Effect of Integrated Nutrient Management on Growth, Yield and economic of Maize (Zea*maysL*.)

ABSTRACT

A field experiment was conducted at the Crop Research Farm, Department of Agronomy, AKS, University, Satna during Rabi season 2023 on Maize crop. crop. The experiment was laid out in Randomized Block Design with ten treatments and three replications. The treatments of Maize T_1- Control,T_2 - 100% RDN by FYM (24 t/ha),T_3- 75% RDN by FYM+25% RDN by VC, T_4 - 75%RDN by FYM+25% RDN by VC+Azotobacter and PSB @ 10 ml/kg seed, T_5- 100% RDN by VC (8 t/ha), T_6 - 75% RDN by VC+25% RDN by FYM, T_7 -75%RDNby VC+25% RDN by FYM+Azotobacter and PSB @ 10 ml/kg seed, T_8 - 50% RDN by VC + 50 % RDN by PM (3.8 t/ha), T_9 - 50% RDN by VC+50% RDN by PM + Azotobacter and PSB @ 10 ml/kg seed,T_{10} - 50%RDN by EC (6 t/ha) + Beejamrut + Jeevamrut spray 500 l/ha (twice). The results of the experiment showed that, plant height (182.15 cm), leaves/ plant (11.56), No. of cob/plant (1.52), Karnel/cob (341.3), seed index (29.42 g), seed yield (39.40q/ha) and stover yield (77.52 q/ha) and harvest index (33.70%). Maximum net returns (178954 INR/ha), and B:C (4.36) were also obtained with the same treatment.

Keywords: Growth; Integrated Nutrient Management; maize yield.

INTRODUCTION

Maize (Zea mays L.) is one of the most significant cereal crops and plays a significant nutrition role in the world for human being and animals. In India, it comes in third place behind rice and wheat. The nutritional breakdown of maize (per 100 g) is as follows: 4 g protein, 30 g of carbohydrates, 3.5 g of dietary fiber, 1.5 g of fat, 3.6 g of sugar, 4 mg of calcium, 0.72 mg of zinc, and other nutrients. In India, maize is emerging as the third most important cereal crop after rice and wheat which occupies an area of 9.86 M/ha with a production of 31.51 MT, having average productivity of about 3.19 t/ha. About 28% of produced maize is used as food, 11% for livestock feed, 48% as poultry feed, 12% in wet milling industry and 1% as seed.

The soil health is maintained by the use of organics by improving the soil organic matter, physio- chemical properties and beneficial microbes. The role of organic manure is to sustain the soil fertility and crop productivity which mainly includes, vermicompost, farmyard manure, cow urine etc. These fermented liquid organics contain nutrients, growth promoting substances and beneficial microbes which helps in improving the metabolic activity, plant growth, development and resistance to diseases and pests.

Knowledge about improved food safety, problems of health hazards and environmental concerns are increasing at an alarming rate both at national and global level in recent years. Hence, there is a great demand on the international market for high quality products and organically grown foods that can capitalize on its potential for large scale organic farming. As consumer demand for good monetary returns, high quality, safe, nutritious and ethical organic foods increases, organic farming is preferred nowadays. In view of high economic returns from maize, the production potential of maize and its potential to generate employment opportunities, there is a need to develop the organic production technology for maize production in the state.

MATERIALS AND METHODS

During the Rabi season of 2022-2023, a field experiment was conducted in alluvial soil at the Crop Research Farm of the Department of Agronomy, AKS, University, Satna Madhya Pradesh. The soil of experimental plot was sandy loam, having a nearly neutral soil reaction (pH 7.35), electrical conductivity (0.23 ds/m), medium in available Nitrogen (192.8 kg/ha) and availablepotassium (224 kg/ha), and low in availablephosphorous (13.70 kg/ha). The experiment wasconducted in a Randomized Block Designconsisting of 10 treatments and 3 replications. The treatments of Maize T_1 - Control,T_2 - 100% RDN by FYM (24 t/ha),T_3 - 75% RDN by FYM+25% RDN by VC, T_4 - 75%RDN by FYM+25% RDN by VC + Azotobacter and PSB @ 10 ml/kg seed, T_5 - 100% RDN by VC (8 t/ha), T_6 - 75% RDN by VC+25% RDN by FYM, T_7 -75%RDN by VC+25% RDN by FYM+ Azotobacter and PSB @ 10 ml/kg seed, T_8 - 50% RDN by VC + 50 % RDN by PM (3.8 t/ha), T_9 - 50% RDN by VC+50% RDN by PM + Azotobacter and PSB @ 10 ml/kg seed,T_{10} - 50%RDN by EC (6 t/ha) + Beejamrut + Jeevamrut spray 500 l/ha (twice).Plant growth parameters, such as plant height (cm), plant dry weight (g/plant) were measured at 30 days

intervals from germination till harvest and yield and yield attributes, such as No. of cobs/plant, No. of rows/cob, No. of grains/row, seed index (g), seed yield (t/ha), stover yield (t/ha) and harvest index (%) were measured at harvest. The observed data were statistically analyzed using analysis of variance as applicable to Randomized Block Design.

3. RESULTS AND DISCUSSION

3.1 Growth Parameter

The data pertaining to growth attributes presented in Table 1, Out of the different INM through organic sources, the application of 50% RDN by VC + 50% RDN by poultry manure + *Azotobacter* + PSB biofertilizers resulted in significantly higher plant height, leaves / plant and basal stem girth over other treatments at every stage of plant growth. Thus, at 90 days stage, the plants were tallest up to 182.15 cm with 14.74 leaves/plant and 13.70 cm stem girth at 60 DAS. The followed by treatment T_8 having 50% RDN + by VC +50% RDN by PM and then T_7 having 75% RDN by VC + 25% RDN by FYM + The increase in growth characters may be as a result of increased supply of nitrogen, multi-nutrients and beneficial microflora as well as increased physico-chemical and biological properties of Soil (Kandel and kumar 2020, Alias et al 2003, Mega et al 2021, Khan et al 2005).

3.2 Yield Attributes

The data of yield attributes and yield (Table 2),had shown significantly and maximum number ofnumber of cobs/plants, cob length, grains/cob, 1000 - grain weight and cob girth weigh/plant) were enhanced significantly due to INM by organic sources treatments. The best INM by organic sources treatment was T_9, having 50% RDN by VC + 50% RDN by PM + Azotobacter and PSB @ 10 ml/kg seed which resulted in significant increase in all the yield attributes over other INM organic treatments. The maximum yield attributes were 1.52 cobs/plant, 18.06 cm length of cob, 341.3 grains/cob, 29.42 g test weight and 16.86 cm cob girth. All these favorable situations might have resulted in greater formation of photosynthates, carbohydrates, protein and their translocation to the sink i.e. reproductive organs. These in turn, increased the higher yield-attributing parameters. These results are in close agreement with those of numerous workers (Pawar*et al.,* 2012; Sharma*et al.,* 2018; Kripa*et al*., 2021; Reddy *et al.,* 2018).

The data exhibited in Table 2. revealed that the grain and straw yield (39.40 and 77.52 q/ha) as well as harvest index (33.70%) were found significantly higher in case of T_9, 50% RDN by VC + 50% RDN by PM + Azotobacter and PSB @ 10 ml/kg seed treatment followed by T_8 (50% RDN by VC + 50 % RDN by PM (3.8 t/ha)

3.3 Economics

The data pertaining to the economics of different treatments presented in Table 2 showed that the maximum net return (₹ 178954/ha), and benefit-cost ratio (4.36) was obtained in the treatment of 50% RDN by VC + 50% RDN by PM + Azotobacter and PSB @ 10 ml/kg seed, and the minimumnet return (₹ 63134/ha), and lowest benefit-cost ratio (2.93) were recorded in treatment 1(control).

4. CONCLUSION

Based on one year field experimental data, it is concluded that amongstthe applied INM organic sources of nutrients, 50% RDN by Vermicompost + 50% RDN by poultry manure+*Azotobacter* + PSB (T_9) proved the best treatment for growing maize.var. JM-218 for Kymore plateau (Satna region) of Madhya Pradesh. This treatment recorded maximum growth parameters (plant height, stem girth and leaves/plant), yield-attributes (cobs/plant, Cob length, grains/cob test weight and cob girth). Thus, the maximum seed yield was 39.40 q/ha, net income up to Rs. 178954/ha with 4.36 B:C ratio as well as seed protein was up to 10.46%. The second and third best organic sources of nutrients were T_8 (50% RDN by VC +50% RDN by PM) and then T_7(75% RDN byVC + 25% RDN by FYM + *Azotobacter* and PSB @ 10 ml/kg seed) respectively with respect to above mentioned parameters.

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Table 1. Growth parameters of maize as influenced by INM through organic sources

Tr. No.	Treatments	Plant height (cm)			Leaves /plant			Basal stem growth (cm)
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	
T_1	Control	68.86	155.40	158.18	8.28	10.65	7.35	8.45
T_2	100% RDN by FYM (24 t/ha)	75.10	167.82	170.10	9.87	12.37	9.10	10.93
T_3	75% RDN by FYM+25% RDN by VC	76.43	169.15	171.00	10.00	12.94	9.89	11.00
T_4	75%RDN by FYM+25% RDN by VC+Azotobacter and PSB @ 10 ml/kg seed	78.20	170.85	172.74	10.14	13.10	10.14	11.24
T_5	100% RDN by VC (8 t/ha)	82.50	175.22	177.23	11.48	13.46	10.38	12.16
T_6	75% RDN by VC+25% RDN by FYM	80.78	173.24	175.10	11.35	13.15	10.26	11.79
T_7	75%RDN by VC+25% RDN by FYM+Azotobacter and PSB @ 10 ml/kg seed	83.21	176.15	178.42	11.63	13.50	10.44	12.43
T_8	50% RDN by VC + 50 % RDN by PM (3.8 t/ha)	84.00	178.27	180.34	11.85	13.78	10.72	12.65
T_9	50% RDN by VC+50% RDN by PM + Azotobacter and PSB @ 10 ml/kg seed	85.87	18.30	182.15	12.10	14.74	11.56	13.70
T_{10}	50%RDN by EC (6 t/ha) + Beejamrut + Jeevamrut spray 500 l/ha (twice)	76.16	168.17	170.28	9.88	12.48	9.12	10.88
	S.Em±	**0.46**	**0.82**	**1.10**	**0.27**	**0.37**	**0.20**	**0.27**
	C.D. (P=0.05)	**1.32**	**2.38**	**3.17**	**0.79**	**1.06**	**0.58**	**0.77**

E.C. = Enriched Compost, 100 % RDN = 120 kg N/ha

Table 2. Yield attributes of maize as influenced by INM through organic sources

Tr. No.	Treatments	No. of cobs/plant	Kernels per cob	Cob length (cm)	Cob girth (cm)	Seed index (g)	Seed yield (q/ha)	Straw yield (q/ha)	Harvest index (%)	Seed protein (%)	Net income (Rs./ha)	B.C. Ratio
T_1	Control	1.05	288.6	13.63	13.82	22.30	15.90	42.17	27.38	7.13	63134	2.93
T_2	100% RDN by FYM (24 t/ha)	1.30	314.2	16.02	16.14	24.12	32.72	65.35	33.36	8.42	136280	3.40
T_3	75% RDN by FYM+25% RDN by VC	1.32	315.6	16.21	16.15	24.83	33.65	68.62	32.90	8.47	142049	3.50
T_4	75%RDN by FYM+25% RDN by VC+Azotobacter and PSB @ 10 ml/kg seed	1.36	321.0	16.34	16.23	25.14	34.53	70.34	32.93	8.58	145733	3.50
T_5	100% RDN by VC (8 t/ha)	1.42	328.5	17.05	16.66	27.93	36.73	73.53	33.31	9.30	159971	3.82
T_6	75% RDN by VC+25% RDN by FYM	1.39	320.4	16.87	16.57	26.56	35.48	74.38	32.30	8.68	153266	3.70
T_7	75%RDN by VC+25% RDN by FYM+Azotobacter and PSB @ 10 ml/kg seed	1.46	330.7	17.43	16.78	28.27	37.62	73.58	33.83	9.45	163376	3.80
T_8	50% RDN by VC + 50 % RDN by PM (3.8 t/ha)	1.48	335.6	17.84	16.80	29.05	38.15	75.76	33.49	9.86	173227	4.35
T_9	50% RDN by VC+50% RDN by PM + Azotobacter and PSB @ 10 ml/kg seed	1.52	341.3	18.06	16.86	29.42	39.40	77.52	33.70	10.46	178954	4.36
T_{10}	50%RDN by EC (6 t/ha) + Beejamrut + Jeevamrut spray 500 l/ha (twice)	1.25	315.8	16.08	16.24	24.54	31.28	63.55	33.00	8.35	141500	4.27
	S.Em±	**0.03**	**1.28**	**0.24**	**0.32**	**0.31**	**0.51**	**0.76**	**0.15**	**0.18**	**-**	**-**

	C.D. (P=0.05)	**0.08**	**3.70**	**0.69**	**0.92**	**0.89**	**1.47**	**2.20**	**0.44**	**0.53**	**-**	**-**

E.C. = Enriched Compost, 100 % RDN = 120 kg N/ha