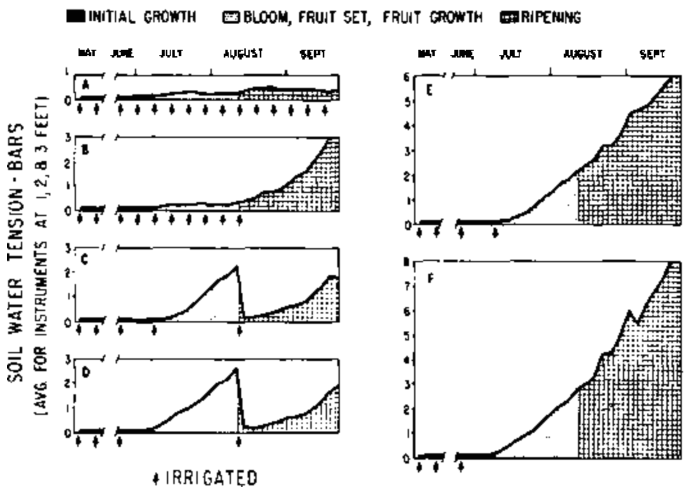
Graph 1. Average soil moisture tensions reached in the top 3 ft of soil under the different irrigation regimes on VF-13L tomatoes. The arrows along the bottom of each graph indicate when each treatment was irrigated.



Frequent Irrigation For Mechanically-TOMATOES

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FREQUENT IRRIGATION, the usual management practice in the production of hand-picked tomatoes, is not necessarily best suited for the new varieties developed for one-time mechanical harvesting. In addition to the need for determinate maturity, dry fields allow much more efficient operation of mechanical harvesting equipment. These studies were conducted to determine how dry the soil can become before affecting yield, maturity, and soluble solids content of the new varieties—and whether a plant or soil moisture index can be developed as a guide to irrigation of the growing crop, as well as the final water cutoff date. Research has previously shown that irrigation practices do affect the relative maturity of the crop and can directly influence yields obtained in a single harvesting operation.

Over half of the processing tomatoes grown in California are concentrated into some product such as catsup or paste. Therefore, tomatoes with a high solids content are desirable. Over the years, the solids content of tomatoes has gradually declined, as growers have increased their average yields per acre through heavy fertilization and frequent irrigation. The lower solids content of tomatoes has required increased energy to concentrate the tomatoes with resulting increases in processing costs. Previous research showed that tomatoes had a higher solids content when high soil moisture tensions were allowed to develop prior to harvest. The question of whether solids can be increased by irrigation management without a concomitant decrease in yield remained unanswered.

This experiment was conducted on Yolo loam soil at Davis with the variety VF-13L. Planting was done on May 7 in 54-inch rows, and 10 gallons per acre of 8-24-0 liquid fertilizer were applied 2 inches below the seed. Enough ammonium sulfate to bring the total actual nitrogen application to 80 lbs per acre was sidedressed on the crop just prior to thinning. Plants were thinned to 12 inches apart in the row when they had about five true leaves.

All plots were irrigated alike at planting time (May 7), again one week after planting, and then just after thinning (June 24). These irrigations totaled approximately 20 acre-inches. The following differential irrigation program was then carried out:

DATES OF IRRIGATIONS* IRRIGATION TREATMEINTS

	A	B	C	D	E	F†
			(inches applied)			
July 1	2	2				
" 8 (early bloom)	"	"	4		4	
" 15	"	"				
" 22	"	"				
" 29	"	"				
Aug. 5	"	"				
" 12 (first pink fruit)	"	"	14		14	
" 19	"					
" 26	"					
Sept. 2	"					
" 9	"					
" 16	"					
Total depth applied	24	14	18	14	4	0
Total number of irrigations	12	7	2	1	1	0

* Table includes only irrigations applied following irrigation at thinning time.
† Irrigated only at time of thinning.

Treatment A provided 2 inches of water per week until six days prior to harvest; B provided 2 inches of water per week until the first pink fruit appeared; C was irrigated during early bloom (when the third flower cluster opened) and for the last time when the first pink fruit appeared; D was irrigated only when the first pink fruit appeared; E was irrigated only during early bloom; and F was irrigated for the last time at thinning.

Soil moisture tension was determined by using gypsum blocks at two sites in the plant rows of treatments C, D, E, and F at depths of 1, 2, and 3 ft. Tensiometers were placed in the plant row in treatments A and B at depths of 1, 2, 3, and 4 ft with one instrument station per plot. Gypsum blocks were also installed in treatment B to continue recording soil moisture tension after the last irrigation.

Graph 1 shows the average soil moisture tension reached in the top 3 ft of soil at different stages of growth. During vegetative growth and up to the first pink

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Detrimental

Harvested

fruit, soil moisture tensions in treatments A and B remained below .35 bar; while over this same period, tensions in other treatments reached 2 to 3 bars. Subsequently, tensions remained below .35 in treatment A; ranged from 2 to 3 bars in treatments B, C, and D; and reached values of 6 in treatment E and 8 in treatment F.

The effects of the irrigation treatments on the relative maturity of the crop are summarized in graph 2. After harvesting all of the fruit in a portion of the row, it was sorted into canning ripe, pink, green, and/or rotten fruit. Data given in this graph were calculated as per cent of the total weight of the fruit from each plot. Almost 70% of the fruit was ripe at harvest in treatment F which was irrigated last at thinning. With greater amounts of irrigation, there was a gradual reduction in the percentage of ripe fruit. On the very wet treatment, less than 40% of the total fruit on the vine was ripe when the plots were harvested.

The influence of irrigation on yield harvestable by mechanical picking is shown more clearly in graph 3. Both the single-harvest yield and the potential yield (if all green fruit had been allowed to ripen and had been harvested) are given. This graph indicates that if the crop is mechanically harvested in one operation, there are no significant differences in yield, except for the one treatment irrigated very frequently until harvest. Frequent irrigation reduced the harvestable yield significantly (because of the marked delay in maturity) but increased the potential yield. In comparing the potential yield against the yield which can be taken in a single harvest, it should be recognized that a considerable portion of the potential yield (often associated with more frequent irrigation) is often lost, even when the crop is harvested by hand in several pickings because of the frequent occurrence of early fall rains or frost.

The table shows the effect of various treatments on soluble solids, total solids, and the calculated yield of salt-free solids per acre. The soluble solids content of the fruit was determined on samples drawn from the canning ripe fruit by the Abbe refractometer. These values were converted into total solids content from suitable tables. As the mean soil moisture tension was allowed to increase prior to harvest, the soluble solids content and the total solids were increased by the same relative amounts. These data were used to calculate the yield of edible solids and juice in pounds per acre (based on 400 gallons of juice per ton of ripe fruit). The relatively dry irrigation treatments (E and F) produced the highest yield of total edible solids per acre. One or more irrigations during the six weeks prior to harvest reduced both the percentage of solids and the yield per acre of edible solids.

This experiment suggests that the yield of tomatoes grown for mechanical harvest may be increased by changing irrigation management practices from those used with previous varieties which were hand-harvested. However, these studies were confined to one trial on an open, deep soil in plots at Davis which offered no restriction to the full development of the root system of the crop. Before these results can be applied to a wide range of growing conditions, they need to be tried on several soil types. These studies will be continued this year over a wider range of growing conditions in the Central Valley tomato-growing districts.

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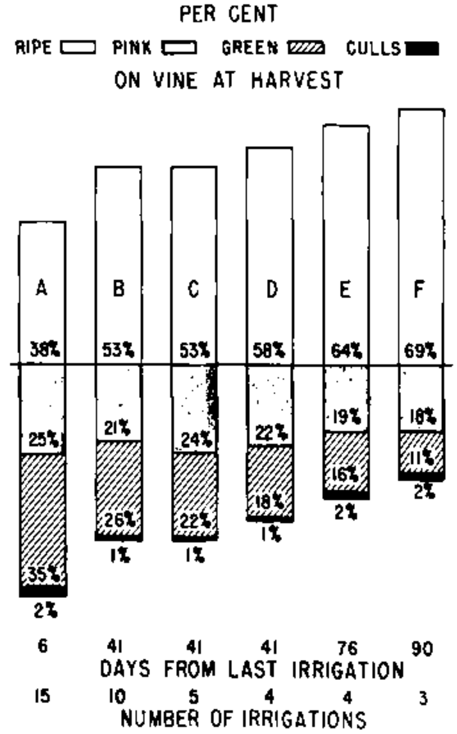
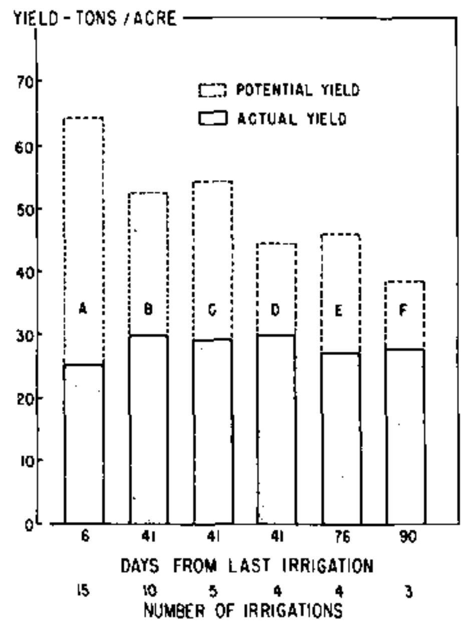
Graph 2. Effect of irrigation on relative maturity of VF-13L tomatoes.



Graph 3. Effect of irrigation on single-harvest yield and on potential yield of VF-13L tomatoes.



EFFECT OF IRRIGATION ON PER CENT SOLUBLE, TOTAL SOLIDS, AND EDIBLE SOLIDS CONTENTS OF TOMATOES PRODUCED PER ACRE

Treatment no.	Water applied after thinning	Irrigation cut-off before harvest	Solids content: Soluble	Solids content: Total	Yield: Juice	Yield: Edible solids
	Inches	Days	%	%	Lbs/A	Lbs/A
A	24	5	3.96	4.26	42,420	1,807
B	14	40	4.31	4.61	50,809	2,342
C	18	40	4.42	4.72	49,643	2,343
D	14	40	4.29	4.59	45,881	2,106
E	4	75	5.02	5.32	51,515	2,741
F	0	90	5.27	5.57	47,603	2,651