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Influence of Integrated Nutrient Management on Seed Yield of Okra under Palam Valley of North Western Himalayas

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ABSTRACT: A field experiment was conducted to study the effect of different quantity of farm yard manure, vermicompost and fertilisers on the seed yield in okra at the experimental farm of Seed Science & Technology department at Palampur. Different seed yield parameters namely days to complete emergence, plant height, capsule length, capsules per plant, and seeds per capsule, shelling percentage & harvest index were recorded. The total number of treatments were ten *viz*; T_1: FYM @ 10t/ha + 75% RDF, T_2: FYM @ 10t/ha + 100% RDF (75:50:50), T_3: Vermicompost @ 5t/ha + 75% RDF, T_4: Vermicompost @ 5t/ha + 100% RDF, T_5: FYM @ 5t/ha + Vermicompost 2.5t/ha + 75% RDF, T_6: FYM @ 5t/ha + Vermicompost 2.5t/ha + 100% RDF, T_7: FYM @ 5t/ha + Fortified Vermicompost 2.5t/ha + 75% RDF, T_8: FYM @ 5t/ha + Fortified Vermicompost 2.5t/ha + 100% RDF, T_9: FYM @ 5t/ha + Vermicompost 2.5t/ha, T_{10}: FYM @ 10t/ha + Fortified Vermicompost 5t/ha. Treatment T_8which consisted of FYM @ 5t/ha + Fortified Vermicompost 2.5t/ha + 100% RDF was found significantly superior for seed yield parameters in comparison to other treatments.

Keywords: FYM, Okra, Seed Yield, Treatment.

INTRODUCTION

Okra (*Abelmoschus esculentus* L.) commonly known as Bhindi or lady's finger belongs to family Malvaceae and is a fast-growing annual vegetable crop grown in tropical and sub-tropical regions of world. It is considered as an important vegetable crop cultivated almost across the country under various agro -climatic conditions. India is the major producer of okra (73.2%) in the world followed by Nigeria (12.1%) and Sudan (3.2%), respectively. In India okra is cultivated over an area of 519000 hectares with estimated production of 6371000 MT (Anonymous, 2020). It is a widely adopted and popular vegetable in Indian households and can be grown in summer and rainy seasons throughout the country. Okra is adaptative up to 1523 m above mean sea level in the Shivalik Hills. In Himachal Pradesh, it covers an area of 3920 ha with a total production of 60,950 tonnes (Anonymous, 2020). However, productivity of okra is shallow in Himachal Pradesh in comparison to other states. The main cause for low productivity is poor organic matter status of soil due to misappropriate application of major nutrients in continuous cropping systems. After the occurrence of green revolution, use of synthetic fertilizers was popularized however, today India stands self-sufficient in food grain production, therefore, addition of organic matter either in the form of crop residues or farmyard manure/vermicompost are important sources for supplementing plant nutrients and maintaining of soil fertility. Vermicompost is a type of bio-fertilizer and it is rich in humus and nitrogen fixing microorganisms. Use of fortified vermicompost has a great significance in organic farming as it plays a therapeutic and nutritional role in enhancing the growth, quality and yield of vegetable crops. Bio-fertilizers are gaining importance because they have low cost, non-residual toxicity and have good ability to augment soil fertility and also provide high returns under favourable conditions.

Neither inorganic nor organic amendments solo can prolong organic matter status of soil and maintain the productivity in a particular area and crop. Okra being a nutrient livening crop responds well to added nutrient, in soil. Thus, the integrated nutrient supply system involving the combined use of bio -fertilizers, organic and chemical sources has been considered as best choice for meeting out the nutrient requirement of the crop and ultimately increasing the seed yield.

Keeping in view these factors, the present investigation was conducted at Experiment Farm of Department of Seed Science and Technology, College of Agriculture, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur during *Kharif* 2018 season to study the influence of integrated nutrient management on quality and seed yield of okra in the palm valley under mid hill conditions of Himachal Pradesh.

MATERIALS AND METHODS

The experimental farm was located at 32°6' N latitude and 76°3' E longitude with a height of 1290.8 m above mean sea level in North Western Himalaya. During the

crop season (June 2018 to Oct 2018) the weekly maximum and minimum temperature ranged between 23.6 to 32.9 °C and 10.1 to 20.6 °C respectively. The weekly relative humidity in morning and evening ranged between 28.1 to 98.3 and 20.0 to 87.6 per cent. The mean weekly sunshine hours ranged from 0.5 to 9.5 hours during the growing season. The soil of experimental site was silty laom in texture, slightly acidic in nature and classified as *Typic Hapludalf* as per the taxonomic system of soil classification. The Nitrogen content at the initiation of experiment was 294.6 Kg ha^{-1}, available phosphorus was 15.6 Kg ha^{-1} and available potassium was 184.2 Kg ha^{-1}. The experiment was laid out in Randomized Block design comprising of ten treatment combination and replicated four times. The experiment consisted of 10 treatments *viz*. T_1: FYM @ 10t/ha + 75% RDF, T_2: FYM @ 10t/ha + 100% RDF (75:50:50), T_3: Vermicompost @ 5t/ha + 75% RDF, T_4: Vermicompost @ 5t/ha + 100% RDF, T_5: FYM @ 5t/ha + Vermicompost 2.5t/ha + 75% RDF, T_6: FYM @ 5t/ha + Vermicompost 2.5t/ha + 100% RDF, T_7: FYM @ 5t/ha + Fortified Vermicompost 2.5t/ha + 75% RDF, T_8: FYM @ 5t/ha + Fortified Vermicompost 2.5t/ha + 100% RDF, T_9: FYM @ 5t/ha + Vermicompost 2.5t/ha, T_{10}: FYM @ 10t/ha + Fortified Vermicompost 5t/ha (Table 1). For sowing P-8 variety is used. Before sowing okra seeds were treated with bavistin @2.5 gram/kg.

Hand ploughing method is used for sowing with a seed rate of 10kg/ha. Row to Row distance used was 45 cm and plant to plant distance was 15 cm with a depth of 4-5 cm and seeds are covered with soil appropriately.

Data was recorded on various parameters like days to complete emergence, number of capsules per plant, plant height (cm), capsule length (cm), Number of seeds/ capsule, 100 seed weight (g), Seed yield - raw seed yield & graded seed yield, seed recovery (%), shelling percentage (%), harvest Index.

Seed recovery percentage was calculated by using following formula:

$$\text{Seed recovery (\%)} = \frac{\text{Graded seed yield}}{\text{Raw seed yield}} \times 100$$

Under laboratory conditions seed were tested for germination after harvesting of crops.

Germination test was conducted in four replications of 50 seeds each by adapting between paper (BP) method as described by ISTA procedures. Each treatment seeds were placed in moist germination paper in incubator at 30°C. Per cent normal seedlings were recorded after 4 days and final count was recorded 21 days after seeding. The germination percentage was calculated as:

$$\text{Germination percentage} = \frac{\text{Number of germinated seeds}}{\text{Number of seeds kept for germination}} \times 100$$

After harvest available NPK in soil is also calculated. Data was analysed using OPSTAT software (Sheoran *et al*., 1998).

RESULTS AND DISCUSSION

Data on days to complete emergence is presented in Table 2. Days to complete emergence was not affected by different nutrient management treatments. This could be due to the availability of sufficient moisture content in the soil at time of sowing. Same results were also recorded by Maheshbabu *et al*. (2008); Devi *et al*., (2013) in soybean. Similar results were reported in 100 seed weight (g) because test weight is a varietal character and is less sensitive to management practices (Table 2). On the other hand, Plant height was significantly affected by treatments. After 30 DAS significantly higher plant height was observed in treatment T_8 while lowest was reported in T_9 (Table 2). More plant height was due to proper nutrition availability which resulted in increase in vegetative growth of the plants. These results were in similarity with the finding of Prasad and Naik (2013); Singh *et al*. (2018) in okra and broccoli. Capsules per plant is most important factor of yield in okra and it was significantly influenced by combined application of chemical fertilizers, vermicompost and biofertilizer. More number of capsules/ plant were recorded in treatment T_8 and lowest was recorded in T_9 (Table 2). Similar findings with higher number of capsules per plant by integrated application of fertilizers has also been recorded by Meena *et al*. (2022) and Sonwami *et al*. (2022) in okra. Different treatments also have significant effect on capsule length and number of seeds per capsule. More capsule length and number of seeds per capsule was recorded in treatment T_8 (Table 2).

This could be due to the higher nutrient use in case of vermicompost fortified with PSB, *Azotobacter*, and *Trichoderma* which resulted into early establishment, vigorous and enhanced vegetative growth leading to longer and wider fruits which also resulted into a greater number of seeds per capsule. These finding are also in similarity with finding of (Rana *et al*., 2018; Kumar *et al*., 2022) in okra. Use of farm yard manure, vermicompost and fertilizers (T_8) had significantly affected the seed yield *i.e*., raw and graded seed yield (Table 3 & Fig. 1). The main reason for this could be rapid mineralization and constant supply of nutrients from Farm yard manure and vermicompost, which might have met the nitrogen requirement of crop at critical stage. Farm yard manure also acts as nutrient reservoir and upon degradation produces organic acids, thereby absorbed released during entire growth period leading to more growth and better yield components. Same finding was also reported by Chaudhary *et al*., (2015); Masud *et al*. (2022). Shelling percentage & Harvest Index had also showed the similar patterns. T_8 treatment had shown the highest shelling percentage (61.6%) and harvest index (0.44) as compared to other treatments (Table 3). Same scenario was also concluded by Sharma *et al*. (2022) in pea.

Table 1: Details of various treatments used.

Sr. No.	Treatments	Symbols used
1.	FYM @ 10t/ha + 75% RDF	T1
2.	FYM @ 10t/ha + 100% RDF (75:50:50)	T2
3.	Vermicompost @ 5t/ha + 75% RDF	T3
4.	Vermicompost @ 5t/ha + 100% RDF	T4
5.	FYM @ 5t/ha + Vermicompost 2.5t/ha + 75% RDF	T5
6.	FYM @ 5t/ha + Vermicompost 2.5t/ha + 100% RDF	T6
7.	FYM @ 5t/ha + Fortified Vermicompost 2.5t/ha + 75% RDF	T7
8.	FYM @ 5t/ha + Fortified Vermicompost 2.5t/ha + 100% RDF	T8
9.	FYM @ 5t/ha + Vermicompost 2.5t/ha	T9
10.	FYM @ 10t/ha + Fortified Vermicompost 5t/ha	T10

Table 2: Effect of different nutrient management treatments on yield attributes of okra.

Treatments	No. of capsules/ Plant	Capsule length (cm)	No. of seeds/ capsule	100 seed weight (g)
T1	8.3	13.2	47.8	6.6
T2	8.8	13.9	48.4	6.7
T3	9.1	14.5	51.2	6.7
T4	9.5	15.3	53.0	6.9
T5	8.7	13.7	48.3	6.7
T6	9.1	14.8	51.7	6.8
T7	9.2	15.2	52.4	6.8
T8	9.7	15.9	53.6	6.9
T9	7.2	11.3	41.5	6.6
T10	8.5	13.6	48.4	6.7
SEm±	0.2	0.5	0.8	0.1
CD 5%	0.7	1.5	2.5	NS

Table 3: Effect of different nutrient management treatments on raw seed yield, graded seed yield, seed recovery, shelling percentage and harvest index.

Treatments	Raw seed yield (kg/ ha)	Graded seed yield (kg/ ha)	Seed recovery (%)	Shelling Percentage	Harvest index
T1	519.5	444.3	85.5	57.4	0.40
T2	558.8	482.9	86.4	59.3	0.41
T3	593.9	520.0	87.6	60.3	0.43
T4	622.5	546.6	87.8	61.4	0.44
T5	553.8	477.4	86.2	60.0	0.41
T6	593.4	520.7	87.7	60.6	0.43
T7	599.4	526.3	87.8	60.8	0.43
T8	631.1	560.2	88.8	61.6	0.44
T9	477.7	393.2	82.3	55.4	0.38
T10	542.5	467.1	86.1	59.6	0.41
SEm±	14.4	13.6	0.4	0.5	0.01
CD 5%	42.8	40.3	1.3	1.5	0.03

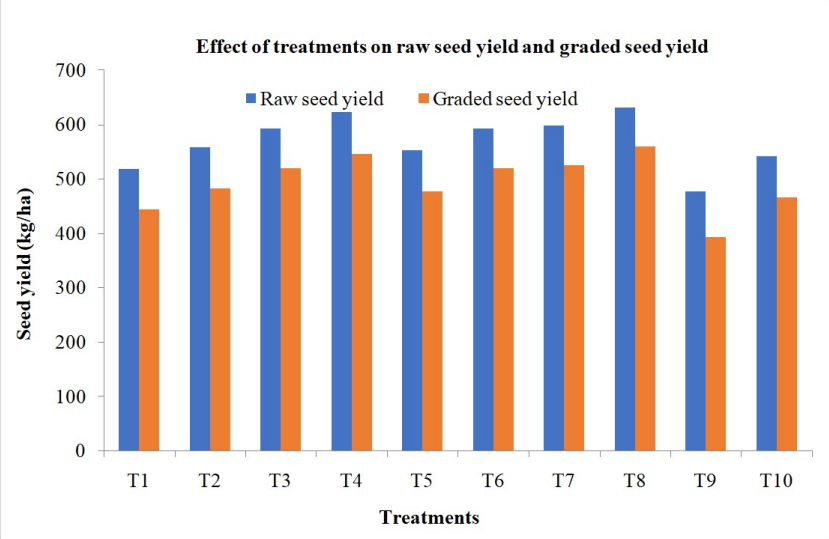

Fig. 1. Effect of treatments on raw seed yield and graded seed yield.

CONCLUSION

Therefore, from the present investigation it can be concluded that seed yield, yield contributing characters such as number of capsules, length of capsules, number of seeds per capsule, recovery and shelling percentage were affected significantly by different treatment combinations. Keeping in these observations it can be recommended that treatment T_8 *i.e.* FYM 5t/ha + Fortified Vermicompost 2.5t/ha + 100% RDF can be used in cultural practices. Further research can be carried out using these treatments in others crops.

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Conflicts of Interest. None.

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