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Effect of Integrated Nutrient Management (INM) On Growth & Yield of Okra *(Abelmoschus esculentus L.)* cv. Arka-anamika

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Abstract

The present investigation was conducted at Research farm, Faculty of Agriculture & Allied Industries, Rama University, Kanpur. The experiment was laid out in RBD with 11 treatments, each replicated thrice. Studies showed that, an increase in vegetative growth was observed in with T_4 treatment which received 50% RDF inorganic + 50% N through Vermicompost (VC) recorded significantly highest plant height (116.27 cm), fresh weight (161.04), days to 50% floweing (28), number of branches per plant (2.88g) number of leaves per plant (32.67), length of internodes (9.14), number of pods per plant (23.64), pod length (16.81 cm), pod weight (14.84g), yield per plant (1.36 kg/ha) and pod yield per ha (17.58 t/ha) were recorded maximum with T_4 treatment which received 50% RDF inorganic + 50% N through Vermicompost (VC).

Key words: *Okra, Fresh weight, Pod length, INM, Vermicompost*

Introduction

Okra (*Abelmoschus esculentus* L.) commonly known as lady's finger, belongs to the family *Malvaceae*. It is one of the important summer vegetable grown widely in sub-tropical region of the world for its tender pods. Okra is one of the most important vegetable crops grown extensively throughout the country during summer and rainy season due to its high adaptability over a wide range of environmental conditions. It is one of the economically important vegetable crops grown in India, especially in southern states. It is widely adapted vegetable in Indian kitchens and can be grown though out the year.

As a vegetable in tender stage, okra is nutritious and it finds an important place in the Indian dietary. Besides the utility of its tender green fingers as a vegetable, it is used in soups and curries. Green pods are rich source of Iodine, vitamin A, B and C. The stems and roots of okra can also be used in paper industry. India ranks first in the world with the production of 3.5 million tonnes (70 % of the total world production) from an area of 0.35 million ha. In Andhra Pradesh, its area and production is 0.29 lakh ha^{-1} and 4.3 lakh tonnes respectively (FAOSTAT, 2016).

Okra requires heavy manuring for its potential production (Pandey *et al*., 1980 and Naik and Shrinivas, 1992). However, the use of expensive commercial fertilizers as per requirements of the crop is not much affordable to the average farmers. Therefore, the application of plant nutrients through organic sources likes compost, farm yard manure and bio fertilizers remain the alternative choice of the growers for maintaining its sustainable production (Subbiah *et al*., 1982; Dart, 1986 and Gaur1990).

Material & Methods

The present investigation was conducted in Research Farm, Faculty of Agriculture and Allied Industry at Rama University, Kanpur (U.P.) during *rabi* season of 2017-18. The experimental farm falls under the Indo-Gangetic alluvial tract of Central Uttar Pradesh. The farm was well laid out and irrigated by tube well. Geographically, Kanpur is situated in the central part of U.P. and subtropical tract of North India between latitude ranging from 25^0 56' to 28^0 58' North and longitude 79^0 31' to 80^0 34' East and is located at an elevation of about 125.9 meters above mean sea level in Gangetic plain. The seasonal rainfall of about 629.5 mm received mostly from 2nd Fortnight of June or first Fortnight of July to mid-October with a few showers in winter season. The maximum and minimum temperature in the *Rabi* season usually occurs 35˚C and 10˚C, respectively. The mean weather data such as weekly average temperature, relative humidity (R.H.), wind speed, and total rainfall etc. were recorded during crop season from meteorological observatory located at student Instructional Farm of the university of CSAUA&T Kanpur.

The experiments were conducted in a Randomized Block Design replicated thrice. There were eleven treatments involving different organic manures along with chemical fertilizers. The different inorganic and organic fertilizers treatments tried were:

T0 Control (without inorganic or organic sources of nutrition)

T1 100% inorganic RDF (N: P: K- 120:60:80)

T2 50% RDF inorganic + 50% N through Farm yard manure (FYM)

T3 50% RDF inorganic + 50% N through Poultry manure (PM)

T4 50% RDF inorganic + 50% N through Vermicompost (VC)

T5 25% RDF inorganic + 75% N through Farm yard manure (FYM)

T6 25% RDF inorganic + 75% N through Poultry manure (PM)

T7 25% RDF inorganic + 75% N through Vermicompost (VC)

T8 100% N through Farm yard manure (FYM) (16.0 t/ha)

T9 100% N through Poultry manure (PM) (5.0 t/ha)

T10 100% N through Vermicompost (VC) (7.0 t/ha) the seeds were sown at the spacing of 45 cm between rows and 30 cm within the row. The field was irrigated immediately after sowing. Bold and healthy seeds of Okra cv. *Arka Anamika* were dibbled at two seeds per hill. Gap filling was done after one week of sowing, vermicompost, farmyard manure and poultry manure was applied to the soil as a basal dose as per the treatments. Nitrogen was applied in the form of urea in two equal splits *i.e.,* as basal dose and subsequent dose at flowering stage. Phosphorus and potassium were applied as a basal dose only in the form of single super phosphate and muriate of potash respectively.

Result & Discussion

Plant height (cm)

Plant height (cm) data ranged between 116.27 cm (T_4) to 87.72 cm (T_0). Among the treatments, T_4 which received 50% RDF inorganic + 50% N through Vermicompost (VC) recorded significantly highest plant height of 116.27 cm, T_4 recorded highest plant height compared to treatments receiving complete organic *i.e.,* T_{10}, T_8 and T_9. The treatments T_2 (115.47 cm), T_3 (114.73 cm) and T_1 (110.10 cm) were significantly at par with each other. Lowest plant height of 87.72 cm was recorded in T_0.

Number of leaves plant^{-1}

The number of leaves per plant at harvest in okra was varying significantly due to application of organic, inorganic and its combinations. However, T_4 (50% RDF inorganic + 50% N through Vermicompost (VC)) recorded numerically more number of leaves (32.67) whereas, less number of leaves per plant (22) was recorded in T_0 (control) during the experiment.

The treatment T_2 and T_3 was also obtained higher number of leaves plant^{-1} over other treatments.

Days to 50 per cent flowering

Among the 11 treatments, T_4 (50% RDF inorganic + 50% N through Vermicompost (VC)) recorded least number of days to 50 per cent flowering and it was at par with (T_2) 50% RDF inorganic + 50% N through Farm yard manure (FYM) and (T_3) 50% RDF inorganic + 50% N through poultry manure. Significant superiority over control might be due to increased photosynthetic activity and uptake of food nutrients resulting in early flowering as reported by Sharma and Bhalla (1995) and Patel *et al.* (2009) in bhendi.

Canopy of plant

The data was exhibited the ranged of canopy of plant ranged between 79.50 cm (T_4) to 48.16 cm (T0). The highest canopy (79.50 cm) was recorded in T_4 treatment which received 50% RDF inorganic + 50% N through Vermicompost (VC), followed by T_2 (69.50 cm), which is at par with T_3 (68.10 cm). The treatments T_2 (69.50 cm), T_3 (68.10 cm) and T_1 (67.75 cm) were at par with each other. The lowest canopy of plant was recorded with T_0 (48.16 cm).

Number of branches plant^{-1}

The data revealed that the number of branches plant^{-1} was ranged between 2.88 (T_4) to 2.03 (T_0). Significantly highest number of branches plant^{-1} (2.88) was recorded with T_4, 50% RDF inorganic + 50% N through Vermicompost (VC) followed by (T_2) 50% RDF inorganic + 50% N through farm yard manure (FYM) (2.77). The treatments T_2 (2.77) and T_1 (2.66) were at par with each other. The lowest number of branches plant^{-1} (2.03) was recorded in T_0 (control).

Yield (t ha^{-1})

Pod yield (q/ha) ranged between 17.58 (t/ha) in T_4 to 5.72 (t/ha) in T_0. Significantly highest pod yield (17.58 t/ha) was recorded in T_4 which received combination of organic and inorganic fertilizers *i.e*., 50% RDF inorganic + 50% N through Vermicompost (VC) which was superior over all other treatments. The treatments T_2 (16.61 t/ha) and T_3 (15.24 t/ha) which were significantly at par with T_4 (17.58 t/ha) and T_1 (14.31 t/ha). The treatments received complete organic manures were recorded less pod yield tonnes per hectare. Lowest yield per hectare (5.72 t/ha) was recorded in T_0 (control).

Table 1: Effect of integrated nutrient management on plant height (cm) of Okra

Treatment	Treatment Combination	Plant height (cm)
T_0	Control (without inorganic or organic sources of nutrition)	87.72
T_1	100% inorganic RDF (N:P:K- 120:60:80)	110.10
T_2	50% RDF inorganic + 50% N through Farm yard manure (FYM)	115.47
T_3	50% RDF inorganic + 50% N through Poultry manure (PM)	114.73
T_4	50% RDF inorganic + 50% N through Vermicompost (VC)	116.27
T_5	25% RDF inorganic + 75% N through Farm yard manure (FYM)	102.37
T_6	25% RDF inorganic + 75% N through Poultry manure (PM)	98.33
T_7	25% RDF inorganic + 75% N through Vermicompost	103.53

	(VC)	
T_8	100% N through Farm yard manure (FYM) (16.0 t/ha)	98.43
T_9	100% N through Poultry manure (PM) (5.0 t/ha)	92.88
T_{10}	100% N through Vermicompost (VC) (7.0 t/ha)	93.43
	C.D.	15.61
	SE(m)	5.26
	C.V.	8.84

Table 2: Effect of integrated nutrient management on number of leaves plant^{-1} of Okra

Treatment	Treatment Combination	No of leaves plant^{-1}
T_0	Control (without inorganic or organic sources of nutrition)	22.00
T_1	100% inorganic RDF (N:P:K- 120:60:80)	29.00
T_2	50% RDF inorganic + 50% N through Farm yard manure (FYM)	30.67
T_3	50% RDF inorganic + 50% N through Poultry manure (PM)	31.33
T_4	50% RDF inorganic + 50% N through Vermicompost (VC)	32.67
T_5	25% RDF inorganic + 75% N through Farm yard manure (FYM)	27.00
T_6	25% RDF inorganic + 75% N through Poultry manure (PM)	26.67
T_7	25% RDF inorganic + 75% N through Vermicompost (VC)	28.33
T_8	100% N through Farm yard manure (FYM) (16.0 t/ha)	25.00
T_9	100% N through Poultry manure (PM) (5.0 t/ha)	24.33
T_{10}	100% N through Vermicompost (VC) (7.0 t/ha)	26.00
	C.D.	5.90
	SE(m)	1.99
	C.V.	12.48

Table 3: Effect of integrated nutrient management on days to 50% flowering of Okra

Treatment	Treatment Combination	Days to 50% flowering
T_0	Control (without inorganic or organic sources of nutrition)	46.67
T_1	100% inorganic RDF (N:P:K- 120:60:80)	34.00
T_2	50% RDF inorganic + 50% N through Farm yard manure (FYM)	30.67
T_3	50% RDF inorganic + 50% N through Poultry manure (PM)	32.67
T_4	50% RDF inorganic + 50% N through Vermicompost	28.00

	(VC)	
T_5	25% RDF inorganic + 75% N through Farm yard manure (FYM)	35.33
T_6	25% RDF inorganic + 75% N through Poultry manure (PM)	36.67
T_7	25% RDF inorganic + 75% N through Vermicompost (VC)	34.33
T_8	100% N through Farm yard manure (FYM) (16.0 t/ha)	41.67
T_9	100% N through Poultry manure (PM) (5.0 t/ha)	42.67
T_{10}	100% N through Vermicompost (VC) (7.0 t/ha)	40.33
	C.D.	8.93
	SE(m)	3.01
	C.V.	14.22

Table 4: Effect of integrated nutrient management on canopy of plant (cm) of Okra

Treatment	Treatment Combination	Canopy of plant (cm)
T_0	Control (without inorganic or organic sources of nutrition)	48.16
T_1	100% inorganic RDF (N:P:K- 120:60:80)	67.75
T_2	50% RDF inorganic + 50% N through Farm yard manure (FYM)	69.50
T_3	50% RDF inorganic + 50% N through Poultry manure (PM)	68.10
T_4	50% RDF inorganic + 50% N through Vermicompost (VC)	79.50
T_5	25% RDF inorganic + 75% N through Farm yard manure (FYM)	62.50
T_6	25% RDF inorganic + 75% N through Poultry manure (PM)	61.10
T_7	25% RDF inorganic + 75% N through Vermicompost (VC)	65.83
T_8	100% N through Farm yard manure (FYM) (16.0 t/ha)	56.17
T_9	100% N through Poultry manure (PM) (5.0 t/ha)	53.72
T_{10}	100% N through Vermicompost (VC) (7.0 t/ha)	57.58
	C.D.	5.89
	SE(m)	1.98
	C.V.	5.48

Table 5: Effect of integrated nutrient management on number of branches plant^{-1} of Okra

Treatment	Treatment Combination	Number of branches plant^{-1}
T_0	Control (without inorganic or organic sources of nutrition)	2.03
T_1	100% inorganic RDF (N:P:K- 120:60:80)	2.66
T_2	50% RDF inorganic + 50% N through Farm yard manure (FYM)	2.77
T_3	50% RDF inorganic + 50% N through Poultry manure (PM)	2.70
T_4	50% RDF inorganic + 50% N through Vermicompost (VC)	2.88
T_5	25% RDF inorganic + 75% N through Farm yard manure (FYM)	2.42
T_6	25% RDF inorganic + 75% N through Poultry manure (PM)	2.40
T_7	25% RDF inorganic + 75% N through Vermicompost (VC)	2.44
T_8	100% N through Farm yard manure (FYM) (16.0 t/ha)	2.30
T_9	100% N through Poultry manure (PM) (5.0 t/ha)	2.26
T_{10}	100% N through Vermicompost (VC) (7.0 t/ha)	2.35
	C.D.	0.14
	SE(m)	0.05
	C.V.	3.27

Table 6: Effect of integrated nutrient management on yield (t ha^{-1}) of Okra

Treatment	Treatment Combination	Yield (t ha^{-1})
T_0	Control (without inorganic or organic sources of nutrition)	5.72
T_1	100% inorganic RDF (N:P:K- 120:60:80)	14.31
T_2	50% RDF inorganic + 50% N through Farm yard manure (FYM)	16.61
T_3	50% RDF inorganic + 50% N through Poultry manure (PM)	15.24
T_4	50% RDF inorganic + 50% N through Vermicompost (VC)	17.58
T_5	25% RDF inorganic + 75% N through Farm yard manure (FYM)	13.05
T_6	25% RDF inorganic + 75% N through Poultry manure (PM)	11.39
T_7	25% RDF inorganic + 75% N through Vermicompost (VC)	13.38
T_8	100% N through Farm yard manure (FYM) (16.0 t/ha)	9.45
T_9	100% N through Poultry manure (PM) (5.0 t/ha)	7.95
T_{10}	100% N through Vermicompost (VC) (7.0 t/ha)	10.13
	C.D.	2.52
	SE(m)	0.85
	C.V.	11.97

Conclusion

It was concluded from the study that treatment which received 50% RDF inorganic + 50% N through Vermicompost (VC) recorded significantly highest plant height (116.27 cm), fresh weight (161.04), days to 50% floweing (28), number of branches per plant (2.88g) number of leaves per plant (32.67), length of internodes (9.14), number of pods per plant (23.64), pod length (16.81 cm), pod weight (14.84g), yield per plant (1.36 kg/ha) and pod yield per ha (17.58 t/ha) were recorded maximum.

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