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Effect of Soil Moisture on the Yield and Yield Components of Maize

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ABSTRACT

Field experiment was conducted with five levels of irrigation at 0, 20, 40, 60 and 80 per cent available moisture regimes under uniform doses of NPK fertilizers to find out the water requirement of maize crop. The results were : (1) The water requirement of maize was found to be 27.65 acre inches (2) There was significant increase in respect of important yield components such as grain weight per plant, 1000-grain weight and the cob yield per plant as the moisture level increased and (3) The moisture level of 60-80 per cent was found to be congenial for highest grain and straw yields of maize.

INTRODUCTION

Experiments in Tamil Nadu were conducted for cotton, ragi, cholam, rice and sugarcane on the total water requirement and the frequency of irrigation. But no information is available about the water requirement of maize crop. Hence a study was undertaken to assess the soil moisture requirement by irrigation and its effect on yield and yield components of maize.

MATERIALS AND METHODS

The experiment was laid out in a split plot design with five levels of irrigation main plot treatments and three cultural practices as sub plot treatments viz., no weeding, mechanical weeding and chemical weeding (sub plots are not discussed in this paper) replicated four times in the Agricultural College Farm, Coimbatore during July-October, 1969. The soil was well drained sandy clay loam. The crop chosen for the study was maize Hi-Strach of 110 days duration. The plots ware given uniform doses of manures and NPK fertilizers (135 N, 67.5 P and 45 kg. of K_2 O/ha)

The average moisture content of temporary wilting (wilting of basal levals) and permanent wilting (wilting of entire plant) were estimated by growing maize plants along with sunflower plants for 25 days and was found out as 10.24 and 9.02 per cent respectively. The moisture content at wilting point i. e., 10.24 per cent was considered as control. The moisture

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content as field capacity was considered as 100 per cent availability and was estimated on moisture equivalent basis. The procedure suggested by Bouyoucos (1935) was adopted to estimate the moisture equivalent and it was estimated as 20.84 per cent

The estimated moisture content between wilting point (10.24 per cent) and field capacity (20.84 per cent) of soil under study was taken as available moisture range to the plants. Five levels of available soil moisture range to the plants. Five levels of available soil moisture range as treatments were maintained by irrigation.

Moisture content in different treatments is given below:

Available moisture in per cent	Soil moisture content in per cantage	Treatments
Control	10.24 wilting point	I_0
20	12.36	I_1
40	14.48	I_2
60	16.60	I_3
80	18.72	I_4
	20.84 Field capacity	

TABLE 1. Water requirement of maize in different soil moisture regimes

Particulars	Soil moisture levels				
	I_4	I_3	I_2	I_1	I_0 [control]
Number of irrigations	16	10	8	7	6
Volume of water given by irrigation in litres	6480	4050	3249	2835	2430
Volume of water by rainfall in litres	4036.36	4036.36	4036.36	4036.36	4036.36
Seepage loss	129.36	129.36	129.36	129.36	129.36
Total consumptive water used in litres	10387.00	7957.00	7147 00	6742.00	6337.00
Amount of irrigation given in terms of acre inches	17.25	10.78	8.62	7 55	6.47
Amount of effective rainfall received in terms of acre inches	10.40	10.40	10.40	10.40	10.40
Total water used in terms of acre inches	27.65	21.18	19.02	17.95	16.87

The plots were irrigated when the soil moisture reached the particular moisture level as per the treatment schedule and the soil moisture was estimated every day using speedy moisture tester which was standardised with gravimetric method. The quantities of water let into the plot was measured by the premier water meter fixed in the irrigation channel. An uniform quantity of 340 litres of water per plot was let in through the meter. The quantity was fixed as the three fourth depth of the furrows were filled with this amount of water without breakage in the furrow.

The main channel was cement lined and the sub channels all through the experimental plots were polythene lined to arrest the losses of water in conveyance and application. Evaporation loss during the conveyance was assumed to be minimum and common to all treatments. To minimise the effect of side percolation of water from one plot to another, buffer channels with two feet diametre were provided all round the plot. The amount of rainfall received during the crop growth was measured by rainguage and the loss of water by way of seepage was measured by effective rainfall apparatus (Ramadoss, 1960). The moisture level was maintained as per the schedule upto 90th day of crop.

TABLE 2. Influence of moisture regimes on plant characters and yield

Moisture level	Plant height at maturity (cm)	Mean grain weight per plant (g.)	Mean 1000-grain weight (g)	Cob yield (kg/ha)	Grain yield (kg/ha)	Straw yield (kg/ha)
I_0	114.66	30.97	214.1	1322.74	1058.19	12036.98
I_1	121.14	50.34	252.8	2936.48	2129.61	14867.60
I_2	123.59	50.42	264.6	3968.22	3002.62	13690.36
I_3	138.14	56.25	261.5	4695.78	3399.44	16408.59
I_4	151.24	86.72	299.4	6613.70	4444.41	16230.02
S E	6.68	5.19	6.54	1064.81	363.75	958.99
C D	20.59	16.00	20.14	3287.01	720.23	2943.09
F Test	Sig	Sig	Sig	Sig	Sig	Sig

Five plants were selected at random from the net plot, labelled and following plant characters were studiad besides recording the water requirement of maize crop.

RESULTS AND DISCUSSION

The data collected on water requirement of maize and all the plant characters were statistically analysed and the results and discussed below.

Water requirement:

The water requirement of maize in different moisture regimes is presented in Table

The results revealed that the water requirement of maize for 80 per cent available moisture treatment was 27.65 acre inches and in the control treatment, it was 16.87 acre inches. Out of the total amount of water used, 10.40 acre inches was received by way of rainfall during the crop period.

The plant height increased with increasing moisture levels. Chaudhry and Macksould (1967) observed that the weekly intervals of irrigation throughout the growing period increased the plant height and ear weight of the pl and produced the highest yield of grain and straw.

The grain weight was significantly higher in I_4 treatment over the other levels of moisture. The treatments I_3 I_2 and I_1 were all on par but significantly superior to I_0. Joseph Berger (1962) and Denmead and Shaw (1960) have also reported that grain yield was affected more than any other plant characters by moisture stress at all stages of growth. Thousand grain weight had increased from 214.1 to 299.4 g. when moisture was raised from control to 80 per cent. Thousand-grain weight was significantly superior in I_4 treatment while I_3 I_2 and I_1 treatments were on par and were superior to I_0.

Cob grain and straw yields

Significantly higher cob yield was obtained in the higher moisture levels. I_1 and I_0 treatments gave significantly lesser cob yield than I_4 treatment. With regard to grain yield, it was found that the highest moisture level gave the highest grain yield and was superior to all other moisture levels. The response of grain yield to moisture was found to be linear. Avetisian and Samatyan (1967) observed that highest productivity of hybrid maize was obtained when the soil moisture was 68 to 70 per cent of its full water holding capacity. Nochaev *et al.* (1968) reported that irrigation increased the yield of hybrid maize by 51 per cent and was maintained at 80 to 85 per cent of field capacity.

The straw yield was significantly higher in the higher moisture levels as compared to lower moisture levels. The treatments of 80 per cent and 60 per cent available moisture levels were on par and superior to control level of moisture.

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REFERENCES

AVETISIAN, A. D. and M. S. SAMATYAN. 1967. On the physiological methods of regulating the watering regime for maize. *Field crop Absir.* **20** : 68.

BOUYOUCOS, G. J. 1935. A comparison between the suction method and the centrifuge method for determining the moisture equivalent of soils. *Soil Sci.* **40** : 165-71.

CHAUDHRY, N.H. and S. W. MACKSOULD. 1967. Effect of irrigation schedule and plant population on the grain yield and other plant characters of hybrid corn grown in Begu plain, Lebanan in 1964. *W. Pak. J. Agric. Res.* **5** : 72–86.

DENMED, O. T. and R. H. SHAW. 1960. The effect of soil moisture stress at different stages of growth and development on yield of corn. *Agron J.* **52** : 272–4.

JOSEPH BERGER. 1962. Maize production and manuring of maize. *Centre 'd' Etrude De L' azote, Geneva.*

NOCHAEV, P. V., I. F. MIKHAILICHENCKO, L. V. ZINNEVIGH and A. T. KOCHEGURA. 1968. Cultivation techniqnes for irrigated maize in the Krasnodam province. *Herbage Abstr.* **39** : 5.

RAMADOSS, L. A. 1960. *Crops and Water in India.* I. C. A. R., New Delhi.