California Avocado Society 1974-5 Yearbook 58: 60-65

AN EVALUATION OF AVOCADO PLANTINGS IN THE SANTA ROSA HILLS OF RIVERSIDE COUNTY

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The Santa Rosa Hills of Riverside County are being developed at a rapid pace. By the time it's over, there will be around 4000 acres of avocados where once only native shrubs existed. The Santa Rosa Hills lie just north of Fallbrook and are part of the same mountain range but at a slightly higher elevation. A great deal of preliminary study was done to determine the suitability of the area. Soil types were thoroughly analyzed and charted, and only those of the well-drained type are being planted. All weather data available for the area was gathered and evaluated. Because of the importance of this development to the avocado industry of California, and in particular to Riverside County, I felt a need to do an evaluation of my own with regards to potential production of trees in this locale. The basis of the evaluation was to directly compare conditions in the Santa Rosa Hills to those of an established area known for above average avocado production. The area was due south, Fallbrook.

Aside from suitable soil and availability of water, temperature is the most limiting factor in growing avocado trees that will produce. There are two main considerations for temperature. Most important is to have minimum temperatures that do not go much below 30°F. on a yearly basis; the second, average or mean day-night temperatures during the blooming period. It was with these two considerations in mind that all weather data from the Santa Rosa Hills was studied in comparison to available weather data from the weather station for the University of California Agricultural Extension, San Diego County, located in the Fallbrook area. This Fallbrook weather station is and has been located at excellent producing orchards that were considered frost free. It was hoped that all comparisons could be made back as far as December 1968, the time of the industry's most recent major freeze. The only station in the Santa Rose Hills located near the acreage being developed for avocados that had data back this far was located in an abandoned lemon grove off the De Luz Road. Its elevation was 1360 ft. at the base of a hill which dropped to 1290 ft. elevation at the immediate canyon floor. The terrain formed a slight basin. Visual observation would suggest moderate to poor air drainage. The area surrounding the station is rather flat. This would be one of the last areas considered for development. It would probably be planted to grapefruit, one of the more cold hardy commercial citrus.

Comparing minimum temperatures for this station back to 1968 freeze dates, the Santa Rosa station had temperatures of 22° and 24° for Dec. 21 and 22 respectively. The orchard in Fallbrook had 24° reading for Dec. 21 with no recordings for Dec. 22. This 2° difference is not too significant, considering the location of the Santa Rosa station and the fact that all the avocado acreage planted and being planted is located in warmer

areas. 98% of these areas are tops and sides of hills that have air drainage down through major canyons. The other 2% is on excellent soil at the bottom of hills, but not canyon bottoms. The lowest that trees are planted is at elevations higher than the tops of the oak trees growing in the canyon bottom. The air drainage should still be good. I would suspect problems only in freeze years such as 1968 for this 2%. Temperatures from the new stations established in 1970 in the Santa Rosa Hills are much more favorable. Temperature station SR-7, on one of the most marginal areas being developed had, as its lowest reading since Dec. 1970, 27° on Dec. 29, 1971. The next coldest was 28° on Jan. 22, 1972. .The Fallbrook station, for the same period, had lows of 28° on Jan. 6, 1971 and 27° on the 27th. The lowest temperature at this marginal Santa Rosa station (SR-7) for Jan. 1971 was 30°. Overall, the designated areas of the Santa Rosa Hills compare favorably with the ideal locations of Fallbrook.

BLOOM TEMPERATURES: The second consideration, as mentioned, is for temperatures during bloom. According to Dr. B. O. Bergh, noted avocado geneticist for the University of California, Riverside, the daily mean temperature is what determines fruit set, not maximum or minimum temperatures. The mean is the average of the daily maximum and minimum temperatures. With daily means below 55°F. the tree opens a few flowers. Between 55-60° the trees bloom but there is very little fruit set. Daily means above 60° are necessary before much fruit will set; and means above 65° give the best fruit set. It is also felt that at least two consecutive days with means above 60° must occur before fruit will set. Naturally, pollination is required for fruit set but is not possible if the weather isn't right. With these considerations as guidelines, temperatures for the marginal Santa Rosa Hills station were compared to those of the U.C. Fallbrook station. Daily mean temperatures were determined for each area during February, March, April and May for the years 1968-1974. All days with means above 60° were recorded for each month for both stations. The same was done for daily means above 65°. In addition, all periods of two or more days with means above 60° and 65° were recorded. These monthly tabulations were then correlated to subsequent production of the avocado industry for the respective years; i.e., bloom temperatures for Feb., March, April and May 1968 are associated with the fruit harvested from Fall 1968 through summer 1969. When compared to the Fallbrook data, a direct relationship was revealed. Each year with several days of mean temperatures above 60° had good production for that crop year. The poorest production year, 1971-72, had the fewest daily means above 60° during the bloom period months. The second highest production year, 1972-73, had the most daily means above 60°. 1974-75 is projected to have the largest crop in history. This is due partly to an adequate number of mean temperature days above 60° but it is also the first year to show the influence of increased avocado acreage.

This author hesitated to include the first 5 years (1968-72) of bloom period temperatures for the Santa Rosa Hills because the weather station was not located in an area typical of those being developed in the Santa Rosa Hills. As you will observe from reading the charts, there are great differences between the two areas for those first five years. In September 1972 the Santa Rosa station was moved to a more typical developing area. The figures suddenly coincide more directly to those of Fallbrook. The reason I include

the figures of the first five years was to illustrate that even the marginal areas of Santa Rosa Hills have moderate production potential.

	FALLBROOK	SANTA ROSA HILLS	IND. PROD. TOTAL LBS.
1968	Daily Mean Temperatures	Daily Mean Temperatures	1968-69
Feb.	13 days above 60°	3 days above 60°	
	4 days above 65°*		
	one 3-day period above 60°	one 3-day period above 60°	
	one 5-day period above 60°		
	one 3-day period above 65°		
March	10 days above 60°	1 day above 60°	
	2 days above 65°		
	one 4-day period above 60°		
April	18 days above 60°	1 day above 60°	
	3 days above 65°		
	one 8-day period above 60°		
	one 9-day period above 60°		
	one 3-day period above 65°		
May	21 days above 60°	11 days above 60°	
	11 days above 65°	2 days above 65°	
	one 4-day period above 60°	one 4-day period above 60°	
	one 16-day period above 60°	one 6-day period above 60°	
	one 4-day period above 65°	one 2-day period above 65°	
	one 7-day period above 65°		
Total Days Above 60°—62		16	122,200,000
1969			1969-70
Feb.	0 days above 60°	0 days above 60°	
March	3 days above 60°	2 days above 60°	
April	4 days above 60°	4 days above 60°	
		one 3-day period above 60°	
May	+22 days above 60°	23 days above 60°	
		1 day above 65°	
	one 20-day period above 60°	one 21-day period above 60°	
Total Days Above 60°—29		29	66,000,000

*The days with mean temperatures above 65° are included in those counted above 60°.
+Some approximations due to unrecorded data. Made according to actual recordings for other station.

	FALLBROOK	SANTA ROSA HILLS	IND. PROD. TOTAL LBS.
1970	Daily Mean Temperatures	Daily Mean Temperatures	1970-71
Feb.	6 days above 60°	0 days above 60°	
	1 day above 65°		
	one 4-day period above 60°		
March	0 days above 60°	3 days above 60°	
April	5 days above 60°	1 day above 60°	
May	+22 days above 60°	17 days above 60°	
	5 days above 65°	6 days above 65°	
	one 4-day period above 60°	one 4-day period above 60°	
	one 9-day period above 60°	one 8-day period above 60°	
	one 9-day period above 60°	one 5-day period above 65°	
	one 5-day period above 65°	(4 days were 96, 99, 100, 98)	
Total Days Above 60°—33		21	129,200,000

1971	0 days above 60°	4 days above 60°	1971-72
Feb.		1 day above 65°	
		one 4-day period above 60°	
March	0 days above 60°	5 days above 60°	
		1 day above 65°	
April	+4 days above 60°	9 days above 60°	
	2 days above 65°	3 days above 65°	
May	2 days above 60°	10 days above 60°	
		3 days above 65°	
		one 8-day period above 60°	
		one 3-day period above 65°	
Total Days Above 60°—6		28	55,200,000

1972	Daily Mean Temperatures	Daily Mean Temperatures	1972-73
Feb.	7 days above 60°	2 days above 60°	
March	+13 days above 60°	5 days above 60°	
	2 days above 65°	2 days above 65°	
April	+17 days above 60°	4 days above 60°	
	one 4-day period above 60°	1 day above 65°	
May	28 days above 60°	16 days above 60°	
	15 days above 65°	7 days above 65°	
	one 11-day period above 60°	one 8-day period above 60°	
	one 17-day period above 60°	one 6-day period above 60°	
	one 4-day period above 65°	one 3-day period above 65°	
	one 11-day period above 65°	one 5-day period above 65°	
Total Days Above 60°—65		27	134,917,419

1973		Santa Rosa Station is now located in a typical avocado development area.	1973-74
Feb.	+2 days above 60°	0 days above 60°	
March	0 days above 60°	0 days above 60°	
April	+5 days above 60°	5 days above 60°	
May	21 days above 60°	19 days above 60°	
	4 days above 65°	6 days above 65°	
	one 3-day period above 60°	one 8-day period above 60°	
	one 15-day period above 60°	one 5-day period above 60°	
	one 3-day period above 65°	one 3-day period above 65° (one day was 99°)	
Total Days Above 60°—28		24	95,000,000

1974	Daily Mean Temperatures	Daily Mean Temperatures	1974-75
Feb.	5 days above 60°	6 days above 60°	
	2 days above 65°	2 days above 65°	
	one 2-day period above 60°	three 2-day periods above 60°	
March	4 days above 60°	6 days above 60°	
	2 days above 65°	2 days above 65°	
	one 2-day period above 60°	one 4-day period above 60°	
April	13 days above 60°	12 days above 60°	
	5 days above 65°	5 days above 65°	
	one 5-day period above 60°	four 2-day periods above 60°	
	one 3-day period above 60°	one 4-day period above 60°	
	one 2-day period above 60°		
May	15 days above 60°	23 days above 60°	
	2 days above 65°	7 days above 65°	
	one 6-day period above 60°	one 12-day period above 60°	
	two 3-day periods above 60°	one 6-day period above 60°	
	one 2-day period above 60°	one 3-day period above 60°	
		one 2-day period above 60° (one day was 99°)	
Total Days Above 60°—37		47	188,000,000*

*Projection

Although Fallbrook temperatures are clearly more optimum for production during 1968-72, it is also evident that one of those years (1971) found the marginal Santa Rosa area to have almost five times more days with mean temperatures above 60°F. than the Fallbrook station. 1969 was a draw. Even though Fallbrook greatly outnumbered the Santa Rosa Hills in 1968, 70, and 71, the total daily means above 60° for these years were at least moderate in number (17, 21, 27) when compared to the poor Fallbrook year of 1971 (6 days above 60°).

As mentioned before, the 1973 and 74 figures reflect the Santa Rosa Hills station change to a more typical area. These figures show the Fallbrook and Santa Rosa Hills to be very similar in bloom period temperature. Fallbrook had four more days with means above 60° in 1973 but the Santa Rosa Hills had ten more days in 1974.

MAXIMUM TEMPERATURES: Temperatures can be too high during bloom also. With this in mind, the years 1970, 73 and 74 are noted for the Santa Rosa Hills. 1970 had a four-day period of maximum temperatures above 95°F. with a high of 100°. 1973 and 74 both had one day of 99°. It is felt that temperatures above 95° can influence young fruit drop but sudden temperatures above 100° are what can cause abnormal fruit drop. There are many considerations involved with high temperatures and fruit drop. We will not go into them here but I did want to note the maximum temperatures experienced in the Santa Rosa Hills because Fallbrook did not experience them. To my knowledge, no detailed study has been performed on this subject for avocados.

SUMMARY: Based on the last two years of weather data I theorize that the avocado production potential of those areas being developed in the Santa Rosa Hills is comparable to that of the ideal areas of Fall-brook. I also feel that marginal areas of the Santa Rosa Hills which are not presently in the development plan are suitable to moderate avocado production. Temperature figures during the bloom period for these marginal areas suggest that alternate bearing would not occur as often. This is a reflection of the stable number of days with mean temperatures above 60°F. from one year to the next. I will elaborate on this possibility a bit more if and when planting begins in these areas.