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Influence of Mahogany (*Swietenia macrophylla* King.) Leaf Litter on Eggplant (*Solanum melongena* L.) Seed Germination Performance

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Abstract: Evaluating the factors that influence seed germination is essential for improving crop establishment. Mahogany (*Swietenia macrophylla* King.) leaf litter can modify soil conditions by regulating moisture and nutrient availability. These alterations may significantly affect the germination performance of eggplant (*Solanum melongena* L.) a widely cultivated and economically important vegetable crop. This study aims to examine the effects of mahogany leaf litter on the germination performance of eggplant (*Solanum melongena* L.) seeds. The experiment included five (5) treatments with different amounts of mahogany leaf litter, along with a control treatment that contained no leaf litter. The germination performance of the seeds was evaluated using parameters such as germination percentage, germination capacity, germinative energy, and energy period. A total of 750 seeds were used for germination testing on germination performance. The field experiment followed a Randomized Completely Block Design (RCBD) with five treatments: T_1 (control), T_2 (100 g), T_3 (200 g), T_4 (300 g), and T_5 (500 g) of mahogany leaf litter, replicated three times. Results showed no significant differences in germination percentage and germinative capacity among treatments. However, germinative energy was significant, with T_2 (100 g) recording the highest value (48%), while the control (T_1) had the lowest (11.33%). Energy period was highly significant, with treatments T_2–T_5 showing faster germination (6–6.33 days). The research shows that mahogany leaf litter has no notable impact on the germination rate or overall viability of eggplant (*Solanum melongena* L.) seeds. That said, applying a moderate quantity (100 g) improved germination vigor and shortened the time to peak germination, leading to quicker results than the control. Overall, while it doesn't boost the total germination percentage, mahogany leaf litter can speed up and enhance the germination process at specific doses.

Keywords: Agroforestry; Eggplant; Germination; Leaf Litter.

INTRODUCTION

Agroforestry was the integration of agriculture and forestry that resulted in better natural resource management and sustainable land use. Agroforestry was also defined as a farming approach that allowed trees and shrubs to grow alongside crops and/or livestock, thereby integrating agriculture and forestry in the same land system. It was defined as a dynamic, ecologically based natural resource management system that diversified and sustained production for increased social, economic, and environmental benefits for land users at all levels through the integration of trees on farms and in the agricultural landscape, according to the International Center for Research in Agroforestry (Tobgay, 2019).

One of the agricultural crops used in the study was eggplant (*Solanum melongena* L.), which belonged to the family Solanaceae. It was a popular vegetable crop grown for its fruits. In terms of production and area, eggplant was the most significant vegetable crop in the Philippines. It was high in nutritional fiber and an excellent source of vitamins and minerals, making eggplant one of the most popular vegetables among Filipinos throughout the country (ISAAA, 2020). Eggplant was one of the most important, low-cost, and widely consumed vegetable crops in the Philippines (Hautea, 2014). According to Gerpacio et al. (2014) they stated that eggplant in the Philippines was an economically important vegetable. It was vital to the domestic vegetable industry, making the nation rank as the seventh-largest

producer of eggplant globally. It provided many small-scale farmers a source of income and employment. Also, due to its high vitamin, fiber, and mineral content, it offered great health and nutritional value. It was one of the most important, low-priced, and extensively consumed vegetable crops in Asia. In the Philippines, the production of eggplant accounted for more than 30% of the volume of the most important vegetables in the country (Hautea et al., 2016).

On the other hand, mahogany (*Swietenia macrophylla* King.) from the Meliaceae family, was a deciduous, tall tree that could reach a height of 10 meters and had a heavy, dark-green, dense crown. It was grown for the commercialization of its wood (Stuartx, 2018). The tropical. Americas were where mahogany originated (Krisnawati et al., 2011); however, due to the high value of its wood, the species was extensively cultivated in Asia, Africa, and several Pacific Islands (Bevacqua, 2021). Issifu et al. (2015) found that germination rates were better in the presence of litter. Linn (2012) discovered that decomposing leaf litter is essential for soil health, providing nutrients and retaining moisture. Becerra et al. (2004) concluded that leaf litter encourages seed germination. Sotes et al. (2018) revealed that seed survival rates were higher with leaf litter, suggesting that conservation efforts should protect both mature plants and leaf litter

Thus, the goal of this study aimed to determine the effect of mahogany leaf litter on the germination performance of eggplant (*Solanum melongena* L.). Specifically, its goals are to determine the germination performance in terms of the following i) germination percentage, ii) germination capacity, iii) germination energy, and iv) energy period.

MATERIALS AND METHODS

Location of the Study Area

The research was carried out at PSAU Bamboo and Rattan RDE Center (15°13'07.20"N 120°41'46.21"E) of Pampanga State Agricultural University (PSAU), situated in San Agustin, Magalang, Pampanga (Figure 1).

Figure 1. Study Site

Experimental Design

The study utilized a Randomized Complete Block Design (RCBD), which consisted of three blocks and five treatments. Each treatment used 50 seeds in germination trays, comprising a total of 750 eggplant seeds.

Experimental Treatments

The experimental treatments were as follows:

T_1- Control (no application)

T_2- 100g of MLL

T_3- 200g of MLL

T_4- 300g of MLL

T_5- 500g of MLL

where: Mll - Mahony leaf litter

Experimental Plant

Eggplant (*Solanum melongena* L.) Fortuner F1 variety was used. This particular variety took around 62-65 days after trans-planting to mature. It was known for being a high-yielding variety with a compact and vigorous build. Its fruit was one of its main features, measuring approximately 26-30cm in length, with a green calyx.

Preparation and Treatment Application

Mahogany leaf litter was collected and prepared for treatment by air-drying and grinding prior to application.

Air-dried mahogany leaf litter was manually mixed thoroughly with topsoil in each polyethylene bag. A measurement was done before the experiment to find out the exact volume of soil media in every polyethylene bag. The exact soil volume of each polyethylene bag was 9 kilograms. The volume of each polyethylene bag was uniformly weighed and was reduced depending on the treatment.

Seeds Sowing

Germination trays were utilized in assessing the germination of eggplant. The eggplant (*Solanum melongena* L.) seeds were sown per hole at a depth of 1.0 cm and covered with fine soil. After sowing the seeds, a mist of water was sprayed, and a plastic covering was put on for a few days to maintain the moisture of the soil.

Data Analysis

The data obtained in the study was statistically analyzed using the Analysis Variance (ANOVA) in Randomized Complete Block Design (RCBD) to find out if there were significant differences among the parameters tested in the study.

Germination Percentage

Germination was checked daily starting from sowing, for 21 days or until no more seeds sprouted over several days. A seed counted as germinated once its hypocotyl hook appeared above the soil (Fandohan et al., 2010).

Mean Germination Time (MGT) was computed based on the procedure of Yousheng and Sziklai (1985), as cited in Fandohan et al. (2010).

$$MGT = \sum ni\ di / n$$

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Where n is the total germination count, ni is the number of seeds germinating on day di, and di refers to the day of the measurement.

Germinative Capacity

According to Domin et al. (2019), germination capacity was the percentage of seeds that would typically germinate under ideal circumstances for the species.

Sprout counts were recorded every 24 hours. Germination energy (GEN) and germination capacity (GC) represent the fraction of seeds that developed sprouts after 14 days.

Germination energy (GEN) and germination capacity (GC) was defined as the fraction of germinated seeds (i.e., sprouts) after 14 days.

Both GEN and GC were expressed as the proportion of germinated seeds G at a specific time t, calculated with the following equation (*Pawłat et al., 2022)*.

$$Germinative = Tng/Tns \times 100$$

where: n - the number of seeds germinated at time t and n_T *- the total number of sown seeds*

Energy Period

According to Ford-Robertson (1971, as cited in Willan, 1985), defines energy period as the parameter refers to the set of seed lot that achieves germination within a specified timeframe (typically 7 or 14 days) under optimal or rigidly specified environmental conditions.

The data was obtained by gathering the peak of germination per treatment per day.

RESULTS AND DISCUSSIONS

Germination Percentage

The mean results were illustrated in Table 1. The highest germination percentage, with a mean of 85.33%, was observed in T_2 (100g), followed by T_1 (control) with 84%. T_3 (200g) showed a mean of 83.33%, while T_5 (500g) had a mean of 80.67%, and T_4 (300g) had the lowest mean of 75.33% among all the treatments.

The Analysis of Variance obtained no significant difference (Pr> F = 0.8448) in the germination percentage among the treatments. This suggests that most eggplant seeds used in the study germinated among all the treatments.

Table 1. Mean Germination Percentage (%).

Rates of Leaf Litter	Mean
T_1- Control (No application)	84.00
T_2- 100g	85.33
T_3- 200g	83.33
T_4- 300g	75.33
T_5- 500g	80.67

= Not significant at p<0.05

The results revealed that mahogany leaf litter did not affect the germination percentage of eggplant. According to the study of Issifu et al. (2015), all three species had higher germination rates in the presence of litter than in its absence. The positive impact of litter on seed germination was more pronounced at higher irradiance levels.

Germinative Capacity

Results were illustrated in Table 2 that T_3 (200g) had the highest mean (98.67%), followed by T_2 (100g) with a mean of 96%, T_1 (Control) had a mean of 92%. In comparison, T_5 (500g) obtained a mean of 89.33%, and T_4 (300g) obtained the lowest mean of 88% (Figure 2.).

The analysis of variance indicated that there was no significant difference (Pr> F = 0.3095) among treatments.

Table 2. Mean Germinative Capacity (%).

Rates of Leaf Litter	Mean
T_1- Control (No application)	92.00
T_2- 100g	96.00
T_3- 200g	98.67
T_4- 300g	88.00
T_5- 500g	89.33

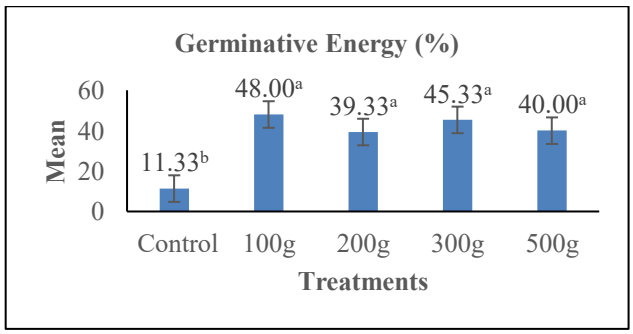
= Not significant at p<0.05

According to Fowler (1986) and Boeken & Orenstein (2001; Loydi et al., 2012), litter can aid in maintaining soil moisture. Furthermore, the presence of litter can increase the longevity of Bromus pictus seeds by ameliorating, which is considered one of the main causes of seed aging (Rotundo and Aguiar, 2005).

Germinative Energy

Based on the results, T_2 obtained the highest mean of (48%), followed by T_4 with a mean of (45.33%), T_5 had a mean of (40%), and T_3 with a mean of (39.33%), while T_1 obtained the lowest germinative energy of (11.33%) (Fig. 1)

Analysis of variance showed that there was a significant difference (Pr > F = 0.0157) among treatments at the 5% level. T_1 was found to be statistically significant among all the treatments in the study (Figure 1).



*=Significant at p<0.05. Treatment means with different letters are significantly different from each other based on Least Significant Difference (LSD). Standard deviation is shown by error bars.

Figure. 1. Germinative Energy

Domin et al. (2020) stated that germination energy is a numerical demonstration of the percentage of seeds that germinate quickly. The results of the study were relevant to the following study of Linn. (2012), where it was revealed

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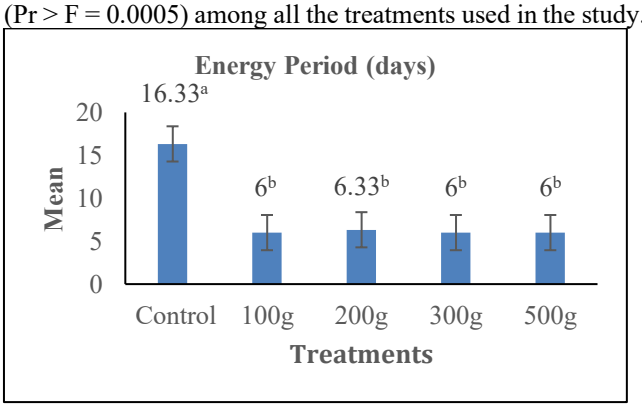
that leaf litter plays an important role in retaining soil health. As the leaf litter decomposes, it offers important nutrients to the soil and helps the soil stay moist. Additionally, Becerra et al. (2004) found that the existence of leaf litter resulted in earlier and more plentiful germination.

Energy Period (days)

The results illustrated in Figure 2 demonstrate that treatments T_2, T_3, T_4, and T_5 showed the shortest energy period. This suggests that the seeds in treatments under mahogany leaf litter had a better energy period than those in the control group. Based on the results, T_3 obtained a mean of (6.33 days) followed by T_2, T_4, and T_5 with a mean of (6 days). The mean of the control group T_1 takes (16.33) days to germinate, longer than those in T_2, T_3, T_4, and T_5 with a mean ranging only from (6-6.33 days).

Analysis of Variance revealed highly significant at the 1% level. The results reveal that T_1 was highly significant ($Pr > F = 0.0005$) among all the treatments used in the study.



**=Highly significant at p<0.01. Treatment means with different letters are significantly different from each other based on Least Significant Difference (LSD). Standard deviation is shown by error bars.

Figure. 2 Energy Period (days)

The finding aligns with the study of Becerra et al. (2004), who observed that leaf litter significantly improves both the speed and consistency of seed germination. Explained that leaf litter acts as a protective cover that helps retain soil moisture and minimizes environmental stress, thereby facilitating earlier germination. In a similar vein, Facelli and Pickett (1991) pointed out that leaf litter plays an important ecological role by altering the physical environment, particularly through maintaining soil moisture and reducing temperature extremes—conditions that are vital for successful germination.

Furthermore, Xiong and Nilsson (1999) reported that leaf litter can enhance seed germination by improving microsite conditions, including light availability and soil structure, depending on its thickness and composition. Likewise, Sayer (2006) emphasized that the decomposition of leaf litter supports nutrient cycling, thereby increasing the availability of nutrients necessary for early seedling development. These observations are reinforced by Baskin and Baskin (2014), who highlighted that factors such as adequate moisture and stable temperature both influenced by the presence of leaf litter are key in breaking seed dormancy and promoting successful germination.

CONCLUSION

In terms of the germination performance of eggplant seeds, the germination percentage and germination capacity revealed that they were not significant. However, it was observed that the treatment with mahogany leaf litter from T_2, T_3, T_4, and T_5 resulted in quicker germination in terms of germinative energy and energy period, as compared to the control group (T_1).

T_2, T_3, T_4, and T_5 obtained the highest peak of germination, ranging from 39.33% up to 48%. In contrast, T_1 obtained only 11.33% of germinative energy. Additionally, T_2, T_3, T_4, and T_5 obtained the shortest energy period, ranging from 6 to 6.33 days, whereas T_1 had an energy period of 16.33 days.

Although mahogany leaf litter treatments promoted quick germination, as observed in the energy period, the germination percentage of the seeds remained the same across all treatments, including the control.

Therefore, we recommend the use of mahogany leaf litter during eggplant (*Solanum melongena* L.) germination helps retain soil moisture, leading to faster seed germination. Additionally, future studies should analyze soil chemical composition under mahogany leaf litter applications and test its allelopathic effects on other crops.

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Conflict of Interest

The authors declared that they have no conflicts of interest.

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