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EFFECT OF PLANTING PATTERNS, MULCHES AND SOIL MOISTURE REGIMES ON GROWTH AND YIELD ATTRIBUTES OF MAIZE (*Zea mays* L.)*

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A two year study was made to find out the effect of planting patterns, organic mulches and soil moisture regimes on growth and yield attributes of maize. Normal planting with irrigation in all furrows resulted significantly higher growth and yield attributes followed by double file planting in deep furrows. Lowest values of growth and yield attributes were observed in normal planting with irrigation in alternate furrows. Paddy straw application at the rate of 8 t/ha improved the plant height, shoot dry matter production, and all the yield attributes of maize in both the years. The influence of moisture regimes on growth and yield attributes was found to be significant in both the years. Irrigation at 40% ASMD performed best followed by 60% and 80% ASMD. Double file planting in deep furrows, full mulch and irrigation scheduling at 40% ASMD were efficient in utilising the available moisture for achieving higher water-use-efficiency.

In maize growing semi-arid tropics of Telangana region of Andhra Pradesh, India, the limited available irrigation water has to be judiciously utilized by optimising irrigation schedules. Further, moisture losses could be reduced by manipulating planting patterns to ensure better growth and development of the crop. The cropping practices such as paired planting, soil mulching with paddy straw (Ravindranath *et al*., 1974), and adaptation of optimum moisture regime (Naidu, 1970) were considered important to improve productive efficiency of water for maize crop. Considering these aspects, a field trial was conducted to study the growth and development of maize as influenced by planting patterns, organic mulches and soil moisture regimes.

MATERIALS AND METHODS

Field experiment was conducted at Agricultural College Farm, Hyderabad in winter 1972—'73 (Year 1) and Summer 1974 (Year 2). The soil texture was sandy clay to sandy loam with 0.49 to 0.38% organic carbon and water holding capacity at 60 cm soil depth was 67 and 98 mm during first and second year respectively. Nitrogen at 150 Kg/ha was applied, ½ as basal and the remaining ½ in two equal splits at 40 and 60 days of crop period. Entire dose of 60 Kg each of P_2O_5 and K_2O was given at sowing.

The experiment was laid—out in split plot design, having 24 treatments replicated thrice. The treatments comprised of planting patterns (four) and organic mulches (three in the first year and two in the second year) allotted to main plots, and irrigation schedules (two in the first year and three in the second year) as sub-plots. The treatmental details are furnished in Table-1.

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The net plot area was 12.96 m^2 in the first year and 9.36 m^2 in the second year. Certified seed of Ganga-5 and "Deccan Hybrid Makka" (DHM) planted at 30 cm apart in all the planting patterns on 3 November 1972 and 28 January, 1974 respectively. A spacing of 60 cm between two furrows in P_1 and P_2 planting patterns 45 cm between two rows within a double file and 75 cm between the two pairs of double files in P_3 and P_4 was adopted to maintain 55,000 plants/ha in all the treatments. Paddy straw was used as mulch. For ensuring good germination, plant stand and early vigour. two common irrigations each of 5 cm depth were applied. Subsequent irrigations were given as per treatments, Irrigation water was measured through 90° 'V' notch weir. Soil moisture was computed by thermo-gravimetric method (Dastane, 1972) The crop was harvested after 120 and 110 days during first and the second year respectively. Values of crop water use efficiency as total dry matter and net return was computed by relating them to the consumptive use of water.

RESULTS AND DISCUSSION

Planting patterns :

In both the years normal planting with irrigation in all furrows resulted in significantly taller plants with greater amount of drymatter (Table 1) and also improved the yield attributes, except 1000 grain weight in year 1 (Table 2). Normal planting with irrigation in alternate furrows resulted in significantly shorter plants with least amount of drymatter and poor yield attributes in both the years. The effects of other two treatments were intermediate and significantly less then the effects of the normal planting with irrigation in all furrows. Between the treatments P_3 and P_4, the differences were not significant in the year 1, but in year 2, P_4 treatment resulted in more shoot dry matter, longer cobs and more grains/cob. The longer cobs with more grain/cob probably resulted in higher yields with P_4 planting pettern (Reddy *et al*, 1978). Thus the data indicated that the vegetative growth which coincided with mid to late winter was not affected by the differences between these two planting, patterns, but the reproductive phase which coincided with late winter and early summer was affected. The more moisture ratained in deep furrows in P_4, probably had a beneficial effect on the crop in summer (year 2) than in winter (year 1).

The crop water-use efficiency as total drymatter and net returns was considerably influenced by planting patterns. Normal planting with irrigation in all furrows (P_1) which resulted in maximum shoot drymatter accumulation produced lowest crop water use efficiency as total drymatter (34. 8 and 26.2 Kg) and net returns (Rs. 3.8 and 2.9) per unit of water (ha/mm) consumed. The two seasons means indicated that P_4 planting was efficient in attaining higher water-use both as total drymatter and net returns.

Mulches :

The full mulch treatment improved both vegetative (except leaf number) and reproductive growth as compared to no mulch treatment (Table 2). Thus full mulch treatment in addition to producing highest amount of drymatter, also resulted in higher crop water-use efficiency as shoot drymatter (63.0 and

Table 1: Influence of planting patterns, straw mulches and soil moisture regimes on growth characters, water use efficiency and net returns of maize.

Treaments	Plant height (cm)		No.of functional leaves		Shoot dry matter production g/pl		Water use-efficiency (Total dry-matter in Kg/ha mm)		Net returns (Rs/ha-mm)	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
*Planting patterns**										
P_1	204.86	187.48	12.67	12.43	257.60	234.45	34.8	26.2	3.8	2.9
P_2	185.17	171.56	12.97	12.35	223.92	176.89	59.4	39.9	5.8	3.5
P_3	196.55	173.16	12.63	12.17	245.89	194 49	63.6	43.4	6.3	3 7
P_4	197.08	174 80	12.85	12.54	231.07	227.49	59.0	49.1	7.1	6.1
S.Ed	5.87	4.98	0.238	0.48	9.25	14.94	N.A	N.A.	N.A.	N.A.
C.D at 5%	12.17	10.66	N.S	N.S	19.07	32.05	—	—	—	—
*Mulches***										
M_0	183.95	158.78	12.75	12 45	230.67	180.60	42.9	29 0	4.2	3.0
M_1	195.95	—	13.00	—	235.62	—	48.6	—	5.3	—
M_2	207.84	194.72	12.59	12.29	252.58	236.05	63 0	47.2	6.9	5.2
S. Ed	5.09	3.52	0.207	0.34	7.96	10.56	N.A.	N.A.	N.A.	N A.
CD at 5%	10.56	7.55	NS	NS	16.50	22.65	—	—	—	—
*Soil Moisture regimes****										
D_1	228.94	199 07	13.29	13,14	288.43	240.96	57.9	38.8	6.8	5.6
D_2	—	175,33	—	12.34	—	204.12	—	37.9	—	3 8
D_3	177.99	155.84	12.27	11.63	191.15	179.75	42.5	35.8	3.9	2.2
S.Ed	3.27	5.09	0.200	0 32	18.31	10.36	N.A.	N.A.	N.A.	N.A.
CD at 5%	6.73	9.97	0,413	0.63	28.58	20.32	—	—	—	—

* = P_1 — Normal planting in ridges and furrows 60 cm apart, with irrigation in all furrows,

* = P_2 — Normal planting in ridges and furrows 60 cm apart, with irrigation in alternate furrows, P_3 — Double file planting in ridges and furrows, with irrigation in planted furrows, and P_4 — Double file planting in deep furrows with irrigating in planted furrows.

** = M_0 — No mulch, M_1 — Paddy straw at the rate of 4 t/ha covering only wetted surface, M_2 — Paddy straw at the rate of 8 t/ha covering both raidges and furrows.

*** = D_1 — Irrigation at 40% ASMD, D_2 — Irrigation at 60% ASMD, and D_3 — Irrigation at 80% ASMD.

Table 2: Effect of different treatments[1] on yield attributes of maize.

Treatments	Cob length (cm)		Cob girth (cm)		Grains/cob		1000-grain weight (g)	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Planting patterns								
P_1	15.47	15.04	13.81	13.16	415.66	377.71	243.02	240.7
P_2	13.82	12.85	12.46	11.84	345.66	239.04	229.48	199.4
P_3	14.76	12.96	13.06	12.05	400.50	245.87	236.20	200.0
P_4	14.72	14.13	13.05	12.07	398.08	314.85	254.27	219.0
S.Ed	0.23	0.42	0.27	0.39	5.64	26.45	5.03	8.5
CD at 5%	0.48	0.90	0.56	0.84	11.69	56.74	10.43	18.3
Mulches								
M_0	14.30	12.91	12.60	11.86	374.67	257.88	229.20	201.8
M_1	14.26	—	12.85	—	394.24	—	240.60	—
M_2	15.51	14.58	13.82	12.69	401.25	330.88	252.60	227.79
S.Ed	0.20	0.31	0.23	0.27	4.85	14.87	4.35	6.05
CD at 5%	0.42	0.66	0.50	0.59	10.05	29.15	9.02	12.98
Moisture regimes								
D_1	16.01	15.08	13.90	13.05	441.02	352.70	256.61	236.29
D_2	—	13.76	—	12.40	—	283.73	—	215.34
D_3	13.30	12.39	12.32	11.32	339.13	246.67	225.08	192.85
S.Ed	0.33	0.40	0.23	0.32	3.49	18.67	7.40	6.06
CD at 5%	0.67	0.79	0.47	0.63	7.19	40.06	15.24	11.87

1 for treatmental details please see Table 1.

47.2 Kg/ha mm) and net returns (Rs. 6.90 and 5.20) per unit of water (ha-mm) consumed. The half mulch treatment which was included in the year 1, resulted in taller plants, more number of grains/cob and heavier grains but the shoot drymatter was not affected as compared to no mulch treatment. The half mulch treatment, however, resulted in higher water-use efficiency as shoot dry matter (48.6 Kg) and net returns (Rs. 5.30) unit water (ha-mm) consumed.

Soil moisture regimes :

All the parameters studied were decreased with increased soil moisture depletion in both the years (Tables 1 and 2). The moisture stress that was created with increase in soil moisture depletion depressed both the vegetative and reproductive attributes. Variation in plant height with moisture regimes was reported by Denmead and Shaw (1960). Stocker (1960) observed that during a period of water stress the first vegetative part to be effected was the leaf. Naidu (1970) reported reduced drymatter production and grain number per with increased soil moisture depletion. Kiesselbach (1950) suggested that severe drought shortens cobs due to destruction of productive tissues.

Finally, the crop water-use efficiency as shoot drymatter, and net return were also decreased with increase in soil moisture depletion.

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