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Pankaj Chandel
M.Sc. Scholar, Department of Agronomy, SHUATS, Prayagraj, Uttar Pradesh, India

Yaqub Masih
Teaching Associate, Department of Agronomy, SHUATS, Prayagraj, Uttar Pradesh, India

Joy Dawson
Professor & Head of Department, Department of Agronomy, SHUATS, Prayagraj, Uttar Pradesh, India

Naveena
M.Sc. Scholar, Department of Agronomy, SHUATS, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Pankaj Chandel
M.Sc. Scholar, Department of Agronomy, SHUATS, Prayagraj, Uttar Pradesh, India

Effect of nitrogen management on organic baby corn (*Zea mays* L.)

Pankaj Chandel, Yaqub Masih, Joy Dawson and Naveena

Abstract

The field experiment was conducted during *zaid* season of 2021 at SMOF (SHIATS Model Organic Farm), Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P). The soil of the experiment plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.51%), available N (230 kg/ha), available P (17.80 kg/ha) and available K (245.10 kg/ha). The experiment was laid out in randomized block design with ten treatments and were replicated thrice. A field experiment was conducted to study the response of baby corn to different sources of organic manures like FYM, sheep manure, poultry manure and vermin compost. Manures are alone and in combination with each other's on growth, yield and economics parameters. Among the different manurial practices, 100% nitrogen through VC (T3: N100 [100% N through VC (3.33 t/ha)]) were registered highest growth parameters (plants height, cob length and dry matter production), yield parameters like (No. of cob/ plant, maximum Cob weight with husk). And all the growth and yield parameters were recorded with the application of 100% nitrogen through VC (T3: N100 [100% N through VC (3.33 t/ha)]). The higher cob yield (11.76 t/ha) and green fodder yield of (23.07 t/ha) were recorded with the application of 100% nitrogen through VC (T3: N100 [100% N through VC (3.33 t/ha)]), maximum gross return (INR 398940.00 /ha), net return (INR 299640.00 /ha) and B:C ratio (3.0) was also recorded in the same treatment.

Keywords: Economics, FYM, poultry manure, vermi compost (VC), sheep manure, yield, green fodder, Cob

Introduction

Baby corn (also known as young corn, mini corn or candle corn) is the ear of corn (*Zea mays* L.) young plant harvested, when the silks have not emerged or have just emerged and that no fertilization has taken place. One of the most important dual-use crops grown year round in India (Singh *et al*. 2015) [10]. Baby corn is becoming popular in domestic and foreign markets and has enormous potential for processing and exporting. An interesting recent development is the cultivation of corn for plant purposes. Currently, Thailand and China are the world leaders in the production of miniature corn. In India, miniature corn is cultivated in Meghalaya, Western Uttar Pradesh, Haryana, Maharashtra, Karnataka and Andhra Pradesh Baby corn is a delicious, decorative and nutritious vegetable, without cholesterol. It is a low calorie vegetable rich in fiber. A baby corn can be compared to an "egg" in terms of minerals. It is probably the only vegetable without pesticide residues. Baby corn is free from pests and diseases and its nutritional value is comparable to that of other expensive vegetables (Pandey *et al*., 2000) [9].

In India, although it is widely cultivated in several regions, the production of mini corn is not a popular enterprise among Indian growers mainly due to a lack of awareness on the whole production, the importance economical and the use of mini-corn. In the current scenario, the use of chemical fertilizers can help achieve the maximum yield of dwarf corn, but this poses a serious health risk and poses a major threat to the sustainability of agriculture. The development of organic production technology for baby corn is needed to achieve higher and cheaper yields (Galinat *et al.* 1985) [2]. The use of chemical fertilizers can be helpful in getting the maximum yield from baby corn but given the current scenario of sustainability, soil and public health, the need has arisen to standardize green technology for the production of corn. Baby corn by integrating thanks to biofertilizers and organic fertilizers. Continuous application of chemical fertilizers presents health risks and reduces a microbial population in the soil, in addition to being quite expensive and therefore increasing the cost of production. In such circumstances, biofertilizers and organic fertilizers can play an important role. The development of a production technology, a nutrient management strategy particularly suitable for organic miniature corn is necessary to obtain higher yields and economic returns (Saha *et al*., 2007) [11]. Most organic fertilizers have a very low nutrient content, which is not sufficient to meet the nutrient requirements of crops, especially when inorganic fertilizers are not applied (Manna *et al*., 2001) [5].

With this in mind, the present investigation has been undertaken to identify and quantify the appropriate biological source for growing organic miniature corn which can minimize the consumption of time, labor, energy and at the same time increase the growth and yield of the plant. Miniature corn. (Saha and Mandal *et al*. 2006) [12] reported that the combined application of organic nutrient sources, namely 1.5 t ha1 neem seed powder or 1.25 t ha1 karanj cake, agricultural manure 7, 5 t ha1, commercial formulation of organic fertilizer granules 0.75 t ha1 and 1.8 ha1 of humus-rich organic manure with 75% RDF were effective in increasing the yield of standard corn by 6, 20% and 40.53% on control (100 percent CDR).

Materials and Methods

The experiment was carried out during *Zaid* season of 2021 at the SMOF (SHIATS Model Organic Farm), Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. The SMOF is situated at 25º24„41.27" N latitude, 81°50„56" E longitude (Google, 2018) and 98 m altitude above the mean sea level. The metrological data recoded during the growing period of experiment including the weekly average of maximum and minimum temperature, relative humidity and rainfall recorded at the Agro-Meteorological observatory unit, School of Forestry and Environment Sciences, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj.

The treatment consisted by levels of Nitrogen [1: N100% (through single N source) 2: N50% + N50% (through combination of two different N sources)] and 4 sources of organic manures [FYM (20 t/ha, 10 t/ha), PM (3.30 t/ha, 1.65 t/ha), VC (3.33 t/ha, 1.66 t/ha), SM (3.33 t/ha, 1.66 t/ha)]. T_1: N100% [100 % N through FYM (20 t/ha)] T_2: N100% [100% N through PM (3.30 t/ha)] T_3: N100% [100% N through VC (3.33 t/ha)] T_4: N100% [100% N through SM (3.33 t/ha)] T_5: N50% + N50% [50% N through FYM (10 t/ha) + 50% N through PM (1.65 t/ha)] T_6: N50% + N50% [50% N through FYM (10 t/ha) + 50% N through SM (1.66 t/ha)] T_7: N50% + N50% [50% N through PM (1.65 t/ha) + 50% N through VC (1.66 t/ha)] T_8: N50% + N50% [50% N through SM (1.66 t/ha) + 50% N through VC (1.66 t/ha)] T_9: Control plot [25% N through every source (FYM, PM, VC, SM)] used. The Experiment was laid out in Randomized Block Design, with seven treatments which are replicated thrice

The soil samples were collected randomly from 0 to 15 cm depth from 5 locations of the experimental field before the layout of the experimental area. A representative homogeneous sample was made by mixing all the samples together, which was analysed to determine the physio-chemical properties of soil. The results of analysis along with the methods used for determination are presented under the following heads. The soil was sandy loam in texture, low in organic carbon (0.51%) and medium in available nitrogen (230 kg/ha), phosphorous (17.80 kg/ha) and low in potassium (245.10 kg/ha). Nutrient sources were organic sources FYM, Vermicompost, Sheep manure and Poultry manure was used in treatment to fulfill the requirement of Nitrogen. Full of the Nitrogen applied as basal dose.

Results and Discussion

The results of the experiment conducted on the topic, "Effect of nitrogen management on organic Baby corn (*Zea mays* L.)" during *Zaid* season at Prayagraj‟, have been presented in this chapter along with discussion on the experimental findings in the light of scientific reasoning and their conformity with the previous researchers. The analysis of variance for all these data has been presented in appendices. Data recorded for different parameters have been presented in Tables.

Growth attributes

Plant Height (cm)

At 45 DAS, there was significant difference between the treatments and maximum plant height (128.07) was observed the applications of vermicompost (3.33) kg/ha, whereas the lowest value (96.81 cm) was observed in treatment 9 Control plot [25% N through every source (FYM,PM,VC,SM)]. Statistical analysis did not reveal any significant difference in the plant height of sweet corn as influenced by vermicompost. Thus, in this study, it is obvious that the highest rate of 34 vermicompost at 5 t/ha produced the highest plant height (172 cm), although statistically in-significant. (Villaver *et al*., 2020) [13] The study of (Joshi *et al*., 2015) [3] revealed that vermicompost improved the plants height due to humic acid and growth promoting bacteria.

Dry weight

Maximum plant dry weight (68.37g) was recorded with T3 that is [100% N through VC (3.33 t/ha)] and T6 and T7 was found to be statistically at par T3 at 45 DAS. (Dadarwal *et al*. 2009) results showed that maximum dry weight accumulation were recorded under 75% NPK from 2.25 tons vermi-compost /ha. Similar result is also achieved by (Sharma *et. al* 2014.).Use of organic fertilizers such as vermi-compost has a positive effect on crop growth, yield. The interactions between earthworms and microorganisms can produce significant quantities of plant growth hormones and humic acids which act as plant regulators (Lazcano *et al.* 2011) [4].

CGR (Crop Growth Rate)

At 30-45 DAS the highest Crop growth rate (g m-2 day-1) (24.41 g m-2 day-1) was found in treatment with the application of T3: [100% N through VC (3.33 t/ha)] and treatment 7, was found to be statistically at par with treatment 3. Vermi compost stimulates to influence the microbial activity of soil, increases the availability of oxygen, maintains normal soil temperature, increases soil porosity and infiltration of water, improves nutrient content and increases growth, yield and quality of the plant (Arora *et al*. 2011) [1].

Yield and Yield attributes

Observations regarding the response of different levels of nitrogen on yield and yield attributes of organic baby corn are given in table 4.6. The observation showed that at yield and yield attributes there was significant difference between treatments.

Number of cobs/plants: The results revealed that there was significant difference between the treatments and maximum number of cob/plant (1.60 plant-1) was observed by the application of T3: 100% N through VC (3.33 t/ha) and T2 and

T7 were statically at par with treatment 3. The data regarding the number of cobs per plant are presented in table 4.6, which indicated that application of nitrogen through vermicompost partly affected the number of cobs per plant. It seems that number of cobs per plant is basically a genetic character and not too much influenced by crop nutrition. These results are in line with the finding of (Naveen *et al.* 2020) [8].

Cob length (cm): The results revealed that there was significant difference between the treatments and maximum Cob length (16.59 cm) was observed by the application of T3: 100% N through VC (3.33 t/ha) and T2, T4, T5, T6, T7 and T8 were statically at par with treatment 3 This result was in accordance with the data recorded by Younas *et al.* (2021) [14]. That the application of vermicompost proved the most effective improving growth and yield attributes maize crop varieties. The highest values of plant height and cob length were recorded with the application of vermicompost, whereas control treatment recorded the lowest values of these traits.

Cob weight (g): The results revealed that there was significant difference between the treatments and maximum Cob weight (52.35 g) was observed by the application of T3: 100% N through VC (3.33 t/ha) and T4, T5, T6, T7 and T8 were statically at par with treatment 3.
Individual cob weight in vermicompost received plots could be due to better interception, absorption and utilization of radiation energy leading to higher photosynthetic rate and finally more accumulation. The overall improvement reflected into better source-sink relationship, which in turn enhanced the yield and yield attributes (Madhavi *et al.*, 1995) [6].

Cob yield (t/ha): The results revealed that there was significant difference between the treatments and maximum cob yield (11.76 t/ha) was observed by the application of T3: 100% N through VC (3.33 t/ha) and T2: 100% N through PM (3.30 t/ha) was found to be statistically at par T3. Mohammadi *et al.* 2017 [7] reported that the cob yield were significantly influenced by various levels of vermicompost. Significantly the highest cob yield (14.15 t/ha) were recorded with the application of vermicompost at 4.00 t/ha followed by application of vermicompost at 2.00 t/ha. The increase in cob yield might be due to remarkable improvement in yield attributes. This might be due to better growth with higher nutrient supply by vermicompost and also provided nutrients for longer period and readily to use form with growth promoting substances which improve overall growth and reflected in yield.

Green fodder (t/ha)): The results revealed that there was maximum green fodder yield (23.07 t/ha) was observed by the application of T3: 100% N through VC (3.33 t/ha), and T5, T6 and T7 were found to be statistically at par with T9. Maximum fodder yield (23.07 t/ha) was recorded due to application of T3: 100% N through VC (3.33 t/ha) at the time of sowing, which was proved significantly superior over the application of FYM, poultry manure and sheep manure. This result was in accordance with the data recorded by Madhavi *et al.*, 1995 [6]. Higher rate of nitrogen by organic manure had beneficial effect on physiological processes, plant metabolism, dry matter production, growth etc. there by leading to higher green fodder.

Economics

The highest gross return (INR 398940/ha), net return (INR 299640/ha) and benefit cost ratio (3.0) were observed by the application of T3: 100% N through VC (3.33 t/ha). Whereas the lowest value gross return (INR 328940 /ha) and net return (INR 231403/ha) respectively were observed by the application of T9: Control plot [25% N through every source (FYM, PM, VC, SM)].

Gross return (/ha)

Maximum gross return (INR 398940 /ha) was recorded in treatment T3: 100% N through VC (3.33 t/ha), whereas the lowest value (INR 328940/ha) was observed in treatment T9: Control plot [25% N through every source (FYM, PM, VC, SM)].

Net return (/ha)

Maximum net return (INR 299640/ha) was recorded in treatment T3: 100% N through VC (3.33 t/ha), whereas the lowest value (INR 231403 /ha) was observed in treatment T9: Control plot [25% N through every source (FYM, PM, VC, SM)].

Benefit cost ratio (B: C)

Maximum benefit cost ratio (3.0) was recorded in treatment: 100% N through VC (3.33 t/ha), whereas the lowest value (2.2) was observed in treatment T2: N100 [100% N through PM (3.30 t/ha)].

Table 1: Effect of Nitrogen management on growth attributes of organic Baby corn

Treatments	Plant height(cm)	Dry Weight (g)	CGR (g/m^2/day)
	45 DAS	45 DAS	30-45 DAS
T1: N100 [100% N through FYM (20 t/ha)]	109.66	58.32	18.89
T2: N100 [100% N through PM (3.30 t/ha)]	120.41	59.92	19.47
T3: N100 [100% N through VC (3.33 t/ha)]	128.07	68.37	24.41
T4: N100 [100% N through SM (3.33 t/ha)]	107.53	59.94	20.50
T5: N50 + N50 [50% N through FYM (10 t/ha)+50% N through PM (1.65 t/ha)]	106.48	62.56	21.63
T6: N50 + N50 [50% N through FYM (10 t/ha)+ 50% N through SM (1.66 t/ha)]	103.82	64.00	20.14
T7: N50 + N50 [50% N through PM (1.65 t/ha)+ 50% N through VC (1.66 t/ha)]	117.17	67.12	22.87
T8: N50 + N50 [50% N through SM (5 t/ha)+ 50% N through VC (1.66 t/ha)]	111.11	62.58	21.31
T9: Control plot [25% N through every source (FYM,PM,VC,SM)]	96.81	57.27	20.37
F test	S	S	S
SEm(±)	1	1.9	0.81
CD (P=0.05)	3.01	5.56	2.4

Table 2: Effect of nitrogen management on yield attribute and economics of Organic Baby corn

T. No.	No. of cobs/plant	Green fodder (t/ha))	Cob length (cm)	Cob weight with husk (g)	Cob Yield (t/ha)	Gross return (INR/ha)	Net Returns (INR/ha)	B:C
T1	1.47	21.06	14.11	39.32	10.72	3,65,120.00	2,59,120.00	2.4
T2	1.53	20.78	15.39	42.80	11.66	3,91,360.00	2,89,060.00	2.2
T3	1.60	23.07	16.59	52.35	11.76	3,98,940.00	2,99,640.00	3.0
T4	1.47	20.18	15.53	43.23	10.90	3,67,360.00	2,84,710.00	2.9
T5	1.47	21.51	15.85	47.12	10.66	3,62,820.00	2,58,670.00	2.5
T6	1.47	21.57	16.23	48.02	10.87	3,69,240.00	2,74,915.00	2.7
T7	1.53	20.09	15.81	51.98	10.36	3,52,600.00	2,51,850.00	2.5
T8	1.47	20.29	15.60	45.68	10.37	3,51,680.00	2,60,755.00	2.6
T9	1.27	19.12	13.66	38.69	9.69	3,28,940.00	2,31,403.00	2.3
F test	S	S	S	S	S	--	--	--
SEm(±)	0.337	0.577	0.664	2.406	0.122	--	--	--
CD (P=0.05)	0.10	1.72	1.97	7.15	0.36	--	--	--

Conclusion

It is concluded that for obtaining significantly highest yield in organic baby corn during *Zaid* season 2021, application of N as vermi compost at 3.33 t/ha (Treatment 3) recorded more No. of cob/plant, maximum Cob weight with husk, Cob length, maximum Cob yield and with highest Benefit Cost ratio.

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