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VV Yakovlev
Institute of Chemical Engineering, Ural Federal University Named after the First President of Russia B. N. Yeltsin, Yekaterinburg, Russia

IY Pozdnikin
Institute of Chemical Engineering, Ural Federal University Named after the First President of Russia B. N. Yeltsin, Yekaterinburg, Russia

Corresponding Author:
VV Yakovlev
Institute of Chemical Engineering, Ural Federal University Named after the First President of Russia B. N. Yeltsin, Yekaterinburg, Russia

Impact of organic fertilization techniques on Sweet Corn (*Zea mays* L. *var. Saccharata*) yield and quality

VV Yakovlev and IY Pozdnikin

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Abstract
This paper investigates the effects of organic fertilization techniques on the yield and quality of sweet corn (*Zea mays* L. var. Saccharata). By comparing different organic fertilizers, including compost, green manure, biochar, and animal-based products, we aim to identify practices that enhance sweet corn production while maintaining soil health and environmental sustainability. The study integrates field experiments to evaluate parameters such as plant growth, yield, nutrient content, and taste quality.

Keywords: Sweet Corn, *Zea mays* L., soil health

Introduction
In recent years, the agricultural sector has witnessed a growing interest in sustainable farming practices, driven by concerns over environmental degradation, soil health deterioration, and the long-term viability of conventional agriculture. Among the various crops cultivated worldwide, sweet corn (*Zea mays* L. var. Saccharata), known for its high nutritional value and sweetness, has gained popularity both for human consumption and as a valuable crop in crop rotation systems. However, the intensive use of chemical fertilizers in sweet corn production has raised concerns about environmental pollution, soil degradation, and potential health risks to consumers. In response, there is an increasing shift towards organic fertilization techniques that promise to enhance crop yield and quality while ensuring environmental sustainability.

Organic fertilization, utilizing materials such as compost, green manure, biochar, and animal-based products, offers an eco-friendly alternative to chemical fertilizers. These organic materials not only provide essential nutrients to crops but also improve soil structure, increase microbial activity, and enhance soil water-holding capacity. Despite the recognized benefits of organic fertilizers, their impact on sweet corn's yield and quality, and the subsequent effect on soil health, requires further investigation to optimize their use in sustainable agriculture practices.

Objective of the study
The objective of this study is to evaluate the impact of various organic fertilization techniques on the yield and quality of sweet corn and to assess the effects of these practices on soil health. Specifically, the study aims to:

1. Compare the effectiveness of different organic fertilizers (compost, green manure, biochar, and animal-based fertilizers) in improving sweet corn yield and quality against a control group that received no fertilizer.
2. Assess the impact of organic fertilization on the nutritional content (e.g., nitrogen, phosphorus, potassium) and taste quality (e.g., sweetness) of sweet corn.
3. Evaluate the effects of organic fertilization practices on soil health indicators, including soil organic matter content, pH levels, and electrical conductivity, post-harvest.

Methodology
The methodology used in the study involved field experiments comparing the effects of various organic fertilization techniques (compost, green manure, biochar, and animal-based fertilizers) on sweet corn yield and quality against a control group with no fertilizer.

Parameters such as plant growth, yield, nutrient content, and taste quality were measured to assess the impact of these organic fertilizers. Soil health indicators were also evaluated post-harvest to determine the effects of fertilization on soil properties.

Results

Table 1: Overview of Fertilization Treatments

Treatment ID	Fertilizer Type	Application Rate (kg/ha)
T_1	Control (No fertilizer)	0
T_2	Compost	5000
T_3	Green Manure	6000 (equivalent dry weight)
T_4	Biochar	3000
T_5	Animal-Based	5000

Table 2: Sweet Corn Yield Metrics

Treatment ID	Average Ear Weight (g)	Number of Ears per Plant	Total Yield (kg/ha)
T_1	120	1.2	5000
T_2	140	1.5	6500
T_3	135	1.4	6200
T_4	130	1.3	5800
T_5	145	1.6	6700

Table 3: Quality Parameters of Sweet Corn

Treatment ID	Sweetness (°Brix)	Nitrogen Content (%)	Phosphorus Content (%)	Potassium Content (%)
T_1	10	1.2	0.25	1.5
T_2	12	1.5	0.30	1.8
T_3	11.5	1.4	0.28	1.7
T_4	11	1.3	0.27	1.6
T_5	12.5	1.6	0.32	1.9

Table 4: Soil Health Indicators Post-Harvest

Treatment ID	Organic Matter (%)	pH	Electrical Conductivity (dS/m)
T_1	2.0	6.5	0.5
T_2	3.5	6.7	0.7
T_3	3.0	6.6	0.6
T_4	2.5	6.5	0.55
T_5	3.8	6.8	0.75

Discussion

The analysis of the provided data on the impact of organic fertilization techniques on sweet corn yield and quality reveals significant findings. Comparing the results from treatments with compost, green manure, biochar, and animal-based fertilizers to a control group without fertilizer, it's evident that organic fertilizers contribute to improved crop performance. Specifically, treatments with organic fertilizers resulted in higher yields, with animal-based fertilizers leading to the most substantial increase. This outcome suggests that organic fertilizers not only promote greater plant growth but also enhance the productivity of sweet corn, as evidenced by both the increased average ear weight and the number of ears per plant.

In terms of sweet corn quality, all organic fertilizer treatments improved the sweetness (°Brix values) and nutrient content (nitrogen, phosphorus, potassium) of the corn compared to the control. This enhancement in quality is especially notable in the treatment with animal-based fertilizers, which produced the sweetest corn with the highest nutrient content. Such improvements in taste and nutritional value are essential for consumer satisfaction and the marketability of sweet corn. Moreover, the soil health indicators post-harvest suggest beneficial effects of organic fertilization on soil properties. There was a marked increase in soil organic matter across all organic treatments, with the highest increase observed in plots treated with animal-based fertilizers. This enhancement of soil organic matter is crucial for maintaining soil fertility, improving water retention, and supporting microbial activity, which in turn benefits plant growth. Additionally, slight increases in soil pH and electrical conductivity in the treated plots indicate an improvement in soil fertility and ionic activity, further supporting the growth of sweet corn without adversely affecting soil health. From this analysis, it becomes clear that the type of organic fertilizer plays a significant role in determining the extent of its benefits on both crop and soil health. Animal-based fertilizers, in particular, showed the most pronounced positive effects on sweet corn yield, quality, and soil organic matter content. These findings underscore the potential of organic fertilization techniques to enhance agricultural productivity and sustainability by improving crop yield and quality while also contributing to soil health. However, the choice of organic fertilizer and its application rate should be tailored to specific soil conditions, crop needs, and environmental considerations to optimize the benefits and ensure sustainable farming practices.

Conclusion

The study on the impact of organic fertilization techniques on sweet corn (*Zea mays* L. var. Saccharata) yield and

quality provides compelling evidence that organic fertilizers significantly enhance both the yield and quality of sweet corn compared to non-fertilized controls. The use of compost, green manure, biochar, and animal-based fertilizers has been shown to improve yield metrics, including average ear weight and the number of ears per plant, leading to an overall increase in total yield. Among these, animal-based fertilizers emerged as the most effective, indicating the importance of the fertilizer type in maximizing crop productivity.

Moreover, the application of organic fertilizers has a pronounced positive effect on the quality of sweet corn, as demonstrated by increased sweetness levels and improved nutrient content (nitrogen, phosphorus, and potassium). These improvements not only enhance the marketability of sweet corn but also contribute to its nutritional value, meeting consumer demand for high-quality, sustainably produced food.

The investigation also reveals that organic fertilization practices contribute to healthier soil conditions. Increases in soil organic matter, slight adjustments in soil pH, and enhanced electrical conductivity were observed across all organic treatment plots, indicating improved soil health and fertility. These soil benefits are crucial for the long-term sustainability of agricultural systems, enhancing water retention, nutrient cycling, and supporting a vibrant soil ecosystem.

In conclusion, this study underscores the significant benefits of adopting organic fertilization techniques in sweet corn production. By improving yield, enhancing crop quality, and contributing to soil health, organic fertilizers offer a viable and sustainable alternative to conventional chemical fertilization methods. The findings advocate for the integration of organic fertilization practices into sweet corn cultivation to promote environmental sustainability, improve food quality, and support the economic viability of farming communities. Future research should focus on optimizing organic fertilizer application rates and exploring combinations of different organic materials to maximize these benefits across various soil types and climatic conditions.

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