Growth and Yield Performance of Baby Corn (*Zea mays* l.) as Influenced by Row Spacing and Phosphorus Application in Black Cotton Soils of Krishan Zone of Andhra Pradesh, India

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Original Research Article

ABSTRACT

Baby corn has a high monetary value, which allows for crop diversification value addition, and revenue generating. As a result, agro-techniques for its cultivation must be standardised. Hence, a field experiment was conducted during the rabi season in black clayey soils at Fodder Production Farm of Livestock Research Station, Sri Venkateswara veterinary University, Lam Farm, Guntur-522034, Andhra Pradesh, India to find out the Influence of different levels of phosphorus (40, 50, 60 kg/ha) and various row spacings (40 x 15 cm, 45 x 15 cm, 50 x 15 cm) on growth and yield of baby corn. The experiment was laid out in Randomised Block Design with nine treatments each replicated thrice. It is observed that crop established with 50 x 15 cm spacing along with application of 50 kg/ha Phosphorus produced Maximum growth attributes viz. Plant height (161.10 cm), Numbers of leaves (12.47), Plant dry weight (90.21 g/plant) and yield attributes viz. No. of cobs/ plant (4.03), Length of cob (24.34 cm), Length of corn (9.47 cm), Cob weight (56.38 g), corn weight (11.61 g), Cob yield (35696.67 kg/ha), Corn yield (7560 kg/ha).

Keywords: Baby corn; growth; phosphorus; row spacing; yield.

1. INTRODUCTION

Maize *(Zea mays L.*) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions [1]. With the rise in people's living standards and the transition in dietary items from non-vegetarian to vegetarian, various veggies have emerged, one of which is baby corn. The small sized fresh green cobs of maize, when picked within 36 hours of silk emergence, popularly known as baby corn. Baby corn production provides opportunities for crop diversification, value addition and revenue generation and is becoming increasingly popular among farmers due to its high remunerative value [2].

One Baby corn can be compared with an 'egg' in terms of minerals. It is a low-calorie, high-fiber vegetable that is cholesterol-free [3]. Besides nutritive advantage, It is free of pesticide residuesas it is harvested within a week of tassel emergence. Baby corn has a reputation for being a healthy and high-quality vegetable. People are looking for excellent meals instead of bulky products as their health concerns grow. As a result, baby corn holds a prominent position as a nutritious and safe vegetable.

To commercialize this new crop, there is an urgent need to find out suitable agro-techniques for higher production and ultimately higher income to the farmers.

Maintenance of optimum crop geometry is essential to harvest maximum solar radiation and to utilize the soil resources effectively in addition wider spacing provided uniform spread of plants because of less crowding which resulted into healthy cobs. Maize being exhaustive crop requires high quantity of nutrients for its growth and development Judicious use of fertilizer is a key for profitable Baby corn crop production as they alone contribute 40-60 per cent of the crop yield. Phosphorus plays a vital role besides nitrogen in plant nutrient that influences well developed roots, that are able to penetrate the ground and gather all the nutrients required by the plant for development.it helps to strengthen the skeletal structure of the plant there by preventing lodging [4] and hence improves the root growth, vigour of the plant and quality of baby corn yield. Therefore, it is of great importance to establish required Phosphorus along with optimum crop geometry for the region concern.

2. MATERIALS AND METHODS

A field experiment was conducted during *Rabi* season of 2020 in field No.6B/FPF at Fodder Production Farm, of Livestock Research Station, Sri Venkateswara Veterinary University, Lam Farm, Guntur-522034, Andhra Pradesh, India. Guntur Andhra Pradesh, India, which is having Sub tropical climate with maximum and minimum temperatures of 31.37 and 15.82 °C, respectively. The soil of experimental field was black clay in nature with pH 8.5 and EC 0.45 dms^{-1} low in Organic carbon (0.42 %) medium in available N (288 kg/ ha^{1}), high in both available P_2O_5 (174 kg / ha^{1}) and K_2O (418 kg / ha).

A combination of nine treatments were replicated thrice and laid out in a randomized block design. Treatments comprised of T_1:40 x 15 cm Row spacing + 40 kg P_2O_5/ha, T_2:40 x 15 cm Row spacing + 50 kg P_2O_5/haT_3:40 x 15 cm Row spacing + 60 kg P_2O_5/ha, T_4:45 x 15 cm Row spacing + 40 kg P_2O_5/ha, T_5:45 x 15 cm Row spacing + 50 kg P_2O_5/ha, T_6:45 x 15 cm Row spacing + 60 kg P_2O_5/ha, T_7:50 x 15 cm Row spacing + 40 kg P_2O_5/ha, T_8:50 x 15 cm Row spacing + 50 kg P_2O_5/ha, T_9:50 x 15 cm Row spacing + 60 kg P_2O_5/ha. Fertilizers were applied according to the treatment description at the time of sowing. Healthy Seeds of Baby corn variety G-5414 of Syngenta Pvt. Ltd., were sown on 23rd November 2020 by dibbling two seeds manually per hill. The first harvesting of baby cobs was carried out 58 days after sowing (20.01.2021) and subsequently green cobs harvested in 2 pickings. The cobs were harvested from an area of one meter square, treatment wise and weighed with and without husk, then the obtained values were converted to per hectare and recorded as kg/ha.

Experiment data collected was subjected to statistical analysis by adopting Fisher's method of Analysis of variance (ANOVA) as outline by Gomez and Gomez [5]. Critical Difference (CD) values were calculated the 'F' test was found significant at 5% level.

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Table. 1 Influence of different levels of Phosphorus and Row Spacing on growth attributes of Baby corn

Tr. Nº	Treatment Combination	Plant height (cm) At Harvest	Number of Cobs (Nº) At Harvest	Plant dry weight (g/plant) At Harvest
T1	40 x 15 cm Row spacing + P2O5 40 kg/ha	134.92	10.20	83.65
T2	40 x 15 cm Row spacing + P2O5 50 kg/ha	137.73	10.27	84.70
T3	40 x 15 cm Row spacing + P2O5 60 kg/ha	154.72	11.40	88.69
T4	45 x 15 cm Row spacing + P2O5 40 kg/ha	138.00	10.47	85.51
T5	45 x 15 cm Row spacing + P2O5 50 kg/ha	148.00	10.53	86.79
T6	45 x 15 cm Row spacing + P2O5 60 kg/ha	158.07	12.33	89.46
T7	50 x 15 cm Row spacing + P2O5 40 kg/ha	153.27	11.07	87.07
T8	50 x 15 cm Row spacing + P2O5 50 kg/ha	161.10	12.47	90.21
T9	50 x 15 cm Row spacing + P2O5 60 kg/ha	152.66	11.20	88.20
	S. Em (±)	2.15	0.07	0.75
	CD (P=0.05)	6.45	0.21	2.27

Table. 2 Influence of different levels of Phosphorus and Row Spacing on yield attributes of Baby corn

Tr. Nº	Treatment Combination	Cob length (cm)	Corn length (cm)	Cob weight (g)	Corn weight (g)	Cob yield (kg/ha)	Corn Yield (kg/ha)
T_1	40 x 15 cm Row spacing + P_2O_5 40 kg/ha	19.32	8.02	48.49	9.53	28456.67	4533.33
T_2	40 x 15 cm Row spacing + P_2O_5 50 kg/ha	20.20	8.24	49.58	9.79	29276.67	5736.67
T_3	40 x 15 cm Row spacing + P_2O_5 60 kg/ha	23.14	8.73	54.73	11.14	35133.33	7250.00
T_4	45 x 15 cm Row spacing + P_2O_5 40 kg/ha	20.68	8.28	50.44	10.12	29573.33	6330.00
T_5	45 x 15 cm Row spacing + P_2O_5 50 kg/ha	21.37	8.43	51.42	10.53	31633.33	6436.67
T_6	45 x 15 cm Row spacing + P_2O_5 60 kg/ha	24.19	9.32	55.27	11.33	35436.67	7396.67
T_7	50 x 15 cm Row spacing + P_2O_5 40 kg/ha	22.26	8.46	52.36	10.33	32453.33	6843.33
T_8	50 x 15 cm Row spacing + P_2O_5 50 kg/ha	24.34	9.47	56.38	11.61	35696.67	7560.00
T_9	50 x 15 cm Row spacing + P_2O_5 60 kg/ha	22.73	8.53	53.62	10.73	34196.67	7126.67
	S.Em(±)	0.14	0.05	0.36	0.16	501.82	55.66
	C.D (P = 0.05)	0.44	0.16	1.08	0.47	1504.54	165.88

3. RESULTS AND DISCUSSION

3.1 Growth Attributes

Influence of different levels of Phosphorus with row spacings have been found to exert a significant increase on growth parameters at Harvest stage. The treatment T_8 (50 kg/ha Phosphorus + 50 x15 cm Row Spacing) exhibited the highest values for almost all the growth parameters *i.e* Plant height (161.10 cm), Number of leaves/plant (12.47) and Dry weight/plant (90.21 g), which might be due to wider space availability between the rows and closer intra- rows helped for increase of root spread which eventually utilized the resources such as water, nutrient, space, sunlight very effectively. P, a component of fertility management, on crop growth seem to be due to maintaining congenial nutritional environment of plant system on account of their greater availability from soil media, which might have resulted in greater synthesis of amino acids, proteins and growth promoting substances, which seems to have enhanced the meristematic activity and increased cell division and their elongation which ultimately enhanced the growth in terms of Plant height, no. of leaves and finally accumulation of dry matter, these results were stated in conformity with Mathukia *et al.,*[6],Singh *et al*., [7].

3.2 Yield Attributes and Yield

The yield parameters; Length of the Cob (24.34 cm), Length of the corn (9.47 cm), Cob weight (56.38 g), Corn weight (9.47 g) were found highest in T_8 (50 kg/ha Phosphorus + 50 x15 cm Row Spacing). Regarding yield of baby corn, the treatment T_8 (50 kg/ha Phosphorus + 50 x15 cm Row Spacing) exhibited the highest cob yield (35696.67 kg/ha) and corn yield (7560 kg/ha). This might be due to increase in Phosphorus levels with wider row spacing levels led to better interception, absorption and utilization of available nutrients and soil moisture which empowered the plant to manufacture more quantities of photosynthates and accumulating enhanced sink capacity and maximum nutrient uptake by the crop. Besides, positive response of yield attributing characters such as length of cob, length of corn, cob weight and corn weight at higher levels of fertilizer dose of Phosphorus and wide spacing levels attributed to higher cob and corn yields, these results were stated in conformity with Medhi Dhabanita and Dutta Rinjumoni [8].

3.3 I Suggest Adding these Paragraphs in the Discussion

The investigations of Olivares et al. [9] point to humidity as one of the factors that affect the availability of phosphorus in plants, these experiences indicate that the movement of phosphorus increases with the water content of the soil. On the other hand, the absorption of phosphorus by plants increases when the matrix suction of the soil decreases, which agrees with the concept that the transfer of the nutrient to the roots is carried out by means of water [10,11,1].

The study by Olivares et al. [9] indicates that coarse-textured soils have lower water content than fine-textured soils at any matrix suction, and therefore less diffusion of phosphorus towards the root. On the other hand, the amount of labile or exchangeable phosphorus will be less in coarse-textured soils than those with a fine texture, which have a higher anion adsorption capacity [12]. Also, inorganic colloids are of interest in the type and amount of clay [13]. Soils rich in organic matter, especially active fractions of it, almost always exhibit relatively low levels of phosphorus fixation.

In corn, the planting densities and the distribution of the plants in the field depend on the development characteristics of the variety (height and branching of the plant) and on environmental factors (soil, precipitation and temperature, among others) [14], which makes an optimal plant density and distribution for corn in some areas, not the best for others, especially if they differ in their growth habit.

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4. CONCLUSION

On the basis of one season experimentation it is found that application crop established with row spacing of 50 x 15 cm along with application of Phosphorus 50 kg/ha found more productive (35696.67 kg/ha) for baby corn production at black clayey soils of Sub-tropical climate.

ACKNOWLEDGMENT

The authors owe their gratitude towards Sri Venkateswara veterinary University, Tirupati Andhra Pradesh, India for their support in providing experimental field, facilities and assistance in conducting this research at Livestock Research Station, Lam, Guntur, Andhra Pradesh.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Olivares B. Tropical conditions of seasonal rain in the dry-land agriculture of Carabobo, Venezuela. La Granja: Journal of Life Sciences. 2018;27(1):86-102. Available:http://doi.org/10.17163/lgr.n27.2018.07
2. Pandey AK, Mani VP, Ved, Prakash Singh RD, Gupta HS. Effect of Varieties and Plant densities on yield, yield attributes and economics of baby corn (*Zea mays* L.). Indian J. Agron. 2002;47(2):221-226.
3. Kumar S, Shivani, Kumar A and Kumar U. Nutritive value and economic analysis of baby corn *(zea mays L*.). International Journal of Tropical Agriculture. 2006;24: 35-39.
4. Raghothama KG. Phosphate acquisition, Annual Review of Plant Physiology and Plant Molecular Biology. 1999;50:665-368.
5. Gomez KA, Gomez AA. Statistical Procedure for Agricultural Research, 2nd edn. John Wiley & Sons, New York. 1984:241- 71.
6. Mathukia RK, Choudhary RP, Ashish Shivran, Nilima Bhosale. Response of Rabi sweet corn to plant geometry and fertilizer. *Critical Biotica*. 2015;7(4): 294-298.
7. Singh G, Kumar S, Singh R, Singh SS. Growth and yield of baby corn (*Zea mays* L.) as influenced by varieties, spacings and dates of sowing. Indian J. Agric. 2015;49(4):353-357.
8. Medhi D, Dutta R. Performance of Baby corn varieties under Different levels of Fertilizers during summer season. International Journal of Current Microbiology and Applied Sciences. 2019;8(1):933-940.
9. Olivares B, Hernández R, Arias A, Molina JC, Pereira Y. Zonificación agroclimática del cultivo de maíz para la sostenibilidad de la producción agrícola en Carabobo, Venezuela. Revista Universitaria de Geografía. 2018;27(2):139-159. Available:https://n9.cl/l2m83
10. Olivares B, Hernández R. Ecoterritorial sectorization for the sustainable agricultural production of potato (*Solanum tuberosum* L.) in Carabobo, Venezuela. Agricultural Science and Technology. 2019;20(2):339-354. Available:https://doi.org/10.21930/rcta.vol20_num2_art:1462
11. Bertorelli M, Olivares BO. Population fluctuation of *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) in sorghum cultivation in Southern Anzoategui, Venezuela. Journal of Agriculture University of Puerto Rico. 2020;104(1):1-16. Available:https://doi.org/10.46429/jaupr.v104i1.18283
12. Olivares B, Araya-Alman M, Acevedo-Opazo C. et al. Relationship Between Soil Properties and Banana Productivity in the Two Main Cultivation Areas in Venezuela. J Soil Sci Plant Nutr. 2020;20(3): 2512-2524. Avaialble:https://doi.org/10.1007/s42729-020-00317-8
13. Olivares B. Descripción del manejo de suelos en sistemas de producción agrícola del sector Hamaca de Anzoátegui, Venezuela. La Granja: Revista de Ciencias de la Vida. 2016;23(1):14–24. Available:https://doi.org/10.17163/lgr.n23.2016.02
14. Olivares BO, Calero J, Rey JC, Lobo D, Landa BB, Gómez JA. Correlation of banana productivity levels and soil morphological properties using regularized optimal scaling regression. Catena. 2022;208: 105718. Available:https://doi.org/10.1016/j.catena.2021.105718

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