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Customized fertilizer on growth, yield and economics of okra (*Abelmoschus esculentus* (L.) Moench)

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Abstract

A field experiment was conducted at the Water Management Research Unit, Vellanikkara, Kerala to evaluate the influence of customized fertilizer and its application schedule on growth, productivity and economics of okra. A customized fertilizer grade was developed base on the soil and crop specific requirement and the grade developed was 22.01 N: 3.35 P: 12.68 K: 5.97 Mg: 0.37 B. The experiment was laid out in randomized block design replicated trice with 12 treatments in three replications viz., FYM + 75% CF (2 splits), FYM + 75% CF (4 splits), FYM + 100% CF (2 splits), FYM + 100% CF (4 splits), FYM + 125% CF (2 splits), FYM + 125% CF (4 splits), FYM + soil test based NPK application (N & K as 2 splits, P as basal), FYM + soil test based NPK application (N & K as 4 splits, P as basal), FYM + NPK as per POP (N & K as 2 splits, P as basal), FYM + NPK as per POP (N & K as 4 splits, P as basal), FYM alone based on N recommendation of POP (2 splits at 30 days interval) and absolute control. The application of fertilizers in two splits and four splits were followed at 30 days and 15 days interval. Lime was applied at 350 kg ha⁻¹ one week before the application of FYM (12 t ha⁻¹). The application of 125% customized fertilizer on two splits produced highest yield of okra (14.46 t ha⁻¹), which was 32.11 percent and 35.16 percent higher than soil test based NPK and recommended dose of fertilizers(110: 35: 70 NPK kg ha⁻¹), however was on par with 125% CF applied in four splits (13.69 t ha⁻¹). The highest net returns (Rs.186709 ha⁻¹) and BC ratio (2.82) was recorded in 125% CF (2 splits).

Keywords: Customized fertilizer, okra, growth parameters, yield, BCR

Introduction

The yield maximization of okra can be achieved by adequate application of fertilizers in right proportion by supplying primary, secondary and micronutrients. Customized fertilizers (CF) are multi- nutrient carriers facilitating the application of the complete range of plant nutrients in right proportion to suit the specific requirements of a crop during its growth stages. Customized fertilizer aggravates the scope of site specific nutrient management and precision agriculture (Rakshit *et al.*, 2012) ^[9]. The Central Fertilizer Committee has included customized fertilizers in the Fertilizer (Control) Order 1985, as a new category of fertilizers that are area/soil/crop specific. Customized fertilizers being crop, soil and area specific showed a good promise to maintain soil health by ensuring appropriate fertilization (Tiwari, 2010) ^[10]. Balanced fertilization through customized fertilizers is needed to expand the concept of nutrient management planning by proper scheduling of nutrients. Nutrient scheduling by split application of nutrients especially soluble fertilizers is an efficient way to reduce the nutrient losses and it further promotes the application of nutrients in a need based manner. Keeping this in view, a study was conducted to assess the effect of customized fertilizer and it's scheduling on the growth and productivity of okra.

Materials and Methods

The field trail was conducted at the Water Management Research Unit, Vellanikkara, Thrissur, (latitude 13° 32' N and longitude 76° 26' E) on a lateritic soil. The experimental site experienced a hot humid tropical climate with average annual rainfall of 1578.38 mm in 73 rainy days and mean monthly temperature from 23.2 °C to 33.3 °C. The experiment consisted of 12 treatments viz., FYM + 75% CF (2 splits), FYM + 75% CF (4 splits), FYM + 100% CF (2 splits), FYM +

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100% CF (4 splits), FYM + 125% CF (2 splits), FYM + 125% CF (4 splits), FYM + soil test based NPK application (N & K as 2 splits, P as basal), FYM + soil test based NPK application (N & K as 4 splits, P as basal), FYM + NPK as per POP (N & K as 2 splits, P as basal), FYM + NPK as per POP (N & K as 4 splits, P as basal), FYM alone based on N recommendation of POP (2 splits at 30 days interval) and absolute control. The application of fertilizers in two splits and four splits were followed at 30 days and 15 days interval. Lime was applied at 350 kg ha⁻¹ one week before the application of FYM (12 t ha⁻¹). Customized fertilizer developed based on the soil and crop specific requirement. For the development of customized fertilizer grade, soil samples were collected from the experimental field where the crop was to be raised and analysed to determine the macro and micro nutrient status of the soil. Based on the soil test rating and nutrient recommendation of okra, the nutrient requirement for growing okra in that particular field was worked out. The nutrients required for developing CF (100%) for okra is N:P:K:Mg:B @ 59:9:34:16:1 kg ha⁻¹. To supply the required primary, secondary and micronutrients, a customized fertilizer grade was arrived. Straight or water soluble fertilizers were selected based on the compatibility of the fertilizers and the quantity of these fertilizers required was worked out based on the nutrient requirement. The quantities of fertilizers required for preparation of 100% CF were 19: 19: 19(47.36 kg ha⁻¹), KNO₃ (55.55 kg ha⁻¹), Urea (93.15 kg ha⁻¹), MgCO₃ (66.67 kg ha⁻¹), Dilubor (5.0 kg ha⁻¹). CF was prepared by mixing the above quantities of fertilizer and the total quantity was worked out by adding the weight of all the individual fertilizers used for the preparation of CF and the total quantity of fertilizer comes to 267.7 kg ha⁻¹. The CF grade was developed by calculating the percentage of nutrients present in the total quantity of CF and the grade developed was 22.01 N: 3.35 P: 12.68 K: 5.97 Mg: 0.37 B. Hence a quantity of 268 kg of CF was needed to supply 100 percent nutrient requirement as CF dose.

After application of the treatments, intercultural operations were carried out as per recommendations (KAU, 2016). Observations on growth and yield attributes were recorded from three labeled plants in each replication. Cost of cultivation for all treatments was worked out on the basis of the existing input and market price of the produce. The economic returns were computed for okra. The analysis of variance was carried out using the randomized block design and comparison of means was made by Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984)^[4].

Results and discussion

Results indicated that customized fertilizer had significant effect on growth parameters such as plant height, number of branches and dry matter production (Table 1). Plant height of okra at harvest was significantly higher with the application of FYM+ 125% CF applied as four splits (217.77 cm). The number of branches was significantly higher at FYM+ 125% CF in two splits (2.33) and was found on par with 75% CF applied either as two or four splits. The application of 100% CF in four splits produced the highest dry matter (4119.75 kg ha⁻¹) which was significantly superior to other level of CF and recommended dose of fertilizers. Increased growth and yield parameters with the application of CF may be due to the balanced nutrition of all macro and micronutrients. Application of nutrients at more splits doses failed to show any significant difference in the growth parameters. Though not significant, higher dry matter production was noticed when nutrients were applied in four splits. The cumulative effect of growth and yield attributes resulted in the

higher dry matter production. The effect of different doses of CF's on fruit plant⁻¹ and yield plant⁻¹ was significant. Yield attributes of okra such as number of fruits per plants and yield per plant were significantly higher with the application of customized fertilizer. The application of FYM+ 125% CF in two splits recorded significantly higher number of fruits per plant (31.43) followed by FYM+ 125% CF in four splits (28.43). The higher fruit yield may be owing to the application of sufficient nutrients in combination which resulted to greater availability of essential nutrients to plants by improving the soil environment which facilitate in better root proliferation leading to higher absorption of water and nutrients and ultimately resulting in higher yield (Dwivedi *et al.*, 2014)^[3]. The highest yield per plant was observed by the application of 125% CF in two splits (407 g) and was on par with 125% CF in four splits (385 g). Application of nutrients in different splits doses showed no significant variation in the number of fruits per plant and per plant yield. The increase in dry matter production due to more split application was not positively reflected in the development of yield contributing character and yield. From this, it was observed that by applying fertilizers in more splits helped to develop better biological yield but failed to contribute towards economic yield. The higher mobilization of nutrients due to enhanced enzyme activities resulted in higher biological yield when applied in splits. Devasenapathy (1997)^[2] reported similar result in rice.

The yield was significantly influenced by the application of customized fertilizer doses. Application of 125% CF in two splits produced the maximum yield (14.46 t ha⁻¹) followed by 125% in four splits (13.69 t ha⁻¹). Higher levels of CF (125%) recorded higher yield compared to 100 and 75 percent CF. Higher doses of customized fertilizer obtained higher yield due to the sufficiency of the nutrients which increased the uptake of nutrients and resulted in better development of growth and yield parameters and finally leading to yield. Application of 125% CF gave a yield increase of 32.11 percent, 35.16 percent and 49.84 percent respectively compared to soil test based, application of nutrients at recommended dose and FYM alone. Yield increase in these treatments may be attributed to the higher growth parameters of these treatments. The improvement in growth characters resulted in higher sink for better yield. In rice, Kaleeswari (2013)^[5] reported increase in yield of 17.70 percent on application of customized fertilizer over the application of conventional recommended dose of fertilizers. Application of 100% CF obtained a higher mean yield (11.37 t ha⁻¹) compared to soil test based NPK application (10.65 t ha⁻¹) and NPK as per POP (10.41 t ha⁻¹). The favourable effects on growth parameters may have had their effects on translocation of photosynthates from vegetative to reproductive parts resulting in better yield. The lower level of CF (75%) performed equally with that of soil test based NPK application and NPK as per POP. In the absence of Mg and B, application of NPK alone as per POP did not increase yield. The integrated application of customized fertilizers, application of soil test based and recommended dose of fertilizers along with FYM gave better yield than application of FYM alone by maintaining balanced C/N ratio and improvement in physico-chemical properties of soil with better root proliferation which indicates that application of organic manure alone will not increase the yield. Faster delivery of nutrients could be achieved through fertilizers since FYM alone could not meet the enormous requirement of nutrients by okra. Similarly, Olaniyi *et al.* (2010)^[8] reported the combined effect of NPK fertilizer and organomineral fertilizer resulted in better growth and yield parameters of okra thereby produced higher

yield. The combination of macronutrients and micronutrients enhanced the efficiency of other micronutrient as compared to sole application of nutrient (Beuerlein *et al.*, 1992) [1].

The economic analysis of the study revealed that the cost of cultivation of 125% CF was highest due to the increased cost of CF (Rs. 86 kg⁻¹). Application of 125% CF in two splits recorded highest gross returns (Rs. 289267 ha⁻¹), net returns (Rs. 186709 ha⁻¹) and BCR (2.82) due to the higher yield obtained (Table 2). Though no significant variation on the yield in treatments applied with 125% CF either as two or four splits, higher BCR was obtained with 125% CF applied as two splits due to lesser labour cost when applied in lesser splits. Cost was higher and the BCR was lesser due to increased labour cost when applied in more splits. Significantly higher BC ratio was recorded in NPK

as per POP (2.74), soil test based NPK in two splits (2.71) and four splits (2.66) compared to lower doses of CF as the cost of fertilizer input added in these treatments was lesser. Cost effectiveness of CF in finger millet was reported by Mudalagiriappa *et al.* (2015) [7] who reported that application of 125 percent of CF grade 20 N: 17 P₂O₅: 11 K₂O: 3 S: 0.4 Zn gave higher mean BCR (2.53) over absolute control (1.26). Results of the study indicated that Customized fertilizers are multi nutrient carriers facilitating the complete range of plant nutrients in the right proportion to suit the specific requirement of a crop. Application of 125 percent of CF grade 22.01 N: 3.35 P: 12.68 K: 5.97 Mg: 0.37 B in two splits at 30 days interval is an economically viable option for increasing the productivity of okra.

Table 1: Growth and yield attributes as influenced by customized fertilizers and nutrient scheduling for okra

Treatments	Plant height (cm)	No. of branches	No. of leaves	Dry matter production (kg ha ⁻¹)	Days to first flowering	No. of fruits plant ⁻¹	Yield plant ⁻¹ (g plant ⁻¹)	Yield (t ha ⁻¹)
T ₁ 75% CF (2 splits)	194.87 ^{ab}	2.33 ^a	18.00 ^a	3282.71 ^b	30.33 ^a	21.98 ^{de}	292 ^{bcd}	10.37 ^{bcd}
T ₂ 75% CF (4 splits)	184.00 ^{ab}	2.33 ^a	18.67 ^a	3702.46 ^{ab}	31.33 ^a	24.15 ^{cde}	300 ^{bcd}	10.65 ^{bcd}
T ₃ 100% CF (2 splits)	186.33 ^{ab}	1.33 ^{bcd}	15.00 ^a	3833.33 ^{ab}	31.33 ^a	25.63 ^{bcd}	316 ^{bc}	11.22 ^{bc}
T ₄ 100% CF (4 splits)	195.23 ^{ab}	1.67 ^{abc}	13.00 ^a	4119.75 ^a	31.00 ^a	25.81 ^{bcd}	324 ^b	11.52 ^b
T ₅ 125% CF (2 splits)	197.00 ^{ab}	2.33 ^a	19.00 ^a	3670.37 ^{ab}	30.67 ^a	31.43 ^a	407 ^a	14.46 ^a
T ₆ 125% CF (4 splits)	217.77 ^a	1.67 ^{abc}	19.00 ^a	3982.71 ^{ab}	30.67 ^a	28.43 ^{ab}	385 ^a	13.69 ^a
T ₇ Soil test based NPK(2 splits)	181.90 ^b	1.33 ^{bcd}	16.67 ^a	3546.91 ^{ab}	30.33 ^a	24.44 ^{cde}	290 ^{bcd}	10.33 ^{bcd}
T ₈ Soil test based NPK(4 splits)	176.00 ^b	1.33 ^{bcd}	20.33 ^a	3988.88 ^{ab}	30.00 ^a	26.46 ^{bc}	309 ^{bc}	10.97 ^{bc}
T ₉ NPK as per POP (2 splits)	200.33 ^{ab}	2.00 ^{ab}	19.67 ^a	3830.86 ^{ab}	30.33 ^a	25.39 ^{bcd}	305 ^{bc}	10.84 ^{bc}
T ₁₀ NPK as per POP (4 splits)	173.90 ^b	1.00 ^{cd}	12.00 ^a	3551.85 ^{ab}	30.67 ^a	21.97 ^{de}	281 ^{cd}	9.98 ^{cd}
T ₁₁ FYM (2 splits)	187.33 ^{ab}	1.67 ^{abc}	19.67 ^a	3511.11 ^{ab}	31.33 ^a	21.72 ^e	264 ^d	9.39 ^d
T ₁₂ Absolute control	132.13 ^c	0.67 ^d	16.00 ^a	1630.86 ^c	32.00 ^a	14.39 ^f	160 ^e	5.67 ^e

*In a column, means followed by common letters do not differ significantly at 5% level in DMRT

Table 2: Economics of customized fertilizer and nutrient scheduling for okra

Treatments	Cost of cultivation (Rs. ha ⁻¹)	Gross returns (Rs. ha ⁻¹)	Net returns (Rs. ha ⁻¹)	BC Ratio
T ₁ 75% CF (2 splits)	91043	207326	116283	2.28
T ₂ 75% CF (4 splits)	97543	213000	115457	2.18
T ₃ 100% CF (2 splits)	96800	224429	127629	2.32
T ₄ 100% CF (4 splits)	103300	230481	127181	2.23
T ₅ 125% CF (2 splits)	102557	289267	186709	2.82
T ₆ 125% CF (4 splits)	109057	273963	164906	2.51
T ₇ Soil test based NPK(2 splits)	76081	206518	130437	2.71
T ₈ Soil test based NPK(4 splits)	82581	219400	136819	2.66
T ₉ NPK as per POP (2 splits)	79124	216867	137743	2.74
T ₁₀ NPK as per POP (4 splits)	85624	199667	114043	2.33
T ₁₁ FYM (2 splits)	83775	187748	103973	2.24
T ₁₂ Absolute control	67275	113452	46177	1.68

Conclusion

The study clearly demonstrates the significant advantages of using customized fertilizers (CF) in enhancing the growth, yield, and economic viability of okra (*Abelmoschus esculentus*). The application of 125% CF, particularly in two splits, yielded the highest okra production at 14.46 t ha⁻¹, surpassing other treatments by notable margins-32.11% higher than soil test-based NPK and 35.16% higher than the recommended dose of fertilizers. This remarkable increase in yield is attributed to the balanced nutrition provided by the CF, which improved essential nutrient availability and root development.

In addition to growth and yield benefits, the economic analysis revealed that this treatment also led to the highest net returns (Rs. 186709 ha⁻¹) and a favorable benefit-cost ratio (BCR) of 2.82. This indicates that customized fertilizers not only enhance productivity but also provide an economically viable option for okra cultivation, particularly when applied in two splits.

The results underscore the potential of customized fertilizers in

promoting sustainable agricultural practices by optimizing nutrient management tailored to specific crop requirements. Thus, the use of customized fertilizers represents a significant advancement in the agronomic approach to enhancing the productivity and profitability of okra farming.

References

1. Beuerlein JE, Oplinger ES, Reicosky D. Mineral content of soft winter wheat as influenced by nitrogen fertilization and management. *Commun Soil Sci. Plant Anal.* 1992;23:455-467.
2. Devasenapathy P. Split application of potassium on rice. *Madras Agric J.* 1997;84(5):256-266.
3. Dwivedi SK, Meshram MR, Pandey N. Response of customized fertilizer on wheat (*Triticum aestivum*) under Chhattisgarh condition. *The Bioscan.* 2014;9(4):1509-1512.
4. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. New Jersey: Wiley Interscience

- Publication; c1984. p. 680.
5. Kaleeswari RK. Impact of customized fertilizer on yield and soil properties of lowland rice ecosystem. Madras Agric J. 2013;100(1-3):150-152.
 6. Kerala Agricultural University (KAU). Package of practices recommendations: crops. Thrissur: Kerala Agricultural University; c2016. p. 278.
 7. Mudalagiriappa Goud RB, Ramachandrappa BK, Nanjappa HV. Influence of customized fertilizer on growth and yield of finger millet (*Eleusine coracana* (L.) Gaertn.) in alfisols of Southern India. Indian J Dryland Agric Res Dev. 2015;30(1):50-54.
 8. Olaniyi JO, Akanbi WB, Olaniran OA, Ilupeju OT. The effect of organo-mineral and inorganic fertilizers on the growth, fruit yield, quality and chemical compositions of okra. J Anim Plant Sci. 2010;9(1):1135-1140.
 9. Rakshit R, Rakshit A, Das A. Customized fertilizers: Marker in fertilizer revolution. Int. J Agric. Env. Biotech. 2012;5(1):67-75.
 10. Tiwari KN. Relevance of customized fertilizers in the era of multi-micronutrient deficiency. Indian J Fertil. 2010;6(12):76-86.