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EVALUATION OF MANAGEMENT OPTIONS ON YIELD AND YIELD ATTRIBUTES OF WINTER MAIZE

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ABSTRACT

Present study was conducted to examine the influence mulching and irrigation on hydrothermal regime of soil with reference to growth and yield of water maize at TCA, Dholi, Bihar. Altogether three of mulch and three levels of irrigation were introduced. The types of mulches were polyethylene sheet (M2), paddy straw @ 5 t/ha (M1) and unmulched (M0) and the levels of irrigation were 12 IW/CPE (I2) and 0.6 IW/CPE (I1) ratios. The recommended dose of fertilizers was applied. With the application of mulch and irrigation levels the soil temperature raised towards optimum. The moisture and temperature plays an important role in movement of icons and nutrients, it is evidenced by significantly increased growth parameter i.e. plant height and leaf area index which ultimately resulted in higher grain and straw yield. The highest mean value of growth parameter was observed in M2I3 combination and lowest in M0I1. The sequence of mean value of yields were M2>M1>M0 whereas the sequence of level of irrigation were I3>I2>I1. The effect of mulching for increasing the growth parameter and yield was found to be significant for increasing the leaf area inbox and yield but for increasing the plant height it was found at par.

***Key wards :** Maize, Zea mays mulching, irrigation, growth, yield.*

Maize is the third most important staple food crop after wheat and rice in the world. Farmers of calcareous belt of North Bihar are well versed with the technologies of growing winter maize at optimum showing time (20th October to 10th November). The availability of phosphorus in calcareous soil particularly in winter season is very low as from the critical perusal of climatic conditions of this tract, it appears that the winter air temperature especially in the month of December and January goes down below 10^{0}C which may become one of the limiting factors for phosphorus uptake in late sown maize which is sown after harvest of paddy resulting thereby the poor yield of late sown maize. Any process which may increase the soil temperature may be helpful in enhancing the phosphorus availability and uptake by plant may result in reducing the phosphorus deficiency and increasing the maize yield. Use of mulch may be helpful in enhancing the soil temperature and thus may be helpful in increasing the grain yield of maize. Similarly change in soil moisture status also brings out changes in soil temperature which may also be helpful in changing the soil hydrothermal regime. Use of mulch and irrigation may be helpful in increasing the soil temperature and conserving soil moisture the rise in soil temperature as a result of mulching is expected to enhance the availability of plant nutrient that move through the process of diffusion. and thus may be helpful in increasing the grain yield of maize as the research finding shows the mulches and irrigation have been found to affect a great deal of plant growth parameters, such as, increased vegetative growth and flowering of plants, the rate of germination, rate of leaf emergence, the total number of leaves produced, the total leaf area, the rate of leaf area development, a length of the period from emergence to teaseling, root and shoot growth, moderated soil temperature, improved water retention in the soil, increased biomass and enhanced yield of crop (Law and Copper, 1979; Khera *et al.*1976; Chaudhary, 1988; Chen Xuejun *et at.* 1996: Mahapatra *et at.* 1998; Angrej and Gaur,2007.

Keeping in view the importance of mulching as well as irrigation, the present study has been undertaken with the objectives to assess the effect of mulching and irrigation levels on plant height; leaf area inbox and grain yield/ha.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* season, at Research Farm Dholi, a campus of RAU, Bihar,

Pusa. Research Farm Dholi enjoy semi-humid, Sub-tropical climate with hot and dry summer moderate rainfall and cold winter. The soil is sandy loam in texture, having pH 8.4 (1:2) and deficient in zinc and phosphorus. The variety Deoki of winter maize was used as test crop. The experiment was conducted with three irrigation Levels, based on IW/CPE ratio (Parihar*et at.* 1974) of 0.6,0.9 and 1.2 and three mulch treatment viz., no mulch (M_0), paddy straw mulch (M_1) and polyethylene sheet mulch (M_2) in factorial randomized block design with three replications. The depth of irrigation water (IW) was kept constant in each irrigation as 5 cm which was measured with a per shell flume installed in irrigation channel and to find out the Cumulative Pan Evaporation (CPE), pan evaporation value were recorded daily in mm of water evaporated from the class A Pan. The same values were summed up to find out the CPE for deciding the irrigation time.

Height of the plant in cm was recorded from the base of the plant of the auricle of the last opened leaf at 30, 45 and 120 days after sowing. Leaf area per plant was recorded at 30, 45 and 90 days after sowing by formula L x B x 0.85 were L is length of leaf, B is the breath at widest portion of the leaf and 0.75 is the constant factor (Reddy, 1980). Cobs from the plants were removed. Grains and Stover weight were calculated on per hectare basis. The experimental data were subjected to statistical analysis to find out the differences among the treatments (Fisher's 1938). Method of analysis was followed to calculate the nature and magnitude of the effect revealed by 'F' test. Appropriate standard errors along with critical differences wherever needed were calculated for the statistical interpretation of the data.

RESULTS AND DISCUSSION

The data on plant height of winter maize are presented in Table-1. It revealed that the effect of mulching for increasing the plant height was found to be significant. The highest value of plant height at 50 days after sowing was recorded in M_2 (30.6 cm) followed by M_1 (29.4 cm) and M_0 (27.2 cm). The highest plant height was maintenance of higher soil temperature at 5 cm depth. The plant height was affected by levels of irrigation not in significant level but at par. The highest value of plant height was recorded in I_3 (30.2 cm) followed by I_2 (28.4 cm) and 28.1 cm) in control. The better growth and higher plant height of maize by irrigation seems to be the contribution of better maintenance of plant water status and availability of nutrients specially phosphorus at higher moisture level and soil temperature. Although the levels of mulch and level of irrigation have significantly affected the plant height, but 70 and 120 days after sowing the effect of mulch was more pronounced. This may be due to the high mobility of phosphorus in presence of optimum thermal condition. The similar supporting statements were also given by Khera *et at.* (1976).

Although, the yields of straw mulch treatments were not a par with polyethylene mulch treatments

Table-1 : Effect of mulch and irrigation levels on plant height (cm) of winter maize at 50, 70 and 120 days after sowing.

Time of sowing	Irrigation level	Mulch level			
		M_0	M_1	M_2	Mean
50 days after sowing (DAS)	I_1	26.36	27.60	30.30	28.09
	I_2	25.16	29.65	30.45	28.42
	I_3	29.80	29.91	31.19	30.28
	Mean	27.11	29.05	30.64	-
70 days after sowing (DAS)	I_1	30.20	28.69	31.40	30.09
	I_2	28.10	31.70	35.10	31.63
	I_3	32.10	34.30	35.50	33.96
120 days after sowing (DAS)	I_1	144.6	161.9	161.9	156.03
	I_2	151.3	160.3	165.6	159.08
	I_3	164.5	164.4	173.8	167.56
	Mean	153.5	162.2	167.0	-

Source	CD at 5% (50 DAS)	CD at 5% (70 DAS)	CD at 5% (120 DAS)
Mulch	2.70	2.69	10.36
Irrigation	NS	2.69	NS
Interaction	NS	NS	NS
CV	-	-	-

Table-4 : Effect of mulch and irrigation levels on phosphorus uptake (kg/ha) in soil after crop harvest.

Irrigation level	Mulch level			
	M_0	M_1	M_2	Mean
I_1	40.93	41.60	45.73	42.75
I_2	42.60	43.13	51.16	45.63
I_3	45.16	48.08	57.20	50.15
Mean	42.90	44.27	51.37	-
Source	CD at 5%			
Mulch	2.67			
Irrigation	2.67			
Interaction	NS			
CV	-			

were more effective in raising the soil temperature in the extreme cold period which might have resulted in the highest grain yield of maize in polyethylene treatment. Similar statements were also given by Chen Xuejun *et at.* (1996) and Mohapatra *et at.* (1980).

So far the level of irrigation are concerned they affected significantly the grain yield at all levels of irrigation and the mean value of grain yield were 50.15 q/ha, 45.63 q/ha and 42.75 q/ha in I_3 I_2 and I_1 irrigation levels, respectively. As all the three levels of irrigation had affected significantly the grain yield of winter maize it might be due to the contribution of favorable moisture level created by irrigation level of higher uptake of phosphorus through mass flow and diffusion. As levels of irrigation maintained high soil moisture content throughout the growing seasons of winter maize, resulting in maintenance of good plant water status, high translocation of food materials, ultimately resulted in high crop yield.

CONCLUSION

The results obtained during the course of investigation can be concluded that the level of mulch and the level of irrigation had raised significantly the soil temperature in winter maize. This is reflected in higher plant height, leaf area index and higher grain and straw yield of winter maize.

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