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Studies on Effect of Planting Ratio on Plant Growth, Yield and Yield Parameters of Drought Tolerant Pre Released Maize Hybrid (*Zea mays* L.)

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A B S T R A C T

An investigation was carried on hybrid seed production in maize during rabi at Agricultural College, Bheemarayanagudi to study the different planting ratio on plant growth parameters like plant height, leaf area, leaf area index, plant girth, days to 50% silking was found non-significant difference among the planting ratio and in days to 50% tasseling (57.56 %) was found significant differences in 4:1 planting ratio and seed yield (42.06 q/ ha), cob weight (162.56 g), number of seeds per cob (617) was recorded significantly higher in 5:1planting ratio and other seed yield contributing parameters *viz.*, cob length (16.67 cm), number of seeds per row (42.33), number of seed rows per cob (14.56) was found higher in 5:1 planting ratio and but highest 1000 seed weight (218 g) was recorded in 3:1 planting ratio as compared to the rest of planting ratios in maize inbreds like female inbred (NEI 92202B) and male inbred (HS-4).

Introduction

Maize (*Zea mays* L.) is an important food and fodder crop of the world. In India, maize is grown over an area of 70.49 million ha with a production of 123.88 million tonnes. In Karnataka, it is cultivated in an area of 1331(‘000 ha) with production of maize classified based on the season, here in *kharif* (2415 Kg/ha), *rabi* (2500 Kg/ha) and *summer* (2750 Kg/ha). (Anon., 2012). The seed of a maize plant is called the kernel made up of approximately 10% protein, 70% carbohydrate, 2.3% crude fibre and 1.4% ash. It is also a source of Vitamins A and E, riboflavin and nicotinic acid. Maize being a C4 plant, water stresses one of the most serious and severe conditions affecting crop productivity. There are a number of biotic and abiotic factors those affect maize yield considerably; however, it is more affected by variations in planting geometry. Water being an integral part of plant plays a vital role in the maintenance of plant life. Its deficiency modifies soil-plant water relationships by lowering tissue water potential and impairing metabolic processes. Planting geometry determines the plant distribution in the field and thereby affects competition among crop plants for mineral nutrients and other essential for growth. In the latest production technology which emphasizes the use of good

quality seeds, planting geometry needs to be applied resourcefully and resolutely. Whereas, the lesser planting geometry increases interplant competition for light, water and nutrients, which may be determined the final yield.

The planting ratio between female and male parents will decide the amount of hybrid seed produced and is influenced by the vigour of the parents (male and female) and especially the pollen producing ability of the male parent. Looking to the flower characters of male parent one can visualize easily the production and supply of pollen to female parent, which is essential to achieve satisfactory pollination and to get better seed set. One of the basic requirements in hybrid seed production is the optimum planting ratio of pollen parent to seed parent to get good seed set. Also, the pattern of planting contributes substantially for the uniform supply of pollen to all the seed parent rows.

Materials and Methods

A field experiment was conducted during *Rabi* 2011-12 at College of Agriculture, Bheemarayanagud situated in North Eastern Dry Zone (Zone-2) of Karnataka at 16^{o} 43' N latitude and 76^{o} 51' E longitude with an altitude of 412 m above the mean sea level. The soil of experimental plot was deep black having 0.60 per cent organic carbon, 215.00 kg ha^{-1} available nitrogen, 27.80 kg ha-1 available phosphorous, 189.50 kg ha-1 available potassium and a pH 7.6. Three treatment combinations comprising of two maize inbreds which were allotted in main plots are female inbred (NEI 92202B) and male inbred (HS-4) and three planting ratios like 3:1, 4:1 and 5:1. The experiment was laid out in randomized completely block design with three replications. Five plants were tagged at random in net plot area for recording various yield components like cob length (cm), cob weight (g), number of seeds per cob, number of rows per cob, number of seeds per cob, 1000 seed weight (g), seed yield (kg ha^{-1}) was computed by dehuske and separate seeds form cobs are clean and recorded the seeds weight of maize hybrid.

The removal of tassels from female inbred is called as detassling. The tassels to be opened next day were selected in female inbred and removed the tassels during detassling. The transfer of pollen from male parent to female parent is called as pollination. The just opened tassels were picked from the female inbred and avoid for selfing in female inbred. One male tassel was used to pollinate three, four and five female detasseled plants as per the treatments and after crossing, different colour thread was tied to the stem of the crossed female inbred for easy identification. Pollination was carried out daily as per the treatments. Five plants in each treatment and replication were randomly selected and tagged for recording the observations on growth characters at 30,60,90 DAS and also at harvest. The yield and yield parameters were collected at and after harvest of the crop. The seed germination was tested as per the ISTA procedure (Anonymous, 1999). Seedling vigour index was calculated as per Abdul-Baki and Anderson (1973) and other quality parameters like root length (cm), shoot length (cm), the statistical analysis was done as per the methodology given by Gomez and Gomez (1984).

Results and Discussion

Plant growth parameters like plant height (cm), leaf area (dm^2), leaf area index was no significant difference among the different planting ratio for Plant height (cm), leaf area and Leaf area index. However, the lowest planting ratio (3:1) recorded numerically Plant height (141.22cm), leaf area (38.52cm) and Leaf area index (2.68) as compared to the

4:1 and 5:1 planting ratio. In plant girth (23.00 mm) recorded numerically highest in 5:1 planting ratio and Days to 50% silking (61.33days) compared to 4:1 (22.22 mm) and 3:1 (21.78 mm). Plant growth parameters like plant height (cm), leaf area (dm^2), leaf area index, plant girth (cm) and Days to 50% silking (Table 1) did not different significantly due to effect of different planting ratios. This may be attributed to genetic characteristics of the parents. Planting ratio of 4:1 recorded significantly higher days to 50% tasseling (57.56 days) as compared to 5:1(56.89 days) and lowest was noticed in 3:1 (55.78 days).

Similar results were also observed by Khadi *et al.,* (1995) Pollen availability is more in 3:1 as compared to others. Who observed that the 2:1 planting ratio found optimum in DDH-2 hybrid seed production?

The variation in days to 50 per cent silking and tasseling between the female and male parental lines may be attributed to the genotypic variation and its interaction with the environment. The genotypic difference in the flowering may further be due to the difference in flower initiation which is in turn affected by environmental factors like temperature, relative humidity, photoperiod and their interaction. Such variation in the days to 50 per cent flowering between the female and male parents was also observed in PVK hy-5 (Anon., 2001) and in TCHB-213 hybrid in cotton by Krishnadoss *et al.,* (1994).

Table.1 Effect of different planting ratios on plant growth parameters in drought tolerant pre released maize hybrid

Treatments	Plant height (cm)	leaf area (dm^2)	Leaf area index	plant girth (mm)	Days to 50% silking	Days to 50% tasseling
P_1 (3:1)	141.22	38.52	2.68	21.78	59.67	55.78
P_2 (4:1)	139.89	36.37	2.52	22.22	60.44	57.56
P_3 (5:1)	137.56	34.64	2.41	23.00	61.33	56.89
Mean	**139.56**	**36.51**	**2.54**	**22.33**	**60.48**	**56.74**
SE.m±	60.47	1.06	0.08	0.54	0.47	0.26
CD at 5%	NS	NS	NS	NS	NS	0.77

NS – non-significant

Table.2 Effect of different planting ratios on seed yield and yield parameters in drought tolerant pre-released maize hybrid

Treatments	Cob length (cm)	Cob weight (g)	Number of seeds per row	Number of seed rows per cob	Number of seeds per cob	1000 seed weight (g)	Seed yield (qt/ha)
P_1 (3:1)	15.89	146.11	41.11	13.89	572	218	37.80
P_2 (4:1)	16.44	149.44	41.67	14.22	592	203	40.31
P_3 (5:1)	16.67	162.56	42.33	14.56	617	211	42.06
Mean	**16.44**	**152.70**	**41.70**	**13.48**	**567**	**207**	**40.05**
SE.m±	0.55	1.47	0.90	0.68	259.03	5.10	1.03
CD at 5%	NS	4.41	NS	NS	4.41	NS	3.09

NS – non-significant

There was no significant difference among the different planting ratio for cob length (cm), number of seeds per row and number of seed rows per cob. However, the higher planting ratio (5:1) recorded numerically higher cob length (16.67cm), number of seeds per row (42.33) and number of seed rows per cob (14.56) as compared to the 4:1 cm and 3:1 planting ratio. Seed weight was recorded non-significantly highest in the 3:1 compared to the 4:1and 5:1 are presented in table 2.

The cob weight (g) (162.56g) and number of seeds per cob (617) were recorded significantly highest in the 5:1 as compared to the 4:1 cm and 3:1 planting ratio are presented in table 2.

In the present study, the planting ratio of 5:1 recorded significantly higher seed yield (42.06 q ha^{-1}) when compared to other planting ratios tested *viz.*, 4:1 (40.31 q ha^{-1}) and 3:1 (37.80q ha^{-1}) in table 2. The similar results were observed in sunflower hybrid BSH-1 by Satyanarayana and Seetharam (1983); Reddy *et al.*, (1989) in which higher yield can be obtained with increased male to female ratio from 1:1 to 1:4. The planting ratio of 5:1 produced the higher seed yield followed by 4:1 and lowest was with 3:1 ratio which was mainly due to larger area of 83 % under 5:1 and 80 % under 4:1 and lowest of 75 % under 3:1 female to male lines (Anon., 1991).

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