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

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Research was conducted by using effective management application of Flyash, Azospirillum and inorganic fertilizer with objective to enhance the growth and yield of okra crop. The field experiment was carried out at the research farm of soil science and agricultural chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during Zaid season 2022. The experiment was laid out in Randomized Block Design (RBD) with 9 treatments replicated three times. Data were collected on plant height, number of leaves, number of branches, fruits per plants and yield. Results showed significant differences on all parameters such that the best plant height with the most leaves, high number of branches, greater number of fruits per plant and highest yield was registered in treatment with the combination of Flyash 25 t ha^{-1}, Azospirillum 2 kg ha^{-1} with

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RDF 100: 60: 50 kg ha^{-1} indicating that the synergy by Azospirillum, Flyash and fertilizers improved growth and yield. The results are based on one season experiment, therefore further investigation is recommended to substantiate the findings.

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 infect 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. Soil is a critical component in the successful cultivation of okra and must be managed carefully to ensure optimal plant growth and yield [1].

Flyash is the end residue from combustion of pulverized bituminous or sub-bituminus 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 [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. The results in improved plant vigor, increased shoot and root growth, and increased flower and fruit production [3].

2. MATERIALS 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 46^0C-48^0C and seldom falls below 4^0C-5^0C. 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 replicated three times. Detailed combination of treatments is given in Table 1. Data were collected on plant height, number of leaves, number of branches, fruits per plants and yield.

3. RESULTS AND DISCUSSION

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

The effect of nutrients from 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 were recorded in T_9 (NPK @100% + FA @100% + Azospirillum @50%) and minimum plant height 20.91, 82 and 106.25 cm were recorded in T_1 (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 as reported by Kumar et al., [1]. Increase in plant height due to increase in NPK, Flyash and Azospirillum that provide due to adequate supply of nutrients which in turn enhanced the 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

Results in Table 2 showed significant difference on number of leaves due to the effect source of nutrients from 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 were recorded in T_9 (NPK @100% + FA @100% + Azospirillum @50%) and minimum number of leaves 8.12, 21.17 and 28.76 were recorded in T_1 (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 their 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 as reported by Verma et al., [5].

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

Results on number of branches per plant revealed significant difference such that the maximum number of branches 16.02, 20.75 and 27.27 at 25, 50 and 75 DAS were registered in T_9 (NPK @100% + FA @100% + Azospirillum @50%) and minimum number of branches 9.11, 15.02 and 19.13 were recorded in T_1 respectively. This could be due to the effect brought about by Flyash, Azospirillum, and inorganic fertilizers. The nutrients positively influences the number of branches in okra plants by improving nutrient availability, enhancing microbial activity, and promoting overall plant vigor [4].

3.4 Number of Fruits per Plant

Results in Table 2 showed significant difference on number of fruits per plant. Treatment (T_9) registered highest number of fruits per plant (19.87) while the lowest number of fruits (14.21) was recorded in the control treatment. This is attributed to the application of NPK, Flyash and Azospirillum. 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 as reported by Yadav et al., [6].

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%]

Table 2. Plant height, number of leaves and branches, fruits per plant and yield of okra at different days intervals

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	82.00	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
MEAN	22.79	87.85	109.71	11.06	24.43	33.41	15.09	17.96	23.48	16.64	110.95
SE+	0.509	0.738	0.569	0.159	0.355	0.660	0.191	0.219	0.383	0.233	0.523
CV%	1.629	2.350	1.822	0.466	1.043	1.937	0.562	0.642	1.125	0.684	1.675
F-test	S	S	S	S	S	S	S	S	S	S	S

3.5 Yield (q ha^{-1})

Results in Table 2 showed significant difference on yield. Okra yield of 118.15 q ha^{-1} was recorded in T_9 (NPK @100% + FA @100% + Azospirillum @50%) as highest while lowest yield (105.25 q ha^{-1}) was recorded in T_1 (Absolute Control) after harvesting [7-9]. The application of NPK and Flyash in T_9 resulted in high yield as compared to T_1. This could 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 synergistic effects of nutrients from the three sources led to an overall improvement in the yield. This indicates the importance of integrated nutrient management practices in improving crop productivity as reported by Kumar et al., [1].

4. CONCLUSION

It is evident to conclude that the application of Flyash and Azospirillum with inorganic fertilizers in treatment T_9 (NPK @100% + FA @100% + Azospirillum @50%) was found best in increasing growth and yield of okra. Since the results are based on one season experiment, further trail is needed to substantiate the results.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kumar V, Yadav A, Singh A, Singh D, Singh R. Effect of integrated nutrient management on growth, yield and quality of okra (*Abelmoschus esculentus* L.). Journal of Pharmacognosy and Phytochemistry. 2017;6(5):3525-3527.
2. Basu M, Pande M, Bhadoria PBS, Mahapatra SC. Potential flyash utilization in agriculture: A global review. Progress in Natural Science. 2019;19(10):1173-1186.
3. Shree M, Kumar V, Tripathi RD. Azospirillum sp. inoculation improves growth and yield of okra (*Abelmoschus esculentus*) in a farmer's field. African Journal of Microbiology Research. 2014; 8(45): 4001-4008.
4. Singh R, Kumar R, Sharma S. Impact of organic and inorganic sources of nutrient on yield and quality of okra (*Abelmoschus esculentus* L. moench). International Journal of Chemical Studies. 2018;6(2): 251-256.
5. Verma A, Kaur S, Kumar A, Singh G. Effect of organic manures and inorganic fertilizers on growth, yield, and quality of okra (*Abelmoschus esculentus* L. moench). Journal of Plant Nutrition. 2013; 36(7):1073-1089.
6. Yadav RL, Yadav KS, Kumar S, Yadav S, Yadav P. Influence of integrated nutrient management on yield and quality of okra (*Abelmoschus esculentus* L.) in inceptisols. Indian Journal of Agricultural Sciences. 2020;90(4):51-54.
7. Das B, Sahoo S, Mishra P. Effect of nitrogen on growth, yield and quality of okra (*Abelmoschus esculentus* L.). International Journal of Agriculture, Environment and Biotechnology. 2014; 7(2):285-291.
8. Ginindza MM, Aderibigbe TO, Jaiyeoba IA. Effect of potassium fertilizer application on okra (*Abelmoschus esculentus* L. moench) growth, yield and quality in Swisszerland. International Journal of Agriculture and Biology. 2015;17(5):973- 978.
9. Meena VD, Dotaniya ML, Coumar V, Rajendiran S, Sharma P. Effect of phosphorus on crop growth, yield, and nutrient content in okra (*Abelmoschus esculentus*) under field conditions. Journal of Plant Nutrition. 2017;40(11):1573-1580.

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