

EFFECT OF INORGANIC FERTILIZERS AND PRESSMUD COMPOST ON NUTRIENT CONTENT AND UPTAKE OF BHENDI

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ABSTRACT: A field experiment was conducted at farmer's field in Sivapuri village, Chidambaram taluk, Cuddalore district, Tamil Nadu with bhendi as test crop in sandy clay loam soil to study the effect of inorganic fertilizers, and pressmud compost on yield, nutrient content and uptake of bhendi. The inorganic N, P, K fertilizers and pressmud compost were applied in different combinations. The results of the experiment clearly revealed that the application of 100% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (T₄) registered the highest fruit yield, stover yield, nutrient content and uptake by bhendi fruit. But, It was on par with application of 75% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (T₇).

Key Words: NPK content, uptake, Pressmud compost, Bhendi.

INTRODUCTION

Okra is an erect herbaceous annual crop species that belongs to the family Malvaceae. Okra has been found to be a rich source of vitamins A, C, thiamine, riboflavin and calcium. It occupies fifth position in area under vegetables in the country. In Tamil Nadu, the area under cultivation is 7,070 hectares with a production of about 67,140 tonnes and the productivity is about 9.5 tonnes ha⁻¹ whereas, the national productivity is 10.5 tonnes ha⁻¹ (Anon, 2010). The productivity of bhendi in Tamil Nadu is less as compared to world average productivity. The application of inorganic fertilizers results in yield increase of this crop. The continuous use of chemical fertilizers has resulted in creating a potential threat of environmental pollution and causing a deterioration of the nutrient status. Continuous and excess use of inorganic fertilizers depleted the inherent soil fertility. At this juncture, there is an urgent need to optimize nutrient recycling to sustain crop production without affecting soil health and protecting environment from pollution.

In view of above problems, there is a need to utilize organic manures, crop residues, organic wastes etc., to a larger extent. In tropical country like India, addition of only organic manures to soil is crucial for maintaining the soil fertility and successful crop production. The crop waste and organic manures can be effectively utilized by way of adopting suitable technologies by integrating with inorganic fertilizer enrichment and composting etc. Apart from chemical fertilizers and organic wastes, industrial wastes like pressmud can also be used in agriculture (Poonkodi and Raghupathy, 2001). Pressmud (sugarcane filter cake) is one of the important by-product of sugar industry. Pressmud is a good media of both organic and inorganic plant nutrients as it contains organic carbon, nitrogen, phosphorus, potassium, calcium and sulphur and abundance of micronutrients. Production of compost from ligno cellulosic residues of by-products of sugar industries is found to be worthy for maintaining health of plant and soil properties and protects the plant from various soil borne diseases. It will pave way for disposal of these wastes effectively reducing the pressure on the import of fertilizers and helping in reducing cost of fertilizer together with a possibility of getting sustainable production. Therefore, the objective of the present study was to find out the effect of inorganic fertilizers and pressmud compost on yield, nutrient content and uptake of bhendi.

Materials and Methods

A field experiment was conducted at Sivapuri village in farmers's holding, Chidambaram taluk, Cuddalore district, Tamil Nadu to find out the effect of inorganic fertilizers and pressmud compost on yield, nutrient content and uptake of Bhendi variety Arka anamika, the test crop under irrigated condition during March to May 2015 with thirteen treatments replicated thrice in a randomized block design. The inorganic NPK fertilizers and pressmud compost were applied in different combinations as per the treatment schedule. The details of the treatments are given below

- T₁ - Recommended dose of fertilizer.
- T₂ - 100% Recommended dose of fertilizer + 10 tonnes of pressmud compost ha⁻¹.
- T₃ - 100% Recommended dose of fertilizer + 12.5 tonnes of pressmud compost ha⁻¹.
- T₄ - 100% Recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹.
- T₅ - 75% Recommended dose of fertilizer + 10 tonnes of pressmud compost ha⁻¹.
- T₆ - 75% Recommended dose of fertilizer + 12.5 tonnes of pressmud compost ha⁻¹.
- T₇ - 75% Recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹.
- T₈ - 50% Recommended dose of fertilizer + 10 tonnes of pressmud compost ha⁻¹.
- T₉ - 50% Recommended dose of fertilizer + 12.5 tonnes of pressmud compost ha⁻¹.
- T₁₀ - 50% Recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹.

The test crop bhendi was grown and fruit yield was obtained at every harvest and the yield of fruits and stover were recorded. The nutrient content of fruit and plant at harvest was analysed for N,P,K and S content and the uptake was obtained from the yield and nutrient content .

Results and Discussion

Fruit yield

The treatment with application of 100% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (T₄) registered the highest fruit yield of 16.49 t ha⁻¹ in bhendi. But, It was on par with the treatment T₇ (75% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹).The treatments next in order were T₃ (100% recommended dose of fertilizer + 12.5 tonnes of pressmud

compost ha⁻¹), T₂ (100% recommended dose of fertilizer + 10 tonnes of pressmud compost ha⁻¹), T₆ (75% recommended dose of fertilizer + 12.5 tonnes of pressmud compost ha⁻¹), T₅ (75% recommended dose of fertilizer + 10 tonnes of pressmud compost ha⁻¹), T₁ (recommended dose of fertilizer), T₁₀ (50% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹), T₉ (50% recommended dose of fertilizer + 12.5 tonnes of pressmud compost ha⁻¹) and T₈ (50% recommended dose of fertilizer + 10 tonnes of pressmud compost ha⁻¹) recording the fruit yield of 16.20, 15.40, 14.62, 13.82, 13.02, 12.21, 11.31, 10.53 and 10.14 t ha⁻¹ respectively. However, the treatments T₄ and T₇ and T₈ and T₉ were comparable with each other. These findings also revealed that addition of 15 tonnes of pressmud compost ha⁻¹ along with 75% recommended chemical fertilizer supplemented the need of 25% chemical fertilizer without comprising significant yield loss. A similar trend was reported by Noor *et al.* (2007), Jawadagi *et al.* (2012) and Singh *et al.* (2013).

Stover yield

Among the different treatments tried, the maximum stover yield of 12.00 t ha⁻¹ was recorded in the treatment with application of 100% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (T₄). The treatment T₇ (75% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹) was next in order recording the stover yield of 11.84 t ha⁻¹. But, the treatments T₇ and T₄ were not significantly different from each other. The increase in yield might be due to enhanced shoot growth and dry matter of the plant and increased number of flowers and fruits. The results obtained were in agreement with the findings of Vanlauwe *et al.* (2002) and Pushpavalli *et al.* (2014).

Nutrient content

Nitrogen

Statistically significant differences were observed in the nitrogen content of plant and fruit due to addition of different levels of inorganic fertilizers and pressmud compost in different combinations. The maximum nitrogen content of 0.28 in plant and 0.31 per cent in fruit was observed in the treatment with application of 100% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (T₄). The treatments next in order were T₇, T₃, T₂, T₆, T₅, T₁, T₁₀, T₉ and T₈. However, the treatments T₄ and T₇ and T₈ and T₉ were not significantly different from each other.

Phosphorus

The observation on phosphorus content in plant and fruit indicated that the addition of different levels of inorganic fertilizers and pressmud compost in different combinations significantly increased the phosphorus content. Among the different treatments tried, the maximum phosphorus content was observed with application of 100% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (T₄) recording 0.118 per cent in plant and 0.102 per cent in fruit. The treatments T₇, T₃, T₂, T₆, T₅, T₁, T₁₀, T₉ and T₈ were next in order. However, the treatments T₄ and T₇ and T₈ and T₉ were on par with each other.

Potassium

It was quite clear from the data that the application of 100% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (T₄) recorded the maximum potassium content of plant (0.230 per cent), and fruit (0.285 per cent). This treatment was followed by T₇ recording the potassium

content of 0.227 per cent in plant and 0.281 per cent in fruit. But, there was no significant difference between the treatments T₄ and T₇ with respect to potassium content in plant.

Sulphur

Among the different treatments tried, the maximum sulphur content in plant (0.079 per cent) and fruit (0.084 per cent) was observed with application of 100% recommended dose of fertilizer + 15 tonnes of press mud compost ha⁻¹ (T₄). The treatments T₇, T₃, T₂, T₆, T₅, T₁, T₁₀, T₉ and T₈ were next in order registering the sulphur content. However, the treatments T₄ and T₇ and T₈ and T₉ were on par with each other.

The results of the analysis indicate that conjoint application of NPK fertilizers and pressmud compost has relatively higher level of both nitrogen and phosphorus content in plant and fruit than organic manures alone. The increased nutrient contents (N, P, K and S) might be due to adequate supply of N, P and K from fertilizers and pressmud compost and S from pressmud compost and thereby greater mobilization of these nutrients along with enhanced transport of soil nutrients through the plant system. These nutrients had synergistic effect with other nutrients and make them release from the soil pool. Similar trend of results were observed by Suge *et al.* (2011).

Nutrient Uptake

Nitrogen

The application of different combinations of inorganic fertilizers and pressmud compost significantly influenced the nitrogen uptake by bhendi plant at harvest and by bhendi fruit. Among the different treatments tried, application of 100% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (T₄) registered the maximum nitrogen uptake of 33.60 kg ha⁻¹ by plant and 51.12 kg ha⁻¹ by fruit. This was followed by the treatment T₇ (75% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹) recording the nitrogen uptake of 31.97 kg ha⁻¹ by plant and 50.22 kg ha⁻¹ by fruit. But, the treatments T₄ and T₇ were comparable. These treatments were followed by the treatments T₃, T₂, T₆, T₅, T₁, T₁₀, T₉ and T₈. The treatment T₈ (50% recommended dose of fertilizer + 10 tonnes of pressmud compost ha⁻¹) registered the least nitrogen uptake by plant and fruit.

Phosphorus

The addition of different levels of inorganic fertilizers and pressmud compost in different combinations increased the phosphorus uptake by bhendi plant. Among the various combinations of inorganic fertilizers and pressmud compost, the maximum phosphorus uptake was observed in the treatment (T₄) with application of 100% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (14.16 kg ha⁻¹ by plant and 16.04 kg ha⁻¹ by fruit). The treatments T₇, T₃, T₂, T₆, T₅, T₁, T₁₀, T₉ and T₈ were next in order recording the phosphorus uptake of 12.91, 11.83, 10.76, 9.76, 8.90, 8.02, 7.23, 6.44 and 6.25 kg ha⁻¹ by plant and 14.48, 12.87, 11.47, 10.03, 8.79, 7.46, 6.53 and 5.98 kg ha⁻¹ by fruit.

Potassium

The data pertaining to potassium uptake by bhendi plant at harvest revealed that there was statistically significant differences in the potassium uptake by plant due to the addition of different levels of inorganic fertilizers and pressmud compost. The maximum potassium uptake of 27.60 kg ha⁻¹ by plant and 47.00 kg ha⁻¹ by fruit was observed in the treatment with application of 100%

recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹ (T₄). The treatments next in order were T₇, T₃, T₂, T₆, T₅, T₁, T₁₀, T₉ and T₈. However, the treatments T₄ and T₇ and T₉ and T₈ were not significantly different from each other in registering the P uptake by plant and fruit.

Sulphur

The sulphur uptake by plant at harvest stage was significantly influenced by the application of different combinations of inorganic fertilizers and pressmud compost at different levels. The maximum sulphur uptake of 9.48 kg ha⁻¹ by plant and 13.85 kg ha⁻¹ by bhendi fruit was recorded in the treatment (T₄) with application of 100% recommended dose of fertilizer + 15 tonnes of pressmud compost ha⁻¹. The treatments next in order were T₇, T₃, T₂, T₆, T₅, T₁, T₁₀, T₉ and T₈ registering the sulphur uptake of 9.12, 8.41, 7.61, 6.86, 6.13, 5.76, 4.99, 4.24 and 4.08 kg ha⁻¹ by plant and 13.45, 12.32, 11.11, 9.81, 8.72, 7.69, 6.67 and 5.89 kg ha⁻¹ respectively by bhendi fruit. However, the treatments T₉ and T₈ were comparable to each other.

The increase in uptake of nutrients NPK by bhendi fruit and plant with application of NPK along with pressmud compost might be due to optimum nutrients supply for the crop in this combination. The solubilization of plant nutrients by addition of organic manures leading to increase in uptake of N, P and K. Similar results were observed by Subbaiah *et al.* (1982) and Bahadur *et al.* (2004).

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Effect of inorganic fertilizers and pressmud compost on nutrient content (%) of bhendi

Treatments	Nutrient Content (%)							
	N		P		K		S	
	Plant	Fruit	Plant	Fruit	Plant	Fruit	Plant	Fruit
T ₁	0.22	0.23	0.085	0.072	0.190	0.200	0.061	0.063
T ₂	0.26	0.28	0.099	0.088	0.211	0.248	0.070	0.076
T ₃	0.27	0.30	0.104	0.094	0.220	0.269	0.074	0.080
T ₄	0.28	0.31	0.118	0.102	0.230	0.285	0.079	0.084
T ₅	0.23	0.25	0.090	0.077	0.197	0.207	0.062	0.067
T ₆	0.25	0.26	0.094	0.083	0.205	0.220	0.066	0.071
T ₇	0.27	0.31	0.109	0.099	0.227	0.281	0.077	0.083
T ₈	0.19	0.18	0.075	0.059	0.166	0.180	0.049	0.055
T ₉	0.19	0.19	0.076	0.062	0.169	0.183	0.050	0.056
T ₁₀	0.20	0.22	0.081	0.066	0.181	0.191	0.056	0.059
SE _d	0.0028	0.0032	0.0018	0.0020	0.0019	0.0020	0.0012	0.0014
CD (p=0.05)	0.0058	0.0068	0.0038	0.0043	0.0039	0.0041	0.0026	0.0029

Effect of inorganic fertilizers and pressmud compost on yield and nutrient uptake of bhendi

Treatments	Yield (t ha ⁻¹)		Nutrient uptake (kg ha ⁻¹)			
	Fruit	Stover	N	P	K	S

	yield	yield	Plant	Fruit	Plant	Fruit	Plant	Fruit	Plant	Fruit
T ₁	12.21	9.44	20.77	28.08	8.02	8.79	17.94	24.42	5.76	7.69
T ₂	14.62	10.87	28.26	40.94	10.76	12.87	22.95	36.25	7.61	11.11
T ₃	15.40	11.37	30.79	46.20	11.83	14.48	25.01	41.42	8.41	12.32
T ₄	16.49	12.00	33.60	51.12	14.16	16.82	27.60	47.00	9.48	13.85
T ₅	13.02	9.89	22.75	32.55	8.90	10.03	19.48	26.95	6.13	8.72
T ₆	13.82	10.39	25.98	35.93	9.76	11.47	21.30	30.40	6.86	9.81
T ₇	16.20	11.84	31.97	50.22	12.91	16.04	26.88	45.52	9.12	13.45
T ₈	10.14	8.33	15.83	18.25	6.25	5.98	13.83	18.95	4.08	5.58
T ₉	10.53	8.47	16.09	20.01	6.44	6.53	14.31	19.27	4.24	5.89
T ₁₀	11.31	8.92	17.84	24.88	7.23	7.46	16.15	21.60	4.99	6.67
SE_d	0.358	0.211	0.679	0.721	0.22	0.28	0.69	0.96	0.16	0.20
CD (p=0.05)	0.752	0.442	1.430	1.520	0.47	0.58	1.45	2.02	0.33	0.42