Effects of Liquid Organic and NPK Fertilizers

By Yustinus Sulistiyanto

Effects of Liquid Organic and NPK Fertilizers on Nutrient and Flavanoid Content in Grass Jelly (*Premna oblongifolia* Merr) Stem Cutting Leaves in Tropical Peat Soil

Yustinus Sulistiyanto, Siti Zubaidah, Adi Jaya, Salampak Dohong, Sih Winarti

Faculty of Agriculture, University of Palangka Raya, Indonesia

Corresponding author : adijaya@agr.upr.ac.id

Abstract

Agriculturally developed peat soils are typically deficient in fertility. The green grass jelly plant (*Premna oblongifolia* Merr) is one of the plants that gives certain health advantages. The purpose of the study was to examine the growth, nutrient absorption, and flavonoid content of grass jelly seed cuttings grown in peat soil by application of organic fertilisers and NPK and observing their interactions. The study employed a completely randomised design with 2 factors: liquid organic fertiliser consisting of 3 types (P0 (without liquid organic fertiliser), P1 (Agrobost), and P2 (Nasa), and NPK fertiliser consisting of 3 levels (NPK 0 g polybag^{-1}, N1 (NPK 1 g polybag^{-1}, and N2 (NPK 2 g polybag^{-1}). The results indicated that there was no interaction between liquid organic fertiliser and NPK fertiliser in terms of leaf growth of grass jelly plant cuttings, as measured by leaf area and fresh weight of grass jelly plant seed leaf cuttings. The N, P, and K nutrition content of grass jelly leaves varied, but Nasa liquid organic fertiliser and 2 g polybag^{-1} NPK fertiliser tended to produce the greatest N, P, and K nutrient content in comparison to other treatments. The administration of liquid organic fertiliser and NPK had no effect on the flavonoid content of grass jelly plant cuttings' leaves.

Keywords: *flavonoid, grass jelly plants, NPK fertilizer, organic fertilizer, peat soil, stem cuttings*

Introduction

The green grass jelly plant (*Premna oblongifolia* Merr) is a shrub-like grass jelly plant with dark green stems that can reach up to 5 metres in length. Green grass jelly leaves have been used traditionally as a jelly-like food producer and as an ingredient in grass jelly ice, which has the effect of chilling the stomach, decreasing fever, and alleviating digestive ailments. According to Hidayat and Napitupulu (2015), grass jelly is ideal for diet programmes due to its low caloric content and high fibre content. Its fibre is beneficial for removing cancer-causing carcinogens from the digestive organs.

Secondary chemical compounds found in grass jelly leaves include saponins, glycosides, flavonoids, alkaloids, tannins, steroids, or triternoids and their potential for cancer treatment, as flavonoids are antioxidants that have the potential to prevent the formation of free radicals and can be used to treat tumours (Santoso et al. 2008). According to Rahayu et al. (2013), the principal constituent of green grass jelly gel that produces pectin polysaccharides is low methoxy. Pectin is a hydrocolloid component with the potential to be utilised as agar. To convert green grass jelly into powder, Meseration and Foam Mat Drying techniques must be utilised. At a mass ratio of 15 grass jelly leaves to 20 distilled water, with 20 emulsifier, and a temperature of 40 degrees Celsius, optimal conditions were attained.

In Indonesia, grass jelly plants are commonly grown in backyards as one of the family's medicinal plants and a refreshing beverage product, therefore it has the potential to be developed as a healthy functional beverage product. This plant is not commonly recognised in Central Kalimantan, Indonesia, but it can grow well in some areas; consequently, attempts to boost grass jelly leaf production are extremely promising, considering the vast amount of accessible land. However, problems exist since the majority of the soil types are peat soils.

According to Anda et al. (2021), the total area of peat in Indonesia is 13.43 million hectares, distributed over Sumatra (5.5 million hectares), Kalimantan (4.54 million hectares), Papua (3.01 million hectares), and other regions. In West Kalimantan, peat covers 1.55 million hectares, of which 1.02 million hectares have a depth of less than 3 metres and 0.53 million hectares have a depth of more than 3 metres. In Central Kalimantan, peat covers 2.55 million hectares, of which 1.86 million hectares have a depth of 3 metres and 0.69 million hectares have a depth of > 3 metres. Tim Peneliti IPB (1986) proposed that peat in Central Kalimantan is categorised as mesotropic peat (moderate fertility level) and oligotropic peat (low fertility level) based on its nutrient content (low fertility level). Low nutrient availability, extremely high cation exchange capacity (CEC), high base saturation (BS), and low pH are the limitations of peat soil as a limiting factor for plant development. Peat soils are typically deficient in nutrients, and their pH ranges from extremely acidic to acidic. In an environment with a high concentration of H^+ ions, nitrate accumulates rapidly. The amount of nutrient N in peat soil is extremely considerable, but it is bound (N-organic) and so unavailable to plants (Munir 1996).

Improving the fertility of peat soils through the application of liquid organic and inorganic fertilisers is one strategy for overcoming the challenges of cultivating plants on peat soils. Liquid organic fertiliser is suitable for use in leaf vegetable plants because it does not cause long-term side effects and is more easily absorbed by plants when applied through the leaves. According to the findings of Lusmaniar et al. (2020), liquid organic fertiliser Agrobost with a concentration of 6 cc liter-1 produced the best plant height and number of branches in green bean plants. Yanto et al. (2016) found that the application of Nasa organic fertiliser had a significant influence on the parameters of oil palm seedling plant height, tuber diameter, root volume, fresh weight, and dry weight, but not on the number of leaves. Inorganic fertilisers added to peat soil can increase the nutritional status of peat soil, hence enhancing its quality. The optimal application of NPK fertiliser at a dose of 1 g $polybag^{-1}$ had an influence on the wet weight and dry weight of green grass jelly plants, according to the findings of Butar-Butar research's (2020). On the basis of these issues, it is required to investigate the influence of liquid organic fertiliser and NPK inorganic fertiliser on the growth of green grass jelly stem cuttings in peat soil.

The objective of this study was to examine the effect of initial information on grass jelly cultivation on peat soil by means of efforts to improve the fertility of peat soil and plants through the application of both organic and an organic fertiliser, as well as its role in increasing the phytochemical content of plants and yields of plants grown on peat soils.

Material and Methods

The study employed a totally randomised design with two factors: liquid organic fertiliser (P), which comprised of three types: P0 (no liquid organic fertiliser), P1 (Agrobost), P2 (NASA), and NPK fertiliser. (N) is comprised of three levels: N0 (no NPK), N1 (NPK 1g polybag^{-1}), and N2 (NPK 2g polybag^{-1}).

The peat soil was collected from the Kalampangan Sub District, Central Kalimantan, Indonesia, air-dried and sifted to a maximum weight of 6 kg, and placed in a 20 x 30 centimetre polybag. The peat soil was dosed with 5 tons ha^{-1} of chicken dung and 1 ton ha^{-1} of lime, then incubated for two weeks. Being supporting data, an examination of the original soil nutrient content was conducted, with pH, N, P, and K as the factors evaluated. The examination of nutritional content was conducted at the University of Palangka Raya's Integrated Laboratory.

The cuttings were picked from grass jelly stems with robust development, a green hue, and a consistent diameter. Cuttings are 20 to 25 cm in length (consisting of 2-3 segments). The cut cuttings are then submerged in a growth regulator solution (Root Most) to encourage root development. After 30 minutes of soaking, the seeds were placed in the prepared polybags. In the morning, seedlings are planted in planting holes in polybag medium, one cutting per polybag. Fertilization with NPK fertiliser was performed twice, with half the treatment dosage administered one week after the first shoots developed (3 WAP) and the other half administered seven weeks later (7 WAP). Apply fertiliser around 5 cm from stem cuttings. The Liquid Organic Fertilizer (LOF) utilised is Agrobost and Nasa, sprayed every two weeks till the plant is three months old. The POC will be applied at a concentration of 3cc liter^{-1}, and each plant will get 3 ml every application. The morning application consists of sprinkling POC over the upper and lower surfaces of the leaves. The plant is watered once each day or according to weather circumstances, up to 250 ml. Intensive weeding is performed by eliminating the visible weeds from the polybags. By eliminating grasshopper pests and caterpillars that damage plants, pest and disease management is accomplished manually. In the meanwhile, flea-borne disorders are controlled with insecticides including garlic extract. After the stem cuttings have grown for 12 WAP, they are harvested by taking old grass jelly leaves, which have a dark green leaf colour, typical leaf size, and new leaves. The observed variables are: 1) leaf area (cm^2 plant^{-1}), measured at 12 WAP using the length x width x correction factor technique, 2) leaf length (cm), and 3) leaf width (cm). Fresh Leaf Weight (g) per plant, as determined by weighing the total leaf weight at 12 WAP. At the age of 12 WAP, an analysis of leaf nutrient absorption, including N, P, and K, was conducted at the Chemistry Laboratory of Lambung Mangkurat University, Banjarmasin. At the Pharmacy Laboratory of Lambung Mangkurat University in Banjarmasin, South Kalimantan, Indonesia, flavonoid content was analysed.

Results and Discussion

Leaf surface area of grass jelly seedlings

According to the findings of an analysis of variance, the interaction between liquid organic and inorganic fertilisers had no significant influence on the leaf area of grass jelly stem cuttings. The quantity of leaves was significantly affected by the individual factors of organic and inorganic fertilisers. Table 1 displays the average leaf area for applications of liquid organic fertiliser and inorganic fertiliser.

Table 1. Average leaf area of green grass jelly stem cuttings (cm2 per plant) in the application of liquid organic fertilizer and inorganic fertilizer in peat soil at the age of 12 WAP

Treatments	NPK Dosages			Average P
	N0 (0g polybag^{-1})	N1 (1g polybag^{-1})	N2 (2g polybag^{-1})	
P0 (without LOF)	574.64	2,113.14	1,099.29	1,262.36 a
P1 (Agrobost)	2,166.94	2,123.12	2,217.30	2,169.12 b
P2 (Nasa)	1,013.78	2,797.16	3,159.27	2,623.40 b
Average N	1,551.79a	2,344.47b	2,158.62b	

Note: Numbers followed by the same letter in the same row are not significantly different according to the HSD 5% test (mean N) and numbers followed by the same letter in the same column are not significantly different according to the HSD 5% test (mean P).

According to Table 1, the application of liquid organic fertiliser P1 (Agrobost) did not differ substantially from P2 (NASA), but it did differ considerably from the control. Applying liquid organic fertiliser to grass jelly stem cuttings can improve their leaf area. This is because NASA's organic fertiliser has a high concentration of macro and micronutrients, which are essential for leaf production. Nasa includes total nutrients in 500 cc as follows: (N, P_2O_5, K_2O) 0.18%, C-organic 4.6%, Zn 41.04 ppm, Cu 8.43 ppm, Mn 2.42 ppm, Cl 0.29%, Na 0.15%, B60.84 ppm, Si 0.01%, Al 6.38 ppm, NaCl 0.98%, Se 0.11 ppm, Cr 0.05 ppm, Mo (Kardinan 2011). The biological fertiliser Agrobost liquid organic fertiliser contains *Azotobacter* sp., *Azospirillum* sp., *Lactobacillus* sp., *Pseudomonas* sp., phosphat solubilizing bacteria, and cellulotic microbes. Azotobacter is a non-symbiotic aerobic nitrogen-fixing bacteria capable of fixing nitrogen at very high concentrations, ranging from 2 to 15 mg nitrogen per gramme of carbon source (Rahmi 2014; Lusmaniar et al. 2020).

Nitrogen elements that can be anchored by the bacteria *Azotobacter* and *Azospirillum* aid in the creation of chlorophyll, which influences photosynthesis in plants. Nitrogen is a component in the formation of organic substances such as amino acids, proteins, nucleoproteins, and different enzymes, hence influencing cell division and cell enlargement (Gardner et al. 1991). According to the findings of Ikhwan et al. (2015), the application of *Azospirillum* isolates increased the number of leaves, leaf area, and plant biomass in maize plants. According to the findings of Lusmaniar et al. (2020), the organic fertiliser Agrobost 6 cc liter^{-1} had the greatest impact on the plant height and number of branches per plant of green beans.

According to the findings of Ikhwan et al. (2015), the application of *Azospirillum* isolate increased the leaf area of maize plants. *Lactobacillus* species have exceptional decomposition abilities. *Pseudomonas* sp. is a hydrocarbon-degrading bacteria. Various types of microorganisms improved the development of grass jelly stem cuttings' leaf surface area.

NPK inorganic fertiliser dosages of N1 (1g plant^{-1}) and N2 (2g plant^{-1}) resulted in a considerably larger leaf area compared to N0 (control). This indicates that applying 1-2g of a high-quality NPK fertiliser per plant can enhance the leaf area of grass jelly stem cuttings. Nitrogen is a key ingredient of the structure of chlorophyll. Plants that receive sufficient nitrogen will have a high chlorophyll content, allowing them to produce wide leaves. Phosphorus is essential for the formation of the cell nucleus, lipids, and proteins. Phosphorus functions in plant development for root development, blooming, and fruit/seed/grain ripening. Potassium's primary purpose is to activate enzymes and maintain cellular hydration. Starch synthesis, ATP generation, photosynthesis, nitrate reduction, and sugar translocation to seeds, fruit, tubers, or roots are active enzymes (Budianta and Ristiani 2013).

In the N0 (control) treatment, plant leaf area was reduced. It was assumed that nutrient availability was limited due to the fact that nutrients were only collected from manure (5 tonnes ha^{-1}) and nutrients from relatively poor peat soil, where the first soil study revealed the presence of nutrients. Total N concentration is 2.65%, total P concentration is 474.60 ppm, and total K concentration is 1.89 me 100g^{-1}. The plants generated a leaf area of 1551.79 cm2 per plant, which was much less than the N1 (1g plant^{-1}) and N2 (2 g plant^{-1}) treatments, which produced leaf areas of 2344.47 cm^2 and 2158.62 cm^2, respectively.

Leaf weight of grass jelly seedlings

The analysis of variance revealed that the interaction between liquid organic fertiliser and inorganic fertiliser had no influence on new leaf fall. Single applications of liquid organic fertiliser and NPK inorganic fertiliser have a substantial impact. Table 2 displays the average fresh weight of leaves administered liquid organic fertilisers and inorganic fertilisers.

Table 2. Average fresh weight of leaves of green grass jelly stem cuttings (g plant^{-1}) in the application of liquid organic fertilizer and inorganic fertilizer in peat soil at the age of 12 WAP.

Treatments	NPK Dosage			Average P
	N0 (0 g plant^{-1})	N1 (1g plants^{-1})	N2 (2 g plant^{-1})	
P0 (without LOF)	14.75	39.21	32.80	28.92 a
P1 (Agrobost)	38.08	38.88	46.17	41.04 b
P2 (Nasa)	31.89	51.22	57.96	47.02 b
Average N	28.24a	43.10b	45.64b	

Note: Numbers followed by the same letter in the same row are not significantly different according to the HSD 5% test (mean N) and numbers followed by the same letter in the same column are not significantly different according to the HSD 5% test (mean P).

Based on Table 2, at 12 WAP, the application of Agrobost liquid organic fertiliser was not statistically different from that of NASA, but it was significantly different from the control. At the age of 12 WAP, using liquid organic fertiliser can enhance leaf area. The application of NPK inorganic fertiliser at a dose of N0 (0 g plant^{-1}) resulted in a considerably smaller leaf area compared to the doses of N1 (1 g plant^{-1}) and N2 (2 g plant^{-1}).

The use of liquid organic fertiliser can boost the fresh weight of grass jelly stem cuttings' leaves. This is because NASA's organic fertiliser has a high concentration of macro and micronutrients, which are essential for leaf production. 500 cc of Nasa has the following nutrients: (N, P_2O_5, K_2O) 0.18%, C-organic 4.6%, Zn 41.04 ppm, Cu 8.43 ppm, Mn 2.42 ppm, Cl 0.29%, Na 0.15%, B 60.84 ppm, Si 0.01%, Al 6.38 ppm, NaCl 0.98%, Se 0.11 ppm, Cr 0.05 ppm, Mo The application of Nasa fertiliser significantly affected the leaf area of white teak seedlings, as demonstrated by Hutubessy's (2013) research (*Gmelina arboria* Roxb).

The biological fertiliser Agrobost liquid organic fertiliser contains *Azotobacter* sp., *Azospirillum* sp., *Lactobacillus* sp., *Pseudomonas* sp., phosphat solubilizing bacteria, and cellulotic microbes. Azotobacter is a non-symbiotic aerobic nitrogen-fixing bacteria capable of fixing nitrogen at very high concentrations, ranging from 2 to 15 mg nitrogen per gramme of carbon source (Rahmi 2014; Lusmaniar et al. 2020). According to the findings of Ikhwan et al. (2015), the application of *Azospirillum* isolate enhanced the vegetative development of maize plants. The species of. The capacity of *Lactobacillus* to breakdown plant materials is exceptional. *Pseudomonas* sp. is a hydrocarbon-degrading bacteria. The use of Agrobost biological fertiliser can aid in the delivery of airborne nutrients and dissolve bindings that render some nutrients inaccessible to plants. Through this method, the availability of nutrients to plants will increase, resulting in a greater fresh weight of stem grass jelly leaf cuttings.

The P0 treatment (without POC) resulted in significantly lower growth in shoot length, number of leaves, leaf area, and fresh leaf weight compared to the organic fertilisers Agrobost and Nasa. This is because the grass jelly stem cuttings only received nutrients from the manure added to the planting medium (5 tons ha^{-1}) and the nutrient content of peat soil, where the initial soil analysis results only contained N-total 2.65%, P-total 474.60 ppm, and K- Physically, the P0 treatment exhibited a yellowish leaf hue, which is indicative of nitrogen-deficient plants. Nitrogen is a component of chlorophyll; if a plant lacks nitrogen, it will exhibit signs of chlorosis.

The use of inorganic NPK fertiliser had a substantial influence on leaf area and leaf fresh weight per plant, according to the findings. N1 and N2 dosages considerably increased leaf area and fresh weight in comparison to N0 (without nitrogen). In the early growth of grass jelly stem cuttings, the need for nitrogen, phosphorus, and potassium can be met by applying chicken manure (5 tons ha^{-1}) and half the dose of NPK (0.5g and 1g $plant^{-1}$), but these nutrients have not been able to significantly increase shoot length, number of shoots, or number of leaves. At the age of 12 WAP, all doses of NPK fertiliser had been administered, and the plants promptly responded by increasing leaf area and leaf fresh weight. At the age of twelve, WAP grass jelly stem cuttings have reached optimal development and may be transplanted directly to the field. This is shown by the absence of a considerable growth in shoot length, number of shoots, and number of leaves, and by the appearance of connected roots on the long stems of shoots, indicating that the plant need a ridge or attachment point.

NPK inorganic fertiliser dosages of N1 (1g $plant^{-1}$) and N2 (2 g $plant^{-1}$) substantially increased leaf fresh weight compared to N0 (control). The fresh weight of the N0 treatment was 28.24 g, which was less than the N1 treatment's 43.10 g and the N2 treatment's (2 g $plant^{-1}$) 45.64 g $plant^{-1}$ fresh leaf weight. This indicates that the application of 1-2 g of a high-quality NPK fertiliser per plant can improve the fresh weight of grass jelly stem cuttings. This is because nitrogen, phosphorus, and potassium are essential for plant development. Nitrogen is a key ingredient of the structure of chlorophyll. Plants with enough nitrogen availability will generate enough chlorophyll for the photosynthesis process, which will influence the amount of photosynthate produced and the growth in leaf fresh weight. Plants with wide leaves and a high chlorophyll content will create enough assimilates for their vegetative development.

Plants that are sufficient for nitrogen nutrients will experience an increase in vegetative growth such as leaf area. High photosynthetic activity is also due to plant sufficiency in the element nitrogen, which forms chlorophyll, so that the allocation of photosynthate in the leaves increases which results in higher leaf fresh weight and significantly different compared to the control.

Phosphorus functions for the preparation of the cell nucleus, fat, protein. In plant growth, phosphorus functions for root growth, flowering and fruit/seed/grain ripening. Potassium main function is to activate enzymes and maintain cell water. Enzymes that are activated include starch synthesis, ATP production, photosynthesis, nitrate reduction, sugar translocation to seeds, fruit, tubers or roots (Budianta and Ristiani 2013).

Nutrient content of leaves of grass jelly plant seeds

The results of the analysis of nutrient uptake of N, P and K on the leaves of grass jelly cuttings showed various results depending on the type of liquid organic fertilizer used and the dose of NPK fertilizer. The results of the analysis of the nutrient content of N, P and K in the leaves of grass jelly cuttings are presented in Tables 3, 4 and 5.

Table 3. N nutrient content (%) in green grass jelly cuttings

Organic Fertilizers	NPK			Average
	N0 (0 g polybag^{-1})	N1 (1g polybag^{-1})	N2 (2g polybag^{-1})	
P0 (Without)	0.4626	1.4492	1.0286	0.9801
P1 (Agrobost)	0.8103	1.1321	1.6030	1.1818
P2 (Nasa)	1.1429	1.7210	2.2071	1.6903
Average	0.8053	1.4341	1.6129	-

Based on Table 3, the highest N nutrient content was in the application of liquid organic fertilizer Nasa + NPK 2 g polybag^{-1}. This is because the N nutrient content in Nasa fertilizer is higher than the Agrobost liquid organic fertilizer and the dose of NPK given is higher (2 grams) compared to treatments N0 and N1. N nutrient uptake is greatly influenced by the nutrient content of the liquid organic fertilizer and the dosage of application, because the roots of grass jelly cuttings will absorb this nutrient through the soil to be accumulated in the leaf organs. The wider and heavier the leaves per plant, the higher the N uptake in the leaves. The results of measuring leaf area and leaf weight by leaf weight of grass jelly cuttings showed that in the P2N2 treatment, leaf area and leaf weight were the highest compared to the other treatments.

Table 4. P nutrient content (ppm) in green grass jelly cuttings

Organic Fertilizers	NPK			Average
	N0 (0g polybag^{-1})	N1 (1g polybag^{-1})	N2 (2g polybag^{-1})	
P0 (Without)	0.0031	0.0118	0.0135	0.0095
P1 (Agrobost)	0.0047	0.0116	0.0072	0.0078
P2 (Nasa)	0.0095	0.0124	0.0119	0.0113
Average	0.0058	0.0119	0.0109	-

The P nutrient content in the leaves of the grass jelly cuttings revealed that the P nutrient content in the leaves treated with the Nasa organic fertiliser was greater than the Agrobost organic fertiliser. This was determined by comparing the P nutrient content between the two organic fertilisers. However, there is a tendency that liquid organic fertiliser does not affect P nutrient uptake in the leaves. This is because more P nutrients are translocated to food reserve storage organs such as seeds, which causes P nutrient uptake in the leaves to be relatively low. Nevertheless, there is a tendency that liquid organic fertiliser does not affect P nutrient uptake in the leaves. In addition to this, the vitamin P plays an even more significant part in the process of energy transfer within the cell.

The application of NPK fertiliser at dosages of 0 g, 1 g, and 2 g per polybag resulted in increased phosphorus (P) nutrient absorption than the administration of 0 gramme of the fertiliser (N0).

Table 5. K nutrient content (me/100 mg) in green grass jelly cuttings

Organic Fertilizers	NPK			Average
	N0 (0 g polybag^{-1})	N1 (1g polybag^{-1})	N2 (2g polybag^{-1})	
P0 (Without)	11.3457	35.8066	25.0658	24.0727
P1 (Agrobost)	29.2911	29.9065	35.5140	31.5705
P2 (Nasa)	24.5298	46.7741	44.5828	38.6289
Average	21.7222	37.4957	35.0542	-

The K nutrient content in the leaves of grass jelly plant cuttings demonstrated that the application of Nasa organic fertiliser provided a higher nutrient content in the leaves than Agrobost liquid organic fertiliser did. This was due to the fact that the K nutrient content of Nasa liquid organic fertiliser was higher than the K nutrient content of Agrobost liquid organic fertiliser. Agrobost fertiliser is a biological fertiliser that contains microorganisms that play a role in binding nutrients. These microorganisms are thought to be unable to play a role in peat soils due to the acidic soil conditions and the extremely low natural nutrient content of peat. However, there is evidence to suggest that this is not the case.

Because NPK fertiliser was able to be absorbed by the roots as well as translocated to the leaves, the K nutrient content in the leaves of grass jelly cuttings was higher in the 1 g and 2 g NPK fertiliser treatment than it was in the control (N0) treatment. This was due to the fact that NPK fertiliser was able to be translocated. On the other hand, statistical studies of the use of inorganic NPK fertiliser did not demonstrate any significant effect on raising the amount of potassium present in the leaves of grass jelly cuttings.

Flavanoid content in the leaves of grass jelly plant seeds

Table 6 presents the findings of an experiment that used UV-Vis spectrophotometry to determine the total flavonoid content of green grass jelly leaves following the application of liquid organic fertilisers (Agrobost and Nasa) and NPK inorganic fertilisers. The experiment was conducted in the presence of the green grass jelly.

Table 6. Flavonoid content (μg/mg) in green grass jelly cuttings

Organic Fertilizer	NPK			Average
	N0 (0g polybag^{-1})	N1 (1g polybag^{-1})	N2 (2g polybag^{-1})	
P0 (Without)	0.15	0.13	0.12	0.13
P1 (Agrobost)	0.19	0.13	0.14	0.15
P2 (Nasa)	0.15	0.13	0.11	0.13
Average	0.16	0.13	0.12	-

According to the findings of the analysis of variance, the interaction between liquid organic fertiliser and inorganic fertilisers did not have a significant influence on the amount of flavonoid that was present in green grass jelly cuttings. A single application of liquid organic fertiliser or NPK inorganic fertiliser did not demonstrate a substantial effect, either. This demonstrates that the administration of organic fertiliser Agrobost, NASA, and NPK fertiliser at levels of 1g and 2g did not alter variations in the flavonoid content in green grass jelly leaves (Table 6).

Table 7 and Figure 1, presents the findings of an experiment that used UV-Vis spectrophotometry to determine the total flavonoid content of green grass jelly leaves following the application of liquid organic fertilisers (Agrobost and Nasa) and NPK inorganic fertilisers. The experiment was conducted in the presence of the green grass jelly.

Table 7. Total Flavonoid Levels of Leaves (μg/mg) of Grass Jelly Stem Cuttings when Applying Liquid Organic Fertilizers and Inorganic Fertilizers to Peat Soil

Variable	Treatments	NPK		
		N0	N1	N2
Total Flavonoid Content	P0 (Without LOF)	0.15	0.13	0.12
	P1 (Agrobost)	0.19	0.13	0.14
	P2 (Nasa)	0.15	0.13	0.11

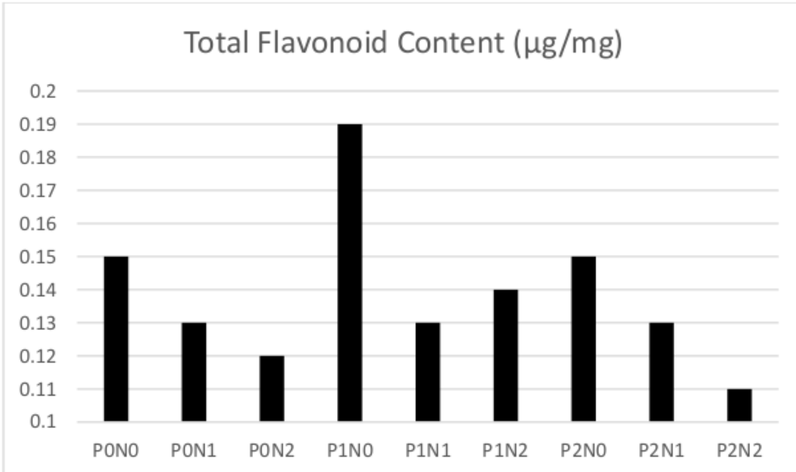

Figure 1. Flavonoid content in the leaves of grass jelly stem cuttings when applying liquid organic fertilizer and NPK fertilizer

In accordance with the findings of the analysis of variance, the interaction between liquid organic fertiliser and inorganic fertilisers did not have a significant influence on the amount of flavonoid that was present in green grass jelly cuttings. A single application of liquid organic fertiliser or NPK inorganic fertiliser did not demonstrate a substantial effect, either. This demonstrates that the application of organic fertiliser Agrobost, NASA, and NPK fertiliser at levels of 1g and 2g did not alter variations in flavonoid concentrations. Figure 1 demonstrates that the application of Agrobost liquid organic fertiliser without NPK inorganic fertiliser (P1N0) gave the highest yield of total leaf flavonoid content in green grass jelly stem cuttings (0.19 μg mg^{-1}), while the treatment of Nasa foliar fertiliser with NPK inorganic fertiliser as much as 2g polybag^{-1} gave the lowest yield of total leaf flavonoid content (0.11 μg mg^{-1}). According to the findings of this research, the total flavonoid content of the seeds of grass jelly stem cuttings without NPK (0 g polybag^{-1}) was greater than that of grass jelly stem cuttings with NPK of 2g polybag^{-1}. It is speculated that plants that were not provided with NPK fertiliser experienced nutritional stress, which led to an increase in the production of secondary metabolites of flavonoids. This was also seen in the P0N0 and P2N0 treatments (0.15 μg mg^{-1} and 0.15 μg mg^{-1}, respectively), which resulted in greater amounts of flavonoids when compared to the P0N2 (0.12 μg/mg^{-1}) and P2N2 (0.11 g mg^{-1}) treatments.

Flavonoids are a type of secondary metabolite that are generated by plants and are considered to be one of the naturally occurring antioxidants that are formed from phenolic compounds. When plants are subjected to particular degrees of stress, they create secondary metabolites in specified quantities. The functions of the many types of secondary metabolites are distinct from one another. These compounds are not essential for the continued existence of the plant, but they do offer a number of benefits, including functioning as a defence mechanism for the plant, both against biotic and abiotic stress, acting as an attractant, and certain compounds having the potential to be utilised by humans as antioxidants or as raw materials for medicinal products (Setyorini and Yusnawan, 2016). According to Nofiani (2008 as cited in Setyorini and Yunnawan 2016), the production of secondary metabolites is controlled by a number of factors, including nutrition, a reduced growth rate, feedback regulation, enzyme inactivation, and enzyme induction.

Conclusion

1. The interaction between liquid organic fertiliser and NPK inorganic fertiliser had no effects on the leaf area of grass jelly stem cuttings, nor did it have any effect on the fresh weight of the leaves of grass jelly stem cuttings.
2. Increasing the leaf area of grass jelly stem cuttings and producing a noticeable impact may be accomplished by applying liquid organic fertiliser in addition to NPK fertiliser.
3. The provision of liquid organic fertiliser and NPK fertiliser can have the effect of significantly increasing the fresh weight of the leaves on grass jelly stem cuttings.

4. Increasing the concentration of nutrient absorption and levels of flavonoids in the leaves of grass jelly stem cuttings with the application of liquid organic fertiliser and NPK fertiliser either individually or individually did not have a significant effects.

Acknowledgments

Thank you to the University of Palangka Raya, as the source of funds for Innovative Basic Research through the University of Palangka Raya PNBP DIPA funds for Fiscal Year 2020 Number: SP DIPA- 023.17.2.677566/2020 in accordance with the Funding Agreement for Implementation of Innovative Basic Research Number: 299/UN24.13/PL/2020, July 23, 2020.

References

Anda, M., Ritung. S., Suryani, E., Sukarman, Hikmat, M., Yatno, E., Mulyani, A., Subandiono, R.E., Suratman, & Husnain. (2021) Revisiting tropical peatlands in Indonesia: Semi-detailed mapping, extent and depth distribution assessment. *Geoderma*, 402, 115235, https://doi.org/10.1016/j.geoderma.2021.115235.

Budianta, D., & D. Rustiani. (2013). *Pengelolaan Kesuburan Tanah Mendukung Pelestarian Sumberdaya Lahan dan Lingkungan*. Unsri Press. Palembang.

Butar-Butar, R.A. (2020). *Pengaruh Pemberian Ampas The dan Pupuk Majemuk NPK (15-15-15) terhadap Pertumbuhan dan Hasil Stek Cincau Hijau* (*Premna oblongifolia* Merr). Skripsi. Fakultas Pertanian, Universitas Muhammadiyah Sumatra Utara Medan.

Gardner, F. P., Pearce, R. B., & Mitchell, R. L. (1991). Physiology of crop plant (Fisiologi Tanaman Budidaya. Translation of Herawati Susilo). Universitas Indonesia Press.

Hidayat, S., & Napitupulu, R.M. (2016).. *Kitab Tumbuhan Obat*. Jakarta: Penebar Swadaya Grup.

Hutubessy, J. I. B. (2013). Pengaruh Pupuk Organik Cair Nasa terhadap Pertumbuhan Bibit Tanaman Jati Putih (Gmelina arborea Roxb). *AGRICA*, *6*(1), 10-22.

Ikhwan, A. K., Waqik, A., Anwar, M., Fitrothul, U., Rahmawati, D., & Pawana, G. (2015). Inokulasi Azospirillium sp dari Lahan Kering Madura Terhadap Pertumbuhan Tanaman Jagung. *Agrovigor: Jurnal Agroekoteknologi*, 8 (2), 46-50.

Kardinan. (2011). *Pupuk Organik Cair Nasa*. POC Nasa. Com. Februari 2011.

Lusmaniar, L., Oksilia, O., & Dewi, S. (2020). Pengaruh Pemberian Pupuk Hayati Agrobost Terhadap Pertumbuhan dan Hasil Tanaman Kacang Hijau (Vigna radiata L.). *AGRONITAS*, *2*(1), 34-42.

Munir, M. (1996). *Tanah-tanah Utama di Indonesia*. Pustaka Jaya. Jakarta.

Rahayu, R., Taslim, E. M., & Sumarno, S. (2013). Pembuatan Serbuk Daun Cincau Hijau Rambat (*Cyclea barbata* L. Miers) menggunakan Proses Maserasi Dan Foam Mat Drying. *Jurnal Teknologi Kimia dan Industri*, *2*(4), 24-31.

Rahmi, R. (2014). Kajian efektifitas mikroba *Azotobacter* sp. sebagai pemacu pertumbuhan tanaman kakao (*Theobroma cacao* L.). *Jurnal Galung Tropika*, *3*(2), 44-53.

Santoso, B. B., Susanto, S., & Purwoko, B. S. (2008). Perbanyakan vegetatif tanaman jarak pagar (Jatropha curcas L.) dengan stek batang: pengaruh panjang dan diameter stek. *Jurnal Agronomi Indonesia (Indonesian Journal of Agronomy)*, *36*(3), 255-262.

Setyorini, S. D., & E. Yusnawan. (2016). Peningkatan kandungan Metabolit Sekunder Tanaman Aneka Kacang Sebagai Respon Cekaman Biotik. *Iptek Tanaman Pangan*, 11 (2).

Sulistiyanto, Y. (2017). *Dinamika Hara pada Hutan Rawa Gambut Tropika*. Kanisius. Yogyakarta. 158 hal.

Tim Peneliti IPB. (1986). *Gambut Pedalaman untuk Pertanian*. Kerjasama Antara Fakultas Pertanian Institut Pertanian Bogor dengan Dinas Pertanian Tanaman Pangan Provinsi Kalimantan Tengah. Palangka Raya.

Yanto, K. Adiwirman., & Nurbaiti. (2016). Pemberian Pupuk Organik Cair terhadap Pertumbuhan Bibit Kelapa Sawit (Elaeis guineensis Jacq) pada Pembibitan Utama. *Jurnal JOM Faperta*, 3 (2): 1-12.

Effects of Liquid Organic and NPK Fertilizers

ORIGINALITY REPORT

7%
SIMILARITY INDEX

PRIMARY SOURCES

1	e-journal.upr.ac.id Internet	231 words — 4%
2	ejournal.uniks.ac.id Internet	20 words — < 1%
3	www.sidomunculpupuknusantara.com Internet	20 words — < 1%
4	phl.menlhk.go.id Internet	15 words — < 1%
5	repository.upr.ac.id Internet	14 words — < 1%
6	9lib.net Internet	11 words — < 1%
7	Arne Sæbø. "Weed control measures in Christmas tree plantations of Abies nordmanniana and Abies lasiocarpa on agricultural land", New Forests, 03/18/2009 Crossref	10 words — < 1%
8	Sudradjat, S Yahya, Y Hidayat, O D Purwanto, S Apriliani. "Inorganic and organic fertilizer packages for growth acceleration and productivity	10 words — < 1%

enhancement on a four-year-old mature oil palm", IOP Conference Series: Earth and Environmental Science, 2018
Crossref

9 Ying Zhang, Hao Wang, Lijing Cui, Yuanyuan Zhang, Yang Liu, Xi Chu, Zhenyi Liu, Jianping Zhang, Li Chu. "Continuing Treatment with Salvia miltiorrhiza Injection Attenuates Myocardial Fibrosis in Chronic Iron-Overloaded Mice", PLOS ONE, 2015
Crossref
10 words — < 1%

10 docobook.com
Internet
10 words — < 1%

11 ejurnal.untag-smd.ac.id
Internet
10 words — < 1%

EXCLUDE QUOTES	ON	EXCLUDE SOURCES	< 10 WORDS
EXCLUDE BIBLIOGRAPHY	ON	EXCLUDE MATCHES	< 10 WORDS