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Short communication

Impact of Sweet corn (*Zea mays* L. Ssp *Saccharata*) under Varying plant densities and fertility levels on Growth parameters and Indices under Sub Humid Southern Plain and Arawalli Hills of Rajasthan

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Maize (*Zea mays* L.) is a miracle crop emerging as the third most important cereal crop next to rice and wheat. Amongst different speciality maize species sweet corn (*Zea mays* L. Ssp *Saccharata*) is gaining popularity in India. Amongst various factors plant density is efficient management tools for maximizing sweet corn green cobs and green fodder yield by increasing the capture of solar utilization within the canopy. An optimum plant density for higher economic yield exists for all crop species and varies with cultivar and environment. Moreover, proper mineral fertilization is considered to be one of the most important requisites in this respect. Therefore, there is need to work out suitable combination of fertility level and plant density for sweet corn varieties under Sub Humid Southern Plain and Arawalli Hills of Rajasthan.

The experiment was laid out at the Instructional Farm, Rajasthan College of Agriculture, Udaipur. The treatments consisted of combination of four planting densities (D_1: 55,555 plants ha^{-1}, D_2: 66,666 plants ha^{-1}, D_3: 83,333 plants ha^{-1} and D_4: 1,11,111 plants ha^{-1}) and four fertility levels (F_1: 80 kg N + 30 kg P_2O_5 + 20 kg K_2O ha^{-1}, F_2: 110 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1}, F_3: 120 kg N + 50 kg P_2O_5 + 40 kg K_2O ha^{-1} and F_4: 140 kg N + 60 kg P_2O_5 + 50 kg K_2O ha^{-1}). The experiment was laid out in randomized block design with factorial concept design with three replications. Sweet corn hybrid 'Sugar-75' was sown at a depth of 2-3 cm sown on 2 July 2018 as per treatments and harvested on 21 Sept 2018. As per treatment 1/3 nitrogen, full phosphorus and potassium were applied at time of sowing through urea and DAP and MOP by drilling fertilizer in crop rows about 4-5 cm below the seeds. The rest 1/3 dose of nitrogen was applied as basal at knee high stage and the remaining 1/3 nitrogen was given at initiation of tassel as top dressing in all experimental plots. The plant densities in net plots area in each experimental plot were counted after thinning and at harvest of crop. The plant densities were expressed in '000 ha^{-1}. Five random plants were sampled from each plot for observing plant height, dry matter production/plant and yield attributes. The sweet corn leaves were removed from three randomly selected plants from each experimental unit and categorized as small, medium and large leave. As suggested by Montgomery the leaf area per plant was calculated by multiplying length and width of leaf and summing up area under each category of leaves and multiplied by sweet corn standard factor 0.74. Thereafter, LAI was calculated by using the formula given by Watson (1997).

The plant population recorded at 15 DAS and harvest increased significantly with increasing plant densities (Table 1). It could be on account of an area available for each plant which directly imposed the availability of different growth inputs to individual plants in the community and indirectly might be on account of some extent of competition among and within the plants for different growth inputs. This finding was similar to Meena *et al.,* 2017.

The fertility levels failed to record perceptible variation in plant population recorded at 15 DAS and harvest (Table 1). The minimum plant height at 45 DAS was recorded under 55,555 plant ha^{-1}. Increasing plant density from 55,555 plants ha^{-1} to 66,666 plants ha^{-1} failed to record significant variation in plant height at 45 DAS and 60 DAS, However, further increase in plant density from 66,666 to 83,333 plants ha^{-1} and 83,333 to 1,11,111 plants ha^{-1} increased plant height significantly at 45 DAS and 60 DAS by 4.44, 4 97 per cent and 3.31, 3.74 per cent, respectively. Advancing plant density from 55,555 to 66,666 plants ha^{-1} failed to record significant variation in plant height at harvest,

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however, advancing plant density from 55,555 to 83,333 and 1,11,111 plant ha^{-1} significantly increased plant height (Table 1). Mutual shading under increased population might be on account of increased crop geometry. As the intensity of shading increase due to high population densities, the plant tends to grow taller and produce low LAI. Such increase in plant height at high population densities was reported by Meena (1993), Sahoo and Mahapatara (2007), Kumar (2008) and Bhatt (2012).

Table 1: Effect of treatments on plant population and plant height

Treatments	Plant population ('000 ha^{-1})		Plant height (cm)			Dry matter accumulation (g $plant^{-1}$)			Leaf area index	
	15 DAS	At harvest	45 DAS	60 DAS	At harvest	45 DAS	60 DAS	At harvest	45 DAS	60 DAS
Plant densities										
55,555 Plants ha^{-1}	53.6	51.6	141.4	191.4	201.1	68.9	106.5	133.0	2.74	3.17
66,666 Plants ha^{-1}	63.7	60.6	146.3	196.3	207.0	67.8	104.9	130.7	2.51	3.06
83,333 Plants ha^{-1}	81.8	78.7	152.8	202.8	213.9	60.5	93.7	116.6	2.31	2.99
1,11,111 Plants ha^{-1}	109.7	106.9	160.4	210.4	220.8	52.3	80.8	104.4	2.11	2.88
SEm±	0.68	0.82	2.24	2.24	4.34	1.85	2.78	3.49	0.04	0.06
CD (P=0.05%)	1.96	2.36	6.46	6.48	12.53	5.34	8.02	10.07	0.11	0.18
Fertility levels										
80 kg N+30 kg P_2O_5+20 kg K_2O ha^{-1}	77.3	74.3	142.0	192.0	199.1	55.6	87.3	109.0	2.21	2.86
110 kg N+40 kg P_2O_5+30 kgK_2O ha^{-1}	77.1	74.6	149.2	199.2	212.8	61.9	95.4	120.0	2.41	3.07
120 kg N+50 kg P_2O_5+40 kg K_2O ha^{-1}	77.1	74.7	153.3	203.3	214.5	64.8	99.9	125.8	2.51	3.08
140 kg N+60 kg P_2O_5+50 kg K_2O ha^{-1}	77.2	74.3	156.4	206.4	216.3	67.0	103.3	129.8	2.53	3.10
SEm±	0.68	0.82	2.24	2.24	4.34	1.85	2.78	3.49	0.04	0.06
CD (P=0.05%)	NS	NS	6.46	6.48	12.53	5.34	8.02	10.07	0.11	0.18

Increasing fertility level from 80 kg N + 30 kg P_2O_5 + 20 kg K_2O ha^{-1} to 110 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1} significantly enhanced plant height at 45, 60 DAS and harvest. At the same time increase in fertility level from 110 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1} to 120 kg N + 50 kg P_2O_5 + 40 kg K_2O ha^{-1} and 120 kg N + 50 kg P_2O_5 + 40 kg K_2O ha^{-1} to 140 kg N + 60 kg P_2O_5 + 50 kg K_2O ha^{-1} failed to exhibit significant variation in the plant height recorded at all stages, however, increasing fertility level from 110 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1} to 140 kg N + 60 kg P_2O_5 + 50 kg K_2O ha^{-1} significantly increased plant height by 4.8 and 3.6 per cent at 45 and 60 DAS, respectively (Table 1). The speciality corn hybrids are highly responsive to applied inputs particularly nitrogen and phosphorus. The balanced utilisation of nutrients stimulated plant growth, resulting in increased LAI and higher plant height.. These results are close in accordance with findings of Kumar (2008), Nath *et al.* (2009) and Meena *et al.* (2017).

The maximum dry matter accumulation was recorded under 55,555 plants ha^{-1} which was statistically at par with dry matter recorded under 66,666 plants ha^{-1} all stages However further increasing plant density from 66,666 to 83,333 and 83,333 to 1,11,111 plants ha^{-1} significantly decreased dry matter accumulation by tune of 12.06, 15.60, 11.90 and 15.90 per cent, respectively at 45 and 60 DAS. However, at harvesting, advancing plant density from 66,666 to 83,333 and 83,333 to 1,11,111 significantly enhanced dry matter accumulation to the extent of 12.09 and 11.06 per cent, respectively (Table 1). It was evident from results that increase dry matter production at lower density ha^{-1} might be on account of less inter plant competition for space, light, nutrient, moisture and better utilization of available resources. This was also reported by Bhatt, 2012.

Application of 110 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1} significantly increased dry matter accumulation over 80 kg N + 30 kg P_2O_5 + 20 kg K_2O ha^{-1}. Further increase in fertility level to the extent of 120 kg N + 50 kg P_2O_5 + 40 kg K_2O ha^{-1} and 140 kg N + 60 kg P_2O_5 + 50 kg K_2O ha^{-1} failed to exhibit significant variation in dry matter accumulation (Table 1). Nitrogen is main constitute of chlorophyll and phosphorus increases root growth, this further boosted dry matter production. Similar response of growth parameters to applied nitrogen and phosphorus levels was reported by Muni swamy *et al.,* (2007), Bhatt (2012) and Meena *et al.* (2017).

Increase in plant density from 55,555 to 66,666, 66,666 to 83,333 and 83,333 to 1,11,111 plants ha^{-1} brought about significant decrease in LAI by 9.16, 8.65 and 9.47 per cent, respectively. The maximum LAI was recorded under 55,555 plants ha^{-1} at 60 DAS which was statistically at par with that of LAI recorded under 66,666 and 83,333 plants ha^{-1}, however, proved significantly higher over that of LAI recorded under 1,11,111 plants ha^{-1} (Table 1). This might be due to that increase in plant population tend to lower LAI. Similar results also concluded by Sahoo and Mahapatara (2007).

Application of 110 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1} significantly increased LAI over 80 kg N + 30 kg P_2O_5 + 20 kg K_2O ha^{-1} by 9.04 per cent. At the same time further increase in fertility level from 110 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1} to 120 kg N + 50 kg P_2O_5 + 40 kg K_2O ha^{-1} and 120 kg N + 50 kg P_2O_5 + 40 kg K_2O ha^{-1} to 140 kg N + 60 kg P_2O_5 + 50 kg K_2O ha^{-1} failed to record perceptible variation in LAI, however, increasing fertility level at 45 and 60 DAS from 110 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1} to 140 kg N + 60 kg P_2O_5 + 50 kg K_2O ha^{-1} significantly increased LAI by 4.9 and 7.3 per cent, respectively (Table 1). This was similarly found by Muniswamy *et al.* (2007).

Based on the findings of the current experiment, which was carried out during the kharif season, 2018, it is concluded that under prevailing agro climatic conditions, 66,666 plants ha^{-1} proved optimum plant density for sweet corn. Application of 110 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1} proved economically profitable fertility level for sweet corn. The present investigation suggests, future needs to undertake experimentation for assessing nitrogen, phosphorus and potassium levels along with some organic sources for sustaining quality production of green cobs, green fodder, soil health and economics.

REFERENCES

Bhatt, P.S. (2012) Response of sweet corn hybrid to varying plant densities and nitrogen levels. *African Journal of Agricultural Research* **7**(46):6158-6166.

Kumar, A. (2008) Growth, yield and water use efficiency of different maize (*Zea mays* L.) based cropping systems under varying planting methods and irrigation levels. *Indian Journal of Agricultural Sciences* **78**(3):244-247.

Meena, A.K., Chouhan. D., Singh, D. and Nepalia, V. (2017) Response of pop corn (*Zea mays* Ssp. *everta*) under varying plant densities and fertility levels *Indian Journal of Agronomy* **62**(1):43-46.

Meena, A.S. (1993) Response of pop corn (*Zea mays* L *averta* Sturt) to different planting densities, row spacing's and nitrogen levels. Ph.D. Thesis (Agronomy), IARI, New Delhi.

Muniswamy, S., Rame, G. and Rajendra, P.S. (2007) Effect of spacing and nitrogen levels on seed yield and quality of maize single cross hybrid PEHM-2. *Mysore Journal of Agricultural Science* **41**(2):186-190.

Nath, K., Nepalia, V. and Singh, D. (2009) Effect of integrated nutrient management on growth and yield of sweet corn (*Zea mays* L. Ssp. *Saccharata). Annual Agriculture Research New Series* **30**:73-76.

Sahoo and Mahapatra (007) Yield and economics of sweet corn (*Zea mays*) as affected by plant population and fertility levels. *Indian Journal of Agronomy* **52**(3):239-242

Watson, D.K. (1997) Comparative physiological studies on the growth of field crops variation in NAR and leaf area between species and varieties. *Annals of Botany* **11**:41-76.