International Journal of Plant & Soil Science

34(22): 1555-1560, 2022; Article no.IJPSS.91754
ISSN: 2320-7035

Effect of Organic Manures and Spacing on Growth and Yield of Sweet Corn (*Zea mays saccharata L.*)

Addepalli Ashritha [a*ϖ] and Victor Debbarma [a#]

[a] Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh-211007, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i2231532

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/91754

Original Research Article

Received 20 August 2022
Accepted 08 September 2022
Published 12 September 2022

ABSTRACT

A field experiment was conducted during *Rabi* 2021-22 at Crop Research Farm, Department of Agronomy, Niani Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh, India. The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice on the basis of one year experimentation. The treatments consisted of FYM 18 t/ha, Poultry manure 3 t/ha Vermicompost 3 t/ha and three levels of spacing i.e.: 40 cm×25 cm, 50 cm×25 cm, 60 cm×25 cm. The results showed that treatment-6 (Poultry manure 3 t/ha + 60 cm x 25 cm) was recorded significantly higher plant height (176.59 cm), maximum number of leaves/plant (14.37) and higher plant dry weight (144.03 g/plant). Whereas the maximum number of cobs/Plant (2.60), maximum cob length (16.57 cm), maximum girth of cob/plant (15.37), maximum cob weight with husk (323.90 g), maximum cob weight without husk (252.10 g), higher cob yield with husk (13.15 t/ha), higher cob yield without husk (8.51 t/ha).

Keywords: Sweet corn; farm yard manure; poultry manure; vermicompost; spacing; growth and yield.

ϖ M.Sc. Scholar;
 # Assistant Professor;
**Corresponding author: E-mail: rajashritha@gmail.com;*

1. INTRODUCTION

"Sweet corn (*Zea mays Saccharata L.)* is a versatile crop, which finds a place in the human diet, animal feed, fodder and industrial raw material. Specialty corn such as baby corn and sweet corn have emerged as alternative food sources, especially for the rich society. Sweet corn is used as a human food in the soft dough stage with succulent grain. The higher content of water-soluble polysaccharide in the kernel adds texture and quality in addition to sweetness" [1]. "Maize is the third most important cereal crop after wheat and rice, in the world. Maize is cultivated in tropical, sub-tropical and temperate countries of the world. Among various specialty corns, sweet corn is a mutant type with one or more recessive alleles in homozygous condition, which enables the endosperm to accumulate twice the sugar content as that of seed corn and controls the conversion of sugar into starch inside the endosperm of kernel" [2].

In the world Maize is produced in an area of 193.7 million hectare with 12% of world food crop production of 1.1 billion tonnes and the productivity is 5.75 ton/ha. In India, maize is produced in an area of 8.15 million hectares with 27 billion tonnes production and an average productivity of 3.8 ton/ha. "In the state of Uttar Pradesh maize is produced in an area of 3.05 lakh hectares with the production of 18.62 lakh tonnes and the productivity is 6 ton/ha" [3].

"In order to achieve higher cob yields, maintenance of plant spacing is the most important factor. A spatial arrangement of plant governs the shape and size of the leaf area per plant, which in turn influences efficient interception of radiant energy, proliferation, growth of roots and their activity. Maximum yield can be expected only when plant population allows individual plant to achieve their maximum inherent potential. Thus, there is need to work out an optimum population density by adjusting inter and intra row spacing in relation to other agronomic factors. The plant spacing of 60 cm × 25 cm found suitable for higher productivity and monetary returns of sweet corn" [4].

"Yields in organic farming are lower than chemical farming during initial years of practice and it takes few years to stability the yields. However, in the long run, if properly followed, yields with organic farming would be far greater than those obtained with chemical farming. Huge quantities of organic materials such as farm yard manure, poultry manure, vermicompost, green manures and crop residues can substitute the inorganic fertilizers to a large extent to maintain the productivity and environmental quality" [2].

"Farmyard manure (FYM) is an important organic resource for agricultural production in livestock-based farming systems in the semi-arid tropics of India. However, Farm yard manure application to the crops is being practiced for long period. Well decomposed FYM in addition to supplying plant nutrients acts as binding material and improves the soil physical properties" [5].

Poultry manure, sometimes called chicken manure, is an excellent soil amendment that provides nutrients for growing crops and also improves soil quality when applied wisely, because it has high organic matter content combined with available nutrients for plant growth.

"Poultry waste consists of droppings, wasted feed, broken eggs, feathers, and sometimes sawdust from poultry floor. It also includes the dead birds and hatchery waste, all of which are high in protein and contain substantial amount of calcium and phosphorus due to high level of mineral supplement in their diet. Poultry manure has been reported to contain more plant nutrients than all other organic manures" [6].

Hence the present investigation was carried out to find out the "Effect of organic manures and spacing on growth and yield of sweet corn (*Zea mays Saccharata L.)"*.

2. MATERIALS AND METHODS

A field experiment was conducted during *Rabi* season of 2021-22, at Crop research farm of Department of Agronomy at Sam Higginbottom University of Agriculture, Technology, And Sciences, Prayagraj (U.P) India. which is located at 25^{o} 24' 42" N latitude, 81^{o} 50' 56" E longitude and 98 m altitude above the mean sea level (MSL). The crop was sown in 14 December 2021. The experiment was laid out in Randomized Block Design comprising of 9 treatments which are replicated thrice. Each treatment net plot size is $9m^2$. Organic manures were applied and spacing was maintained as per the treatment details in combinations as follows, T_1: FYM 18 t/ha + 40 cm x 25 cm, T_2: FYM 18 t/ha + 50 cm x 25 cm, T_3: FYM 18 t/ha + 60 cm x 25 cm, T_4:Poultry manure 3 t/ha + 40 cm x 25 cm, T_5: Poultry manure 3 t/ha + 50 cm x 25 cm,

T_6: Poultry manure 3 t/ha + 60 cm x 25 cm, T_7: Vermicompost 3 t/ha + 40 cm x 25 cm, T_8: Vermicompost 3 t/ha + 50 cm x 25 cm and T_9: Vermicompost 3 t/ha + 60 cm x 25 cm. The growth parameters and yield attributes were recorded at harvest from randomly selected plants in each plot. The data was computed and analysed by following statistical method [7].

3. RESULTS AND DISCUSSION

3.1 Effect of Organic Manures and Spacing on Growth Parameters of Sweetcorn

3.1.1 Plant height (cm)

It is evident from Table 1 that significantly highest plant height (176.59 cm) was recorded in the treatment 6(Poultry manure 3 t/ha + 60 cm x 25 cm). However, the treatment 5(Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm).

"Significant increase in plant height was with the application of poultry manure 3t/ha might be due to the development of shoot apical meristem may be a reason to gain better height. It appeared that the use of chicken manure enhanced the functions of the apical meristem, which led to an increase in height. The optimal height of the plants improves the acquisition of solar energy, which will help maintain photosynthesis" Asfaw [8].

3.1.2 Number of leaves/plant

Significantly maximum number of leaves/plant (14.37) was recorded in the treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). However, treatment 5 (Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm).

Significant and maximum number of leaves/ plant increased in poultry manure (3t/ha) might be due to the manure application will have a positive effect on plant growth and energy. This is because the leaves are the main components of photosynthesis in plants. The increase in the number of leaves was a precursor to a large number of assimilates and this allows for further transfer of grain. In addition, the high number of leaves in poultry manure treated plants contributes to better canopy production and weed compression. The poultry manure has high nutrition which promotes plant growth and makes nutrients available to the plant and poultry manure was found to improve leaf quality by providing an adequate amount of nutrients that accelerate leaf growth. Similar findings were reported by Asfaw [8].

3.1.3 Plant dry weight (g)

Significantly maximum dry weight (144.03 g/plant) was recorded in treatment 6 Poultry manure 3 t/ha + 60 cm x 25 cm. However, treatment 5 (Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm).

"Significant increase in plant dry weight was with the application of poultry manure 3t/ha might be due to the nutrients triggered the vigorous growth of plants thereby achieving higher leaf area, LAI and this further boosted the dry matter production and hastened the flowering and maturity period. Superior growth attributes obtained with high rates of Poultry manure" [9].

3.2 Effect of Organic Manures and Spacing on Yield and Yield Attributes of Sweetcorn

3.2.1 Number of cobs/plant

Significantly maximum number of cobs/plant (2.60) was recorded with the treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). However, treatment 5 (Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). Significant and maximum number of cobs/plant is increased with the spacing of 60 cm × 25 cm might be due to greater availability of photosynthates, metabolites and nutrients to develop reproductive structures seems to have resulted in increased number of cobs/ plant [4].

3.2.2 Length of cob/plant (cm)

"Significantly maximum length of cob/plant (16.57 cm) was recorded with the treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). However, treatment 5 (Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm

x 25 cm). Significant and maximum length of cob/plant is increased with the spacing of 60 cm × 25 cm might be due to increased number of leaves, leading to higher photosynthetic rate and accumulation of more assimilates which in turn increased the sink size" [10].

3.2.3 Girth of cob/plant (cm)

Significantly maximum girth of cob/plant (15.37 cm) was recorded with the treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). However, treatment 5 (Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). Significant and maximum girth of cob/plant is increased with the spacing of 60 cm×25 cm might be due to wider spacing provided uniform spread of plants because of less crowding which resulted into healthy cobs and thereby increases the weight, length of cob, and girth of corn [11].

3.3 Cob Weight (g)

a) With husk

Significantly maximum cob weight with husk (323.90 g) was recorded with the treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). However, treatment 5 (Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) which were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm).

b) Without husk

"Significantly maximum cob weight without husk (252.10 g) was recorded with the treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). However, treatments 5 (Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). Significant and maximum cob weight is increased with the spacing of 60 cm × 25 cm might be due to the lesser competition for radiation and nutrients that allowed the plants to accumulate more biomass with higher capability to convert more photosynthates into sink resulting in higher values for the aforementioned attributes" Uwah [9].

3.4 Cob Yield (t/ha)

a) With husk

Significantly highest Cob yield (13.15 t/ha) was recorded with the treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). However, treatment 5 (Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm).

b) Without husk

Significantly highest Cob yield (8.51 t/ha) was recorded with the treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm). However, treatments 5 (Poultry manure 3 t/ha + 50 cm x 25 cm) and treatment 9 (Vermicompost 3 t/ha + 60 cm x 25 cm) were found to be statistically at par with treatment 6 (Poultry manure 3 t/ha + 60 cm x 25 cm).

Table 1. Effect of Organic manures and Spacing on growth parameters of Sweet corn

S. No	Treatments	Plant height (cm)	Leaves/plant	Dry matter (g plant^{-1})
1.	FYM 18 t/ha + 40 cm x 25 cm	173.08	13.44	141.51
2.	FYM 18 t/ha+ 50 cm x 25 cm	173.40	13.49	141.83
3.	FYM 18 t/ha+ 60 cm x 25 cm	174..89	13.97	142.82
4.	Poultry manure 3 t/ha + 40 cm x 25 cm	174.39	13.87	142.54
5.	Poultry manure 3 t/ha + 50 cm x 25 cm	175.93	14.18	143.34
6.	Poultry manure 3 t/ha + 60 cm x 25 cm	176.59	14.37	144.03
7.	Vermicompost 3 t/ha + 40 cm x 25 cm	173.86	13.71	142.24
8.	Vermicompost 3 t/ha + 50 cm x 25 cm	175.43	14.06	143.13
9.	Vermicompost 3 t/ha + 60 cm x 25 cm	176.26	14.27	143.76
	SEm (±)	0.24	0.08	0.24
	CD (P 0.05)	0.71	0.23	0.73

Table 2. Effect of organic manures and spacing on yield attributes and yield of sweet corn

Treatments	No. of Cobs/plant	Length of Cob/plant (cm)	Girth of Cob/plant (cm)	Cob weight (g)		Cob yield (t/ha)	
				With Husk	Without Husk	With Husk	Without Husk
1. FYM 18 t/ha+ 40 cm x 25 cm	1.83	15.42	14.10	305.20	236.66	11.75	6.72
2. FYM 18 t/ha+ 50 cm x 25 cm	1.90	15.59	14.23	307.44	238.83	11.85	6.92
3. FYM 18 t/ha+ 60 cm x 25 cm	2.13	16.01	14.74	318.59	243.90	12.51	7.72
4. Poultry manure 3 t/ha + 40 cm x 25 cm	2.00	15.90	14.54	315.18	242.60	12.24	7.43
5. Poultry manure 3 t/ha + 50 cm x 25 cm	2.30	16.35	15.11	321.44	248.61	12.89	8.08
6. Poultry manure 3 t/ha + 60 cm x 25 cm	2.60	16.57	15.37	323.90	252.10	13.15	8.51
7. Vermicompost 3 t/ha + 40 cm x 25 cm	1.97	15.68	14.44	313.10	240.66	12.04	7.08
8. Vermicompost 3 t/ha + 50 cm x 25 cm	2.23	16.15	15.01	311.99	245.78	12.76	7.92
9. Vermicompost 3 t/ha + 60 cm x 25 cm	2.43	16.47	15.25	322.17	250.47	13.04	8.33
F test	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S. EM (±)	0.11	0.04	0.10	0.82	1.20	0.09	0.16
CD (P = 0.05)	0.34	0.13	0.29	2.46	3.59	0.27	0.49

"Significant and highest cob yield is increased with the application of poultry manure 3t/ha might be due to increased availability of nutrients to the sweet maize crop at higher rate of poultry manure resulted in the production of longer ears, accompanied by increased grain filling that produced more grains/ear. superior ear and grain development was due to increase availability of adequate supply of nutrients from the poultry manure and greater production of photosynthates and their efficient translocation for development of reproductive parts The influence of Poultry manure on sweet maize yield parameters could be ascribed to the ability of this organic manure to supply nutrients and organic matter to the soil and in improving soil physical condition" [9].

4. CONCLUSION

Based on the findings of the investigation it may be concluded that treatment with Poultry manure 3 t/ha and spacing 60 cm x 25 cm performed exceptionally in all growth and yield parameters and in obtaining maximum cob yield of sweet corn. Hence, Poultry manure 3 t/ha with spacing 60 cm x 25 cm may be more preferable and can be recommended to the farmers.

ACKNOWLEDGEMENTS

Authors are thankful to all the faculty members of Department of Agronomy and University authorities, Sam Higginbottom University of Agriculture Technology And Sciences, Prayagraj, Uttar Pradesh (U.P) India, for their guidance and constant support for improving the quality of this work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Venkatesh S, Sanjay R, Shekhar JC. Sweet corn. Speciality corn Technical

Series 1, Directorate of Maize Research New Delhi. 2003;1-3.
2. Pande S, Naik MR, Naidu SMM. Effect of different sources of organic manures on sweet corn (*Zea mays* Saccharata) Environmrent & Ecology. 2014;33(2A): 810-813.
3. FAO. World Food and Agriculture - Statistical Yearbook 2021. Rome; 2021.
4. Naik AA, Reddy MF, Babu PVR, Kavitha P. Effect of plant density and nitrogen management on growth, yield and economics of sweet corn *(Zea mays* var. Saccharata) The Pharma Innovation Journal. 2019;8(6):839-842.
5. Jayant Kumar Paikra, Sanjay K, Dwivedi, Harishankar. Effect of Integrated Nutrient Management on Productivity and Profitability of Sweet Corn (*Zea mays* L. saccharata) International Journal of Current Microbiology and Applied Sciences. 2018;6:2762-2769.
6. Ali GA. Uses of manure and fertilizer as soil management Technique for sustainable crop production. Paper presented at workshop organized by Taraba State Local Government Service Commission on 8 and 9; 2005.
7. Gomez KA, Gomez AA. Statistical procedures for agricultural research (2 ed.). John Wiley and Sons, New York. 1984;680
8. Asfaw MD. Effects of animal manures on growth and yield of maize (*Zea mays L*.) Journal of Plant Science and Phytopathology. 2022;6:033-039.
9. Uwah DF, Ogar CC. Effects of poultry manure and plant population on soil properties and agronomic performance of sweet maize (*Zea mays* L. saccharata Strut). International Journal of Applied Science and Technology. 2014;4(4): 190-201.
10. Kar PP, Barik KC, Mahapatra RK, Garnayak LM, Rath BS, Bastia DK, Khanda CM. Effect of planting geometry and nitrogen on yield, economics and nitrogen uptake of sweet corn. Indian Journal of Agronomy. 2006;51(1): 43-45.
11. Neelam, Dutta R. Production of baby corn as influenced by spacing and nutrient management. International Journal of Current Microbiology and Applied Sciences. 2018;7(12):1332-1339.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/91754