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Performance of Growth and Yield Attributing Characters of Sweet Corn (*Zea mays* L.) in Relation to Three Planting Geometries and Levels of Phosphorus Grown in Uttar Pradesh

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ABSTRACT: During *zaid* season, a field investigation study was conducted at crop research farm, Sam Higginbottom University of Agriculture, Technology and Sciences to find out the effect of growth and yield attributing characters of sweet corn (*Zea mays* L.) in relation to three planting geometries and levels of phosphorus grown in Uttar Pradesh. A Randomized Block Design was followed with nine treatment combinations and three replications based on the factors of planting geometry (60 cm × 15 cm, 60 cm × 20 cm and 60 cm × 25 cm) and phosphorus levels (P at 45, 60 and 75 kg/ha). Growth characters such as plant height (173.67 cm), number of leaves (9.33/plant), dry weight (115.32 g/plant) was noticed maximum in 60 cm × 25 cm + P at 75 kg/ha but CGR (50.83 g/m^2/day) was recorded in 60 cm × 15 cm + P at 75 kg/ha and RGR (0.0457 g/g/day) in 60 cm × 15 cm + P at 45 kg/ha. Yield attributes such as cobs (1.33/plant), grain rows (16.33/cob), grains (28.13/row), cob length (20.63 cm) and seed index (21.31 g) was noticed higher in treatment combination of 60 cm × 25 cm + P at 75 kg/ha, respectively.

Keywords: Growth attributes, planting geometry, Phosphorus, Yield attributes.

INTRODUCTION

Corn (*Zea mays* L.) is also called as queen of cereals. It is one of the cereals most widely grown in the world and has significance in utilization as human food, animal feed and raw material for many industrial sectors. Nearly 50 to 55 per cent of the total maize production in India is consumed as food of about 30 to 35 per cent for poultry, piggery and fish meal industry and 10 to 12 per cent to wet milling processing industries. In 100 g of maize seeds, 10% protein, 4% oil, 70% carbohydrate, 2.3% crude fibre, 10.4% albuminoids and 1-4% ash and also contains vitamin A, riboflavin and vitamin E were present.

Sweet corn is a medium plant type and produces green ears during 65 to 75 days after sowing. It is harvested earlier by 35 to 45 days earlier compared to normal maize cropping period. Sweet corn has higher demand as a crunchy product in exhibitions, circus, theatres and in amusement parks which is increasing with increasing population in urban areas. Because of its higher demand, sweet corn is grown for commercial production (Thakur *et al*., 2015). It is one of the important enterprises focusing on diversified and value added products. Green cobs of sweet corn which are steam boiled and fire baked acquire more popularity in urbanites as a favourite dish, which in turn provides a premium price for growers (Shanti *et al*., 2012).

The size and shape of the leaf area of plants governed by spatial arrangement, influences efficient interception of radiant energy, proliferation, root growth and their performance. Yield can be expected higher only when population of plants allow individual plant to achieve their required inherent potential (Naik *et al*., 2019).

As it is an exhaustive crop which has higher potential compared to other cereals and absorbs large amount of nutrients from soil during the growth stage. Phosphorus is the second most limiting macronutrients in most of the soils. It is responsible for growth, sugars and starch consumption, formation of nucleus, photosynthesis, cell division and formation of fats in plants. For later growth of the crops, compounds of phosphate reserves energy from the metabolism of carbohydrates and photosynthesis. Generally, phosphorus is mobile in plants which moves from older to younger cell tissues in the development of leaves, stems and roots. Applying phosphorus in sufficient quantities promote quality of vegetative growth, rapid growth and matures early (Sadiq *et al*., 2017).

Keeping the above points in consideration, the present investigation was done to study the relation of spacing and phosphorus application in sweet corn.

MATERIAL AND METHODS

The experiment was conducted at the research site of crop research farm, Sam Higginbottom University of

Agriculture, Technology and Sciences, Prayagraj. The soils of the area of experimental field constituting a part of central Gangetic alluvium and is sandy loam in texture with a pH of 7.1. The first factor consist of planting geometries viz. 60 cm × 15 cm, 60 cm × 20 cm and 60 cm × 25 cm and the second factor consists of phosphorus levels viz. 45, 60 and 75 kg/ha, respectively. In this experiment, row to row distance was same in all plots but plant to plant distance differed according to the factors considered. As the crop was grown in summer season, one irrigation was given just after sowing for ensuring proper germination and second irrigation during tassel formation. Hand weeding was done only once manually at 25 DAS. Growth parameters such as plant height, number of leaves/plant, dry weight, CGR and relative growth rate were noted at every 20 days interval during the cropping period. Yield parameters like cobs/plant, grains/cob, grain rows/cob, grains/row, cob length and seed index were recorded just before harvest of the crop. Data analysis of each parameter was done in Raghunadh M. Patil software.

RESULTS AND DISCUSSION

Growth attributing characters. Plant height at harvest stage of sweet corn presented in Table 1 showed a significant difference among treatments. However, plant height (173.67 cm) at 60 cm × 25 cm + P at 75 kg/ha recorded significantly higher which was followed by 60 cm × 20 cm + P at 75 kg/ha (169.07 cm). Number of leaves/plant recorded non-significant difference so that, maximum values was noticed in 60 cm × 25 cm + P at 75 kg/ha (9.33) and least number of leaves/pant in 60 cm × 15 cm + P at 45 kg/ha (8.20) at harvest. At harvest stage, dry weight is significantly higher in 60 cm × 25 cm + P at 75 kg/ha (115.32 g/plant) which was statistically at par with 60 cm × 20 cm + P at 75 kg/ha (111.49 g/plant). Crop growth rate at harvest, showed significant values higher in 60 cm × 15 cm + P at 75 kg/ha (50.83 g/m^2/day) and at par values in 60 cm × 15 cm + P at 45 kg/ha (49.84 g/m^2/day) and 60 cm×15 cm + P at 60 kg/ha (48.81 g/m^2/day) (Table 1). Regarding relative growth rate, values among the treatments differed non-significant. Highest RGR (0.0457 g/g/day) was recorded in 60 cm × 15 cm + P at 45 kg/ha and lowest RGR (0.0407 g/g/day) was noticed in 60 cm × 25 cm + P at 75 kg/ha, respectively. The plant density at wider crop geometry is less competition for nutrients and water by the plants and higher levels of phosphorus might be attributed to the fact that phosphorus is a constituent of nucleic acids, coenzymes, phospholipids and mostly in ATP. It activates the coenzymes for production of amino acids in synthesis of proteins which might be the reason in attaining maximum growth parameters. Almost similar results were observed by Bhatt, (2012); Dhanwade *et al*., (2018).

Table 1. Effect of planting geometry and phosphorus levels on growth attributing characters of sweet corn.

Sr. No.	Treatments	Plant height (cm)	Number of leaves/plant	Dry weight (g)	CGR (g/m^2/day)	RGR (g/g/day)
1.	60 cm × 15 cm + P at 45 kg/ha	140.37	8.20	86.72	49.84	0.0457
2.	60 cm × 15 cm + P at 60 kg/ha	153.43	8.93	90.70	48.81	0.0424
3.	60 cm × 15 cm + P at 75 kg/ha	165.80	9.13	97.94	50.83	0.0420
4.	60 cm × 20 cm + P at 45 kg/ha	145.03	8.27	93.12	37.58	0.0431
5.	60 cm × 20 cm + P at 60 kg/ha	155.60	9.00	102.99	38.77	0.0412
6.	60 cm × 20 cm + P at 75 kg/ha	169.07	8.33	111.49	40.83	0.0412
7.	60 cm × 25 cm + P at 45 kg/ha	147.87	8.40	99.18	30.16	0.0408
8.	60 cm × 25 cm + P at 60 kg/ha	159.23	9.20	108.64	32.74	0.0426
9.	60 cm× 25 cm + P at 75 kg/ha	173.67	9.33	115.32	33.12	0.0407
	SEm±	2.05	0.29	1.70	1.36	0.0016
	CD (P=0.05)	6.14	-	5.11	4.09	-

Yield attributing characters. Yield parameters viz. cobs/plant, grain rows/cob, grains/row, cob length and seed index showed a significant difference among the treatments except cobs/plant and cob length parameters (Table 2). However, grain rows (16.33/cob), grains (28.13/row) and seed index (21.31 g) noticed significantly higher values in the treatment combination of 60 cm × 25 cm + P at 75 kg/ha which was followed by the treatment combination of 60 cm × 20 cm + P at 75 kg/ha as grain rows (15.73/cob), grains (27.67/row) and seed index (20.85 g). However, cobs (1.33/plant) and cob length (21.72 cm) was reported maximum in the treatment of 60 cm ×25 cm + P at 75 kg/ha and minimum cobs (1.00/plant) and cob length (20.63 cm) was reported in 60 cm × 15 cm + P at 45 kg/ha treatment combination. Increased P application and plant density tend increased the yield parameters. The enhanced yield component may be due to increased growth characters of plant, leading to higher photosynthetic rate and accumulation of more assimilates which in turn increased the sink size. The above findings were corroborated by the authors of Khan *et al*., (2017); Manishaben *et al.,* (2018).

Table 2. Effect of planting geometry and phosphorus levels on growth attributing characters of sweet corn.

Sr. No.	Treatments	Cobs/plant	Grain rows/cob	Grains/row	Cob length (cm)	Seed index (g)
1.	60 cm× 15 cm + P at 45 kg/ha	1.00	13.40	25.00	17.97	17.89
2.	60 cm × 15 cm + P at 60 kg/ha	1.07	13.93	25.67	18.74	19.23
3.	60 cm × 15 cm + P at 75 kg/ha	1.20	14.20	26.00	18.87	20.51
4.	60 cm × 20 cm + P at 45 kg/ha	1.13	14.07	25.87	18.57	18.36
5.	60 cm × 20 cm + P at 60 kg/ha	1.20	15.20	26.67	19.29	19.38
6.	60 cm × 20 cm + P at 75 kg/ha	1.27	15.73	27.67	19.60	20.85
7.	60 cm × 25 cm + P at 45 kg/ha	1.13	14.73	26.33	18.47	18.65
8.	60 cm × 25 cm + P at 60 kg/ha	1.27	15.13	26.93	19.39	19.83
9.	60 cm × 25 cm + P at 75 kg/ha	1.33	16.33	28.13	20.63	21.31
	SEm±	0.10	0.28	0.29	0.85	0.20
	CD (P=0.05)	-	0.84	0.87	-	0.61

CONCLUSION

It can be concluded that, maintaining planting geometry of 60 cm × 25 cm along with application of phosphorus at 75 kg/ha was found remunerative for higher vegetative and reproductive attributing characters of sweet corn grown during *zaid* season.

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Conflict of Interest. None.

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