



## Weed incidence and profitability of peanut (*Arachis hypogaea* L.) as affected by planting density and integrated nutrient applications

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### ABSTRACT

This study sought to evaluate the weed incidence and profitability of peanut production as affected by planting density and integrated nutrient applications. The experiment was laid out in a split-plot arranged in Randomized Complete Block Design (RCBD) with three replications. The different planting densities: D1 - 1 plant per hill and D2 - 2 plants per hill served as the main plot, and different fertilizer combination; N0 - Control (no fertilizer application), N1 - Inorganic fertilizer at 45-45-45 kgha-1 N, P2O5, K2O, N2- 5 tha-1 poultry litters + hyper plus foliar fertilizer, N3 -2.5 tha-1 poultry litters + 22.50-22.50-22.50 kgha-1 N, P2O5, K2O + hyper plus foliar fertilizer, N4 - 5 tha-1 vermicomposts + hyper plus foliar fertilizer and N5 - 2.5 tha-1 vermicompost + 22.50-22.50-22.50 kgha-1 N, P2O5, K2O + hyper plus foliar fertilizer as the sub plots. Results revealed that application of complete rate of inorganic fertilizer (45-45-45 kgha-1 N, P2O5, K2O) and 2.5 tha-1 poultry litters + 22.50 - 22.50 - 22.50 kgha-1 N, P2O5, K2O + 1 li foliar fertilizer ha-1) obtained the higher weed incidence and the heavier weeds' fresh weight than the other organically treated peanut plants. Likewise, the dominant weed species were the following for grasses: jungle rice (*Rottboellia cochinchinensis* L.), barnyard grass (*Echinochloa crus-galli* L.), Indian goosegrass (*Eleusine indica* L.), while for sedges: flat sedge (*Cyperus compactus* L.) and tall fringe rush (*Fimbristylis dichotoma* L.) and for broadleaves: primrose willow (*Ludwigia octovalvis* (Jacq.), garden spurge (*Euphorbia hirta* L.) and spreading dayflower (*Commelina diffusa* Burm.) On the other hand, different planting densities did not influence peanuts' yield characteristics. This means peanut production can be planted in single or double seeds per hill, but single seed per hill is more practical and advantageous. Likewise, different fertilizer combinations did not cause to vary in the yield parameters of peanut except for the non-marketable pod yield (tha-1). Moreover, an increase in the net return was noted in D2N0 with PHP 73,980.00 with 125% ROI, followed by D1N2 with PHP 56,082.40 and ROI of 94%.

**KEYWORDS:** *Planting density, integrated nutrient applications, organic fertilizer, inorganic fertilizer*

### 1 INTRODUCTION

Peanut (*Arachis hypogaea* L.) is considered a highly valued crop like corn and rice and an income-generating crop to farmers (Sarcol and Cagasan 2016). Peanut is one of the important crops in the Philippines. However, as of 2019, its production was reduced from 12.30 thousand metric tons (2018) to 12.25 thousand metric tons (2019), with a 0.5 percent decrease in peanut production recorded by the Philippine Statistics Authority (2019). Thus, it is a need to find ways to increase peanut production. Identifying an optimal plant density is a critical management decision (Assefa et al. 2016). Plant density was described as the number of plants within a given area (Hamel n.d.). Studies have shown that as the planting density increases, the total crop yield increases and reaches a maximum. At that point, further increase in planting density may also result in reduced yield (Ngouajio, 2011).

In crop production, nutrient management is one of the important factors to consider, as the sole application of organic fertilizer cannot provide enough nutrients for the crop needs. Thus, the combination of inorganic fertilizer is recommended. Moreover, organic fertilizers have comprised various plant-derived materials ranging from fresh or dried plant material to animal manures and litters to agricultural by-products. The nutrient content of organic fertilizers varies greatly among source materials and readily biodegradable materials to make better nutrient sources (Green, 2015). However, organic fertilizer application needs to have a large volume to consider effective, thus supplement of hyper plus foliar fertilizer was done in this study, (Muscanescu, 2013). Likewise, inorganic fertilizer is fully artificial and manufactured in exact doses that meet the plant's specific needs. There was also a risk of using inorganic fertilizer, which can be toxic and leach into the soil due to dosage that affects the growth of crops (Mowbot Team, 2018).

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Table 1. Amounts of different fertilizers applied per treatment plot (12 m<sup>2</sup>)

| Treatments  | Amount of Fertilizer per plot (12m <sup>2</sup> )  |
|---|--|
| N <sub>0</sub> – Control (No fertilizer applied)  | 0 kg   |
| N <sub>1</sub> – 45-45-45 kg ha <sup>-1</sup> N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O   | 0.386 kg plot <sup>-1</sup> of complete fertilizer (side-dressed @ 20 DAS)   |
| N <sub>2</sub> – 5 tha <sup>-1</sup> poultry litters + 1 li foliar fertilizer ha <sup>-1</sup>  | 6 kg plot <sup>-1</sup> poultry litters were applied 2 weeks before planting + 1.2 ml hyfer plus foliar fertilizer applied at 25, 35 and 45 DAS  |
| N <sub>3</sub> – 2.5 tha <sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O + 1 li foliar fertilizer ha <sup>-1</sup> | 3 kg plot <sup>-1</sup> poultry litters were applied 2 weeks before planting + 0.192 kg plot <sup>-1</sup> N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O (20 DAS) + 1.2 ml hyfer plus foliar fertilizer applied at 25, 35 and 45 DAS |
| N <sub>4</sub> – 5 tha <sup>-1</sup> vermicompost + 1 li foliar fertilizer ha <sup>-1</sup>   | 6 kg plot <sup>-1</sup> vermicompost was applied 2 weeks before planting + 1.2 ml hyfer plus foliar fertilizer applied at 25, 35 and 45 DAS  |
| N <sub>5</sub> – 2.5 tha <sup>-1</sup> vermicompost + 22.50 – 22.50 – 22.50 kg N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O + 1 li foliar fertilizer ha <sup>-1</sup>    | 3 kg plot <sup>-1</sup> vermicompost was applied 2 weeks before planting + 0.192 kg plot <sup>-1</sup> N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O (10 DAS) + 1.2 ml hyfer plus foliar fertilizer applied at 25, 35 and 45 DAS     |

Moreover, different plant density was tested in this study to determine the effect of weed incidence to peanut plants.

There are many studies conducted using the combinations of different fertilizers but limited to peanut crop in relation to the planting densities, hence, this study was conducted to: Evaluate the productivity and weed response of peanuts as influenced by planting density and integrated nutrient applications and assess the profitability of peanut production per hectare as influenced by different planting densities and integrated nutrient applications.

## 2 MATERIALS AND METHODS

The study was conducted at the experimental area of the Department of Agronomy, College of Agriculture and Food Science, Visayas State University, Visca, Baybay City, Leyte, from February 5, 2022, to May 05, 2022. A 569.8 m<sup>2</sup> experimental area was plowed and harrowed thoroughly twice at one-week interval to pulverize the soil and to incorporate the weed residues in the soil. This was done to hasten its decomposition that provides good

soil conditions for seed germination. Furrows was made at a distance of 0.50 m between rows after the second harrowing.

### Experimental Design and Treatments

The experimental area of 569.8 m<sup>2</sup> was laid out in Split-plot arranged in a Randomized Complete Block Design (RCBD) with three (3) replications. There were two (2) main plots, each was divided into five (5) subplots measuring 3 m x 4 m. One (1) meter alleyway was provided between the replications and 0.5 m between treatment plots to facilitate farm operations and data gathering. The following are the treatments used in the study: Planting Density, D<sub>1</sub> – 1 seed per hill and D<sub>2</sub> – 2 seeds per hill as the main plot. Integrated Nutrient Applications; N<sub>0</sub> – Control (no fertilizer application), N<sub>1</sub> – Inorganic fertilizer at 45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O (RR), N<sub>2</sub> – 5 tha<sup>-1</sup> poultry litters + hyper plus foliar fertilizer, N<sub>3</sub> – 2.5 tha<sup>-1</sup> poultry litters + 22.50-22.50-22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + hyper plus foliar fertilizer, N<sub>4</sub> – 5 tha<sup>-1</sup> vermicompost + hyper plus foliar fertilizer, N<sub>5</sub> – 2.5 tha<sup>-1</sup> vermicompost + 22.50-22.50-22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + hyper plus foliar fertilizer, as the subplot.

### **Planting**

Seeds was sown directly to the soil per plot following the rates of the treatments of the study at one (1) seed per hill and two (2) seeds per hill to achieve the desired population of 100,000 to 200,000 plants hectare<sup>-1</sup>. The furrow distance was 0.50 m between rows and 0.20 m between hills. Additional seeds were sown beside the rows to replace right away the missing hills caused by ants, mole cricket and avian infestations at second day after sowing.

### **Application of Fertilizers**

The organic fertilizers were applied uniformly in furrows and incorporated into the soil in each treatment plot two weeks before planting (WBP) at the rate of 5tha<sup>-1</sup> (N<sub>2</sub> and N<sub>4</sub>) and 2.5tha<sup>-1</sup> (N<sub>3</sub> and N<sub>5</sub>). While, the complete fertilizer (14-14-14) was drilled in the furrows 20 days after sowing (DAS) following the treatments' rate at 45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O and 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O. Liquid foliar fertilizer was applied three times at 25, 35, and 45 days after sowing (DAS) following the recommended rate of 100ml per 16 liters of water (knapsack sprayer). Table 1 shows the actual amount of organic and inorganic fertilizer applied plot<sup>-1</sup>.

### **Cultivation and Maintenance**

Hilling up was employed four (4) weeks after sowing the peanut seeds or before flowering to minimize disturbance of peg formation in the soil for pod development. This allows the peanut seedlings for stability, better anchorage and to minimize weed occurrence. Spot-weeding was done to minimize the regrowth of weeds that appeared in the experimental area. Application of chemical pesticide was not applied due to controllable insect pest population which is below critical level. Leaf sucking and leaf feeding insect was controlled by handpicking then crushed to prevent further infestations and reproduction. Ants was also controlled by tracing and destroying their colony. Harvesting was done when peanuts reached their maturity period at 110 days from sowing. This was harvested by uprooting/pulling the peanut plants.

### **Data Gathered**

For weed parameters, two (2) quadrat samples (50 cm x 50 cm) was used. Identification of prevalent weed species; this was determined by identifying the major weed species such as grasses, sedges, and broadleaves present in each treatment plots at 15 and 40 DAT. For the weed incidence; this was recorded by determining the degree of weed incidence present within each treatment plot before weeding operation using the following rating scale developed by UPLB: no incidence (0%), light incidence (1-20%), moderate incidence (21-40%),

moderately high incidence (41-60%), heavy incidence (61-80%), severe incidence (81-100%). While for the fresh weight of weeds (g quadrat<sup>-1</sup>); this was determined by weighing the collected weed species within the 2-quadrats in each treatment plot at 15 and 40 DAT. Lastly, for the dry weight of weeds (g quadrat<sup>-1</sup>); this was determined by oven drying the weeds obtained from the 2-quadrat sample. Oven drying was done for 3 days until constant weight was attained.

For yield characteristics, number of pods per plant; this was determined by counting the total number of fully developed pods from the ten (10) sample plants in each treatment plot. Number of seeds per pod; this was determined by counting the number of seeds from the ten (10) sample pods in each treatment plot at harvest. Weight (g) of 1,000 seeds; this was obtained by weighing the 1,000 clean and dried seeds taken randomly from the ten (10) sample plants in each plot. Marketable pod yield (tha<sup>-1</sup>); this was obtained by weighing the clean and dried marketable pods within the harvestable area in each treatment plot. Marketable pods in kilogram ha<sup>-1</sup> were computed using the formula:

$$\text{Weight of marketable pods (t ha}^{-1}\text{)} = \frac{\text{Wt. of marketable pods (kgplot}^{-1}\text{)}}{\text{Harvestable Area (7.2m}^2\text{)}} \times \frac{10,000 \text{ m}^2 \text{ ha}^{-1}}{1,000 \text{ kg t}^{-1}}$$

While for the non-marketable pod yield (tha<sup>-1</sup>); this was determined from the weight obtained from those unfilled, immature, and diseased pods from each treatment plot at harvest. Total pod yield (tha<sup>-1</sup>), the weights of marketable pods and non-marketable pods (tha<sup>-1</sup>) was summed up to obtain the total yield (tha<sup>-1</sup>). Shelling Recovery (%); this was done by weighing 500 grams' sample pods, then shelled and compute the percent shelling recovery using the formula below:

$$\% \text{ Shelling recovery} = \frac{\text{Weight of seeds (g)}}{\text{Weight of unshelled pod samples (500g)}} \times 100$$

Seed yield (t ha<sup>-1</sup>). This was obtained by multiplying the total pod yield per hectare by the percent shelling recovery in each treatment plot.

$$\text{Seed Yield (tha}^{-1}\text{)} = \frac{\text{Pod yield (tha}^{-1}\text{)} \times \% \text{ Shelling recovery}}{100}$$

Harvest Index. This was determined by the ratio of the economic yield and biological yield of the crop. A high harvest index means that the photosynthates was consumed in the production of the reproductive parts thereby producing a high yield in proportion to the herbage yield. While, low harvest index means that the photosynthates consumed was higher in the production of

the herbage yield in proportion to pods formed (Papong and Cagasan, 2020). The dried pods and herbage of three (3) sample plants from each treatment plot was weighed separately to obtain the harvest index.

This parameter was obtained using the formula:

$$\text{Harvestable Index} = \frac{\text{Economic Yield}}{\text{Biological Yield}} = \frac{\text{Dry grain yield}}{\text{Dried grain yield} + \text{Dried herbage yield}}$$

### Profitability Analysis

Production cost was determined by recording all expenses incurred throughout the conduct of the study from land preparation up to harvesting. This includes the cost of labor, materials and fertilizer during the entire duration of the experiment. Gross income was computed multiplying the yield to the current price of dried peanut seeds. Net profit was obtained by subtracting the gross income to total expenses using the formula:

### Statistical Analysis

Analysis of variance of all data collected was done using Statistical Tool for Agricultural Research (STAR) version 2.0.1. A comparison of means was made using the Honestly Significant Difference (HSD) Test based on a 5% significance level.

$$\text{Net Return} = \text{Gross Income} - \text{Total Expenses}$$

Where:

$$\text{Gross Income} = \text{Yield computed hectare}^{-1} \text{ basis} \times \text{Current price of the crop (PHP kg}^{-1}\text{)}$$

$$\text{ROI} = \frac{\text{Net Income}}{\text{Cost of Investment}} \times 100$$

## 3 RESULTS AND DISCUSSION

### Weed Parameters

Data on weed incidence at 15 DAS and 40 DAS of peanut as influenced by planting density and integrated nutrient applications are presented in Table 2. Results revealed that planting density at 15 DAS and 40 DAS obtains the same result in weed incidence on D<sub>2</sub> (2 plants per hill) and D<sub>1</sub> (1 plant per hill) with moderately high and moderate weed invasiveness. Integrated nutrient applications recorded weed incidence that ranges from heavy to light invasiveness at 15 DAS and 40 DAS. Results revealed that at 15 DAS, N<sub>1</sub> (45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O) obtains heavy weed invasiveness while N<sub>4</sub> (5

tha<sup>-1</sup> vermicomposts + 1 li foliar fertilizer ha<sup>-1</sup>) was noted to have moderate weed invasiveness. At 40 DAS, Treatments 0, 1, 2, and 5 obtain a moderate weed invasiveness, while Treatment 3 and 4 were recorded to have light weed incidence. This was similar to the findings of El-Metwally and Abdelhamid (2008) on faba bean where the application of compost encouraged the growth of weeds on faba beans. Also, applying compost alone or in combination with 50 or 100 percent of the advised NPK rate boosted the development of faba bean more than weeds before flowering.

On the other hand, fresh weight weeds (g quadrat<sup>-1</sup>) and dry weight (g quadrat<sup>-1</sup>) as influenced by planting density and integrated nutrient applications are presented in Table 3. Data reveals that planting density had no significant effect on weeds' fresh and dry weight (g quadrat<sup>-1</sup>) at 15 DAS and 40 DAS. Numerically, D<sub>2</sub> (2 plants per hill) obtains heavier fresh weight (g quadrat<sup>-1</sup>) on 15 DAS as well as the fresh and dry weight at 40 DAS while, D<sub>1</sub> (1 plant per hill) obtains a heavier dry weight at 15 DAS. Moreover, data revealed a highly significant result on the fresh weight of weeds (g quadrat<sup>-1</sup>) at 40 DAS in terms of integrated nutrient applications. The heaviest fresh weight was obtained on plots applied with a complete rate of inorganic fertilizer (45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O) followed by N<sub>3</sub> (2.5 tha<sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>). In contrast, the lightest fresh weight was obtained on N<sub>4</sub> (5 tha<sup>-1</sup> vermicomposts + 1 li foliar fertilizer ha<sup>-1</sup>). These findings contradict Korres, (2018), who stated that weeds are highly responsive to nutrients. In contrast, the faster the release rates of inorganic fertilizer favor the growth and competitiveness of weeds. At the same time, plots applied with pure organic had shown a significantly reduced presence of weed growth. This might be due to the method of application of organic fertilizer where according to Liebman et al. (2009), band or furrow fertilizer application rather than broadcast fertilizer application boosted crop growth and hastened weed competition. Additionally, numerical results revealed that N<sub>2</sub> (5 tha<sup>-1</sup> poultry litters + 1 li foliar fertilizer ha<sup>-1</sup>) gains heavier fresh weight and Treatment 0 on the dry weight of weeds during 15 DAS while Treatment 1 (45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O) obtains the heavier dry weight at 40 DAS.

In addition, Table 4 reveals the dominant weed species on peanuts as influenced by planting density and integrated nutrient applications. Major weed species observed in the experimental area belong to various weed morphology (grasses, sedges, and broadleaves), families and life cycles. Grasses like jungle rice (*Rottboellia cochinchinensis* L.), barnyard grass (*Echinochloa crus-galli* L.), Indian goosegrass (*Eleusine indica* L.) that commonly belong to *Poaceae* family with an annual life

Table 2. Weed incidence at 15 and 40 DAT of peanut as influenced by planting density and integrated nutrient applications

| TREATMENT  | WEED INCIDENCE  |          |
|--|-----------------|----------|
|  | 15 DAS          | 40 DAS   |
| <b>Planting Density (PD)</b>   |                 |          |
| D <sub>1</sub> = 1 plant per hill  | moderately high | moderate |
| D <sub>2</sub> = 2 plants per hill   | moderately high | moderate |
| <b>Integrated Nutrient Applications (INA)</b>  |                 |          |
| N <sub>0</sub> = Control (No fertilizer applied)   | moderately high | moderate |
| N <sub>1</sub> = 45-45-45 kg ha <sup>-1</sup> N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O  | heavy           | moderate |
| N <sub>2</sub> = 5 tha <sup>-1</sup> poultry litters + 1 li foliar fertilizer ha <sup>-1</sup>   | moderately high | moderate |
| N <sub>3</sub> = 2.5 tha <sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg ha <sup>-1</sup> N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O + 1 li foliar fertilizer ha <sup>-1</sup> | moderately high | light    |
| N <sub>4</sub> = 5 tha <sup>-1</sup> vermicompost + 1 li foliar fertilizer ha <sup>-1</sup>  | moderate        | light    |
| N <sub>5</sub> = 2.5 tha <sup>-1</sup> vermicompost + 22.50 – 22.50 – 22.50 kg ha <sup>-1</sup> N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O + 1 li foliar fertilizer ha <sup>-1</sup>    | moderately high | moderate |

Table 3. Fresh weight (g quadrat<sup>-1</sup>) of weeds at 15 and 40 DAS on peanut as influenced by planting density and integrated nutrient applications

| TREATMENT                                     | 15 DAS                                  |                                       | 40 DAS                                  |                                       |
|---|---|---------------------------------------|---|---------------------------------------|
|   | FRESH WEIGHT (g quadrat <sup>-1</sup> ) | DRY WEIGHT (g quadrat <sup>-1</sup> ) | FRESH WEIGHT (g quadrat <sup>-1</sup> ) | DRY WEIGHT (g quadrat <sup>-1</sup> ) |
| <b>Planting Density (PD)</b>                  |   |                                       |   |                                       |
| D <sub>1</sub> – 1 plant per hill             | 27.10                                   | 21.43                                 | 18.22                                   | 4.67                                  |
| D <sub>2</sub> – 2 plants per hill            | 34.98                                   | 16.96                                 | 19.22                                   | 4.83                                  |
| F test  | ns                                      | ns                                    | ns                                      | ns                                    |
| <b>Integrated Nutrient Applications (INA)</b> |   |                                       |   |                                       |
| N <sub>0</sub>                                | 34.65                                   | 22.75                                 | 18.00ab                                 | 4.17                                  |
| N <sub>1</sub>                                | 35.13                                   | 22.47                                 | 28.00a                                  | 6.67                                  |
| N <sub>2</sub>                                | 38.90                                   | 21.02                                 | 13.00b                                  | 6.17                                  |
| N <sub>3</sub>                                | 19.90                                   | 12.62                                 | 25.00ab                                 | 6.17                                  |
| N <sub>4</sub>                                | 27.97                                   | 16.98                                 | 12.50b                                  | 3.33                                  |
| N <sub>5</sub>                                | 29.68                                   | 19.32                                 | 15.83ab                                 | 4.67                                  |
| F test  | ns                                      | ns                                    | **                                      | ns                                    |
| C.V. (a) %                                    | 32.85                                   | 22.03                                 | 23.33                                   | 16.08                                 |
| C.V. (b) %                                    | 37.37                                   | 38.28                                 | 32.20                                   | 34.16                                 |

Means within a column followed by the same letter and those without letter designations are not significantly different at 5% level, HSD.

Legend:

N<sub>0</sub> = Control (No fertilizer applied)

N<sub>1</sub> = 45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O

N<sub>2</sub> = 5 tha<sup>-1</sup> poultry litters + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>3</sub> = 2.5 tha<sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>4</sub> = 5 tha<sup>-1</sup> vermicompost + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>5</sub> = 2.5 tha<sup>-1</sup> vermicompost + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

cycle. Grasses were usually growing in the area because the area used in the study was the rainfed lowland rice.

Likewise, sedges: flat sedge (*Cyperus compactus* L.) and tall fringe rush (*Fimbristylis dichotoma* L.) grew in the

area that belongs to the family *Cyperaceae* and has an identified perennial life cycle and broadleaves like primrose willow (*Ludwigia octovalvis* (Jacq.)), garden spurge (*Euphorbia hirta* L.) and spreading dayflower (*Commelina diffusa* Burm.) with an annual life cycle that belongs to family *Onagraceae*, *Commelinaceae*, and *Euphorbiaceae*.

### **Yield and Yield Components**

Yield and yield components such as number of pods per plant, number of seeds per plant, and weight (g) of 1000 seeds of peanut were presented in Table 5. Results revealed that planting density did not significantly affect the number of pods per plant, number of seeds per plant, and weight (g) of 1000 seeds of peanut. Regarding numerical results, D<sub>2</sub> (2 plants per hill) obtains more pods and seeds per plant and heavier seeds than D<sub>1</sub> (1 plant per hill). The findings of this experiment were in contrast to the study of Bakal et al. (2020), where they stated that in terms of pod number, weight per plant and 100 seed weight values were decreased when planting density was also increased but resulted in having an increased shelling percentage, pod, and kernel yield.

On the other hand, integrated nutrient applications did not show significant variations in the number of pods per plant, number of seeds per plant, and weight (g) of 1000 seeds. Numerical results revealed that N<sub>3</sub> (2.5 tha<sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kgha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>) obtains more pods while the least number was observed on N<sub>0</sub> (no fertilizer applied). N<sub>4</sub> (5 tha<sup>-1</sup> vermicomposts + 1 li foliar fertilizer ha<sup>-1</sup>) and N<sub>5</sub> (2.5 tha<sup>-1</sup> vermicompost + 22.50 – 22.50 – 22.50 kgha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>) obtain a greater number of seeds per plant while least number was obtained on N<sub>3</sub>. Additionally, N<sub>5</sub> (2.5 tha<sup>-1</sup> vermicompost + 22.50 – 22.50 – 22.50 kgha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>) obtains heavier seeds while the lightest seeds were observed on N<sub>1</sub> (45-45-45 kgha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O). No significant interaction was noted in peanuts between planting density and integrated nutrient applications in terms of the number of pods per plant, the number of seeds per plant, and the weight (g) of 1000 seeds. This was due to the affected peg and pod formation during the heavy rains specifically observed on April, four (4) weeks before harvesting. This was supported by the idea provided by “The Peanut Grower” (2020), whereas deterioration or rotting was completely observed on matured pods. Depending on the pathogens and the climate, the color and texture of infected pods can vary from tan to brown with dry decay to oily, dark brown/black with moist decomposition. Due to the weakening of pegs, many pods may stay in the soil after digging. Groundnut Farming Manual (2019) stated that pod rot often has no visible symptoms above ground,

though badly afflicted peanut plants may be dark green and flowers longer. Aside from that, the root system is generally unaffected.

On the other hand, Table 6 present the data and interaction effect of planting density and integrated nutrient application on peanuts. Planting density did not significantly affect the weight of marketable and non-marketable pod yield as well as the total pod yield of peanuts. This finding was contrary to the statement of Nguiojio et al. (2011), where an increase in planting density also increases the total peanut yield. However, a further increase in planting density may also reduce yield. Numerical results revealed that D<sub>2</sub> (2 plants per hill) obtains a heavier pod yield than D<sub>1</sub> (1 plant per hill). Aside from that, integrated nutrient applications were found to be highly significant in terms of weight of non-marketable pod yield (tha<sup>-1</sup>) but were not marked significant on the weight of marketable pod yield (tha<sup>-1</sup>) and total pod yield (tha<sup>-1</sup>).

Heaviest non-marketable pods were found on plants not applied with any fertilizers (N<sub>0</sub>) but significantly comparable to plants applied with the recommended rate of inorganic fertilizer at 45-45-45 kgha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O (N<sub>1</sub>), and plants applied with 2.5 tha<sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li ha<sup>-1</sup> foliar fertilizer (N<sub>3</sub>), 5 tha<sup>-1</sup> vermicomposts + 1 li ha<sup>-1</sup> foliar fertilizer (T<sub>4</sub>) and 2.5 tha<sup>-1</sup> vermicomposts + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li ha<sup>-1</sup> foliar fertilizer (N<sub>5</sub>). The lightest non-marketable pods were obtained in plants with 5 tha<sup>-1</sup> poultry litters + 1 li foliar fertilizer ha<sup>-1</sup> (N<sub>2</sub>) but statistically similar to plants under the treatments (N<sub>1</sub>, N<sub>3</sub>, N<sub>4</sub>, and N<sub>5</sub>). These results were extremely influenced by environmental factors such as continuous and heavy rainfall that leads to well-saturated soils in the experimental area during pegging and pod development. This environmental aspect permits peanut pods to soak in water over several days, resulting in visible damages such as the browning of pegs, pod rot, and fungal infestations. This observation was similar to Nyvall, 2013 who stated that extensive soaking of peanut pegs causes rotting and black tips and peanut pods show symptoms of brown to black necrosis. Likewise, Ginzberg et al (2010) suggested that soil moisture within the pod-development zone should be kept to a minimum during the last four weeks of growth for successful productivity. Additionally, yield and yield components were also affected due by rodent attacks that caused drills, broken pods, and cut petioles (Alia et al. 2020). Rodent attacks were considered the most problematic vertebrate pest in peanut production (Loko et al. 2020). Rodent attacks can be addressed by applying rodenticides such as zinc phosphate (Singla and Babbar, 2015), biological control like avian predators (Labuschagne et al. 2016),

Table 4. Dominant weed species observed in the experimental area as influenced by planting density and integrated nutrient applications of peanut

| WEED GROUP  | COMMON NAME          | LOCAL NAME    | SCIENTIFIC NAME                       | FAMILY NAME   | LIFE CYCLE |
|-------------|----------------------|---------------|---------------------------------------|---------------|------------|
| Grasses     | Itchgrass            | Aguiñgay      | <i>Rottboellia cochinchinensis</i> L. | Poaceae       | Annual     |
|             | Junglerice           | Guinga        | <i>Echinochloa colona</i> L.          | Poaceae       | Annual     |
|             | Indian goosegrass    | Paragis       | <i>Eleusine indica</i> L.             | Poaceae       | Annual     |
| Sedges      | Purple nutsedge      | -             | <i>Cyperus rotundus</i> L.            | Cyperaceae    | Perennial  |
|             | Tall fringe rush     | Bungot-bungot | <i>Fimbristylis dichotoma</i> L.      | Cyperaceae    | Perennial  |
|             | Primrose Willow      | -             | <i>Ludwigia octovalvis</i> (Jacq.)    | Onagraceae    | Annual     |
| Broadleaves | Garden spurge        | Tawa-tawa     | <i>Euphorbia hirta</i> L.             | Euphorbiaceae | Annual     |
|             | Spreading day flower | -             | <i>Commelina diffusa</i> Burm.        | Commelinaceae | Annual     |

Table 5. Number of pods per plant, number of seeds per plant, and weight (g) 1000 seeds of peanut as influenced by planting density and integrated nutrient applications

| TREATMENT                              | NUMBER OF      |                 | WT (g) OF 1000 SEEDS |
|--|----------------|-----------------|----------------------|
|  | PODS PER PLANT | SEEDS PER PLANT |                      |
| Planting Density (PD)                  |                |                 |                      |
| D <sub>1</sub> – 1 plant per hill      | 26.88          | 1.91            | 376.32               |
| D <sub>2</sub> – 2 plants per hill     | 28.43          | 1.99            | 401.85               |
| F test                                 | ns             | ns              | ns                   |
| Integrated Nutrient Applications (INA) |                |                 |                      |
| N <sub>0</sub>                         | 24.95          | 1.94            | 403.81               |
| N <sub>1</sub>                         | 28.13          | 1.91            | 354.84               |
| N <sub>2</sub>                         | 27.22          | 1.94            | 386.83               |
| N <sub>3</sub>                         | 30.85          | 1.85            | 365.13               |
| N <sub>4</sub>                         | 26.83          | 2.03            | 370.08               |
| N <sub>5</sub>                         | 27.97          | 2.03            | 453.84               |
| F test                                 | ns             | ns              | ns                   |
| C.V. (a) %                             | 32.09          | 8.77            | 7.97                 |
| C.V. (b) %                             | 14.31          | 6.85            | 19.65                |

Means within a column followed by the same letter and those without letter designations are not significantly different at 5% level, HSD.

Legend:

N<sub>0</sub> = Control (No fertilizer applied)

N<sub>1</sub> = 45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O

N<sub>2</sub> = 5 tha<sup>-1</sup> poultry litters + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>3</sub> = 2.5 tha<sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>4</sub> = 5 tha<sup>-1</sup> vermicompost + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>5</sub> = 2.5 tha<sup>-1</sup> vermicompost + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

Table 6. Weight of marketable and non-marketable pod yield (tha<sup>-1</sup>) and total pod yield (tha<sup>-1</sup>) of peanuts as influenced by planting density and integrated nutrient applications

| TREATMENT                              | WT OF MARKETABLE POD YIELD (t ha <sup>-1</sup> ) | WT OF NON-MARKETABLE POD YIELD (t ha <sup>-1</sup> ) | TOTAL POD YIELD (t ha <sup>-1</sup> ) |
|--|--|--|---------------------------------------|
| Planting Density (PD)                  |  |  |                                       |
| D <sub>1</sub> – 1 plant per hill      | 1.41   | 0.23   | 1.66                                  |
| D <sub>2</sub> – 2 plants per hill     | 1.42   | 0.40   | 1.82                                  |
| F test                                 | ns   | ns   | ns                                    |
| Integrated Nutrient Applications (INA) |  |  |                                       |
| N <sub>0</sub>                         | 1.37   | 0.43a  | 1.80                                  |
| N <sub>1</sub>                         | 1.33   | 0.37ab   | 1.70                                  |
| N <sub>2</sub>                         | 1.57   | 0.16b  | 1.77                                  |
| N <sub>3</sub>                         | 1.48   | 0.28ab   | 1.80                                  |
| N <sub>4</sub>                         | 1.36   | 0.36ab   | 1.71                                  |
| N <sub>5</sub>                         | 1.38   | 0.28ab   | 1.65                                  |
| F test                                 | ns   | **   | ns                                    |
| C.V. (a) %                             | 1.42   | 177.04   | 52.45                                 |
| C.V. (b) %                             | 1.41   | 38.80  | 15.52                                 |

Means within a column followed by the same letter and those without letter designations are not significantly different at 5% level, HSD.

Legend:

N<sub>0</sub> = Control (No fertilizer applied)

N<sub>1</sub> = 45-45-45 kgha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O

N<sub>2</sub> = 5 tha<sup>-1</sup> poultry litters + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>3</sub> = 2.5 tha<sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>4</sub> = 5 tha<sup>-1</sup> vermicompost + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>5</sub> = 2.5 tha<sup>-1</sup> vermicompost + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

and fertility control (Jacoblinert et al. 2021) and by applying physical barriers (Cavia et al. 2019).

Interaction effects between planting density and integrated nutrient applications did not significantly observe in terms of weight of marketable and non-marketable pod yield as well as on the total pod yield.

Feng et. al (2013) stated that double-seed sowing of peanuts was the most dominant practice of the farmers. Their study confirms that single-seed sowing has the same results as double-seed sowing, which could promote peanut yield by ensuring root growth dominance, optimizing the root-shoot ratio, and enhancing the productivity potential of each seedling.

Additionally, Table 7 presents the data on planting density and integrated nutrient application in terms of percent shelling recovery, seed yield, and harvest index. Planting density has no significant effect on peanut's percent shelling recovery, seed yield and harvest index.

D<sub>2</sub> (2 plants per hill) obtains higher and heavier results in terms of percent shelling recovery and seed yield but D<sub>1</sub> (1 plant per hill) obtains a higher harvest index, numerically. This might be due to the high amount of organic matter and macronutrients in the soil as indicated in the soil analysis.

Integrated nutrient applications did not appear significant regarding percent shelling recovery, seed yield, and harvest index. In terms of numerical results, N<sub>2</sub> (5 tha<sup>-1</sup> poultry litters + 1 li foliar fertilizer ha<sup>-1</sup>) obtains a higher percent shelling recovery. In comparison, N<sub>4</sub> (5 tha<sup>-1</sup> vermicomposts + 1 li foliar fertilizer ha<sup>-1</sup>) obtains a lower shelling recovery, indicating a uniform low seed production in all treatment plots. N<sub>0</sub> and N<sub>2</sub> obtain heavier seed yields while N<sub>5</sub> (2.5 tha<sup>-1</sup> vermicomposts + 22.50 – 22.50 – 22.50 kgha<sup>-1</sup> N P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>) resulted in having the lightest seed yield. A higher harvest index was observed on N<sub>1</sub> (45-45-45 kgha<sup>-1</sup> N P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O) while N<sub>0</sub> (no fertilizer applied) gains the lower harvest index where low HI could have been attributed to non-marketable pods that possess immature,

unfilled, and damaged pods. Planting density with integrated nutrient applications does not have significant

Moreover, return on investment (ROI) is a financial metric commonly used to determine the probability of

Table 7. Percent shelling recovery (%), seed yield (tha<sup>-1</sup>) and harvest index (HI) of peanuts as influenced by planting density and integrated nutrient applications

| TREATMENT                              | PERCENT SHELLING RECOVERY (%) | SEED YIELD (tha <sup>-1</sup> ) | HARVEST INDEX |
|--|-------------------------------|---------------------------------|---------------|
| Planting Density (PD)                  |                               |                                 |               |
| D <sub>1</sub> – 1 plant per hill      | 61.17                         | 1.02                            | 0.42          |
| D <sub>2</sub> – 2 plants per hill     | 64.11                         | 1.17                            | 0.40          |
| F test                                 | ns                            | ns                              | ns            |
| Integrated Nutrient Applications (INA) |                               |                                 |               |
| N <sub>0</sub>                         | 63.83                         | 1.16                            | 0.40          |
| N <sub>1</sub>                         | 63.17                         | 1.07                            | 0.42          |
| N <sub>2</sub>                         | 65.67                         | 1.16                            | 0.41          |
| N <sub>3</sub>                         | 62.83                         | 1.13                            | 0.41          |
| N <sub>4</sub>                         | 58.83                         | 1.01                            | 0.41          |
| N <sub>5</sub>                         | 61.50                         | 1.02                            | 0.41          |
| F test                                 | ns                            | ns                              | ns            |
| C.V. (a) %                             | 1.42                          | 17.04                           | 9.71          |
| C.V. (b) %                             | 1.41                          | 18.80                           | 12.77         |

Means within a column followed by the same letter and those without letter designations are not significantly different at 5% level, HSD.

Legend:

N<sub>0</sub> = Control (No fertilizer applied)

N<sub>1</sub> = 45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O

N<sub>2</sub> = 5 tha<sup>-1</sup> poultry litters + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>3</sub> = 2.5 tha<sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>4</sub> = 5 tha<sup>-1</sup> vermicompost + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>5</sub> = 2.5 tha<sup>-1</sup> vermicompost + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

interaction in terms of percent shelling recovery, seed yield, and harvest index. Studies by Zhao et al. 2017 confirm that peanuts sown under single sowing had the same harvest index as those under double sowing.

generating a profit from a given investment. For instance, D<sub>1</sub>N<sub>0</sub> (no fertilizer applied) obtains the highest ROI with 125%. This means that there is an equivalent gain of PHP 1.25 pesos for every peso invested.

### Profitability Analysis

The cost and return analysis results of peanut production per hectare as influenced by planting density and integrated nutrient applications are presented in Table 8. D<sub>2</sub>N<sub>0</sub> gained the highest net income with PHP 73,980.00 with an economically favorable ROI of 125%, followed by D<sub>1</sub>N<sub>2</sub> with PHP 56,082.40 and an ROI of 94%. Negative or high loss of return was observed on 1 plant per hill and combinations of 5 tha<sup>-1</sup> vermicompost + 1 li foliar fertilizer ha<sup>-1</sup> (D<sub>1</sub>N<sub>4</sub>) with PHP -27,643.00 and -24% ROI and 2 plants per hill with combinations of 5 tha<sup>-1</sup> vermicompost + 1 li foliar fertilizer ha<sup>-1</sup> (D<sub>2</sub>N<sub>4</sub>) with PHP -5,643.00 and -5% ROI. This was due to the high cost of vermicompost per sack (@ PHP 600.00 per sack) and the high fertilizer requirement applied in the field.

### 4 CONCLUSION

Based on the results of the study, the following conclusions can be drawn: application of complete rate of inorganic fertilizer (45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O) and 2.5 tha<sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup> obtained the highest weed incidence and the heaviest weeds' fresh weight than the other treated peanut plants. Likewise, there was no significant influence on the planting density and integrated nutrient applications on peanut yield (tha<sup>-1</sup>), but it caused highly significant results on non-marketable pod yield. Moreover, there was an increase in the net income when using a two plants per hill even without the

Table 8. Profitability analysis (ha<sup>-1</sup>) of peanut as influenced by planting density and integrated nutrient applications

| TREATMENT                          | SEED YIELD (t ha <sup>-1</sup> ) | GROSS INCOME (PHP ha <sup>-1</sup> ) | PRODUCTION COST (PHP ha <sup>-1</sup> ) | NET RETURNS (PHP ha <sup>-1</sup> ) | ROI (%) |
|------------------------------------|----------------------------------|--------------------------------------|---|-------------------------------------|---------|
| Planting Density                   |                                  |                                      |   |                                     |         |
| D <sub>1</sub> – 1 plant per hill  |                                  |                                      |   |                                     |         |
| N <sub>0</sub>                     | 0.99                             | 99,000                               | 53,020.00                               | 45,980.00                           | 87      |
| N <sub>1</sub>                     | 1.00                             | 100,000                              | 61,893.40                               | 38,106.60                           | 62      |
| N <sub>2</sub>                     | 1.16                             | 116,000                              | 59,917.60                               | 56,082.40                           | 94      |
| N <sub>3</sub>                     | 1.10                             | 110,000                              | 63,946.6                                | 46,053.40                           | 72      |
| N <sub>4</sub>                     | 0.87                             | 87,000                               | 114,643.00                              | -27,643.00                          | -24     |
| N <sub>5</sub>                     | 0.97                             | 97,000                               | 88,441.00                               | 8,559.00                            | 10      |
| D <sub>2</sub> – 2 plants per hill |                                  |                                      |   |                                     |         |
| N <sub>0</sub>                     | 1.33                             | 133,000                              | 59,020.00                               | 73,980.00                           | 125     |
| N <sub>1</sub>                     | 1.14                             | 114,000                              | 67,893.40                               | 46,106.60                           | 68      |
| N <sub>2</sub>                     | 1.15                             | 115,000                              | 65,530.60                               | 49,469.40                           | 75      |
| N <sub>3</sub>                     | 1.15                             | 115,000                              | 69,946.60                               | 45,053.40                           | 64      |
| N <sub>4</sub>                     | 1.15                             | 115,000                              | 120,643.00                              | -5,643.00                           | -5      |
| N <sub>5</sub>                     | 1.06                             | 106,000                              | 84,441.00                               | 21,559.00                           | 26      |

Price of peanut = PHP 100.00/kg (Dried Seeds)

Legend:

application of any fertilizer materials D<sub>2</sub>N<sub>0</sub> of PHP 73,980.00 with 125% ROI and gained PHP 1.25 pesos in

N<sub>0</sub> = Control (No fertilizer applied)

N<sub>1</sub> = 45-45-45 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O

N<sub>2</sub> = 5 tha<sup>-1</sup> poultry litters + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>3</sub> = 2.5 tha<sup>-1</sup> poultry litters + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>4</sub> = 5 tha<sup>-1</sup> vermicompost + 1 li foliar fertilizer ha<sup>-1</sup>

N<sub>5</sub> = 2.5 tha<sup>-1</sup> vermicompost + 22.50 – 22.50 – 22.50 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 1 li foliar fertilizer ha<sup>-1</sup>

every peso invested, while the negative return was obtained both on D<sub>1</sub>N<sub>4</sub> and D<sub>2</sub>N<sub>4</sub> with -27,643.00 and -5,643.00% loss with ROI of -24% and -5%.

### RECOMMENDATION

1. Initial soil analysis must determine the area's soil properties before formulating different fertilizer combinations.
2. The use of poultry litter as an organic source of macronutrients is highly recommended as it provides higher nutrients and is a top cheap source of organic fertilizer.
3. Sow peanut seeds based on their planting season, preferably during late wet and early dry seasons, to prevent losses and achieve successful peanut growth and productivity.
4. A long-term study of integrated nutrient applications on peanuts may be conducted to verify the results on the status of the soil properties in marginal areas.

### REFERENCES

- Alia Z., Khachekhouch E., Amara D.G., Tennech N., Sekour, M. & Souttou, K. (2020). The rodents damages caused on *arachis hypogaea* and *pisum sativum* cultures in the South Region. *Algeria. Ponte International Journal of Science and Research*, 76(2).
- Assefa Y., Vara Prasad P.V., Carter P., Hinds, M., Bhalla, G., Schon, R., & Ciampitti I. A. (2016). Yield responses to planting density for US modern corn hybrids: A synthesis-analysis. *Crop Science*, 56(5), 2802-2817
- Bakal, H., Kenetli, A., & Arioglu, H. (2020). The effect of plant density on pod yield and some agronomic characteristics of different growthtype peanut varieties (*arachis hypogaea* L.) grown as a main crop. *Turkish Journal of Field Crops*, 25(1), 92-99.
- Cavia, R., Guidobono, J.S., Fraschina, J., & Busch, M.

- (2019). Effects of physical barriers and eradication on recolonization of rodents in poultry farms. *International Journal of Pest Management*, 65(4), 370-380.
- El-Metwally, I.M., & Abdelhamid, M.T. (2008). Weed control under integrated nutrient management systems in faba bean (*vicia faba*) production in Egypt. *Planta daninha*, 26, 585-594.
- Escototo, A.R. (2020). Effects of conservation tillage practices on soil properties and growth performance of sweet corn (*zea mays* L. var. Sacchrata) Varieties (MS thesis). Visayas State Univeristy, Leyte, Philippines.
- Feng, Y., Guo, F., Li, B., Meng, J., Li, X., & Wan, S. (2013). Effects of single-seed sowing on root growth, root-shoot ratio, and yield in peanut (*arachis hypogaea* L.). *Acta Agronomica Sinica*, 39(12), 2228-2237.
- Ginzberg, I., Tubi, A., Buchshtab, O., Wininger, S., Ben-Dor, B., Fogelman, E. & Kapulnik, Y. (2010). Soil type and wetness affect tint of peanut (*arachis hypogaea* L.) pod shell. *Peanut Science*, 37(2), 144-150.
- Green, B.W. (2015). Feed and Feeding Practices in Aquaculture. Woodhead Publishing Series in Food Science, Technology and Nutrition, 27-52. <https://doi.org/10.1016/B978-0-08-100506-4.00002-7>.
- Groundnut Farming. (2019). Technology Innovation Management & Entrepreneurship Information Service. Accessed 31 May 2022 from <https://www.technopreneur.net/technology/project-profiles/food/Groundnut.htm>.
- Korres, N. E. (2018). Agronomic Weed Control: A Trustworthy Approach for Sustainable Weed Management. Non-Chemical Weed Control, 97-114. doi:10.1016/b978-0-12-809881-3.00006-1.
- Labuschagne, L., Swanepoel, L.H., Taylor, P.J., Belmain, S. R., & Keith, M. (2016). Are avian predators effective biological control agents for rodent pest management in agricultural systems. *Biological Control*, 101, 94-102.
- Loko, Y.L.E., Montcho, D., Zandjanakou-Tachin, M., Orobiyi, A., Toffa, J., Hounmakou, E., & Dansi, A. (2020). Farmers' management of peanut (*arachis hypogaea* L.) diversity, their varietal preference traits and uses in Southern and Central Benin. *Journal of Crop Science and Biotechnology*, 23(3), 259-272.
- Mathivanan, S., SP, C. A. A., & Bakiyaraj, R. (2012). Effect of vermicompost on growth and yield of groundnut (*Arachis hypogaea* L.). *Int. J. Environ. Biol*, 2(1), 7-11.
- McElwain, A. (2019). Are peanuts peas... or nuts? The Irish Times. <https://www.irishtimes.com/life-and-style/food-and-drink/are-peanuts-actually-peas-or-nuts-1.3793899>.
- Mi, G., Chen, F., Yuan, L., & Zhang, F. (2016). Ideotype root system architecture for maize to achieve high yield and resource use efficiency in intensive cropping systems. *Advances in Agronomy*, 139, 73-97.
- Mowbot Team. (2018). Organic Fertilizer vs. Inorganic. <https://www.mowbot.com/blog/organic-fertilizer-vs-inorganic>.
- Muscănescu, A. (2013). Organic versus conventional: advantages and disadvantages of organic farming. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 13(1), 253-256.
- Ngouajio, M. (2011). Using the right planting density is critical for opportunity yield and revenue for vegetable crops. Michigan State University Extension. [://www.canr.msu.edu/news/using\\_the\\_right\\_planting\\_density\\_is\\_critical\\_for\\_optimum\\_yield\\_and\\_revenue](://www.canr.msu.edu/news/using_the_right_planting_density_is_critical_for_optimum_yield_and_revenue).
- Ngouajio, M., & McGiffen, M.E. (2002). Going organic changes weed population dynamics. *Hort Technology*, 12(4), 590-596.
- Nyvall, R.F. Ed. (2013). Field crop diseases handbook. Springer Science & Business Media.
- Papong, J.R. & Cagasan, U.A. (2020). Growth and yield performance of upland rice (*Oryza sativa* L. var. Zambales) intercropped with mungbean (*Vigna radiata* L.) and peanut (*Arachis hypogaea* L.). *International Journal of Agriculture Forestry and Life Sciences*, 4(1), 34-41.
- Sarcol, B.P., & Cagasan, U.A. (2016). Performance of Peanut (*arachis hypogaea* L.) as Influenced by Time of Planting Sweetpotato (*ipomoea batatas* L.) as Intercrop. *Annals of Tropical Research*, 38(1), 122-133.
- Singla, N., & Babbar, B.K. (2015). Critical timings and methods of rodent pest management in groundnut (*Arachis hypogaea* L.) crop. *Legume Research-An International Journal*, 38(5), 681-686.
- The Peanut Growers. (2020). Rains amplified pod rot issues accessed 26 June 2022 from <https://peanutgrower.com/feature/rains-amplify-pod-rot-issues/>.
- Zhao, C., Shao, C., Yang, Z., Wang, Y., Zhang, X., & Wang, M. (2017). Effects of planting density on pod development and yield of peanuts under the pattern of precision planted peanuts. *Legume Research-An International Journal*, 40(5), 901-905.