THE INFLUENCE OF IRRIGATION UPON GROWTH AND YIELD OF STRAWBERRIES

ROY K. SIMONS
University of Illinois, Urbana

Responses of two varieties of strawberries growing under two levels of soil moisture were recorded for the growing seasons of 1956, 1957, 1958 and 1959 at the University of Illinois Agricultural Experiment Station, Urbana. Substantially virus-free plants of Howard 17 (Premier) and Vermilion strawberries were planted in the spring of 1955 to determine the effects of varied soil moisture levels upon yield and quality of the fruit under midwest growing conditions. Varietal responses, total yield, harvest periods, weight per berry, total number of berries per harvest, soluble solids and pH of the juice have been reported previously (Simons, 1958). The yield data compiled for harvest seasons of 1956, 1957, 1958 and 1959 were analyzed statistically by the methods of analysis of variance with all treatment comparisons made on an individual degree of freedom basis.

Soil Moisture Utilization by Strawberries. Soil samples were collected from the rows and row middles of each variety at the 1-3 and 6-8 inch depths for soil moisture evaluation by the gravimetric method. The irrigated plots were compared with the non-irrigated plots with a total of three replications for each sample observed. These plots were selected from the original planting that consisted of randomized complete blocks, with six replications intended to be low, medium and high in moisture levels for each variety. However, as a result of the amount and frequency of natural rainfall, the moisture levels were essentially non-irrigated and irrigated.

Additional water was applied to the irrigated plots of strawberries for five growing seasons when the upper 6-8 inches of the soil profile was below field capacity in moisture content (Table 1).

Table 1 shows such frequent applications of water that rainfall alone would have been insufficient for successful strawberry production. Soil moisture records at the two depths were similar for both varieties in each year. In some instances all the rain fell at one time and proper utilization of moisture by the plant was not possible. This is recorded in Figure 1 when rainfall was infrequent throughout the 1957 growing season. Response of berries to sufficient and insufficient moisture levels during the critical period of fruit bud formation in August, September and October was particularly evident in the foliage and in fruit production the following spring. The increase in yield for Vermilion in 1959 is attributed to the two applications of water in September and October 1958.

Figures 1, 2 and 3 show the rainfall and the soil moisture levels for irrigated and non-irrigated Vermilion plots at the 6-8 inch depths in the row during the 1957, 1958 and 1959 growing seasons. Shallow depths of 1-3 inches produced rapid fluctuations, but significantly higher

TABLE 1.—Amount of water applied to the irrigated plots of strawberries for five growing seasons.

Year	Amount of water applied (acre inches)	
1955	July 2	1.46
	Aug. 19	1.63
	Aug. 24-26	1.05
	Sept. 1-2	.94
	Sept. 6-9	.83
	Sept. 17	.97
1956	May 26	1.55
	June 6	1.08
	June 9	1.58
	June 13	.55
	July 2	.64
	Sept. 14	.86
	Oct. 12	1.04
1957	May 18	2.44
	May 26	2.25
	May 29	1.58
	June 26	1.11
	July 12	1.21
	Aug. 1	1.03
	Aug. 2	1.23
	Aug. 9	1.42
	Aug. 16	1.90
	Aug. 23	1.80
	Sept. 6	.87
	Sept. 17	1.56
1958	Sept. 12	1.50
	Oct. 22	1.61
1959	May 7	1.96
	June 5	1.77
	June 19	1.98
	June 26	1.60
	June 29	1.53
	July 6	3.21
	July 16	2.41
	July 23	2.98
	Aug. 7	3.14
	Sept. 9	2.03

TABLE 2.—Yield (quarts/acre) of Howard Premier and Vermilion strawberries, 1956, 1957, 1958 and 1959, as affected by irrigation.

Year	Variety	Non-irrigated	Irrigated	% increase
1956	Howard Premier	7,230	8,885	22.8
	Vermilion	7,492	10,192	26.7
1957	Howard Premier	5,706	6,511	14.1
	Vermilion	6,141	7,644	24.5
1958	Howard Premier	5,818	6,378	9.6
	Vermilion	5,538	8,167	47.4
1959	Howard Premier	4,556	4,686	2.8
	Vermilion	6,639	7,518	13.2

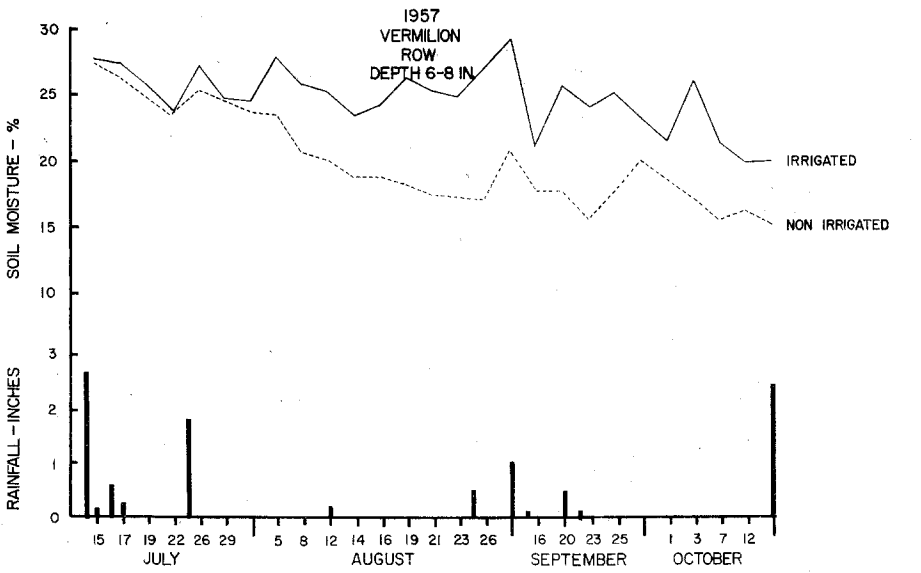

Fig. 1.—Soil moisture in the row at 6-8 inch depth for Vermilion—irrigated vs. non-irrigated, 1957.

moisture content was retained in the irrigated plots. However, when the soil moisture at the 1-3 inch depth was compared with that at the 6-8 inch depth, there was a general tendency for the 6-8 inch depth to have a higher soil moisture content throughout the growing season.

Since the Vermilion berry responded significantly to additional water, the levels of natural soil moisture supply would have to be classified as insufficient for plant performance. For example, a 47.4% increase in yield was accomplished in 1957 by adding irrigation water. The plants that were not irrigated did not produce sufficient runners for commercial production of strawberries.

During the 1959 harvest season, it was observed that Vermilion increased 13.2% when water was applied and Howard Premier by only 2.8% (Table 2). The soil moisture trends for the 1958 season show that Vermilion was in the deficit moisture range during early September through October at a critical time when fruit buds were developing. The increased yield of Vermilion from the irrigated plots in 1959 was an indication of this deficiency.

The 1959 data show the effects of adding supplemental water to these strawberry plots (Fig. 3). The soil moisture was in the deficit range from early June throughout the remainder of the growing season. Field observations of these plants show that they were low in vigor; little or no runner production was made after renovation in June.

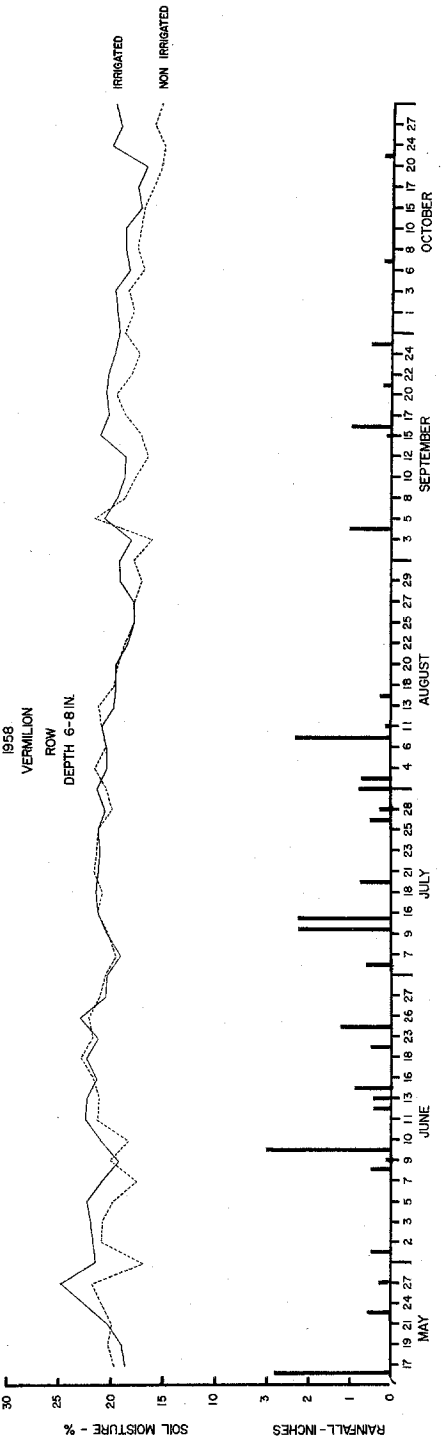

Fig. 2.—Soil moisture in the row at 6-8 inch depth for Vermilion—irrigated vs. non-irrigated, 1958.

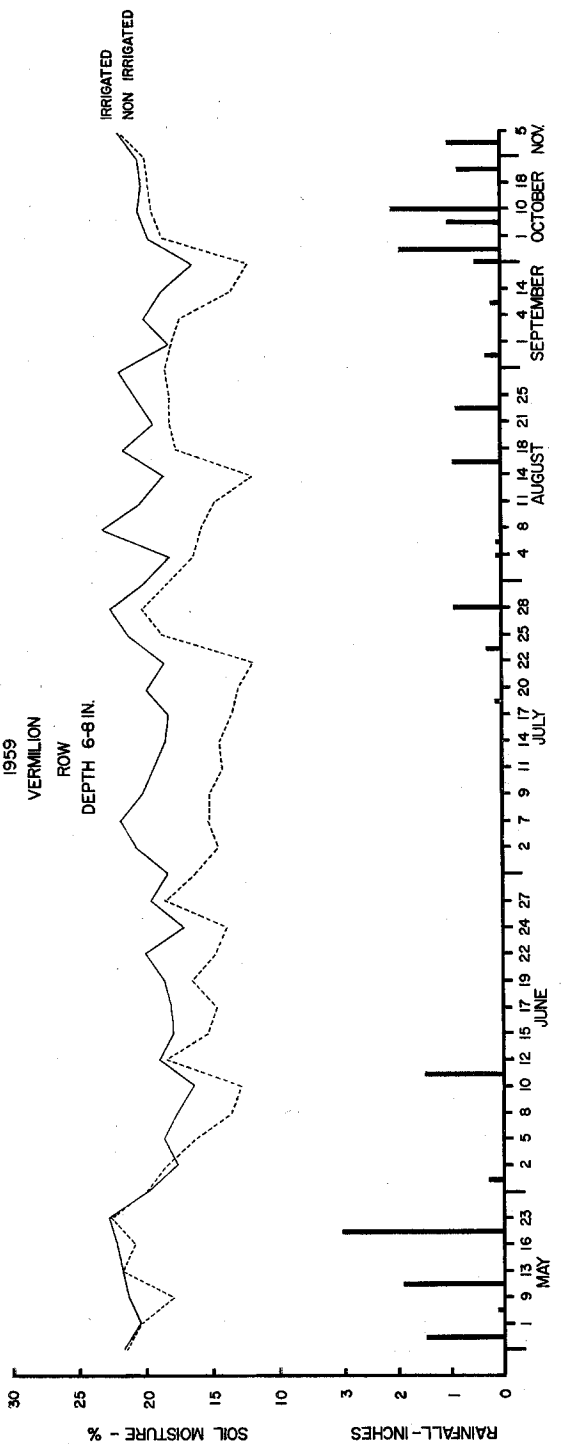

Fig. 3.—Soil moisture in the row at 6-8 inch depth for Vermilion—irrigated vs. non-irrigated, 1959.

TABLE 3.—Average berry weight (grams) of Howard Premier and Vermilion strawberries, 1956, 1957, 1958 and 1959, as affected by supplemental irrigation.

Variety	Non-irrigated				Irrigated			
	1956	1957	1958	1959	1956	1957	1958	1959
Howard Premier	6.43	5.90	5.75	5.45	6.04	5.56	6.96	5.42
Vermilion	6.95	6.86	7.83	7.56	6.61	6.83	8.90	7.37

TABLE 4.—Average berry weight (grams) of Howard Premier and Vermilion strawberries for three harvest seasons of 1957[1], 1958[2], and 1959[3].

Period	Variety					
	Howard Premier			Vermilion		
	1957	1958	1959	1957	1958	1959
1	7.8	9.0	8.4	9.7	12.9	12.6
2	5.7	6.6	6.0	6.7	8.0	7.7
3	3.5	3.7	3.0	4.2	4.7	3.5

[1] Period 1. Pickings 1 & 2. Period 2. Pickings 3, 4 & 5. Period 3. Pickings 6 & 7.
[2] Period 1. Pickings 1 & 2. Period 2. Pickings 3, 4, 5, & 6. Period 3. Pickings 7 & 8.
[3] Period 1. Pickings 1 & 2. Period 2. Pickings 3 & 4. Period 3. Pickings 5 & 6.

Yield Response for Four Harvest Seasons. Data from the four experimental years showed significant increases in total yield for the berry plots that received supplemental moisture. Total yield for the harvest seasons of 1956, 1957, 1958 and 1959 is shown in Table 2.

The yield for 1956 and 1957 showed a marked response to the application of supplemental water. A highly significant response was noted in both varieties between the non-irrigated and irrigated plots in 1956 and 1957. For 1958, Vermilion responded with a 47.4% increase when additional water was applied. Again, a significantly greater response to irrigation was recorded by Vermilion than by Howard Premier in the 1959 harvest season. It is evident that each variety responded significantly to irrigation, but greater increases were noted for Vermilion. The interaction between irrigation and varieties was statistically significant.

Total weight of fruit harvested for the four harvest years was significantly greater from plants where supplemental irrigation had been applied during the preceding grow-

ing season. Distinct differences were recorded between the two varieties, Vermilion significantly yielding more than Howard Premier in all the treatments.

Average berry weight is of considerable importance in successful strawberry production. The data in Table 3 show the differences between Howard Premier and Vermilion varieties of berries for the harvest seasons of 1956, 1957, 1958 and 1959.

Irrigation did not have any effect upon size of the berries for the 1956 and 1957 harvest seasons but there was a response for 1958. This may be explained by the lack of water in August, September and early October of the preceding year at the time of fruit bud formation. This is a carry-over effect of the additional water that was applied during October 1957 when severe drought conditions occurred. The contributing factor for increased yields in response to irrigation was the greater fruiting potential as a result of an increased number of fruit buds following application of additional water the preceding year.

Definite differences in berry size are recorded between these two varieties. Vermilion produced the largest berry under both conditions each year. Comparisons of the two varieties during the three picking periods for 1957, 1958 and 1959 are shown in Table 4.

The data in Table 4 show that the Vermilion variety maintained larger berries than Howard Premier throughout the harvest periods during the three years they were studied. Less effort was expended in the harvesting and a higher price could be expected in marketing the fruit. This shows how important it is to choose a variety that will maintain berry size throughout the harvest season. Berry size for period 3 as recorded in Table 4 is not commercially feasible as the berries are too small for a profitable return.

The number of berries produced is not indicative of the size of the yield. Under desirable moisture conditions (the irrigated plots), Howard Premier produced the most berries for 1956 and 1957 but did not equal Vermilion in berry size or in number of quarts. However, for 1958, Vermilion produced more berries as well as larger berries and the greater number of quarts.

Summary

Howard 17 (Premier) and Vermilion strawberries were studied for four harvest seasons in order to determine the effects of varied soil moisture levels upon yield and quality of the fruit. Responses for each variety were recorded, including total yield, harvest periods, weight per berry and total number of berries per harvest.

Rainfall was too infrequent for successful strawberry production. Supplemental moisture applied during critical periods of fruit bud formation resulted in significant yield increases. Soil moisture at the 6-8 inch depth was greater and persisted longer for more effective plant growth than relying on the moisture content at the 1-3 inch depth.

Both varieties of strawberries produced significantly higher yields when irrigated. The irrigated plots produced berries of greater size. Yields were greater for Vermilion

than for Howard Premier. When supplemental moisture was applied at necessary intervals, the Vermilion berry produced good commercial yields and the berries were larger than Howard Premier throughout the harvest season.

Literature Cited

Simons, Roy K. 1958. Response of Howard Premier and Vermilion varieties of strawberries to supplemental irrigation. Proc. Amer. Soc. Hort. Sci., 71: 216-223.

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