

FOLIAR APPLICATION OF ALPHA-NAPHTHALENE ACETIC ACID (ANAA) AND INORGANIC FERTILIZER ON YIELD AND YIELD COMPONENTS OF VISAYAN WHITE CORN AT HORTICULTURAL MATURITY

Jonalou Gollas Maquigod

Kapalong College of Agriculture, Sciences and Technology
jonaloumaquigod@gmail.com

Ruel Baquino Toredez

Kapalong College of Agriculture, Sciences and Technology
rtoredez@gmail.com

ABSTRACT

Research on optimizing the use of fertilizers and plant growth regulators has become essential in the quest to increase agricultural output. The native Philippine maize variety known as Visayan white corn, or *Tinigib*, offers a chance to investigate these developments. Improper application techniques for growth regulators and inadequate fertilizer frequently make it difficult for farmers to maximize productivity. The challenge is finding the exact mixtures and dosages that can greatly improve crop production without suffering from negative side effects. This study aims to address this gap by evaluating the effect of foliar application of alpha-naphthalene acetic acid (ANAA) combined with inorganic fertilizer on the yield and yield attributes of Visayan white corn at horticultural maturity, employing a randomized complete block design with five (5) treatment and (3) replications. Results revealed that Treatment no. 2, composed of 20 ml ANAA and RR NPK, was concluded to yield the highest corn output, showcasing the efficacy of combining ANAA with inorganic fertilizer to enhance yield.

Keywords: alpha-naphthalene acetic acid (ANAA), foliar, horticultural maturity, inorganic, *tinigib*

INTRODUCTION

Rice, white corn, *saba*, sweet potato, and cassava are staple foods in the Philippines, with white corn being particularly important in the Visayas and Mindanao regions. Among cereals, maize (*Zea mays* L.) holds significant production potential and ranks as the third-largest crop globally, after rice and wheat (Muthukumar et al., 2005). In India, maize is cultivated across 9.22 million hectares, yielding 28.72 million tons with a productivity rate of 3.115 kg/ha (Rao et al., 2021). As a source of calories, vitamins, and minerals, maize is crucial for food security. Visayan white corn, harvested at horticultural maturity, has tender, sweet, and light-colored kernels used for various culinary purposes (Moreau, 2011).

However, the productivity of white corn in the Philippines faces challenges due to ineffective fertilizer management and the adverse effects of climate change. Many local farmers lack access to modern agricultural techniques, resulting in low yields and poor-quality crops. This was mentioned by Gezie and Tejada Moral, 2019 the major obstacles include poor soil quality, land degradation, reliance on rainfall, restricted availability to high-quality seeds and fertilizers, low income, a lack of funding, and inadequate policies, in addition, weather extremes like drought and severe rains brought on by climate (Tessema & Simane, 2019).

Traditional farming practices, combined with 'the overuse of artificial fertilizers, have exacerbated environmental degradation and hindered sustainable agricultural development. Inadequate fertilization and lack of growth regulators, such as foliar feeding, further contribute to these issues.

One promising solution lies in the use of plant growth regulators, such as alpha-naphthalene acetic acid (ANAA), which has shown potential in enhancing nutrient uptake, stimulating plant growth, and improving reproductive processes, such as flowering and fruiting (Rao et al., 2021). The application of ANAA, when combined with inorganic fertilizers, could potentially improve the growth and yield quality of Visayan white corn, offering a more sustainable farming approach. This aligns with the United Nations' Sustainable Development Goals (SDGs), particularly SDGs 2 (Zero Hunger), 12 (Responsible Consumption and Production), and 13 (Climate Action).

While past studies, like Rao et al. (2021), showed that applying NAA and nitrogen can improve baby corn growth and yield, there is still little research on how foliar ANAA and inorganic fertilizers affect **Visayan white corn**. Most research focuses on hybrid or sweet corn, not on traditional varieties like white corn in the Philippines. This seeks (1) determine the effects of ANAA plus inorganic fertilizers on growth and yield, (2) identify the most effective treatment, and (3) assess the economic profitability of the treatments. This research intends to contribute valuable insights into improving crop productivity and supporting sustainable agricultural practices in the Philippines.

METHODOLOGY

Location and Duration of the Study. This experimental quantitative study was conducted at Sitio Patel, Gupitan, Kapalong, Davao del Norte, from February to June 2024. The province of Davao Del Norte, located in the Davao Region of Mindanao, experiences an average annual temperature of 26.7°C and a precipitation of approximately 2,282 mm, which aligns with the climatic conditions required by the crop featured in this study.

Experimental Design. This study was an experimental quantitative research study in a randomized complete block design (RCBD) that assessed the effects of foliar application of ANAA combined with inorganic fertilizer on the yield and yield components of Visayan white corn. The experimental area measured 270 m² and was divided into 15 plots/blocks, replicated three times. Within each block, five treatment plots were allocated, with each plot measuring 3 m by 4 m. The five treatments were as follows:

T1- No Application (control group)

T2- 10 ml ANAA + RR NPK (inorganic fertilizer)

- T3- 20 ml ANAA + RR NPK
- T4- 30 ml ANAA + RR NPK
- T5- RR NPK + ANAA (ratio not specified)

Soil Analysis. Soil samples were collected using an "X" pattern from the experimental site. These samples were analyzed at the Regional Soil Testing Laboratory of the Department of Agriculture, Regional Field Office Agdao, Davao City, to determine the nitrogen, phosphorus, potassium, and pH contents of the soil. The result shows that the soil pH is moderately acidic at 5.6. The recommended fertilizer rate for NPK is 60-60-60. The application rates are as follows: 600 g/plot of compost, 1.5 tons of lime, 90 g/plot of urea, 900 g/plot of duofos, 120 g/plot of muriate of potash, and 510 g/plot of complete fertilizer. On application, if compost is available. Apply the minimum amount of the recommended inorganic fertilizer. Apply composed manure/vermicompost with 5% NPK. Incorporate lime into the soil, half to 1 month before planting at the rate of 1-2 tons per hectare.

Planting and Fertilization. The area was plowed and harrowed thoroughly to prepare the soil. Visayan white corn seeds were planted at a rate of two seeds per hill, at a depth of 12 cm, with a spacing of 30 cm by 50 cm between hills. Fertilizer application was based on the soil analysis results. The first application included phosphate, potash, and half of the nitrogen fertilizer, applied in a band 2 in. to the side and 2 in. below the seed during planting. The remaining nitrogen fertilizer was applied when the plants reached knee-high (i.e., 12–19 in.) at 4 weeks after planting.

Watering and Maintenance. Watering was done manually using a sprinkler, ensuring minimal soil disturbance. Hand-pulling and mechanical tools, such as grass hooks and *bolo*, were used to control weeds and prevent competition for resources.

Harvesting. Corn was harvested after 72 days, 6:00 am in the morning during the horticultural maturity stage by pulling the ears firmly from the stem. During the postharvest phase, ears were sorted and husked, and silks were removed for better storage.

Data Gathered

Plant Height. Measurement of plant height was obtained in every 15, 30, 45, 60 days, and at harvest of per plot for each treatment. Plant height was measured from the base of the plant to the tip of the highest functional leaf using a ruler or a meter stick.

Number of Days to Tasseling. This data was measured by counting the number of days when 50% of the experimental plants per plot produced a tassel.

Number of Days to Silking. This data was obtained by counting the number of days when 50% of the experimental plants per plot produced silk.

Number of Ears. This data was obtained by counting the number of corn ears of 10 randomly selected corn plants per plot.

Ear Length. This data was obtained by measuring the corn ears of 10 randomly selected corn plants per plot. Measurement was done from the tip of the corn ear up to the lace. This data is measured in centimeters using a tape measure or a ruler.

Ear Diameter. This data was obtained in centimeters by using a caliper of 10 randomly selected corn plants per plot.

Weigh per Ear. This data was obtained by weighing the corn ears of 10 randomly selected corn plants per plot, using a digital weighting scale.

Yield without the Husk (kg/area). This data was obtained by weighing the total yield with the husk and the total yield without the husk of the harvested plants per plot using a digital weighing scale. This data was converted to a tons-per-hectare basis using the formula below:

$$\text{Yield (t/ha)} = \frac{\text{Fruit Yield (kg)} \times 10,000\text{m}^2/1 \text{ ton}}{\text{Area size (m}^2\text{)} \times 1\text{ha}/1000 \text{ kg}}$$

Economic Analysis. The Return of Production Cost (PRC) on the performance of corn was determined by dividing net income by the total cost of production times 100, which is mathematically expressed in the formula below:

$$\text{RPC (\%)} = \frac{\text{Net Income}}{\text{Total Expenses}} \times 100$$

Statistical Analysis. All data were subjected to statistical analysis using the analysis of variance (ANOVA) with a 5% level of significance to test for significant differences between treatments. The means of significantly different treatments were compared using the honest significant difference (HSD) test.

RESULTS

Plant Height

Table 1 shows the data on the plant height of Visayan white corn as influenced by ANAA plus inorganic fertilizer.

Table 1

Plant Height of Visayan White Corn as Influenced by ANAA Plus Inorganic Fertilizer

Treatment	Days After Planting (cm)				At Harvest
	15	30	45	60	
T1- (Control)	15.70 ^b	26.70 ^b	72.50 ^b	161.83 ^c	210.97
T2- 10 ml ANAA + RR NPK	16.20 ^a	30.30 ^a	87.60 ^a	194.50 ^a	216.73
T3- 20 ml + RR NPK	15.90 ^a	29.60 ^a	80.70 ^a	183.30 ^b	214.63
T4- 30 ml + RR NPK	16.00 ^a	29.40 ^a	84.40 ^a	184.30 ^b	212.33
T5- RR ANAA	15.90 ^a	29.10 ^a	82.30 ^a	184.13 ^b	203.50

CV. (%)	8.80	3.88	4.60	0.34	1.41
F-test	*	*	*	**	**

Note: Means having the same letter are not significantly different at 5% level of significance using HSD.

Results showed that at 15, 30, 45, and 60 days after planting (DAP), plants treated with ANAA and RR NPK which stand for recommended rate of nitrogen, phosphorus, and potassium (NPK) fertilizer (T2, T3, T4) grew significantly taller than the control group (T1), with T2 (10ml ANAA + RR NPK) having the highest height. By 45 DAP, all treatments except the control group showed improved plant height, with T2 still leading. At 60 DAP, T2 (10ml ANAA + RR NPK) was recorded to have the tallest average plant height, while T1 (control group) had the shortest. Moreover, by harvest time, there were significant differences among treatments, indicating that the early growth benefits persisted through to the final stage. The findings suggest that ANAA combined with the recommended rate (RR) of NPK enhances early and mid-growth stages, and its effect on plant height remains significant up to harvest.

Number of Days to Silking

Table 2 shows the data on the days to silking of Visayan white corn as influenced by ANAA plus inorganic fertilizer.

Table 2

Days To Silking of Visayan White Corn as Influenced by ANAA Plus Inorganic Fertilizer

Treatment	Replication			Mean*
	I	II	III	
T1- (Control)	45.00	45.00	45.00	45.00 ^c
T2- 10 ml ANAA + RR NPK	44.00	44.00	45.00	44.33 ^b
T3- 20 ml ANAA + RR NPK	43.00	44.00	43.00	43.66 ^a
T4- 30 ml ANAA + RR NPK	45.00	45.00	45.00	45.00 ^c
T5- RR ANAA	44.00	45.00	44.00	44.33 ^b

CV. (%) = 4.19

F-test: Significant

Note: Means having the same letter are not significantly different at 5% level of significance using HSD.

The number of days to silking of the Visayan white corn was affected using ANAA plus inorganic fertilizer. T1 (control) took the longest to silk, averaging 45 days. Among the treatments, T3 (20 mL ANAA + RR NPK) had the shortest silking time at 43.66 days, showing a faster silk emergence. Treatments T2 (10 mL ANAA + RR NPK) and T5 (RR ANAA) had similar silking periods of 44.33 days, while T4 (30 mL ANAA + RR NPK) had the same silking time as the control group at 45.00 days. Statistical analysis showed significant differences among treatments where T3 was noticeably different among the treatments. This suggests that applying 20 mL ANAA + RR NPK (T3) would speed up silking, while a higher ANAA level (30 mL) did not have the same effect. The results indicate that the amount of ANAA used influences the timing of silking in the Visayan white corn.

Number of Days to Tasseling

Table 3 shows the data on the number of days to tasseling of Visayan white corn as influenced by ANAA plus inorganic fertilizer.

Table 3

Number of Days to Tasseling of Visayan White Corn as Influenced by ANAA Plus Inorganic Fertilizer

Treatment	Replication			Mean*
	I	II	III	
T1- (Control)	55.00	54.00	55.00	54.66 ^c
T2- 10 ml ANAA + RR NPK	55.00	50.00	55.00	53.33 ^b
T3- 20 ml ANAA + RR NPK	50.00	54.00	53.00	52.33 ^a
T4- 30 ml ANAA + RR NPK	55.00	54.00	54.00	54.33 ^c
T5- RR ANAA	55.00	52.00	54.00	53.66 ^b

CV. (%) = 3.33

F-test: Significant

Note: Means having the same letter are not significantly different at 5% level of significance using HSD.

The control group (T1) had an average of 54.66 days to tasseling. Treatments T2 and T5, with mean scores of 53.33 and 53.66 days, respectively, showed a slight reduction in terms of the days to tassel compared to the control group. The most effective treatment was T3 (20 ml ANAA + RR NPK), which resulted in the lowest mean score of 52.33 days. Increasing the ANAA concentration to 30 ml in T4 did not further reduce the days to tasseling, with a mean of 54.33 days, similar to the control group. Statistical analysis showed a significant F-test, and the HSD test revealed that T3 was significantly different from the control and T4. Treatments T2 and T5 were also significantly different from the control and T4.

Corn Ear Length

Table 4 shows the data on the corn ear length of Visayan white corn as influenced by ANAA plus inorganic fertilizer.

Table 4

Corn Ear Length of Visayan White Corn as Influenced by ANAA Plus Inorganic Fertilizer

Treatment	Replication			Mean*
	I	II	III	
T1- (Control)	12.50	11.80	11.70	12.00 ^b
T2- 10 ml ANAA + RR NPK	12.80	13.10	12.10	12.70 ^a
T3- 20 ml ANAA + RR NPK	13.50	12.60	12.90	13.00 ^a
T4- 30 ml ANAA + RR NPK	12.20	12.10	12.90	12.40 ^a
T5- RR ANAA	12.80	12.10	12.40	12.40 ^a

CV. (%) = 4.09

F-test: Significant

Note: Means having the same letter are not significantly different at 5% level of significance using HSD.

The control group (T1) exhibited the shortest average ear length at 12.00 cm. All other treatments (T2, T3, T4, and T5) showed increased ear length compared to the control group. The longest average ear length (13.00 cm) was observed in the T3 treatment (20 ml ANAA + RR NPK). Treatments T2 (10 ml ANAA + RR NPK) and T5 (RR ANAA) had average ear lengths of 12.70 cm and 12.40 cm, respectively, while T4 (30 ml ANAA + RR NPK) resulted in an average ear length of 12.40 cm. Statistical analysis revealed a significant F-test, and HSD testing indicated that the control group was significantly different from all the other treatments.

Corn Ear Diameter

Table 5 shows the data on the ear diameter of Visayan white corn as influenced by ANAA plus inorganic fertilizer.

Table 5

Ear Diameter of Visayan White Corn as Influenced by ANAA Plus Inorganic Fertilizer

Treatment	Replication			Mean*
	I	II	III	
T1- (Control)	4.01	4.14	4.04	4.06 ^c
T2-10 ml ANAA + RR NPK	4.22	4.10	4.30	4.21 ^a
T3- 20 ml + RR NPK	4.32	4.33	4.14	4.26 ^a
T4-30 ml + RR NPK	4.01	4.30	4.22	4.18 ^b
T5- RR+ ANAA	4.13	4.14	4.09	4.12 ^b
CV. (%) = 12.20				
F-test: Significant				

Note: Means having the same letter are not significantly different at 5% level of significance using HSD.

Table 5 presents the effects of ANAA plus inorganic fertilizer on the ear diameter of the Visayan white corn. The control group (T1) had the smallest average ear diameter of 4.06 cm. All treatments with ANAA and/or fertilizer showed increased ear diameter compared to the control group. The largest average ear diameters were observed in T2 (10 ml ANAA + RR NPK) and T3 (20 ml ANAA + RR NPK), with values of 4.21 cm and 4.26 cm, respectively. Treatments T4 (30 ml ANAA + RR NPK) and T5 (RR + ANAA) had average ear diameters of 4.18 cm and 4.12 cm, respectively. Statistical analysis showed a significant F-test, and HSD testing indicated that the control group was significantly different from all the other treatments. T2 and T3 were significantly different from T1, T4, and T5.

Corn Weight per Ear

Table 6 shows the data on the weight of ear of Visayan white corn as influenced by ANAA plus inorganic fertilizer.

The experiment included a control group (T1), varying concentrations of ANAA with RR NPK (T2: 10ml, T3: 20ml, T4: 30ml), and RR ANAA alone (T5), with each treatment replicated three times. The control group (T1) had the lowest average ear weight of 56.33g. All the other treatments showed an increase in average ear weight. Treatments T2 (10 ml ANAA + RR NPK) and T3 (20 ml ANAA + RR NPK) had the highest average weights, 75.00 g and 75.33 g, respectively. Treatment

T4 (30 ml ANAA + RR NPK) resulted in an average weight of 74.00 g, while T5 (RR ANAA) had an average weight of 66.00 g. Statistical analysis using a significant F-test and HSD testing showed that the control group was significantly different from all other treatments.

Table 6

Weight per Ear of Visayan White Corn as Influenced by ANAA Plus Inorganic Fertilizer

Treatment	Replication			Mean*
	I	II	III	
T1- (Control)	54.00	60.00	55.00	56.30 ^b
T2- 10 ml ANAA + RR NPK	72.00	76.00	77.00	75.00 ^a
T3- 20 ml ANAA + RR NPK	76.00	75.00	75.00	75.33 ^a
T4- 30 ml ANAA + RR NPK	77.00	72.00	75.00	74.00 ^a
T5- RR ANAA	67.00	70.00	61.00	66.00 ^a

CV. (%) = 4.09

F-test: Significant

Note: Means having the same letter are not significantly different at 5% level of significance using HSD.

Results revealed a significant difference between fertilized and unfertilized corn plants. It was also observed that there were no significant differences among the other treatments, which included T2, T3, T4, and T5. This was the case despite the observed variations in average weights. The coefficient of variation for the experiment was 4.09%.

Yield without the Husk (t/ha)

Table 7 shows the data on the yield without the husk of Visayan white corn as influenced by ANAA plus inorganic fertilizer.

Table 7

Yield without the Husk of Visayan White Corn as Influenced by ANAA Plus Inorganic Fertilizer

Treatment	Replication			Mean*
	I	II	III	
T1- (Control)	5.63	5.83	4.31	5.26 ^c
T2- 10 ml ANAA + RR NPK	8.04	11.56	19.82	10.86 ^a
T3- 20 ml ANAA + RR NPK	8.11	11.65	11.62	11.03 ^a
T4- 30 ml ANAA + RR NPK	11.52	8.99	8.72	9.76 ^b
T5- RR ANAA	7.35	8.15	8.30	7.93 ^{bc}

CV. (%) = 10.08

F-test: Significant

Note: Means having the same letter are not significantly different at 5% level of significance using HSD.

The control group (T1) exhibited the lowest average yield without the husk, at 5.26 t. Treatments T2 (10 ml ANAA + RR NPK) and T3 (20 ml ANAA + RR NPK) produced the highest average yields, 10.86 t and 11.03 t, respectively. Treatment T4 (30 ml ANAA + RR NPK) resulted in an average yield of 9.76 t, while T5 (RR ANAA) had an average yield of 7.93 t. Statistical analysis, using a significant F-test and HSD testing, revealed that the control group was significantly different from all other treatments. Treatments T2 and T3 were not significantly different from each other but were significantly different from all other treatments. T4 was significantly different from both T2 and T3, as the control group or T1. T5 was not significantly different from T4, nor was it significantly different from the control.

Economic Analysis

Table 8 shows the economic analysis of Visayan white corn as influenced by AANA plus inorganic fertilizer.

Table 8

Cost and Return Analysis of ANAA combined with RR NPK on the Yield and Yield Attributes of Visayan White Corn

	T1	T2	T3	T4	T5
Yield (t/ha)	5.26	10.86	11.03	9.76	7.93
Total Expenses	47,500	55,950	56,400	56,850	50,450
Gross Income	184,100	380,100	386,050	341,600	277,550
Net Income	136,600	324,150	329,650	284,750	227,100
RPC%	286.53	576.36	584.48	500.88	450.15

Treatment with 20ml ANAA + RR NPK (T3) recorded the highest yield at 11.03 t/ha followed by the treatment with 10ml ANAA + RR NPK (T2) at 10.86 t/ha, while control treatment (T1) obtained the lowest yield value of 5.26 t/ha, implying that the application of ANAA and RR NPK considerably boosted production of maize. In terms of profitability, T3 had the highest net income (₱329,650) and return per cost (584.48%), making it the most cost-effective treatment. T2 also performed well, with a net income of ₱324,150 and an RPC of 576.36%. Meanwhile, the control treatment (T1) had the lowest net income (₱136,600) and RPC (286.53%), showing poor economic returns. Treatments T4 (30ml ANAA + RR NPK) and T5 (RR ANAA alone) had moderate results, but they were less profitable than T2 and T3.

T3 (20ml ANAA + RR NPK) proved to be the best treatment for increasing both yield and income, followed by T2 (10ml ANAA + RR NPK). The study confirms that applying ANAA with RR NPK is beneficial for improving the yield and profitability of Visayan white corn.

DISCUSSION

Plant Height

Plants with ANAA and RR NPK were significantly different from unfertilized plants. T2 with 10ml ANAA and RR NPK obtained the tallest plant height upon measurement several days after planting, measuring 16.20 cm, 30.30 cm, and 87.80 cm, respectively. According to Pangaribuan (2019), corn plants treated with 10 ml of ANAA and NPK fertilizer showed a significant improvement in plant height when compared to the control group. The application of these substances together stimulated more robust vegetative growth of the stem and foliage of corn plants. This was evident through the taller stature and overall healthier appearance of the treated plants, indicating that the combination of ANAA and NPK fertilizer effectively enhanced the growth and development of the corn plants. Improved plant height from NAA application may be due to the loosening of cell walls, which allows for more cell division and elongation, especially with the help of natural gibberellins. It may also be due to the increased availability of nitrogen, which supports plant growth during all stages of development of corn (Muthukumar et al., 2005). Together, these treatments result in significant improvements in both plant height and overall growth, demonstrating the synergistic effect of using both ANAA and NPK fertilizer in corn cultivation.

Number of Days to Silking

ANOVA results revealed a significant difference among treatment mean scores. T3 with 20 ml ANA A plus RR NPK made the crop the earliest to produce silk, and this one is comparable to other treatments tested. This was confirmed by Sudding (2019), who found that corn plants treated with 20 ml of ANAA and NPK fertilizer showed a substantial increase in plant height, with an average corn silking increase of 25-30 % compared to the untreated control group. This significant growth enhancement indicates that the NPK promotes cell elongation, and NPK fertilizer, which provides essential nutrients, effectively stimulates more vigorous vegetative growth. Besides, Khalofah (2020) stated that NPK fertilizer accelerated the overall growth rate of the corn plants, leading to earlier developmental milestones, including the silking stage. This rapid growth indicates that the treatment effectively enhances the physiological processes involved in plant development. The NPK acting as a synthetic growth hormone, stimulates cell division and elongation that support various growth functions. As a result, the plants develop more quickly, reaching critical stages such as silking, the period when the female flowers are ready for pollination sooner than those in the untreated control group.

Number of Days to Tasseling

The analysis of variance revealed a significant difference. T3 showed an average of 52.33 days to tasseling, making it the earliest to produce a tassel and significantly different among the treatments. These variations in tasseling times across the different treatments highlight the diverse effects that ANAA combined with inorganic fertilizers can have on the growth stages of Visayan white corn. According to Aribel (2020), corn plants treated with 10 ml of ANAA and NPK fertilizer reached the tasseling stage significantly earlier than those in the untreated control group, with an average reduction of 5-8 days. The application of ANAA, a synthetic plant hormone, likely accelerated cell division and growth processes, while the NPK fertilizer provided essential nutrients needed for robust development. This combination enhanced the overall growth rate of the plants, enabling them to reach the tasseling stage more quickly. This earlier transition not only indicates improved plant vigor

and health but also suggests potential benefits for crop scheduling and management, as it allows for a timelier and possibly more uniform pollination period.

Corn Ear Length

Results revealed that T3 (20 ml ANAA + RR NPK) obtained the highest average mean on length per ear and was significantly different from control plants. Results showed that the length per ear of Visayan white corn was affected by ANAA plus inorganic fertilizer. The result was aligned to the claim of Canaso (2019) in which it was found that the corn plants treated with 20 ml of RR NPK (i.e., a specific formulation of NPK fertilizer) exhibited a significant increase in corn ear length compared to the control group. This notable improvement in ear length indicates the effectiveness of the treatment in enhancing the reproductive development of the corn plants. The higher concentration of these nutrients likely promotes healthier and more vigorous ear growth, resulting in longer ears. This increase in ear length not only suggests improved yield potential but also reflects the overall health and vitality of the treated plants. Consequently, the application of 20 ml of RR NPK fertilizer can be considered an effective strategy for maximizing corn yield and quality. In consonance to the result of the study conducted by Wei (2022), it was found that the combined treatment facilitated greater kernel development within the ears, contributing to the observed increase in corn ear length. This enhancement in kernel development can be attributed to the synergistic effect of RR NPK fertilizer and other growth-promoting substances present in the treatment.

Moreover, Curin (2022) stated that the 20 ml of ANAA and RR NPK treatment facilitated greater corn kernel development within the ears, contributing to the observed increase in ear length. This enhancement in kernel development can be attributed to the synergistic effect of RR NPK fertilizer and other growth-promoting substances present in the treatment. Additionally, other components of the treatment may contribute to improved nutrient uptake and utilization by the plants, further supporting kernel growth. As a result, the ears of corn plants treated with the combined treatment exhibit more robust and densely packed kernels, leading to an increase in overall ear length. This indicates not only improved yield potential but also higher quality kernels, which are essential for various industrial and culinary purposes.

Corn Ear Diameter

Results showed that T3 (20 ml ANAA + RR NPK) obtained the highest average mean on ear diameter and was significantly different from T1, T4, and T5. Results showed that the ear diameter of Visayan white corn was affected by ANAA plus inorganic fertilizer. The study conducted by Sukbo (2021) found out that the combined application of ANAA and NPK fertilizers resulted in significantly larger ear diameters in corn plants. This increase in ear diameter is a clear indicator of the enhanced growth and development achieved through this treatment. The combined effect of ANAA and both types of fertilizers creates a synergistic environment where nutrient uptake and utilization are optimized. The resulting increase in ear diameter compared to untreated plants highlights the effectiveness of this combined treatment. A larger ear diameter means the ears can support a higher number of larger kernels, directly contributing to increased yield potential. Additionally, the improved structural development indicates better overall plant health and resilience.

Corn Weight per Ear

Findings revealed that T3 (20 ml ANAA + RR NPK) obtained the highest mean score on weight per ear and was significantly different from T1. Results showed that the weight per ear of

Visayan white corn was affected by the application of ANAA plus inorganic fertilizer. In view of this finding, Thissen (2019) revealed that the combination between 20 ml of ANAA and NPK fertilizers ensures that the corn plants receive a balanced and sufficient supply of nutrients, optimizing their growth environment. This combination enhances the plants' ability to produce kernels that are both larger and denser, meaning each kernel contains more mass and is packed more tightly within the ear. As a result, the overall weight of the ears increases, reflecting the improved kernel size and density. This increase in ear weight indicates a higher yield potential and better quality of the harvested corn, making the combined treatment an effective strategy for boosting agricultural productivity.

Besides, Adajar (2021) stated that the combined treatment of 20 ml and NPK fertilizers led to a noticeable improvement in kernel size and density within the ears of corn plants, which significantly contributed to the observed increase in ear weight. When ANAA and NPK fertilizers are used together, they create a synergistic effect that maximizes nutrient uptake and utilization. This combination ensures that the corn plants have an optimal supply of nutrients and growth hormones, leading to enhanced kernel development. The kernels become larger and more densely packed within the ears, resulting in heavier ears overall.

Yield without the Husk

The study revealed statistically significant differences among all control and treatment groups. In fact, T3 (20ml ANAA + RR NPK) produces the highest yield, while T1 obtained the lowest yield among all the treatments. Therefore, results showed that the combination of ANAA plus inorganic fertilizer significantly affected the yield without husk of Visayan white corn. In support of this finding, Subedi (2022) found that the increase in corn ear weight is a clear indicator of improved yield potential and better quality of the corn harvest. This is significant because heavier ears typically contain more and better-developed kernels, which directly translate to higher overall grain production. The combined treatment of 20 ml of ANAA and NPK fertilizer has proven to be an effective strategy in achieving this outcome. Thus, the combined treatment of 20 ml of ANAA and NPK fertilizer proves to be a highly effective strategy for boosting both productivity and quality of corn. It offers substantial benefits for agricultural practices, enabling farmers to achieve higher yields and better crop performance, ultimately leading to more profitable and sustainable farming operations. In addition, Muthukumar et al., 2019 emphasize that NAA, as a type of auxin, supports plant growth by encouraging cells to divide, grow larger, and stretch. This helps improve overall plant development and also supports flowering and fruiting.

Economic Analysis

Results indicated that treatment with 20 ml ANAA + RR NPK (T3) resulted in the highest yield of 11.03 t/ha, whereas the lowest was 5.26 t/ha for the control treatment (T1), with the following indications that absence of ANAA and RR NPK lowered production remarkably. T3 proved to be the most profitable in economic analysis with the greatest net income of ₱329,650 as well as 584.48% return per cost (RPC). T2 followed closely, with a net income of ₱324,150 and an RPC of 576.36%, proving its cost-effectiveness. On the other hand, the control treatment (T1) yielded the lowest net income (₱136,600) and RPC (286.53%), demonstrating poor economic returns.

The study shows that using 20 ml ANAA + RR NPK (T3) boosts both yield and profitability in Visayan white corn production, making it the best option. The 10ml ANAA + RR NPK (T2) is also

effective for farmers with limited resources. However, using only RR ANAA (T5) or no ANAA and RR NPK (T1) leads to lower productivity and profits. The T3 treatment gave the highest yield (11.03 t/ha) and net income (₱329,650), while the control (T1) had the lowest yield (5.26 t/ha) and income (₱136,600). T3 and T2 are the most profitable, with high returns on investment.

Summary

The study examined the effects of foliar application of ANAA combined with inorganic fertilizers on the yield and yield attributes of Visayan white corn, locally known as *tinigib*, at horticultural maturity. Results showed that plant height was significantly higher in treatments with ANAA and inorganic fertilizer (T2, T3, T4) compared to the control treatment (T1) during the early, mid-growth stages, and at harvest with T2 (10 ml ANAA + RR NPK) producing the crops with the tallest height. The application of ANAA also influenced the number of days to silking and tasseling, with T3 (20 ml ANAA + RR NPK) leading to the shortest silking (43.66 days) and tasseling (52.33 days) periods. Corn ear length, diameter, and weight per ear were significantly improved in all treatments compared to the control treatment, with T3 achieving the longest ear length (13 cm) and the highest weight per ear (75.33 g). Yield without the husk followed a similar trend, where T3 had the highest yield (11.03 t/ha), followed closely by T2 (10.86 t/ha). Economic analysis indicated that T3 resulted in the highest profitability, while the control treatment had the lowest return despite minimal expenses.

Conclusion

The findings suggest that the foliar application of ANAA combined with inorganic fertilizers enhances the growth and yield of Visayan white corn or *tinigib*. While ANAA significantly improves plant height during the early stages, its effect does not persist during the harvesting stage. However, it plays a crucial role in accelerating silking and tasseling, which may contribute to improved yield attributes. Treatments with ANAA and inorganic fertilizers resulted in larger and heavier corn ears, with T3 (20ml ANAA + RR NPK) producing the best overall results in terms of growth, yield, and profitability. The study highlights the potential of ANAA as an effective growth regulator when used at optimal concentrations.

Recommendation

Based on the results, it is recommended that farmers apply 20 ml ANAA combined with recommended rates of inorganic fertilizer based on soil analysis result (T3) to achieve better growth, higher yield, and greater economic returns in Visayan white corn production. Lower concentrations (10 ml ANAA) also provide benefits and could be considered as an alternative for cost-conscious farmers. However, increasing ANAA to 30ml does not offer additional advantages and is not recommended. Further research is suggested to explore the long-term effects of ANAA on soil health and its potential application in other corn varieties. This includes studies under varying soil types and environmental conditions, application to other corn genotypes, increasing the land area and samples, and physico-chemical analysis of soil and plant responses.

REFERENCES

Adajar, M. (2021). Application of foliar biofertilizers with and without NPK in cultivating white-glutinous corn. *Journal of Agriculture and Applied Biology*, 2(2), 105–113.

- Arancon, N. Q., Owens, J. D., & Converse, C. (2019). The effects of vermicompost tea on the growth and yield of lettuce and tomato in a non-circulating hydroponics system. *Journal of Plant Nutrition*, 42(19), 2447–2458.
- Aribel, K. (2020). *Determining corn growth stages*. <https://www.krugerseed.com/en-us/agronomy-library/corn-growth-stages-and-gdu-requirements.html>
- Canaso, M. (2019). Effects of fertilization on the growth and yield of sweet corn under no tillage in Bukidnon, Philippines. *International Journal of Scientific and Research Publications*, 8(7).
- Curin, A. (2022). Ear reproductive development components associated with kernel set in maize: Breeding effects under contrasting environments. *Field Crops Research*, 304, 109150. <https://doi.org/10.1016/j.fcr.2021.109150>
- Gezie, M., & Tejada Moral, M. (2019). Farmer's response to climate change and variability in Ethiopia: A review. *Cogent Food & Agriculture*, 5, Article 1613770. <https://doi.org/10.1080/23311932.2019.1613770>
- Khalofah, M. (2020). *The impact of NPK fertilizer on growth and nutrient accumulation in juniper (Juniperus procera) trees grown on fire-damaged and intact soils*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8794100/>
- Muthukumar, V. B., Velayudham, K., & Prakash, T. (2005). Effect of different plant growth regulators and split application of nitrogen on the productivity of baby corn. *Research Journal of Agricultural and Biological Sciences*, 1(4), 303–307.
- Pangaribuan, M. (2019). Liquid organic fertilizer from plant extracts improves the growth, yield and quality of sweet corn (*Zea mays* L. var. *saccharata*). *Pertanika Journal of Tropical Agricultural Science*, 42(3), 1157–1166.
- Rao, K. S., Singh, S., Chandra, K. R., & Dawson, J. (2021). Effect of nitrogen and foliar application of naphthalene acetic acid (NAA) on growth and yield of baby corn (*Zea mays* L.). *International Journal of Plant & Soil Science*, 33(22), 55–61.
- Subedi, M. (2022). Ear position, leaf area, and contribution of individual leaves to grain yield in conventional and leafy maize hybrid. *Crop Science*, 11(4). <https://doi.org/10.1002/csc2.20702>
- Sudding, M. (2019). The effect of NPK 15-15-6-4 compound fertilizer on corn growth and yield. *IOP Conference Series: Earth and Environmental Science*, 911(1), 012047. <https://doi.org/10.1088/1755-1315/911/1/012047>
- Sukbo, P. (2021). *Optimizing maize yields using growth stimulants under the strategy of replacing chemicals with biological fertilizers*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9732421/>
- Tessema, I., & Simane, B. (2019). Vulnerability analysis of smallholder farmers to climate variability and change: An agro-ecological system-based approach in the Fincha'a sub-basin of the Upper Blue Nile Basin of Ethiopia. *Ecological Processes*, 8, Article 5. <https://doi.org/10.1186/s13717-019-0164-6>
- Thissen, A. (2019). *Plant nutrition: Food security and sustainability of agro-ecosystems through basic and applied research* (Vol. 5, Issue 4). <https://doi.org/10.1007/0-306-47624-X>
- Wei, M. (2022). *Plant density and nitrogen supply affect the grain-filling parameters of maize kernels located in different ear positions*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6405445/>