



IMPACT AND APPLICATION OF BIO-FERTILIZERS ON GROWTH AND YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* (L.) 'ARKA ANAMIKA' IN AGRA (UP).

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ABSTRACT

A field experiment was conducted to assess the effect of biofertilizers on growth and yield of okra during Kharif session 2019-2020 at Agriculture farm of Shri Megh Singh College, Agra. Experiment was followed to RBD with 5 treatments along with control and 3 replications. The tested variety Arka Anamika was treated with combined application of recommended and reduced dose of NPK, FYM and Azospirillum was used as biofertilizer. Performance of Treatment (T2) was excellent with respect to growth and yield was best in the treatment where combined application of all the three biofertilizers were given. This was closely followed by the treatment where reduce doses were applied and control condition.

KEYWORDS: Okra, Growth, Yield, NPK, FYM and Azospirillum.

INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench) is one of the most important summer vegetable crops belongs to family Malvaceae, grown for its tender green fruits. In India okra occupies an area of 4.5 lakh ha⁻¹ with a production of 48.03 lakh t ha⁻¹.^[1] Okra is cultivated throughout India for its immature fruits which are generally cooked as vegetable. The nutritional constituents of okra include calcium, protein, oil and carbohydrates; others are iron, magnesium and phosphorus. Okra is recommended for consumption by WHO due to its ability to cure diseases. Okra has been found to be a rich source of vitamins A and C, calcium, thiamine and riboflavin. It is also rich in iron and is used as a medicine in the treatment of the peptic ulcer.^[2] It has high nutritive value, therapeutic benefits and export potential. Nutritional requirement of vegetables is very high due to its short duration and hence usually chemical fertilizers are used for vegetable production. This has disturbed the natural balance of the soil, by destroying the beneficial microorganisms which maintain the health and fertility of the soil by their metabolic activities. The beneficial plant microbe interactions in the rhizosphere are the primary determinants of plant health and soil fertility. The lost biological activity in the soil, due to excess use of chemical fertilizers, can be restored slowly by incorporating artificially multiplied cultures of beneficial microorganisms in the form of biofertilizers.^[3]

Biofertilizers have become an important component in integrated nutrient supply system to improve crop growth and yield through better nutrients supplies. Azospirillum is non-symbiotic N₂ fixing bacteria and considered to be very important for nitrogen fixation. Farm yard manure is rich in nutrients basically using cow dung, cow urine, waste straw and other dairy wastes. The organic manure FYM not only provides nutrient to the plant but also improves the soil texture by binding effect of soil aggregates. Organic manure increases cation exchange capacity, water holding capacity and phosphate availability of the soil beside improving the fertilizer use efficiency and microbial population of soil, it reduces nitrogen losses due to slow release of nutrients.^[4]

Biofertilizers are carrier based preparations containing live or latent cells of efficient strains of beneficial microorganisms in a viable state intended for seed, soil or root application with the objective of increasing the number of such microorganisms and accelerating certain microbial process to augment the extent of availability of nutrients in a form which can be easily assimilated by the plants.^[5] They influence the total soil micro flora, soil enzyme activity and in turn soil health.^[6] As a cost effective supplement to chemical fertilizers, biofertilizers can help to economize the high investment needed for fertilizer use.^[7] These non-conventional sources of nutrients are gaining immense importance as they improve long term sustainability of soil which ultimately results in improved yield and

yield components. In this context the present study was conducted to assess the effect of biofertilizers on yield and yield attributing characters of okra and also to investigate the effectiveness of biofertilizers, when applied along with chemical fertilizers

MATERIALS AND METHODS

The experiment was conducted on okra cv. Arka Anamika during June-September in the Agriculture farm, Shri Megh Singh College, Agra. The experiment was laid out in a Randomised Block Design with 5 treatments and 3 replications. The plot size adopted was 3.6 x 3.6 m with spacing of 60 x 45 cm. The manures and fertilizers were given as per recommended and reduced form.

Treatment combination were experimented are as follows- T1- NPK@120 kg. ha⁻¹ and FYM @ 25 t ha⁻¹, T2- NPK@110 kg. ha⁻¹ and FYM @ 25 t ha⁻¹, T3- NPK@100 kg. ha⁻¹ and FYM @ 25 t ha⁻¹, T4- NPK@ 90 kg. ha⁻¹ and FYM @ 25 t ha⁻¹, T5- NPK@80 kg. ha⁻¹ and FYM @ 25 t ha⁻¹ and Control *Azospirillum* was applied to soil @ 2 kg ha⁻¹ along with FYM.

The source of nitrogen, phosphorus and potassium

were NPK mixture. The bioinoculants *Azospirillum* were procured from college lab. Observations were recorded on fruit weight, fruit girth, number of fruits per plant, yield per plant and total fruit yield. Data relating to each character was analysed by applying the Analysis of Variance (ANOVA) and the means were compared using Duncan's Multiple Range Test (DMRT). MSTATC was used for computation and data analysis.

RESULTS AND DISCUSSION

Inoculation of all the biofertilizers along with double dose of FYM (T2) recorded the highest fruit weight (150.11 g) and fruit girth (10.14 cm) compared to control (Table 1). Application of FYM might have helped the soil to improve the nutrient status, water holding capacity, physical, chemical and biological properties which in turn helped better absorption of nutrients and expression of better biometrical parameters. Conjoint application of FYM, inorganic fertilizers and biofertilizers might have acted complementary and supplementary to each other and resulted in adequate and slow, but steady supply of nutrients resulting in better parameters in T1 and T2.

Table 1: observation of combined effect of NPK and biofertilizers on growth of okra.

Treatment	No. of fruit/plant	Length of fruit (cm)	Weight of fruit/plant (g)	Fruit yield/plot(kg)
T0	7.23	7.88	138.41	2.13
T1	7.88	10.08	143.16	2.10
T2	11.78	10.14	150.11	2.23
T3	10.33	9.23	145.03	2.21
T4	10.12	9.15	143.33	2.06
T5	9.70	9.28	150.11	2.19

Table -1 depicted that plant height ranged between (86.32 to 101.54) was noticed as maximum in treatment T2 where combined application of NPK and FYM applied. In treatment T₁ plant height was noticed as 92.43 which was less than T₂ treatment. Number of leaves was also observed higher i.e. 16.54 as compared to other treatment and control showed 15.66. Number of nodes per plant was ranged between

8.00 to 10.32 which was higher than other treatment and control condition. Maximum number of flower per plant i.e. 10.43 was noticed in treatment T2 which was higher as compared T₁ i.e. 10.13, T₃ i.e. 10.21, in T₄ i.e. 10.23 and in T₅ it was 10.28 simultaneously. All the treatment showed as higher than control i.e. 9.10.

Table 2: Observation of combined effect of NPK and biofertilizers on yield of okra.

Treatment	Plant height (cm)	No. of leaves/plant	No. of nodes/plant	No. of flower/plantplant
T0	86.32	15.66	8.00	9.10
T1	92.43	16.00	8.20	10.13
T2	101.54	16.54	10.32	10.43
T3	95.99	15.94	9.85	10.21
T4	100.01	16.37	10.22	10.23
T5	101.18	15.63	10.31	10.28

Table -2 showed Number of fruits per plant showed significant differences among the treatments and it ranged from 7.23 to 11.78. The highest number of

fruits per plant (11.78) was recorded in the treatment (T₂) where double dose of FYM was applied along

with *Azospirillum*, which was more than control. Supply of nutrients might have increased the production, translocation and accumulation of photosynthetic to growing points. This might have

stimulated the plants to produce productive flowers ultimately resulting in increased yield and more number of fruits per plant.



(A) Fruiting of okra in tested field



(B) Fruits of okra

Application of double dose of FYM might have created better soil condition due to higher rate of multiplication of inoculated microbes leading to enrichment and mobilisation of bound nutrients and improvement in soil aggregation. FYM provides macro and micro nutrients, increase the water holding capacity and aeration for better root formation. Decomposition of FYM increased solubility of nutrients by forming humic complex which are easily assimilated by plants.^[8] All these might have made quick mobilisation and availability of nutrients which could have resulted in increased yield attributes like fruit weight, fruit length and number of fruits ultimately resulting in higher yield. Response of biofertilizers was better at lower dose of chemical fertilizers. *Azospirillum* might have increased the number of cells as well as elongation of individual cells and better translocation of soluble ions. Better crop due to all these factors might have helped in increasing photosynthetic rate and more physiological and biochemical activities which in turn resulted in increased yield and yield components.

The findings of the present study indicated that combined application of all the three biofertilizers along with FYM was the best, with respect to yield. The second best performance was obtained when FYM, inorganic fertilizers and biofertilizers were applied signifying that a reduction of 15 per cent chemical fertilizers is possible by using biofertilizers.

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