

Original Research Article

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Response of Different Maize (*Zea mays* L.) Varieties to Planting Densities

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ABSTRACT

An experiment was conducted at the Agriculture Research farm of the Arunachal Universities of Studies, Namsai, Arunachal Pradesh during rabi season 2018-19 to study the response of different maize varieties to the planting densities. The experiment was conducted with twelve treatment combinations comprising of four planting densities viz., S1 (70cm x 20cm), S2 (60cm x20cm), S3 (50cm x 20cm), S4 (40cm x 20cm) and three varieties V1 (Bond NMH 007), V2 (HQPM-1), V3 (Local) in a split plot design with three replications. The results revealed that the variety Bond NMH 007 was superior to other varieties. Although maximum plant height (220.35cm) was observed in the Local variety whereas the other growth parameters were found to be the highest in variety Bond NMH 007 such as number of leaves (10.83), number of cobs (2.00), ear diameter (16.70 cm), cob length (21.53 cm), 50% tasselling (85.79), fresh weight (181.33 g), dry weight (141.78 g), number of seed per cob (315.96), grain yield per plant (126.37 g) and grain yield per plot (2.24 kg). Among different planting densities S1 (70cm x 20cm) recorded highest value for plant height at 120 days after planting (191.47cm), diameter of ear per plant (15.92cm), cob length per plant (20.58cm), days to 50% tasselling (81.22 days), number of seed per cobg (286.83). Fresh weight per cob (175.75g), dry weight (137.22g) and highest grain yield per plant(119g). The results also showed that planting density S1(70cm x 20cm) with V1(Bond NMH 007) variety obtained highest value for most of the parameters.

Keywords

Maize,
Planting densities,
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Introduction

Maize (*Zea mays* L.) belonging to Poaceae (Gramineae) is one of the most important cereal crops in the global agricultural economy both as food as well as for man and feed for animals and is also known as 'queen of cereals'. Maize being "C4 and day-neutral plant," has a very high yield potential. It is one of the most versatile crops with wider adaptability in varied agro-ecologies. The

highest maize producing countries are United State at number one position accounting for about 38%, followed by china 23% respectively. Whereas, India contributes around 2%. According to farm ministry data India produced only 15.5 million tonnes maize in year 2015-16 kharif season, falling from 17.01 million tonnes a years ago. Similarly, there was fall in production by nearly 23% on the same year to 5.53 million tonnes due to soil moisture stress. However,

in year 2016-17 production of maize recorded to be increased by 23000 thousand metric tonnes. Maize is one of the most popular cereal crop cultivated next to rice, millet, wheat etc. in Arunachal Pradesh. According to latest crop production Statistics of Department of Agriculture, Arunachal Pradesh 2016-17, maize is grown under the area of 40703 ha with an output of 59907 metric tonnes during Kharif season. During Rabi season it is grown under the area of 9597 ha with the annual production of 15543 metric tonnes. Major maize producing districts of Arunachal Pradesh are Tawang, East Kameng, Upper Subansiri, East Siang and Papumpare. As in the case of any other crops production and productivity of maize is also influenced by the genetic makeup or varietal character. Varieties suited to specific agro climatic condition are to be identified and popularized. Maize is a non-tillering crop, and each plant counts for the yield. Unlike tillering plants such as rice or wheat, maize cannot compensate for lost space therefore, it is very important that plant density is maintained in maize. Pepó and Sárvári (2013), reported that maize is a plant with individual productivity and therefore plant density determines yield significantly. Plant density is a production factor that affects yield to the greatest extent. Overcrowding may reduce yields lead to poor quality of fruits. Spacing also plays an important role in disease management by reducing the risk of diseases which are contagious and also improves the immune system of the crop.

Materials and Methods

The field experiment was carried out during rabi season, 2018-2019 at the Agriculture Research Farm of Arunachal University of Studies, Namsai. The effect of three different variety (V1=Bond NMH007, V2=HQPM-1 and V3=Local) with four planting densities (S1= 70cm x 20cm, S2= 60cm x 20cm,

S3=50cm x 20cm and S4=40cm x 20cm) on growth and yield characters of maize was evaluated in split plot technique with twelve treatment combination with three replication each. The maize varieties were planted during the second week of December. Five plants were selected randomly from the net plot in each treatment and replication and tagged for the purpose of recording different observation. The various observations on growth and yield were recorded and analysed statistically.

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under the following headings:

Effect of variety on crop characters and yield contributing characters of maize

The plant height(cm), number of leaves per plant, days to 50% tasselling, number of cobs per plant, ear diameter (cm), cob length (cm), fresh weight and dry weight of cobs per plant(g), number of seeds per cob and grain yield per plant (g) were significantly influenced by various varieties (Table 1a & Table 1b). In the present study, variety V3 (local) recorded highest plant height of 220.35cm and lowest (174.07cm) by V1 (Bond NMH007 (Table 1a). Highest number of leaves (10.83) was recorded by V1 (Bond NMH007) and lowest number of leaves (8.55) by V1 (Local) (Table 1a). The maximum days (85.79days) was recorded by V1 (Bond NMH 007) whereas V3 (Local) recorded minimum days (67.58 days) to 50% tasselling (Table 1a). The number of cobs per plant was found to be superior in variety V1 (Bond NMH 007) of 2.00 and the other two varieties V2 (HQPM-1) and V3 (Local) where at par i.e. 1.65 and 1.61 respectively (Table 1a).

Table.1a Effect of variety plant height, number of leaves per plant, days to 50 % tasselling, number of cobs per plant, ear diameter and cob length

Variety	Plant height (cm)	Number of leaves plant ⁻¹	Days to 50% tasselling	Number of cobs plant ⁻¹	Ear (cm)	Cob (cm)
V1- Bond NMH007	173.66	10.83	85.79	2.00	16.70	21.53
V 2 - HQPM-1	172.21	10.31	83.95	1.65	15.45	18.20
V3-Local	220.35	8.55	67.58	1.61	13.03	17.43
CD(5%)	4.05	1.79	0.81	0.26	0.65	0.73
S.Em (±)	1.00	0.44	0.20	0.06	0.16	0.18

Table.1b Effect of variety on fresh weight, dry weight, number of seeds per cob and grain yield per plant

Variety	Fresh weight (g)	Dry weight (g)	Number of seeds plant ⁻¹	Graing yield plant ⁻¹ (g)
V1- Bond NMH007	181.33	141.78	315.96	126.37
V 2 - HQPM-1	159.46	122.90	248.70	111.33
V3-Local	140.11	103.86	216.33	82.72
CD(5%)	3.06	0.67	1.99	7.10
S.Em (±)	0.83	0.16	0.49	1.76

Table.2a Effect of planting density on plant height, number of leaves per plant, days to 50 % tasselling, number of cobs per plant, ear diameter and cob length

Variety	Plant height (cm)	Number of leaves plant ⁻¹	Days to 50% tasselling	Number of cobs plant ⁻¹	Ear diameter (cm)	Cob length (cm)
S1- 70cm x 20cm	191.47	9.77	79.54	1.84	15.92	20.58
S2- 6cm x 20cm	186.35	10.13	81.22	1.77	15.38	19.12
S3- 50cm x 20cm	189.07	10.13	78.25	1.73	15.05	18.18
S4- 40cm x 20cm	188.07	9.66	77.42	1.66	13.90	18.33
CD(5%)	3.24	NS	1.45	NS	0.72	0.79
S.Em (±)	1.08	0.23	0.48	0.10	0.24	0.26

Table.2b Effect of planting density on fresh weight, dry weight, number of seeds per cob and grain yield per plant

Variety	Fresh weight (g)	Dry weight (g)	Number of seeds plant ⁻¹	Grain yield plant ⁻¹ (g)
S1-70cm x 20cm	175.75	137.22	286.83	114.00
S2-6cm x 20cm	157.00	122.25	255.17	107.94
S3-50cm x 20cm	158.27	117.42	253.22	103.21
S4-40cm x 20cm	150.47	114.49	246.11	102.08
CD(5%)	1.33	1.26	2.58	4.21
S.Em (±)	0.44	0.42	0.86	1.40

Table.3a Interaction effect of planting density and variety on plant height, number of leaves per plant, days to 50 % tasselling, number of cobs per plant, ear diameter and cob length

Variety	Plant height (cm)	Number of leaves plant ⁻¹	Days to 50% tasselling	Number of cobs plant ⁻¹	Ear diameter (cm)	Cob length (cm)
T1-V1S1	171.82	11.06	86.85	2.33	17.58	23.93
T2-V1S2	174.00	11.06	85.30	1.93	16.64	21.16
T3-V1S3	175.00	10.53	85.77	1.93	16.23	20.42
T4-V1S4	173.83	10.67	85.26	1.80	16.23	20.60
T5-V2S1	181.20	9.53	86.12	1.66	15.83	19.75
T6-V2S2	167.06	10.80	84.70	1.46	15.76	18.81
T7-V2S3	177.53	10.46	84.00	1.66	15.90	17.13
T8-V2S4	163.06	10.46	81.00	1.80	14.33	17.13
T9-V3S1	227.40	8.73	65.66	1.53	14.34	18.06
T10-V3S2	218.00	8.53	73.66	1.93	13.75	17.40
T11-V3S3	214.70	8.53	65.00	1.60	14.33	17.00
T12-V3S4	221.33	7.86	66.00	1.40	11.15	17.26
CD(5%)	6.15	NS	2.32	NS	NS	NS
S.Em (±)	2.00	0.89	0.75	0.13	0.32	0.36

Table.3b Interaction effect of planting density and variety on fresh weight, dry weight, number of seeds per cob and grain yield per plant

Variety	Fresh weight (g)	Dry weight (g)	Number of seeds plant-1	Grain yield plant-1 (g)
T1-V1S1	216.00	173.30	355.00	128.33
T2-V1S2	171.00	132.48	301.86	128.82
T3-V1S3	178.00	133.00	316.00	125.66
T4-V1S4	160.33	128.33	291.00	122.66
T5-V2S1	155.67	117.18	285.83	120.66
T6-V2S2	157.00	118.00	246.00	112.3
T7-V2S3	164.83	127.28	230.00	106.66
T8-V2S4	160.33	129.15	233.00	105.66
T9-V3S1	154.70	121.18	219.66	93.00
T10-V3S2	143.00	116.28	217.66	82.66
T11-V3S3	130.00	92.00	213.66	77.31
T12-V3S4	130.75	86.00	214.33	77.93
CD(5%)	2.30	2.23	4.68	NS
S.Em (±)	1.66	0.33	0.98	3.52

Among variety highest ear diameter (16.70 cm) was recorded by V1(Bond NMH007) lowest ear diameter was recorded by V3 (Local) of 13.03cm (Table 1b). The highest cob length (21.53cm) was found in V1 (Bond NMH007) and lowest cob length (17.43 cm) was obtained in V3 (Local). The results are in conformity with Gozubenii *et al.*, (2001) in maize who reported that variation in ear characteristics of maize depends upon the genotype and environmental conditions. The result showed that V1 (Bond NMH007) recorded highest fresh weight of 181.33g and dry weight of 141.78g and the lowest fresh weight (140.11g) and dry weight (103.86g) was recorded by V3 (Local) (Table 1b). A similar report was also obtained by Zamir *et al.*, (2011). The results showed that V1 (Bond NMH007) recorded maximum number of seeds per cob of 315.96 and the lowest was recorded by V3 (Local) of 216.33 (Table 1b). The highest grain yield (126.37g) was recorded by V1 (Bond NMH007) and lowest grain yield (82.72g) was recorded by V3

(Local) (Table 1b). This may be due to specific varietal and environmental factors such as climate, soil, water, topography etc.

Effect of planting density on crop characters and yield contributing characters of maize

The planting density had a significant effect on plant height, ear diameter, cob length, days to 50% tasselling, fresh weight, dry weight, number of seeds per cob and yield per plant (Table 2a & 2b). The plant height was highest at wider spacing of S1 (70cm x 20cm) of 191.47cm and lowest plant height (186.35) was obtained in S4 (40cm x 20cm) (Table 2a). The planting density S1 (70cm x 20cm) recorded highest ear diameter (15.92cm) and the lowest was recorded by S4 (40cm×20cm) of 13.90cm, whereas S2 and S3 were at par (Table 2a). The cob length was highest in S1 (70cm×20cm) of 20.58cm and the lowest was recorded by S3 (50cm×20cm) of 18.18cm. The data revealed that cob length decreased

with increasing planting density (Table 2a). These results indicate that there is a positive relationship between plant spacing and cob length of maize, which may be probably due to variable plant competition. Similar results were found by Zamir *et al.*, (2011) and Karim *et al.*, (1983) in maize. The maximum days taken to 50% tasselling was recorded in S2 (60cm×20cm) of 81.22days and minimum was recorded by S4 (40cm×20cm) of 77.42days, whereas S1 (70cm x20cm) of 79.54days and S3(50cm x 20cm) of 78.25 days are at par (Table 2a). The highest fresh weight (175.75g) and dry weight (137.22g) was recorded by S1 (70cm×20cm) and lowest fresh weight (150.47g) and dry weight (114.49g) was recorded by S4 (40cm×20cm) (Table 2a). The highest number of seeds per cob was recorded in S1 (70cm×20cm) of 286.83 and lowest was recorded by S4 (40cm×20cm) of 246.11 (Table 2b). The highest grain yield per plant was recorded in S1 (70cm×20cm) of 114.00g and the lowest was recorded by S4 (40cm×20cm) of 102.08g (Table 2b). Hasan *et al.*, (2018) recorded longest plant, highest cob, maximum diameter of cob, highest number of kernel per cob, the highest 1000 grain weight, maximum grain yield and maximum stover yield in spacing of 75cm x 25cm. Sabo *et al.*, (2016) reported that wider intra-row spacing in maize of 25cm recorded highest plant height, number of leaves, leaf area, number of cob per plot, cob length, 100 seed weight and grain yield.

Interaction effect of planting density and varieties of growth and yield characters of maize

The interaction effect of planting density and variety was found to be significant for plant height, days to 50% tasselling, fresh weight, dry weight and number of seeds per cob (Table 3a &3b). The tallest plant height (227.40 cm) was obtained from interaction effect of Local variety with S1 (70cm x

20cm) and smallest plant (163.06) was recorded by variety HQPM-1 with S1(70cm x20cm), (Table:3a). The maximum days (86.85 days) taken to 50% tasselling was recorded by the T3 (V1S2) whereas minimum days (65.00 days) was recorded in T11(V3S3), (Table:3a). The highest fresh weight was recorded by the T1 (V1S1) is 216.00g whereas lowest was recorded in T12(V3S4) is 130.75g. The maximum dry weight was recorded by the T1 (V1S1) is 173.30g whereas T12 (V1S1) recorded the lowest dry weight of 86.00g, (Table:3b).. The highest number of seed per cob was recorded by the T1 (V1S1) is 355.00 whereas T11 (V3S3) recorded lowest number of seeds per cob is 213.66 which is at par with T12 (V3S4) is 214.33, (Table:3b). Wider spacing produce higher seed, result is supported by Gulluoglu *et al.*, (2017).

The results thus obtained from this investigation concluded that planting density of maize is an important factor to get a optimum growth and yield. From the finding of present experiment it can be concluded that variety V1 (Bond NMH 007) is more suitable than the other two varieties. Spacing S1 (70cm x20cm) has been found to be the ideal spacing for Namsai region. Wider spacing has influence on growth parameters this may be due to efficient utilization of light, space, moisture and aeration for growth and development. Variety Bond NMH 007 found to be the most superior and its performance was consistently superior to that of the other varieties followed by HQPM-1.

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