IRRIGATION STUDIES WITH SWEET CORN, CABBAGE AND SNAP BEANS AT GAINESVILLE

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The practice of irrigation originated about the same time as man and at the same place, in the Garden of Eden, according to Genesis 2:10. Since that time man has realized the value of irrigation and has built his communities, cities and even nations in areas where water could be secured for the irrigating of his crops. Despite the fact that the State of Florida has an annual precipitation of 52 inches of rainfall its distribution is such that growers are aware of the need for irrigation. This is evidenced by the large acreage of vegetables being produced on land where provisions have been made for the addition of water by many methods of application.

An experiment was started at Gainesville in 1945 to determine the effectivness of irrigation in improving the yield and quality of vegetables. The experimental plots were located on Arredonda loamy sand with the soil having some variations in moisture equivalents. Individual plots were approximately 1/24 acre in size with sufficient aisle space to prevent the overlapping of the several irrigation treatments. A temporary sprinkler irrigation system was used the initial year of the experiment but was replaced after that year by a permanent overhead sprinkler irrigation system. The latter system consisted of an oscillating nozzle on a single upright for each individual plot.

Sweet corn was grown as a spring crop the initial year on replicated plots irrigated with the temporary system and cabbage and snap beans have been grown as winter and spring crops respectively on the replicated plots irrigated with the permanent system for the past two years. Moisture treatments given the vegetables were: (1) no irrigation; (2) light irrigation to maintain the soil moisture above the point where permanent wilting would occur; (3) heavy irrigation or twice the amount applied in the light irrigation treatment to maintain the moisture nearer the moisture holding capacity; (4) the same amount of water as applied in the heavy irrigation treatment but divided into two applications three days apart. Due to operating difficulties the split treatment was not applied to plots planted to sweet corn during the first year of the experiment.

The timing of irrigation applications was made on a weekly schedule with sweet corn. The time for irrigating cabbage and beans during 1946 was determined from visual observations of the vegetables and soil for signs indicating the need for water. Soil moisture determinations were also made to check these observations. However, the following year an evaporimeter was employed to assist in determining the time for application of irrigation water. An attempt was made to irrigate the vegetables after 1 inch of water had evaporated from an open tank which was 48 inches in diameter and 10 inches deep. Soil moisture determinations were made as a further check prior to each irrigation.

The amount of water applied at each individual irrigation has varied from year to year. All sweet corn plots received water at the time of planting to assure germination and after that irrigation one set of plots received no additional water until after the first harvest was made. The plots receiving the light irrigation treatment received 1/2 to 3/4 inch of water each week, while the heavy irrigated plots received twice this

amount. The amount of water applied to cabbage and beans in the winter and spring of 1946 varied from 1/4 to 1/2 inch per individual application to plots receiving the light amount of irrigation. Twice this amount was applied as individual application to plots receiving the heavy amount of irrigation. The amount of each individual application was increased for cabbage in the winter and beans in the spring of 1947. The four moisture treatments were made by applying the following approximate amount of water respectively for each treatment at the time of irrigation: (1) no water; (2) 1/2 inch of water; (3) 1 inch of water; (4) 1 inch of water divided into two applications of 1/2 inch of water separated by approximately three days.

Experimental plots planted to sweet corn were divided to test the effect of irrigation on two varieties of sweet corn, Golden Cross Bantam and Illinois Golden 10. The plots were further divided to permit the study of a spacing test using the variety Illinois Golden 10, which was planted at spacings of 24 and 30 inches between hills in the seed row.

During the two winter seasons the experi-

TABLE 1.—Comparative Precipitation Records for the Period of the Irrigation Studies

Month	Inches of Rainfall	
	Measured Precipitation	Normal Precipitation
	Sweet Corn 1945	
March	Trace (1)	3.35
April	4.28 (1)	2.40
May	2.72 (1)	3.15
	Cabbage 1945-46	
November	2.00 (1)	1.82
December	9.22 (1)	3.21
January	2.21	3.16
February	2.53	2.92
	Beans 1946	
March	2.55	3.35
April	1.88	2.40
May	7.22	3.15
	Cabbage 1946-47	
November	.01 (2)	1.82
December	.23	3.21
January	1.55	3.16
February	4.34 (3)	2.92
	Beans 1947	
March	4.76 (4)	3.35
April	1.93	2.40
May	.09 (5)	3.15

(1) Weather Bureau Records, Gainesville, Station.
(2) Measured only from Nov. 21 to Nov. 30.
(3) Measured only from Feb. 1 to Feb. 15.
(4) Measured only from March 12 to March 31.
(5) Measured only from May 1 to May 12.

mental plots were planted to cabbage, the individual plots were divided into three equal sections to permit the study of a sub-treatment dealing with the application of nitrogenous fertilizer. These fertilizer sub-treatments were: (A) 1,600 pounds of an 8-7-5 fertilizer per acre; (B) 1,600 pounds of a 4-7-5 fertilizer per acre plus additional nitrogen in the form of two side dressings each of 200 pounds of nitrate of soda; (C) 1,600 pounds of a 4-7-5 fertilizer. All fertilizer, except the side dressings, were applied at planting time. Copenhagen Market, variety of cabbage, was planted in 1946 and Glory of Enkuizen in 1947.

Two varieties of snap beans were planted each year that beans were grown, Florida Belle and Logan in 1946 and Stringless Black Valentine and Logan in 1947. In 1946, each of the two varieties used were planted at two spacings. One spacing was at the regular rate recommended with the bean planter employed which was approximately 8 seed per foot of seed row. The second spacing tested was at a lighter rate of approximately 6 seed per foot of seed row, causing a wider spacing between plants. All bean plots received the same fertilizer treatment for the two years which consisted of 1,200 pounds of a 4-7-5 fertilizer per acre. An additional side dressing of nitrogen and potassium was given the beans in 1947.

Results

Normal precipitation (1) is compared in Table 1 with the measured precipitation for the several seasons in which the tested vegetables were grown. Precipitation in the spring of 1945 was lower than normal while in the winter and spring of 1946 it was close to normal. The precipitation recorded in the winter and spring of 1947 was again lower than normal. Because of the distribution and amount of natural rainfall the number of irrigations varied with the individual crop and season. The amount of irrigation water applied to cabbage and beans is given in Table 2.

Sweet Corn.—Yields were greatly affected by irrigation as shown in Table 3. The average yields from the first harvest show that the plots receiving the heavier amounts of irrigation produced approximately 10 times the corn as produced from the plots receiving no irrigation. Yield of corn from plots receiving the light irrigation were a little more than half that harvested from the heavy irrigated plots. Illinois Golden 10 produced the highest yield of corn and with that variety the 30 inch spacing produced more corn at the first harvest than that spaced at 24 inches. It is interesting to note the increase in the yields of the sweet corn after irrigation was applied to all treatments after the first harvest. The yield from the

TABLE 2.—Number of Inches of Irrigation Water Applied to Cabbage and Snap Beans

Year	Crop	Irrigation Treatment		
		Light	Heavy	Soil Application
1945-46	Cabbage	1.12*	2.44*	2.11*
1946	Beans	1.40	2.84	1.80
1946-47	Cabbage	3.04	5.41	4.89
1947	Beans	3.50	7.04	6.52

*Initial irrigation at planting not included.

previously non-irrigated plots increased greatly but the plots irrigated throughout the entire season produced the larger yields.

Cabbage.—The data in Table 4 shows the effects of irrigation and fertilizer treatment on the yield of cabbage. During the 1946 growing season in which the precipitation was close to normal there was little differences in the yield of cabbage as a result of irrigation treatment. Small increases in the average yield occurred on plots receiving the light and split application treatment of irrigation. The result of the 1947 season, which had less rainfall than normal, were more pronounced. Increases in yield were secured despite the fact that freezing weather near the end of the season prevented the normal heading of the cabbage and necessitating the harvesting of the cabbage at an immature stage. The highest average yield of cabbage for that season was harvested from plots irrigated by the split application treatment followed by the heavy and light irrigation treatments. The initital stand of cabbage was also affected in 1947 as a result of treatment and a larger number of cabbage replants were required on plots receiving no irrigation. A marked reduction in aphid infestation was observed on plots subjected to irrigation treatments.

Results from the fertilizer study reveal that the highest yield was secured in 1946 by side dressing the cabbage with additional nitrogen. In 1947, no large differences in yield were secured as a result of the fertilizer treatments.

Beans.—Irrigation was a factor contributing to the increase of bean yields for both years studied. The results of this study are given in Table 5 and show that the highest yield of beans secured in 1946 was harvested from plots irrigated with the split application treatment of irrigation. This yield was followed closely by that harvested from the plots irrigated with light irrigation treatment. During 1947, which was a much drier year, irrigation was again found to be effective in increasing the yield of beans. The highest average yield of 291.2 bushels per acre of snap beans was harvested from the plots receiving the split application treatment of irrigation, whereas those plots receiving no irrigation produced an average yield of 24.0 bushels of beans per acre. At an average price of two dollars per bushel for beans this would have meant a difference of $533 in the value of the crop grown under irrigation and that under natural rainfall.

From the data in Table 5 it can be ob-

TABLE 3.—Effect of Several Amounts of Irrigation on the Yield of Sweet Corn-1945

Variety	Spacing	Irrigation Treatment		
		Pounds Per Acre		
		No Irrigation	Light Irrigation	Heavy Irrigation
Golden Cross Bantam	24 in.	133.9	704.2	1283.0
Illinois Golden No. 10	24 in.	169.9	823.7	1370.9
Illinois Golden No. 10	30 in.	167.0	1137.6	2041.9
Total Average at First Harvest		156.9	888.5	1565.3
Total Average for *Entire* Crop		1332.5*	1967.0	2515.2

*Irrigation made to corn after first harvest.

served that all varieties of beans studied generally exhibited similar reactions to irrigation treatments. No differences between the varieties Logan and Florida Belle, were secured in 1946. Logan, however, did produce more beans than Stringless Black Valentine in 1947.

The spacing of the bean seed at the rate of 8 seed per foot produced a large yield of beans than those bean seed planted and spaced at a rate of 6 seed per foot of seed row during the 1946 season.

Summary

The yield of sweet corn, cabbage and snap beans was maintained at a high level by the use of irrigation. Large increases in yield may be expected in dry seasons from the use of irrigation and some increases may also be expected in seasons of near normal rainfall.

An even supply of moisture in the soil is essential for the best results with cabbage and beans as evidenced by the yields secured from these vegetables for the two seasons when irrigated with the split application treatment of irrigation. In periods of normal rainfall light irrigation appeared to be effective in maintaining the yield of cabbage and beans.

Results indicate that the spacing of the variety, Illinois Golden 10, at 30 inches gave increased yield over the 24 inch spacing in the dry season of 1945. Illinois Golden 10 in this season produced more corn than Golden Cross Bantam.

Side dressing of cabbage with additional nitrogen in the form of nitrate of soda appeared to be effective in increasing yields during the season with near normal precipitation.

Literature Cited

1. U. S. Department of Commerce. Weather Bureau. Florida Section. *Climatological Data*, *L*: 77, 1946.

TABLE 4.—The Effect of Several Irrigation and Fertilizer Treatments on the Average Yield of Cabbage

Fertilizer Sub-Treatments	Tons Per Acre				Average for Fertilizer Treatment to 1945-1946** 1946-1947
	Irrigation Treatment				
	None	Light	Heavy	Split	
8-7-5	5.03	5.87	5.13	5.19	5.31
4-7-5 plus side dressing	7.30	9,27	8.00	7.30	7.97
4-7-5	5.24	5.38	4.28	5.49	5.10
Average for Irrigation Treatments	5.86	6.84	5.80	5.99	
	1946-47 Season				
8-7-5	2.28	5.07	5.40	6.76	4.88
4-7-5 plus side dressing	2.28	5.31	6.06	6.46	5.03
4-7-5	2.49	5.34	5.86	7.08	5.19
Average for Irrigation Treatment**	2.35	5.24	5.77	6.77	

**F value highly significant.

TABLE 5.—THE EFFECT OF SEVERAL IRRIGATION TREATMENTS ON THE AVERAGE YIELD OF SEVERAL VARIETIES OF SNAP BEANS

	Yields of beans in bushels per acre				Average for Varieties 1946 and 1947*
	Irrigation Treatment				
	None	Light	Heavy	Split	
Florida Belle	153.3	168.5	153.6	174.0	162.4
Logan	138.9	180.2	154.3	178.4	162.9
Average for Irrigation Treatment*	146.1	174.3	153.9	176.2	
1947 Season					
Stringless Black Valentine	22.5	180.6	231.0	274.1	177.1
Logan	25.4	213.6	229.7	308.3	194.3
Average for Irrigation Treatment**	24.0	197.1	230.4	291.2	

*F value significant
**F value highly significant