The Journal of Phytopharmacology 2021; 10(5):374-377
Online at: www.phytopharmajournal.com

Research Article

ISSN 2320-480X
JPHYTO 2021; 10(5): 374-377
September- October
Received: 25-08-2021
Accepted: 25-09-2021

doi: 10.31254/phyto.2021.10516

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Effect of integrated nutrient management on growth, yield attributes, yield and economics of sweet corn under northern tract condition of Madhya Pradesh

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ABSTRACT

Background: In most areas where corn is sown, the crop growth is usually affected by low available nitrogen. The experiment was carried out during 2019 *Kharif* seasons to investigate the effect of integrated nutrient management on growth, yield attributes, yield and economics of sweet corn under northern tract condition of Madhya Pradesh. **Methods:** The experiment was laid out in randomized block design with three replicates. Observations were recorded on growth parameters (plant height, dry matter accumulation), yield attributes (number of cobs per plant, number of rows per cob, number of grains per cob, cob length, grain weight per cob) and green cob yield and stover yield of sweet corn. **Results:** Revealed that combination of 75% RDF + BF + 25 % VC recorded higher mean growth parameters were plant height (196.4 cm), dry matter (193.45 g plant^{-1}) and yield attributes were number of cobs per plant (1.60), length of cob (20.2 cm), number of rows per cob (16.5), number of grains per cob (612), grain weight per cob (126 g) and green cob yield & stover yield (18603 & 9770 kg ha^{-1}, respectively) as compared to rest of treatments, whereas above parameters lowest under absolute control. The practice of integration of 75% RDF + BF + 25 % VC gave maximum net returns of ₹ 306657 ha^{-1} compared to other treatments.

Keywords: Sweet corn, INM, Growth parameters, Yield attributes, Green cob yield, Stover yield, Net returns.

INTRODUCTION

Sweet corn (*Zea mays* L. *saccharata*) is a member of the grass family Gramineae. It is additionally acknowledged as sugar corn hybridized variety of maize specifically bred to increase the sugar content and provides green ears in 75 to 90 days after sowing. Sweet corn is an important source of carbohydrate and contains a vary of nutrients, mainaly vitamins B group. In sweet corn quality dietary exceptional relies upon moisture (72.7%) total solids (22.3%), protein (13%), and lipids (3.5%) [11]. In India, Corn occupied 9.22 million hectares area with a production of 26.88 million tonnes and average yield of 2.92 tonnes ha^{-1} [1]. It is one of the major crops in the Madhya Pradesh, covers approximately 9.02 lakh ha area. Sweet corn predominantly grown in Neemuch, Mandsaur, Ratlam, Indore, Ujjain, Khandwa, Chhindwara, Jhabua and Katni districts.

As the corn is considered an exhaustive crop, requires more nutrient, organic nutrient management practices play an important role in sustaining productivity of sweet corn. Sustainable yield levels could be achieved by applying appropriate combination of organic manures and chemical fertilizers [14]. Organic manures, particularly VC and FYM not only supply macronutrients but also meet their requirements of micronutrients. To sustain and enhance the soil fertility and crop productivity the role of organic manures and organic nutrients are most important [12]. Integrated Nutrient Management (INM) is an option to alleviate soil fertility constant as it uses available organic and inorganic nutrients for sustainable agricultural production and productivity.

METHOD AND MATERIALS

The experiment was conducted at the Research Farm, College of Agriculture, RVSKVV, Gwalior during the *Kharif* 2019. The soil of the experimental site was sandy clay loam in texture, medium in organic carbon (0.57%) and low in available nitrogen (212 kg ha^{-1}), medium in phosphorus (12.5 kg ha^{-1}) and medium in potassium (267 kg ha^{-1}) content. It was neutral in soil reaction (7.3 pH) and normal electrical conductivity (0.37 ds /m). The rainfall was 560.4 mm, climate and weather conditions were normal for better growth and development of the crop. The treatments consisted of 12 nutrient management were T_1 - Absolute control, T_2 - 100% RDF (NPKZn), T_3 - 75% RDF + 25% VC (N% based), T_4 - 100% RDF + 25% VC (N% based), T_5 - 50% RDF + 50% VC (N% based), T_6 - 75% RDF + BF, T_7 - 100% RDF + BF, T_8 - 50% RDF + BF, T_9 - 50% RDF + BF + 50% VC, T_{10} - 75% RDF + BF +

25% VC, T_{11} - 50% RDF + BF + 25% VC, T_{12} - 125% RDF (NPKZn) were tested in randomized block design (RBD) with 3 replications.

Seed of sweet corn (*var*. Sugar-75) was sown in field on 27th July 2019 after ploughing and leveling. Seed was sown at depth of 4-5 cm with the spacing 60 cm x 25 cm in all plots and recommended nutrient dose of 120:60:60:5 N, P_2O_5, K_2O, Zn were applied. Out of this half dose of N was applied in the form of urea in two splits *i.e.* ½ at the time of sowing, ½ at knee high stage. A common dose of 60 kg P_2O_5, 60 kg K_2O and 5 kg Zn per ha was applied as basal dose in the form of single super phosphate, muriate of potash, zinc sulphate (36% zinc), BF (nano) @ 20kg/ha and VC (1.5 % N based) respectively, at the time of sowing. Observations were recorded at maturity on growth (plant height, dry matter accumulation), yield attributes (*viz.*, number of cobs per plant, cob length (cm), number of rows per cob, number of grains per cob and grain weight per cob) and yield. All data were subjected to analysis of variance according to the experimental design used in this study and critical difference means of treatments.

RESULTS AND DISCUSSION

Growth Parameters

The significantly variation was recorded on growth parameters *viz.*, plant height and dry matter showed in Table 1. The application of 75% RDF + BF + 25% VC produced significantly higher growth parameters ie., plant height and dry matter (196.4 cm and 193.45 g per plant, respectively) which was at par with the application of 50% RDF + BF + 50% VC but significantly higher over rest of the treatments. Moreover, the lowest growth parameters were measured in absolute control plots. The results so obtained in performances probably due to nutrients were responsible for increased cell division, cell enlargement, growth, and photosynthesis which are responsible for quantitative increase in plant growth. These results of present study are in agreement with the findings of several other investigators [2, 5, 8, 10] who reported that plant growth was significantly increased by the combination of 100% RDF + pressmud compost @ 5 t ha^{-1} as compared to other treatments.

Yield Attributes

Data in respect yield attributes were given in Table 1 showed significant variation in all the treatments. The yield attributes believed to be closely associated with grain yield resulting high productivity [13]. The yield attributes (*viz.*, number of cobs per plant, cob length (cm), number of rows per cob, number of grains per cob and grain weight per cob) increased significantly with treatment 75% RDF + BF + 25% VC and recorded appreciably higher values of above parameters over rest of the treatments. Whereas, the lowest yield attributes were recorded in absolute control plots. Similar results were found by other investigators [7, 13, 16].

Green cob and Stover yield

It is apparent from the data depicted in Table 1 showed that all the treatment significantly influenced the green cob and stover yield over absolute control plots. The maximum green cob yield (18603 kg ha^{-1}), and stover yield (9770 kg ha^{-1}) was recorded with treatment 75% RDF + BF + 25% VC which also remained at par with treatment 50% RDF + BF + 50% VC but significantly superior to rest of the treatments. The results are close conformity with these of several other investigators [4, 8, 16].

Harvest index

The ratio between economic and biological yield expressed in percentage as significantly affected by different treatments. Harvest index data depicted in Table 1 revealed that application of 75% RDF + BF + 25% VC resulted in significantly maximum harvest index (65.6%). The minimum harvest index (58.7%) was recorded under absolute control. Similar results were found by scientist [15].

Table 1: Effect of integrated nutrient management on growth parameters and yield attributes of sweet corn

Treatments	Plant height (cm)	Dry Matter (g $plant^{-1}$)	Number of Cobs $plant^{-1}$	Number of rows cob^{-1}	Number of grains cob^{-1}	Cob length (cm)	Grain weight (g cob^{-1})
T_1 - Absolute control	158.8	142.15	1.07	13.2	417	12.1	104
T_2 - 100% RDF(NPKZn)	187.8	185.42	1.41	15.6	509	17.2	111
T_3 - 75% RDF + 25% VC (N% based)	185.7	180.50	1.37	15.1	460	16.4	107
T_4 - 100% RDF + 25% VC (N% based)	194.8	191.12	1.55	16.3	568	18.8	121
T_5 - 50% RDF + 50% VC (N% based)	186.0	182.26	1.38	15.4	490	16.9	108
T_6 - 75% RDF + BF	175.4	171.80	1.33	14.4	447	15.3	105
T_7 - 100% RDF + BF	193.9	188.50	1.53	16.2	548	18.4	117
T_8 - 50% RDF + BF	167.8	160.52	1.27	14.1	430	13.8	104
T_9 - 50% RDF + BF + 50% VC	195.1	191.95	1.57	16.4	593	19.4	123
T_{10} - 75% RDF + BF + 25% VC	196.4	193.45	1.60	16.5	612	20.2	126
T_{11} - 50% RDF + BF + 25% VC	177.5	175.20	1.35	14.7	460	15.8	106
T_{12} - 125% RDF(NPKZn)	191.5	187.20	1.51	16.1	529	17.6	111
SEm±	3.473	3.481	0.030	0.270	14.1	0.694	2.7
CD(P=0.05)	10.166	10.190	0.088	0.790	41.3	2.030	8.0

RDF - Recommended dose of fertilizer, BF - Biofertilizer, VC – Vermicompost

Production economics

Computation of valued revealed that the maximum net returns (306657 ₹ ha^{-1}) as compared other of its treatments were found under the treatments where 75% RDF + BF + 25% VC had applied (Table 2). This mainly due to maximum yield produced under this level which overcome the cost of BF, VC and benefited more. Although lower net returns were recorded under absolute control plots (179667 ₹ ha^{-1}). It is evident from the data that B:C ratio was lowest (4.17) under T_5 – 50% RDF + 50% VC and maximum (5.47) under T_7 where 100% RDF + BF at par T_2 – 100% RDF (5.41) and its remaining treatments. These findings lend support to the report of investigators [3, 6].

Table 2: Effect of integrated nutrient management on green cob yield, stover yield and harvest index and economic analysis of sweet corn

Treatments	Green cob yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)	COC (₹/ha)	GMR (₹/ha)	NMR (₹/ha)	B:C Ratio
T_1 - Absolute control	11458	8050	58.7	53510	233177	179667	4.36
T_2 - 100% RDF(NPKZn)	16047	9620	62.5	60156	325743	265587	5.41
T_3 - 75% RDF + 25% VC (N% based)	15307	9600	61.4	68495	310933	242438	4.54
T_4 - 100% RDF + 25% VC (N% based)	17047	9720	63.7	70156	345793	275637	4.93
T_5 - 50% RDF + 50% VC (N% based)	15763	9610	62.1	76833	320072	243239	4.17
T_6 - 75% RDF + BF	14504	9500	60.4	60295	294831	234536	4.89
T_7 - 100% RDF + BF	16700	9710	63.2	61956	338855	276899	5.47
T_8 - 50% RDF + BF	13866	9120	60.3	58633	281885	223252	4.81
T_9 - 50% RDF + BF + 50% VC	17897	9730	64.8	78633	362798	284165	4.61
T_{10} - 75% RDF + BF + 25% VC	18603	9770	65.6	70295	376952	306657	5.36
T_{11} - 50% RDF + BF + 25% VC	14980	9590	61.0	68633	304395	235762	4.44
T_{12} - 125% RDF(NPKZn)	16290	9710	62.7	61818	330655	268837	5.35
SEm±	337.98	178.05	0.604				
CD(P=0.05)	989.40	521.23	1.769				

COC – Cost of cultivation, GMR – Gross monetary returns, NMR – Net monetary returns

CONCLUSIONS

From the present experiment it is concluded that application of 75% RDF + BF + 25% VC significant enhanced growth, yield attributing characters and yield of sweet corn and more remunerative over rest of the treatments, which suggests that the 75% RDF + BF + 25% VC application is more scientific management of nutrients in northern tract condition of Madhya Pradesh.

Conflicts of interest

The authors declare no conflict of interest.

Financial Support

None declared.

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HOW TO CITE THIS ARTICLE

Barde B, Sasode DS, Joshi E, Singh V, Patel R. Effect of integrated nutrient management on growth, yield attributes, yield and economics of sweet corn under northern tract condition of Madhya Pradesh. J Phytopharmacol 2021; 10(5):374-377. doi: 10.31254/phyto.2021.10516