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Performance of pre release late maturity maize genotypes as influenced by planting density and nutrient levels

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Abstract
Field experiment was carried out at Department of Millets, Tamil Nadu Agricultural University, Coimbatore during *Kharif*, 2017 in sandy clay loam soil to study the effect of planting density and nutrient levels on pre release late maturity maize genotypes with their interactions. The results revealed that BIO 9681 (G_4) and ADV 7022 (G_1) were found to be the promising late maturity maize genotypes under 50 x 20 cm spacing with 250:80:100 NPK kg/ha.

Keywords: Maize, genotypes, planting density, nutrient levels, growth and yield

Introduction
Maize (*Zea mays* L.) is the most promising cereal crop grown widely in India after rice and wheat. It has been, continued to be used as human food, animal feed and as a source of large number of industrial by-products thus creating more demand and production. (Yadav *et al.*, 2016) [1]. The yield of the crop depends on genetic makeup, climatic, edaphic and management factors. Amongst, genotypes, spacing and nutrient management practices play a vital role in enhancing the yield of maize. Plant population is the major factor which influences the yield directly. Higher plant population produced 25% more grain yield as compared to lower plant population. (Shapiro C.A. and Wortmann C.S, 2006) [2] and Abdul *et al*., 2007) [3]. Maize being an exhaustive crop, requires more nutrients during growth and development. Balanced application of nitrogen, phosphorus and potassic fertilizers improved the productivity and their contribution is 40 - 45 percent. (Fahad Khan *et al*., 2014) [4]. Hence, the present experimentation was conducted to study the performance of pre release late maturity maize genotypes to different planting density and NPK levels with their interactions.

Materials and methods
Field experiment was conducted in sandy clay loam soil at Department of Millets, Tamil Nadu Agricultural University, Coimbatore during *Kharif*, 2017 to study the effect of varying planting density and nutrient levels on pre release late maturity maize genotypes with their interactions. The soil was low in available N and P and high in available K. The experiment was laid out in a split – split plot design. In the main plot, two planting densities *viz*., D_1- 60 x 20 cm and D_2 - 50 x 20 cm and in the sub plot, three nutrient levels *viz*., N_1: 250:75:75 NPK kg/ha N_2: 200:65:80 NPK kg/ha and N_3: 250:80:100 NPK kg/ha and in the sub sub plot, four genotypes *viz*., G_1: ADV 7022, G_2: PMH 1, G_3: Seed Tech 2324, and G_4:BIO 9681 were tried in three replications. Observations on plant height, yield attributes and yield were recorded.

Results and Discussion
Effect of planting density and nutrient levels on growth, yield attributes and yield of pre release late maturity maize genotypes (Table 1)
Experimental results revealed that planting densities and nutrient levels exerted significant influence on growth, yield attributes and yield of genotypes. The interaction effect was not significant. Nevertheless, among the planting densities, higher plant height was recorded in D_2 (232.5 cm). More competition for resources viz., space, sunlight and nutrients under high plant density resulted in higher plant height. The results are in accordance with the findings of Pal and Bhatnagar (2012) [5] and Mohseni *et al*. (2013) [6].

No significant effect was observed with respect to nutrient levels. Nevertheless, N_3 recorded higher plant height of 233.2 cm, which was followed by N_1.This might be due to more vegetative growth under high auxin level which increased the plant height. These results are in conformity with the findings of Dawadi and Sah (2012) [7] and Nsanzabaganwa *et al.*, (2014), [8] who reported that plant height increased with increase in NPK levels. In respect of genotypes, BIO 9681 (G_4) registered higher plant height (235.5 cm) at harvest and it was comparable with G_1. This was ascribed to the genetic makeup of plants.

Among planting densities, 60 x 20 cm (D_1) registered higher cob length (16.9 cm), cob girth (14.2 cm), no. of grain rows/cob (15.6), no. of grains/row (35.0) and 100 seed weight (33.1 g). The yield attributing characters were improved compared to 50 x 20 cm which was ascribed to better availability of light, aeration and nutrients. Similar view has been expressed by Jaliya *et al.*, (2008) [9].With regard to nutrient levels, N_3 recorded higher cob length (16.8 cm), cob girth (14.2 cm), no. of grain rows/cob (15.7), no. of grains/row (35.1) and 100 seed weight (33.1g). The increased levels of NPK applied to the crop favoured more availability thus improved the uptake. The results are in accordance with the findings of Thakur *et al*., 1991. [10]. The genotype G_4 (BIO 9681) recorded higher cob length (17.0 cm), cob girth (14.3 cm), no. of grain rows/cob (16.1), no. of grains/row (36.0) and 100 seed weight (30.6 g).

In respect of yield, 50 x 20 cm (D_2) recorded higher yield of 9050 kg ha^{-1} which was significantly superior to D_1. Among nutrient levels, higher yield of 8885 kg ha^{-1} was observed in N_3 and it was comparable with N_1 but was superior to N_2. The interaction effect was not significant. With regard to genotypes, G_4 (BIO 9681) registered higher grain yield of 8962 kg $ha^{-1}$and it was comparable with G_1 and G_2 but was superior to G_3.This was due to genetic makeup of plants, which facilitated higher nutrient uptake thus increased the yield. Similar view has been expressed by Javed *et al*. (1985) [11].

Effect of planting density and nutrient levels on economics of pre release late maturity maize genotypes (Table 2)

In respect of economics, BIO 9681 (G_4) under 50 x 20 cm spacing with 250:80:100 NPK kg/ha registered the highest net return (Rs. 94557/ha) and BC ratio (2.58). This was followed by ADV 7022 (G_1) which registered a net return of Rs. 90779/ha with a B: C ratio of 2.51.The lowest net return (Rs. 82733/ha) and B: C ratio (2.38) was registered in Seed Tech 2324 (G_3).

Conclusion

From the experimental results, it could be concluded that BIO 9681 (G_4) and ADV 7022 (G_1) were found to be the promising late maturity maize genotypes under 50 x 20 cm spacing with 250:80:100 NPK kg/ha.

1. Effect of planting density and nutrient levels on growth, yield attributes and yield of pre release late maturity maize genotypes

Treatments	Plant height (cm) at harvest	Cob length (cm)	Cob girth (cm)	No. of grain rows/cob	No. of grains/ row	100 seed weight (g)	Grain yield ($kgha^{-1}$)
Main plot							
D_1	229.8	16.9	14.2	15.6	35.0	33.1	8435
D_2	232.5	16.0	13.6	15.3	33.8	32.5	9050
CD (p=0.05)	1.70	0.40	NS	NS	NS	NS	186
Sub plot							
N_1	233.0	16.6	14.0	15.6	34.7	32.9	8857
N_2	227.2	15.8	13.6	15.1	33.4	32.5	8485
N_3	233.2	16.8	14.2	15.7	35.1	33.1	8885
CD (p=0.05)	NS	0.50	0.50	0.3	NS	NS	321
Sub sub plot							
G_1	233.4	16.6	14.1	15.6	34.9	32.4	8810
G_2	231.9	16.4	13.9	15.2	33.9	33.8	8747
G_3	223.7	15.8	13.4	14.8	32.9	34.5	8450
G_4	235.5	17.0	14.3	16.1	36.0	30.7	8962
CD (p=0.05)	NS	0.60	0.50	0.60	1.30	1.10	358

2. Effect of planting density and nutrient levels on economics of pre release late maturity maize genotypes

Treatments	Net return ($Rs.ha^{-1}$)	B:C ratio
$D_1N_1G_1$	83350	2.47
$D_1N_1G_2$	81887	2.44
$D_1N_1G_3$	75840	2.34
$D_1N_1G_4$	86764	2.53
$D_1N_2G_1$	78710	2.42
$D_1N_2G_2$	77346	2.40
$D_1N_2G_3$	71592	2.29
$D_1N_2G_4$	82042	2.48
$D_1N_3G_1$	83479	2.46
$D_1N_3G_2$	82051	2.44
$D_1N_3G_3$	76002	2.33
$D_1N_3G_4$	87101	2.53
$D_2N_1G_1$	90630	2.52
$D_2N_1G_2$	89037	2.49
$D_2N_1G_3$	82560	2.38
$D_2N_1G_4$	94313	2.58

$D_2N_2G_1$	85540	2.47
$D_2N_2G_2$	84064	2.44
$D_2N_2G_3$	77916	2.34
$D_2N_2G_4$	89106	2.53
$D_2N_3G_1$	90779	2.51
$D_2N_3G_2$	89225	2.49
$D_2N_3G_3$	82733	2.38
$D_2N_3G_4$	94557	2.58

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