E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(9): 569-573
Received: 13-07-2024
Accepted: 17-08-2024

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Studies on natural farming protocols in okra (*Abelmoschus esculentus* L.) under Bundelkhand region

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DOI: https://doi.org/10.33545/2618060X.2024.v7.i9Sh.1549

Abstract
A field experiment was carried out to study on natural farming protocols in okra (*Abelmoschus esculentus* L.) Under Bundelkhand region during Kharif 2023 at Organic Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Bundelkhand University, Jhansi. The experiment was laid out in Randomized Block Design (RBD) 9 treatments comprising three replications each. The application of organic nutrients might have improved the soil physical and chemical properties and leading to the adequate supply of nutrients to the plants which might have promoted the maximum vegetative growth while the minimum plant growth was due to non-availability of nutrients. It was noticed that number of both leaves and branches per plant increased with increasing plant height successively with the increasing levels of nutrient. Combination of organic nutrients also recorded maximum plant height and number of leaves and branches also which helped the plants in better photosynthesis to attain vigor. On first day of flowering, days on 50% flowering, Days to first capsule setting, Days to first capsule picking and Number capsule per plant observed that Integration of different natural farming protocols favoured vigorous growth and synthesized more these hormones in plants, which might have helped to the translocation as well as more quantity of available phosphorus through the xylem vessels and their accumulation in the auxiliary buds that would have favoured the plant to enter reproductive phase. Average capsule weight (g), capsule length, Average capsule diameter (cm), capsule Yield per plant (kg/plant), capsule Yield per plot (kg/plot), Average capsule yield per hectare (t/ha), Seed index [1000-seed weight (g)] and Total soluble solid (0Brix) concluded that different natural farming protocols play an important role in improving productivity and quality of fruit.
Doses of Different natural farming protocols increased the vigour of plants, assimilating area, size of fruit, thereby resulting into higher weight of fruit.

Keywords: Organic, protocol, *kharif*, natural farming

Introduction
Okra requires heavy manuring for its potential production. Indiscriminate use of inorganic fertilizers leads to nutrient imbalance in soil causing ill effect on soil health and microflora. Hence, there is need to reduce the use of chemical fertilizers and encourage the application of biofertilizers to the maximum possible level. Biofertilizer fix appreciable amount of atmospheric nitrogen in soil, enhance plant growth by production of organic acid and growth substances, and make available the complex phosphorus to the plant, which may cause an appreciable reduction in consumption of inorganic fertilizers. Biofertilizers are inputs containing micro-organisms capable of mobilizing native elements from non-stable form to usable form through biological processes. However, the use of expensive commercial fertilizers as per a requirement 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.
Beejamruth is rich in beneficial micro flora like Azospirillum, Azotobacter, Phosphobacteria, Pseudomonas, Lactic acid bacteria and Methylotrophs and is known to protect the seed from harmful soil and seed – borne pathogens. Thus, it helps in the better germination, seedling growth, plant root and shoot growth, seedling vigour and yield. Jeevamruth is an organic

solution which is rich on microorganisms. It is a mixture of cow dung, urine, Jaggery, flour, active soil, and water. Panchagavya: Panchagavya is a mixture of five products obtained from the indigenous cow. It increases the uptake of N, P and K, growth and yield parameters like plant height, root length, fruit yield and yield attributes like protein and fiber content which adds to the overall yield results. The soil enriched with biofertilizers (Azotobacter + PSB) increased the seed germination and seedling vigour in okra cv. Parbhani Kranti, they provides additional substances that are not found in chemical fertilizers concluded that significant increase of microbes in soil was found with application of manures, vermicompost and biofertilizers.

Materials and Methods

Effect of 9 treatments *viz.*, T_1 Control (Water Spray), T_2 Beejamrut (1000 ml/ha), T^3 Jeewamrit @ 500 lit./h, T_4 Beejamrit + jeewamrit @ 1000 ml + 500 lit/h, T_5 Crop residue @ 5 ton/h, T_6 Beejamrit @ 1000 ml + Jeewamrit @ 500 ml + Cropresidue @ 5 ton/h, T_7 INM {(100% RDF + FYM10 tan/h + Azatobacter @ 2 5 g/kg seed + PSB @ 25 g/kg seed)}, T_8 Jeewamrit @ 500 lit./h + Crop residue @ 5 ton/ha, T_9 Recommended Dose of Fertilizers (RDF) was evaluated to study the effects of organic liquid formulations on growth parameters, yield and yield attributes of okra. The variety was used NS7774 for the experiment. The experiment was conducted under field conditions in 2.4 m×1.8 m plot using randomized block design with three replications. Plots sprayed with plain water served as check/control.

Treatments

T_1	Control (Water Spray)
T_2	Beejamrut (1000 ml/ha)
T_3	Jeewamrit @ 500 lit./h
T_4	Beejamrit + jeewamrit @ 1000 ml + 500 lit/h
T_5	Crop residue @ 5 ton/h
T_6	Beejamrit @ 1000 ml + Jeewamrit @ 500 ml + Cropresidue @ 5 ton/h
T_7	INM {(100% RDF + FYM10 tan/h + Azatobacter @ 25 g/kg seed + PSB @ 25 g/kg seed)}
T_8	Jeewamrit @ 500 lit./h + Crop residue @ 5 ton/h
T_9	Recommended Dose of Fertilizers (RDF)

The experimental data recorded during the investigation were subjected to statistical analysis of "Analysis of Variance (ANOVA)" technique for drawing comparison. The significance and non-significance of the treatments were judged with the help of "F" test. The significance differences between the means were tested with the critical difference (CD) at 5% probability level.

Results and Discussion

High application of organic and inorganic nutrients might have improved the soil physical and chemical properties and leading to the adequate supply of nutrients to the plants which might have promoted the maximum vegetative growth while the minimum plant growth was due to non- availability of nutrients.

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Average Capsule weight (g), Capsule length, Average Capsule diameter (cm), Capsule Yield per plant (kg/plant), Capsule Yield per Capsule (kg/plot), Average Capsule yield per hectare (t/ha), Seed index [1000-seed weight (g)] and Total soluble solid (0Brix) concluded that different natural farming protocols play an important role in improving productivity and quality of fruit. Doses of Different natural farming protocols increased the vigour of plants, assimilating area, size of fruit, thereby resulting into higher weight of fruit.

Table 1: Effect of different natural farming protocols on plant height (cm) of the Okra

Treatment Notation	Treatment details	30 DAS (cm)	60 DAS (cm)	At Harvest (cm)
T_1	Control (Water Spray)	45.37	63.38	98.60
T_2	Beejamrut (1000 ml/ha)	52.47	72.35	106.50
T_3	Jeewamrit @ 500 lit./h	53.09	73.40	104.52
T_4	Beejamrit + jeewamrit @ 1000 ml + 500 lit/h	54.57	75.38	108.50
T_5	Crop residue @ 5 ton/h	50.43	73.16	105.37
T_6	Beejamrit @ 1000 ml + Jeewamrit @ 500 ml + Cropresidue @ 5 ton/h	56.37	78.60	114.42
T_7	INM {(100% RDF + FYM10 tan/h + Azatobacter @ 25 g/kg seed + PSB @ 25 g/kg seed)}	59.06	81.60	117.49
T_8	Jeewamrit @ 500 lit./h + Crop residue @ 5 ton/h	55.62	73.28	111.33
T_9	Recommended Dose of Fertilizers (RDF)	55.37	67.38	108.00
	Mean	53.48	72.95	108.30
	'F' Test	S	S	S
	S.E.(m)	0.39	0.27	0.72
	C.D. at 5%	0.86	2.51	2.05

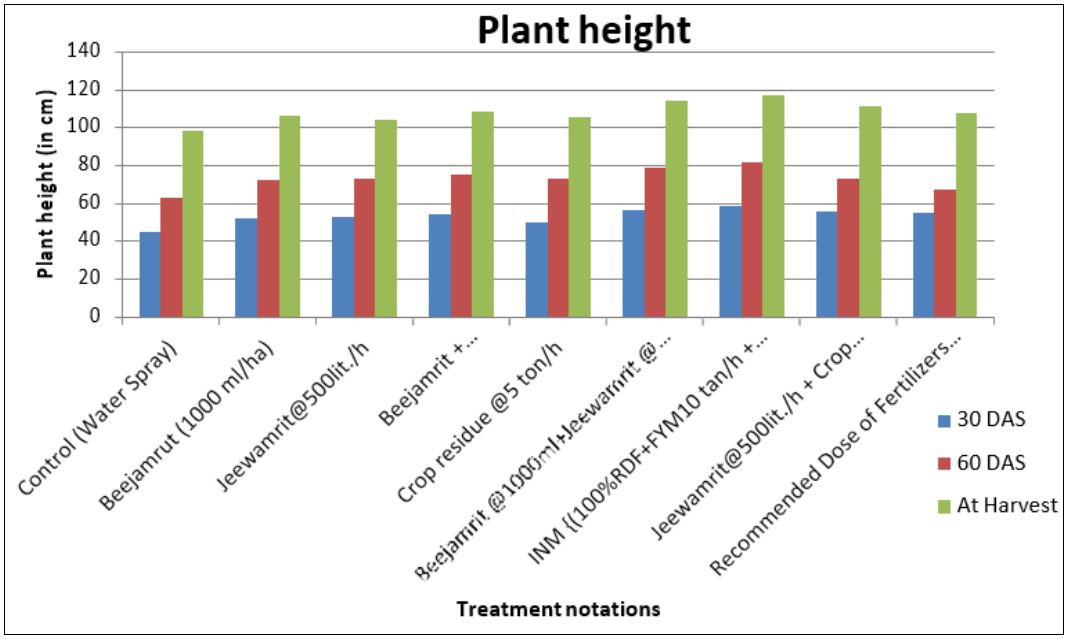

Fig 1: Histogram of effect of different natural farming protocols on plant height (cm) of okra

Table 2: Effect of different natural farming protocols on days to first flowering of Okra

Treatment Notation	Treatment details	Days
T_1	Control (Water Spray)	45.90
T_2	Beejamrut (1000 ml/ha)	43.65
T_3	Jeewamrit @ 500 lit./h	42.81
T_4	Beejamrit + jeewamrit @ 1000 ml + 500 lit/h	43.86
T_5	Crop residue @ 5 ton/h	44.95
T_6	Beejamrit @ 1000 ml + Jeewamrit @ 500 ml + Cropresidue @ 5 ton/h	43.93
T_7	INM {(100% RDF + FYM10 tan/h + Azatobacter @ 25 g/kg seed + PSB @ 25 g/kg seed)}	44.85
T_8	Jeewamrit @ 500 lit./h + Crop residue @ 5 ton/h	43.09
T_9	Recommended Dose of Fertilizers (RDF)	44.39
	Mean	44.16
	'F' Test	S
	c.v.	7.32
	S.E.(m)	0.61
	C.D. at 5%	1.75

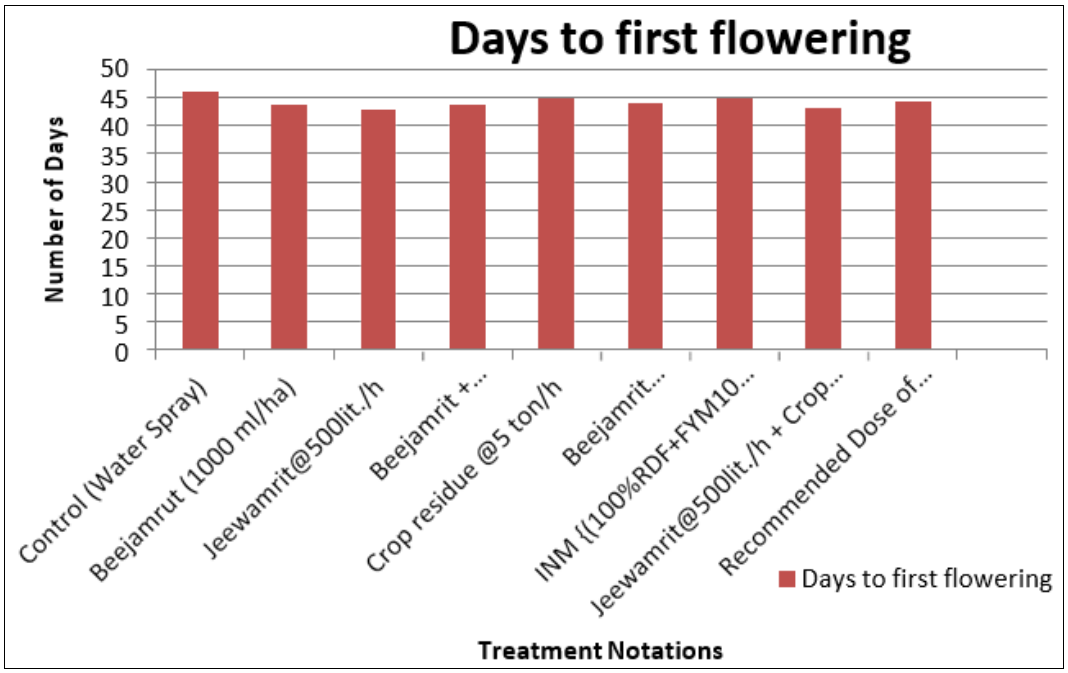

Fig 2: Histogram of effect of different natural farming protocols on days to first flowering of the okra

Table 3: Effect of different natural farming protocols on stem diameter (cm) of Okra

Treatment Notation	Treatment details	Stem diameter (cm)
T_1	Control (Water Spray)	7.47
T_2	Beejamrut (1000 ml/ha^{-1})	10.35
T_3	Jeewamrit @ 500 lit./ha^{-1}	8.02
T_4	Beejamrit + jeewamrit @ 1000 ml + 500 lit/ha^{-1}	8.99
T_5	Crop residue @ 5 ton/ha^{-1}	10.77
T_6	Beejamrit @ 1000 ml + Jeewamrit @ 500 ml + Cropresidue @ 5 ton/ha^{-1}	10.92
T_7	INM {(100% RDF + FYM10 tan/ha^{-1} + Azatobacter @ 25 gm/kg seed + PSB @ 25 gm/kg seed)}	11.39
T_8	Jeewamrit @ 500 lit./ha^{-1} + Crop residue @ 5 ton/ha^{-1}	11.07
T_9	Recommended Dose of Fertilizers (RDF)	10.07
	Mean	9.89
	'F' Test	S
	c.v.	8.37
	S.E.(m)	0.13
	C.D. at 5%	0.38

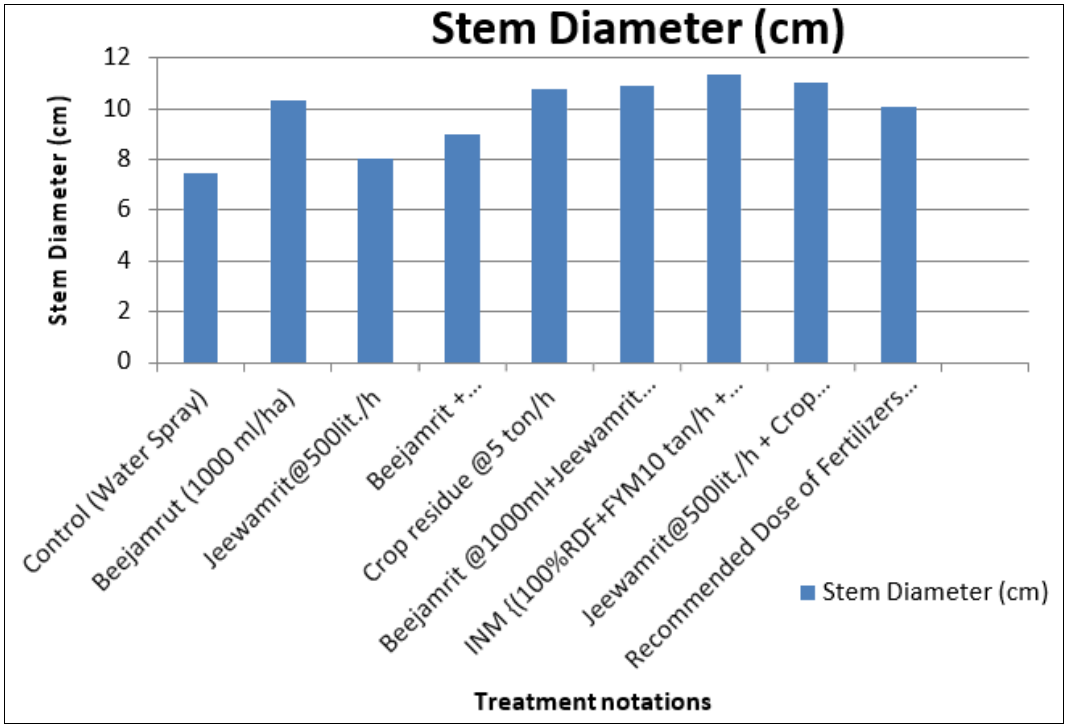

Fig 3: Histogram of effect of different natural farming protocols on stem diameter of the okra

Table 4: Effect of different natural farming protocols on Capsule yield per plot (kg/plot) of okra

Treatment Notation	Treatment details	Kg/plot
T_1	Control (Water Spray)	13.78
T_2	Beejamrut (1000 ml/ha)	15.33
T_3	Jeewamrit @ 500 lit./h	14.91
T_4	Beejamrit + jeewamrit @ 1000 ml + 500 lit/h	14.97
T_5	Crop residue @ 5 ton/h	14.93
T_6	Beejamrit @ 1000 ml + Jeewamrit @ 500 ml + Cropresidue @ 5 ton/h	16.92
T_7	INM {(100% RDF + FYM10 tan/h + Azatobacter @ 25 g/kg seed + PSB @ 25 g/kg seed)}	17.36
T_8	Jeewamrit @ 500 lit./h + Crop residue @ 5 ton/h	16.31
T_9	Recommended Dose of Fertilizers (RDF)	16.68
	Mean	15.69
	'F' Test	S
	c.v.	8.30
	S.E.(m)	0.19
	C.D. at 5%	0.60

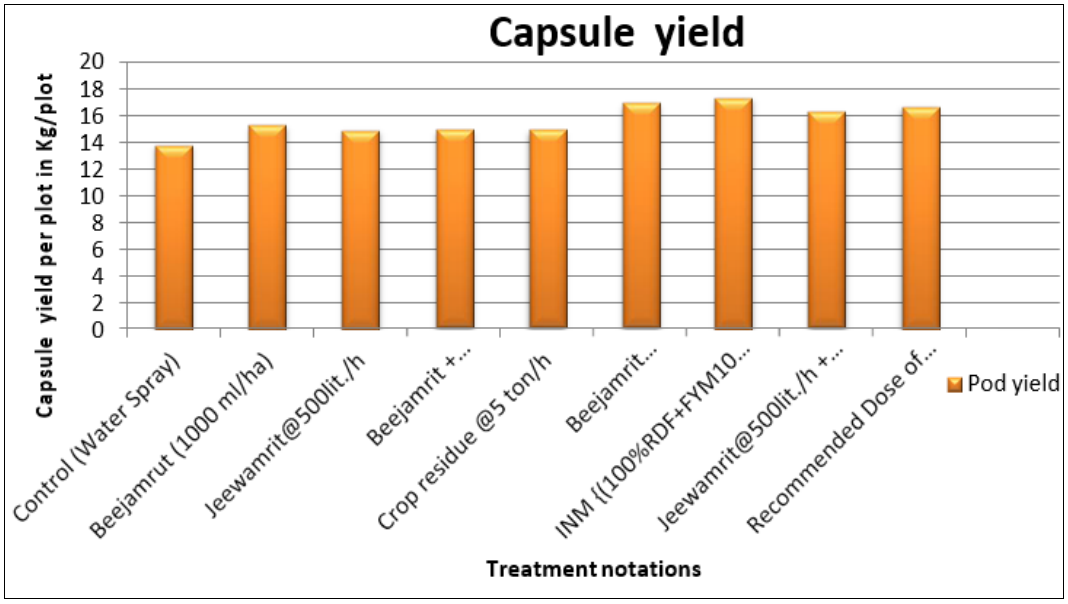

Fig 4: Histogram of effect of different natural farming protocols on Capsule yield per plot (kg/plot) of the okra

Conclusion

In conclusion, the application of both organic and inorganic nutrients significantly enhanced soil properties, resulting in improved nutrient availability and promoting vigorous vegetative growth. Organic nutrients particularly improved soil quality and plant health, leading to greater plant height, leaf and branch number, and better photosynthesis. The integration of various natural farming protocols fostered earlier and more abundant flowering, capsule setting, and fruiting, contributing to increased capsule weight, size, and yield. These practices also elevated overall fruit quality, as evidenced by higher total soluble solids and seed weight. Thus, natural farming protocols are crucial for optimizing plant productivity and fruit quality.

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