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EFFECTS OF ORGANIC AND INORGANIC FERTILIZERS ON DIFFERENT CROP GROWTH STAGES OF OKRA (*Abelmoschus esculentus* L.)

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ABSTRACT

This study evaluates the impact of organic and inorganic fertilizers on the growth and yield of okra (Abelmoschus esculentus L.) across different developmental stages. Organic fertilizers enhance soil structure, microbial activity, and long-term fertility, while inorganic fertilizers offer immediate nutrient availability, boosting early growth and yield. Results highlight that although inorganic inputs improve short-term performance, overuse can degrade soil quality. Organic sources support sustainability but act slowly. Integrated nutrient management, combining both types, was most effective—improving seedling vigor, flowering, dry matter production, and overall yield. A balanced fertilization approach is essential for optimizing productivity and maintaining soil health in okra cultivation.

KEYWORDS: Integrated nutrient management, Okra growth stages, Organic and inorganic fertilizers, Sustainable vegetable production

INTRODUCTION

Okra (*Abelmoschus esculentus L.*), a widely cultivated vegetable in tropical and subtropical regions, plays a significant role in human nutrition due to its high content of vitamins, minerals, and dietary fibre. As a fast-growing crop with a short maturity period, okra requires adequate and balanced nutrient supply throughout its growth stages-from germination to flowering and pod development-for optimal yield and quality. Fertilizers, both organic and inorganic, are critical in ensuring this nutrient availability. Organic fertilizers, such as compost, manure, and biofertilizers, improve soil structure and enhance microbial activity, leading to long-term soil fertility and sustainable crop production. In contrast, inorganic fertilizers, including urea, NPK blends, and other chemical formulations, provide readily available nutrients that can promote rapid plant growth and high yields, though often with environmental concerns

over time. The use of either fertilizer type, or a combination thereof, can have varying effects on the physiological and morphological development of okra at different growth stages (Ayodele *et al.*, 2008). Understanding the comparative impacts of organic and inorganic fertilizers on okra growth is essential for developing effective nutrient management practices that not only boost productivity but also maintain soil health. This study aims to evaluate how different fertilizer treatments influence okra growth parameters such as germination rate, plant height, leaf number, flowering time, and fruit yield-across various developmental stages. The findings can guide farmers, agronomists, and policymakers in choosing appropriate fertilization strategies for sustainable okra production (Karim *et al.*, 2024).

EFFECT OF ORGANIC AND INORGANIC FERTILIZERS APPLICATION ON DIFFERENT CROP GROWTH STAGES

SEEDLING STAGE

The seedling growth stage of okra is highly sensitive and sets the foundation for the plant's overall development and productivity. At this early stage, adequate nutrient availability is essential for strong root formation, early shoot growth, and healthy leaf emergence. Organic fertilizers, such as well-decomposed compost or vermicompost, improve soil structure, enhance moisture retention, and stimulate microbial activity, which collectively create a favourable environment for seedling establishment. However, the slow nutrient release from organic sources may not always meet the immediate demands of fast-growing seedlings. Inorganic fertilizers, particularly those rich in phosphorus and nitrogen, provide quick nutrient access, promoting faster germination, root elongation, and early leaf growth. While inorganic fertilizers may boost seedling vigour in the short term, meanwhile excessive use can lead to nutrient imbalances or salt stress. A balanced approach that combines both organic and inorganic fertilizers can enhance seedling growth effectively, offering immediate nutrient supply while supporting soil health and resilience (Sharma and Behera, 2010).

FLOWERING STAGE

The flowering stage of okra is a vital reproductive phase that directly influences fruit set and overall yield. During this period, the plant requires a balanced supply of nutrients particularly phosphorus and potassium to support flower initiation, development, and retention. Organic fertilizers, such as composted manure or poultry litter, enrich the soil with micronutrients and organic matter, improving soil structure and biological activity, which can enhance flower quality and longevity over time. However, their nutrient release is gradual and may not fully satisfy the high, immediate nutrient demand during peak flowering. Inorganic fertilizers, especially those with appropriate phosphorus and potassium concentrations, provide quick nutrient availability, encouraging abundant flowering and reducing flower

drop. Yet, over-reliance on chemical inputs can lead to nutrient leaching and reduced soil fertility. Combining organic and inorganic fertilizers during the flowering stage can offer a synergistic effect-ensuring immediate nutrient uptake while improving soil health-thereby promoting better flower formation and setting the stage for higher fruit yields (Yadav & Lourduraj, 2006).

YIELD RESPONSE

In okra production, inorganic fertilizers typically lead to higher yields in the short term due to their rapid nutrient availability. For example, applying NPK at 100–120 kg/ha has been shown to significantly enhance flowering, fruit set and overall fruit size. In contrast, organic fertilizers such as well-decomposed poultry manure or compost release nutrients more slowly through gradual mineralization, resulting in moderate short-term yields. However, with long-term application, organic fertilizers improve soil structure, water retention, and fertility, which ultimately support sustained or increasing yields over time. Studies indicate that okra grown with 10–15 tons/ha of poultry manure, especially when combined with good practices like mulching and irrigation, can achieve yields comparable to those with chemical fertilizers, while also improving fruit taste and nutritional quality. Therefore, while inorganic fertilizers offer immediate productivity advantages, organic fertilizers provide more sustainable benefits in terms of soil health and crop quality (Silwal *et al.*, 2023).

DRY MATTER PRODUCTION

The application of organic, inorganic, and integrated fertilizers significantly influences dry matter production in okra cultivation, each with distinct effects. Organic fertilizers like poultry manure improve soil structure and microbial activity, releasing nutrients slowly and supporting steady dry matter accumulation; for example, okra plants treated with 10–15 tons/ha of poultry manure have shown notable increases in biomass over time. Inorganic fertilizers such as NPK (100–120 kg/ha) and urea, on the other hand, supply immediate nutrients, promoting rapid early vegetative growth and leading to higher initial dry matter production, with studies reporting increased leaf area and plant biomass during the early growth stages. However, reliance on inorganic inputs alone may lead to soil degradation and reduced long-term productivity. Integrated fertilizer use, which combines 60 kg/ha of NPK with 7.5 tons/ha of poultry manure, has been found to enhance nutrient uptake, sustain photosynthetic activity, and result in significantly higher total dry matter yields than either source used independently. This integrated approach not only boosts immediate plant growth but also supports long-term soil fertility and sustainable production (Ayoola & Makinde, 2008)

CONCLUSION

The application of organic and inorganic fertilizers plays a pivotal role in influencing the growth, development, and yield of okra across various growth stages. Organic fertilizers contribute significantly to improving soil structure, enhancing microbial activity, and promoting sustainable agricultural practices, although they release nutrients slowly. In contrast, inorganic fertilizers offer immediate nutrient availability, resulting in rapid vegetative growth, earlier flowering, and higher short-term yields. However, long-term reliance on chemical inputs can lead to soil degradation and environmental concerns. The evidence from various studies clearly indicates that an integrated nutrient management approach-combining both organic and inorganic fertilizers-strikes the optimal balance. It not only enhances seedling vigour, flowering success, and dry matter accumulation but also sustains soil fertility and ensures continued productivity. Therefore, adopting a balanced fertilization strategy is essential for achieving both high yields and sustainable okra production in the long run.

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