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Effect of organic and inorganic source of nutrient on growth, yield and quality attributes of okra seed cv. Kashi Pragati

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Okra [*Abelmoschus esculentus* (L.) Moench] is an economically important vegetable crop belonging to the Malvaceae family grown in sub-tropical and tropical parts of the world. It originated in tropical Africa, also known as lady's finger or bhindi. Because of its richness in nutrition, taste, medicinal and industrial value, okra is one of the most popular vegetables in all sections of people (Harisha *et al.* 2021). The fruits are harvested at tender stage and consumed as a vegetable. Okra usually required 90-100 days for complete the production cycle. Okra can be cultivated in *Kharif* and *Rabi* in both seasons. All parts of okra fresh leaves, buds, flowers, pods, stems and seeds can be used for different purposes; hence, it is a multipurpose crop in terms of its uses (Gemede *et al.* 2015; Maurya and Yadav 2021). The production of healthy food in a sustainable manner is a major challenge for agriculture. The performance and quality parameters of okra were measured and analyzed. Applying the organic amendments significantly increased the vegetative growth and yield parameters of okra Aboyegi *et al.* (2022). The injudicious use of fungicides, chemical fertilizers and pesticides are responsible for the deterioration of soil health and, ultimately, our green plants. Therefore, to maintain soil fertility and to supply plant nutrients in balanced proportion for optimum growth, yield and quality of crop, an integrated approach is to be practiced under specific agro-ecological situations through the combined use of organic and inorganic sources of plant nutrients. An improvisation in the yield was observed by the application of Vermiwash and vermicompost, along with the nitrogen phosphorus and potassium dosage. This application of organic manures increased soil fertility and productivity while producing the greatest and most sustainable crop output Sanwal *et al.* (2007). Balancing the nutrition supply, organic manures (particularly with PGPR) enhance soil's physical and chemical characteristics (Thapa *et al.* (2020). To reduce the acidity of

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the soil and increase crop productivity, organic manure could be used Ayodele, (2013). A combination of organic and inorganic sources of nutrients may be useful to produce an adequate economic return with good soil health for the ensuing crop production. Thus, the study on the effects of organic and inorganic manures and their effect over control was designed and studied in order to identify and report the nutrient management in okra.

The field experiment was carried out at the Vegetable Research Farm, Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh during *Kharif* season of 2021. The experiment included seven treatments combination in a Randomized Block Design (RBD) with three replications. All the different combinations of organic and inorganic nutrients treatments.viz., T_1: Recommended NPK @ 100:60:60 kg/ha (Control), T_2: Vermicompost @ 5 t/ha, T_3:FYM @ 20 t/ha,T_4:Mustard cake @ 2.0 t/ha,T_5:Vermicompost @ 5 t/ha + PSB + *Azospirillum* (each @ 5 kg/ha),T_6 : FYM @ 20 t/ha + PSB + *Azospirillum* (each @ 5 kg/ha),T_7: Mustard cake @ 2.0 t/ha + PSB + *Azospirillum* (each @ 5 kg/ha). The seeds of Kashi pragati were sown in a plot size of 3.15m X 3.0 m, spaced with 45 x 30 cm. All other recommended cultural practices were followed to raise healthy crop. The observation were recorded in randomly taken and tagged plants from each replication on morphological traits viz, plant height (cm), Number of branches, Number of fruit per plant, fruit length (cm), fruit weight (g), fruit yield per plant (kg), fruit yield q/ha, seed weight per plant (g), 100 seed weight (g), seed yield per plant (g), seed yield per plot (kg), seed yield q/ha, germination %, vigor index I, vigor index II. The data collected on various parameters under study were statistically analyzed and means were compared at 5% level of significance described by Panse and Sukhtme (1967).

Effects of organic and inorganic nutrients on plant growth

Plant height ranged between 64.17 (T_4) to 92.92 (T_5) and the tallest plants height at the time of maturity was recorded under T_5: Vermicomposting @ 5 t/ha + PSB + *Azospirillum* with 92.92 cm followed by T_2 : Vermicomposting @ 5 t/ha with 88.90 cm. The lowest plant height was observed in T_4: mustard cake (@ 2 t/ha) with 64.17 cm. It indicates that okra responded well to vermicompost, FYM and mustard cake coupled with biofertilizers. The maximum number of branches was recorded under T_5: Vermicompost @5t/ha+ PSB + *Azospirillum* with (4.83) followed by T_6: FYM @ 20 t/ha + PSB+ *Azospirillum* with 4.42. The lowest number of branches per plant was observed in T_4: mustard cake (@ 2 t/ha) with 3.38. It indicates that okra responded well to vermicompost, FYM and mustard cake coupled with biofertilizers. The highest germination percent of okra was found under treatment *viz*., T_5 (91.67) that is followed by treatment T_2 (87.04) and Treatment T_6 (85.62%), respectively. The result was conformed to the finding of (Meena *et al.* 2019), Kumar *et al.* (2017).

Effects of nutrients on pod yield and attributing traits

The maximum number of fruit per plant were recorded under T_5: Vermicompost @ 5t/ha+ PSB + *Azospirillum* with (18.38) followed by T_2: Vermicompost @ 5t/ha with 18.15. The lowest number of fruits per plant was observed in T_4: mustard cake (@ 2 t/ha) with 12.60. It indicates that okra responded well to vermicompost, FYM and mustard cake couple with biofertilizers. This result is corroborated with Mal, B. et al. (2014) findings. The maximum fruit weight (g) were recorded under T_5: Vermicompost @ 5t/ha+ PSB + *Azospirillum* with 14.92 g followed by T_2: Vermicompost @ 5 t/ha with 14.68 g. The maximum fruit length was recorded under T_5: Vermicompost @ 5t/ha+ PSB + *Azospirillum* with 13.63cm followed by T_2: Vermicompost @ 5 t/ha with 13.58 cm. The lowest number of fruit length was observed in T_4: mustard cake (@ 2 t/ha) with 8.03 cm. It indicates that okra responded well to vermicompost, FYM, and mustard cake coupled with biofertilizers. The maximum fruit yield/plant (kg) were recorded under T_5: Vermicompost @ 5t/ha+ PSB + *Azospirillum* with 0.277 kg followed by T_2: Vermicompost @ 5 t/ha with 0.263 kg, The lowest number of fruit yield/plant was observed in T_4: Mustard cake (@ 2 t/ha) with 0.137 kg. It indicates that okra responded well to vermicompost, FYM and mustard cake couple with biofertilizers. The maximum seed weight/plant (g) were recorded under T_5: Vermicompost @ 5t/ha+ PSB +*Azospirillum* with 22.94 g followed by T_2: Vermicompost @ 5 t/ha with 22.02 g. The lowest seed weight/plant number was observed in T_4: mustard cake (@2 t/ha) with 17.77 g. It indicates that okra responded well to vermicompost, FYM and mustard cake coupled with biofertilizers. This result is corroborated with the findings of Abou *et al.* (2006); and Bhusan *et al.* 2013).

Effects of nutrients on seed yield and related traits

The highest seed yield/plot (kg) were recorded under T_5: Vermicompost @5t/ha+ PSB + *Azospirillum* with 1.18kg followed by T_2: Vermicompost @ 5t/ha with 1.12kg. The lowest number of seed yield was observed in T_4: Mustard cake (@ 2 t/ha) with 0.82kg. It indicates that okra responded well to vermicompost, FYM and mustard cake couple with biofertilizers. The maximum seed yield (q/ha) were recorded under T_5: Vermicompost @ 5t/ha+ PSB + *Azospirillum* with 12.48 q/ha followed by T_2: Vermicompost @ 5t/ha with 11.85 q/ha. The lowest number of seed yield q/ha was observed in T_4: mustard cake (@ 2 t/ha) with 8.72q/ha. It indicates that okra responded well to vermicompost, FYM and mustard cake couple with biofertilizers. The maximum 100 seed weights (g) were recorded under T_5Vermicompost @5t/ha+

Table 1: Effect of organic and inorganic sources of nutrient on plant growth, yield attributes and BC ratio in okra

S. No.	Plant height (cm) at maturity	Number of branches	Number of fruit per plant	Fruit weight (g)	Fruit length (cm)	Fruit yield per plant (kg)	Seed weight per plant(g)	Seed yield/ plot (kg)	Seed yield(q/ ha)	100 seed weight (g)	Germination (%)	Vigour index I	Vigour index II	Cost benefit ratio
T_1	68.78	3.54	15.03	11.71	9.20	0.143	18.31	0.86	9.11	4.56	69.97	1567.55	0.011	2.79
T_2	88.90	4.39	18.15	14.68	13.58	0.263	22.02	1.12	11.85	5.93	87.04	2009.95	0.004	2.84
T_3	78.83	4.01	16.05	12.25	10.23	0.147	20.53	1.00	10.58	5.30	79.71	1626.29	0.003	2.96
T_4	64.17	3.38	12.60	11.00	8.03	0.137	17.77	0.82	8.72	4.36	66.99	1448.27	0.014	2.57
T_5	92.92	4.83	18.38	14.92	13.63	0.277	22.94	1.18	12.48	6.24	91.67	1998.40	0.005	3.65
T_6	86.68	4.42	18.05	14.29	12.06	0.257	21.39	1.08	11.39	5.69	85.62	1789.68	0.011	3.17
T_7	79.91	4.16	17.13	13.19	11.11	0.190	20.45	1.01	10.69	5.34	80.98	1683.29	0.013	3.23
SEm±	2.31	0.136	0.787	0.631	0.526	0.010	0.794	0.030	0.33	0.235	2.40	53.14	0.00036	0.091
CD at 5%	7.13	0.421	2.453	1.96	1.637	0.031	2.44	0.093	1.03	0.726	7.41	163.7	0.00079	0.281
CV %	5.01	5.57	8.275	8.307	8.188	8.430	6.71	5.19	5.43	7.63	5.19	5.31	5.14	6.25

PSB + *Azospirillum* with 6.24 g. followed by T_2: Vermicompost @ 5t/ha with 5.93g. The lowest number of 100 seed weight was observed in T_4: mustard cake (@ 2 t/ha) with 4.36g. It indicates that okra responded well to vermicompost, FYM and mustard cake couple with biofertilizers. This result is corroborated with Chaudhary et al. (2015) and Sachan et al. (2017) findings.

Effects of nutrients on Seed vigor index I & II

The highest seed vigor index 1 were recorded under T_2: Vermicompost @ 5t/ha with 2009.95, followed by T_5: Vermicompost @ 5t/ha+ PSB + *Azospirillum* with 1998.40. The lowest seed vigor index 1 was observed in T_4: mustard cake (@ 2 t/ha) with 1448.27. It indicates that okra responded well to vermicompost, FYM and mustard cake couple with biofertilizers. The highest seed vigor index II were recorded under T_4 mustard cake (@ 2 t/ha) with 0.014, followed by T_7: mustard cake @2.0 t/ha+ PSB +*Azospirillum* with 0.013. The lowest seed vigor index II was observed in T_3: FYM @ 20 t/ha with 0.03. It indicates that okra responded well to vermicompost, FYM and mustard cake couple with biofertilizers. This result is corroborated with the findings of Kumar & Muthukrishnan (2015).

Benefit Cost ratio (B: C ratio)

The benefit cast ratio fetched from different treatments is summarized in Table 1. The benefit cast ratio recorded significant result with the application of different treatments. The highest amount of benefit cast ratio was fetched from treatment T_5 (3.65), which was significantly superior over all other treatments except treatment T_6 (3.17) and T_7 (3.23). The lowest amount of benefit cost ratio was fetched from the treatment T_4 (2.57). Organic and inorganic combined nutrient supplies have favourable effect on increasing the growth yield quality characters. These findings are in close conformity with Dutta, (2020).

In conclusion, the combined application of organic and bio-fertilizer (Vermicompost @ t/ha + PSB @ 5 kg/ha + Azospirillum @ 5 kg/ha) improved plant height, number of branches, number of fruit per plant, fruit weight, fruit length, fruit yield per plant, seed weight per plant, seed yield per plot, seed yield, 100 seed weight and germination percentage Moreover, vigor index I increase with the application of vermicompost @ 5 t/ha and vigor index II increase with the application of Mustard cake @ 2.0 t/ha.

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