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Effect on Yield and Yield Component of Maize (*Zea mays* L.) Due to Planting Patterns and Different Irrigation Levels

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ABSTRACT

To study the effect of two planting patterns viz.60 cm apart single rows and 30/90 cm apart double row strips (30 cm from row to row and 90 cm from strip to strip) and different irrigation levels *viz.* 0, 3, 4, 5 and 6 irrigations on growth and yield of maize, a field trial was carried. The growth and yield of maize were not influenced by planting patterns but number of plants per plot at harvest, number of grains per cob, 1000 grain weight, biological yield, grain yield and harvest index were significantly affected by different irrigation levels. When planting spacing was kept at 30/90 cm apart; double row strips (30 cm from row to row and 90 cm from row to row) and 6 irrigations, maximum grain yield (7.37 t ha^{-1}) was produced.

Key Words: Yield components; Maize, Planting patterns; Irrigation levels

INTRODUCTION

Maize is used as food grain for human consumption in some parts of India. It is being used for manufacturing industrial products like starch, syrup, alcohol acids, etc. More than 90 per cent of the people use the maize oil for consumption purpose in USA. In addition it is also used as an important feed and fodder for animals. Tollenaar and Aguilera(1992) reported that growth and yield of maize significantly influenced by planting patterns. Toor(1990) found that grain yield was influenced up to a measurable extent by the planting geometry. The planting geometries did not affect significantly days taken to tasseling, grain weight per cob, 1000-grain weight, dry stalk weight, and harvest index.

At critical stages of plant growth, availability of adequate amount of moisture not only optimizes the metabolic process in plant cell but also increases the effectiveness of the mineral nutrients applied to the crop. Any degree of water stress may, consequently produce deleterious effects on growth and yield of the crop. Dai *et al (*1990) found that growth and development of all the cultivars and hybrids of maize at different growth stages are inhibited by water stress.

The present study, in view of importance of planting patterns and irrigation levels at different growth stages, was undertaken to find their suitable combination for augmenting maize yield under agro-ecological conditions of Dirang, Arunachal Pradesh.

MATERIALS AND METHODS

To evaluate the effect on yield and yield component of Maize (*Zea mays* L.) due to planting patterns and different irrigation levels, a field experiment was conducted at the KVK farm, Dirang, West Kameng, Govt. of Arunachal Pradesh. Planting patterns were 60 cm apart single row and 90 cm apart double row strips. Irrigation levels were I_0 = no irrigation, I_1= one irrigation during vegetative growth + one irrigation at tasseling + one irrigation at silking, I_2 = three irrigations during vegetative growth + one irrigation at grain formation, I_3 = two irrigations during vegetative growth + one irrigation at tasseling + one irrigation at silking + one irrigation at maturity and I_4 = two irrigations during vegetative growth + one irrigation at tasseling +

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one irrigation at silking + one irrigation at grain formation + one irrigation at maturity. Randomizing planting patterns in main plots and irrigation levels in sub plots, the experiment was laid out in randomized complete block design with split-plot arrangement. The net plot size was 8 x 3.6 m. By using the standard procedures, the observations on growth and yield characteristics of the crop were recorded. Using Duncan's Multiple Range (DMR) test at 5% probability level. Data were analyzed statistically and treatments comparison was done as per statistical procedures reported by Steel and Torrey (1984).

RESULTS AND DISCUSSION

Effect on plant population

The plant population was not significantly affected by planting patterns (Table I). The average value varied from 165.1 to 163.5. Simon (1991) reported that with high level of irrigation, number of plants / m^2 were higher. In this experiment, the plant population/ plot was significantly affected by irrigation levels. At irrigation level I_4, significantly higher numbers of plants (173.3) were recorded but were statistically at par with I_3, I_2 and I_1. In case of control, the minimum numbers of plants (135.0) per plot were recorded. At harvest, interaction affect of planting patterns and irrigation levels on number of plants/ plot was also found to be non-significant.

Number of cobs per plant

Data (Table1) showed that the number of cobs/ plant were not influenced by the planting pattern. Significant effect of cultivar and planting patterns upon number of cobs per plant were observed by Thomson and Jordan (1995). Statistically, similar number of cobs/plant were given by irrigation levels I_4, (1.22), I_3 (1.19), I_2 (1.12) and I_1 (1.04). I_0 produced the minimum number of cobs /plant (0.64). The interaction effect of planting patterns and different irrigation levels was also found to be non-significant.

Number of grains per cob

Ali (1995) reported that planting pattern had non-significant effect on number of grains per cob. Similarly, planting patterns had no significant effect on number of grains/cob. The number of grains/cob ranged between (451.5 to 455.5) and were significantly affected by irrigation levels. Wajid (1990) found that numbers of grains/cob were significantly affected by high irrigation levels. In case of I_4 , The maximum numbers of grains (603.9)/ cob were recorded and minimum (153.7) in case of control. Infact, interaction effect of planting patterns and different irrigation levels was found to be non significant.

Similarly data (Table1) showed that the effect of planting pattern on 1000-grain weight was not significant whereas effect of irrigation was significant and was highest (276.8 g) in treatment I_4.

Biological yield (t ha^{-1}). On biological yield, the planting patterns had non-significant effect (Table 1). However, when the maize crop was planted in 30/90 cm apart; double row strips, maximum biological yield (16.57 t ha^{-1}) was obtained. Puste and Kumar (1988) reported that during the vegetative stage than during the grain-filling phase, maize growth was more sensitive to water stress. Similarly, when the crop was planted in 30/90 cm apart; double rows strips at I_4 irrigation levels, the maximum biological yield (23.28 t ha^{-1}) was obtained. Table.1 showed that with increasing number of irrigation levels, there was a gradual increase in biological yield. At irrigation level I_4 maximum biological yield (23.28 t ha^{-1}) was achieved over I_3, I_2, I_1 and I_0 (21.02, 18.87, 15.76 and 3.85 t ha^{-1} respectively.

Grain yield (t ha^{-1}). Significantly, higher yield recorded in 60 cm apart single rows than 30/90 cm apart double rows Kalia (1992). Table 1 showed that in various planting patterns, grain yield exhibited non-significant differences. Rizzardi *et al.* (1994) concluded that neither spacing patterns nor planting patterns could differ grain yield and yield components.

Ghinassi and Trucchi (1999) reported that from the last vegetative period, maize pollination was particularly sensitive to water stress. Similarly, the grain yield was significantly affected by different irrigation levels. In I_4 ,the highest grain yield (7.37 t ha^{-1}) was obtained. In control, the lowest grain yield (0.40 t ha^{-1}) was recorded. Water stress also affected other parameters such as plant height, lodging percentage and commercial grain yield. On grain yield, interaction effect of planting

Table 1. Effect on yield and yield components of maize.

Treatments	No.of Plantsper plot atharvest	No.of cobs plant^{-1}	No.of grains cob^{-1}	1000-grain wt.(g)	Grain yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
Planting patterns							
P_1= 60 cm	165.07	1.02	451.5	203.3	4.54	16.54	24.46
P_2= 30/90 cm	163.48	1.02	455.5	203.8	4.59	16.57	25.05
LSD	N.S	N.S	N.S	N.S	N.S	N.S	N.S
Lrrigation levels							
I_0	135.01 b	0.64 b	152.8 d	116.3 e	0.31 e	03.85 e	10.02 d
I_1	169.18 a	1.04 a	419.5 c	170.5 d	3.95 d	15.76 d	25.30 c
I_2	171.34 a	1.12 a	556.5 b	204.5 c	5.03 c	18.87 c	27.11 bc
I_3	172.51 a	1.19 a	534.9 b	249.7 b	6.15 b	21.02 b	29.51 ab
I_4	173.34 a	1.22 a	603.9 a	276.8 a	7.37 a	23.28 a	31.82 a
LSD	4.359	0.181	26.80	30.28	0.371	1.112	2.381

I_0 = No irrigation; I_1 = One irrigation during vegetative growth + one irrigation at tasseling + one irrigation at silking; I_2 = Three irrigations during vegetative growth + one irrigation at grain formation; I_3 = Two irrigations during vegetative growth + one irrigation at tasseling + one irrigation at silking + one irrigation at maturity; I_4 = Two irrigations during vegetative growth + one irrigation at tasseling + one irrigation at silking + one irrigation at grain formation + one irrigation at maturity; NS= Non-significant; Any two means not sharing a common letter differ significantly at 5% level of significance

patterns and different irrigation levels was found to be non-significant.

Harvest index (%). Toor (1990) found that planting pattern had non significant effect on Harvest Index. Similarly, table-1 showed non-significant effect on harvest index by planting patterns. Wajid (1990), reported that irrigation frequencies significantly affected harvest index. Similarly,with each successive increase in irrigation, there was progressive increase in harvest indices. The highest harvest index (31.82 %) was showed by I_4 levels, which was statistically at par with I_4 (29.51 %). likewise, I_3 and I_2 are also statistically at par while I_2 is statistically different from I_4 but In control, lowest harvest index (10.02 %) was observed.

CONCLUSIONS

It may be concluded that in combination i.e. planting pattern of 30/90 cm apart double row strips and irrigation level I_4 (two irrigations during vegetative growth + one irrigation at tasseling + one irrigation at silking + one irrigation at grain formation + one irrigation at maturity) as compared to other treatments were found to be more efficient.

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