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Effect of Different Liquid Fertilizers on Yield and Economic Analysis of Glutinous Corn (*Zea Mays Linn*.)

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Abstract
Foliar fertilization is the most convenient and effective method of fertilizer application. This study was conducted to determine the effects of different fertilizers on the growth of glutinous corn in terms of plant height, 15, 30, 45 and 60 DAP, number of days from emergence to tasseling, number of glutinous corn per plot, number of marketable and non-marketable corn per plot, weight of corn per plot, and weight of corn ear per hectare; and to find out the cost and return analysis of glutinous corn supplemented with different liquid fertilizer. The experiment was conducted in a Randomized Complete Block Design (RCBD) with four treatments replicated three times. Treatment includes three different liquid foliar fertilizers and a control. The analysis of variance for RCBD was used to test the significant difference on the data gathered among treatments at 5% and 1% level. Findings revealed that the height a corn 15, 30, 45 and 60 days after planting and on the number days from seed emergence to flowering were not significantly affected by the supplementation of different liquid fertilizers. No significant difference among treatment means was observed between the number of marketable and non-marketable corn ears per plot. The number of glutinous corn per plot, weight of glutinous corn in kilogram per plot, and weight of glutinous corn in tons per hectare were significantly affected by the different liquid fertilizers. In terms of cost and return, Nutriplant AG also gave the highest profit. Thus, application of Nutriplant AG can increase growth and yield and can increase profits of the farmer.

Keywords: Glutinous corn, Liquid fertilizer, Foliar fertilization

1. Introduction
Corn (Zea mays L.) is the second most important crop in the Philippines after rice with approximately one-third of Filipino farmers (~1.8 million) depending on this crop as their major source of livelihood (Mutuc *et al*. 2011). It has been claimed that corn is more nutritious than rice and a better source of energy. In times of rice scarcity, milled corn or corn grits combination with rice is used as staple food.

Maize is staple food in most part of the world and has third position after wheat and rice (Zamir *et al.* 2013). It is a basic staple food grain for large parts of world including Africa, Latin America, and Asia (Yaouba *et al.* 2012). Recently, there is a worldwide interest in green corn production. Growing green corn requires a relatively shorter period ranging from 60 to 70 days from planting to harvesting to enable the farmers to have three to four cycles resulting to higher annual income among enterprising Filipino farmers especially those living near commercial food centers.

Sweet and glutinous corn are the most commonly grown variety for "green corn production" because of its short growing period and they are more nutritious and delicious compared with other varieties (Bacanto, 2004).

The use of foliar fertilizer is more economical and effective than the granulated form of fertilizer, which can be attributed to the presence of micronutrients such as manganese, zinc, iron and magnesium which make foliar fertilizers more advantageous than any other fertilizer containing no trace elements. Recognizing the necessity of advanced and appropriate technology to increase farm income and promote information the use of foliar fertilizers as supplement, hence, this study was conducted to determine the effect of different liquid foliar fertilizers on the growth and yield of glutinous corn and evaluate the productivity and profitability of glutinous green corn supplemented with different liquid fertilizers.

2. Materials and methods

2.1. Experimental treatments and design: The experimental field was prepared and laid out using the Randomized Complete Block Design (RCBD) with four treatments replicated three times. The treatments were consisting of four foliar fertilizers. The experimental area was divided into twelve plots including the borders. Each plot measures 5 x 4 meters. Pathways, measuring fifty centimeters (50 cm) wide was provided between plots which served as drainage.

2.2. Procurement of seeds and treatment: One kilogram of glutinous corn seeds was purchased from a reliable source at Bailan, Pontevedra, Capiz. All the seeds that were used in the study were treated with Nutriplant SD using slurry method before planting

2.3. Basal application.
Basal fertilizer application was done at planting time using 964 grams of complete fertilizers (14-14-14) per plot or 22.97 grams per hill.

2.4. Planting of corn: Glutinous corn was planted at a distance of 75 centimeters between furrows and 50 centimeters between hills with four seeds per hill. There were five rows in a plot and seventeen hills of corn in a row, hence, a total of 85 hills per plot.

2.5. Thinning: Ten days after planting, thinning was undertaken. One plant was retained per hill.

2.6. Foliar application: The application of fertilizers was done two weeks after planting at the following recommended rates: Nitrofert 10 tablespoons per 16 liters of water per tank load, Nutriplant AG 8 tablespoons per 16 liters of water and Crop Giant 6 tablespoons per 16 liters of water tank load. The rate of application was 1liter for Nitrofert, 1liter for Nutriplant AG and two kilograms of Crop Giant per hectare. The second, third and fourth application intervals were done at 15 days interval.

2.7. Weeding cultivation: Two weeks after planting hand weeding was done using the hand trowel. Cultivation with the use of garden hoe followed after each weeding to loosen the soil and promote aeration. Second weeding was done at two weeks intervals to suppress the growth of weeds.

2.8. Pest management: Clean and sanitation culture was adopted to get rid of the crop from pest's infestation. Fifteen days after planting, spraying with Cymbush was done at the rate of one (1) tablespoon per liter of water to control the possible infestation of aphids, corn borers and whorl maggots, after which infestation was minimized.

2.9. Harvesting: Harvesting for the glutinous corn started when the plants were 65 days old and ended at 70 days after planting. This was done by picking the corn ears and removal of its cover and classifies the ears according to sizes. Removal of the marketable fruits was done immediately. Marketable fruits were separated and weighed and ready for disposal.

2.10. Data Collection

2.10.1 Agronomic Characteristics

2.10.1.1 Plant height.
The sample plants were measured from the ground surface to the tip of the tassel of the corn at maturity.

2.10.1.2 Days from seedlings emergence to tasseling.
This was done by recording the number of days from planting up to the time when 90% of the plants in each plot produced tassels.

2.10.2 Yield and Yield Component

2.10.2.1 Number of marketable corn ears/plot.
All marketable corn ears were counted in each plot or treatment.

2.10.2.2 Weight of marketable corn ears in kilograms per plot.
This was determined by weighing the green corn ears produced in every plot.

2.10.2.3 Weight of marketable corn ears (tons per hectare).
Yield was determined by weighing the green corn taken from each plot. The weight of corn ears per plot was used as basis for the computation of plot yield. Yield per plot was converted to tons per hectare using the formula:

$$\text{Yield (tons per hectare)} = \frac{\text{Yield (kg) x 10 000 m}^2}{\text{Area/plot x 100 kg/ton}}$$

2.10.3 Financial Profitability

2.10.3.1 Gross income was taken from the sales of glutinous corn. Gross income computation was based on the prevailing market price at the time the crops were harvested.

2.10.3.2 Cost of production. The cost of production covered all expenses that were incurred in the conduct of the study. These include input such as seeds, fertilizers, chemical and labor cost which includes land preparation, planting, weeding and cultivation, spraying, harvesting and processing of the farm products. Other expenses covered land rental and farm implements.

2.10.3.3 Net income. Net income was obtained by deducting all the expenses from the total gross income.

2.10.3.4 Return on investment. The return on investment was obtained by the following formula:

$$\text{Return on Investment} = \frac{\text{Net Income}}{\text{Cost of production x 100}}$$

2.11. Data analysis
All data collected was statistically analyzed using the F test for RCBD. The result was tested both at 5 % and 1 % levels of significance. Significant differences among treatments were tested using Least Significant Mean Difference (LSMD) Test.

3. Results & Discussion

A. Planting Height 15, 30, 45 and 60 Days after Planting (DAP)

Table 1 presents the height of corn 15, 30, 45 and 60 days after planting. Plants that were supplemented with Nutriplant AG produced the tallest plant with a mean of 28.93, 74.17, 123.6 and 144, 7 cm. in all stages respectively. Treatment A-

Control or plants not applied with different liquid fertilizer had the shortest plants of 32.13, 70.9, 105.1 and 127.03 cm. in all stages. Analysis of variance however revealed that supplementation of different liquid fertilizers has no significant effects on the height of corn 15, 30, 45, and 60 days after planting.

B. Average Number of Days from Emergence to Tasseling

Table 2 presents the data on the flowering period of corn plant. The data revealed that Treatment A had the shortest period from emergence to tasseling which was 45 days from planting. This was followed by Treatment B and C with 49.0 and 51.0 days, respectively. The longest duration was obtained by Treatment D which was 45 days. Statistical Analysis revealed no significant differences were observed among treatment means at both 1% and 5% levels of profitability.

Table 1: Plant height (cm.) at 15, 30, 45, and 60 days after planting and number of days from emergence to tasseling

TREATMENT	Plant Height (cm)				Days from emergence to tasseling
	15 DAP	30 DAP	45 DAP	60 DAP	
A– Control	32.13	70.9	105.1	127.03	54
B– Nitrofert	33.13	74.84	121.4	138.1	49
C-Crop Giant	32.9	70.94	119.8	143.87	51
D–Nutriplant AG	28.93	74.17	123.6	144.7	54
CV (%)	12.63	29.82	4.57	7.41	4.59

C. Average Number of Corn Ears per Plot

According to Cheema *et al*. (2010), that number of grain per ear is an important yield determining factor in maize. Table 3 presents the data on the average number of glutinous corn ears per plot. The data revealed that Treatment D gave the highest number with 81. 33 per/plot; next was Treatment C with a mean of 78.67 per/plot and followed by Treatment B with a mean of 77.67 per/plot. The least harvested number of corn ears was obtained by Treatment A with a mean of 76.67 per/plot. The analysis of variance indicated that the number of glutinous corn ear per plot was significantly affected by the supplementation of different liquid fertilizer. According to the study of Stevens *et al*. (2002) he conduct foliar application of nitrogen, phosphorus, potassium and sulfur fertilizers after pollination in 2 cultivars of early maturing and late maturing. Base to their findings, foliar application of fertilizers caused decline of grain number in late maturing cultivar in some cases. However, according to SadaPhah and Das (2006) that significant increase of grain number in wheat spike after foliar application of urea. According to the results of this study, that increasing grain number in wheat spike is resulted from improved condition of feeding for spikes regarding to nitrogen presence in the first phase of growth. MacNeal and Davis (2004) study using nitrogen fertilizers and indicated that yield improved is primarily based on increase of tillering, grain number in spike and weight of grain.

D. Number of Marketable Corn Ear per Plot

Table 4 shows the data on the number of marketable corn ears per plot. It was found out that Treatment D got the most number of marketable ears per plot with a mean of 75.33, followed by Treatment C and B with average mean of 71.3 and 70.0 ears respectively. Treatment A got the lowest number of corn ear with an average mean of 68.0. Analysis of variance revealed that there was no significant difference on the number of marketable corn ear per plot as affected by the supplementation of different liquid fertilizer.

E. Number of Non – Marketable Ears per Plot

The number of non – marketable corn ears per plot is presented in table 5. It was observed that treatment D got less number of non – marketable corn ears with an average of 60/ per plot. It was followed by treatment C and B with an average mean of 7.33 and 7.67/ plot treatment A got the most number of non – marketable corn ears with 9.67 fruits per plot. Analysis indicated that there were no significant differences observed among treatments. This indicated that the different liquid fertilizer had no influence on the production on the number of non – marketable of glutinous corn.

F. Weight of Corn Ears per Plot

The data on the weight of corn ears in kilograms per plot are reflected in Table 6. The highest weight of corn ears from the harvested corn was obtained from Treatment D with a mean of 9.4 1kg. This was followed by Treatments C and D with a mean of 8.74 and 8.03, respectively while the lightest weight was obtained from Treatment A with 1.01 kg per plot. Analysis of Variance revealed that the weights of corn ears were significantly (that the weight of corn ears were significantly) affected by the supplementation of different liquid fertilizer both at 5% and 1% levels of significance. Supplementation of liquid fertilizers was significantly higher over Control. Zeidan *et al.* (2010) stated that the maximum grain and straw yields (kg/fed) were attained with Zn Foliar application on wheat plants. Garcia and Honway (1987) described that foliar application on soybean in grain filling period with a composition of nitrogen, phosphorus, potassium and sulfur rises the yield from 500 to 1500 kg/ha, but Boote *et al*. (1998) perceived that by applying nitrogen, phosphorus, potassium and sulfur composition with foliar application in grain filling period has no significant effect on yield. Foliar application of nitrogen fertilizer rise little nutrition application and cause the leaves to absorb nutrition, and disturb harvest amount (Stevens *et al.* 2002). According to Gebeyehou *et al.* (2002), that there is a strong association between final grain weight and grain filling period.

According to Yuncai *et al.* (2008) that application of foliar fertilization increase plant growth as fresh and dry weight even though there was a decline in evapotranspiration, and improved the uptake of K, Ca, Mg and P elements.

Table 2: Yield parameters of glutinous corn as affected by the different liquid fertilizer.

Treatment	Average number ears per plot	Number of marketable corn ears per plot	Number of non-marketable corn ears per plot	Average weight of ear in kilograms per plot.	Average weight of ear in tons per hectare
A (Control)	76.7a	68.0	9.67	7.01d	4.70d
B (Nitrofert)	77.7bc	70.0	9.67	8.0c	5.35c
C (Crop Giant)	78.7ab	71.3	7.33	8.74b	5.83b
D (Nutriplant AG)	81.3a	75.33	6.0	9.40a	6.27a
CV (%)	3.7	3.64	16. 51	5.12	5.10

G. Weight of Corn Ears per Hectare

The data in Table 7 presents the average weight of corn ears in tons/ ha. Treatment D got the highest weight of corn ear with average mean 6.27 tons/ha, followed by Treatments C and B with means of 5.83 and 5.35 tons/ ha respectively. The lowest mean weight was obtained from Treatment A with a mean of 4.70 tons/ha. Analysis of Variance indicated that the height in (tons/ha) of glutinous green corn was significantly affected by the supplementation of different liquid fertilizers. LSMD result showed that corn supplemented with different liquid fertilizers has obtained heavier weight compared to Control. The study is in agreement with the study by Provez *et al*. (2009) indicated that foliar application significantly improved hundred grain weight, biological yield, grain yield and N uptake by the crop. However, in the study of Abd EL-Fattah (2012), it was remarked that the best results of ear weight, 100 grains weight, ear length perceived with foliar application at 125%, while the best effects of number of rows and ear yield found with soil application at the similar recommend rate. Mengel and Kirkby (2001) stated that the rise in fresh and dry weight could be inferred on the basis of the role N and K in improving plant metabolism, enhancing plant meristimatic activity and increasing photosynthesis rate. Also Yassen *et al.* (2010) revealed that application of Fe, Mn and Zn significantly improved grain yield and yield components of wheat compared with control (Spraying plants with tap-water). Ziaeian and Malakouti (2010) described that corn yield improved by using micronutrients. In this study soil application of Zn and Fe was more effective that foliar spray but foliar spray for Mn was more efficient that soil application. Results also indicated that the optimum use of fertilizer not only improved yield and enhanced the quality. These results of this study may be attributed that foliar fertilization increased biological yield and nutrient absorbed by plant tissues (Provez *et al.* 2009).

H. Cost and Return Analysis of Glutinous Corn

Table 8 presents the cost and return analysis of glutinous green corn supplemented with different liquid fertilizers. Results revealed that corn supplement with Nutriplant AG had the highest gross income of PhP 62,700.00/ha. This was followed by Treatment C supplemented with Crop Giant with Php 58,300.00 per/ha, while the corn plants in Treatment B supplemented with Nitrofert had a gross income of Php 53,500.00/ha. Treatment A (Control) realized only a total Php 47,000.00 net income. Treatment D followed by Treatment C and B worth Php 25,300.00/ha. and Php 20, 480.00/ha. respectively, and the harvest net income was from Treatment A with Php 16, 300.00 /ha. With regards to ROI (Return on Investment) Treatment D had the highest with 86.05 percent, Treatment C and B with 76.66 and 62.02, respectively. The lowest was obtained by Treatment A with 53.09 percent. Thus, it was found out that application of different liquid foliar fertilizer greatly reduced that cost of production and therefore increasing the net income and percent ROI compared to control.

Table 8. Cost and return analysis of glutinous corn as affected by the supplementations of liquid fertilizers.

TREATMENT	COST OF SUPPLIES MATERIALS (PHP)	LAND RENTS (PHP)	COST OF LABOR (PHP)	TOTAL PROJECT COST (PHP)	GLUTINOUS CORN YIELD (KG/HA)	PRICE/ UNIT (PHP)	TOTAL GROSS INCOME (PHP)	NET IN-COME (PHP)	ROI (%)
A - Control	11,850	6,000	12,850	30,700	4,700	10	47,000	16,300	53.09
B - Nitrofert	13,520	6,000	13,500	33,020	5,350	10	53,500	20,480	62.02
C - Crop Giant	13,500	6,000	13,500	33,000	5,850	10	58,300	25,300	76.66
D - Nutriplant AG	14,200	6,000	13,500	33,700	6,270	10	62,700	29,000	86.05

8. Conclusions

Based on the findings of the study the following conclusions were drawn: Glutinous corn supplemented with Nutriplant AG obtained the highest yield in terms of height in centimeters, number of marketable corn ears and weight of corn ears in kilograms and in tons per hectare. In terms of cost and return, Nutriplant AG also gave the highest profit.

9. References

1. ABD EL-FATTAH A.A. SELIM E.M. AND AWAD, E.M. 2012. Response of Corn Plants (Zea mays) to Soil and Foliar Applications of Mineral Fertilizers under Clay Soil Conditions. Journal of Applied Sciences Research, 8(8): 4711-4719
2. BACANTO, S.O. 2004. The Effect of Planting Density Intercrop's and Liquid Foliar Fertilizer on the Performance of Glutinous Corn. Published Thesis. Panay State Polythecnic College.
3. BAUTISTA, O.K. 2003. Introduction to Tropical Horticulture. University of the Philippines, Los Baños, Laguna.
4. BOOTE JR, GALLAHER N, ROBERTSON WK, HINSON K, HAMMOND C (1998). Effect of foliar fertilization and photosynthesis, leaf nutrition on yield of soybean. Agron. J. 70: 781-791.
5. BOSNIO O, D. 2002. Amagram; Amway Philippines (March, May 2002), Brgy. San Juan, San Pablo, Laguna p.19
6. CABALONGA F, D. 2002. Power of the Three Boast Crop Production of Eastern Samar Farm, Amagram, September 2002.
7. CHEEMA M.A. FARHAD W. SALEEM M.F. KHAN H.Z. MUNIR A. WAHID M.A. RASUL F. HAMMAD H.M. 2010 - Nitrogen management strategies for sustainable maize production. Crop Environ. 1(1): 49-52
8. DARONDON, M. C. 2003. Growth and Yield Performance of Cucumber Applied with Different Liquid Fertilizer.
9. GARCIA RL, HONWAY JJ. 1987. Foliar fertilization of soybean during the seed-filling period. Agron. J. 68: 653-657.
10. GEBEYEHOU G, KNOTT DR, BAKER RJ. 2002. Relationships among durations of vegetative and grain filling phases, yield components, and grain yield in durum wheat cultivars. Crop Sci. 22: 287-299.
11. LAI, S.V. 2002 Microbial Fertilizer Increase Yield Improve Soil Fertility, Agriculture Magazines. Vol.22, No.23
12. MACNEAL FH, DAVIS DJ (2004). Effect of nitrogen fertilization on yield, column number, and protein content of certain spring wheat varieties.Agron. J. 99: 375-378.
13. MENGEL, K. AND E.A. KIRKBY, 2001. Principles of plant nutrition. 5th ed. Kluwer Academic Publishers. pp: 849.
14. MUTUC, M. E. R. M. REJESUS AND J. M. YOROBE JR. 2011. Yields, insecticide productivity, and Bt corn: evidence from damage abatement models in the Philippines. AgBioForum, 14(2): 35-46.
15. SADAPHAH MN, DAS NB (2006). Effect of spraying urea on winter wheat (Triticum aestivum). Agron. J. 101: 137-141.
16. PROVEZ, K. M.Y. MEMON, M. IMTIAZ AND M. ASLAM, 2009. Response of wheat to foliar and soil application of urea at different growth stages. Pak. J. Bot. 41(3): 1197-204.
17. SANCHEZ, C. 2001. Organic Versus Inorganic Fertilizer Use in Lowland Rice Farming Agricultural Magazines September 2002 Vol.6, No.9, pp.14-15.
18. SANCHEZ, C. 2001. Agricultural Supply, Nitrofert Liquid Plant Food, Fertilizers and Pesticide Authority, Australia.
19. STEVENS B, KILLEN M, BJORNESTAD L (2002). Use of micronutrient fertilizers in sugar beet production. Powell Research and Extension Center. Agron. J. 84: 22-25.
20. YAOUBA, A. N. L. TATSADJIEU, D. P. M. JAZET, AND C. M. MBOFUNG. 2012. Inhibition of fungal development in maize grains under storage condition by essential oils. International Journal of Biosciences 2 (6): 41-48.
21. YASSEN, A. E.A.A. ABOU EL-NOUR AND S. SHEDEED, 2010. Response of Wheat to Foliar Spray with Urea and Micronutrients. J. American Sci. 6(9): 14-22.
22. YUNCAI, BUR, HUCS, Z. AND U. SCHMIDHALT, 2008. Effect of foliar fertilization application on the growth and mineral nutrient content of maize seedling under drought and salinity. J. Bot. 1747-1765.
23. ZAMIR M.S.I. YASIN G. JAVEED H.M.R. AHMAD A.U.H. TANVEER A. YASEEN M. 2013 - Effect of different sowing techniques and mulches on the growth and yield behavior of spring planted maize (Zea mays L.). Cercetări Agronomice în Moldova, 1(153): 77-82.
24. ZIAEIAN, A.H. AND M.J. MALAKOUTI, 2001. Effect of Fe Mn, Zn and Cu fertilization on the yield and grain quality of wheat in the calcareous soils of Iran. Plant Nutrition - Food Security and Sustainability of Agroecosystems (Eds W.J. Horst, *et al*.), Kluwer Dordrecht, the Netherlands, pp: 840-841.
25. ZEIDAN, M.S. MANAL F. MOHAMED AND H.A. HAMOUDA, 2010. Effect of Foliar Fertilization of Fe, Mn and Zn on Wheat Yield and Quality in Low Sandy Soils Fertility. World J. Agric. Sci. 6(6): 696-699.