

Effect of Organic and Inorganic fertilizer on Growth and Yield attributes of Okra (*Abelmoschus esculentus* L.)

ABSTRACT

Research was conducted by using effective management application of Flyash and Azospirillum with inorganic fertilizer with objective to enhance the growth and yield of okra crop. It has been concluded from the trial that the different level of Flyash with inorganic fertilizers in the experiment gave the highest value. Effective results were obtained with T₉ treatment with combination Flyash 25 t ha⁻¹, Azospirillum 2 kg ha⁻¹ with RDF 100: 60: 50 kg ha⁻¹. This treatment result shown the best plant height with the most leaves, high number of branches, greater number of fruits per plant and highest yield in compared with the control treatment T₁ which had the lowest result in all categories. T₉ was found to be the best for the improvement of growth and yield of okra therefore, farmers of Prayagraj region can adopt this combination to give the highest yield of Okra.

Keywords: Azospirillum, Flyash, growth, inorganic fertilizers and yield parameters

1. INTRODUCTION

Okra or ladies finger (*Abelmoschus esculentus* L.) requires well draining soil that is rich in organic matter and nutrients such as nitrogen, phosphorus, and potassium. Soil also affects the water holding capacity and pH level, which can impact the plant's growth and yield. Additionally, soil health is crucial for the prevention of diseases and pests that can damage the okra plant. Therefore, it is important to maintain soil fertility and quality through proper management practices such as crop rotation, composting, and appropriate irrigation. In summary, soil is a critical component in the successful cultivation of okra and must be managed carefully to ensure optimal plant growth and yield Kumar *et al.* [1].

Flyash is the end residue from combustion of pulverized bituminous or sub-bituminous coal (lignite) in the furnace of thermal power plants and consists of mineral constituents of coal which is not fully burnt. Flyash has great potentiality in agriculture due to its efficiency in modification of soil health and crop performance. The high concentration of elements (K, Na, Zn, Ca, Mg and Fe) in flyash increases the yield of many agricultural crops. But compared to other sectors, the use of flyash in agriculture is limited. Flyash having both the soil amending and nutrient-enriching

properties, is helpful in improving crop growth and yield in low fertility acid lateritic soils. Many researchers have demonstrated that flyash increased the crop yield and improved the physical and chemical characteristics of the soil Basu *et al.* [2]

Azospirillum works by colonizing the roots of the okra plant and fixing atmospheric nitrogen, which is then used by the plant for its growth and development. This results in improved plant vigor, increased shoot and root growth, and increased flower and fruit production Shree *et al.* [3].

2. MATERIAL AND METHODS

The field experiment which was carried out at the research farm of soil science and agricultural chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during in Zaid season 2022. The maximum temperature of the location ranges between 46⁰C-48⁰C and seldom falls below 4⁰C-5⁰C. The relative humidity ranges between 20-94%. The average rainfall of this area is around 1100mm annually. The experiment was laid out in Randomized Block Design (RBD) with 9 treatments detailed combination of treatment are given in Table 1. The treatments have been replicated three times. The different treatments were employed randomly in each replication. The details of the treatment combinations are given in Table 1 and observation were recorded plant height, number of leaves, number of branches, fruits per plants and yield.

Table 1. Treatment Combination

Treatment	Treatment Combination
T ₁	Absolute control
T ₂	[NPK @ 0% + FLYASH @ 50% + AZOSPIRILLUM @ 25%]
T ₃	[NPK @ 0% + FLYASH @ 100% + AZOSPIRILLUM @ 50%]
T ₄	[NPK @ 50% + FLYASH @ 0% + AZOSPIRILLUM @ 0%]
T ₅	[NPK @ 50% + FLYASH @ 50% + AZOSPIRILLUM @ 25%]
T ₆	[NPK @ 50%+FLYASH @ 100% + AZOSPIRILLUM @ 50%]
T ₇	[NPK @ 100% + FLYASH @ 0%+ AZOSPIRILLUM @ 0%]
T ₈	[NPK @ 100% + FLYASH @ 50% + AZOSPIRILLUM @ 25%]
T ₉	[NPK @ 100% + FLYASH @ 100% + AZOSPIRILLUM @ 50%]

3. RESULTS AND DISCUSSION

3.1. Plant Height (cm) at 25, 50 and 75 DAS

The effect of organic and inorganic source of nutrients NPK, Flyash and Azospirillum on plant height was found significant at 25, 50 and 75 DAS. The maximum plant height 25.91, 92.12 and 114.89 cm was recorded in T₉ (NPK @100% + FA @100% + Azospirillum @50%) and minimum plant height 20.91, 82 and 106.25 cm was recorded in T₁ (Absolute Control) at 25, 50 and 75 DAS respectively. The application of NPK, Flyash and Azospirillum in combination can result in a synergistic effect on plant growth and development. NPK provides essential nutrients to plants. This leads to improved plant growth and development, resulting in an increase in plant height at different growth stages Kumar *et al.* [1]. Increase in plant height due to increase in NPK, Flyash and Azospirillum may be due to adequate supply of nutrients which in turn helps in vigorous vegetative growth of plants and subsequently increase the plant height through cell elongation, cell division and photosynthesis of plant cell. Similar findings were reported by Singh *et al.* [4].

3.2 Number of Leaves per Plant at 25, 50 and 75 DAS

The effect of organic and inorganic source of nutrients NPK, Flyash and Azospirillum on number of leaves was found significant at 25, 50 and 75 DAS. the maximum number of leaves 14.02, 27.52 and 39.31 cm was recorded in T₉ (NPK @100% + FA @100% + Azospirillum @50%) and minimum number of leaves 8.12, 21.17 and 28.76 was recorded in T₁ (absolute control) at 25, 50 and 75 DAS respectively. The combination of organic and inorganic fertilizer can have a synergistic effect on plant growth and development. Flyash provides a source of organic matter and nutrients, while Azospirillum enhances nutrient uptake and produces plant growth regulators. the combination of these two inputs can promote vegetative growth and increase the number of leaves in okra plants Verma *et al.* [5]

3.3 Number of Branches per Plant at 25, 50 and 75 DAS

The effect of organic and inorganic source of nutrients NPK, Flyash and Azospirillum on number of branches was found significant at 25, 50 and 75 DAS. The maximum number of branches 16.02, 20.75 and 27.27 was recorded in T₉ (NPK @100% + FA @100% + Azospirillum @50%) and minimum number of branches 9.11, 15.02 and 19.13 was recorded in T₁ (Absolute Control) at 25, 50 and 75 DAS respectively. the combined application of Flyash, Azospirillum, and inorganic fertilizers can positively influence the number of branches in okra plants by

improving nutrient availability, enhancing microbial activity, and promoting overall plant vigor Singh *et al.* [4].

3.4 Number of Fruits per Plant

The table 2 show the effect of organic and inorganic source of nutrients NPK, Flyash and Azospirillum on number of fruits per plant. The effect of organic and inorganic source of nutrients NPK, Flyash and Azospirillum on number of fruits per plant was found significant. The maximum number of fruits per plant 19.87 was recorded in T₉ (NPK @100% + FA @100% + Azospirillum @50%) and minimum number of fruits 14.21 was recorded in T₁ (Absolute Control) after harvesting respectively. The specific effects of Flyash, Azospirillum and inorganic fertilizers on fruit production in okra can vary depending on factors such as soil conditions, environmental factors, crop management practices, and the specific formulations and concentrations of the fertilizers used Yadav *et al.* [6].

3.5 Yield (q ha⁻¹)

The Table 2 show the effect of organic and inorganic source of nutrients NPK, Flyash and Azospirillum on yield. The effect of organic and inorganic source of nutrients NPK, Flyash and Azospirillum on yield was found significant. The maximum yield of okra 118.15 q ha⁻¹ recorded in T₉ (NPK @100% + FA @100% + Azospirillum @50%) and minimum yield of okra 105.25 q ha⁻¹ was recorded in T₁ (Absolute Control) after harvesting respectively [7-9].

The application of NPK and Flyash in T₉ (NPK @100% + FA @100% + Azospirillum @50%) resulted in higher yield of okra as compared to T₁ (Absolute Control). This can be attributed to the availability of essential nutrients and improved soil health, which led to better growth and development of the plants and ultimately, higher yield. The combined application of these nutrients resulted in synergistic effects, leading to an overall improvement in the yield of okra. The higher yield in treatment T₉ (NPK @100% + FA @100% + Azospirillum @50%) indicates the importance of integrated nutrient management practices in improving crop productivity Kumar *et al.* [1].

Table 2. Effect of organic and inorganic fertilizer on plant height, number of leaves, number of branches, fruits per plant and yield of okra at different days interval after crop harvest.

Treatment	Plant Height (cm)			No. of Leaves			No. of Branches			Fruits per plant	Grain Yield (q ha ⁻¹)
	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS		
T ₁	20.10	82.0	106.25	8.12	21.17	28.76	9.11	15.02	19.13	14.21	105.25
T ₂	21.19	86.16	108.13	8.67	21.73	29.64	11.17	15.37	20.20	14.87	106.14
T ₃	22.22	87.08	109.09	9.29	22.62	30.53	12.60	16.76	22.90	15.61	108.82

T ₄	20.99	85.01	107.16	10.44	23.58	31.48	13.71	17.49	21.87	15.03	106.15
T ₅	23.09	89.11	111.17	11.17	24.60	32.31	13.96	17.89	24.40	17.15	115.32
T ₆	24.10	90.07	112.06	11.86	25.67	34.57	14.73	18.78	25.31	18.02	116.15
T ₇	22.49	88.06	108.53	12.47	26.11	36.49	15.32	19.67	23.81	16.77	108.53
T ₈	25.06	91.05	110.15	13.54	26.91	37.64	15.54	19.92	26.51	18.24	114.05
T ₉	25.91	92.12	114.89	14.02	27.52	39.31	16.02	20.75	27.27	19.87	118.15

4. CONCLUSION

It is revealed from the trial that application of Flyash and Azospirillum with inorganic fertilizers in treatment T₉ was found best in increasing growth and yield of okra. Since the results is based on one season experiment, further trail is needed to substantiate the result.

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