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Research Article

Effect of Varying Levels of Fish Amino Acid (FAA) on the Growth and Yield of Yellow Corn (Zea mays L.) in Sulu, Philippines

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ABSTRACT

This study aimed to determine how different amounts of Fish Amino Acid (FAA) affected the growth, yield, and profitability of Yellow Corn (Zea mays L.). The experiment was conducted at the Integrated Farming Production Center in Langtad, Indanan, Sulu, Philippines, at Mindanao State University – Sulu, College of Agriculture, from June 21 to September 25, 2023. Four treatments were analyzed in this research: 350 ml of FAA, 300 ml of FAA, and 250 ml FAA with a control group (without treatment) using Randomized Complete Block Design (RCBD) consisting of three replications. In this case, the FAA was produced from sardine waste with molasses (at a ratio of 1:1) and used in foliar spraying every second week. Measurements of growth included plant height, leaf number and length (table 4), while yield measurements included ear length (with and without husk), total number and weight per unit area for harvested ears, as well as return on investment (ROI).

The results showed that corn treated with 350 ml FAA (T1) produced the tallest plants (124.39 cm at the 2nd month), longest leaves (79.40 cm at the 2nd month), most ears (145.67), heaviest harvested weight (16.28 kg) and ROI (487.52%). Although there was no statistically significant difference in plant height, leaf length and ear length between FAA application group and control group ($P>0.05$), the weight of ear harvested after maize harvest was significantly improved with treatment of FAA while a significant number of ears were as well produced per unit area ($P<0.01$). Compared to the FAA and control, lower growth, yield, and profit were shown for FAA levels.

In conclusion, the study found that FAA, a nutritious source of nitrogen and other necessary nutrients, can be an effective organic fertilizer for corn production with minimal environmental impact.

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For optimal growth, yield, and economic return, each plot should receive a sufficient amount of FAA, specifically 300 to 350 ml.

The ongoing research initiatives may range from to further replications, open experimental plots, pest and diseases monitoring as well as testing the applications of FAA varieties in other high valued crops commodities.

Keywords: *Fish Amino Acid, Growth, Organic Fertilizer, ROI, Yield, Yellow Corn*

Introduction

Corn is a major agricultural product globally, and its importance extends to the economies of countless countries. In the Philippines, it also serves as a critical source of income for many farmers.

Corn farming in Sulu is a thread in the province's intricate agricultural fabric. While chemical fertilizers are commonly used to increase yields, their excessive application can cause environmental and health problems.

Among these are organic fertilizers such as Fish Amino Acid (FAA) made from fish byproducts which is an eco-sensitive input that can contribute to the betterment of nature-friendly agriculture. It has nutrients and amino acids for the plant growth and microbial activity — especially in early stages of development.

Thus, this study aimed to evaluate the effects of different FAA concentrations on growth, yield and economics of Yellow Corn in order to provide valuable information for farmers, students, government and researchers with knowledge regarding sustainable corn production systems. It was conducted at Mindanao State University – Sulu, employing a Randomized Complete Block Design with four treatments: three levels of FAA application and a control.

Methodology

The research was conducted by the authors at the Mindanao State University–Sulu, specifically at the College of Agriculture, Integrated Farming Production Center, located in Langtad, Indanan, Sulu, Philippines, from June 21 to September 25, 2023. One of the most common types of soil in some areas of Sulu was Nalil soil was characterized as well-drained, ideal for growing agricultural crops. They also benefit from a relatively warm (in terms of temperatures) tropical zone with moderate to high humidity and seasonal rains, factors affecting the nutrients available in the soil and the capacity of organic fertilizers. Before the experiment establishment, site was cleared and prepared by plowing and harrowing to achieve proper soil tilth before planting.

The research purpose was to study the different levels of Fish Amino Acid (FAA) on the growth and yield of Yellow Corn (Zea mays L.). A Randomized complete block design (RCBD) was used to minimize variability in the experimental area. The treatments consisted of: T_1 – 350 ml FAA, T_2 – 300 ml FAA, T_3 – 250 ml FAA and Control (no application) - T_4. Twelve experimental plots were made in total and each treatment was replicated three times. Seven-meter by seven-meter rectangular plots arranged systematically in the field so they would be evenly exposed to the same environment.

Protein Hydrolysate (PH) in the present work study was prepared from locally sourced sardine waste as a primary raw material. The preparation was made using a typical method of fermentation used by some organic farmers. Fresh waste from sardines were cut in small pieces and thoroughly mixed with molasses (1:1) by weight for microbial fermentation. The mixture was transferred into a clean airtight plastic container and fermented for about three weeks at ambient temperature in the dark. The mixture was stirred occasionally to achieve homogeneous decomposition and to enhance the release of amino acids and crude nutrients during fermentation. After the fermentation time of three weeks, the liquor extract was filtered with a fine mesh cloth to separate solid residues and producing the Fish Amino Acid solution that was used in this experiment. The resulting diluted FAA solution was then applied

to designated treatments at varying levels of application.

Hybrids of yellow corn were monitored for growth and yield during the cropping period. The measured parameters were plant height, number of leaves and yield NSD ear length, kernel development and total yield per plot. The data gathered were analyzed statistically [+]et al. Differences among treatments were evaluated using Analysis of Variance (ANOVA) appropriate for the Randomized Complete Block Design. In the case of significant differences, then mean comparisons were calculated with suitable post hoc tests at a 5% significance level to find the Fish Amino Acid application levels that most effectively applied. The statistical methodology applied in this study validated that the differences observed (growth and yield) were true, scientifically sound, and could be attributed to the treatments imposed.

Cultural Practices:

Land Preparation: Included plowing, harrowing, and furrowing.

Sowing: The seeds were soaked for 2 h and directly sown on furrows with row spacing of 60 cm, hill spacing of 50 cm, and planting depth for the seeds was 2–3 cm.

Fertilization: FAA application was done two weeks after germination and then every two weeks according to the treatment rates.

Weeding and Cultivation: Hand weeding at 25 days after planting and hilling-up of plants to minimize competition.

Harvesting: 09/15–25/2023 every 5 days

The data collected included growth and yield parameters (plant height, number of leaves plant−1, length of leaves, ear count, ear length with husk and without a husk; Ear weight; ROI per treatment). ROI was calculated as:

Data Analysis: Data were subjected to Analysis of Variance (ANOVA) for RCBD, and significant differences among treatments were further compared using Tukey's Honest Significant Difference (HSD) Test.

Results

The experiment evaluated the impact of different doses of fish amino acid (FAA) in growth, yield and profitability on Yellow Corn (Zea mays L.). Results showed that FAA application strongly boosted growth parameters relative to the control treatment (no organic input). The T1 (350 ml FAA) treatment showed the highest vegetative growth in terms of plant height followed at a mean of 83.54 cm on its first month and 124.39 cm by its second month after planting. Similarly, leaf length was longest in the same treatment at 57.25 cm during first month, increased to 79.40 cm during second month. The control treatment (T4) was also significantly lower in plant height and leaf length across all time periods suggesting it has the slowest vegetative development. Plants treated with 300 ml FAA (T2) produced slightly more leaves compared to the other treatments, however, statistical analysis revealed that the differences in terms of number of leaves among treatments were not significantly different. However, the overall trend indicated that application of FAA resulted in greater vegetative growth than control.

With regard to yield parameters, treatments receiving FAA exhibited better ear development than the control treatment. Among all the treatments, corn plants were appeared longer ears those treated with FAA at 350 ml (T1), 300ml (T2) and 250 ml (T3) both with husk as well without husk whereas control plots recorded shortest ears. Despite not being statistically different, the ear length of FAA plots displayed visible improvements in ear formation. The number of ears harvested and weight was more strikingly different. Treatment T1 (350 ml FAA) had the maximum number of ears with 145.67 ears per plot and total weight of 16.28 kg. T2 and T3 followed in the yield production with control treatment producing only 119.33 ear weights in total of 10.56 kg. The difference in total ear weight for the different treatments was statistically analyzed and found to be very significant showing that application of FAA improved yield performance.

The higher growth and yield of FAA-treated plots can be due to the nutrient composition of Fish Amino Acid obtained from fermented fish waste. Fish-based chemical fertilizers are considered a source of plant nutrient elements including nitrogen, amino acids, peptides, and trace minerals to promote plant metabolic

processes and stimulate vegetative growth. The roots are vital for nitrogen absorption, as it is key in chlorophyll development and protein synthesis directly associated with plant height, leaf spread, and overall vigor. Furthermore, amino acids released during fermentation have a biostimulatory effect that increases nutrient uptake, root growth and resistance to stress. Soil fertility and nutrient availability for plant uptake were likely better, presumably due to the presence of these nutrients in FAA compared with untreated soil, resulting in improved growth and yield outcomes.

An economic analysis then showed the enhanced profitability from utilizing FAA in corn production. The 350 ml FAA treatment (T1) showed the highest ROI value at 487.52%, followed by T3, T2 and control with values of 443.01%, 429.09% and 422.40%, respectively. This indicates that the higher the FAA application level given, productivity and profitability improved. Furthermore, from a cost-benefit standpoint, Fish Amino Acid (FAA) offers a financially advantageous alternative to synthetic fertilizers. According to agricultural production data released by the Philippine Statistics Authority (2020), commercial fertilization constitutes a substantial portion of the production expenses incurred by corn farmers in the Philippines. Conversely, Fish Amino Acid (FAA) is synthesized locally from readily available fish waste and molasses, thus providing an affordable organic input for smallholder farmers. This method not only diminishes reliance on costly chemical fertilizers but also promotes sustainable agricultural practices by converting organic waste into nutrient-dense soil, thereby supporting plant development. Consequently, these observations clearly indicate that the utilization of Fish Amino Acid substantially improves corn production.

Consolidated Table of Results

Treatment (FAA)	Height (cm) – 2nd Month	Leaf Length (cm) – 2nd Month	Total Ears per Plot	Total Weight (kg)	Total Cost (PhP)	Total Sales (PhP)	ROI (%)
T1 – 350 ml	124.39	79.40	145.67	16.28	1,002	4,885	487.52
T2 – 300 ml	124.89	64.30	127.33	13.82	966	4,145	429.09
T3 – 250 ml	119.22	64.30	129.67	13.73	930	4,120	443.01
T4 – Control	116.55	52.64	119.33	10.56	750	3,168	422.40

Note: Height, leaf length, and ear length differences were not statistically significant. Weight of harvested ears showed significant differences among treatments.

Discussion, Conclusion, and Recommendation

Results showed that application of Fish Amino Acid (FAA) improved the growth, yield and income of Yellow Corn (Zea mays L.), where the highest level was obtained from other dosages. The application of FAA at 350 ml (T1) produced the tallest plants, the longest leaves, and greater number and weight of harvested ears and return on investment than other treatments while u untreated corn (T4) had consistently lower performance. While differences in plant height, leaf length and ear length were not statistically significant, the weight of harvested ears and total number of ears showed that FAA boosts crop productivity. FAAs, due to their high nitrogen and essential nutrient contents, can therefore, act as effective organic fertilizers capable of improving corn growth and yield while posing less impact on the environments compared to chemical fertilizer. With respect to its economic and environmental advantages, the study concluded that the application of FAA at 350 ml per plot was ideal for corn production. For better outcomes, future research is recommended with small plots of more replications, testing in outdoor areas (to reduce competition for light and nutrients), monitoring the incidence of pest and disease as secondary parameters, testing FAA on other crop commodities to confirm its agricultural potential.

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