.

ting by storing the dates at a high moisture content is meager. Only one sample of each of two varieties, Barhee and Hayany, were available which had moisture content high enough to bring about a reduction in spotting. In the case of the Hayany no sample was stored that had a moisture content within the susceptible range but the tendency for this variety to sugar spot is well known by those who have handled it commercially.

Additional evidence as to the effect of high moisture content upon the development of sugar spotting is being obtained on the 1941 crop. At the inspection on April 1 (1942) the fruit had been in storage 5 to 6 months at about 25°F. The condition of the fruit in relation to the moisture content at that time is shown in table 2.

The data given in table 2 were obtained by noting the condition of individual fruits and determining the moisture content of the same individual fruits. Data are given for 5 varieties and a total of 65 fruits.

For four varieties samples were available in which the moisture content was high enough to prevent spotting. Samples that were dry enough to prevent spotting for the length of time given were available for all the varieties used.

These results substantiate those of Barger (4) and also those of Hilgeman and Smith (5). The results of these workers may be considered as being complementary rather than contradictory, as might at first appear to be the case.

As stated previously, Christie (3) and Barger (4) have reported the formation of sugar spots at room temperature, and such spotting is common in cold storage. That the rate of formation of these spots is affected by temperature, however, has been amply demonstrated. Barger (4) found that the appearance of the spots could be delayed by lowering the storage temperature. He reported using temperatures down to 5°F. His results were substantiated by results which were obtained in the present investigations when fruit was stored at 25°, 7°, and -10°F. Comparable lots of fruit were held at these temperatures 1 year. The results are shown in table 3.

TABLE 2

The relation between moisture content and severity of sugar spotting in dates. 1940 season.

Barhee		Halawy		Maktoom	
Percent moisture	Severity of spotting	Percent moisture	Severity of spotting	Percent moisture	Severity of spotting
40	O	35	O	37	O
40	O	33	O	36	O
40	O	31	XXXX	31	XX
36	O	30	XXXX	30	XX
35	O	27	XX	30	XX
31	XXX	26	XXXX	26	O
30	XXX	26	XX	24	XX
28	X	24	XXXX	22	O
27	XXX	24	XXX	21	O
26	XX	24	O	21	O
25	O	23	O	**Medjhool**	
24	X	22	O	40	O
24	O	21	O	34	O
23	X	20	O	34	X
23	O	17	O	33	O
23	O	**Khadrawy**		33	O
23	O	33	XX	32	XX
22	O	32	XX	29	XX
22	O	29	X	19	O
22	O	24	XXX	19	O
21	O	24	XXX		
21	O	20	O		
20	O	19	O		
		16	O		

All fruit had been stored 5 to 6 months at about 25°F. in moisture proof containers. See footnote to table 1 for meaning of spotting symbols.

TABLE 3

The effect of storage temperature upon the development of sugar spotting in dates. 1940 season.

Variety	Storage temperature Degrees F. 25	7	-10
Barhee	XXX	XX	O
Khadrawy	XXX	XX	O
Saidy	XXX	X	O

All lots had been stored 1 year at the temperatures given. See footnote to table 1 for meaning of spotting symbols.

Samples which corresponded to those which spotted severely at 25°F. spotted much less at 7° and not at all at -10° in one year. Fruit that had been stored a year at the lower temperatures did not deteriorate any more rapidly upon subsequent removal to room temperature than did other lots of similar moisture content which had been stored at a higher temperature. Dates that had been prevented from forming sugar spots by being held at low temperatures spotted upon removal to a higher temperature provided conditions were such as to favor the development of the spots. In other words, spotting was inhibited only as long as the temperature of the fruit was kept low.

If one is to use a high moisture content to control sugar spotting it is also necessary to lower the storage temperature considerably if the fruit is to be kept for a long period

in order to prevent other forms of deterioration such as souring, darkening, loss of flavor, and syrupiness.

The humidity of the storage must be maintained at the proper level if dates are to be stored at the temperatures usually used for dates and if the containers are permeable to moisture. If this is not done fruit originally stored at a moisture content above or below the range of high susceptibility to sugar spotting may give off or absorb moisture in sufficient quantity to bring the moisture content to a point at which the fruit is likely to form sugar spots. Barger (4) has stressed the fact that moisture changes in the fruit occur more rapidly at high than at low temperatures under similar conditions of humidity and moisture content. Since this is true it is far less important to control the humidity at low storage temperatures than if relatively high storage temperatures are used.

These results indicate that sugar spotting in dates may be delayed or prevented by proper moisture control or by low temperatures or by a combination of both of these methods. Moisture content in the range of about 22 to 33 per cent should be avoided unless a low storage temperature is used.

(1) The writer is indebted to Mr. Robert E. Cook for assistance in preparing many of the samples of the 1940 season for storage; and to the California Date Growers' Association and the Los Angeles Ice and Cold Storage Co. for their generosity in making their storage facilities available for parts of the work reported herein.

(2) Mason, S. C. 1923. The Saidy date of Egypt. U. S. D. A. Bull. 1125, 35 pp., illus.

(3) Christie, A. W. 1925. Value of wax wraps for carton packed dates. Date Growers' Inst. 2:11-12.

(4) Barger, W. R. 1934. The effect of humidity and containers on dates. Date Growers' Inst. 11:14-18, illus.

(5) Hilgeman, R. H. and Smith, J. G. 1938. Maturation and storage studies with soft varieties of dates. Date Growers' Inst. 15:14-17, illus.

RAIN AND HIGH HUMIDITY TOLERANCE OF COMMERCIAL DATE VARIETIES

By Roy W. Nixon, U. S. Date Garden, Indio, California

All varieties of dates are, under some conditions, injured more or less by rain or high humidity. Damage to the fruit varies greatly from year to year and from garden to garden depending upon such conditions as the intensity and duration of the rain, the relative maturity of the fruit at the time of exposure, the type of protection given the bunches, the amount and method of fruit thinning, and probably a number of factors as yet unknown. However, over a period of years some varieties have been definitely less damaged than others; and at occasional intervals it seems desirable to examine the record and to evaluate commercial date varieties in relation to their tolerance to rain and high humidity — undoubtedly the greatest hazard to date culture in the United States.

To focus attention upon the subject and to draw out comments and criticisms that may provide further information a table has been prepared in which an attempt has been made to summarize 19 years of observation. The varieties have been listed in order of decreasing tolerance as determined by estimates of the total relative loss of fruit. The exact placing of any particular variety with reference to those immediately above or below it in the list may be open to question and further observations may result in some slight shifting up or down, but the general grouping is not likely to be changed radically.

Damage from rain and high humidity primarily takes the form of checking, blacknose, splitting (also known as tearing) and excessive hydration, and secondarily of spoilage from fruit rot, fermentation, and souring. These different types of injury have been discussed in detail at previous Institutes. Reference to them here will be confined to incidental comments on the different varieties. Actually it is often difficult to classify spoilage according to cause. The grower's chief concern, if he is selecting a variety with reference to tolerance to rain and high humidity, is the amount of good fruit he can reasonably expect to obtain over a period of years.

Accompanying the tabulation of rain and high humidity tolerance are columns with comments on yield and keeping quality. Keeping quality classification is based upon observations of the appearance, consistency and flavor of the fruit after storage at room temperatures and at about 28 degrees F. Experiments in recent years indicate that probably fruit of any variety may be successfully stored if the temperature is low enough. Comments on keeping quality are based entirely on observations, discussions with date growers and packers, and information available in the literature. Further data may raise or lower the ratings of the different varieties, particularly those that have not been extensively planted. The writer has been impressed by the variation in fruit of the same variety between different seasons and different gardens and suspects that an experimental study of the maturity and composition of the fruit with reference to curing and storage woud make it possible to handle and keep all varieties of dates to better advantage.

COMMENTS

Dayri—In addition to the fact that damage from any source has been slight, this variety takes high rank because the texture and quality of the semi-dry fruit has generally improved when ripening occurred during humid weather. Low yields are due to frequent failures to get a good set of fruit.

Kustawy—This date has a consistently good record from the beginning. Relatively little damage from any source has been observed.

Thoory — A moderate amount of splitting, confined to small ruptures near the stem end, has occurred from time to time and there has been a little fruit drop. Wet fruit has softened and darkened and grades have been lowered, but there has been little total loss.

Khadrawy—There has been moderate checking and splitting but relatively little spoilage from fruit rot or souring.

Halawy — Occasionally there has been some rather severe apical checking, but there has been relatively little spoilage from fruit rot and souring. Slight losses from drop

COMMERCIAL DATE VARIETIES LISTED ACCORDING TO TOLERANCE TO RAIN AND HIGH HUMIDITY

Tolerance	Variety	Yield*	Keeping Quality
High	Dayri	Low	Very good
	Kustawy	Medium	Good
Medium	Thoory	Medium	Very good
	Khadrawy	Low	Good
	Halawy	Medium	Very good
	Sayer	Medium	Good
	Zahidi	High	Very good
	Khalasa	Low	Very good
	Maktoom	Medium	Fair
	Barhee	High	Good
	Saidy	Medium	Very good
	Tazizoot	High	Fair
Low	Deglet Noor	High	Very good
	Iteema	Medium	Fair
	Hayany	High	Poor
	Rhars	High	Good

*Below 125 lbs—Low
125 to 175 lbs.—Medium
Above 175 lbs.—High

have occurred. On the other hand, this variety has a tendency to shrivel in dry weather and often grades have apparently been improved by humidity above normal.

Sayer — Very little checking has been observed but there have been moderate losses from fruit rot.

Zahidi—About on a par with Halawy as regards checking and splitting, more susceptible to fruit rot and drop, slightly less susceptible to souring.

Khalasa — Spoilage from all sources has been moderate.

Maktoom—This variety would be near the top of the list as far as checking and splitting of the fruit are concerned, but there has been considerable spoilage when ripening occurred in humid weather, mostly from souring and drop. Under ordinary storage conditions more than average deterioration has been observed from souring, darkening, and loss of flavor.

Barhee—Fruit moderately damaged by checking, splitting and souring but not much by fruit rot. Fruit loses much of its distinctive flavor under ordinary storage, but does not darken or sour as badly as Maktoom.

Saidy—Only slightly damaged by checking and splitting, but considerable losses from fruit rot and drop have been incurred. The flavor actually improves with storage.

Tazizoot — Checking has been moderate but the fruit has been badly damaged by splitting and souring. Fruit drop is also a source of considerable loss.

Deglet Noor—Serious losses have repeatedly occurred from blacknose, splitting and rot, although the fruit sours less readily than many of the varieties higher in this list.

Iteema — There has been more spoilage than with Deglet Noor, due to much greater susceptibility to souring. Fruit sometimes badly checked.

Hayany — Fruit has frequently been badly checked; heavy losses have been common, mostly due apparently to souring.

Rhars—Fruit has frequently split badly and there have been heavy losses from souring and fruit drop after even light showers.

A COMPARISON OF THE COMMERCIAL GRADES OF DEGLET NOOR DATES*

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INTRODUCTION

Dates, like many other agricultural products, are marketed most successfully after they have been assorted into different commercial grades. The quality of fruit from different gardens, and even of that from the same garden, may vary considerably. Because of this, it is necessary to establish means of assorting the grower's fruit crop into classes, so that products of uniform character can be made available to the consumer. The packing-house performs this function.

Different properties are used in grading different agricultural products. Some fruits are graded on a physical basis, others on a chemical basis; or, as with dates, both physical and chemical properties are used in establishing grades. Although dates are assorted chiefly on the basis of mass, form, and blemishes, which are physical characteristics, they must also comply with chemical characteristics pertaining to the content of moisture and sugar.

In an earlier paper (3), the writers reported the composition of Deglet Noor dates in relation to different soil fertilizer treatments. The fruit, exclusive of culls, was analyzed as it was taken from the palms, without reference to the commercial grades. Although the fertilizer treatments affected the yield, they did not produce significant differences in the chemical composition of the fruit. Since this fruit had not been graded, the question was raised regarding possible differences between the commercial grades. A comparative study of the commercial grades of Deglet Noor dates, with special reference to total sugars, reducing sugars, and moisture content, was therefore undertaken. Samples of standard and substandard grades of fruit from five date gardens representing different localities in the Coachella Valley were accordingly obtained in mid-harvest season from the packing-house of the California Date Growers' Association, Indio, California. Certain chemical analyses were made on each of these samples. It is the purpose of the present paper to report the results of these analyses and to discuss the relative importance of certain physi-

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cal and chemical characteristics of the fruit, on which grade separations are now based.

METHODS OF SAMPLING AND ANALYSIS

When the fruit from a date garden is delivered to the packing-house, an aliquot portion or "sample" (about 10 per cent of the lot) is passed over the sample grading belt to determine the proportions of the different commercial grades.** These proportions, when applied to the total weight of fruit delivered, determine its relative value.

The fruit for this investigation was assorted on the sample grading belt in the packing-house. Fruit from gardens 1 and 2 was obtained October 20; that from gardens 3, 4, and 5 was obtained November 5, 1941. The sample of each grade was inspected critically, for the purpose of eliminating all fruits that were not typical of that particular grade. By such a process of elimination, the samples ultimately obtained were thought to typify the various commercial grades. Selected samples were preferred to random samples because some of the fruits of the latter could have been placed in either one of two grades.

With fruit from five gardens, it was possible to compare early ripening dates, grown on the "floor" of the Coachella Valley, with other, late-ripening fruits from the Indian Wells district. It was also possible to compare fruit from well-managed, highly fertilized gardens with that from poorly managed gardens which lacked fertilizer. A general description of the gardens follows.

Garden 1 is located 2 miles southwest of Coachella, on the valley floor. Although the soil has some heavy spots, it is composed chiefly of Coachella fine sand and Coachella very fine sand. About 7 pounds of ammonium sulfate per palm, with or without small amounts of animal manure, have been applied yearly. The irrigations have been irregular, and orchard management, as a whole, has been neglected somewhat. The fruit matures relatively early.

Garden 2 is located 1 mile southwest of Coachella on fairly light soil of the Coachella series. This garden has received 10 to 12 tons of steer manure per acre in each of the last two years. The orchard management is excellent, and the fruit matures relatively early.

Gardens 3, 4, and 5 are located 7 to 8 miles west of Indio in the Indian Wells district on fine sandy soils of the Coachella and Indio series. The fruit from this district matures later than that from any other part of the Coachella Valley. The fertilizer program in garden 3 consists in the application of 10 tons of manure per acre and 10 pounds of ammonium sulfate per palm per year. Orchard management in this garden is excellent.

No fertilizer, except the nitrogen which occurs naturally in the irrigation water, has been applied in garden 4 at any time during the last twelve years. Except for the lack of fertilizer, the orchard management is good.

Garden 5 has received 400 pounds of manure and 20 pounds of ammonium sulfate per palm per year since 1935. The orchard management is very good, as shown by the exceptionally high yields obtained.

The samples for analysis were brought to the laboratory and weighed, after the fruit had been wiped free of dirt and the calyxes had been removed. After the seeds had been removed and weighed, the fruit samples were finely ground in a meat grinder. 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 carbohydrates were determined on known fresh weights of the ground 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 (depending on the size of the fruit sample) were taken for the determination of reducing and total sugars by the Shaffer-Hartmann method (1). The total sugar was determined on the extracts after the sucrose had been inverted by the action of HCl at room temperature.

RESULTS

Because of unfavorable climatic conditions, there was much low-grade fruit in the date crop of 1941. The largest percentage of fruit was classified in grade B2 (fig. 1). The percentages of fruit in grades A and B1 were unusually low, and those in grades D and culls were unusually high. Except in the fruit from garden 4, which was 0.5 per cent A grade and 9.1 per cent B1 grade, A-grade fruit was lacking and B1-grade fruit was found in only small amounts. Fruit of C grade was practically absent in lots of fruit from the Indian Wells district, but was present to the extent of 6.8 and 7.3 per cent in gardens 1 and 2, respectively.

It was thought that moist weather in August (table 1) had very greatly increased the severity of checking and blacknose, and that light rains

TABLE 1

Rainfall recorded at the U. S. Experiment Date Garden, Indio, California, and at the Martinez Indian Reservation, Thermal, California, during the months of July to December, inclusive, 1941.*

Date		Rainfall, in inches: U. S. Experiment Date Garden	Rainfall, in inches: Martinez Indian Reservation
July	17	Trace	.....
	23	Trace	.....
	24	0.07	0.08
Aug.	9	.....	0.23
	10	0.82	1.52
	11	0.64	.....
	14	.....	Trace
	15	Trace	.....
Sept.	12	0.01	.....
	13	.....	Trace
	28	Trace	0.19
Oct.	12	0.05	0.08
	13	Trace	.....
	21	.....	0.10
	22	0.06	0.12
	23	0.11	0.71
	24	0.68	.....
Nov.	12	1.03	.....
	13	0.46	0.90
Dec.	9	.....	0.26
	10	0.07	0.29
	12	0.20	.....
	23	.....	0.04
	24	0.01	.....
	26	0.05	.....
	29	0.31	0.39
Total		4.57	4.91

*Data supplied through the courtesy of Walter Reuther, Agent, and Carl L. Crawford, Assistant Scientific Aide (date investigations), U. S. Department of Agriculture.

**The authors (3) have published elsewhere a detailed description of the commercial grades. Briefly stated, grade A is extra fancy, B1 is fancy, B2 is star choice, C is the dry date, D is substandard grade used for by-products, and Culls are non-edible.

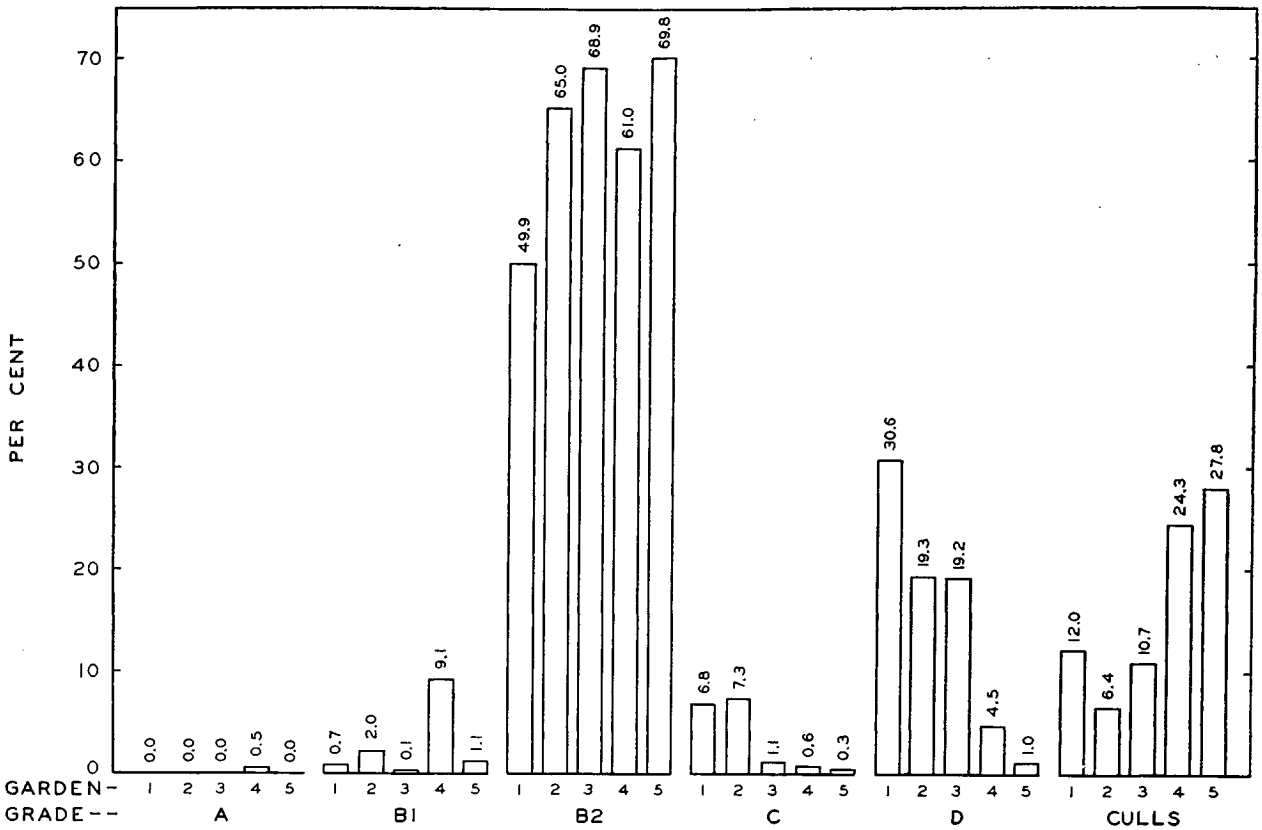

Fig. 1.—Percentage distribution of fruit (fresh-weight basis) in the commercial grades in five date gardens. These values were derived from an aliquot portion of the pick and serve as a basis for estimating the quality of fruit. Samples of assorted fruit for analysis were taken from grades A to D, inclusive.

during the harvest season had favored the activity of the fruit-spoilage fungi. Much of the large, moist fruit, which would probably have gone into grades A and B1, was discarded with the culls because of fungus injury. Other large fruits having blacknose were placed in grade B2 if slightly affected and in grade D if severely affected. C-grade fruit (the classification of the standard dry date) was almost lacking in fruit from the three late-maturing gardens near Indian Wells. This may be attributed both to the rainfall and to the heavy irrigations in these gardens prior to the harvest season. The fruit in substandard grade D was of two kinds, that which was too small for the standard grades and that which was large but severely blemished. The high percentages of culls are indicative both of the serious fruit-spoilage condition in the gardens at the time of picking and of possible negligence on the part of the fruit pickers. Since there is a small charge to the grower for each pound of cull fruit obtained in the packing-house, the growers attempt to discard in the field as many culls as possible. With different pickers in the various gardens, it is possible that some exercised more discrimination than others.

When the experimental samples from the five gardens were compared on the basis of fresh weight and composition of an average fruit (fig. 2), it was found that the relative mass (in grams) of the seed was essentially uniform, while that of the dry matter of the flesh (sugars and non-sugars) was only slightly greater in grades A and B1 than in grades C and D. Differences in moisture content were most evident and were principally responsible for the variation in total weight. Moisture contents ranged from 17 to 31 per cent of the fresh weight (fig. 3), a range extending well above the limits of tolerance as defined for standard grades of Deglet Noor dates (3).

The total sugars composed 74 to 81 per cent of the dried pulp (fig. 3). These figures stand well above the minimum requisite of 68 per cent for dates of standard and substandard grades. Remarkable uniformity in the percentage of total sugars was found in these samples, irrespective of grade or source. The substandard fruit had as much or more total sugar than fruit of the standard grades. This result justifies the impression that fruits with blacknose, or "sugar tips" as they are called, may actually contain a higher percentage of sugar than normal fruits.

The percentages of reducing sugars showed greater variation than those of total sugars. They tended to be considerably higher in grades A and B1 than in the lower grades. The same tendency was noted in the moisture percentages, a fact which calls attention to the direct relation between moisture and the inversion of sucrose.

DISCUSSION

The importance to the grower of quality in date fruits is sufficient cause for studying the physical and chemical characteristics of the different grades. Information derived from such a study should help the grower to know in what way the fruit of one grade may vary from that of another. In a previous report (3) it was shown that edible quality, as determined by packing-house grades, is directly related to certain physical and chemical properties. The evaluation of these

factors has been the ultimate aim in this investigation.

Perhaps the most interesting fact about the data in figure 1 is the large proportion of fruit classed as grade B2, irrespective of the garden from which the fruit came. Also, an unusual amount of fruit was classed in grade D and culls. This lowering of grade was due to the rains that occurred during the ripening and harvest seasons, which brought about severe checking and blacknose and later made conditions favorable to fungus spoilage.

The experiments were extended to include the average fresh weight per fruit in each grade (fig. 2) and the relative proportions of certain additive fractions, namely, moisture, solids (not sugars), total sugars, and seeds, that make up the fresh weight. The grade-A fruit did not have the highest average fresh weight per fruit, neither did it have the highest concentration of total sugars. The fruit in grade B1, garden 2, had, on the average, greater fresh weight and more total sugars than grade-A fruit from garden 4. Furthermore, fruits in grade B1 from gardens 4 and 5 were equal to the grade-A fruit from garden 4. It is unfortunate that samples from only one of the gardens (garden 4) had grade-A fruit. Although the samples from the different gardens varied considerably with a given grade, the average fresh weight of the fruit in each grade nevertheless showed a slight tendency to decrease from grade A to the culls (fig. 2).

If the results of the chemical analyses are expressed on a percentage basis, the relation of moisture to the reducing and total sugars of the different grades can be shown. To emphasize this point, the percentages of total and reducing sugars, as illustrated in figure 3, were calculated on a dry-weight basis, but the percentages of moisture were calculated on a fresh-weight basis.

An inspection of the moisture data shows a gradual decrease in moisture in the standard grades from A to C (fig. 3). Grade D also shows a decrease in moisture in most instances; but some fruit of high moisture content was classed in grade D because of excessive physical defects (principally blacknose), which may not in any way be related to the chemical constitution of the fruit. Notice should be taken also of the large variation in moisture of samples from the different gardens. As an extreme case, all the standard grade samples from garden 5 were excessively high in moisture. The grade-C fruit from this garden, which was supposed to contain less than 20 per cent water, actually had nearly 28 per cent moisture and needed dehydration. In fact, only two of the grade-C samples (those from gardens 1 and 2) should have been placed in this class.

The curves for the graded samples (fig. 3) show that, in general, the reducing sugars decrease with decrease in moisture. Sievers and Barger (2) have shown that there is a gradual inversion of the sucrose in the fruit while on the tree or after picking, and that this reaction is accelerated by increase in temperature and moisture. These two factors are favorable for the activity of the enzyme invertase, which changes sucrose to reducing sugars. In view of these facts, it is fairly safe to say that the irregularities in the curves for the reducing sugars can be produced by any factor that affects the rate of inversion of the sucrose. Furthermore, the conditions that accelerate the inversion of sucrose also produce other

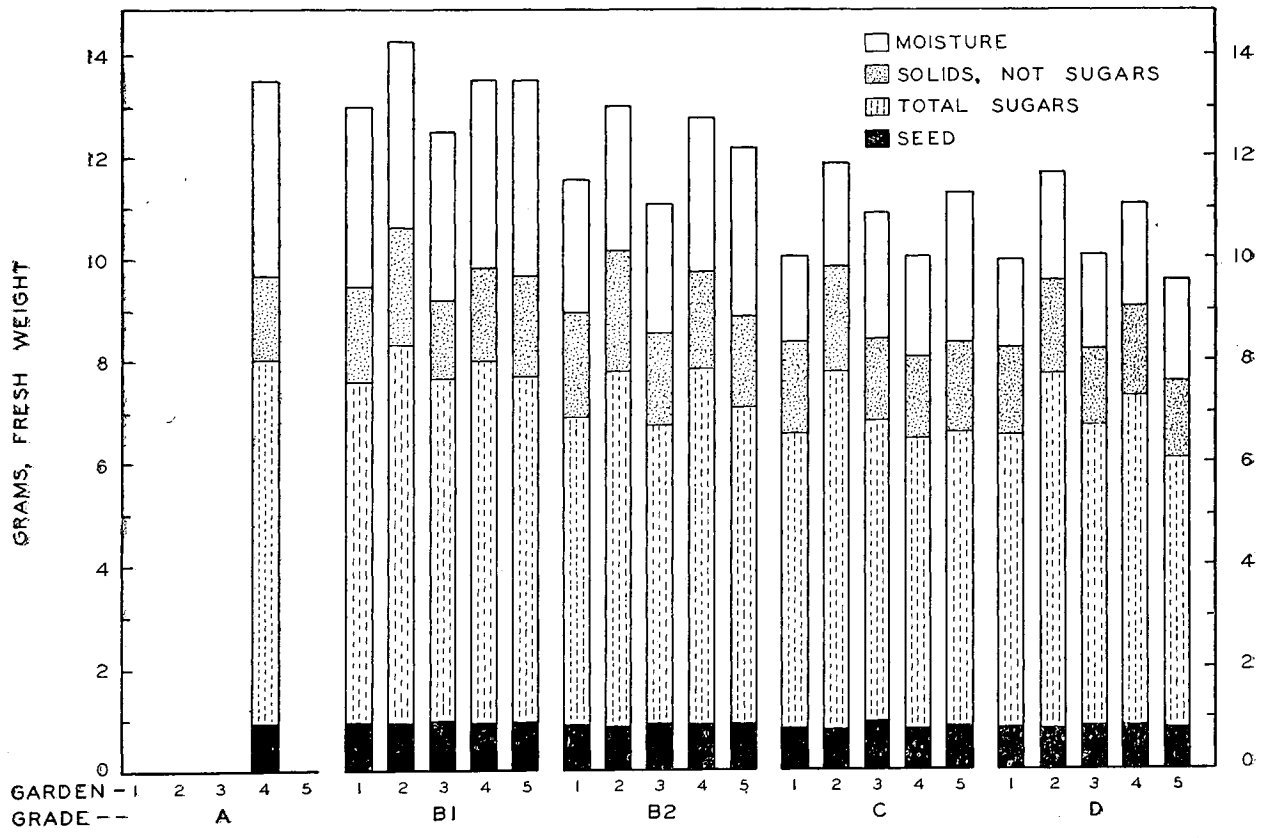

Fig. 2.—Relative proportions of moisture, solids (not sugars), total sugars, and seed (fresh-weight basis, in grams) in an average fruit (without calyx) of each grade except culls, from each of five date gardens.

changes in the fruit detrimental to keeping quality. Under such conditions, therefore, there would be no constant value for the amount of reducing sugars in the date fruits. Sievers and Barger (2) emphasized the importance of keeping the reducing sugars in the Deglet Noor date below 25 per cent.

Apparently, the reducing sugars can easily be altered in the date fruit by environmental conditions. These changes do not affect the amount of total sugars, since total sugars include reducing sugars and sucrose after inversion. The existence of such variability in the reducing sugars demonstrates thoroughly the difficulty in using this chemical characteristic as a criterion of quality in the commercial grades.

When the concentration of total sugars is studied in relation to the moisture in the grade samples, it can be seen that the total sugars do not decrease with a decrease in moisture from grades A to D, inclusive. This behavior is different from that of the reducing sugars. There is, with one or two exceptions, more variation in samples from the different gardens than in the commercial grades from any one garden. The close grouping of the total-sugar curves demonstrates that the differences between the samples are not sufficiently great to be of value in differentiating one grade from another, from a practical, packing-house standpoint. The mean concentration of sugar (dry-weight basis) in samples from the commercial grades from the five gardens was 77.79 per cent, with a standard deviation of 1.77 per cent, which shows how far the values tend to scatter from the mean of the group.

In a previous report to this Institute (3), it was stated that the classification of date fruits is based principally upon physical characteristics and general appearance, rather than upon chemical composition. There are, however, two chemical properties used in the grading of dates: the first, is the limitation of moisture in the various grades; and the second, the minimum concentration of total sugars (68 per cent) on a dry-weight basis. An inspection of the moisture curves (fig. 3) will show that all the B1 samples had a moisture content higher than 25 per cent. None of the samples had a total sugar concentration as low as 68 per cent. It must be admitted that fruits with the minimum requirement of sugar would be very poor indeed for edible purposes. The reason for this is that other metabolic changes would occur correspondingly with the reduction of total sugars to produce off-flavors.

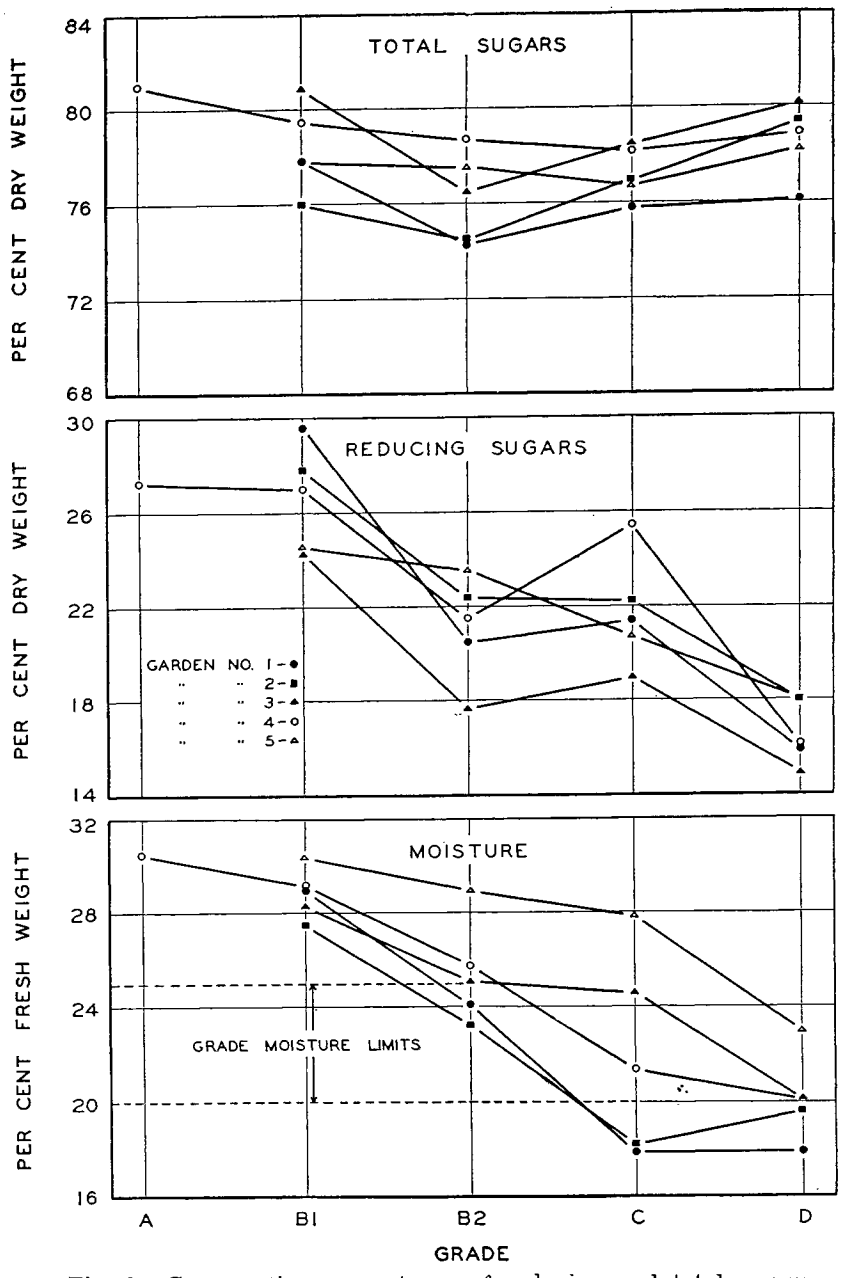

Fig. 3.—Comparative percentages of reducing and total sugars (dry-weight basis) and of moisture (fresh-weight basis) of the different commercial grades of fruit from the five date gardens.

On the basis of the foregoing considerations, it may be said that the moisture content is the chemical factor most directly related to fruit quality. Although the fruit samples from the different gardens were not graded on the basis of moisture, the grades showed a marked difference in water content. The fruit was actually graded by experienced persons on the basis of its physical appearance as it passed along on a belt conveyor. From the amount of moisture in these samples, it is apparent that the better grades of fruit have, on the whole, a higher percentage of water than the lower grades; but, on the other hand, excessive moisture in the fruit may increase the amount of cull fruit because of fungus spoilage.

Although the composition of Deglet Noor dates may show slight seasonal variation in a given locality, such variation is much less pronounced than the consistent differences in composition between date varieties. Apparently, the factors which determine the composition of a given date variety (Deg-

let Noor, for example) are heritable; but within a given variety, the environmental conditions under which the fruit is grown may also produce some changes in concentration of the constituents which make up the composition of the fruit. Within a given variety, therefore, the changes in composition due to environmental factors would be more or less limited. The rate at which the constituents are formed in the fruit would be altered, rather than their final concentration in the fruit at maturity. This signifies, then, that for comparative purposes, the fruit should, if possible, be picked from the different gardens at the same stage of maturity.

As this study is concerned with only one date variety, the differences in composition encountered in samples from the five different gardens (fig. 3) are due solely to environmental factors. This is well demonstrated by the amounts of total sugars in fruits from these gardens. Although the differences are relatively small between gardens, they do show the effect of the environment on the composition of the fruit. Therefore, aside from these factors, it would be expected that the composition of Deglet Noor fruits would approach a more or less constant value.

The experimental results of this paper should be interpreted from the viewpoint of the grower, the packer, and the consumer. Although each of these agencies has a different function, the moisture content of the date fruit is fundamental to the consideration of each viewpoint. To the grower, the moisture relationships are of great importance in determining fruit quality. Excessive moisture due to irrigation or rains, favors water injury, blacknose, and fungus spoilage; insufficient moisture results in loss because of reduced tonnage and a lower grade classification.

From the packer's standpoint, the amount of moisture in the commercial grades should be within the range of 20 to 25 per cent. This range has been found to be the most desirable for storage and packing (2). Dates delivered to the packing-house with excessive or insufficient moisture require either dehydration or hydration before storage or shipping. These additional treatments are expensive. Because of the marked uniformity in the composition of Deglet Noor dates (dry-weight basis), it would seem desirable to avoid a multiplicity of commercial grades.

If it is assumed that the consumer is chiefly interested in dates as a source of energy, it is safe to say that the same amount of energy could be derived from eating equivalent amounts of dates from grade A or from grade C, provided each had the same percentage of moisture. It should not be concluded, however, that the energy relation is the only criterion of food value; vitamins and flavor are also important. Nevertheless, it is of interest to the consumer that the proportion of total sugars to the dry weight is, within experimental error, the same in all commercial grades.

CONCLUSIONS

This investigation has been made to determine the physical and chemical characteristics of the different commercial grades of Deglet Noor dates. The data were determined on five grades of fruit from five gardens located in different areas of the Coachella Valley. While the percentage distribution of the fruit of the different grades varied considerably in the five gardens, the total sugars (dry-weight basis) of the different grade samples were remarkably uniform. The concentration of reducing sugars and the moisture content decreased with the descending order of grade quality. The average fresh weight of the fruit of the different grades from a given garden, showed a slight tendency to decrease with the decrease in quality of the fruit. While the commercial grading of dates is based principally on the physical characteristics and general appearance of the fruit, moisture content appears to be the most important chemical property involved in fruit quality. The water relation in the fruit is fundamental to the production and marketing of date fruits.

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AFTERNOON SESSION

Chairman, John B. Schneider, Extension Specialist in Marketing, University of California

A BRIEF REPORT ON ACTIVITIES OF COACHELLA VALLEY DATE GROWERS, INC.

By Frank H. Winter, Manager

The Coachella Valley Date Growers, Inc., thanks to the many years efforts of its boards of directors and management, and due to the shortage of imported dates as a result of the war, now finds itself in a new position, that of having a product for which the demand now exceeds the supply.

At the beginning of the harvesting of the 1941 crop it was evident that the supply of sub-standard dates would be below normal. The late summer and fall rains had materially decreased the tonnage of No. 2 dry dates and at the same time, through the efforts of our sales representative, Mr. Gordon Wilcox, in the East, through the efforts of the Garden of the Setting Sun and our buyer-manufacturers on the West Coast, the demand substantially began to increase. For the first time, pro-ration was necessary and an estimated crop of one and three-quarters million pounds of sub-standard dates was pro-rated over contracts for some three million pounds of seeded dates.

Thus the year of the 1942 crop became a year of carefully allocating seeded dates, rather than a selling campaign. When the tonnage was even less than expected, the allocation became more severe, such that no customers obtained more than three hundred thousand pounds of seeded dates.

The problem of the past crop, other than the distribution of our product, were those of careful inspection at the time of acceptance of No. 2 dry dates, and again at the seeding plants. The packing houses were informed that the passage of spotted dates was even more serious in the dry pool than with the standard grade dates, as once a moldy date is graded, it's mold will spread through entire lots.

After the No. 2 dry dates were accepted, the greatest quantity of them were seeded at the Garden of the Setting Sun, and the California Date Growers Association, a smaller portion being seeded in Los Angeles by Andrew Reich & Co. The dates were checked carefully as they went into the seeding machine in order to catch any spotted dates that escaped the inspection at the packing houses. It is confidently believed that there will be no complaints on this year's seeded products.

Our selling has been handled directly to the buyer-manufacturer on the West Coast, by Gordon Wilcox, our representative in the Eastern States, and by the Garden of the Setting Sun in the South and Middle West. The efforts of the two latter have produced an outstanding demand for seeded dates, and to very reputable manufacturers who use tonnages in terms of car loads rather than pounds. From all present indications, the demand for our product this coming year will be in the neighborhood of five million pounds. It will be necessary for us to supply this demand, as the price obtainable for the seeded dates will insure an excellent return to the grower this coming year; a price greater than that of the lower grades of standard dates last year,—and this without a Government subsidy.

A recent meeting of representative growers and packers held in the office of the Coachella Valley Date Growers, Inc., brought forth the opinion that by putting all of the doubtful dates into the pool this next year, the grading of the standard dates would be simplified, and a higher premium could be realized for standard grades; so we can say that the dry pool policy will now be one of returning higher prices to its members rather than merely offer an outlet for dates into which there was no grade in which they could be placed.

REPORT OF UNITED DATE GROWERS OF CALIFORNIA

A Cooperative Marketing Association Organized
Under the Laws of the State of California

By Wm. W. Cook, President United Date Growers

Instead of listening to a mass of statistics, you might prefer to consider a few of the background facts that show the reason for United's being, and the reason for its steady growth. It has always appeared strange that so many discussions of cooperative operations leave the heart of the matter untouched. So often consideration of methods of marketing an agricultural commodity degenerate into an argument as to the relative price received from profit making bodies as against the price recevied from a cooperative. This is one basis for judging efficiency, though the very fact that a cooperative's return is considered as a **price** is indicative of a questionable concept of the cooperative principle and function. A cooperative formed on the basis of premises implied by this line of thought is doomed to disaster.

No cooperative can function satisfactorily, nor can it survive over a term of years unless:

(a) The producers are co-operatively minded and think of their

cooperative as a projection of their own business.

(b) Their cooperative is managed efficiently and economically.

(c) Their cooperative is operated for the benefit of its members and not simply as a source of livelihood for paid personnel.

The first item above is basic. It means that the producer of the commodity in question must attack his marketing problem from the point of view expressed by the question, "How can I **and my neighbors** market **our** crops to the best advantage of all of us?" Not "How can I market **my** crop so I can get a little more for it than any of my neighbors?" The man who closes his eyes to the fact that joint effort will give more satisfactory returns to all and, over a period of time, make the whole group more prosperous, **will make a poor member for a cooperative.** Many of this mind in an industry doom to failure any attempt at cooperative effort.

Once there exists a sincere desire to work together for the good of all, it is possible to determine the means to accomplish the end desired. The next step is the setting up of an organization and machinery to do the required work. This brings us to items "b" and "c" above.

These matters are the responsibility of the members of the cooperative organization. Competent directors must be selected; they in turn must employ competent and efficient management. The directors must maintain a check and control on the management employed, to assure themselves of efficiency and to guard against management's domination of the producers by whom it is employed.

A cooperative can perform many or few functions. How much it should do, how many kinds of operation it should perform, is a matter of individual judgment. In the case of United Date Growers, activity has been confined to inspecting and receiving, storing, shipping, and marketing. Necessary office work is of course done and some purchasing of supplies for members. The policy adopted has been that of going only as far as is absolutely necessary to assure satisfactory results; that is, do what is necessary at as little expense as possible, but do not engage in additional activities just to make the organization big and important.

It is easy to see that it would be too costly to sell all our dates directly to consumers from a chain of shops all over the United States. We all agree on this. The next step is whether or not to attempt to sell all our dates to retail stores, thus eliminating middleman profits. Considerable argument develops at this point. Our conclusion has been that the profit eliminated is more than offset by selling, billing, and collecting expense. Therefore, United is operating on the policy of selling to retail stores only where it can do so conveniently and at low expense, employing agents on a commission basis wherever possible, and depending on existing organizations, dealing in commodities similar to dates, doing the actual selling to the retail store. This appears to be a sound operation employing existing agencies wherever they can serve for less cost than a direct operation by United or perform the function more efficiently at no greater expense. Advertising of dates, promotional and dealer service work, and overseeing and assisting the operations of agents, brokers, and large dealers completes the marketing function.

Five years ago United was a small organization, with no capital, handling fifty per cent of the small date crop of 1937. Today it handles the marketing of over seventy per cent of all dates grown in California. Its members have furnished working capital by means of a small revolving fund deduction each year.

The dates handled by United have been sold to better advantage each year since United's organization. The date industry has received better prices despite poor quality caused by the most adverse weather conditions in the history of California date growing. The general average of acceptability of date packs has improved steadily. Dates are becoming an item in demand all over the United States by virtue of publicity secured because we are all working together. United has become the voice of the date industry and is therefore much more powerful than the voices of each of us individually. But it is not "United," some separate entity apart from ourselves that has accomplished these things; it is us, we who are the members of United; we date growers who **are** United, we are doing them.

There are a few who do not participate in this endeavor to make the date industry of greater value. We grumble at holding the umbrella for their benefit. Some members resent the participation in the benefits of our cooperative program of a minority who do not contribute toward the cost of market development and advertising. More serious is the disrupting influence on the orderly distribution and marketing of our dates by this minority grading or selling dates in a manner or at a price that does not conform to the general industry program. We hope they will see the value of united effort and join with us. If not, the benefits are so obvious to the rest of us that we propose to carry on and make the date industry continue a successful agricultural enterprise despite the attitude of a few who are unwilling or unable to comprehend the basic principles and purposes of cooperative action.

REPORT OF DATE MARKETING SURVEY NOW IN PROGRESS

By Eugene C. Jarvis, in Collaboration with J. Wallace Stevenson

In order that we may have first hand information prior to the new season, United Date Growers is making a survey of the general market situation as it pertains to dates, and all comparable products. This survey is nothing unusual, and is made every year, as it is necessary for us in planning each year's operations and keeping abreast of the times. This work is now being carried on under the direct supervision of J. W. Stevenson, sales manager for United, and of course is not yet completed.

We must obtain first hand information in regard to the general trend of merchandising and consumer purchasing as it relates to the problems of selling next year's date crop, and the crops thereafter. The information, when complete, will be of benefit to the industry in building a sound, efficient method of distribution that will continue after the present war boom is over. It will also aid in setting up basic prices and will help determine the industry's promotional and advertising program. In order to properly direct your own affairs, you must keep up with all merchandising conditions and personally have the "feel" of the market.

This, of course, is being done by personally surveying the different districts and cities; by contacting present users of California dates and similar products; to determine how last year's crop was moved and to obtain their ideas and present thoughts in regard to the new season. New accounts and distributors who should be handling California dates and who are in a position to increase date distribution through new and wider channels are also being contacted, as well as the various Governmental departments and export agencies.

Naturally, this survey is being restricted to the major cities of the United States, and the more heavily populated centers where dates can be merchandised and sold in large quantities, so that all overhead and expenses cannot only be kept at a minimum, but actually reduced from year to year. All information is not yet in, and as there are many details that are not of general interest, will attempt to stick to generalities and present the over-all facts that have been gathered to date.

For our own work we have divided the United States into different territories, and find these territories also offer different problems.

California and Southwest: This territory is very close to the area of production and of course does not ever present a true picture. Los Angeles has always been noted as a "dumping ground" for all agricultural products and has always been a very cheap market. Dates are redistributed from Los Angeles to San Francisco, the Northwest, Salt Lake and Denver, and into Texas and the Southwest. California, of course, is the seat of the dried fruit industry and has many large packing concerns that are large users of California dates. These packers have their own distribution setup and many sell throughout the entire U. S. A. Unfortunately for us all, whenever the Los Angeles market becomes glutted, the market slumps very noticeably, which happened this last spring, and unless carefully handled and some sort of control is maintained, this falling market very often is reflected through the major Eastern cities. The solution in this area is principally to restrict the supply of dates, and to tighten up on inspection and control of grades, more particularly the substandard grade.

Pacific Northwest: This area is peculiar unto itself and is one of the early markets developed. Trucks run up here from Los Angeles, and a market for hydrated dates has been strongly developed. In past years this has always been a cheap market and one large distributor has pretty well dominated the situation. At the present time, with national defense work and heavy demands on paper products, the main cities, Portland and Seattle, are very prosperous and all food products are high. There is now a good demand for high type merchandise but an economical system of distribution has not yet been worked out for this type of trade. Exportations are fairly heavy into Canada from this area.

North Central District: This is one of the most difficult districts in which to obtain a large distribution, and at the present can only be efficiently taken care of by redistributing from Spokane in the West and Minneapolis in the East. All of this country is sparsely settled and has a low purchasing power. It is very costly to ship merchandise into the smaller cities of this area, and the best method of distribution is to work through wholesale grocers who carry a full line of grocery items and service the entire area. A large volume will probably never be moved here, but it is a necessary territory, to round out the general program.

Mountain Area: This runs from the North Central portion down to the southwestern part of Arizona. Salt Lake City and Denver are the only two cities that it has been practical to ship to in carlot quantities. This area as a whole has a small population and the market here is easily upset, as conditions in Los Angeles invariably are reflected here, due to truck lines operating from the Coast. Distributors from the Pacific Northwest also cover part of this territory and there is considerable over-lapping and a good deal of bootlegging of poor quality fruit. Chain stores and wholesale grocers provide most of the distribution.

Middle West: Chicago is the hub of this district, and it is one of the most heavily populated districts, approximately 20 per cent of the nation's population, purchasing power, stores and business is here. Chicago itself is a center of distribution and a packing center. Many large food packers and distributors are located in the surrounding area and this has been one of the strongest date markets. Conditions here are very good for this coming season. A very large percentage of the date crop will be moved in Chicago, as many distributors purchase their supplies and re-distribute in the surrounding territory. There are several large manufacturers and packers that will use California dates next year, and they will be purchasing in F. O. B. carlot quantities. Minneapolis can also be classified in this territory and handles some exports for Canada, as well as does Detroit.

South: This territory covers all of Texas and through to Florida,

including New Orleans and Atlanta, Georgia. Business has been very good in this territory, and in most cities we find either a very high type market for high class merchandise or a very cheap market. The stores in part of this district operate on a very small margin of profit. Due to the warmer climate, the date season is necessarily shorter here than in the northern territories. This territory has wonderful possibilities for our better merchandise, as many people spend their winters in the southern portions. Various truckers service the Texas area from Los Angeles, and F. O. B. sales can easily be made here. Some of the New York distributors have established offices in Florida and other southern states. This makes it very simple to make the one contact in New York, then arrange shipments to the branch offices.

East: New York is the hub in this district, which covers from Washington on through to Boston. Some exportations to Canada are made from this area. Here there is approximately 28 per cent of the total U. S. population and the demand for California dates is perhaps more developed here than in any other district except Los Angeles. There are many large distributors and date customers in New York. Several large wholesale grocers and dried fruit operators service not only New York proper but many of the suburbs and outlying territories. There is no limit to the amount of development work that can be done here, with a minimum of expense. It must, however, be done properly and all work correlated.

Any farm industry necessarily has to market its product through the regular, established channels of trade, as it is impossible to deal directly with the retailer. The cost of distribution is too high. With this thought in mind, the retailer or smaller purchaser is temporarily forgotten.

In reviewing the entire situation as it pertains to different localities, we find that it ties in very definitely with certain large packers, distributors or users of California dates that might perhaps operate out of Los Angeles, New York, Chicago or elsewhere, and then re-distribute over wide territories that lap over into the districts mentioned above. In analyzing these various accounts that can be sold direct or through brokers, we find that they can perhaps be placed into five different categories.

First, there are the packers of food products that buy in large quantities direct from the source of supply and handle such items as dried fruit, pectin, citrus products and of course, dates. These large packers make various manufactured products, such as mincemeat, canned fruit and juices, as well as using the various products in their natural state, by packaging them in small consumer packages. Many of these concerns package under their own brand and under private brands. They distriute in a national way, although most of them somewhat restrict their territories. For example, packers out of New York perhaps will not go west of the Mississippi and packers on the Coast very often do not go East except in the metropolitan areas.

At the present time approximately six of these large packers have been contacted during this survey and we find that they are in a position, and willing to handle large quantities of California dates. They are willing to pay whatever price is set. Their only restrictions are that the industry maintain a permanent source of supply of dependable quality and uniform grades, and of course they will not stand for any cutting of prices or for better deals being made to other like concerns. The success of their business depends upon their efficiency in operation as well as their salesmanship on the finished product.

Of course if the base price is so high that the finished product sells for more money than the consumer will pay, sales will drop off. This is the only price qualification in which these people are interested. They sell either in bulk or consumer packages, which they pack themselves. This type of sale is mostly on a F. O. B. cash basis. Some competition is encountered from foreign dates and dried fruits, more particularly the Calamyrna fig through these channels.

Second, there are the wholesale produce dealers. They have always played an important part in distributing California dates and will continue to do so. They do not usually employ salesmen, but operate from their warehouse direct with the retailer and chains, and operate on a smaller margin than wholesale grocers. The produce market is probably the best developed of any market at the present time. Dates are sold as fresh fruit through this channel and there is sometimes competition with fresh fruits when they come on the market during the early spring.

Third, there are the wholesale grocers and jobbers. Wholesale grocers naturally handle any number of food products and service the grocery stores in and around certain areas. Many of them sell the industry's brands as well as their own private label goods. The benefits of these large wholesale grocers are many. Some of them are extremely large and will buy in quantities of from 20 to 30 cars. This means that they can take full cars at any one of their numerous branches throughout the country. They take their merchandise on an F. O. B. basis and handle the redistribution along with their other items. They have as many as from 100 to 1,000 salesmen. Wholesale grocers are perhaps the only means that we have of economically distributing dates in certain sparsely settled territories.

Fourth, there are the large chain stores. Many of the larger chains are so set up that operations can be based very similarly to the wholesale grocer and in fact, some wholesale grocers operate their own voluntary chains and service cooperative retail buying groups. The chains buy from the large packers, produce dealers, wholesale grocers and direct from the industry, usually through brokers.

Fifth, there are the Class A stores and smaller chains of super markets. The smaller retail stores come at the bottom of the list, and from an industry standpoint, it is impractical to service these outlets direct from the source of supply, such as an individual grower or a growers' organization.

In summary we find there is overlapping of service among the various trade classifications. The industry itself must necessarily work either direct with the larger accounts on a carlot basis or through brokers. This eliminates a large sales force and a top-heavy organization that would ultimately cost the growers too much money. With the proper setup a minimum force of promotional salesmen or what might be termed "factory representatives" can properly take care of the entire crop and see that it is properly distributed through all types of channels and that the highest possible price is obtained for the growers by reducing expenses and giving a good product to the consumer, at prices that will return

the grower a profit, yet which will not freeze free movement of fruit.

It has been found that all the different types of date outlets mentioned above will continue to use California dates in a profitable and businesslike manner only so long as they have a constant and dependable source of supply. By this I mean that the industry itself must be sound and must have a sound policy. Obviously if there is no control whatever on grades and prices, the large users of our product will never feel secure in building up their business and investing money in a packaging or distribution setup. If the growers do not continue to work together in large enough numbers so that fruit can be accumulated for these concerns, they cannot do business, as it would cost too much for them to make individual contacts with a large numer of small growers.

In analyzing the various territories and reports that have been coming in, I think general conclusions can be drawn that will perhaps be of more interest than the incidental parts of this survey. The market for California dates has not yet been scratched. The main difficulty so far has been the lack of tonnage and dependable source of supply, which is necessary to interest your larger and more efficient distributors and packers. This coming year these objections, of course, will be largely overcome, due to the promotional campaigns of present growers' co-ops, the increased tonnage and the heavy demand for all food products, that has created interest on the part of many concerns who heretofore would not listen to anyone trying to sell them California dates. The most important thing at the present time in this connection is to properly handle and work with all new accounts, until they have become fully acquainted with California dates and their problems. If this is not done, there is danger that the growers may very easily find themselves in the same position they were in, in 1932, and acquire the same reputation that most of the California fruit industries used to have.

United Date Growers made its first market survey two years ago, to discover why California dates were not more generally accepted by the dealers and retailers. There obviously was something the matter, as at this time, there were no chains of any consequence east of the Rocky Mountains, that were handling California dates. Many accounts that used to handle them had refused, and many excellent potential outlets did not even know that dates were grown in California. The information gathered in this first survey was presented to the growers, and the expression was received that they wanted the situation corrected. In completely analyzing the situation, it was found that there were three factors to consider, in order to establish trade confidence, which was the key to successful distribution.

First, there had to be an elimination of price cutting. No legitimate business will push an item that fluctuates and that is not stabilized.

Second, there had to be a stabilized tonnage and dependable grades.

Third, one large enough source of supply, as the larger distributors preferto look to one place for their requirements, and will not build these requirements beyond the potential supply.

Another sore spot seemed to be that there were not enough higher type stores handling California dates.

As a result of these findings and the support given by the growers, United put on a program that would correct these situations. The only possible way this could be done was to obtain the cooperation of a larger percentage of the growers. Now that the date industry has reached the point where it can take advantage of the present market conditions, and completely establish itself in the proper channels of trade, and with the consumer, it is more necessary than ever that more growers cooperate with the present program that so far, has proved most satisfactory.

We find that the demand for California dates can definitely be tied in with importations from foreign countries, not from the standpoint of the consumer, but from that of the dealer and merchant, who, as long as he can get a supply of a staple article that he has handled for years, will not be interested so much in trying to replace it with an item that is more or less unknown. Dried fruit and Calamyrna figs in particular, travel in the same channels as California dates, and our market is somewhat tied in with them.

We received practically no benefit this past year from lack of importations, the reasons being that importations of dates did not stop until last fall. It is estimated that at the present time there is a large enough supply of imported dates here in this country to supply the package trade through the holiday (31,000,000 pounds). In order to supply the trade with imported dates through this season, one of the largest importers is having to prorate all customers to 25 per cent of last year's purchases, and another large one has set up a 40 per cent pro-ration.

In looking forward to the prospects of marketing a probably 20 to 25 million pounds of California dates within the next few years (which, incidentally, is approximately half of the importations for the years 1939 and 1940), we find we must partially adapt ourselves to the general demands of the public, as well as sell our crop through all channels of trade, the four main channels of course being through the produce department, through the grocery department, through the specialty business such as department stores and candy trade, and through the baking and manufacturing trade.

The best developed market at the present time is the produce departments, where dates are handled as fresh fruit. This type market is an excellent one, and we find that the fig people have been putting on a sales promotion and advertising campaign to increase the sale of whole figs in the produce stands, and to date have been very seccessful. Their program is very similar to ours, and is bringing increased returns to the growers. Also a year or two ago, the imported date handlers were putting on a program to induce the retailers to display their product along with fresh fruits and vegetables.

While the sale of California dates as fresh fruit is without question very necessary, there are some disadvantages if we attempt to sell the whole crop this way. For example, there are not very many supermarkets in the East, although the number has been growing. This means that display space is sometimes limited and when fresh strawberries and other fruits are on the market, the merchant will very seldom display dates on the fruit and vegetable stands. This has been found to be true, by carefully checking the market and analyzing sales, which have always fallen off during the spring months. It has always been necessary, and indications are that it is still necessary, to have California dates properly

and attractively displayed, as they are not a staple article demanded by the consumer, such as beans, sugar, or certain canned items. Our distribution can be increased with less effort by obtaining a certain portion of sales through other channels, rather than attempting to crowd the produce market to its limit.

Therefore, it is necessary to distribute in the dried fruit channels of trade, where dates will be sold in the grocery department, as a grocery item. Thus it will be easier for the consuming public to become acquainted with California dates and use them in place of the imported varieties and brands, as these have always been sold mostly in this department.

The dried fruit market has been especially good, and dried fruit growers have obtained very good prices this past year, which can be attributed partly to the large purchases of their products by the Government for exportation to our war allies. The shortage of tin cans will also stiffen the demand for dried and dehydrated fruits and vegetables. This in turn will greatly stimulate the demand for California dates through the dried fruit channels.

The department store trade should be much better this coming season, as many of their special items are now being eliminated, due to our National Defense program. Also the high prices now obtained on certain specialty items means their volume will be greatly reduced. Consequently, they are looking for new items to hold up the dollar volume, and we should have an excellent opportunity to market a certain portion of the crop in special packages for these people.

Candy manufacturers will also be hard pressed to obtain the necessary ingredients for their manufacture, and many are now very much interested in using dates.

In regard to the specialty trade, California has always been noted for its specialty packers and dried fruit packers, who package many fancy Christmas baskets that are sold nationally. They will use large quantities of California dates and are willing to pay a higher price than for other dried fruits, but will not go too far out of line.

There will be a large demand for date by-products to be used in baking and manufacturing of certain food products. This by-product part of the date program is becoming more and more important. We find that approximately 75 per cent of the California fig crop is sold by-product form; less than 25 per cent being sold as whole figs. The date industry is in much more enviable position, as we only market 25 per cent of our production as by-products and already have a well developed produce market. The general demand and prices that can be obtained will determine the percentage of the date crop that will be sold this way. The fig people are increasing their returns by attempting to sell more of their crop outside of the by-product channels.

At the present time there are good prospects for the exportation of dates through private exporters, to South America and Canada, and also we are attempting to interest the Government in purchasing California dates for Army and Navy use. The sale of dates to be used in the Army and Navy will naturally be a big boon to the California date industry, as this is one way to get California dates recognized and demanded by the consuming public.

This present survey still indicates that our program and policy of past year must be continued; this policy and program of course being to have a personal representative of the growers in the major markets, in order to keep in touch with the general situation and to provide the necessary service and promotional work to keep the dealer and the trade interested. California dates must be watched, to see that they are properly moved, so they will not deteriorate on the store shelves from excessive drying out or souring.

Dates cannot be called a luxury any more and must be treated as a food, in order to efficiently distribute and sell the production we hope to have within the next five years. More money can be returned to the grower in this way than by trying to get an enormous price for a luxury item that naturally will necessitate excessive costs.

The survey shows that the major part of the California date crop is sold in small consumer packages. The housewife has been trained and is accustomed to buying her food products in neat, sanitary packages. Retail merchants like their unit price to the consumer to fall in certain price brackets. For example, we find that most food items sell in the East for either 15c, 19c, 25c or 29c per unit or package. This of course is not uniform, but generally holds true in most areas. If the unit price goes above 29c, the volume usually drops very noticeably. This means that most industries each year, when a change in price takes place, have to figure out and develop packages to meet these limitations. It is entirely possible, however, that this coming year, with such a spiraling market, these particular brackets will be done away with and it might also be possible that smaller packages will be used, so that the price per unit will not be too high to the consumer. Information received so far indicates that the largest moving item right now is a 25c seller.

It is obviously impossible for the local industry to do all the packaging that is necessary. Therefore we have interested eastern concerns who have specialized in the packaging of food products. Arrangements have been made for them to purchase dates in carload lots, F. O. B. California for Eastern shipment, where they can package dates and distribute them along with other products, thereby reducing overhead and relieving the home industry of the burden of grading, packaging and shipping its entire crop and placing it on the market prior to Christmas.

In this day of competition and higher costs, all operations must be streamlined, and duplications eliminated. This is being done to a certain extent, with new contacts now being made, whereby new facilities can be made available to the date growers. F. O. B. shipments in carlot quantities from the Coast are not only cheaper, but the merchandise can be re-distributed and put on the market much faster.

The present outlook is excellent. The date industry, however, is still in its infancy and improvements can and will be made in growing, packing and marketing. The growers must produce a larger tonnage and do it efficiently; the packing houses must increase their facilities, be able to put out better grades more economically, and the marketing agencies must continue to decrease expenses and overhead by encouraging F. O. B. carlot sales and developing larger outlets, so that shipping costs, storage and sales expense on the part of the industry can be held at a minimum.

It is not the intent of the local growers' organizations to ever cre-

ate a monopoly as far as sales are concerned. This is one of the reasons United refuses to grant an exclusive agency. We know that competition in sales will always be necessary. However, an orderly marketing program can never be properly worked out, so that the growers will obtain the maximum possible from their crop unless a common starting point, as far as sales are concerned, is created. That is, the growers themselves must stay together and manage their own business. They should set the price, and put out uniform and dependable grades, and have all purchasers deal with them collectively, through any media or organization which they employ for this purpose. This will mean that all purchasers of the California date crop will be on the same basis, and can depend upon a permanent source of supply at a stable price, and will know that their competitor will not be able to purchase more cheaply; also that their competitor will not be selling inferior grades at cut-throat prices. The growers and packers who put out inferior grades which mould or sour or become wormy, are doing more harm to the industry than any other one thing.

Generally speaking, this survey has shown that the opportunity for which all date growers have been hoping and looking forward to for the past ten years is now at hand. There are many new customers for California dates; some of them never having handled dates before. In order for the industry to get the maximum benefit from present and future market conditions and also build a solid foundation for the future, it is most necessary that grades and quality be watched very closely and no low grade dates be allowed on the market. With a strong market such as we are now going to have, which will greatly increase the net returns, many sharp-shooting operators will start selling culls and sub-standard dates through the regular market channels. This means that many people will purchase California dates for the first time and be disappointed with the quality — and will prefer the imported varieties. Such shortsightedness as this will do untold damage and can only be controlled through the growers themselves. If the growers will stay together and turn all their low grade fruit into by-products, marketing the better grades only, more money can be obtained from the crop and a sound future assured. Cash buyers from selling orchard run fruit and substandards on the Eastern market which was done last season.

Many of the new California date accounts will attempt to over-buy, thinking the problem is the same as with imported dates. It will take careful handling on the part of the industry to make sure that these new users have a satisfactory year and receive a good product. They will be needed in years to come.

Some large firms now have plans for the exploitation of the California date industry. They were not interested in our product until we began to develop the market for our dates and show the profit possibilities in the date business. Now they see an opportunity, and due to the size of their organizations and cash assets, believe they can force their way into the industry by purchasing large enough quantities to dominate the entire market. No one need be told that if this happens, the date industry will be subjected to the continual threat of these accounts discontinuing the handling of California dates. The California date growers would then have to start all over again to rebuild their market. All large firms now interested in handling California dates of course do not have these ideas in mind, but some have, and by the nature of their correspondence, have made pretty clear their intentions.

Due to food shortages and a rising market, many brokers and other buyers are attempting to get on the "gravy train." Most of them are in contact with the present date accounts and hope they will be able to obtain a nice commission or profit on the side. The date growers must see to it that there are not too many profits in between the ultimate consumer and the grower. These operators are only able to sell through the larger accounts, and make no pretense of developing the market or getting new distribution. This will always have to be done by the growers themselves through their own organization. The future of the date industry at the present time is in the lap of each individual grower, and if a large enough percentage do not stick together on grades, prices and markets, they cannot this year obtain as high a return for their crop as they are entitled to.

In conclusion, I can say that we date growers are now in a spiraling market, and have the opportunity of following one of two policies:

First: That of selling here and there as we can, taking advantage of the highest price, to those who are interested mostly from a speculative standpoint and who will not be permanent outlets. By marketing in this manner, trade relations can very easily be disrupted and the general policy could be such that after the war boom is over, we will again find ourselves in the same position we were in 1932.

The second alternative is: That of building a method of sound distribution through well-established, permanent organizations and dealers who will be able to properly distribute dates and make them available to the general public year after year. In following this policy, proper trade relations can be maintained and all dealers and storekeepers convinced that dates are a profitable item to handle. In turn the consumer will be accustomed to our excellent product, and will continue to demand it. Needless to say, this latter policy is being followed by United Date Growers, as it is fully realized that the date growers have a high investment per acre, and must obtain returns for many years to come, if that investment is to be justified.

IMPORTANCE OF GRADES TO GROWERS — DISCUSSION

Led by Leonhardt Swingle

The importance of grades is one of the most important that the date grower has to consider. His returns from the selling associations are based on the grades delivered, and even if the sale is made to the cash buyer, the grade of the fruit which he has to offer very materially effects the price he may expect. Again, the cost of dividing his fruit into grades is the work of the packer and the grower pays the packer for this work. So both his total income and his cost are influenced by the grade that is grown.

A good many years ago in these Institutes we had a discussion on the establishment of standard grades, for at the start of the Coachella Valley date industry, sales were by samples and not by grade. We have more or less established standard grades since that time but a great many people have come to question if we have not established too many grades to the detriment of all concerned, even to the consumer. The fact is, that most every summer the date growers meet and decide to have fewer grades, but when the year is over we have about the same number with possibly one or two more. We cannot settle this question today. The industry is too young and our ideas and methods of marketing are still subject to modification. Let us hope that this discussion will bring to all of us a realization of the complexity and importance of grades in California dates.

The first speaker will be Mr. Van der Meid, who will speak as a packer with the viewpoint that there are too many grades, followed by Mr. Duncan and Mr. Cavanagh, as growers, who contend that it is an impossibility to grow dates in one grade. Then Mr. Mitchell as a packer who feels that a number of grades are necessary, substantiated by Mr. Atkinson, as an inspector.

WHY THE NUMBER OF COMMERCIAL GRADES OF DEGLET NOOR DATES SHOULD BE REDUCED

By P. W. Van der Meid

For the past several years many date growers have expressed the opinion that there are too many grades of Deglet Noor dates. Year after year passes by and nothing further seems to be done about it.

From the standpoint of the consumer so many different grades are, needless to say, rather confusing. After all, the public is interested only in a good, uniform grade of dates. The vast majority of the date buying public does not know a Fancy from a Choice or perhaps a Choice from a Standard grade.

With the prospect now of the date growers receiving a higher return from the substandard dates, they can afford to place all off-grade dates in the sub-standard grade and maintain a fairly high standard for the upper grades.

From the standpoint of the dealer the job of selling would be greatly simplified if there were fewer grades. Naturally, the cheaper grades will outsell the better grades. Then, the dealer has to exert greater sales effort to move the higher priced grades. As far as I know, the foreign dates which have been shipped into this country have been put up in two principal grades. One, a grade to be packaged and consumed as a whole date, and the other a lower grade, which is used for candy, baking and by-products.

Most certainly the grading and packing operation would be greatly simplified if there were less grades. Needless to say, this past season was abnormal. Due to the great amount of sugar tipped dates it was deemed necessary to make eleven different grades. They were as follows: Extra Fancy, Star Choice, Star Choice Sugar Tip, Standard, Standard Sugar Tip, No. 1 Dry, No. 1 Dry Sugar Tip, No. 2, or substandard, Spotted dates and Culls. Making all of these grades called for at least one re-run of a good part of the fruit as it was humanly impossible for even the expert to make all of these grades in one operation. Even in a normal season the present set-up calls for at least seven grades.

It is my opinion that the grades should be limited to five. They are as follows: Fancy, Choice, a limited amount of Standard, No. 1 Dry and Sub-standard. In a year when there are a great number of sugar-tips, I would suggest making a fairly soft grade, and place the balance in with the sub-standard.

Unless someone familiar with the sales angle can show good reason why so many grades are necessary, I would suggest that this matter of cutting down the number of grades be given very serious consideration before we get into another season.

SOME REASONS FOR QUALITY AND CHARACTER DIFFERENCES IN DATES

By H. L. Cavanagh

It is generally known that each section of the Valley produces a date characteristic to that particular locality. These quality and character differences materially add to the complexity of the uniform grading of the dates. Were it possible to handle all of the dates produced in the Valley in the same manner and have a uniform product by so doing, we would have a simpler and less costly operation.

Even when produced under the same cultural practices, gardens in the different sections of the Valley still retain the different characteristics of that section. These differences may be due to topographical and climatic differences. For example: dates produced in the Indian Wells district are normally of good quality for the district as a whole and are of the same type with the same characteristics. As compared to dates of some other section of the Valley, the dates produced in this area probably derive their characteristics from the elevation and the cooler night temperatures during the summer months. The cooler nights having a tendency to delay the ripening of the crop until the cooler fall weather when the ripening process is slower with a resultant good quality. Dates produced in the floor of the Valley may, as a result of a few exceptionally warm days during the early ripening season, be forced into premature ripening with a resulting tendency to dryness. These conditions produce a wide variation in grades and add to the complexity of the packing house operation.

We also find rather marked differences in the dates produced in the same section and under the same cultural practices. These dif-

ferences may be due to soil differences. The lighter, sandier soils producing an earlier ripening and drier date as compared to the softer better quality date produced on the heavier type soils with a deep water penetration. In spite of all we can do, these grade differences still remain.

SOME REASONS FOR QUALITY AND CHARACTER DIFFERENCES IN DATES

By Hawley O. Duncan

Different quality or grade of dates are grown on different ranches, and sometimes on the same block. As all too often the soil will range from a sandy loam to a hard adobe condition on the top soil.

When this condition is present you will have two very distinct quality or grade of dates. The sandy loam will produce a heavy crop each year with a high percentage of the dates going in the Star Choice and Fancy grades with size just a bit larger than average.

The hard or adobe type soil will have a lighter crop per palm, year after year, also they will run more to Standard Grade and No. 1, and No. 2 Dry. Partly because the quality is not there, and partly because the normal size was not attained, and in some cases the color is somewhat off normal.

We feel the better quality dates are produced with sandy loams two or three feet of top soil, with thin layers of silt thereafter.

Sandy soil without a layer of silt is not so good either, as it requires more water and fertilizer, but the dates can be sized up to normal size with fruit a little more to the firm or dry side when ripe.

SOME REASONS FOR QUALITY AND CHARACTER DIFFERENCES IN DATES

By Don H. Mitchell

A number of times in the past date growers have met at the close of a season and decided to simplify our grading system. Plans would be made and agreed upon to reduce the number of grades. Since no two seasons are alike, the finish of the following season would find as many as ever, though usually not the same ones exactly.

At the California Date Growers Association this past year we had thirteen separations, but this does not mean thirteen grades. The presence of an excessive percentage of "blacknose" dates accounted for three of the separations.

Too broad a grade, that is, a grade with a very noticeable difference in value between the best and the poorest in it, is apt to confuse a purchaser. We often hear the statement that the consumer "doesn't know one date from another." It is true that Mrs. Housewife would have difficulty putting into words her reactions in buying a poorly graded lot of dates. She instinctively prefers a lot that is uniform and acts on that preference. This preference, translated into sales, affects the retailer, the wholesaler, and is felt along the line to the grower. As a result it usually happens that either the lowest quality dates in a lot set the price for that lot, or, if an attempt is made to price the lot on average quality, a feeling of dissatisfaction is felt somewhere along the line due to the presence of such dates as are below par.

It is impossible, of course, to grade our product with the same degree of uniformity that is obtained with manufactured articles. There will be considerable range between the best and the poorest in a regular grade in spite of all that we can do. I personally feel that four or five grades will not give us the uniformity that is essential unless additional separations are made within the grade itself. A good illustration is the appearance every season of what are called "dark soft" dates in the Fancy, Choice, and Standard grades. These are much darker in color than the average, stronger in flavor, and usually more perishable. Some consumers prefer them, the majority do not. If separated, and sold by themselves to the outlets that prefer them everyone is happy. If mixed through the grades the result is often a lower average sales price.

After all, our main objective as handlers of dates, is as high an average return to the grower as possible. Making a reasonable number of separations, enough to give us passable uniformity, helps us attain that objective. When the time comes that the consuming public does not want uniformity enough to pay us more than it costs us to give it to them, it will then be time to consider selling dates "orchard run."

THE IMPORTANCE OF GRADES TO GROWERS

By Paul Atkinson

Grading is the inspector's "stock and trade" and naturally he feels no doubt as to its importance in all phases of the date industry.

Only by working on a sound grade structure can the true premium be paid to the grower with high quality fruit. I believe this structure must have no less than three grades of natural dates and two of dry dates. The Star Choice being our average at the present time. Eliminating the standard grade leaves the inspector no alternative but to condemn a lot of fruit that is slightly below average. By eliminating the fancy grade no premium could be given for better than average fruit. A grade of dates for dehydrating is essential and also one for uses other than marketing as whole dates which we call number two drys but which also included softer dates of low quality.

Separating the dates for hydrating into what we call "hard dry" and waxy tip" makes it easier for the processor to do an accurate job. This means a superior product and also a minimum of waste due to over or under hydration. Indirectly it means money to the grower.

Preliminary grades of "green" and "soft" should be made in all packing-houses. The proper curing of the dates put in these grades not only improves the keeping quality but also enables the grower to get a much better grade-out than would otherwise possible. This fact was brought to my attention time after time this past season.

(Mr. Swingle Resumes)

It is apparent that the Choice grade of Deglet Noor dates is the most important commercial grade for California dates. To a great many users and consumers, their size and moisture content, or color is not of very much importance, so long as they are within the customary standards of this grade. There are, however, a number of users who for one reason or another, have a demand for a certain size, or moisture content or color of Choice dates. This demand must be met by the selling organization and it would seem that the answer would be not another grade, but the segregation of Choice into these different types that are in demand for certain users. They would all be Choice dates, but to the person who wanted small Choice, or large

Choice, because a certain size is necessary for his package, or a certain moisture content is necessary, he could secure it. Not by making more grades, but by a little more careful classification and labor on the different types, all within the Choice grade. Along with this would go the throwing out from the Standard grade class into the substandard or by-products grade, of all dates—even though they be very good, but just don't fit into any recognized grade, or type. We must cease thinking of the by-products pool as only for poor dates, but regard it as the mainstay in the marketing of the entire date crop, and as the medium by which the balance of the date crop can be more easily graded and classified.

IN REGARD TO GRADES FOR CALIFORNIA DATES

By Edna Cast

We still maintain what we have maintained for years, that for commercial sales only two **price grades** should be made by the date industry; these to be Fancy and Choice.

As packers, we believe this is entirely practical. It would fall to the packing-house to make segregations of softer and firmer fruit—dark, and light, or sugar tips—but the grade name would be based solely on the value of the fruit.

Defining Fancy Grade as a date presenting a perfect appearance and selling at a fancy price.

Defining Choice Grade as a date which does not present a perfect appearance, but is comparable to the Fancy grade in eating qualities, but at a lesser price. (Good hydrated dates would sell at the Choice price.)

Any date that looks out of place in either price grade should not be sold as a whole date, but placed in the By-products grade. This would insure the customer always of dates of good eating qualities—with only a price differential.

Much missionary work has been done, and many different date products have now been worked out, so the ultimate return to the grower would not be reduced by placing a good portion of the crop in the by-products, but actually increased, for the following reasons:

1. It would cut out chiseling on grades.
2. It would lessen the confusion to the public, who are not interested in grades—only in the eating quality.
3. It would mean the public would receive only better dates, and this would increase the demand for good California dates.
4. It would command respect for the California date industry.

THE NEED OF A GENERAL DATE PRICING POLICY—ITS IMPORTANCE TO GROWERS

By Robbins Russel

I believe it was Chief Justice John Marshall who said, "The power to tax is the power to destroy." The remarks following do not attribute the full of that power to **pricing.** Yet, the more I learn of selling, the more it is clear that improper pricing, just as unwise taxation, serves to tear down and destroy.

Notwithstanding its importance, I venture to assert that — when removed from the limited sphere of personal barter — a pricing policy, as an integral part of a real market program,—is but ill-understood by we farmers. Not only is our agricultural history rich in examples of the results of that lack of training, but also it has (and still does) produced costly and damaging legislative experimenting.

Within the last decade or so, a prominent Department of Agriculture official advocated disregard of cost of production in setting prices. In one rich farming section of our country a well-publicized "Agricultural" movement developed under a leader demanding "Every farmer to be guaranteed cost of production plus a fair profit."

I mention these obvious examples of the erroneous because of the distressing ability of such superficial thinkers to attract substantial followings and so play a definite part in making agricultural policies,—policies which because of their unsoundness, frequently lead to damage to our agricultural economy.

In approaching the subject of a Date Pricing Policy, I draw on past history, to indicate a few things not to do.

Let's go back to the Coachella Valley of 1919 - 1920 — when telephones, and paved roads were still a comparative rarity; with the Southern Pacific restaurant at the Indio station the best eating place, and the old Gard building in Indio, the Valley skyscraper. In those simple days of our "ancient history," Palm Springs was still a small village, where Indian-operated hot-baths cost a quarter and complete informality was the rule, being neither fashionable nor expensive.

In these "far distant" times I am describing, there was a "pioneer" date grower near Indio, named Fred Johnson.

Four mature Deglet Noor palms, in full production on his property, were the Mecca of all Valley real estate promoters—being considered the prototype of the thousands of acres which these fervent realtors already had sprouting in all sections of the Valley. If any of you care to examine the files of the Date Palm, in particular those prior to 1922 or 1923, you will find some tales and precasts which, in the light of present day history, are as fantastic as the contemporary operations of Superman.

Mr. Johnson's four old palms, and his marketing practices — coupled with that distressing tendency so evident among promoters, to substitute **gross** for **net**—supply the basis for all too many of these newspaper articles.

The tragic side is that such "fairy tales," when put forth by persons presumably in authority, do have effect. I venture that most of us know of cases of heartbreak over the failure of plans based on such fantasies, not to mention the savings lost. But to return to Mr. Johnson.

I well remember my first trip to see his operations, early in the date harvest of 1920. I was especially interested in his primitive packing house, where the Deglet Noor crop was maturated in trays, fitted with

heavy lids which could be (and were) tightened down on the closely packed dates, by means of butterfly screw nuts. In this way he kept them under pressure during processing. As I recall it, even by best present day standards, this produced a very creditable product.

Mr. Johnson's sales record deserves special mention. It made a lasting impression, as it exemplified that rare condition of the producer being, to all intents, in full charge of his market. This record consisted of a paper-backed, school notebook, in which the old man wrote in pencil, the name, address, date of receipt, pounds ordered and money sent, for every order as received. On the back of this page, he fastened the checks accompanying these orders—for, as I recall, his was a strictly cash business.

When the dates were ripe, orders were filled beginning with the oldest. As each was shipped, its check was cashed. When the whole crop was gone, all remaining checks (for then, demand exceeded supply) were mailed back to the senders.

The simplicity of this fascinated me—illustrating what can be done when you have all the supply and many persons want it. How prices were originally set up, I did not come to the Valley early enough to find out. When I knew him, Mr. Johnson's retail base was $1.00 per pound. Yet his property passed out of his hands early in the 20's—indicating that his grasp of our marketing economy partook of that unreal quality commented on earlier in these remarks. Though he was in on the "ground floor" his lasting contribution to our young industry was negligible.

A second illustration from our past is (or was) the original Covalda (Coachella Valley Date Association), with which the Downings, Bruce Drummond and many other of the pioneer figures were associated. I do not have details of its organization at hand. How these were affected by the "Johnson precedent," however, is illustrated by the provision that members were to be paid for their dates, **within three days after delivery to the packing house,** according to the following scale which I quote from memory: $1.25 per pound for 1st grade; $1.00 for 2nd grade; 75c for 3rd grade. Needless to remark, Covalda passed from the scene speedily. I never learned of any member who received this "contract price."

One other point bearing on the business sanity of the founders of Covalda. As originally constructed approximately 60% of the available floor space of the packing house, was used for offices and director's rooms, leaving only about 40% for the operating end.

Why do I recall these "fantasies" from the past, which are merely illustrative of many more, the inclusion of which time does not permit? Simply because contemporary Coachella Valley date growers actually b e l i e v e d in them — contributed money and crops to them—and all too many, vigorously resented any adverse criticism, irrespective of the qualifications of the critic.

To those interested in further examples of this character, the files of the Date Palm, and the Coachella Valley Submarine, during the second and third decades of this century, are a fertile field.

The examples I have cited, as well as the numerous others to be found in old files, seem to indicate two principal faults, which we growers must overcome, if we are to develop or maintain a sound, general price policy:

FIRST: Each seller must comprehend and apply the established general laws of merchandising, including pricing.

SECOND: The unreasoned conviction that because one profoundly wishes a certain result, such result can be attained irrespective of historical and present fact, presumably by the very intensity of the sponsor's belief and effort, must be overcome and eliminated from our planning. This is a vice which has, and will continue to cost us all, until we insist on programs based on established fact and carried out in accordance with tested policies—irrespective of whose theories have to be overriden in the process. In short, stop trimming facts to fit the conclusions we want and instead, draw conclusions **from impartial and comprehensive** facts.

Before taking up the specific requirements of a businesslike pricing policy for any industry, as I see them, may I—as one grower to another—state what I firmly believe to be an underlying fault of so much of agriculture's (including our date industry) troubles? It is, that speaking as an industry, date farming cannot be carried on as a "way of life"—to be treated as we treat our l i v i n g programs — **emotionally!** These United States once were primarily agricultural. They are no longer! In my opinion, the failure of Coachella Valley date growers to distinguish between the operations of their homes—and the operation of their farms—even though both are located on the same land—and to operate the farms on industrial principles, similar to any manufacturer—underlies much of our past and present troubles. The principle was enunciated during the slave troubles of the last century that these United States cannot exist half slave and half free. Since our business pattern is made by industry, I believe — to paraphrase the above—that our economy, will not provide equal support to a distributive minded industry, and producer minded agriculture!

With the foregoing "back-ground" remarks "off my chest," I'll now list my ideas as to the more important requirements of a business-like pricing policy:

FIRST: **Any business — whether industrial or agricultural—must return a profit, if it is to continue.** No amount of emotional satisfaction with our desert homes as a "way of life" will keep those homes belonging to us, unless our income actually meets **all charges**, including necessary reserves. Unless our date industry—which means each of us individually — is able to show an average profit over costs, it is as certain as the coming of day after night, that present owners will be displaced by others more realistic.

SECOND: **Dates**, when properly grown and handled, **are not very perishable.** Also, being perennial, our industry faces the inescapable condition that—barring some catastrophe—there will be another crop next season. Disregard or ignorance of these ever-present conditions, results in the deadening situation termed surplus, or carry-over. Consequently, any date marketing program, unlike such strictly perishable crops as avocado and citrus, must give major consideration to **actual use** of the dates, not merely their sale. In brief, **each crop must be marketed so as to have it consumed before the next is ready for sale.**

THIRD: **The continental USA is, and will remain, the principal market for our dates.** Therefore any really successful sales program must be geared to this market. And let me emphasize that by **this market**, I refer **to the whole USA**—not some particular, more accessable section.

Two tendencies, by no means confined to our date industry, should be guarded against at all times. These are: (a) Conviction that one is "endowed with a knowledge of markets,"—their requirements as to grades, packs and prices,—without actually taking a sample case and "hitting the trail"—calling on the trade through which the dates are distributed. There is little that is attractive in such trips—requiring, as they do, long hours, little sleep, irregular meals, and contact with persons of types frequently distasteful. Yet—when all is said and done—personal knowledge, which depends largely on personal contact—remains the underlying foundation of successful selling of products like our dates. Only those having such contacts, as well as knowledge of the production end, are able to appraise the whole of the problem and so reach conclusions as to policy and prices, which are economically sound. (b) It is because of these very requirements that it is axiomatic never to entrust pricing to salesmen alone, — nor marketing programs to producers and manufacturers alone. Failure to understand that what we learn in one section of our great country, or from one section of "the trade," does not necessarily reflect the whole picture accurately. In my opinion, our date industry, having grown up in the shadow of the Los Angeles market, has not yet learned sufficiently that L. A. is not USA, so far as date prices and programs go. As emphasized above, our facts and our scale of value, must be national in scope, not local — otherwise we are very apt to have only a "worm's eye view" of the possibilities and so allow the real profits on our dates to be gleaned by others. This ever present need for a broad nation-wide understanding of the market, is one of the most potent of arguments for the principle of joint, or cooperative action. Otherwise the individual operator is prone to be too limited in his grasp of the whole, and so be misled in his pricing, to his own and the industry's loss.

FOURTH: One of the outstanding characteristics of our American economy is that it has been competitive. I am convinced that competition is desirable—otherwise the pattern of our economy tends to become fixed—to stop progressing. However, that does not blind me to faults which, in our industry, frequently are the result of the ignorance or extreme short-sightedness of we growers. When factions within our industry fight each other, through low prices, deceitful terms, poor grades, campaigns of slander to the trade, (termed "knocking the competition"), or the many other forms which such "fratricidal" struggles can take, it is we growers who are the losers—all of us. The downward spiral of prices, which such situations always produce (irrespective of general price trends), inevitably ends at a level which approximates the cost of packing, transport and selling—with practically nothing left for the grower. In this agricultural gamé, no grower or group of growers—not even the largest,—can be superior to the industry. We are somewhat like a garrison in that if we are to prevail, we must operate a working agreement among ourselves,—reflecting a factual spirit of compromise and fair play — so that a "unified front" on those essentials on which our industry's success depends—is maintained. In short, in our industry, the community of interest **always** outweighs the divergence of interest between we growers. Any boob can move merchandise by cutting prices. That is not selling—merely robbing our own industry. If we are ignorant or short-sighted enough, as we have been so frequently in the past, to offer the trade such opportunities for long profit, the blame is only on us for being the originators of such idiocy.

FIFTH: Grades must be realistic. We have grades because all dates are not of identical quality and so, in the eyes of the buyer, have different value. Since this is the season for grades, it follows that only those which are real to the buyer, should be used. Unless this is so,—unless buyers are able to distinguish one from another by the fruit—not the package--maintaining such grades incurs an added cost which must be paid by the growers and presents an added opportunity for "chiseling." This also tends to forcing prices down.

SIXTH: Under circumstances now existing in our industry, and as we can continue to maintain them, **no whole dates should be sold at prices which do not give a fair profit to the producers.** This means, of course, that some dates cannot be sold in whole form—though still more or less edible. Nor sould they be. Our customers will continue to buy dates at a fair price, only if they give satisfaction,—if they are good to eat. When we allow whole dates not measuring up to this, to pass from our control in whole form, we simply defeat our own efforts to improve industry returns. By selling these borderline, undesirable grades, to an unknowing public, we not only injure our reputation, but also lose profitable customers. We growers are fortunate that the date is a fruit which, so long as it is mature and sound, can be utilized and sold—in the form of what are loosely termed "by-products." If we growers have any appreciation of the long range welfare of our industry, we shall take full advantage of this favorable fact.

The Coachella Valley date industry is "of age." This has come, so easily that many still do not realize it. We growers as an industry, must "step out on our own," and I, for one, have no tolerance for that school of thought which would still keep us tied to one or another set of apron strings. Our necessary leadership—our fund of experience—can only be developed to the full, by going on our own. So long as we feel we must hire some outsiders to do our merchandising, just so long may we be sure of depriving ourselves of the inestimable value of such experience. By a reasoned, temperate, factual consideration of our industry's needs and by applying the simple policies mentioned above, I have no doubt but that the economically justified position of our industry, will be gained.

If any of us still think we are "cuter" and can "cut some corners" ahead of the rest of our industry, just remember—

There never was a product made
This fact you must confess
But that some boob can make it worse
And sell his junk for less.

SUMMARY AND GENERAL EVALUATION OF THE DATE MARKETING SITUATION

By John B. Schneider

It is a pleasure to review the discussions which have already been presented, because there has been included so much which is worth repeating. I do not intend to repeat these completely since there will be ample opportunity for each of you to review the discussions in the official proceedings when they appear. I do wish to emphasize, however, that the remarks include much that would be sound at any time, and is particularly timely for the economic situation in which the industry now finds itself.

The United States is now engaged in a war and you are engaged in the production of a crop which is affected materially by the present war. There are some things which we might learn by reviewing the situation in the last war, but in many respects the current situation of the California date industry is materially different from what it was during the last war. Production in the United States in 1917 amounted to only 60 thousand pounds, whereas production last year exceeded 10 million pounds. Although we were dependent almost entirely on imports during the last war, now we supply an important segment of our domestic consumption. Nevertheless, we still rely to a large extent on imports for dates consumed in the United States. The last war was responsible for a great curtailment of date imports. They dropped from 31 million pounds in 1915 to 5¼ million pounds in 1917. Whether this same drastic curtailment will take place in this war depends on many factors with which you are quite familiar. Should the curtailment take place, you now have an opportunity which you did not have during the last war. The timely remarks which you have had directed to you by the previous speakers really ask you whether this opportunity is to be used only as a grand and glorious holiday during which you will take every possible advantage of your ultimate consumers or whether you will utilize this opportunity wisely. You will have a chance to meet for the first time many new consumers upon whom you will make an important impression. This may serve you well or ill after the war is over, depending on the nature of the impression you make. If the consumers are not impressed favorably, they will welcome the return of the imported product.

The distribution system which you use at the present time, you are advised, might well be such as to take full advantage of your present bargaining position, and at the same time be developed in such a way that it might function effectively after the war is over, when there will be available not only dates from abroad but also increased quantities from your own gardens. There are many possible ways in which your dates might reach the consumer. Each of these various outlets can render a useful service and should be utilized as efficiently as possible. You have a unique commodity which may move to the consumers in a variety of ways. If you choose but one you tend, to that extent, to limit your distribution which would not be use to do for various reasons. The channels which should be developed are those which can render the best services not only in the immediate present but for the long pull as well.

We heard much this afternoon concerning grades. There seems to be some difference of opinion, though underneath I sense a feeling of agreement. It is quite true that in the production of dates as in the production of any agricultural commodity, a definite fixed type cannot be produced as in a factory. We often hear the remark that two persons are as like as two peas in a pod. However, even a hurried glance at the peas in any pod will usually show considerable variation in the different peas. No two are exactly alike. If, to have commodities exactly alike were a prerequisite for grading, then grading could hardly be possible in any agricultural commodity. That it is possible has been demonstrated. There are many factors which cause variations and these cannot be eliminated entirely. However, as has been mentioned by several people, these factors of production are not the deciding factors in deciding whether or not it is wise to grade. The important question is, "Does it pay to grade?" To answer this question, it is necessary to take into account the total returns after costs of grading have been deducted. The total returns should take into account not only those for any given grade but also the total for all grades. If the answer is in the affirmative, then by all means grade. The present economic situation is one in which it is particularly important to grade since you wish to make the best possible impression on the users of your product. However, grading is desirable at all times if it enhances consumer satisfaction which is reflected to the producer in enhanced incomes. This is a subject which must be answered on the basis of facts and not opinion. Those who have discussed this subject this afternoon have had ample experience which enables them to give sound advice.

Mr. Russel has tackled a question which is one of considerable importance to the industry. The present economic conditions are such that we may either fritter away our present golden opportunity and grasp for temporary very high prices and, in some cases, for a commodity which may not be of the best grade, or we might utilize the present opportunity in such a way as to profit this year and in the future as well. Neither should "ability of the consumer to pay" nor "costs of production" be ignored completely. They are both important factors. A knowledge of costs in the garden and costs in the marketing process, together with a knowledge of consumers' income and of the general market situation are indispensable for a wise pricing policy. Seeking exorbitant prices under present conditions would deprive many prospective consumers from enjoying California dates and might even go so far as to retard movement into the market, thereby causing a carryover which is always an important price-depressing influence. On the other hand, using low prices as the only tool with which to secure volume has many undesirable effects. It reduces income to growers. It tends to shift atten-

tion from other effective devices for expanding consumption. As a matter of fact, during times such as these when consumers' incomes are high, these lower prices to the producer may not even be passed on to the consumers, thus not expanding consumption.

Again I wish to recommend the careful reading of the remarks made by those who have spoken this afternoon, keeping in mind the timeliness of the remarks in the light of the present economic situation in which the California industry finds itself. You have been advised to utilize this golden opportunity effectively. I believe it is sound advice and I believe you will follow it.