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Effect of organic nutrient management on maize production under South Gujarat condition

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Abstract

The field experiment was carried out on Certified Organic Farm of ACHF, Navsari Agricultural University, Navsari during 2012-13 to find out the effect of different organic sources on growth, yield, nutrient content and uptake by maize crop. The treatment containing application of 50% NADEP compost + 50% castor cake on equivalent N basis of RDN recorded significantly higher plant height, cob length, cob girth, cob weight, number of grains per cobs, grain and stover yield of maize. Significantly higher total N, P, K and S contents and its uptake were also found under treatments containing 50% NADEP compost + 50% castor cake on equivalent N basis of RDN than other treatments.

Keywords: organic manures, maize, nutrient content and uptake, yield

1. Introduction

Maize (*Zea mays* L.) is one of the important cereal crop after only wheat and rice in the world. In India, it ranks fourth after rice, wheat and sorghum. Maize is being consumed as food by human being, fodder by animals and also required by the various industries. Globally, maize is cultivated on an area of 146 million ha with production of 680 million tonnes and productivity 4650 kg ha⁻¹. In India, maize is cultivated on 8.19 million ha of land with production of 19.29 million tonnes and productivity 2355 kg ha⁻¹. Gujarat occupies an area of 0.48 million ha producing 7.86 million tonnes of grain with productivity of 1532 kg ha⁻¹ (Anon., 2012-13) [1]. The present farming system totally depends on use of chemical fertilizers, pesticides and growth regulators for enhancing crop production. It is a well-documented fact that increased dependence on agrochemicals including fertilizers has led to several ill effects on the crop production, environment, soil and human health. To minimize these ill effects from agrochemicals there is a need to reconsider the alternative to chemical agriculture. So the use of organic manures receiving the greater attention and regain its popularity in recent years. Organic farming hold a great promise due to local availability as a source of multiple nutrients and ability to improve the soil fertility which results into getting maximum return through increasing quality crop production. Hence, the present experiment was conducted to study the effect of different organic sources on growth, yield and nutrient content and uptake by maize crop.

2. Materials and Methods

The field experiment was carried out on Certified Organic Farm of ACHF, Navsari Agricultural University, Navsari (Gujarat) during 2012-13 by using ten treatments containing different organic manures which were replicated three times in randomized block design. The treatments comprises T₁: 100% NADEP compost (basal application), T₂: 75% NADEP compost (basal application), T₃: 50% NADEP compost (basal application), T₄: 50% NADEP compost + 50% castor cake (basal application), T₅: Jivamrut @500 lit ha⁻¹ (15 days interval), T₆: Jivamrut @500 lit ha⁻¹ (30 days interval), T₇: Panchgavya @50 lit ha⁻¹ (15 days interval), T₈: Panchgavya @50 lit ha⁻¹ (30 days interval), T₉: Jivamrut @500 lit ha⁻¹ + panchgavya @50 lit ha⁻¹ (15 days interval) and T₁₀: Jivamrut @500 lit ha⁻¹ + panchgavya @50 lit ha⁻¹ (30 days interval). All the organic manures were applied on equivalent N basis of RDN. The soil of the present study was low in available N, medium in available P₂O₅, high in K₂O and clay in texture. The observations were recorded on plant height, yield attributing characters, grain and stover yield of maize Whereas, total N content were analysed by Kjeldahl method and total P, K and S were analysed by wet-digestion (di-acid) method given by Tandon (1995) [6].

The nutrient uptake was formulated by multiplying the nutrient content with total yield of maize crop and divided by 100. The obtained data were analyzed as per statistical methods given by Panse and Sukhatme (1967) [2].

3. Results and Discussions

3.1 Growth and Yield Attributes

Table 1: Effect of organic nutrient management on growth and yield of maize

Treatment	Plant height (cm)		Cob length (cm)	Cob girth (cm)	Cob weight (g)	Number of grain per cobs	Grain yield (q ha ⁻¹)	Stover yield (q ha ⁻¹)
	30 DAS	At harvest						
T ₁	72.27	206.73	14.49	13.16	124.33	496.33	24.53	47.35
T ₂	70.27	205.33	14.22	12.98	119.00	488.77	23.55	46.57
T ₃	69.93	194.93	13.41	12.35	107.67	430.13	20.28	43.69
T ₄	80.60	228.13	17.89	14.96	155.00	601.67	30.38	55.11
T ₅	69.53	190.53	13.29	12.60	110.00	452.07	18.56	36.82
T ₆	70.13	189.70	12.77	11.73	100.33	407.63	16.58	34.71
T ₇	66.20	188.80	14.23	12.26	113.00	429.13	19.99	34.94
T ₈	69.53	202.67	14.49	12.67	109.33	442.37	20.45	42.73
T ₉	75.40	223.27	16.90	14.51	146.67	577.27	26.87	50.16
T ₁₀	72.40	217.20	14.90	13.18	131.67	536.03	24.62	47.88
SEm±	3.60	6.78	0.99	0.60	9.66	34.87	1.52	2.34
CD (0.05)	NS	20.16	2.93	1.78	28.71	103.62	4.51	6.95

The data related to the growth and yield attributing characters of maize were influenced significantly due to different organic treatments except plant height at 30 days after sowing (DAS) (Table 1). The treatment receiving application of 50% NADEP compost + 50% castor cake (T₄) on equivalent N basis of RDN recorded significantly higher plant height at harvest (228.13 cm) and was at par with treatment T₉ and T₁₀. Significantly higher cob length of maize (17.89 cm) was observed with the treatment which received application of 50% NADEP compost + 50% castor cake (T₄) than other treatments except treatments T₉. However, treatment T₄ (50% NADEP compost + 50% castor cake) recorded significantly higher cob girth (14.96 cm), cob weight (155.00 gm) and number of grain per cobs (599.80) than other treatments but was found to be at par with treatments T₉ and T₁₀. Similar results were also reported by Yadav and Christopher (2006) [7] Patel *et al.* (2009) [3].

3.2 Grain and Stover Yield

The data presented in Table 1 indicated that different organic treatments significantly influenced the grain and stover yield of maize. Significantly higher grain yield (30.38 q ha⁻¹) as well as stover yield (55.11 q ha⁻¹) were observed with the treatment T₄ (application of 50% NADEP compost + 50% castor cake) over rest of the treatments but former treatment found to be at par with treatment T₉. The considerable improvement in maize yield might be due to the fact that it acts as a nutrient reservoir and upon decomposition produces organic acids; thereby absorbed nutrient ions are released slowly for the entire growth period leading to higher yield. The results were supported by the findings of Yadav and Christopher (2006) [7] and Patil (2013) [5].

3.3 Nutrient Content

Table 2: Effect of organic nutrient management on nutrient content of grain and stover

Treatments	Grain (%)				Stover (%)			
	N	P	K	S	N	P	K	S
T ₁	1.86	0.185	0.595	0.43	0.54	0.174	1.59	0.28
T ₂	1.86	0.185	0.591	0.43	0.52	0.168	1.54	0.26
T ₃	1.82	0.173	0.575	0.32	0.47	0.161	1.50	0.24
T ₄	1.94	0.193	0.616	0.48	0.59	0.184	1.64	0.33
T ₅	1.84	0.178	0.578	0.35	0.51	0.166	1.54	0.26
T ₆	1.82	0.170	0.565	0.24	0.45	0.159	1.48	0.18
T ₇	1.84	0.178	0.585	0.29	0.52	0.168	1.54	0.20
T ₈	1.82	0.176	0.575	0.35	0.51	0.165	1.52	0.26
T ₉	1.90	0.191	0.608	0.44	0.56	0.181	1.60	0.31
T ₁₀	1.89	0.188	0.595	0.44	0.56	0.174	1.59	0.29
SEm±	0.05	0.00	0.01	0.02	0.02	0.00	0.03	0.01
CD (0.05)	NS	0.01	0.03	0.05	0.05	0.014	0.09	0.03

Nutrient content in grain and stover of maize influenced significantly due to different organic treatments except N content in grain (Table 2). Among different organic treatments, the treatment containing application of 50% NADEP compost + 50% castor cake (T₄) recorded significantly higher P (0.193%), K (0.616%) and S (0.48%) contents than rest of the treatments but was found to be at par with treatment T₁, T₂, T₉ and T₁₀. In case of nutrient content in stover, treatment T₄ *i.e.*, treatment receiving application of 50% NADEP compost + 50% castor cake registered significantly higher N (0.45%), P (0.184%) and K (1.64%)

contents in maize stover than other treatments except treatments T₁, T₉ and T₁₀. Significantly higher S content (0.33%) was found with the treatment T₄ than other treatments but was found to be at par with treatment T₉. The higher nutrient contents by maize crop might be obtained due to higher accumulation of all the above nutrients in soil by the application of large amount of organic manures such as NADEP compost and castor cake. The results are strongly supported by the findings of Patel (2012) [4] and Patil (2013) [5].

3.4 Nutrient Uptake

Table 3: Effect of organic nutrient management on nutrient uptake by maize grain and stover

Treatments	Grain (kg ha ⁻¹)				Stover (kg ha ⁻¹)			
	N	P	K	S	N	P	K	S
T ₁	45.44	4.54	14.62	10.62	25.72	8.21	74.82	13.26
T ₂	43.80	4.36	13.92	10.07	24.34	7.84	73.25	12.15
T ₃	36.97	3.52	11.64	6.48	20.70	7.07	65.53	10.47
T ₄	59.05	5.88	18.75	14.55	32.53	10.16	90.50	18.39
T ₅	34.08	3.31	10.72	6.57	18.80	6.13	56.74	9.43
T ₆	30.21	2.81	9.36	3.99	15.69	5.51	51.36	6.25
T ₇	36.69	3.55	11.67	5.73	18.19	6.02	53.78	6.96
T ₈	37.15	3.62	11.76	7.17	21.76	7.06	65.81	11.09
T ₉	51.09	5.14	16.34	11.80	28.07	9.07	80.29	15.32
T ₁₀	46.59	4.63	14.64	10.81	26.90	8.34	75.55	13.95
SEM _±	3.18	0.31	0.97	0.72	1.34	0.53	3.83	0.68
CD (0.05)	9.46	0.93	2.88	2.14	3.99	1.572	11.37	2.03

The data presented in Table 3 indicated that different organic treatments influenced nutrient uptake by maize crop significantly. Among different treatments, treatment T₄ (application of 50% NADEP compost + 50% castor cake) gave significantly higher N, P and K uptake by grains (59.05, 5.88 and 18.75 kg ha⁻¹, respectively) than other treatments but was stayed at par with treatments T₉. Whereas, treatment T₄ (application of 50% NADEP compost + 50% castor cake) gave significantly highest S uptake by grains (0.44 kg ha⁻¹) over other organic treatments.

In case of uptake of nutrient by stover, treatment containing application of 50% NADEP compost + 50% castor cake (T₄) gave remarkably highest N (32.50 kg ha⁻¹) and S (18.39 kg ha⁻¹) uptake over rest of the treatments. Significantly higher P (10.16 kg ha⁻¹) and K (90.50 kg ha⁻¹) uptake by stover was observed with the treatment which received application of 50% NADEP compost + 50% castor cake (T₄) than all other treatments excluding treatment T₉. Similar findings were observed by Zalate and Padmani (2009) ^[8], Patel (2012) ^[4] and Patil (2013) ^[5].

4. Conclusion

From this field experiment, it can be concluded that application of recommended dose of N through NADEP compost along with castor cake in equal proportion on equivalent N basis was found to be most effective for obtaining higher yield and increasing nutrient content and uptake in maize crop.

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