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Banana Stem Utilization As A Plant Container With Planting Media And Watering Interval On Lettuce (*Lactuca sativa* L.) Productivity

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ABSTRACT

Banana pseudostem is a type of agricultural waste that has the potential to replace polybags. The planting media used in lettuce growing must be suitable for increasing plant development and productivity. Furthermore, water requirements must be met, as banana pseudostems have a high water content and are expected to minimize the watering procedure. The goal of this research was to find a good planting medium and watering interval for lettuce development and production in a banana pseudostem planting container. From March to June 2021, this study was done at UPT Agrofarm RIU. A Factorial Completely Randomized Design was employed in the study (CRD). The first is the planting medium, which is divided into four levels: M1: top soil, M2: RYP soil, M3: peat soil, and M4: RYP soil and peat soil (1:1). The second aspect is the watering interval, which is divided into three categories: F1: daily, F2: every two days, and F3: every three days. The results showed that using peat medium as a planting container and watering once every three days boosted leaf number, plant wet and dry weight, and root volume.
Keywords*: banana stem, peat, planting medium, RYP, watering*

1. INTRODUCTION

Lettuce (Lactuca sativa L.) is one of the most popular and widely consumed vegetables in the community, with a high market value. In 2019, lettuce exports totaled 1,000 tons, while imports totaled 171,000 kg (Central Bureau of Statistics, 2019). This demonstrates that this vegetable has a lot of potential for development. However, as Indonesia's population grows, so does the amount of fertile land available, which is accompanied by the creation of settlements in urban areas.

As a result, efforts must be made to make efficient use of land, including the usage of polybags. However, once the crop is complete, this practice will pollute the environment. This is because polybags will no longer be utilized, and the non-biodegradable nature of plastic can pollute the land and environment, causing the soil to become infertile. Polybags are plastic materials that are difficult for soil bacteria to digest, according to Pudjiono et al., (2012). So we'll need something other than banana stems to replace the environmentally beneficial polybags. Banana stems also contain elements that are good for plant growth, such as phosphate (Sari et al., 2018).

A suitable planting medium is required to promote the development and yield of lettuce. Top soil is good for planting (topsoil). This is a nutrient-rich stratum (Foller & Silvina, 2017). However, in Riau Province, which is dominated by peat soil and RYP, this sort of top soil is uncommon.

Due to their low nitrogen concentration, both of these soils have limitations when utilized as a planting medium (Yolanda et al., 2013). Despite their flaws, peat soil and RYP soil have the potential to be used as planting media with correct treatment.

The use of banana stems as a planting container boosted the development and productivity of mustard plants, according to research (Karnilawati et al., 2018). This is due to the presence of starch in banana stems, which serves as a source of plant nutrition as well as bacteria that can be composted (Pangestika, 2017). The qualities of peat soil and RYP are projected to improve as a result of this.

Irrigation, in addition to planting material, is used to boost lettuce productivity. This is done to ensure that water is available in the soil at all times. The importance of watering for plants cannot be overstated (Sari et al., 2016). Because banana stems have a high water content (96.2%), watering plants on the growing media every two days is possible (Bago, 2021; Karnilawati et al., 2018).

The results of Lutfiana et al(2019) .'s study showed that using banana stems reduced the intensity of watering on cayenne pepper seedlings to once a day. According to Tambunan et al., (2013), mustard plant development and yield were not affected by a 3-day watering interval compared to a one-day watering interval. The 6-day watering period, according to Akbar (2020), produces growth and yields comparable to the tighter (2-day) watering intervals used on red lettuce.

It is projected to boost lettuce yield by employing planting media treatment and watering intervals on lettuce plants with banana pseudo-stem media. The goal of this experiment was to find an appropriate planting material and watering interval for growing and producing lettuce plants in banana stem pots.

2. RESEARCH METHODS

From March to May 2021, this study was conducted at the Greenhouse of UPT RIUA Agrofarm, Riau Islamic University (RIU), Kampar Regency. Grand Rapid lettuce seeds, banana stems, NPK Grower, dolomite, and rockwool were among the materials employed. Digital scales, ovens, and other planting equipment are among the tools employed.

The experimental design was a completely randomized factorial design (CRD). The first factor is different planting media (M), which include top soil (M1), RYP soil (M2), peat soil (M3), and soil combined with RYP and peat (1:1), among others (M4). Watering Interval (F) is the second element, which includes watering once a day (F1), every two days (F2), and every three days (F3) (F3). Three replications of each treatment were used.

The following are the steps involved in putting the research into action:

1. Seeding Seeds
   Seedlings were grown in wet rock wool media in a container. Tweezers are then used to introduce lettuce seeds into the media.
2. Preparation of Banana Stems
   The fake banana stems utilized have a diameter of 20-25 cm and are devoid of pests and illnesses. Following that, a planting hole was dug with dimensions of 8 x 8 cm, a depth of 10 cm, and a gap of 25 cm between the planting holes.
3. Planting

Planting After the lettuce seedlings have been planted for 14 days, it is time to plant them. Furthermore, the seeds are planted with the 1 planting hole seed in a banana stem container.

4. Providing Care
   a. Expanding media
      2 weeks before planting, planting material is put into the pseudo-stem of bananas.
   b. Interval Between Waterings
      The watering interval treatment was carried out with a volume of 500 ml for each treatment.
5. Harvesting of lettuce begins at the age of 30 days, when all parts of the lettuce plant are pulled to the roots.

Plant height, number of leaves, plant fresh weight, plant dry weight, root length, and root volume were all measured in this study. A additional test of Honest Significant Difference (HSD) at the level of 5% was used to statistically assess observational data.

3. RESULTS AND DISCUSSION

a. Plant stature

The interaction of planting media with watering interval treatments considerably improved lettuce plant height, according to the results of plant height observations (Table 1). The highest plant height of 32.67 cm was achieved with RYP planting media: peat and a three-day watering interval (M4F3).

This is because soils with high Fe and Al elements, such as RYP soil, can neutralize organic acids in peat soil. This agrees with Septiyana et al., (2017), who claim that using materials/media containing polyvalent cations (such as Al and Fe) can minimize organic acids and harmful ions in peat soils while also increasing nutrient availability.

According to Foller & Silvina (2017), peat soil includes organic matter that plants require, but RYP soil functions as a soil enhancer, improving the physical and chemical qualities of the soil so that plants can grow effectively. Organic matter in peat soil and RYP enhances the availability of nutrients including nitrogen, phosphate, and potassium, which lettuce plants require for rapid growth.

Banana stems can also be used as a substitute for planting containers, which helps to keep the soil moist. According to Setianingsih et al., (2016), moisture created in polybags or pots from banana pseudo stems produces similar results, implying that banana stem pots can take the place of polybags in soil moisture management.

Table 1 shows the average lettuce plant height (cm) based on the planting media used and the watering interval.

Watering Interval	Planting Media				Average
	Top Soil (M1)	RYP (M2)	Peat (M3)	RYP : Peat (M4)	
1 day (F1)	21.17 e	25.33 cde	29.33 abc	24.50 cde	25.08 b
2 days (F2)	22.17 de	27.33 a-e	28.50 a-d	32.17 ab	27.54 a
3 days (F3)	25.83 b-e	28.00 a-d	29.83 abc	32.67 a	29.08 a
Average	23.06 c	26.89 b	29.22 ab	29.78 a	
KK = 8.02 %	HSD F = 2.42	HSD M = 2.80	HSD FM = 6.62		

Note that numbers followed by uneven letters in the same row and column differ significantly at the 5% level, according to HSD.

Watering intervals will be reduced if the media humidity is maintained. The study's findings revealed that the shorter the watering interval, the higher the plant height generated.

b. The total number of leaves

The interaction and main effect of planting media treatment and watering intervals had a substantial influence,

according to the results of observations of the number of leaves.

Table 2 reveals that the treatment of peat growth media with once-every-three-day watering intervals (M3F3) produced the most lettuce leaves, 7.33 leaves. Except for top soil (M1) media treatment with all watering interval treatments, it was not statistically different from the other treatments.

Because of the availability of nutrients, particularly Nitrogen (N), which was sufficient for lettuce plant growth, the peat media treatment with watering intervals of once every three days (M3F3) produced more leaves.

Peat media has a lot of nitrogen, but it's in an organic form that plants can't use (Andriani et al., 2020). Because of the sluggish rate of nitrogen mineCRDization and the high mobility of nitrogen in the soil, this is the case (Wijanarko et al., 2012).

Other than as pots, banana stems were used in this study to boost nitrogen availability in peat media. This is due to the presence of N-fixing bacteria in banana stems (Kusumawati, 2015).

The increase in nitrogen availability was accompanied by a rise in chlorophyll and protein, resulting in increased plant growth and leaf number. Chlorophyll is a pigment that absorbs sunlight during the photosynthesis process, whereas protein is an enzyme that aids plant metabolic processes, allowing plants to exploit photosynthesis for growth (Foller and Silviana, 2017).

Table 2 shows the average number of lettuce leaves for various planting media and watering intervals.

Watering Interval	Planting Media				Average
	Top Soil (M1)	RYP (M2)	Peat (M3)	RYP : Peat (M4)	
1 day (F1)	21.17 e	7.17 ab	6.50 abc	6.00 a-d	6.17 b
2 days (F2)	22.17 de	6.17 a-d	6.67 abc	7.00 ab	6.29 ab
3 days (F3)	25.83 b-e	6.70 ab	7.33 a	7.00 ab	6.72 a
Average	23.06 c	6.68 a	6.83 a	6.67 a	
KK = 7.24 %	HSD F = 0.51	HSD M = 0.59	HSD FM = 1.40		

Note that numbers followed by uneven letters in the same row and column differ significantly at the 5% level, according to HSD.

Furthermore, peat soil has a stronger water binding ability than other media, thus it will be able to boost plant growth if there is enough water and nutrients in the medium (Hendrata & Sutardi, 2010). As a result, watering intervals on peat media must be carefully monitored. Giving water too frequently might waste nutrients and cause plant roots to die or rot. As a result, a three-day watering interval offers maximum plant growth.

c. Wet Weight Planting

The interplay between planting material treatment and watering intervals had a substantial effect on the wet weight of lettuce plantations, according to the results of the investigation. The highest lettuce wet weight of 19.57 g was achieved with peat media treatment with watering intervals of once every three days (M3F3) (Table 3). It was, however, not substantially different from the M3F2, M2F3, and M4F3 treatments, which were 18.06 g, 17.93 g, and 16.39 g, respectively, nor from the other treatments.

Because the nutrients needed by plants such as nitrogen and phosphorus in the creation of plant tissue were met, peat media treatment with watering intervals of once every 2 days and once

every 3 days was able to enhance the wet weight of lettuce, resulting in a rise in the fresh weight. According to Pribadi et al., (2015), peat has a high content of organic matter and nitrogen in its chemical qualities, but a low mass density in its physical properties. So that the peat media blends in well with the roots of the plants. Banana stems can also improve soil fertility and foster strong roots when combined with organic matter.

The ability of peat soil to absorb water is greater than that of other media (Dariah et al., 2014). Because of the huge water storage capacity, the roots are able to absorb more nutrients and their water needs are met. As a result, photosynthesis is proceeding normally, and assimilate may be transported to all areas of the plant, particularly the leaves and stems. As can be shown in Figure 1, growing lettuce on peat soil produces better results than other treatments.

When compared to other treatments, peat soil treatment with watering intervals of 2-3 times per day produced the maximum wet weight. Because the roots are damp, it is thought that watering once a day makes the plants prone to root rot.

As a result, it can cause changes in leaf color, dry leaves, and leaf chlorosis, resulting in plant growth disruption (Asona, 2013).The plant will be harmed by too much or too little water. If the plant doesn't get enough water, it won't get enough oxygen, and too much water might cause rot in the roots (Sari et al., 2016).

Figure 1: 28-day-old lettuce plants on varied growing media

Table 3: Average lettuce cropping wet weight (g) with different planting material and irrigation intervals

Watering Interval	Planting Media				Average
	Top Soil (M1)	RYP (M2)	Peat (M3)	RYP : Peat (M4)	
1 day (F1)	9.80 e	12.68 cde	15.80 abc	12.51 cde	12.70 c
2 days (F2)	10.07 e	15.27 bc	18.06 ab	14.62 bcd	14.50 b
3 days (F3)	11.08 de	19.57 a	17.93 ab	16.98 ab	16.39 a
Average	10.32 c	15.84 ab	17.26 a	14.70 b	
KK = 9.16 %	HSD F = 1.47	HSD M = 1.70	HSD FM = 4.03		

Note that numbers followed by uneven letters in the same row and column differ significantly at the 5% level, according to HSD.

d. Dry Weight Planting (g)

Table 4 reveals that the peat media treatment with two-day watering intervals (M3F2) produced the maximum dry weight of 1.38 g, but it was not substantially different from the M3F3,

M4F3, and M4F2 treatments. Because microorganisms in banana stems have the potential to help organic matter in peat media breakdown effectively, treatment of peat media with watering intervals of once every two days resulted in greater dry weight. So that plant roots grow faster and are better equipped to absorb nutrients and water.

The availability of water for plants can then be maintained by watering every two days. Because microorganisms in banana stems have the potential to help organic matter in peat media breakdown effectively, treatment of peat media with watering intervals of once every two days resulted in greater dry weight. So that plant roots grow faster and are better equipped to absorb nutrients and water. The availability of water for plants can then be maintained by watering every two days. Because microorganisms in banana stems have the potential to help organic matter in peat media breakdown effectively, the interaction treatment of peat media with watering intervals of once every two days resulted in greater dry weight.

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Plants require nutrients in the process of photosynthesis, which has an impact on their dry weight. According to Jumin (2010), dry weight is a measure of a plant's ability to store dry materials. The amount of photosynthate produced determines how much dry matter may be stored. (Sulistyowati, 2011) went on to say that increasing vegetative growth, specifically the number of leaves, would increase the plant's dry weight. The more lettuce leaves there are, the more photosynthate is produced during photosynthesis. Then the photosynthate is spread throughout the plant so that the leaves and stems grow large. This is linked to an increase in the dry weight of the plant. According to Nurdin (2011), an increase in the photosynthetic process will result in an increase in the plant's dry weight.

Table 4 shows the average dry weight (g) of lettuce for various planting soil and watering intervals.

Watering Interval	Planting Media				Average
	Top Soil (M1)	RYP (M2)	Peat (M3)	RYP : Peat (M4)	
1 day (F1)	0.69 e	0.95 b-e	0.97 bcd	0.86 cde	0.87 b
2 days (F2)	0.36 f	1.06 bc	1.38 a	1.15 ab	0.99 b
3 days (F3)	0.75 de	1.05 bc	1.15 ab	1.21 ab	1.04 a
Average	0.60 c	1.02 bc	1.17 a	1.07 ab	
KK = 9.54 %	HSD F = 0.10	HSD M = 0.12	HSD FM = 0.28		

Note that numbers followed by uneven letters in the same row and column differ significantly at the 5% level, according to HSD.

e. Length of the Root

The findings of the root length observation after it was completed revealed that the interaction had no significant influence on lettuce root length, but the primary effect of the treatment of planting material and watering intervals did. The peat (M3) planting medium improved the lettuce root length by 12.22 cm, as shown in Figure 2. It was, however, not significantly different from RYP media (M2) and a blend of RYP: Peat (M4), nor from top soil (M1) media. This is likely due to the presence of local decomposer microorganisms that can produce compost directly within the banana stem. This causes organic matter in peat soil to degrade properly, increasing nutrient availability and encouraging root growth.

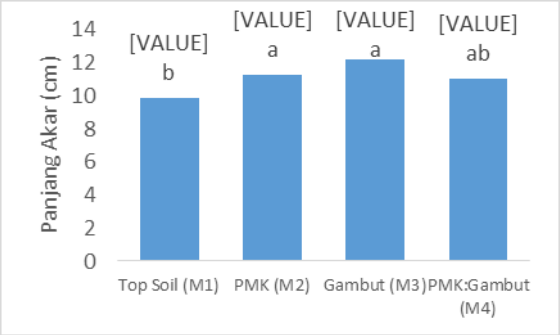

Figure 2: Average lettuce root length (cm) vs. planting material treatment

Furthermore, banana stems include substances such as anthraquinones, saponins, and flavonoids that aid in the formation of root hairs in plants, allowing plant roots to adequately absorb nutrients (Hariyono & Supriyadi, 2016).

Fertilization and liming were also used in this study. Plants gain access to nutrients, particularly P, as a result of this. The advantages of organic fertilizer for the environment Liming, on the other hand, can raise the pH of peat soil.

The P nutrient becomes available when the pH of the soil is close to neutCRD. Furthermore, the harmful effects of Al and Fe can be decreased, allowing lettuce roots to develop normally.

Figure 3 demonstrates that growing lettuce root length with a watering frequency of once a day (F1) and every three days (F3) had a substantial effect, with lengths of 11.54 cm and 11.46 cm, respectively. Because banana stems have a high moisture content of 96 percent, the humidity of the planting media is properly maintained, a watering interval treatment every three days (F3) can generate roots that are not significantly different from a treatment once a day. This allows the plants to live despite the fact that they are watered less regularly.

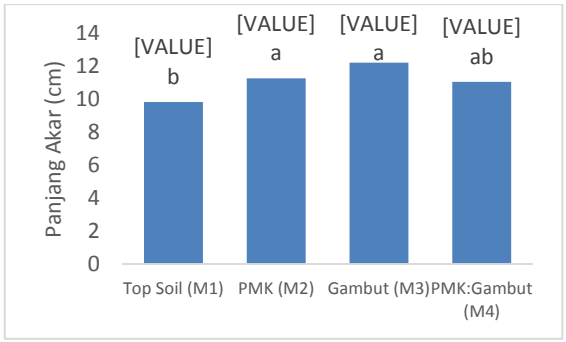

Figure 2. Average root length (cm) of lettuce with planting media treatment

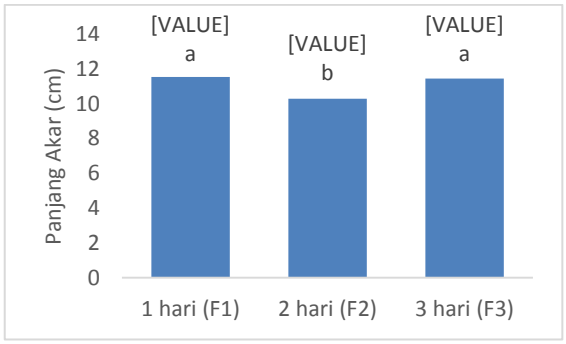

Figure 3: Average root length (cm) of lettuce with treatment f (watering interval). Volumetric Roots (cm3)

The interaction and main effects of planting media treatment and watering intervals had a substantial effect on lettuce root volume, according to the results of the root volume observation after analysis. Table 5 shows the average volume of lettuce roots detected by the HSD test at a 5 percent level.

The results revealed that peat media treatment with once-every-three-day watering intervals (M3F3) produced the highest root volume of 2.08 cm, which was substantially different from the other treatments. The enormous volume of roots in the peat media treatment with once-every-three-day watering intervals (M3F3) is attributed to peat media's ability to absorb more water and the humidity of the media being adequately maintained due to the usage of banana stems.

Because banana stems have a high water content, they don't need to be watered on a regular basis, saving water. Fresh banana stems have a water content of roughly (94-97 percent) and a pH of around 7.5, according to (Saputro, 2017). As a result of the peat soil media treatment, the water contained in banana stems can act as a buffer for planting media, causing the pH in the peat media to neutralize and the availability of nutrients to rise, affecting lettuce root volume development.

Table 5. Average root volume (cm3) of lettuce with planting media treatment and watering interval

Watering Interval	Planting Media				Average
	Top Soil (M1)	RYP (M2)	Peat (M3)	RYP : Peat (M4)	
1 day (F1)	1.00 c	1.15 bc	1.20 bc	1.13 bc	1.12 b
2 days (F2)	1.05 bc	1.20 bc	1.35 b	1.17 bc	1.19 b
3 days (F3)	1.18 bc	1.33 b	2.08 a	1.27 bc	1.47 a
Average	1.08 c	1.23 b	1.54 a	1.19 bc	
KK = 8.18 %	HSD F = 0.11	HSD M = 0.13	HSD FM = 0.31		

Note that numbers followed by uneven letters in the same row and column differ significantly at the 5% level, according to HSD.

4. CONCLUSION

Plant height, number of leaves, wet and dry weight of roots, and root volume increased as a result of the combination of peat medium treatment and three-day watering intervals. The planting media treatment had a considerable impact on all treatments. Peat media is the most effective treatment. All treatments were affected by the primary watering interval treatment. Watering once every three days is the most effective treatment.

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