

## **Influence Of Planting Time Interval with Dose of Local Organic Liquid Fertilizer (Lof-Nachi) On Growth and Production of Cowpea (*Vigna Unguiculata* L.) In Ermera Municipality**

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### **Abstract**

This study aimed to determine the optimal planting time interval and dose of local organic liquid fertilizer (Lof-nachi) for the growth and yield of cowpea (*Vigna unguiculata* L.) plants. The experiment was conducted over six months, from May to October 2024 in Fatuqueru Village, Railaco Administrative Post, Ermera municipality, located at an altitude of 880 m above sea level with an annual rainfall of approximately 2,000 mm. A split-plot experimental design (3 × 3 factorial) was employed, with two factors: planting time interval and dose of local liquid fertilizer. Results showed that productivity parameters were significantly influenced by the interaction between planting time interval and fertilizer dosage. Three yield parameters from the combined treatments showed significant differences. The number of pods and fruit length were significantly different ( $p < 0.01$ ), while the overall yield parameter was highly significant ( $p < 0.001$ ). The highest yield was obtained from the two-week planting interval combined with a fertilizer dose of 1,500 L/ha (I2A2), producing 3.51 t/ha. In contrast, the lowest yield was recorded in the control treatment (I0A0), with 1.47 t/ha. These findings highlight the importance of optimizing both planting schedules and organic fertilizer application to enhance cowpea productivity under local agro-ecological conditions.

**Keywords:** cowpea, planting time interval, local liquid fertilizer, Lof-nachi

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### **INTRODUCTION**

Cowpea (*Vigna unguiculata* L.) is a vegetable that has long been cultivated in Timor-Leste. Although the exact date of its introduction is unclear, it is likely that Portuguese agronomists brought the plant to the region as part of efforts to diversify local agriculture. Over time, adaptation to specific areas and climates has led to the development of various local varieties distinguished by color, resilience, and other agronomic traits. Today, this cowpea

bean is widely consumed and recognized as an important food source for Timorese communities (Adebo, 2023; Adekunle Stephen Toromade et al., 2024).

Globally, food security challenges continue to increase due to climate change, population growth, and declining agricultural productivity. Legume crops such as cowpea play an important role in addressing nutritional deficiencies because they contain high protein, vitamins, and mineral contents. In many developing countries, cowpea is considered a strategic crop for improving household food security and supporting sustainable agricultural systems.

Many farmers practice intercropping, particularly with cowpea. For example, with cowpea are often planted alongside maize during the fall season. In this system, maize and with cowpea seeds are sown together in the same hole, allowing the maize stalks to serve as natural supports for the climbing bean plants. This approach also accelerates the planting season by enabling two crops to be established simultaneously. However, cowpea legume is generally cultivated in smaller quantities, as they are not considered the primary crop in most farms. Data from the 2019 Agricultural Census illustrates this trend: while maize occupied 90,000 hectares nationwide, with cowpea cultivation covered only 1,070 hectares (TLAC Report, 2019).

In Timor-Leste, with cowpea are typically planted once during the rainy season. High rainfall intensity during this period often reduces yields. Excessive precipitation during flowering and fertilization interferes with pollination, either directly or by limiting pollinator activity, ultimately decreasing productivity (Lawson and Rands, 2019). Municipalities at medium to high altitudes, such as Ermera, Aileu, and Ainaro, are particularly affected due to their heavy rainfall patterns (Hasinah & Armis, 2012).

Cowpea production in Timor-Leste remains relatively low. According to statistical data from the Ministry of Agriculture and Fisheries (MAF, 2012), average yields were 1.07 t/ha in 2003 and increased to 2.5 t/ha by 2006. Despite this improvement, productivity is still considerably lower than in Indonesia, where yields range between 6.2 and 15 t/ha (Anonymous, 2003), even though both countries share similar climatic conditions. At the medium altitude in Aileu municipality, cowpea produced 1.6 t/ha (Gusmão and Sitorus, 2021). One major constraint is the limited knowledge among farmers regarding appropriate cultivation techniques, from seed preparation to harvest. Fertilizer use is minimal: chemical fertilizers are expensive and often unavailable in remote areas, while only a small number of farmers apply organic fertilizers, either liquid or solid. Liquid fertilizer, however, is relatively inexpensive to produce since raw materials are locally available, and its application has been shown to improve yields in legumes such as groundnut (Krismawati et al., 2024).

Cowpea thrives best in tropical climates with high rainfall. Within Timor-Leste's diverse agro-climatic zones, yields are generally higher at low to medium altitudes. The country has six agro-climatic zones, as classified by the Advanced Research Project Agency Network (ARPAPE, 1992) and further described by Molyneux et al. (2012) and Andrade et al. (2018). At medium and higher altitudes, rainfall volume and intensity must be carefully managed to avoid yield losses. Cowpea can extensively in the low lands and mid altitude regions (Agbogidi & Egho, 2012). For instance, in Ermera municipality, where experimental trials were conducted,

cowpea performed best at altitudes around 880 m above sea level, with optimal growing conditions at temperatures between 20–25 °C and effective annual rainfall of 1,500–2,500 mm. Cowpea can achieve good yields under favorable soil conditions with proper structure and texture, minimal pest and disease pressure, and the application of locally produced liquid fertilizers. The local produce of liquid fertilizer of *Lof-nachi* has shown promising growth and results. In Timor-Leste, cowpea is widely cultivated and sold in local markets, yet the crop has not expanded significantly nor gained recognition internationally. Traditionally, cowpea is consumed mixed with maize or processed into a small food for consume (Seeds of Life, 2013). Planting time intervals are an important cultivation technique for optimizing cowpea bean production. Regular observation of plant growth under different planting schedules helps identify the most effective practices. Jumini et al. (2012) reported that interval planting during the rainy season can improve yields by reducing the negative impact of excessive rainfall. Effective planting time management also minimizes competition between species, allowing cowpea to utilize soil nutrients more efficiently (Gusmao & Sitorus, 2021).

Despite the importance of cowpea, productivity in Timor-Leste remains relatively low compared to neighboring countries with similar climatic conditions. Previous studies have shown that rainfall intensity, planting schedules, and nutrient management significantly influence cowpea growth and productivity. However, studies integrating planting interval management and local organic liquid fertilizer application under medium-altitude conditions in Timor-Leste are still limited.

The novelty of this research lies in the combined evaluation of planting time intervals and locally produced *Lof-nachi* liquid fertilizer under high-rainfall conditions in Ermera municipality. Unlike previous studies focusing only on fertilizer application or planting schedules separately, this study examines the interaction between both factors in determining cowpea productivity.

Cowpea fruits and seeds are nutritionally valuable, being rich in protein and vitamins such as A, B1, B2, B3, B6, and B11. They also contain essential minerals including magnesium, zinc, phosphorus, and calcium. When consumed appropriately, cowpea can be associated with health benefits, including the prevention or management of diabetes, cancer, and heart disease (Jayathilake et al., 2018). In addition, older seeds can be processed into sugar or used as animal feed.

The objective of this research is to determine the most appropriate planting time interval at high altitudes in Ermera municipality for optimizing the growth and yield of cowpea plants. The experiment evaluates two key factors: planting time interval and liquid fertilizer dose. The interaction of these factors as treatments is expected to influence the growth parameters and productivity of cowpea bean. Planting time interval was applied as a cultivation technique to identify the optimal schedule for cowpea production. Proper timing is critical to avoid adverse climatic conditions that can negatively affect yield. Managing planting schedules effectively helps mitigate the impact of extreme weather and ensures better crop performance. The results of this study are expected to provide practical implications for farmers in medium-altitude regions by recommending appropriate planting schedules and

organic fertilizer doses. In addition, the findings may support government programs promoting sustainable agriculture and local organic fertilizer utilization in Timor-Leste.

## RESEARCH METHOD

This research employed a quantitative field experimental approach using a split-plot design with three replications (Creswell & Creswell, 2023; Sugiyono, 2020). The main plot consisted of planting time intervals, while the sub-plot consisted of different doses of local organic liquid fertilizer (Lof-nachi). The study was conducted from May to October 2024 in Fatuqueru Village, Railaco Administrative Post, Ermera municipality. Lof-nachi fertilizer was produced from locally available organic materials and applied according to treatment doses of 0 L/ha, 1,000 L/ha, and 1,500 L/ha. Data collection instruments included measuring tapes, vernier calipers, soil pH meters, thermometers, weighing scales, and field observation sheets. Growth and yield data were analyzed using analysis of variance (ANOVA) with a 95% confidence level. Significant differences among treatments were further tested using Duncan's Multiple Range Test (DMRT). Statistical analyses were performed using SPSS version 25.

This study was conducted from May to October 2024 in Ermera municipality, specifically in the Railaku administrative post, Fatuqueru village, at an altitude of 880 m above sea level with an annual rainfall of approximately 2,000 mm.

The equipment used included a knife, large needle, measuring tape, ruler, digital thermometer, vernier caliper, notebook, and pencil.

The experiment was conducted with split plot design (SPD) with two factors:

### **Planting time interval (I) as main plot**

- a. I0: Straight planting (control)
- b. I1: Planting one week after the control
- c. I2: Planting two weeks after the control

### **Dose of local liquid fertilizer (Lof-nachi) (A) as sub plot**

- a. A0: No fertilizer (control)
- b. A1: 1,000 L/ha of local organic liquid fertilizer
- c. A2: 1,500 L/ha of local organic liquid fertilizer

The combination of these factors formed the treatment structure, which was used to evaluate their influence on cowpea growth and production parameters.

## Research Implementation

The soil at the experimental site was tilled twice, and 27 plots were established with three replications. Each plot measured 3 m × 3 m, with 50 cm spacing between replication blocks. The total experimental area was 33 m × 11 m. The site had previously been used for maize cultivation for nearly 10 years.

Seeds were sown at a spacing of 50 cm × 50 cm. Planting holes were dug to a depth of 5–7 cm, with two cowpea seeds placed in each hole before being covered with soil. The first replicate (control) was planted initially, followed by the second and third replicates at one and two weeks after the control planting, respectively.

Weeding, pest management, and disease control practices were applied uniformly across all treatments. No plots were excluded from maintenance activities. Irrigation was not required, as rainfall was consistent throughout the growing season from planting to harvest.

### Data Collection

Three categories of variables were measured. The **environmental parameters** included soil temperature and soil pH. The **plant growth parameters** measured were plant height, stem diameter, and number of leaves. Finally, the **yield parameters** assessed were total fruit per plot, length of fruit, and overall productivity.

### RESULT AND DISCUSSION

Table 1 presents the interaction effects of planting time interval and local organic liquid fertilizer (Lof-nachi) dose on soil characteristics, vegetative growth, and yield parameters of cowpea. The observed variables included soil temperature, soil pH, stem diameter, number of leaves, plant height, number of pods, fruit length, and overall productivity.

**Table 1. Effect of planting time interval and Lof-nachi liquid fertilizer dose on soil properties, growth, and yield parameters of cowpea in Ermera municipality**

Fertilizer Dose	Planting Time Interval	Soil temperature (°C)	Soil pH	Stem diameter (mm)	Number of leaves	Plant height (cm)	Number of pods (per plot)	Fruit length (cm)	Yield (t/ha)
A0	I0	27.0	6.2	5.3	7.8	236.7	224.0	21.4	1.5
A0	I1	26.9	6.4	5.6	8.4	246.7	352.1	21.8	3.0
A0	I2	27.1	6	5.6	6.6	256.7	348.0	22.4	3.0
A1	I0	27.1	6.3	5.9	8.2	242.2	396.0	23.7	3.2
A1	I1	28.6	6.7	6.0	10.1	232.2	364.1	32.0	3.1
A1	I2	27.4	6.8	5.9	8.7	253.3	376.1	25.7	3.0
A2	I0	27.8	6.7	6.3	7.8	252.2	300.0	28.0	2.8
A2	I1	27.2	6.7	5.9	8.0	228.9	484.1	28.3	3.0
A2	I2	27.4	6.8	5.7	8.6	243.3	576.0	25.0	4.4
		Ns	**	*	ns	ns	**	**	***
		(p > 0.05)	(p < 0.01)	(p < 0.05)	(p > 0.05)	(p > 0.05)	(p < 0.01)	(p < 0.01)	(p < 0.001)

Source: Data Processed

Based on Table 1, the interaction between planting interval and fertilizer dose significantly affected several reproductive and yield-related parameters of cowpea. The highest productivity was observed in treatment combination I2A2, indicating that a two-week planting interval combined with 1,500 L/ha of Lof-nachi fertilizer provided the most favorable conditions for cowpea production under medium-altitude environments with high rainfall intensity.

The results demonstrated that the interaction between planting interval and Lof-nachi fertilizer significantly affected several growth and yield parameters of cowpea. The combination treatment I2A2 consistently produced the highest productivity, indicating that delayed planting combined with higher fertilizer application improved crop adaptation under high rainfall conditions. Increased soil pH values in fertilized plots indicated that Lof-nachi contributed to improved soil fertility and nutrient availability. Organic liquid fertilizer contains essential nutrients such as nitrogen, phosphorus, and potassium, which support vegetative growth and reproductive development. Similar findings were reported by Krismawati et al. (2024), who observed significant yield improvement in maize following organic fertilizer application in dryland systems. The increase in pod number and fruit length under fertilizer treatments suggests that nutrient availability during flowering and pod formation played a crucial role in enhancing productivity. Furthermore, delayed planting intervals reduced excessive rainfall exposure during critical reproductive stages, thereby improving pollination efficiency and pod development. The highest yield of 4.4 t/ha obtained in treatment I2A2 confirms that the integration of proper planting schedules and organic fertilizer management can substantially improve cowpea production in medium-altitude environments (Lawson & Rands, 2019).

After conducting analysis of variance (ANOVA) on the parameter data, some variables showed significant interactions between treatments, others showed only main effects, and some showed no significant differences (Fox, 2020; Sandoval et al., 2025).

For soil temperature, leaf number, and plant height, no significant differences were observed among treatments. Soil temperature at both planting and harvest remained stable, largely due to consistent rainfall during the harvest period and the presence of cowpea vegetation. This condition supports the findings of Rini & Nuraisyah (2021) who emphasized that vegetation cover is crucial for maintaining soil moisture and reducing evaporation caused by direct sunlight. Leaf number and plant height also showed no significant differences across treatment combinations, with only minor variations in values between treatments. Soil pH showed a significant interaction between the two factors, with differences among treatment combinations ( $p < 0.01$ ). Plots without liquid fertilizer and with delayed planting intervals had lower average pH values compared to those receiving fertilizer treatments. The highest pH was observed in treatment A2, with an average of 6.73, which was greater than all other treatments. In the final observation, the dose of organic liquid fertilizer (Lof-nachi) influenced leaf number. Treatment A1 recorded the highest leaf count (7.52), while treatment A0 had the lowest (6.52). This effect is attributed to the nitrogen content in Lof-nachi, which promotes leaf growth when applied at sufficient doses. Syafriana (2009) similarly reported that appropriate application of organic liquid fertilizer stimulates plant growth and enhances leaf development. For stem diameter, significant differences were observed in response to fertilizer dosage (Maintang et al., 2021; Mawali et al., 2023; Pangaribuan et al., 2019; Zewde et al., 2018). Treatments A1 and A2 produced the largest diameters, measuring 5.93 mm and 5.96 mm, respectively, indicating that higher doses of Lof-nachi contributed positively to stem thickening.

Three yield parameters from the combined treatments showed significant differences. The number of pods and fruit length were significantly different ( $p < 0.01$ ), while the overall yield parameter was highly significant ( $p < 0.001$ ). Both the liquid fertilizer dose and the planting time interval had a clear influence on cowpea yield.

## CONCLUSION

The combination of liquid fertilizer dose and planting time interval is important for farmers in medium-altitude regions with high rainfall intensity. The experiment conducted in Gleno Administrative Post, Ermera municipality, around 880 m above sea level, annual rainfall 1,250–2,250 mm, showed that weekly planting intervals provided effect and not produce significant differences in results. However, fertilizer dose treatments demonstrated clear and significant effects, particularly on yield. Plots treated with liquid fertilizer achieved markedly better outcomes compared to unfertilized plots, highlighting the importance of improving soil fertility through the application of organic fertilizers (both liquid and solid) or chemical fertilizers. The use of local organic liquid fertilizer (Lof-nachi) specifically showed a positive influence on production, confirming its potential as an effective input for enhancing cowpea yield under these conditions.

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