Reaffirming the Critical Role of Transformative Research and Knowledge Production in the Age of Post-Truth

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Assessing the Effect of Fertigroe® Application on the Growth and Yield of Raniag Potato Variety

Mikhaela Kathrina H. Dizon[1*], Angel G. Po[1], Jolene Lynette A. Shi[1], and Jazlyn Daniella C. So[1]

[1] *De La Salle University Integrated School Manila*

**corresponding author: mikhaela_dizon@dlsu.edu.ph*

Divina M. Amalin

[1] *De La Salle University Integrated School Laguna*

Abstract: A fertilizer is a substance incorporated into the soil to increase soil fertility, plant nutrients, and crop cultivation. However, most fast-release fertilizers available in the market engender soil deterioration, which leads to environmental degradation and food insecurity. Past researchers have analyzed the effect of numerous fertilizers on potato production, although few have explored slow-release types. In this study, experimentations were carried out to discover the efficacy of FertiGroe®, a slow-release nanofertilizer known to improve a plant's nutrient uptake and crop yield while being less harmful to the environment. The specific objectives of this study were to compare the differences between FertiGroe®, commercially available fertilizer, and no fertilizer application in terms of the growth of Raniag potato (*Solanum tuberosum*) crops, and determine the effectiveness of FertiGroe® in terms of the yield produced. An experiment was conducted in the De La Salle University - Laguna Campus, wherein potato tuberlets were planted and treated varyingly using (1) FertiGroe®, (2) commercially available fertilizer, and (3) no fertilizer. In a span of 30-80 days after planting, its growth and yield parameters were recorded. The results of the experimentation showed no significant differences across the treatments. The researchers, therefore, conclude and reject the hypothesis that FertiGroe® is more effective for the growth and yield of Raniag potato crops compared to other fertilizer treatments. It is recommended that a follow-up trial be conducted to verify the result of this study.

Keywords: slow-release fertilizer; *Solanum tuberosum*; FertiGroe®; nanofertilizer; Raniag

1. INTRODUCTION

1.1. Background of the Study

Around 10% of the world's population still suffers from chronic hunger (Action Against Hunger, 2022). As an agricultural product, potatoes could reduce world hunger as it has the highest crop yields for the past years. Due to its short growth duration and undemanding management, it is widely used as a planting material at home and in the agricultural industry.

Moreover, chemical fertilizers have decreased famine among the population. It has been a part of farming traditions for decades until their negative effects on the soil were discovered, including soil hardening and depletion in soil quality and fertility. They also bring up greenhouse gasses caused by the absorption of polluted air and water (Abad, 2018).

Food insecurity and soil deterioration leading to environmental degradation is a problem experienced globally. In light of this, the researchers aim to resolve this problem by testing the efficacy of FertiGroe®, a slow-release nanofertilizer developed by researcher-scientists at the University of the Philippines Los Baños, that contains macronutrients N, P, K (Basay et al., 2021). Since it is nano-sized (1 nm to 100 nm), the plant better absorbs its nutrients due to the increased surface area. Additionally, FertiGroe® exhibits enhanced economic yield and is safer for

the environment since it regulates the release of nutrients and ensures the absorption of nutrients (S&T Media Services, 2021). Few papers have compared the nanofertilizer with other conventional fertilizers such as urea and complete fertilizers. Potato clone CIP 385130, also known as Raniag, was identified as an outstanding performer in the lowland. Moreover, "Raniag" matures early at 75-80 days after planting and yields high crops, producing a mean yield of 21.7 t/ha. Tubers of this variety are round, with white flesh color and pale yellow skin color. This potato variety has a fine eating quality and can be processed into chips with 18.8% dry matter content.

When proven truly effective, this research can pave the way for its mass production, which would eventually make it accessible to farmers and the general public.

1.2. Research Objectives

The general objective of this study is to analyze the efficacy of FertiGroe® application on Raniag potato crops. For the specific objectives, the researchers aimed:

a) to compare the differences between FertiGroe®, commercially available fertilizer, and no fertilizer application in terms of the growth of Raniag potato crops;
b) to determine the effectiveness of FertiGroe® in terms of the yield produced;

1.3. Scope and Limitations

This research aimed to analyze the efficacy of FertiGroe® application on Raniag potato crops. An experiment was conducted to conclude which of the following best complemented the growth of Raniag potato crops: Fertrigroe application, commercially available inorganic nanofertilizer application, or no applied fertilizer. Processes including plant and soil nutrient content analysis are beyond the scope of the research.

1.4. Significance of the Study

The general community would benefit from this study since the increase in potato production can lead to fewer cases of malnutrition and food insecurity. Potatoes (*Solanum tuberosum*) also provide humans with essential nutrients: calories, proteins, carbohydrates, fiber, and sodium, as well as potassium and vitamin C.

Given that potatoes (*Solanum tuberosum*) have a large yield, they would be a major contribution to the economy. Specifically, (1) by producing and harvesting more potatoes, farmers would earn a more stable income increasing their financial resources to support their families. (2) Moreover, the market would be less likely to experience a shortage of potatoes.

The research community would be able to take advantage of the experiment, as they can take it as an insight for future research and learn from the recommendations.

2. METHODOLOGY

2.1 Creating Fertigroe® and Selecting Commercially-available Inorganic Nanofertilizer

To determine the amount of macronutrients in the soil, such as Nitrogen, Phosphorus, and Potassium (NPK), a soil analysis was done using a field diagnostic kit and a soil test kit from the University of the Philippines Los Baños. A small sample from the soil composite was subjected to analysis for pH, NPK content, and salinity status. The test kit used gave only the approximate fertility status of the soil; it only sufficed for a fertilizer recommendation to be made for specific crops. For this case, the result showed low levels of the macronutrients, and based on the test kit booklet, the recommended rate required to achieve the optimum harvest is 120-120-120.

Thus, using the two different fertilizers, this recommended rate was applied to the soil. The available single FertiGroe® fertilizers were pulverized using a grinder, measured accordingly, and mixed together to form the FertiGroe® fertilizer.

2.2 Preparation of Materials

The necessary instruments were prepared prior to the experiment:

- Raniag Potato Tuberlets

- Fertilizers (14-14-14 NPK Combination FertiGroe® and commercially-available inorganic nanofertilizer with identical NPK content)
- Planting materials and gloves
- Grinder and Sifter
- Brine solution

After the experiment, they measured and compared the results using the following instruments:

- Digital Weighing Scale
- Meter stick
- Vernier Caliper

2.3 Set up the Experiment

The experiment was conducted at an open field in the De La Salle University–Laguna Campus using the randomized complete block design (RCBD). To prevent extraneous factors such as insect damage or diseases, an insect trap made of brine solution was considered. The setup comprised three fertilization treatments which were replicated three times per treatment.

2.4 Conduct the Experiment

Fertigroe® and the commercially-available counterpart were applied only once during the crop's lifespan. During the experiment, the potato plants were observed weekly and watered depending on the weather. Data collection was conducted every Wednesday through the destructive sampling of the Potato crops and its analysis afterward. The experiment approximately had a duration of 120 days (4 months) and was expected to have a full-grown potato plant by the end of Term 2.

2.5 Data Collection

The measuring instruments used were the meter stick, digital weighing scale, and vernier caliper, as mentioned in Section 2.2. The duration of the data collection period lasted for 30-60 days (2 months).

The plant growth parameters were sourced from the shoot and root system of the Raniag potato plant. Specifically, the following data were collected:

- Plant height. In terms of morphology and development, it reflects plant growth and health.
- Plant vigor. Plants with weak, feeble, and thin stems may indicate a stressed plant.
- Number of leaf stories. Few leaf stories and leaves can be a symptom of nutrient deficiency in plants.
- Root depth. Longer roots are preferred since they indicate a healthier plant and have better chances of improving crop yield and survival.

The plant yield parameters were sourced from the tubers produced by the Raniag potato plant. Specifically, the following data were collected:

- Quantity of tubers. The total number of edible or marketable tubers was calculated in the final growth stage.
- Average size. Through the destructive sampling, the tubers' length and width were measured.
- Average weight. Upon harvesting the potatoes during the final growth stage, they were weighed to assess the effect of FertiGroe® on the quality of the potato produced.

2.6 Research Design

The experimentation concerned a number of ethical issues. First, in order to avoid violating any ethical concerns and to show respect towards the company, the brand of the commercially-available fertilizer was kept anonymous. Second, there is a possibility that FertiGroe® would be ineffective and may even cause damage to the chosen soil, crop, or environment. To avoid this, the experiment was conducted in a separate field and an enclosed laboratory. Lastly, all data collected in this paper were gathered and coded accurately without any alterations and manipulations.

2.7 Data Analysis

This research study utilized a categorical and continuous quantitative approach to analyze the data set derived from the two data collection instruments: Plant growth parameters assessment and Yield parameter assessment on the Raniag Potato variety. Furthermore, statistical analysis was employed to fully analyze and identify the pattern and trends observed in the data. Specifically, the mean potato weight and size, number of

tubers, number of leaf story, plant vigor, root depth, and plant height from all the replications in a single group was calculated to represent the typical value of the dataset. The Analysis of Variance (ANOVA) test was utilized to find out if the means of the independent groups differ significantly from one another.

The data collected in the growth parameter assessment were the plant height (in), root depth (in), plant vigor, and number of leaf stories. The plant vigor was measured on a scale of 1-5; the description of each scale is shown in Table 1 (Amalin et al., n.d.).

Table 1

Plant Vigor Scale

Scale	Description
1	Plants are weak with few stems and leaves, very pale
2	Plants are weak with few thin stems and leaves, pale
3	Better than less vigorous
4	Plants are moderately strong with robust stems and leaves
5	Plants are strong with robust stems and leaves

The yield parameter assessment included the total number of edible or marketable tubers per plant and the average weight (g), length (mm), and width (mm) of harvested potatoes during the ripening stage of the crop, which was at 77 days after planting (DAP).

Marketable tubers must be consistent in shape and size (45-85 mm), with disease-free skin (Market, 2017), while edible tubers must be tight-skinned, firm to the touch, and free from imperfections (Snyder, 2020). In addition, bigger potato tuber sizes are more favorable compared to smaller ones as it implies that potato tubers were given the correct balanced nutrition.

3. RESULTS AND DISCUSSION

This chapter presents the results and discussion on the efficacy of FertiGroe® on the growth of potatoes, as well as a comparison to commercial fertilizer and no fertilizer.

3.1 Growth Parameters

Table 2

Plant Height Parameter (in)

Treat.	1st DS	2nd DS	3rd DS
FertiGroe®	15.84722222	11.46111111	24.51388889
Commercial	15.57777778	11.15277778	22.98611111
Control	16.47222222	13.25	22.76388889
P-value	0.98		

Table 3

Root Depth Parameter (in)

Treat.	1st DS	2nd DS	3rd DS
FertiGroe®	6.986111111	14.31944444	12.05555556
Commercial	7.277777778	14.25	9.402777778
Control	9.555555556	11.70833333	10.26388889
P-value	0.945		

Table 4

Leaf Story Parameter

Treat.	1st DS	2nd DS	3rd DS
FertiGroe®	7.777777778	7.777777778	6.777777778
Commercial	7.666666667	8.222222222	5.555555556
Control	7.555555556	7.111111111	5.222222222
P-value	0.6883		

Table 5

Plant Vigor Parameter

Treat.	1st DS	2nd DS	3rd DS
FertiGroe®	3.111111111	3.333333333	3.888888889
Commercial	3.444444444	3.444444444	2.555555556
Control	3.111111111	2.888888889	2.444444444
P-value	0.2674		

Table 6

Tuber Number Parameter (Vegetative Stage)

Treat.	1st DS	2nd DS	3rd DS
FertiGroe®	3	4.555555556	3.555555556
Commercial	3.444444444	3.444444444	3.222222222
Control	4.111111111	2.888888889	3.222222222
P-value	0.7584		

Table 7

Tuber Weight Parameter (Vegetative Stage) (g)

Treat.	1st DS	2nd DS	3rd DS
FertiGroe®	2.896666667	9.528888889	12.69960317
Commercial	2.11	11.06333333	11.71407407
Control	3.086666667	9.563333333	14.93166667
P-value	0.9754		

Table 8

Tuber Length Parameter (Vegetative Stage) (mm)

Treat.	1st DS	2nd DS	3rd DS
FertiGroe®	20.24111111	23.94333333	27.53464286
Commercial	21.35777778	24.21888889	25.45481481
Control	20.73666667	25.48666667	28.47083333
P-value	0.8932		

Table 9

Tuber Width Parameter (Vegetative Stage) (mm)

Treat.	1st DS	2nd DS	3rd DS
FertiGroe®	18.47666667	21.89444444	24.1547619
Commercial	19.64222222	21.53666667	22.71972222
Control	19.26333333	23.09777778	24.80777778
P-value	0.8544		

3.2 Yield Parameters

Table 10

Number of Tubers Parameter (Tuber Yield)

Treatment	Number of tubers (per plant)
FertiGroe®	2.279166667
Commercial	2.691919192
Control	2.392255892

Table 11

Tuber Length Parameter (Tuber Yield)

Treatment	Length *(mm)*
FertiGroe®	30.70579105
Commercial	31.97924435
Control	32.08320348

Table 12

Tuber Weight Parameter (Tuber Yield)

Treatment	Weight *(g)*
FertiGroe®	17.13981724
Commercial	18.59013653
Control	18.88225503

Table 13

Tuber Width Parameter (Tuber Yield)

Treatment	Width *(mm)*
FertiGroe®	26.6963557
Commercial	28.00462853
Control	28.23744924

Results showed no significant difference between the application of the different treatments in all the growth parameters. Furthermore, in the tuber yield assessment during the ripening stage of the crop, FertiGroe® performed poorly compared to the two other treatments. Factors that may have affected the inefficacy of the FertiGroe® application may include crops being planted in a sloped area. Water runoff may have occurred such that the fertilizers slid downwards and did not infiltrate the soil properly. Second, the changing weather conditions may have caused some of the crops to absorb more water and acquire more nutrients. Finally, the FertiGroe®'s inability to dissolve may have prevented the plants from receiving the full amount of nutrients they needed in order to achieve optimum growth.

4. CONCLUSIONS

The researchers conclude and reject the hypothesis that FertiGroe® is more effective for the growth and yield of Raniag potato crops compared to other fertilizer treatments. The results suggest that the use of both FertiGroe® and the synthetic NPK did not contribute to the growth of the Raniag potato contrary to the results of previous studies. To verify this experiment, it is highly recommended to conduct a follow-up trial with modifications to address the high variability of treatment effects.

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