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REGULAR ARTICLE

EFFECT OF INORGANIC FERTILIZERS AND PRESSMUD COMPOST ON SOIL PROPERTIES, YIELD AND QUALITY OF BHENDI

P. POONKODI, A. ANGAYARKANNI, R. VIJAYAKUMAR, A. BALAKUMAR*

Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar 608 002, Tamil Nadu, India

ABSTRACT

A field experiment was conducted at farmer`s field in Sivapuri village, Chidambaram taluk, Cuddalore district, Tamil Nadu to study the effect of inorganic fertilizers and pressmud compost on soil properties, yield and quality of bhendi cultivar Arka anamika as a test crop. The experimental soil was sandy clay loam with a pH of 7.20, EC of 0.64 dSm^{-1} and CEC of 19.20 c mol (p^+) kg^{-1}. The results of the experiment clearly revealed that the application of 100% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1} (T_4) registered the maximum fruit and stover yield of bhendi the same treatment T_4 improved the quality attributes of bhendi viz., crude protein content, ascorbic acid content and crude fibre content. The available N, P, K and S content in the post harvest soil was maximum in the treatment T_4. This treatment was followed by application of 75% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1} (T_7) regarding yield and quality attributes, as well as available nutrients status of post harvest soil. However, these two treatments were comparable to each other.

Keywords: Bhendi, Pressmud compost, Inorganic fertilizers

INTRODUCTION

Okra, *Abelmoschus esculentus* (L.) Moench, is a vegetable crop found to be a rich source of vitamins A and C, thiamine, riboflavin and calcium. It is also rich in iron and is used as a medicine in the treatment of many diseases [1]. The area under cultivation of this crop in India is about 4,32,000 hectares and production is about 45,28,000 metric tonnes. 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} [2]. The productivity of bhendi in Tamil Nadu is less as compared to world average productivity. Hence, there is an imperative need to increase the production of bhendi by adopting some improved cultivation practices.

The continuous use of chemical fertilizers has resulted in creating a potential threat of environmental pollution and causing a deterioration of the nutrient status [3]. At this juncture, there is an urgent need to optimize nutrition recycling to sustain crop production without affecting soil health and protecting environment from pollution. To overcome this, scientists prefer biologically dynamic and sustainable farming which stresses the importance of judicious use of organic manures with chemical fertilizers to augment productivity of crops. 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 [4]. Pressmud compost 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. This will be reducing cost of fertilizer together with a possibility of getting sustainable production.

MATERIALS AND METHODS

The field experiment was conducted in the farmer's field at Sivapuri village, near chidambaram, cuddalore district, tamil nadu. The effect of inorganic fertilizers and pressmud compost on yield of bhendi with ten 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 treatments included were T_1-Recommended dose of fertilizer, T_2-100% recommended dose of fertilizer+10 tonnes of pressmud compost ha^{-1}, T_3-100% recommended dose of fertilizer+12.5 tonnes of pressmud compost ha^{-1}, T_4-100% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1}, T_5-75% recommended dose of fertilizer+10 tonnes of pressmud compost ha^{-1}, T_6-75% recommended dose of fertilizer+12.5 tonnes of pressmud compost ha^{-1}, T_7-75% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1}, T_8-50%

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*Corresponding Author

A. Balakumar

Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar 608 002, Tamil Nadu, India

Email: bala05kumar@gmail.com

recommended dose of fertilizer+10 tonnes of pressmud compost ha^{-1}, T_9-50% recommended dose of fertilizer+12.5 tonnes of pressmud compost ha^{-1}, T_{10}-50% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1}. The test crop bhendi cv. Arka Anamika was grown and harvested at maturity stage. The yield of fruit and stover were recorded. The quality of bhendi fruit and the post harvest soil nutrient status were estimated.

RESULTS AND DISCUSSION

Fruit yield

The treatment with application of 100% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1} (T_4) registered the highest fruit yield of 16.49 t ha^{-1}in bhendi. But, It was on par with the treatment T_7 (75% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1}) the treatment next in order were T_3 (100% recommended dose of fertilizer+12.5 tonnes of pressmud compost ha^{-1}), T_2 (100% recommended dose of fertilizer+10 tonnes of pressmud compost ha^{-1}), T_6 (75% recommended dose of fertilizer+12.5 tonnes of pressmud compost ha^{-1}), T_5 (75% recommended dose of fertilizer+10 tonnes of pressmud compost ha^{-1}), T_1 (recommended dose of fertilizer), T_{10} (50% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1}), T_9 (50% recommended dose of fertilizer+12.5tonnes of pressmud compost ha^{-1}) and T_8 (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 T_4 and T_7 and T_8 and T_9 were comparable with each other. These findings 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). The lowest yield was obtained in the treatment with application of 50% recommended dose of fertilizer+10 tonnes of pressmud compost ha^{-1} (T_8). This suggested that 10 tonnes of pressmud compost ha^{-1} may not be enough to reduce 50% of chemical fertilizer from the present conventional recommendation.

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} (T_4). The treatment T_7 was next in order recording the stover yield of 11.84 t ha^{-1}. These treatments were followed by T_3, T_2, T_6, T_5, T_1, T_{10}, T_9 and T_8 registering the stover yield of 11.37, 10.87, 10.39, 9.89, 9.44, 8.92, 8.47 and 8.33 t ha^{-1} respectively. But, the treatments T_7 and T_4 and T_8 and T_9 were not significantly different from each other.

Quality parameters

Crude protein content

The data presented in table 2 revealed that the crude protein content was significantly superior under the conjoint use of recommended dose of fertilizer and pressmud compost. The treatments T_4 (100% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1}) and T_7 (75% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1}) recorded the highest protein content of 1.94 per cent compared to other treatments. The treatments next in order were T_3, T_2, T_6, T_5, T_1, T_{10}, T_9 and T_8 recording the crude protein content of 1.87, 1.75, 1.63, 1.56, 1.44, 1.38, 1.19 and 1.13 per cent respectively. However, the treatments T_9 and T_8 were statistically on par with each other. This was in line with the results of Akande *et al.* [5] who revealed that the intense protein synthesis in the metabolism of the bhendi crop and its efficient storage in the presence of abundant supply of available nutrients and it might be met from the applied inorganic fertilizers with pressmud application.

Ascorbic acid content

Among the different treatments tried, the maximum ascorbic acid content was noticed with application of 100% recommended dose of fertilizer+15 tonnes of pressmud compost ha^{-1} (T_4) recording the ascorbic acid content of 15.80 mg 100g^{-1}. This was followed by the treatment T_7 recording the ascorbic acid content of 15.42 mg 100g^{-1}. This treatment was followed by T_3, T_2, T_6, T_5, T_1, T_{10}, T_9 and T_8 recording the ascorbic acid content of 14.73, 14.07, 13.34, 12.62, 11.98, 11.29, 10.60 and 10.21 mg 100g^{-1} respectively. But, the treatments T_4 and T_7 and T_9 and T_8 were comparable. The highest amount of ascorbic acid content might be due to balancing effects of nutrients available to the plants under the conditions of integrated application of inorganic fertilizers with pressmud compost as reported by Suchithra and Manivannan [6].

Table 1: Effect of inorganic fertilizers and pressmud compost on fruit and stover yield (t ha^{-1}) of bhendi (Mean of three replications)

Treatments	Fruit yield	Stover yield
T_1	12.21	9.44
T_2	14.62	10.87
T_3	15.40	11.37
T_4	16.49	12.00
T_5	13.02	9.89
T_6	13.82	10.39
T_7	16.20	11.84
T_8	10.14	8.33
T_9	10.53	8.47
T_{10}	11.31	8.92
SE_d	0.358	0.211
CD (p=0.05)	0.752	0.442

Table 2: Effect of inorganic fertilizers and pressmud compost on quality parameters of bhendi (Mean of three replications)

Treatments	Ascorbic acid (mg 100g^{-1})	Crude fibre (%)	Crude protein (%)
T_1	11.98	17.02	1.44
T_2	14.07	13.01	1.75
T_3	14.73	12.93	1.87
T_4	15.80	11.23	1.94
T_5	12.62	15.88	1.56
T_6	13.34	14.14	1.63
T_7	15.42	11.87	1.94
T_8	10.21	20.02	1.13
T_9	10.60	19.63	1.19
T_{10}	11.29	18.25	1.38
SE_d	0.25	0.45	0.018
CD (p=0.05)	0.52	0.95	0.038

Crude fibre content

It was quite clear from the data (table 13) that the treatment (T_4) recorded the least crude fibre content of 11.23 per cent. This treatment was followed by T_7 recording the crude fibre content of 11.87 per cent. But, there was no significant difference between the treatments T_4 and T_7 with respect to crude fibre content in fruit. The maximum crude fibre content of 20.02 per cent was recorded in the treatment with 50% recommended dose of fertilizer+10 tonnes of pressmud compost ha^{-1} (T_8). Agbede *et al.* [7] reported similar.

Post harvest soil nutrients

Among the different treatments tried, (T_4) registered the available nitrogen content of 182.0 kg ha^{-1}. The treatments T_7, T_3, T_2, T_6, T_5, T_1, T_{10}, T_9 and T_8, registered the available nitrogen content of 179.2, 173.6, 170.8, 168.0, 168.0, 164.4, 162.4, 156.8 and 154.0 kg ha^{-1} respectively. Miller *et al.* [8] and Katkar *et al.* [9] reported similar results.

The maximum available phosphorus content was registered in the treatment T_4 (10.45 kg ha^{-1}). The treatments T_7, T_3, T_2, T_6, T_5, T_1, T_{10}, T_9 and T_8 registered the available phosphorus content of 9.70, 9.35, 9.30, 8.90, 8.85, 8.40, 8.10, 7.45 and 6.30 kg ha^{-1} respectively. In the conjoint application of nutrients, organic materials like pressmud compost is highly promising, solubilizing P from insoluble Ca, Fe and Al phosphates [10]. The increase in available N and P might be due to increased N and P availability from the applied fertilizers and to the increased efficiency of applied nutrients.

The maximum potassium content of (T_4) recorded 168.15 kg ha^{-1}. The maximum available sulphur content of 7.80 mg kg^{-1} was registered in the treatmentT_4. The treatment next in order was T_7 which recorded the available sulphur content of 7.61 mg kg^{-1}. The treatment T_8 recorded the least available sulphur content of 6.32 mg kg^{-1}. The increased available S content of the soil in T_4 might be due to more vegetative and root growth with application of sulphur through pressmud compost and was made released to plant by microbial activity in association with the roots in the rhizosphere. Application of both organic and inorganic fertilizers released nutrients slowly and steadily to the plant for a considerable period of time resulting in favorable effect on the crop [11].

Table 3: Effect of inorganic fertilizers and pressmud compost on available nitrogen, phosphorus, potassium and sulphur content of the post harvest soil (Mean of three replications)

Treatments	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})	Available S (mg kg^{-1})
T_1	164.4	8.40	147.88	6.03
T_2	170.8	9.30	156.90	6.64
T_3	173.6	9.35	162.01	7.40
T_4	182.0	10.45	168.15	7.80
T_5	168.0	8.85	153.88	6.49
T_6	168.0	8.90	155.18	7.21
T_7	179.2	9.70	167.18	7.61
T_8	154.0	6.30	143.08	6.32
T_9	156.8	7.45	146.04	6.82
T_{10}	162.4	8.10	146.20	7.01
SE_d	2.27	0.185	2.23	0.07
CD (p=0.05)	4.82	0.390	4.70	0.15

CONCLUSION

The present study established the beneficial effect of conjoint application of inorganic fertilizers along with the pressmud compost, an organic fertilizer. Furthermore, the use of expensive chemical fertilizers as per the requirement of the crop is not affordable to the average farmers and complete reliance on the use of fertilizers ignoring the organic manures affect the soil environment. The best combination of 75% recommended dose of inorganic fertilizers along with 15 tonnes of pressmud compost ha^{-1} can be applied for bhendi crop. By adopting this conjoint application, 25% dose of inorganic fertilizers will be saved and also it will improve fertilizer use efficiency for sustainable production of the crop without harming the environment. Thus, the outcome of present investigation may be useful for further studies on large scale field application of pressmud compost in combination with inorganic fertilizers to meet the nutrient requirement of soils in boosting the production of bhendi crop.

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