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The Effects of Fertilizer and Moisture on the Yield of Sweet Corn

Rex F. Nielson

Utah State University

THE EFFECTS OF FERTILIZER AND MOISTURE ON THE YIELD OF SWEET CORN

by

Rex F. Nielsen

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INTRODUCTION

Sweet corn is rapidly becoming an important cash crop in many of the irrigated regions of the intermountain West. The income from this crop is relatively small in comparison to that from other major agricultural products; however, sweet corn production has a definite place in the economy of the region.

One of the factors limiting increased acreage of sweet corn in many areas is low yields. Yields have been increased materially in recent years with the development of hybrid varieties, superior to the standard varieties previously used. Better cultural practices are improving yields, but much remains to be done in this phase of the work.

Plant growth is affected by many complex factors, two of which are soil fertility and moisture. A considerable number of investigations have been carried out where either fertility or moisture effects have been studied independently. Few studies have been made where the two factors have been studied jointly in the same experiment. Recent trends in experimental research tend to emphasize the value of studying two or more factors at the same time, thereby making it possible to study interactions that otherwise would not have been observed.

This study was an attempt to determine the effects of various soil fertility and soil moisture levels on the yield of sweet corn. These factors were studied simultaneously. By studying the relationships that exist between moisture and fertility, it is theoretically possible to arrive at the optimum level for both factors, thus obtaining maximum yields.

Studies leading to the data reported in this paper were conducted on Nibley silty clay loam at the Utah State Agricultural College Forage Crops Experimental Farm near Nibley, Utah.

REVIEW OF LITERATURE

Fertilizer

Numerous investigations have been made concerning the fertilizer requirements of sweet corn. The results of these studies vary considerably, as would be expected, and many apply only to limited areas. The basic fertility level of a soil is the principal factor which determines whether or not a response will be found with any fertilizer treatment. Generally speaking, nitrogen is often the limiting factor affecting corn yields; however, phosphorus and potassium assume important roles in some areas.

Vittum (12) working in New York found that side dressing sweet corn with 37 pounds of nitrogen gave considerable increase in yield over plots not fertilized. He found that the increase in the yield was not due to a larger number of ears per plot, but to an increase in the size of ears. Richardson and Minges (8) in California found that nitrogen applied in bands materially increased ear size and yield. Their studies indicate 160 pounds of nitrogen induced the best yields. They observed no response when either phosphorus or potassium was applied as a fertilizer. In studies conducted in Ohio, Bushnel (2) found no significant response to phosphorus in a fertility trial that had been carried on over a 26-year period. The response to nitrogen was highly variable from year to year. Klein (5) at California noted sweet corn gave a response to nitrogen when 400 pounds of ammonium sulfate was applied. Metzger (6) at Maryland found that high amounts of nitrogen and potassium caused delayed maturity, excessive husk growth and multiple ear production.

Other investigators have found nitrogen gave no response, and in some cases exhibited a depressing effect on the yield of sweet corn. Prince and Blood (7) in New Hampshire observed no response when 40 pounds of nitrogen were applied per acre. This was partially attributed to lack of rainfall. The third year of their experiments when moisture was more favorable a significant response to nitrogen was observed. Huelsen and Gillis (4) at the Illinois station found that nitrogen had a depressing effect on yield when applied singly, but when paired with high rates of phosphorus, nitrogen promoted significantly higher yields. They also observed that phosphorus tended to hasten maturity.

Moisture

In studies on soil moisture Cordner (3) at Oklahoma found that irrigations after the silking stage gave increased yields of sweet corn. The results of his studies are listed below.

Number of Irrigations		Tons Per Acre	Wt. Per Ear
(1940)	7	6.45	.63
	4	6.23	.61
	3	5.05	.61
	0	4.94	.51
(1941)	3	4.69	.56
	2	3.88	.56
	1	3.28	.52
	0	2.67	.51

Bouyoucos and Mick (1) in their soil moisture studies with the gypsum block, found that when a soil exhibits 75,000 ohms resistance, plants can no longer obtain moisture from the soil.

When a resistance of 2,000 ohms is reached, 50% of the available moisture in the soil has been removed. At a resistance of 450 to 600 ohms the soil is said to be at about the moisture equivalent.

Russell, Davis and Bair (9) used tensiometers to follow the soil moisture conditions under sweet corn. Their results indicate that corn roots first absorbed moisture at a shallow depth directly beneath the corn hills. This was followed by lateral absorption occurring at successively lower depths. Bests results were obtained in following the soil moisture when tensiometers were placed diagonally between the hills of corn between the rows. This method would be impractical when corn is irrigated, because the instrument would be located in the irrigation furrow.

METHOD OF PROCEDURE

The corn was planted May 17, 1948 at the rate of 10.9 pounds per acre, the variety being Golden Hybrid 2439. The planter used was a standard 2 row type with rows spaced 36 inches apart. The distance between kernels in the rows varied from 4 to 12 inches, with 8 being the average. The seed was sown at a depth of 3 inches.

The seedbed had been fall plowed and was floated just before planting time. Moisture conditions of the soil were favorable for good germination.

Previous cropping history of the land consisted of alfalfa for several years prior to 1946 and barley in 1947. Soil analysis indicated 4 ppm CO_2 soluble phosphate, and 5 ppm nitrate nitrogen.

The experiment was so designed that differences in yield could be accurately tested statistically. The field was divided into 54 plots, each plot containing six rows 36 feet in length. The two outside rows of each plot were left as guard rows. The second rows in from either side of the plots were used for making rapid tissue tests, and in testing stage of maturity. The remaining two rows in the center of each plot were used for collecting yield data.

The 54 plots were divided into 3 replications consisting of 18 plots per replicate. Each of the 18 plots received a different moisture and fertilizer treatment assigned at random.

In order to determine the levels most reasonable in the utilization of fertilizer, six treatments were established. Nitrogen in the ammonium nitrate form was applied singly at 3 rates, 42, 99, and 136 pounds per acre. Two combination treatments were made, one consisting of 206 pounds of treble superphosphate plus 42 pounds of nitrogen and another of 206 pounds of treble superphosphate plus 68 pounds of nitrogen. The sixth treatment was a check and received no fertilizer.

The fertilizer was drilled close to the plants on both sides of the row to a depth of 4 inches. All rows in each treated plot were fertilized. The applications were made June 7th and 8th, when the corn was 6 to 8 inches high. A drill equipped with revolving cans was used to apply the fertilizer in bands at the side of each row. The rate of delivery is adjusted by changing gear ratios. This limits the number of rates that can be applied. The rates chosen were nearest to those desired and when calibrated were not exact multiples of 100 pounds.

In order to study the relationship between moisture and fertility, three moisture levels were paired with each fertilizer treatment. These three levels were designated as high, medium and low. It was desired that the medium moisture level would be near optimum in most cases, and that the high and low levels would be extremes.

The moisture content of the soil was measured by means of tensiometers and Bouyoucos blocks. These instruments were placed in the center of each plot in the yield rows. The tensiometers were placed at a 12-inch depth and the blocks at 12 and 24 inch depth. Tensiometers were used on the high and medium moisture plots, with blocks being used on the medium and low moisture plots.

The plots where high moisture was maintained were irrigated when the tensiometers registered 300 centimeters of water tension. Medium moisture plots were irrigated when the tension reached 600 centimeters or when the resistance on the blocks registered 2,000 ohms at the 12-inch depth. Low moisture plots were irrigated when the blocks showed a resistance of 10,000 ohms at the 12-inch depth. Readings were taken on the tensiometers and blocks at regular intervals in order to keep a close check on the soil moisture changes.

Irrigation water was applied in furrows, each plot being irrigated independently of the others. No effort was made to determine the amount of water applied to each plot, as moisture stress was the factor being studied. The water was allowed to run on each plot for about 8 hours at each irrigation. This period of time was sufficient to saturate the plots and affect the readings on the instruments during the major portion of the growing season. Listed below are the dates the various moisture plots were irrigated.

Irrigation Dates

High	Medium	Low
June 18	July 7	July 12
July 5	July 20	July 27
July 12	July 27	Aug. 19
July 20	Aug. 10	
July 27	Aug. 26	
Aug. 6		
Aug. 16		

In order to determine the percent of water available at the minimum levels, a pot experiment was set up in the greenhouse during the winter months. Tensiometers and Bouyoucos blocks were placed in 3-gallon glazed pots at a uniform depth. Corn was planted in the pots and allowed to become well established. Soil samples were then taken from the pots in the vicinity of the instruments after being reduced to given levels of tension and resistance. Each moisture level was replicated three times and three soil samples were taken from each pot. The moisture content of these samples was determined on an oven dry basis, and the data plotted on semi-log paper.

Rapid tissue tests were made at two intervals during the growing season in order to determine the nitrate content of the growing plants. The Purdue Method (10) was followed in making the tissue tests.

The corn was harvested over the period of Aug. 30 to Sept. 4. When the crop on each plot reached maturity, all the ears were picked from the yield rows, then counted, weighed, and a tare percentage calculated. The tare percentage was determined by the method used by commercial canners which consists of the removal of immature ears, long shanks and worm damage. The time of harvest was determined by picking samples from the plots and testing the degree of maturity by the color-thumbnail method. This is the method predominately used in commercial fields.

The fodder was harvested from each plot and yield data were collected on September 9. At this time measurements were made to determine the average height of the corn on each plot.

RESULTS

It was observed in early July that differences were beginning to appear in the field between plots receiving various treatments. High moisture plots not fertilized turned light green and were spindly in appearance. Medium and low moisture plots maintained a dark green color and normal growth. As the season progressed the variation between treatments became more pronounced. Plots receiving high moisture and no fertilizer showed definite signs of nitrogen deficiency. Records of these differences were made on color slides. Low moisture plots appeared stunted due to lack of water. Photographs were taken at this time which clearly illustrate the variation that existed. Some of the striking relations can be noted in figures 1 and 2. By the time the corn was ready to harvest, the variation mentioned above had become even more striking, plots could be outlined clearly by their color and height differences.

All the data collected from this experiment are summarized in tables 1, 2, and 3. The statistical analysis of these data are presented in table 4. There were no significant differences in the yield of ear corn that could be attributed to fertilizer treatment. Fertilizers did induce significant differences in nitrate content of the tissue, height of plants and yield of fodder. Moisture treatments also had an effect on the yield of fodder, average weight per ear and height of plants. There was no significant interaction between fertilizer treatments and moisture levels. The variation between replications was highly significant, which indicates a considerable soil fertility gradient existed over the field. It was originally thought that this gradient was reasonably uniform, but the results of this experiment show that the fertility gradient was highly variable.

A covariance analysis was made to determine the relationships between the various expressions of yield. These data are summarized in table 5.

Yield in tons per acre of ears is highly correlated with the number of ears per plot. This relationship and the fact that numbers of ears per plot were not affected by treatment presented a basis for adjusting the yields of ears per acre to a uniform number of ears per plot. Table 6 shows the analysis of variance of yield expressed as tons of ears per acre, as yield in tons of ears per acre adjusted through covariance to a uniform number of ears per plot, and as number of ears per plot. When the tons of ears per acre were analyzed as individual degrees of freedom in table 6, the linear effect of nitrogen approached significance, thus indicating a response to nitrogen. Phosphorous had no effect on yield.

Figure 1. The influence of three moisture levels on the growth of corn on plots treated with 300 lbs. of ammonium nitrate. Plant 1 received the high moisture level, plant 2 medium moisture level, and plant 3 the low moisture level. Note the striking differences in size due to the moisture variable.

Figure 2. The influence of three nitrogen levels on the growth of corn on low moisture plots. Fertility levels were 300 lbs. of ammonium nitrate for plant 1, 127 lbs. for plant 2 and no fertilizer applied to plant 3. The fertilizer shows no evidence of affecting growth in this photograph.

Table 1. The yield of ears, the number of ears, and the average weight per ear of sweet corn as influenced by fertilizers and moisture treatments.

Treatments	Yield of ears in tons/acre				Number of ears per plot				Ave. weight per ear (lbs)			
	Replicate				Replicate				Replicate			
	1	2	3	Average	1	2	3	Average	1	2	3	Average
(1) Control												
H	1.34	6.78	7.54	5.22	36	84	100	73.3	.39	.85	.37	.68
M	3.34	8.40	5.54	5.76	56	108	79	81.0	.63	.81	.73	.72
L	4.39	6.88	5.44	5.57	68	103	80	83.7	.68	.70	.72	.70
(2) 42 # N.												
H	6.02	6.40	6.11	6.18	80	85	81	82.0	.78	.79	.79	.79
M	6.49	7.45	9.45	7.80	94	107	115	105.3	.72	.73	.86	.77
L	4.68	5.83	5.92	5.48	71	82	89	80.7	.69	.74	.70	.71
(3) 99 # N.												
H	6.69	7.64	6.40	6.91	94	101	87	94.0	.74	.79	.77	.77
M	5.44	6.69	5.92	6.02	82	85	79	82.0	.70	.82	.78	.77
L	4.68	5.25	6.30	5.41	70	77	92	79.7	.70	.71	.72	.71
(4) 136 # N.												
H	7.45	5.92	7.35	6.91	88	76	90	84.7	.89	.82	.86	.86
M	7.07	8.21	6.49	7.26	94	96	87	92.3	.79	.90	.78	.82
L	5.73	5.25	7.74	6.24	88	78	108	91.3	.68	.71	.75	.71
(5) 42 # N., 99 # P_2O_5												
H	4.01	8.12	7.45	6.53	66	110	95	90.3	.64	.77	.82	.74
M	4.30	6.21	5.92	5.48	63	80	78	73.7	.71	.81	.79	.77
L	5.25	4.97	8.12	6.11	82	74	107	87.7	.67	.70	.79	.72
(6) 68 # N., 99 # P_2O_5												
H	6.21	6.49	6.69	6.46	81	82	88	83.7	.80	.83	.80	.81
M	6.88	6.97	7.26	7.04	100	90	93	94.3	.72	.81	.82	.78
L	3.63	6.21	8.02	5.95	67	88	104	86.3	.57	.74	.81	.71

Moisture: H. High moisture 300 cm. of tension at 12" depth.
M. Medium moisture 2,000-3,000 ohms resistance at 12" depth.
L. Low moisture 10,000-20,000 ohms resistance at 12" depth.

Table 2. The yield of green fodder, total green weight, and average height of sweet corn as influenced by fertilizers and moisture treatments.

Treatments	Green fodder-tons/acre				Total green weight-fodder/ears				Average height - feet			
	Replicate				Replicate				Replicate			
	1	2	3	Ave.	1	2	3	Ave.	1	2	3	Ave.
(1) Control												
H	5.73	14.33	12.70	10.92	7.45	21.49	20.63	16.52	6.00	7.75	6.50	6.75
M	6.40	13.37	10.22	10.00	10.03	22.25	15.95	16.08	6.50	6.75	6.00	6.42
L	7.93	11.75	10.03	9.90	12.51	19.20	15.76	15.82	6.50	6.00	6.75	6.42
(2) 42 # N.												
H	10.60	11.94	11.36	11.30	16.71	18.43	17.95	17.69	7.50	7.50	6.50	7.17
M	10.79	12.61	15.95	13.12	17.67	20.44	25.79	21.30	6.00	6.00	7.25	6.42
L	8.50	9.84	10.89	9.74	13.47	15.85	17.19	15.50	6.50	6.75	6.50	6.58
(3) 99 # N.												
H	11.08	11.75	11.56	11.46	18.05	19.48	18.43	18.65	6.50	6.50	6.50	6.50
M	9.36	12.51	12.89	11.59	15.18	19.77	19.20	18.05	6.50	7.50	6.25	6.75
L	8.69	10.60	10.98	10.09	13.66	15.95	17.86	15.82	6.50	5.50	6.50	6.17
(4) 136 # N.												
H	12.61	11.65	12.61	12.29	20.25	17.76	20.25	19.42	7.25	6.50	6.00	6.58
M	12.51	13.85	12.51	12.96	20.15	22.25	19.39	20.60	7.25	6.75	6.75	6.92
L	11.56	12.70	14.33	12.86	17.67	18.53	22.35	19.52	6.50	6.50	6.25	6.42
(5) 42 # N., 99 # P_2O_5												
H	8.98	12.89	14.42	12.10	13.18	21.48	22.06	18.91	6.50	6.75	7.50	6.92
M	8.79	12.13	10.60	10.51	13.18	18.53	16.71	16.14	6.50	7.25	6.00	6.58
L	9.55	9.84	13.66	11.02	14.99	15.18	22.16	17.44	5.75	6.50	6.50	6.25
(6) 68 # N., 99 # P_2O_5												
H	11.84	13.56	14.80	13.40	18.34	20.63	22.16	20.38	7.50	7.25	6.50	7.08
M	12.61	14.04	15.57	14.07	20.05	21.11	23.40	21.52	6.50	6.50	6.50	6.50
L	8.12	11.84	13.37	11.11	12.42	18.43	21.77	17.54	5.50	6.50	6.50	6.17

Moisture: H. High moisture 300 cm. of tension at 12" depth.
M. Medium moisture 2,000-3,000 ohms resistance at 12" depth.
L. Low moisture 10,000-20,000 ohms resistance at 12" depth.

Table 3. The influence of fertilizers and moisture on the nitrate content of corn tissue at two stages of growth.

Treatments		Test A-July 28, '48			Test B-Aug. 9, '48		
		Replicate			Replicate		
		1	2	3	1	2	3
(1) Control							
	H	1	1	2	2	1	3
	M	1	2	3	1	2	2
	L	1	2	2	1	2	2
(2) 42 # N.							
	H	1	2	2	1	1	2
	M	3	3	2	2	3	2
	L	1	2	3	1	2	2
(3) 99 # N.							
	H	2	2	3	3	1	3
	M	3	2	2	2	2	2
	L	2	2	3	1	2	3
(4) 136 # N.							
	H	2	3	2	3	3	2
	M	3	3	3	3	3	2
	L	3	2	3	1	3	3
(5) 42 # N., 99 # P_2O_5							
	H	1	3	2	1	3	2
	M	1	1	3	1	1	2
	L	2	1	2	3	1	3
(6) 68 # N., 99 # P_2O_5							
	H	2	2	2	1	2	2
	M	2	2	3	1	2	2
	L	1	3	2	3	2	3

Note: 1. None or low nitrate
2. Medium nitrate
3. High nitrate

Moisture: H. High moisture 300 cm. of tension at 12" depth.
M. Medium moisture 2,000-3,000 ohms resistance at 12" depth.
L. Low moisture, 10,000-20,000 ohms resistance at 12" depth.

Table 4. The analysis of variance of yield, ears per plot, weight per ear, fodder, height, and relative nitrate content of sweet corn.

Source	D.F.	Tons of ears/acre M.sq.	No. of ears per plot M.sq.	Weight per ear M.sq.	Tons fodder per acre M.sq.	Total yield ears + fodder M.sq.	Height M.sq.	Tissue A July 9 M.sq.	Tissue B Aug. 9 M.sq.
Treatments	17	1.5605	184	.0070	5.1764*	11.7231	.2560	.54	.56
Moisture	2	2.8424	67	.0238*	8.5383*	20.6481	1.1261*	.72	.12
Fertilizer	5	1.8248	138	.0091	9.1290**	18.9127*	.0678	1.19*	.77
M x F	10	1.1720	232	.0026	2.5278	6.3433	.1762	.19	.55
Reps	2	14.8071**	1,177**	.0448**	45.5111**	114.5343**	.1990	1.99*	1.68
Error	34	1.5346	170	.0046	2.1044	6.8737	.2652	.41	.52
Total	53								

* Significant at 1% level
** Significant at 5% level

Table 5. Correlation coefficients of errors which are exclusive of all treatment influences.

Net yield of ears tons/acre	Ears of corn No./plot	Ave. weight per ear	Total yield green fodder	Average height of corn
Net yield of ears, tons per acre	.97**	.82**	.88**	.47**
Ears of corn, number per plot		.66**	.80**	.31
Average weight per ear			.84**	.64**
Total yield green fodder				.57**

** Significant at the 1 % level.

Table 6. Analysis of variance of data adjusted to the same number of ears per plot.

		Mean Squares		
Source 1/	D.F.	Yield in tons of ears/acre	Number of ears/plot	Yield in tons of ears/acre adjusted to uniform number of ears
<u>Moisture</u>	2			
M_L	1	2.9584	.44	3.1703**
M_Q	1	2.7265	133.56	1.6793**
<u>Fertilizer</u>	5			
N_L	1	5.4566	309.	.5115
N_Q	1	.1736	75.	.1542
N_C	1	2.5872	226.	.0495
P_0 v P_1	1	.0117	14.	.0519
P_0 v P_1 x N_2 v N_3	1	1.5006	156.	.0056
<u>Moisture x Fert.</u>	10			
N_LM_L	1	1.1116	43.	.2054
N_LM_Q	1	1.2915	66.	.1519
N_QM_L	1	1.3301	400.	8.2608**
N_QM_Q	1	1.0499	322.	.3465
N_CM_L	1	.1435	93.	.2421
N_CM_Q	1	.5973	221.	.3192
P_1 v P_0 x M_L	1	.6112	92.	.0077
P_1 v P_0 x M_Q	1	.2553	34.	.0042
P_1 v P_0 x N_2 v N_3 x M_L	1	.1853	126.	.3402
P_1 v P_0 x N_2 v N_3 x M_Q	1	.8896	339.	.5018
<u>Reps</u>	2			
<u>Error</u>	34	1.5346	170.	.1311
<u>Total</u>	53			

1/ M = Moisture
L = linear effect
Q = quadratic effect
C = cubic effect
N = nitrogen
P = phosphorus
v = versus
x = times

Numbers refer to fertilizer rates.

The adjustment of tons of ears to a uniform number of ears per plot makes the effect of moisture highly significant and the interaction of fertility and moisture become significant at the 5 percent level.

The time of maturity was affected considerably by fertilizer and moisture treatments. Plots receiving high rates of fertilizer and medium or high moisture levels matured as much as four days ahead of plots receiving small amounts of fertilizer and medium or low moisture levels. Phosphorus seemed to hasten maturity on plots where it was applied. The ripening of the corn on highly fertilized plots was very uniform, all the ears maturing at about the same time. Plots treated with small amounts of fertilizer and low moisture levels ripened very irregularly, some of the ears being over-ripe and others immature. This condition is undesirable as the quality of corn can not be controlled unless several pickings can be made. It is common practice among commercial growers to pick all the corn at one time, which makes uniform ripening a desirable feature.

Results from the tissue tests indicate that the nitrate content of the plants grown on unfertilized plots contained insufficient nitrogen for proper growth of the corn. The corn having poor color was low in nitrate content. Some of the corn having normal color also was low in nitrate content. Thus, the test would substantiate the findings of others in that the visual diagnosis of nitrogen deficiency must be supplemented with tissue tests in order to make correct interpretations.

Figure 3 illustrates the soil moisture conditions determined by the pot experiments. Available moisture (11) on this curve is defined as that between permanent wilting percentage and moisture equivalent.

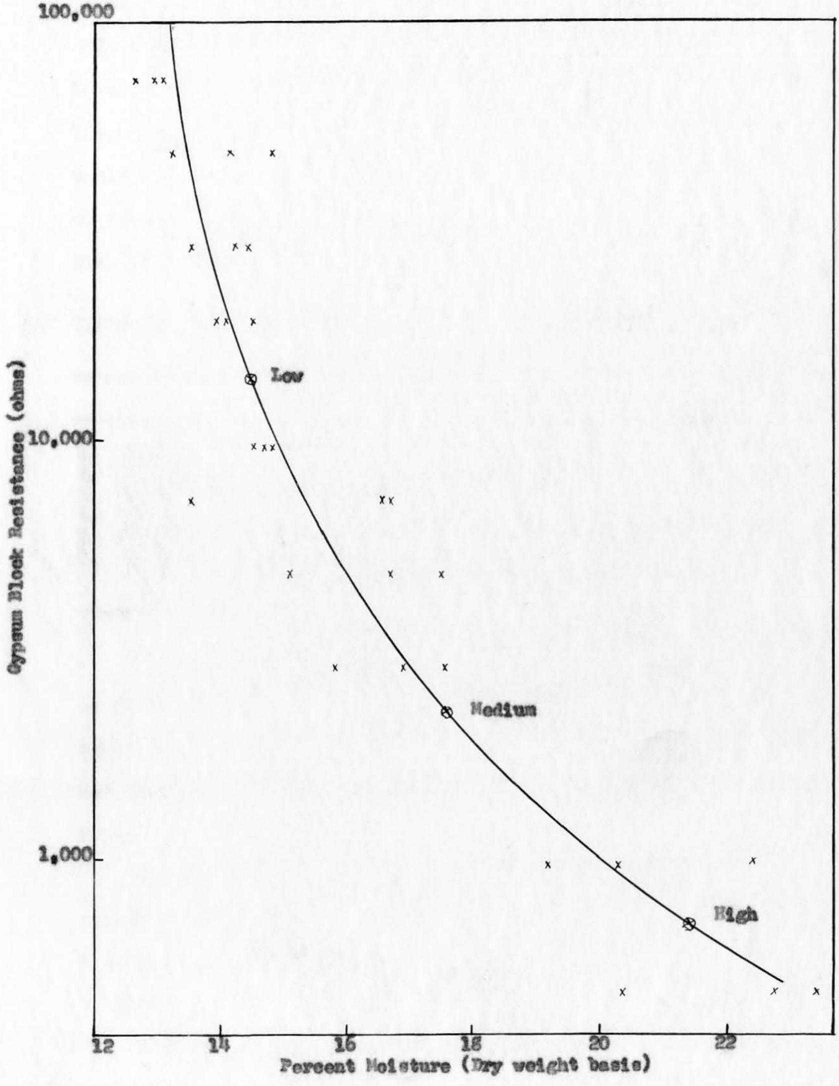
On this basis the high moisture plots were maintained approximately between field capacity and 88 percent available moisture, medium between field capacity and 47 percent, and low between field capacity and 14 percent. The data collected from field moisture measurements are presented and summarized in appendix figures 1 and 2.

DISCUSSION

The fact that treatments did not significantly alter the yield of marketable corn is difficult to explain. Major differences appeared likely, due to the differences observed in the field during the growing season. One of the sources of error that could have complicated the problem was the effect of previous crops grown on the field. Two years prior to the corn experiment, alfalfa plots were grown on the land. It is possible that the placement of these plots could have caused marked variation in the fertility level or soil structure at various locations in the field. A crop of barley grown the season prior to the corn experiment was uniform and exhibited no visible effects of variable fertility. At the time the field was chosen for the experiment it was thought that the residual effect of the alfalfa would be uniform.

Assuming that the field was highly variable in residual fertility may account for some of the differences between plots treated alike. If we observe in table 6 that when the plots are adjusted to a uniform number of ears, the moisture and interaction of moisture and fertility become significant. This indicates that the effect expected from moisture and fertilizer treatments may have been masked due to the failure of the soil to be uniform.

Figure 3. Soil moisture resistance curve from greenhouse pot trials (Drawn by method of least squares)



The effect of various fertility and moisture levels is shown in table 7. A statistical analysis of this data shows that the linear effect of nitrogen closely approaches significance at the 5 percent level. This indicates that the maximum influence of nitrogen fertilizers was not reached with the heaviest application, otherwise there would have been a significant quadratic effect. The high mean yield of fertilizer treatment number 2 is exaggerated by the abnormally high yields from two individual plots at the medium moisture level.

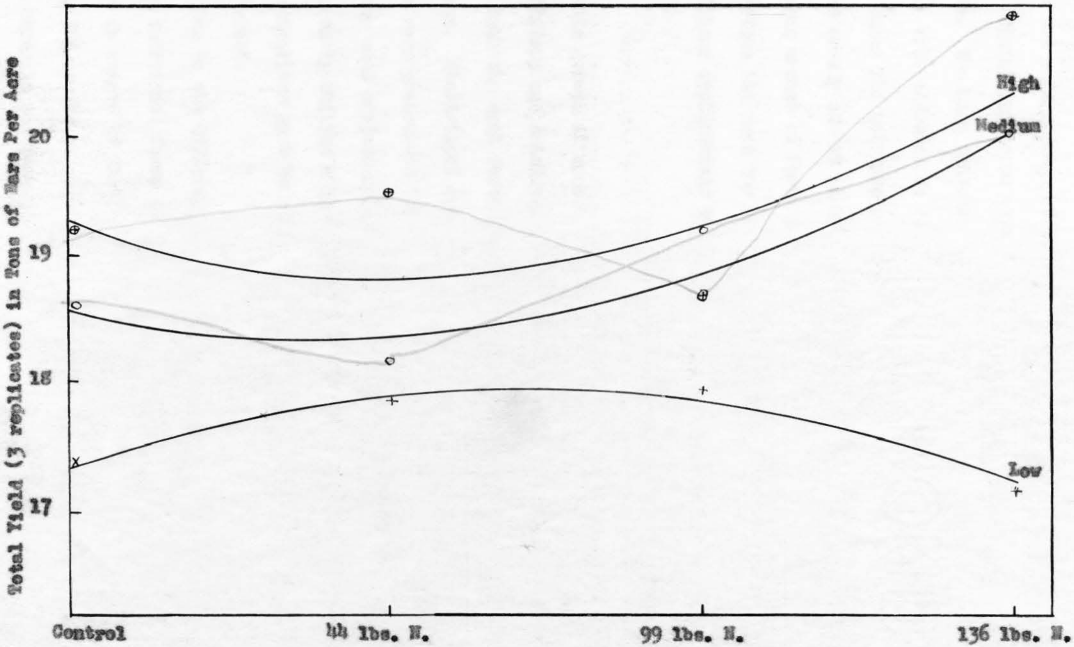
Table 7. The average tonnage of ears per acre as influenced by fertilizer and moisture.

	Moisture Levels			
	High	Medium	Low	Mean
1. Control	5.22	5.76	5.57	5.52
2. 44 lbs. N.	6.18	7.80	5.48	6.49
3. 99 lbs. N.	6.91	6.02	5.41	6.11
4. 136 lbs. N.	6.91	7.26	6.24	6.80
5. 42 lbs. N. 99 lbs. P_2O_5	6.53	5.48	6.11	6.04
6. 68 lbs. N. 99 lbs. P_2O_5	6.46	7.04	5.95	6.48
Mean	6.37	6.56	5.79	

The influence of the various moisture treatments is shown graphically by the curves in figure 4. The curves are parabolas fit by the least squares method on adjusted yields. The actual yield data was not plotted because there were no significant differences due to treatment.

The decrease in yield of the first nitrogen level on the high and medium moisture curves is perhaps not the true picture because of abnormally high mean yields from fertilizer treatment number 2 referred to above.

Figure 4. The relationship of moisture and fertilizer and their effect on yield of sweet corn.



It is shown by the curve in figure 4 that the high nitrogen level had a depressing effect when associated with low moisture, but a beneficial influence when combined with medium or high moisture levels. The high moisture level plots produced the most corn when yields were adjusted as described previously. These data indicate that where the moisture supply is inadequate, high rates of nitrogen may adversely affect yield, but when the moisture supply is optimum the same amount of fertilizer may likely be beneficial. This further emphasizes the need for having such variable factors as moisture and fertilizer applications studied in the same experiment.

CONCLUSIONS

The growth of sweet corn can be influenced by applying nitrogen fertilizers and moisture. The data reported in this paper indicate that both the soil fertility and moisture levels should be kept in balance. Statistical evidence shows that the effect of moisture is often more pronounced than that of fertilizer. It would be desirable to know what minimum moisture levels should be maintained in order to efficiently utilize a given quantity of nitrogen fertilizer. Further investigations must be made before this phase of the problem is fully understood.

Due to the differences in fertility and irrigation practices between individual farms it is not possible to make specific recommendations in regard to fertilizer requirements. Generally speaking, however, 200 pounds of ammonium nitrate applied, sidedressed, to sweet corn early in the season will tend to increase yields profitably.

The results indicate that the soil moisture content should be maintained at a level above the moisture content designated as low in these studies. It was noted that where plants wilted early in the day as they did on the low moisture plots, growth was retarded and yields were reduced. Excessive irrigations should be avoided, especially where the fertility level of the soil is low.

If the experiment were to be continued by the writer, an attempt would be made to use Bouyoucos blocks exclusively to measure moisture content of the soil. By placing the blocks at various depths, the moisture levels could be followed rather accurately. During the months of July and August when transpiration was excessive, it was difficult to keep the tensiometers in operation.

Excessive labor was involved in irrigating the various moisture plots due to their complete randomization. Further studies could be carried on with considerably less labor required if the fertilizer treatments were superimposed on the moisture treatments. It is the authors opinion that any loss in the refinement of the experiment would be more than compensated for by reduced labor and by greater accuracy in moisture control.

SUMMARY

1. Sweet corn is an important cash crop in many of the irrigated regions of the West. A study was carried out during the summer of 1948 at the Forage Crops Experimental Farm near Nibley, Utah in order to determine methods of increasing yields.

2. A field experiment consisting of three moisture levels and six soil fertility levels was established in order to study the independent and interrelated effects of fertilizer and moisture. The trial involved 54 plots, all treatments being completely randomized. Moisture levels were measured by means of tensiometers and Bouyoucos blocks. Two sets of rapid tissue tests were made to determine the nitrate content of the growing plants.

3. Considerable variation was observed during the summer among the plots receiving different treatments. Photographs were taken which clearly illustrate the differences observed.

4. Statistical analysis of the data indicates phosphorus gave no response, moisture had a highly significant effect, with nitrogen exhibiting a linear response. Time and uniformity of maturity was influenced by fertilizer and moisture treatments.

5. The results of this study show that the yield of sweet corn can be increased profitably by proper management of moisture and fertility. Further studies will be required before specific recommendations on fertilizer and moisture levels can be made.

Farm Research

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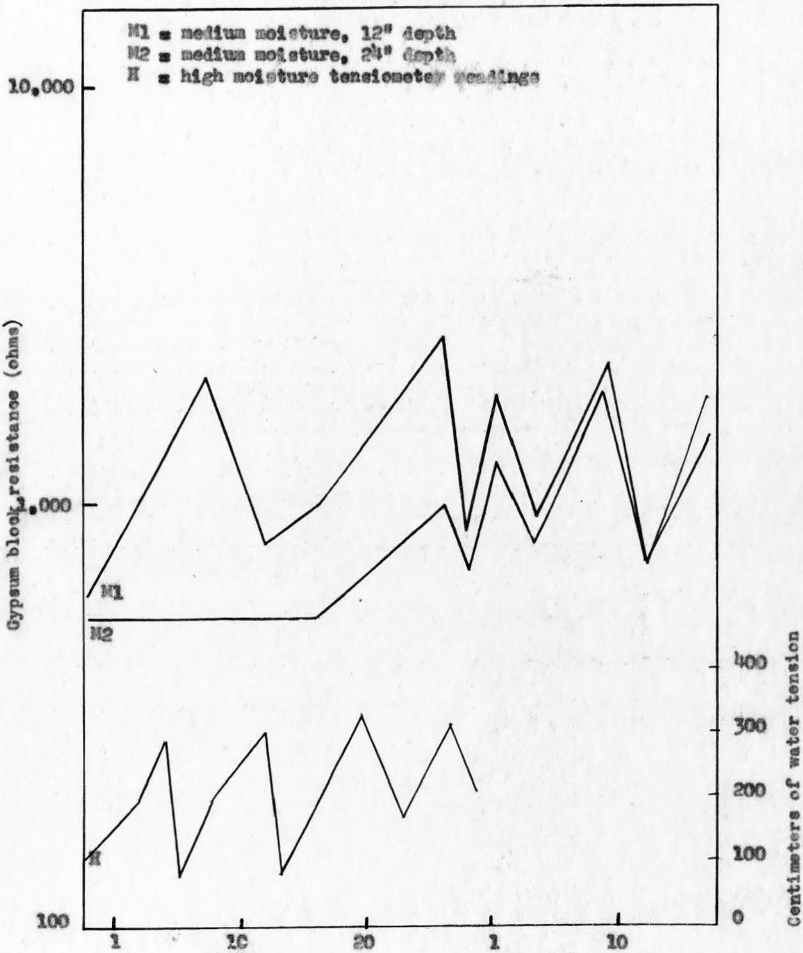
Appendix Figure 1. Curves showing resistance block and tensiometer data on high and medium moisture plots.



Appendix Figure 2. Curves showing resistance block data at 12 and 24 inch depth on low moisture plots.