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Effect of organic, inorganic and bio fertilizers on growth, seed yield and quality traits of okra [*Abelmoschus esculentus* (L.) Moench]

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Abstract
The present experiment was carried out during February to June 2018 in Field Experimentation Centre of the Department of Genetics and Plant Breeding, SHUATS, Prayagraj. The experiment was conducted in Randomized Block Design (RBD), with twelve treatments, replicated thrice with one variety of Okra. the treatments were T_1 (100% RDF +100 % FYM), T_2 (100% RDF + 50 %FYM), T_3 (50% RDF + 100% FYM), T_4 (100% RDF +50% NC), T_5 (50% RDF + 100% NC), T_6 (100% RDF +50% VC), T_7 (50% RDF + 100% VC), T_8 (100% RDF + 50% PSB), T_9 (50% RDF + 100%PSB), T_{10} (50% RDF + 100% NC + Bio fertilizer (PSB)), T_{11} (50% RDF + 100% VC + Bio fertilizer (PSB)) and T_{12} (50% RDF + 100 % FYM + 100% PSB). From the present experimental findings it is found that the treatment combination T_6 (100% RDF + 50% VC) was found best in terms of Growth, Seed yield and quality of Okra, followed by treatment T_7 (50% RDF + 100% VC) in all the parameters and lowest readings was observed in treatment T_{10} (50% RDF + 100% NC + Bio-fertilizer (PSB)) in terms of seed yield and treatment T_9 (50% RDF + 100% PSB) in terms of quality parameters.

Keywords: Okra, FYM, vermicompost, neem cake, biofertilizer and PSB

Introduction
Okra [*Abelmoschus esculentus* (L.) Moench], is an economically important vegetable crop grown in tropical and sub - tropical parts of the world. This crop is suitable for cultivation as a garden crop as well as on commercial farms. It is grown commercially in India, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Pakistan, Burma, Japan, Malaysia, Brazil, Ghana, Ethiopia, Cyprus and Southern United States. India ranks first in the world with 3.5 million tonnes (70% of the total world production) of okra produced from over 0.35 million hectare land (FAOSTAT, 2008) [4].

Okra belongs to family Malvaceae with 2n=8x=72 or 144 and is polyploidy in nature. There are 30 species under genus *Abelmoschus* in the old world and four in the new world. Out of them *Abelmoschus esculentus* is the only species known to be cultivated extensively as commercial vegetable. Being it is self pollinated crop, occurrence of out crossing to an extent of 20 per cent by insects has made an often cross - pollinated crop.

Being native of tropical Africa, it is widely cultivated in India. Uttar Pradesh, Assam, Bihar, Orissa, Maharashtra, West Bengal and Karnataka are important okra producing states. In India, it is grown in an area of 0.36 million hectares with annual production of 3.5 million tonnes and productivity of 9.72 tons per hectare. In Karnataka it occupies an area of 18,150 hectares with production of 1, 55,940 tonnes and productivity of 8.75 tons per hectare. Okra is valued for its delicious tender fruits. It is the best source of iodine and calcium. Okra accounts for 60 per cent of export of fresh vegetables excluding potato, onion and garlic (Sharma and Arora, 1993) [9].

Seed is the important basic input in agriculture and quality seed is very important in crop establishment too. Hence, production of healthy crop depends on many factors of seed and agronomic aspects of cultivation. Fertilizers play a crucial role to meet nutrient requirement of the crop. Persistent nutrient depletion is posing a greater threat to the sustainable agriculture. Therefore, there is an urgent need to reduce the usage of chemical fertilizers and in turn increase the usage of organics, which are needed to improve the yield and quality levels. The aforesaid consequences have paved way to grow okra using different organic sources and biofertilizers, use of organic manure in combination with chemical fertilizers and it helps in

improving physico - chemical properties of soil structure, water holding capacity and soil aeration, chemical properties and supply of essential nutrients in balanced ratio, supply of nutrients, slow release of nutrients, stimulation of soil flora and fauna. Vermicompost, besides being a rich source of micronutrients acts as chelating agent and regulates the availability of metallic micronutrients to the plants and increases the plant growth and yield.

Materials and Methods

The Experimental was conducted in Randomized Block Design (RBD) with 12 treatments of Organic, Inorganic and Biofertilizers with three replications in the Research field of Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during February to June, 2018. Total number of treatments were Eight *viz.* T_1 (100% RDF +100 % FYM), T_2 (100% RDF + 50 %FYM), T_3 (50% RDF + 100% FYM), T_4 (100% RDF +50% NC), T_5 (50% RDF + 100% NC), T_6 (100% RDF +50% VC), T_7 (50% RDF + 100% VC), T_8 (100% RDF + 50% PSB), T_9 (50% RDF + 100%PSB), T_{10} (50% RDF + 100% NC + Bio fertilizer (PSB)), T_{11} (50% RDF + 100% VC + Bio fertilizer (PSB)) and T_{12} (50% RDF + 100 % FYM + 100% PSB). And variety Kashi Mohini were used for cultivation.

Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the south east of Utter Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46 ºC- 48 ºC and seldom falls as low as 4 ºC- 5º C. The relative humidity ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

Results and Discussion

The present investigation entitled "Effect of Organic, Inorganic and Bio Fertilizers on Growth, Seed Yield and Quality Traits of Okra [*Abelmoschus esculentus* (L.) Moench]" was carried out during February to June 2018 in Research Field of Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The results of the present investigation, regarding the effect of organic, inorganic and Biofertilizers on growth, Seed yield and quality of Okra, have been discussed and interpreted in the light of previous research work done in India and abroad. The experiment was conducted in Randomized block design with 12 treatments and three replications.

The results of the experiment are summarized below.

In terms of Plant height the treatment T_6 (100% RDF + 50% VC) recorded maximum (21.65, 85.77 and 142.11 cm) Plant height, at 30, 60 and at Harvest Days respectively followed by T_7 (50% RDF + 100 VC) with (20.05, 82.29 and 138.24 cm) at 30, 60 and at harvest days respectively, where as minimum plant height (17.95, 72.65 and 115.35 cm) was recorded in treatment T_4 (100% RDF + 50% NC). The increase in plant height in best treatment might be due to higher amount of nitrogen, having greater availability of salt like nitrate, phosphate and potash which significantly increase the plant height (Kumar *et al.* 2013) [5]. Observations regarding plant height were in close conformity with the Das *et al*. (2014) [3], Sidhya *et al.* (2015) [11] and Singh *et al*. (2015) [13].

In terms of Number of leaves the treatment T_6 (100% RDF + 50% VC) recorded maximum (9.20, 30.60 and 33.04 leaves) at 30, 60 and at harvest Days respectively, followed by T_7 (50% RDF + 100% VC) with (8.67, 28.49 and 30.18 leaves) at 30, 60 and at Harvest days respectively, where as minimum Number of leaves (7.36, 23.80 and 25.24 leaves) was recorded in treatment T_9 (50% RDF + 100%PSB). The reason for increase number of leaves and number of branches per plant could be attributed to the solubilisation effect of plant nutrients by addition of vermicompost leading to increased uptake of NPK (Singh *et al*., 2015) [13]. Similar findings have been reported by Yadav *et al.* (2006) [16], Prasad and Naik (2013) [7] and Sharma *et al*. (2015) [10].

In terms of days for 50% flowering the treatment T_6 (100% RDF + 50% VC) recorded minimum (41.87 days), followed by T_7 (50% RDF + 100 VC) with (43.18 days) where as maximum days for 50% flowering (48.83 days) was recorded in treatment T_1 (100% RDF + 100% FYM). Early flowering may be due to interaction effect as vermicompost have soil microbes, nitrogen fixing bacteria, phosphate solubilising bacteria and growth hormone auxin, gibberellins and cytokines which influence and enhance efficiency of nitrogen greater than that of chemical fertilizer which influence early flowering (Das *et al.*, 2014) [3]. Earliness in day to flowering in okra was observed with integrated nutrient application by Mal *et al.* (2013) [6] and Tyagi *et al*. (2016) [15] in okra.

In terms of days for pod initiation the treatment T_6 (100% RDF + 50% VC) recorded minimum (46.62 days) for pod initiation, followed by T_7 (50% RDF + 100% VC) with (49.53 days) where as maximum days for pod initiation (55.27 days) was recorded in treatment T_{11} (50% RDF + 100% VC + Bio fertilizer (PSB)). This may be attributed to the synergistic effect of organic manure in making available more plant nutrient by improving the soil physical and chemical condition and solubilising the nutrients. Moreover, the organic manures are also significant sources of major and micronutrients much needed by plants (Tyagi *et al*., 2016) [15]. Similar results have been reported by Das *et al.* (2014) [3] and Sharma *et al.* (2015) [10] in okra.

In terms of Days for crop maturity the treatment T_6 (100% RDF + 50% VC) recorded minimum (90.08 days) for crop maturity, followed by T_7 (50% RDF + 100% VC) with (91.60 days) where as maximum Days to crop maturity (98.99 days) was recorded in treatment T_{11} (50% RDF + 100% VC + Bio-fertilizers). This may be attributed to the synergistic effect of organic manure in making available more plant nutrient by improving the soil physical and chemical condition and solubilising the nutrients. Moreover, the organic manures are also significant sources of major and micronutrients much needed by plants (Tyagi *et al*., 2016) [15]. Similar results have been reported by Das *et al.* (2014) [3] and Sharma *et al.* (2015) [10] in okra.

In terms of Number of fruits/plant the treatment T_6 (100% RDF + 50% VC) recorded maximum (16.73 fruit/plant), followed by T_7 (50% RDF + 100% VC) with (15.04 fruit/plant) where as minimum number of fruits/plant (9.64) was recorded in treatment T_2 (100% RDF + 50% FYM). Similar findings of significantly higher number of fruits/plant by the use of organic manure & inorganic fertilizers have also been reported by Prasad and Naik (2013) [7], Singh *et al.* (2015) [13] and Tyagi *et al*. (2016) [15] in okra.

In terms of Fruit length the treatment T_6 (100% RDF + 50% VC) recorded maximum (24.95 cm) Fruit length, followed by

T_7 (50% RDF + 100% VC) with (23.59 cm) where as minimum fruit length (18.73 cm) was recorded in treatment T_2 (100% RDF + 50% FYM). Maximum fruit length in best treatments is might be due to combined application of organic manures and inorganic fertilizers which might have acted complementary and supplementary to each other and resulted into adequate slow but steady supply of nutrients (Bairwa *et al*., 2009) [1]. The availability of nutrients at the critical stages of the crop growth resulted early establishment, vigorous growth and development of plants leading to longer and wider fruits (Mal *et al*., 2013) [6]. High value in fruit length and fruit diameter was observed due to integrated nutrients application by Kumar *et al.* (2013) [5] in okra.

In terms of Fruit diameter the treatment T_6 (100% RDF + 50% VC) recorded maximum (2.33 cm) Fruit diameter, followed by T_{10} (50% RDF + 100% NC + Bio fertilizer (PSB)) with (2.17 cm) where as minimum Fruit diameter (1.88 cm) was recorded in treatment T_4 (100% RDF + 50% NC). Maximum fruit diameter in best treatments is might be due to combined application of organic manures and inorganic fertilizers which might have acted complementary and supplementary to each other and resulted into adequate slow but steady supply of nutrients (Bairwa *et al*., 2009) [1]. The availability of nutrients at the critical stages of the crop growth resulted early establishment, vigorous growth and development of plants leading to longer and wider fruits (Mal *et al*., 2013) [6]. High value in fruit length and fruit diameter was observed due to integrated nutrients application by Kumar *et al.* (2013) [5] in okra.

In terms of Fruit weight the treatment T_6 (100% RDF + 50% VC) recorded maximum (10.02 g) Fruit weight, followed by T_7 (50% RDF + 100% VC) with (8.98 g) where as minimum fruit weight (6.48 g) was recorded in treatment T_2 (100% RDF + 50% FYM). The availability of nutrients at the critical stages of the crop growth resulted early establishment, vigorous growth and development of plants leading to longer and wider fruits (Mal *et al*., 2013) [6]. Similar findings have been reported by Yadav *et al*. (2006) [16], Bairwa *et al.* (2009) [1] and Singh *et al.* (2015) [13], in okra.

In terms of Number of seeds/fruit the treatment T_6 (100% RDF + 50% VC) recorded maximum (47.01) Number of seeds/fruit, followed by T_7 (50% RDF + 100% VC) with (44.85) Number of seeds/fruit where as minimum Number of seeds/fruit (33.73) was recorded in treatment T_4 (100% RDF + 50% NC). The availability of nutrients at the critical stages of the crop growth resulted early establishment, vigorous growth and development of plants leading to longer and wider fruits with more number of seeds (Mal *et al*., 2013) [6].

In terms of Seed yield/fruit the treatment T_6 (100% RDF + 50% VC) recorded maximum seed yield per fruit with (3.22 g), followed by T_7 (50% RDF + 100% VC) with (2.67 g) where as minimum seed yield per fruit (2.03 g) was recorded in treatment T_9 (50% RDF + 100% PSB). The availability of nutrients at the critical stages of the crop growth resulted early establishment, vigorous growth and development of plants leading to longer and wider fruits with more number of seeds (Mal *et al*., 2013) [6].

In terms of Test weight of 100 seeds the treatment T_6 (100% RDF + 50% VC) recorded maximum (6.84 g) test weight of 100 seeds, followed by T_2 (100% RDF + 50% FYM) with (6.73 g) where as minimum Test weight of 100 seeds (5.11 g) was recorded in treatment T_1 (100% RDF + 100% FYM). The availability of nutrients at the critical stages of the crop growth resulted early establishment, vigorous growth and development of plants leading to longer and wider fruits with more number of quality seeds (Mal *et al*., 2013) [6]. Similar findings previously also reported by (Singh Smriti and R. B. Ram, 2018) [12]

In terms of Seed yield/plant the treatment T_6 (100% RDF + 50% VC) recorded maximum seed yield per plant with (53.09 g), followed by T_7 (50% RDF + 100% VC) with (40.13 g) where as minimum seed yield per plant (22.13 g) was recorded in treatment T_{10} (50% RDF + 100% NC + Bio-fertilizer (PSB)).

In terms of Seed Yield/Plot, treatment T_6 (100% RDF + 50% VC) recorded maximum seed yield per plot with (424.07 g) in twelve treatments of organic, inorganic and Bio-fertilizers, followed by T_7 (50% RDF + 100% VC) with (321.85 g) where as minimum seed yield per plot (176.16 g) was recorded in treatment T_{10} (50% RDF + 100% NC + Bio-fertilizer (PSB)).

In terms of Seed yield/ha the treatment T_6 (100% RDF + 50% VC) recorded maximum seed yield with (1517.67 kg/ha), followed by T_7 (50% RDF + 100% VC) with (1335.36 kg/ha) where as minimum seed yield (922.20 kg/ha) was recorded in treatment T_{10} (50% RDF + 100% NC + Bio-fertilizer (PSB)). The availability of nutrients at the critical stages of the crop growth resulted early establishment, vigorous growth and development of plants leading to longer and wider fruits with more number of seeds (Mal *et al*., 2013) [6]. Similar findings previously also reported by (Singh Smriti and R. B. Ram, 2018) [12]

In terms of Germination (%) the treatment T_6 (100% RDF + 50% VC) recorded maximum Germination % with (85.05 %), followed by T_5 (50% RDF + 100% NC) with (79.84 %) where as minimum Germination % (64.54 %) was recorded in treatment T_9 (50% RDF + 100% PSB). High germination percent in best treatment is might be due to combined effect of inorganic and organic nutrients, Rehmatullah *et al.,* (2016) [8] reported that germination percentage gave highly significant results for various treatments of NPK fertilizers. Similar findings previously also reported by Suthar *et al.* (2005) [14] in Brinjal.

In terms of Hard seed (%) the treatment T_1 (100% RDF + 100% FYM) recorded minimum Hard Seed % with (11.10 %), followed by T_7 (50% RDF + 100% VC) with (11.66 %) where as maximum Hard Seed % (19.97 %) was recorded in treatment T_9 (50% RDF + 100% PSB). Minimum hard seed percent in best treatment is might be due to combined effect of inorganic and organic nutrients, Rehmatullah *et. al.,* (2016) [8] reported that germination percentage gave highly significant results for various treatments of NPK fertilizers. Similar findings previously also reported by Suthar *et al.* (2005) [14] in Brinjal.

In terms of Root length the treatment T_6 (100% RDF + 50% VC) recorded maximum Root Length with (12.13 cm), followed by T_7 (50% RDF + 100% VC) with (11.50 cm) where as minimum Root length (9.21 cm) was recorded in treatment T_2 (100% RDF + 50% FYM). Organic manures have good amount of micronutrients might improve physical & chemical properties of soil. Therefore more biomass was produced by the plants which resulted in the sustainable healthy plant system (Kumar *et al*., 2013) [5].

In terms of Shoot length the treatment T_6 (100% RDF + 50% VC) recorded maximum Shoot Length with (27.52 cm), followed by T_7 (50% RDF + 100% VC) with (26.22 cm) where as minimum Shoot length (20.38 cm) was recorded in treatment T_2 (100% RDF + 50% FYM). Organic manures

have good amount of micronutrients might improve physical & chemical properties of soil. Therefore more biomass was produced by the plants which resulted in the sustainable healthy plant system (Kumar *et al*., 2013) [5].

In terms of Seedling length the treatment T_6 (100% RDF + 50% VC) recorded maximum Seedling Length with (39.43 cm) in twelve treatments of organic, inorganic and Bio-fertilizers, followed by T_7 (50% RDF + 100% VC) with (37.41 cm) where as minimum Seedling length (29.33 cm) was recorded in treatment T_2 (100% RDF + 50% FYM). The reason for increase Seedling length could be attributed to the solubilisation effect of plant nutrients by addition of vermicompost leading to increased uptake of NPK (Singh *et al*., 2015) [13]. Similar findings have been reported by Yadav *et al.* (2006) [16], Prasad and Naik (2013) [7] and Sharma *et al*. (2015) [10].

In terms of Seedling dry weight the treatment T_6 (100% RDF + 50% VC) recorded maximum Seedling dry weight with (17.61 mg), followed by T_7 (50% RDF + 100% VC) with (16.44 mg) where as minimum Seedling dry weight (13.52 mg) was recorded in treatment T_2 (100% RDF + 50% FYM). Organic manures have good amount of micronutrients might improve physical & chemical properties of soil. Therefore more biomass was produced by the plants which resulted in the sustainable healthy plant system consequently increased fresh and dry weight of plant (Kumar *et al*., 2013) [5].

In terms of Vigour index (I) treatment T_6 (100% RDF + 50% VC) recorded maximum Vigour index (2925.62) in twelve treatments of organic, inorganic and Bio-fertilizers, followed by T_7 (50% RDF + 100% VC) with (2582.56) where as minimum Vigour index (1811.31) was recorded in treatment T_2 (100% RDF + 50% FYM).

In terms of Vigour Index (II) treatment T_6 (100% RDF + 50% VC) recorded maximum Vigour index (1497.23) in twelve treatments of organic, inorganic and Bio-fertilizers, followed by T_7 (50% RDF + 100% VC) with (1282.15) where as minimum Vigour index (884.83) was recorded in treatment T_9 (50% RDF + 100% PSB). Similar findings previously also reported by Suthar *et al.* (2005) [14] in Brinjal.

Table 1: Effects of Organic, Inorganic and Biofertilizers on Plant Height (cm), Number of leaves/plant, Days to 50% Flowering, Days to pod initiation, Days to Crop maturity, Number of fruits per Plant, Fruit length (cm), Fruit diameter (cm) and Fruit weight (g) of Okra [*Abelmoschus esculentus* (L.) Moench].

Symbols Treatment Treatment Symbol	Treatment combination	Plant Height (cm)			Number of Leaves/Plant			Days to 50% flowering	Days to pod initiation	Days to crop maturity	Number of fruits per plant	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)
		30 DAS	60 DAS	At Harvest	30 DAS	60 DAS	At Harvest							
T_1	100% RDF +100 % FYM	19.34	74.26	118.14	8.00	24.87	26.56	48.83	54.72	98.64	12.96	20.60	2.06	7.93
T_2	100% RDF + 50 %FYM	19.25	75.78	129.19	7.47	26.12	28.12	47.20	52.83	95.15	9.64	18.73	2.12	6.48
T_3	50% RDF + 100% FYM	17.32	73.05	127.13	8.06	26.09	29.10	46.29	52.57	94.45	12.58	19.11	2.07	7.27
T_4	100% RDF +50% NC	17.95	72.65	115.35	8.25	27.05	29.17	45.94	51.67	93.68	11.87	19.54	1.88	6.95
T_5	50% RDF + 100% NC	17.09	74.74	131.21	8.05	26.95	27.94	44.68	50.39	95.47	12.04	18.62	2.03	7.84
T_6	100% RDF +50% VC	21.65	85.77	142.11	9.20	30.60	33.04	41.87	46.62	90.08	16.73	24.95	2.33	10.02
T_7	50% RDF + 100% VC	20.05	82.29	138.24	8.67	28.49	30.18	43.18	49.53	91.60	15.04	23.59	2.04	8.98
T_8	100% RDF + 50% PSB	18.48	75.68	126.16	8.18	25.56	26.89	47.25	53.68	94.72	11.60	22.13	2.01	7.58
T_9	50% RDF + 100%PSB	17.96	75.01	124.88	7.36	23.80	25.24	46.32	52.68	93.43	14.35	21.00	2.08	6.56
T_{10}	50% RDF + 100% NC + Bio fertilizer (PSB)	19.01	76.01	125.00	8.33	26.13	28.56	45.78	52.97	94.22	10.65	21.97	2.17	7.30
T_{11}	50% RDF + 100% VC + Bio fertilizer (PSB)	19.26	77.79	121.00	8.37	24.62	26.20	48.44	55.27	98.99	12.16	23.10	1.97	8.02
T_{12}	50% RDF + 100 % FYM + 100% PSB	19.99	77.97	126.07	8.40	27.70	29.02	47.22	53.78	97.44	13.90	22.25	2.11	7.98
F-test		S	S	S	S	S	S	NS	S	S	S	S	S	S
SE(d)		0.215	0.472	0.763	0.207	0.375	0.515	6.218	0.469	0.345	0.435	0.643	0.068	0.239
C.V.		1.387	0.753	0.736	3.099	1.734	2.225	16.525	1.100	0.446	4.160	3.697	4.039	3.778
C.D.		0.448	0.985	1.593	0.433	0.783	1.075	N/A	0.979	0.720	0.907	1.342	0.143	0.499

Table 2: Effects of Organic, Inorganic and Biofertilizers on Number of seeds per fruit, Seed yield/fruit, Test weight of 100 seeds, Seed yield/plant (g), Seed yield per Plot (g), Seed yield kg/ha, Germination %, Hard Seed %, Root length (cm), Shoot length (cm), Seedling length (cm), Seedling dry weight (mg) and Vigor Index (I) and (II) of Okra [*Abelmoschus esculentus* (L.) Moench].

Symbols Treatment Treatment Symbol	Treatment combination	Number of seeds per fruit	Seed yield per fruit (g)	Test weight of 100 seeds (g)	Seed Yield per plant (g)	Seed Yield per plot (g)	Seed yield kg/ha	Germination %	Hard Seed %	Root length (cm)	Shoot length (cm)	Seedling length (cm)	Seedling dry weight (mg)	Vigor index (I)	Vigor index (II)
T_1	100% RDF +100 % FYM	38.23	2.08	5.11	26.65	212.70	1,110.53	78.05	11.10	9.76	22.03	31.65	14.80	2,283.75	1,155.26
T_2	100% RDF + 50 %FYM	35.08	2.36	6.73	22.79	181.24	949.56	68.88	17.16	9.21	20.38	29.33	13.52	1,811.31	931.30
T_3	50% RDF + 100% FYM	40.00	2.33	5.82	29.17	232.49	1,215.67	73.24	14.23	10.43	24.25	34.69	15.40	2,262.97	1,125.46
T_4	100% RDF +50% NC	33.73	2.06	6.12	24.32	193.68	1,013.31	71.16	15.06	11.16	25.33	36.16	15.24	2,239.35	1,085.05
T_5	50% RDF + 100% NC	36.20	2.25	6.21	26.91	214.72	1,121.36	79.84	13.24	10.44	25.39	35.38	15.85	2,555.08	1,265.38
T_6	100% RDF +50% VC	47.01	3.22	6.84	53.09	424.07	1,517.67	85.05	11.80	12.13	27.52	39.43	17.61	2,925.62	1,497.23
T_7	50% RDF + 100% VC	44.85	2.67	5.94	40.13	321.85	1,335.36	78.02	11.66	11.50	26.22	37.41	16.44	2,582.56	1,282.15
T_8	100% RDF + 50% PSB	39.20	2.19	5.61	25.26	200.84	1,052.75	72.44	14.86	10.83	23.33	33.97	14.72	2,192.57	1,066.25
T_9	50% RDF + 100%PSB	34.18	2.03	5.94	29.16	232.79	1,214.98	64.54	19.97	9.67	21.03	30.27	13.74	1,842.04	884.83
T_{10}	50% RDF + 100% NC + Bio fertilizer (PSB)	36.97	2.08	5.57	22.13	176.16	922.20	78.15	12.65	10.47	23.09	33.22	14.55	2,339.62	1,135.36
T_{11}	50% RDF + 100% VC + Bio fertilizer (PSB)	41.95	2.33	5.55	28.09	224.03	1,170.53	65.79	19.38	11.05	24.45	35.27	15.69	2,115.52	1,032.84
T_{12}	50% RDF + 100 % FYM + 100% PSB	40.81	2.37	5.80	32.45	259.07	1,312.55	73.58	15.41	10.51	22.83	33.05	15.45	2,188.60	1,135.50
F-test		S	S	S	S	S	S	S	S	S	S	S	S	S	S
SE(d)		0.397	0.056	0.151	0.351	2.911	14.333	0.694	0.714	0.165	0.293	0.421	0.217	7.909	5.992
C.V.		1.247	2.964	3.119	1.430	1.489	1.511	1.148	5.943	1.911	1.505	1.511	1.740	0.425	0.648
C.D.		0.829	0.118	0.316	0.732	6.075	29.916	1.449	1.490	0.345	0.611	0.879	0.452	16.507	12.506

Conclusion

From the present investigation it is concluded that the treatment combination T_6 (100% RDF + 50% VC) was found best in terms of Growth, Seed yield and quality of Okra, followed by treatment T_7 (50% RDF + 100% VC) in all the parameters and lowest readings was observed in treatment T_{10} (50% RDF + 100% NC + Bio-fertilizer (PSB)) in terms of seed yield and treatment T_9 (50% RDF + 100% PSB) in terms of quality parameters.

References

1. Bairwa HL, Shukla AK, Mahawer LN, Kaushik RA, Shukla KB, Ameta KD. Response of integrated nutrient management on yield, quality and physico-chemical characteristics of okra cv. Arka Anamika. Ind. J. Hort. 2009; 66(3):310-314.
2. Das PK, Sarangi D, Jena MK, Mohanty S. Response of greengram (*Vigna radiata* L.) to integrated application of vermicompost and chemical fertilizer in acid lateritic soil. Indian Agriculturist. 2002; 46(1, 2):79-87.
3. Das AK, Prasad B, Singh R. Response of chemical fertilizer and vermicompost on okra (*Abelmoschus esculentus* L.) cv. Pravani Kranti. The Asian J. of Horti. 2014; 9(2):372-376.
4. Faostat, 2008 (http://www.fao.org).
5. Kumar T, Kumar M, Singh MK, Kumar A, Kumar S, Singh B. Impact of integrated nutrient management (INM) on growth and economic yield of okra. Ann. Hort. 2013; 6(1):107-114.
6. Mal B, Mahapatra P, Mohanty S, Mishra HN. Growth and yield parameters of okra (*Abelmoschus esculentus*) influenced by diazotrophs and chemical fertilizers. J Crop and Weed. 2013; 9(2):109-112.
7. Prasad PH, Naik A. Effect of varying NPK levels and bio-fertilizers on growth and yield of okra [*Abelmoschus esculentus* (L.) Moench] under sustainable condition. *Trends Biosci.* 2013; 6(2):167-169.
8. Rehmatullah Khetran, Muhammad Afzal Kasi, Syed Abdul Hadi Agha, Shagufta Fahmid, Jaffar Ali. Effect of different doses of NPK fertilizers on growth of okra (Abelmoschus esculentus (L) Moench) Int. J Adv. Res. Biol. Sci. 2016; 3(10):213-218
9. Sharma DR, Arora SK. Improvement of okra. In: Advances in Horticulture Vegetable Crops. Part I (ed. Chadha, K. l. and Kalloo, G.) Malhotra Publishing House, New Delhi. 1993, 343-364.
10. Sharma IJ, Samnotra RK, Kumar V, Rai AP, Dhotra B. Effect of organic and inorganic fertilizers on the growth and yield of okra under sub-tropical region. Ann. Plant and Soil Res. 2015; 17(2): 215-218.
11. Sidhya P, Pandit MK, Bairagi S, Shyamal MM. Effect of mycorrhizal inoculation, organic manure and inorganic fertilizers on growth and yield of okra [*Abelmoschus esculentus* (L.) Moench]. J Crop and Weed. 2015; 11:10-13
12. Singh Smriti, Ram RB. Effect of organic, inorganic and bio-fertilizers on yielding and fruiting traits of okra [*Abelmoschus esculentus* (L.) Moench], Journal of Pharmacognosy and Phytochemistry. 2018; 7(5):90-93.
13. Singh KV, Anuj K, Kumar M, Soni S, Kumar A, Singh MK. Response of different organic and inorganic fertilizers on growth and yield of okra (*Abelmoschus esculentus* (L.) Moench). Ann. Hort. 2015; 8(1):107-109.
14. Suthar MR, Singh GP, Rana MK, Makhan-Lal. Growth and fruit yield of brinjal (*Solanum melongena* L.) as influenced by planting dates and fertility levels. Crop Research, Hisar. 2005; 30(1):77-79.
15. Tyagi SK, Shukla A, Mittoliya VK, Sharma ML, Khire AR, Jain YK. Effect of integrated nutrient management on growth yield and economics of okra under nimar valley condition of Madhya Pradesh. Int. J Tropical Agri. 2016; 34(2):415-419.
16. Yadav P, Singh P, Yadav RL. Effect of organic manures and nitrogen levels on growth, yield and quality of okra. Indian J Hort. 2006; 63(2): 215-217.