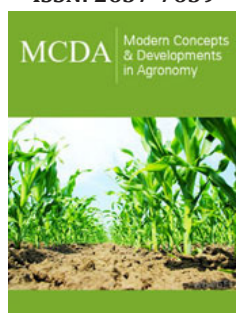


Evaluation of Green Farm plus Organic Liquid Fertilizer on Growth and Yield Performance of Bread wheat (*Triticum aestivum* L.)

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Abstract

Low fertilizer use hampers the productivity and sustainability of many Ethiopian farming systems. To address this challenge, this study evaluated the performance of Green Farm Plus liquid fertilizer, an alternative to expensive chemical fertilizers, for improving bread wheat growth and yield. Field experiments were conducted in Humbo and Boloso Sore districts of Wolaita zone (Southern Nations, Nationalities, and Peoples' Region) in 2023. Treatments included Green Farm Plus, Eco Green liquid fertilizer, and a control (no fertilizer). The experiment used a randomized complete block design with four replications. Plant height, spike length, seeds per spike, thousand seed weight, and grain yield were measured. Both Green Farm Plus and Eco Green improved bread wheat performance compared to the control. Notably, Green Farm Plus significantly enhanced growth and yield parameters. This suggests its potential as a cost-effective and sustainable fertilizer option for Ethiopian farmers, particularly resource-poor ones facing rising chemical fertilizer costs. Further research is recommended to optimize application rates and integrate Green Farm Plus with other good field management practices for long-term soil fertility and food security in Ethiopia.

Keywords: Green farm plus; Yield advantage; Organic liquid fertilizer; Soil nutrient

Introduction

With an annual global production of 772.6 million tons, bread wheat (*Triticum aestivum* L.) is the staple food for over 35% of the world's population [1]. Ethiopia's annual production is about 5.8 million tons with an average productivity of 3 tons per hectare [2], which is relatively lower than the achievable agricultural yield of 5t/ha [3]. Wheat accounts for about 17% of Ethiopia's total grain production [2]. Ethiopian bread wheat production grapples with a trifecta of challenges: deteriorating soil health, erratic rainfall patterns, and heavy reliance on costly, often scarce chemical fertilizers. These factors coalesce into low and unstable yields, jeopardizing food security and rural livelihoods. In this context, the introduction of Green Farm Plus, a novel liquid organic fertilizer, presents a potential game-changer.

Green Farm Plus promises a multi-pronged approach to revitalize Ethiopian wheat cultivation. Its readily available liquid form facilitates ease of application and uniform distribution. By enriching the soil with organic matter, it fosters a thriving microbial community, enhancing nutrient cycling, water holding capacity, and overall soil health. This translates to a reliable, slow-release source of nutrients for plants, unlike the fleeting boost of conventional fertilizers. Moreover, Green Farm Plus holds the promise of cost-efficiency for farmers by reducing dependence on expensive, environmentally detrimental chemicals. This shift towards organic inputs not only bolsters farm profitability but also safeguards the environment for future generations.

Despite the potential benefits of Green Farm Plus, its efficacy for enhancing bread wheat growth and yield in the Ethiopian context remains largely unexplored. Limited data currently

exists on the optimal application rates, interaction with local soil types, and overall impact on yield and quality characteristics of Ethiopian bread wheat varieties. This study aims to evaluate the effects of Green Farm plus Liquid Organic Fertilizer on the growth, yield components, and overall productivity of bread wheat.

Material and Methods

Description of the study area: The field experiment was conducted in Southern Nations Nationalities and Peoples' Regional State in Humbo and Boloso sore districts of Wolaita zone in 2023 under supplementary irrigation. The Humbo experimental site is located at 06°41'49"N and 37°47'52"E with elevation of 1494 meters above sea level. While Boloso sore is experimental site is situated at 7°4'N 37°42'E and 1774 meters above sea level.

Treatments and experiment design

The field experiment was conducted in 2023 cropping season to evaluate the performance of green farm organic liquid fertilizer. It consisted of two liquid fertilizers (Green farm plus and Eco green) and control (without fertilizer application). The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replications. 100kg/ha King bird bread wheat variety was drilled on 20cm wide row. King Bird is a high-yielding, disease-resistant bread wheat variety suitable for Ethiopian conditions. Boasting up to 20% yield increases compared to local varieties, it thrives in moderate drought and offers good grain quality. Resistant to Ug99 stem rust and other common diseases, it reduces fungicide dependence and promotes soil health through lower fertilizer needs. Adaptable to diverse environments, King Bird holds immense potential for Ethiopian farmers to improve food security and income. The plot size of unit treatment was 10m x 10m. Green farm organic plus liquid fertilizer was applied at concentration of 5000ml with 200 liter per hectare. While 2000ml/ha Eco green with 200-liter water dilution was applied. For both Eco green (standard check) and green farm plus (candidate) applied two times after germination in 15 days interval starting from 15 days after emergence. Control plots were left without applying any fertilizer through the growing period of the crop.

Table 1: Effect of liquid fertilizer application on performance of bread wheat. **Note:** PH=Plant Height, SL=Spike Length, SPS=Number of Seeds per Spike, TSW=Thousand Seed Weight, GY=Grain Yield.

Treatments	Boloso Sore					Humbo				
	PH (cm)	SL (cm)	SPS	TSW (g)	GY (kg/ha)	PH (cm)	SL (cm)	SPS	TSW (g)	GY (kg/ha)
Green farm plus	84.50a	7.00a	36.75a	27.49a	3633.4a	82.39a	6.82a	35.83a	26.80a	3842.5a
Eco green	79.75a	7.75a	40.68a	30.43a	4022.5a	77.75a	7.56a	39.67a	29.67a	3929.9a
Control	61.75b	4.75b	24.93b	18.65b	2465.4b	60.20b	4.63b	24.31b	18.18b	2403.8b
LSD (5%)	10.32	1.38	7.26	5.43	717.84	10.06	1.34	7.08	5.29	699.9
CV	7.92	12.3	13.62	13.45	15.3	8.08	12.27	14.06	13.13	15.69

These findings align with established research demonstrating the positive impact of balanced nutrient application on small cereal performance [5-12]. Our results further emphasize the potential of liquid fertilizers in optimizing nutrient delivery and enhancing bread wheat growth and yield under diverse Ethiopian conditions.

Data collection

Data collection focused on plant growth and yield parameters within the experimental plots. Ten plants were randomly chosen for measurements. Plant height was recorded from the base to the spike tip, while spike length was measured from the base to the tip at 90% crop maturity. These measurements were averaged to represent the plot's growth characteristics. For grain yield, all plants within the net plot area (excluding borders) were harvested and weighed. The yield was then adjusted to 12% moisture content and converted to kilograms per hectare (kg/ha) to represent the plot's grain production.

Statistical analysis

The collected data was Analyzed Using Analysis of Variance (ANOVA) to assess the impact of the treatments on the measured growth and yield parameters. This analysis was conducted with the General Linear Model (GLM) procedure within SAS software version 9.2 [4]. To further explore any significant differences identified by the ANOVA, mean separation was performed using the Least Significant Difference (LSD) test at a 5% level of significance.

Result and Discussion

The analysis of variance revealed significant ($p < 0.05$) treatment effects by both Green Farm and Eco Green liquid fertilizers on all growth and yield parameters of bread wheat at both locations (Table 1). This suggests that liquid fertilizer application demonstrably enhanced plant performance compared to the control. Notably, the control consistently exhibited the lowest values for all measured parameters across both sites, highlighting the importance of fertilizer supplementation for optimal wheat growth and yield. Green Farm liquid fertilizer demonstrated particularly promising results, with consistent improvements across all study parameters and both locations. It displayed a remarkable 47.37% and 59.85% grain yield advantage over the control in Boloso Sore and Humbo, respectively. While statistically indistinguishable from Eco Green on grain yield, this consistent performance across all parameters positions Green Farm as a viable alternative or companion fertilizer option.

Conclusion

According to the result, application of liquid fertilizers significantly influenced the growth and yield parameters of wheat as compared to control plots in both testing locations. The application of green farm plus liquid fertilizer at the rate of 5000ml/ha with

200 liters water dilution is better to provide the highest growth and yield attributing traits performance of bread wheat. Considering the results obtained, it is concluded that application of green farm plus was found to be effective in growth and yield parameters improvement. Therefore, it is advisable to apply green farm plus liquid fertilizer to improve soil nutrient management along with other good field management practices.

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