International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Morphological Characteristics of Pasote Plants (*Dysphania ambrosioides* L.) Domesticated by Nursery on Several Planting Media

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Abstract

Indonesia is a country rich in natural resources and diversity, one of which is medicinal plants that grow wild. Indonesian people have long known medicinal plants that have been used for generations, most of them grow wild. There are many types of medicinal plants in Indonesia, one of which is the Pasote plant (*Dysphania ambrosioides* L.). This medicinal plant has been widely researched for its pharmacological effects and has even been produced by CV. Biovina. To produce a large amount of biomass, it is necessary to carry out domestication. Initial research was carried out for seeding and nurturing media that can grow well. This study aims to determine the morphological characteristics of Pasote (*D. ambrosioides* L.) plants in several planting media. An experimental experiment in the Biovina experimental garden with five treatments for 5 replicates. The media type is M1-M5. The results of the study on the morphological characteristics of Pasote *plants (D. ambrosioides*) in several planting media on the 0th to 28th day can be concluded that the morphology of Pasote plants is different in each planting medium. The largest planting medium with the highest number of leaves is 15 leaves in M4 media and the highest Pasote plant is also in M4 medium (sand medium: AB Mix) which is 6,596 cm. The highest percentage of germination was achieved in M4 of 100% and the fastest germination on the 2nd day occurred in Pasir and AB Mix media. The results of this study support good growth in the future for germination for 28 days is Sand : AB Mix media with an average environmental temperature of 26$^{oC,\ air}$ humidity of 3.3 and pH of the medium of around 6.6. The morphological character is the same as the morphological character when in the field in the original both color, smell, morphological shape of the leaves, roots and stems. The best media can be used in sandy planting media and AB Mix media.

Keywords: Characteristics, Morphology, *Dysphania ambrosioides*, Planting Media

1. Introduction

Indonesia is a country rich in natural resources and diversity, one of which is medicinal plants [1]. Medicinal plants are plants that can be used as medicine because one of the entire part of the plant has active substances that are useful for curing diseases [2]. The Indonesian people have long known medicinal plants which have usually become yard plants and have been used for generations [3]. There are many types of medicinal plants in Indonesia, one of which is the Pasote plant (*Dysphania ambrosioides* L.) [4].

In North Sulawesi plants *D. ambrosioides* L. is a wild growing [5], the Kakas people often call this plant Pasote while the Minahasa Toutemboan people often call it Sambote [6]. This plant is often used as a complementary ingredient to Manado porridge (Tinutuan) as a substitute for basil[7]. The old people in Minahasa also used this plant as a medicine to treat gout, antidiabetic, anticancer and as a pain reliever [4]. The results of the in vitro cytotoxic study of Pasote methanol extract by Maningkas et al. (2019) have an IC50 of 50.131 µg/mL, which means that the methanol extract of Pasote leaves has the potential to be used as an anticancer and antioxidant[8]. This is also supported by the research of Pandiangan et al. (2017) which showed that ethanol extract of Pasote seeds can reduce blood sugar levels in white male rats during 48 hours of application by 4% [9]. The results of the study by Pinatik et al. (2020) showed that epazote D. ambrosioides ethanol extract had the effect of lowering the rectal temperature of rats induced by the DPT-HB vaccine.

Ghareeb et al. (2016) stated that the Pasote plant contains secondary metabolite compounds in the form of flavonoids, terpenes, sesquiterpene pygmol, xyloside, coumarins, and essential oils. Flavonoid compounds that have an antipyretic effect that lowers body temperature by inhibiting the action of the enzyme cyclopsigenase in the hypothalamus. Because of the many benefits of this Pasote, it will be commercialized in the future, but this Pasote is classified as a wild plant. For a product that requires uniform and standardized raw materials, it is necessary to domesticate the Pasote. The habitat for the growth of Pasote is in certain areas (e.g. Langowan and Motoling) that need to be looked for factors

It grows so that it can grow in a prepared experimental garden (domestication). In the context of domestication, it is necessary to know the right planting medium so that the growth of the Pasote is optimal (Soares et al., 2024).

Planting media or growing media is a place used to grow and develop plants in general, this medium is in the form of soil in general. Planting media has four main functions, namely supporting plants, retaining available water, storing nutrients for plants and maintaining moisture around plant roots (Cahyati, 2006). The results of the research of Laksono and Sugiono, (2017) the planting medium in sawdust obtained the optimal electrical conductivity (EC) value of 2.5-3.5 mS cm-1 with a maximum fresh weight per plant of 161.17 g, while in the planting medium using husk charcoal with the optimal EC value of 2.0-2.5 mS cm-1 with the fresh weight per plant is 165.21 gr. The results of Ainina and Aini's (2018) research on cocopeat planting media with 1000 ppm AB Mix nutrients produced a heavier fresh weight than 500 ppm and 700 ppm which resulted in a fresh weight with an average of 171.64 g while the standard fresh weight was 150 g.

Seeing the importance of the Pasote plant as a medicine that is still growing wild and the growth factor of the planting medium is also this factor, it is necessary to develop and cultivate it. For its cultivation, Pasote plants need growing media, namely soil and other media. It is not yet known how the influence of the planting medium on the morphological characteristics of the growth of the Pasote plant, therefore this

research needs to be carried out because this plant can only grow in a few places, besides that this research has also never been done by researchers before.

1.2 Problem Formulation: What are the morphological characteristics of Pasote plants (*D. ambrosioides*) in some growing media?

1.3 Research Objectives: This study aims to determine the morphological characteristics of Pasote plants (D. ambrosioides) in several planting media

1.4 Research Benefits: The benefit of this study is to provide information about the morphological characteristics of Pasote plants (*D. ambrosioides*) in several planting media in an effort to cultivate Pasote plants and their domestication.

2. Research Methods

Time and Place of Research

This research has been carried out in June 2021–September 2021 at the Biovina Herbal Laboratory in Jaga II, Sea Mitra Village, Pineleng District, Minahasa Regency.

Tools and Materials

The tools used in this study were small shovels, digital cameras, stationery, rulers, label paper, measuring cups, plastic cups, polybags, wire, plastic basins, dippers, stirring spoons, soil *testers*, pH, thermometers, Bendrat and pliers.The materials to be used are Pasote seeds, sand, rice husks, sawdust, humus soil, AB Mix, Rock Rowl and water.

Working procedure

Research Design

This study is an experimental experiment in the Biovina experimental garden with five treatments, namely M_1 (sand: humus soil = 1:1), M_2 (humus soil: rice husk = 1:1), M_3 (sand: sawdust = 1:1), M_4 (sand: AB *Mix*), M5 (AB Mix). Each treatment was carried out five times.

Plant Preparation

Before planting, Pasote will be selected first before seeding with the following stages:

1. The seeds used were taken from the Sea Mitra Biovina Laboratory. The seeds are mature and brownish in color and have dried.
2. Next, the seeding stage. Where at this stage there are five media to be used such as M1, M2, M3, M4 and M5 treatments.
3. 100 Pasote seeds are evenly sown in the seeding tub. At this stage, seeding is carried out for one week (7 days)

Pasote Planting

Before planting, the plant medium is prepared in advance according to by treating. Then the Pasote seedlings that have been sown for one week (7 days), then transferred into a *polybag* measuring 15x10 cm for the medium that has been filled with the treatment of the planting medium. Each of these treatments is carried out five times, at this stage the best time for planting Pasote is morning and evening.

Plant Care

Plant care is carried out by weeding and watering. Weeding is carried out every two days on a regular basis. This aims to maintain the cleanliness of the planting area by removing the weeds that grow. Watering is carried out every day until the capacity is spacious, twice a day in the morning and evening this aims to ensure that the plant gets enough water.

Research Parameters

1. **Germination Parameters:** The germination speed parameter is characterized by the release of radicula on the seeds. In this quantitative observation, measurements were made of plant length, germination power and germination percentage (Cinintya *et al.* 2018).
2. **Plant height:** The height of the plant is measured from the base of the stem to the tip of the highest leaf using a ruler, in this measurement is done every two days (Adawiyah and Afa, 2018).
3. **Number of leaves (strands):** In the observation of the number of leaves is carried out every two days, in this measurement each polybag is calculated the number of leaves (Adawiyah and Afa, 2018).
4. **Soil pH:** In this observation, the measurement uses a Soil Tester device that is plugged into the ground.
5. **Soil moisture:** In this observation, the measurement also uses a Soil Tester tool that is plugged into the ground.
6. **Temperature:** In this observation, the measurement uses a tool, namely a thermometer.

2. Data Analysis

The data obtained will be analyzed using Fingerprint Analysis (ANAVA) at a confidence level of 95% (Sigala *et al.,* 2019). If a significant difference in calculation is obtained, it will be further tested with BNT 5% (Susilawati, 2015).

3. Results and Discussion

The results of this study aim to evaluate the morphological characteristics of Pasote plants *(Dyspania ambrosioides*) cultivated on several different planting media, namely Sand and Humus Soil 1:1 (M_1), Humus Soil and Rice Husk 2:1 (M_2), Wood Dust 1:1 (M_3), Sand and AB Mix (M_4), AB Mix (M5) for 7 days of seeding and 28 total plantings. Observations were carried out during the 7-day germination period at seeding, and 21 days of observation of various morphological parameters measured, including plant height, number of leaves, leaf area, root length, and fresh and dry weight of plants. The following are the results of the research obtained.

4.1 Germination Parameters at the Time of Equalization

The results of the observation of Pasote germination during seeding can be seen as shown in Table 1. The data presented was the percentage of germination from 100 seeds sown on various growing media, including Sand and Humus Soil 1:1 (M_1), Humus Soil and Rice Husk 2:1 (M_2), Sand and Wood Powder 1:1 (M_3), Sand and AB Mix (M_3), AB Mix (M5) for 7 days.

Table 1. Percentage (%) of germination of Pasote seeds (*D. ambrosioides L.*) from CV. Biovina on several types of planting media for 7 days of planting.

Day	M1 (%)	M2 (%)	M3 (%)	M4 (%)	M5(%)
0	0	0	0	0	0
1	0	0	0	4	0
2	8	11	7	22	3
3	25	24	26	38	18
4	49	42	46	55	35
5	62	63	67	74	55
6	81	87	80	85	73

7	99	100	96	100	94

The data calculated is sprouts every day. Day 0 is the day when planting is carried out. The analysis of the percentage data is the number of sprouts (n) divided by the number of seeds planted or sown on the seeding medium (t). So the germination percentage = (n/t) x100%. The fastest germination observation results were in M4 media or Sand media fed with AB Mix media, which was 4% on day 1 or 24 hours after planting. Then the fastest germination is also in M4 followed by M2 (Humus soil: Rice husk 2:1), then the most germination is in M4 (Sand: AB-Mix) and M2 are the same 100%. The development process of Pasote seed germination is as shown in Figure 1. The results of the data analysis showed that the percentage of germination of M_4 or Sand and AB Mix media produced the best germination, namely after 7 days of germination or 100% germination (the concentration in germination growth in plants was not significantly different where the growth was almost 100% of the plants grew in each planting medium. This can be seen in the table that the growth reaches 94% to 100% growth.

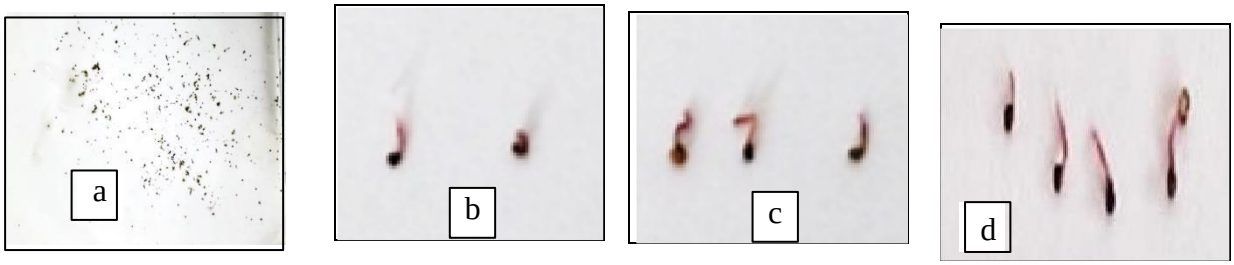


Figure 1. The germination process of Pasote seeds (a). 100 seeds on the 0th day on paper, (b). Day 1 after planting, (c). Day 2 after planting (c), Day 4 after planting (d).

The seed development process in germination in M4 medium is best because of the sufficient water used to activate the enzymes Hydrolase and Protease decompose amylum and proteins in the seed which induce cell division in the hypocotyl from the seed or seed (Taiz *et al.*, 2015). The response of different seed germination to different media seems to depend on the optimal moisture content (Salisbury and Roos, 1995). Optimum water that can produce a good seed metabolism process characterized by the appearance of radicula and plumula that grow normally within a certain set time will produce pure seeds under favorable conditions (Purnobasuki, 2011). Excessive water content such as in AB Mix media alone, even though the nutrition is sufficient, still produces non-optimal germination. Excessive water content can actually reduce oxygen in the catabolism process which reduces oxygen levels so that germination is lower than other media with optimal water (Salisbury and Roos, 1995). The media with optimal growth is M4 media (Sand Media and AB Mix).

The results of data analysis in Table 1 show that on the second day the germination growth in the M4 treatment was higher so that it reached (22%), then followed by M2 (11%), M1 (8%), M3 (7%) and the lower M5 treatment only reached (3%). This is because the planting medium is different so that the germination growth is different (Figure 2). Plants have an ability to adapt to various environmental conditions to environmental changes, this is influenced by the genetic traits of the plant (Muhidin *et al*,.2013).

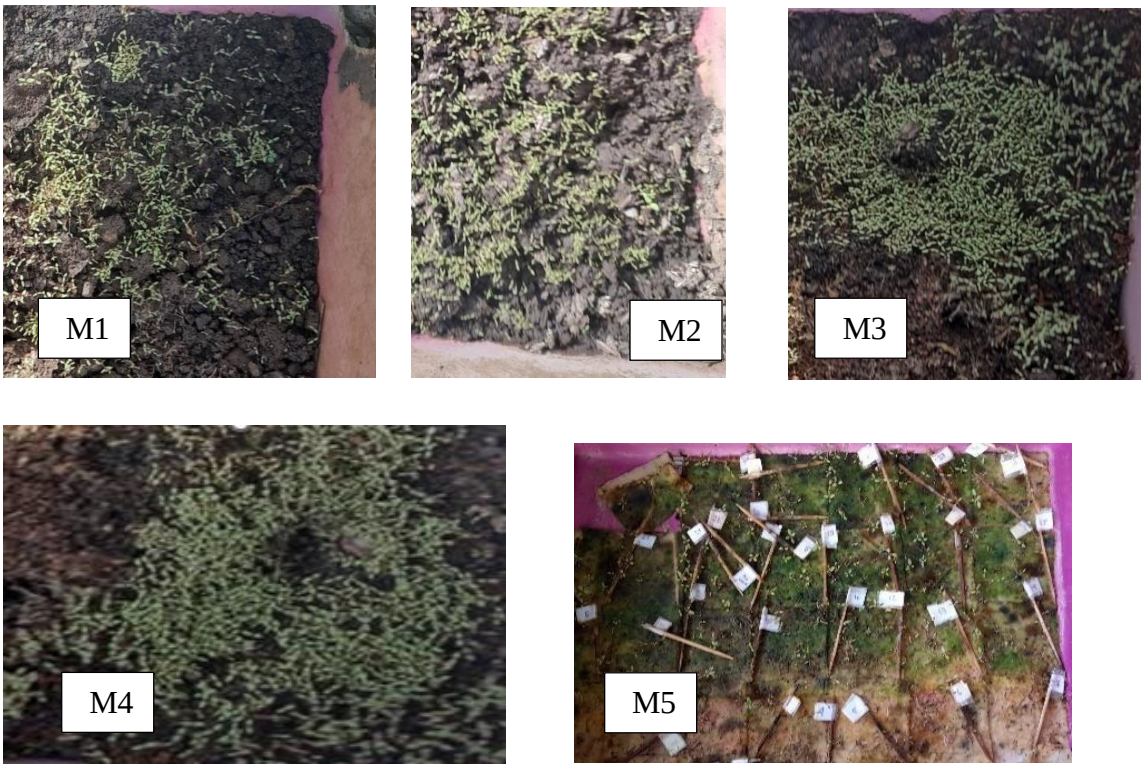


Figure 2. The appearance of seedlings produced on each Pasote medium (*D. ambrosioides L.*) on several types of planting media, Sand and Humus Soil 1:1 (M_1), Humus Soil and Rice Husk 2:1 (M_2), Sand and Wood Powder 1:1 (M_3), Sand and AB Mix (M_4), AB Mix (M5) for 7 days.

Table 2 shows the germination rate that can be measured by calculating the number of plants that grow each day, to determine the response of the seed treatment to germinate under optimal conditions (Copeland and Mc. Donald, 2001). From the results of this study, we can see that the percentage of germination rate of media from one media to another is different from each other (Figure 2), in addition to environmental factors and nutrients in the media can affect its growth (Taiz *et al.*, 2015).

Table 2. The number of seeds that germinate is marked by the release of radiculka (pink) Pasote (*D. ambrosioides L.*) on several types of planting media, Sand and Humus Soil 1:1 (M_1), Humus Soil and Rice Husk 2:1 (M_2), Sand and Wood Powder 1:1 (M_3), Sand and AB Mix (M_4), AB Mix (M5) for 7 days.

Name Sample	Day 0	1	2	3	4	5	6	7
M1	0	0	8	25	49	62	81	99
M2	0	0	11	24	42	63	87	100
M3	0	0	7	26	46	67	80	96
M4	0	4	22	38	55	74	55	100
M5	0	0	3	18	35	55	73	94

The germination process is the initial stage in the plant life cycle that starts from seed until young plants start growing. According to Bewley and Black, (1994) that the germination process starts from water imbibing, the seeds absorb water from the surrounding environment. This process causes the seeds to

swell and triggers enzymatic activity in the seeds. Water is an essential component required for chemical reactions in seed cells. The absorbed water activates enzymes in the seeds, which begin to break down the food reserves stored in the endosperm or cotyledons into a form that can be used by the plant embryo. Too much water can interfere with cellular respiration (Copeland and McDonald, 2001). Enzyme activation in seeds begins to undergo cellular respiration. This process breaks down carbohydrates to produce the energy needed for embryonic growth (Taiz and Zeiger, 2010). The cells in the embryo begin to divide and elongate. This process causes the radicula (embryonic roots) to elongate and penetrate the seed shell (Hopkins and Hüner, 2008). Radicula first emerge from seeds and begin to grow down into the soil in search of water and nutrients. Plumula (embryonic buds) then emerge and grow upwards towards the Light (Bewley and Black, 1994).

Table 3. Germination rate of Pasote (D. ambrosioides L.) on several types of growing medium for 7 days. The planting media used include: a mixture of Sand and Humus Soil with a ratio of 1:1 (M1), a mixture of Humus Soil and Rice Husk with a ratio of 2:1 (M2), a mixture of Sand and Wood Powder with a ratio of 1:1 (M3), a mixture of Sand and AB Mix (M4), and AB Mix (M5). Based on the results in Table 3 which explains that M4 grows faster compared to other media, besides that the least growth is M5 where during germination only 94 grow. This is because there is a decrease in the ability of the seed to divide the cells in the seed because the medium is only made of liquid and the buffer is only a thin *rock rowl* so that the medium appears to lack oxygen in cell respiration or aeration (Taiz *et al.*, 2015), while humus soil dries out the medium rather quickly when observed directly because the large volume of water watering is the same volume for all types of planting media (Soares *et al.*, 2024).

Name Sample	Day								Total
	0	1	2	3	4	5	6	7	
M1	0	0	8	17	24	13	19	18	99
M2	0	0	11	13	18	21	24	13	100
M3	0	0	7	19	20	21	13	16	96
M4	0	4	18	16	17	19	11	15	100
M5	0	0	3	15	17	20	18	21	94

The tall growth of plants on different growing media is due to different germination processes, which are affected by the varied water imbibinations of each medium. Imbibed water causes the seeds to swell and triggers enzymatic activity in the seeds. Water is an essential component needed for chemical reactions in seed cells. The absorbed water activates enzymes in the seeds, which begin to break down the food reserves stored in the endosperm or cotyledons into a form that can be used by the plant embryo. However, too much water can interfere with cellular respiration (Copeland and McDonald, 2001). Activation of enzymes in seeds leads to cellular respiration, where carbohydrates are broken down to produce the energy necessary for embryonic growth (Taiz and Zeiger, 2010). The cells in the embryo begin to divide and elongate, which causes the radicula (embryonic roots) to elongate and penetrate the seed shell (Hopkins and Hüner, 2008). The radicula is the first structure that emerges from seeds and begins to grow down into the soil in search of water and nutrients. Then, the plumula (embryonic shoot) emerges and grows upwards towards the light (Bewley and Black, 1994). The growing and elongated plumula causes the tall growth of the plant noted in the Appendix.

4.2 Pasote Plant Height

Pasote height measurements and analysis were carried out following (Soares *et al.*, 2024). Based on the results of the analysis of the variety fingerprint at the confidence level, it shows that the height of the plants in several planting media carried out has no real effect on each treatment. To determine plant growth, one parameter is used, namely plant height. In addition, there are several factors that can affect the plant growth process, including environmental, physiological and genetic factors in the plant.

Table 4. Average plant height (in cm) for 28 days on different types of growing media. The planting media used includes: a mixture of Sand and Humus Soil with a ratio of 1:1 (M1), a mixture of Humus Soil and Rice Husk with a ratio of 2:1 (M2), a mixture of Sand and Wood Powder with a ratio of 1:1 (M3), a mixture of Sand and AB Mix (M4), and AB Mix (M5).

Day to	M1	M2	M3	M4	M5
0	0	0	0	0	0
2	0.14	0.14	0.14	0.12	0.18
4	0.42	0.54	0.38	0.28	0.44
6	0.68	0.9	0.72	0.46	0.64
8	1.02	1.38	1.24	0.82	0.86
10	1.28	1.7	1.54	1.16	1.16
12	1.52	2.02	1.76	1.42	1.46
14	1.8	2.32	1.98	1.9	1.7
16	2.04	2.56	2.24	2.34	1.94
18	2.26	2.9	2.56	2.7	2.18
20	2.54	3.14	2.88	3.18	2.48
22	2.82	3.4	3.26	3.54	2.72
24	3.14	3.64	3.52	4.16	2.98
26	3.46	4	3.8	4.8	1.88
28	3.76	4.24	4.2	6.1	0

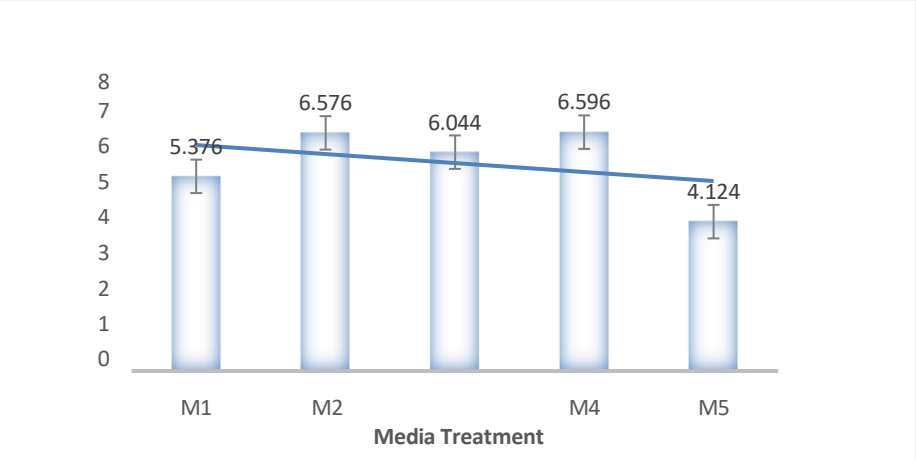


Figure 2. Graph of the average plant height (cm) for 28 days that were treated on several types of planting media including Sand and Humus Soil 1:1 (M_1), Humus Soil and Rice Husk 2:1 (M_2), Sand and Wood Powder 1:1 (M_3), Sand and AB Mix (M_4), AB Mix (M5).

The results of data analysis show the average plant height in Figure 2 and Table 4. Based on this data, the height of plants in M4 media reached 6,596 cm, higher than M5 media which only reached 4,124 cm. This difference is due to the variation of planting media which greatly affects plant growth, so that plants on M4 medium can grow more optimally.

Based on the results of research by Rachman and Utami (2006), the tall growth of plants in some media is more effective at the beginning of the growth period compared to the late period, which results in inhibitions in plant growth. Although its growth was stunted, its growth graph still showed an improvement, which was evident from the speed of the transition from germination to the plant phase. On the 8th day, the height of the Pasote plant on M1 medium (1.02 cm) was higher than that of M5 medium (0.86 cm). Likewise, on the 14th day, the plant height on M1 medium (1.8 cm) was higher than that of M5 medium (1.7 cm). The photosynthesis process will take place perfectly if the soil conditions and the availability of the nutrients needed are good so that plants can be used to carry out the photosynthesis process properly in supporting the tall growth of the plant. The higher the nutrients obtained, the better it will be (Sinaga, 2012). According to Mandala (2008) Nitrogen plays a very important role for hydroponic plants where it can stimulate the growth of plants for the whole growth, especially in the stems, branches and leaves.

Based on the results obtained by the plant height in the treatment of M1, M2 and M3 has no real effect, sawdust media is a medium that dries easily, this must be considered again so that the plant does not dry out while the sand medium is a planting medium whose nutrient absorption is relatively small so that the ability to store water is very low so that the medium dries quickly (Ismail, 2013).

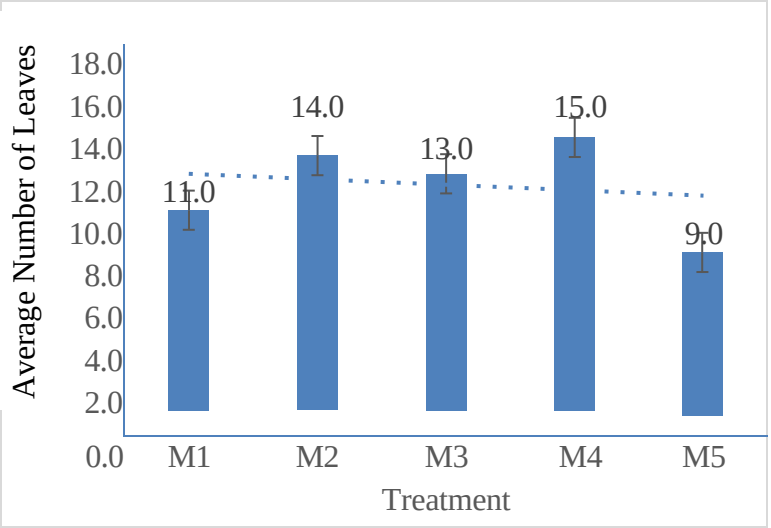
4.3 Number of Leaves

The measurement and analysis of the number of Pasote leaves is carried out following the method [10]. Leaves are organs in plants that act as a place for the photosynthesis process to take place. The process of photosynthesis in leaves occurs due to the presence of chlorophyll in the leaf mesophyll. The number of leaves in a plant can affect the intensity of photosynthesis; The more leaves, the higher the photosynthesis yield. This can have an impact on plant growth.

Table 5. The number of leaves of Pasote sprout plants (*D. ambrosioides*) in several types of planting media includes Sand and Humus Soil 1:1 (M_1), Humus Soil and Rice Husk 2:1 (M_2), Sand and Wood Powder 1:1 (M_3), Sand and AB Mix (M_4), AB Mix (M5) for 28 days.

Day	M1	M2	M3	M4	M5
0	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00
6	2.00	2.00	2.00	2.00	2.00
8	3.40	3.60	3.40	3.40	3.00
10	3.40	3.60	3.60	3.60	3.00
12	4.20	4.00	4.00	4.40	3.20
14	4.40	4.60	4.80	4.60	3.20
16	4.40	5.00	5.20	5.40	4.20
18	5.00	6.00	5.40	6.00	4.60
20	5.20	6.40	6.60	6.60	5.60

22	5.60	6.80	6.80	8.20	5.80
24	6.20	8.00	7.40	8.80	6.20
26	6.20	8.40	8.00	10.00	4.40
28	7.20	9.00	8.80	10.60	0.00
Average	11.0	14.0	13.0	15.0	9.0



Picture. 4. Average graph of the number of Pasote leaves (*D. ambrosioides*) treated with different types of media over 28 days. The media used include a mixture of Sand and Humus Soil with a ratio of 1:1 (M1), a mixture of Humus Soil and Husk with a ratio of 2:1 (M2), a mixture of Sand and Wood Powder with a ratio of 1:1 (M3), a mixture of Sand and AB Mix (M4), and AB Mix (M5).

Based on the results of the analysis of the raw data in Appendix 1, it is shown that the graph by type of media has the highest plant height at M_4 and the number of leaves is also the same. Table 5 and Figure 4 show that the highest plant height data is at M4 as well, which is in line with its germination. The germination process is the beginning of causing the seeds to swell and triggering enzymatic activity in the seeds. Water is an essential component required for chemical reactions in seed cells. The absorbed water activates enzymes in the seeds, which begin to break down the food reserves stored in the endosperm or cotyledons into a form that can be used by the plant embryo. Too much water can interfere with cellular respiration (Copeland and McDonald, 2001). Enzyme activation in seeds begins to undergo cellular respiration. This process breaks down carbohydrates to produce the energy needed for embryonic growth (Taiz and Zeiger, 2010). The cells in the embryo begin to divide and elongate. This process causes the radicula (embryonic roots) to elongate and penetrate the seed shell (Hopkins and Hüner, 2008). Radicula first emerge from seeds and begin to grow down into the soil in search of water and nutrients. Plumula (embryonic buds) then emerge and grow upwards towards the Light (Bewley and Black, 1994).

The results of data analysis showed that the average number of leaves of Pasote plants from day 0 to day 28 was not significantly different. This is because the leaves have opened perfectly and the photosynthesis process is thorough. Based on Figure 3, it is known that M_4 produces the highest number of leaves reaching 15 leaves compared to other media, in M_5 media is the lowest medium that produces the number of leaves which only produces 9.0.

In Figure 4, the average number of leaves graph shows that from day 0 to day 28 there is an increase in the average number of Pasote leaves in M_1, M2, M3 and M4 media, while in M_5 medium on the 26th to

28th day there is a decrease in the number of leaves, this is due to the decrease in nutrients so that the photosynthesis process in this plant is reduced so that it can cause the plant to die.

4.4 Soil PH Monitoring

Soil pH is an indicator of acidity degree used to determine the level of acidity or alkalinity possessed by a solution, pH is measured in the range of 0-14 pH. It can be said to be neutral if the degree of acidity and alkalinity is on a pH scale of 7, this is because the pH is a neutral pH. The pH of the soil is basically close to the same on all media.

Table 6. pH of Pasote Planting Media (*D. ambrosioides*) for 28 days on several media, as follows.

Name Sample	pH Day 1-														
	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28
M1	6.4	6.2	6.4	6.2	6.2	6.2	6.4	6.4	6.4	6.4	6.2	6.2	6.2	6.4	6.4
M2	6.4	6.2	6.4	6.2	6.2	6.2	6.4	6.4	6.4	6.4	6.2	6.2	6.2	6.4	6.4
M3	6.4	6.2	6.4	6.2	6.2	6.2	6.4	6.4	6.4	6.4	6.2	6.2	6.2	6.4	6.4
M4	6.5	6.5	6.5	6.5	6.5	6.7	6.7	6.5	6.5	6.5	6.5	6.7	6.7	6.5	6.5
M5	6.5	6.5	6.5	6.7	6.7	6.5	6.5	6.5	6	6.5	6.5	6.5	6.7	6.7	6.7

Hydroponics is an alternative technique that cultivates plants without using large areas of land or land, this is very suitable for people who want to plant but do not have a large area of land (Wati and Sholihah, 2021). During 28 days of planting, the pH level between 6.0-6.7 is still neutral, based on the results of research by Pancawati and Yulianto (2016) hydroponics can affect growth in the absorption of nutrients in the roots so that the growth can be said to be successful or not depending on the absorption of nutrients in the roots. If the pH of hydroponic nutrients is below the environment, namely pH 3-5 with a temperature above 26°C, it will result in the growth of fungi on the AB Mix medium so that it can cause plant roots to rot and die, this is because the pH is unstable.

There are several factors that can affect the high and low temperature of the soil, one of which is the pH of the soil (Ardhana and Gede, 2012). Based on the results of this study, the soil pH of 6.2-6.4 is H with ideal soil conditions, because we all know that a good soil pH is 6.0-8.0

4.5 Soil Moisture

Humidity is an indicator to find out how much or how little water is contained in the air, which is related to the air temperature in this case is usually expressed in the form of a percentage. One of the humidity is in plants, to find out that plants do not dry out quickly caused by evaporation, moisture is needed in plants. The results of data analysis showed that soil moisture was measured sequentially every two days (Table 7). Table 7 shows that the moisture observation data in general the humidity of the medium did not change much during the observation of germination and planting during 28 days of planting on all planting media of Pasote (*D. ambrosioides*).

Table.7 The moisture content of Pasote (*D. ambrosioides*) planting media in various types of media includes a mixture of Sand and Humus Soil with a ratio of 1:1 (M1), a mixture of Humus Soil and Husk with a ratio of 2:1 (M2), a mixture of Sand and Wood Powder with a ratio of 1:1 (M3), a mixture of Sand and AB Mix (M4), and AB Mix (M5).

Name Sample	Humidity Day 1-														
	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28
M1	2.5	2	2	2.5	2.5	2.5	2	2	2	2	2.5	2.5	2.5	2	2
M2	2.5	2.5	2	2.5	2.5	2.5	2	2	2	2	2.5	2.5	2.5	2	2
M3	2.5	2.5	2	2.5	2.5	2.5	2	2	2	2	2.5	2.5	2.5	2	2
M4	2	3	3.5	3	3.5	2.5	3	2.5	3.5	3	2.5	2.5	3.5	3.5	3.5
M5	3	3.5	3.5	2.5	2.5	3.5	2.5	3.6	3.3	3.3	3	2.5	2.5	3.5	3.6

Soil moisture is a ratio of water to air concentration where the ideal soil moisture in agricultural crops is 0%-40% moisture in dry soil while the moisture in wet soil is 60%-100% ideally. According to Wahyudin *et al.* (2017) The moisture content of plant substrates such as soil, husk charcoal, sand or wood powder is determined based on the ratio of the weight of water contained in the medium to the absolute dry weight of the medium. Soil moisture is also a factor in the control and absorption of minerals in such plants.
Humidity data can be seen in Table 7. In the table, the humidity of 2-2.5 Pasote growth will increase the percentage of germination according to the soil moisture and will be at a certain limit. This shows that the moisture in the soil medium, it is necessary to control it so that the growth yield is optimal [11]. In general, the nutrient levels needed by hydroponic plants range from 600-1400 ppm. If the ppm is too high, it can cause the plant to slow down and over time it will die, this is due to the high concentration of media in the hydroponic plant [12] .

4.6 Temperature (^{OC})

Temperature is an element that affects the growth and development of a plant, because temperature can affect plant activities such as photosynthesis, respiration, transpiration and growth. The maximum temperature for plants is 15-30 ^{OC} (Aprilia *et al.,* 2022) while the optimum temperature in the soil for some types of plants is 20-35 ^{OC} and the optimum soil moisture is 50-70% (Meilianto *et al.,* 2022). Soil quality can be affected by the temperature in the soil so that it affects the soil quality to support plant growth in the amount of solar radiation absorption at the soil surface and water absorption. The lower the temperature in the soil, the less water absorption in the roots, so the plant easily wilts (Karyati *et al.,* 2018). The ambient temperature is determined before planting, which is carried out sequentially every two days, the temperature is measured as follows.
Table.8 Measurement of environmental temperature (°C) for planting Pasote (*D. ambrosioides)* was carried out with various planting media treatments, namely: sand humus media with a ratio of 1:1 (M1), soil humus and husk with a ratio of 2:1 (M2), sand with AB Mix (M3), sand and wood powder with a ratio of 1:1 (M4), and AB Mix (M5)

Temperature (°C)	Day														
	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28
M1	27	26	27	27	26	28	28	28	26	30	30	28	28	30	28
M2	27	26	27	27	26	28	28	28	26	30	30	28	28	30	28
M3	27	26	27	27	26	28	28	28	26	30	30	28	28	30	28
M4	27	26	27	27	26	28	28	28	26	30	30	28	28	30	28
M5	27	26	27	27	26	28	28	28	26	30	30	28	28	30	28

The results of this study revealed that the growth of Pasote plants is influenced by environmental temperature, with temperature changes occurring throughout the growth period. The growth of Pasote increases from day 0 to day 14 at temperatures between 26-28°C. However, on the 22nd to 28th day, the temperature rises to 28-30°C, which leads to a decrease in the growth rate of the plant.

Based on observations on the 18th to 20th day, the high environmental temperature reached 30°C causing a decrease in the growth quality of Pasote plants. In addition, on the M5 medium there is mold growth, which is caused by high air temperatures. According to research by Gairola *et al.* (2011), temperature has a significant influence on seed response in plant growth varies based on species and genetics which can affect growth rate, number of leaves and plant height.

Singh *et al.* (2001) the optimum temperature in germination in soil medium in watermelon seeds is 22°C while Rusmin *et al.* (2014)[9] reported that germination temperature and germination medium had a significant effect on the maximum growth potential in porwoceng with a temperature of 23-25°C with stencil paper medium (CD) which was the best combination of treatment for the purwoceng seed testing method. The higher the temperature, the more it will affect the nutrients in the plant, so it is necessary to add it to stay in normal nutrients [13].

4.7 Morphological Characteristics of Pasote Plants

To obtain optimal cultivation yields, it is important to understand how the growing medium affects the growth and development of these plants [14]. Therefore, this study focuses on analyzing the morphological characteristics of Pasote plants cultivated in sand media and AB Mix (M4) because the plant is taller, has more leaves, and more roots than cultivated in other media [15]. The morphology of the roots, stems and leaves of M4 media can be seen in Figure 5. Morphological character after planting seedlings in seeding (Figure 5A) which appears light purple in the hypocotile [16], and the dark brown cotyledons are still covered in the seed skin. After 5 days of growth, it looks like Figure 5 B: the cotyledons enlarged and opened into 2 cotyledons and were yellowish-green, although the hypocotyles were still yellowish-purple. Figure 5 B on ABmix hydroponic media [17].

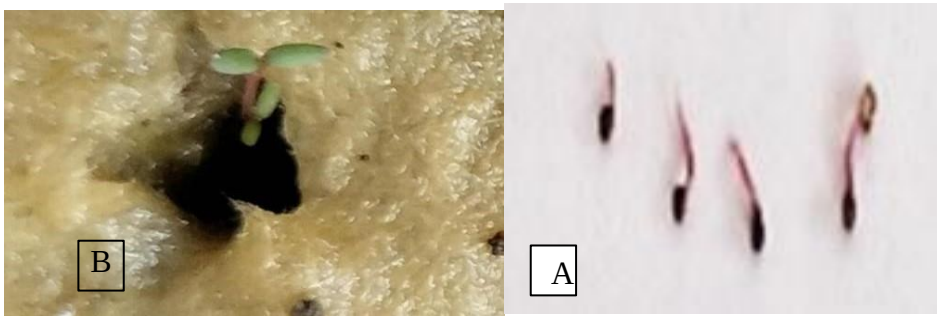


Figure 5. Morphological characters in the germination of Pasote seeds (A) on the 4th day, Day 5 after planting (B).

Observations show that the height of the Pasote plant varies descriptively according to the morphological characteristics of the plant [18], illustrated in Figure 6 with the development of the planting medium used by M4 which is further discussed for further use. (Figure 6). Pasote plants grown on Sand and AB Mix mixed media showed higher growth [12], compared to those grown on other media although they have not been statistically tested (Figure 6). This is most likely due to the better nutrient content and more supportive media structure in Sand and AB Mix[19]. Sand Media: AB Mix provides optimal conditions

for better absorption of water and nutrients, thus promoting higher vertical growth. overall (John and Smith, 2018). It appears that the roots are still light purple to pink, the leaves are light green, the root system is mounted, the leaf bones are pinnate, the leaf edges are serrated and the leaf surface is fluffy (Figure 7)

Figure 6. The morphological character of Pasote development in planting in M4 media (Sand: ABmix) gradually according to the planting day on M4 media after 7 days of seeding.

In Figure 7 it is shown that the leaf morphological characteristics of the leaf count parameter are also an important indicator of optimal plant growth [19]. In the Sand:AB Mix media, the Pasote plant has a higher number of leaves compared to other media as shown in Figure 4. This shows that the Sand:AB Mix medium provides better conditions for the formation of new leaves. More leaves also mean increased photosynthetic capacity, which contributes to better overall plant growth (John and Smith, 2018). Of course, the size of the leaves, both long and wide, also shows the difference between the five growing media. The leaves on the Sand:AB Mix medium tend to be larger, which reflects better growing conditions. Larger leaves indicate that the plant can optimize the photosynthesis process, accumulating more energy[20], and support stronger and healthier growth. In contrast, the leaves on the sand medium are smaller, indicating limitations in the plant's ability to absorb nutrients and water effectively (Figure 7).

Figure 7. The development of morphological characters in planting in M4 media (Sand: Abmix) gradually according to the planting day on M4 media until 28 days of planting.

Although the study is more focused on the top of the plant, root structure also plays an important role in supporting overall plant growth. Sand Media: AB Mix [21], which is rich in nutrients and has a culture container made like a hydroponic medium (Figure 8) that has good and abundant water capacity and reservoirs, which supports the development of a wider root system and deeper healthy and well-developed roots allow plants to absorb more water and nutrients, which is especially important during periods of drought or other stressful conditions (Smith *et al.*, 2020).

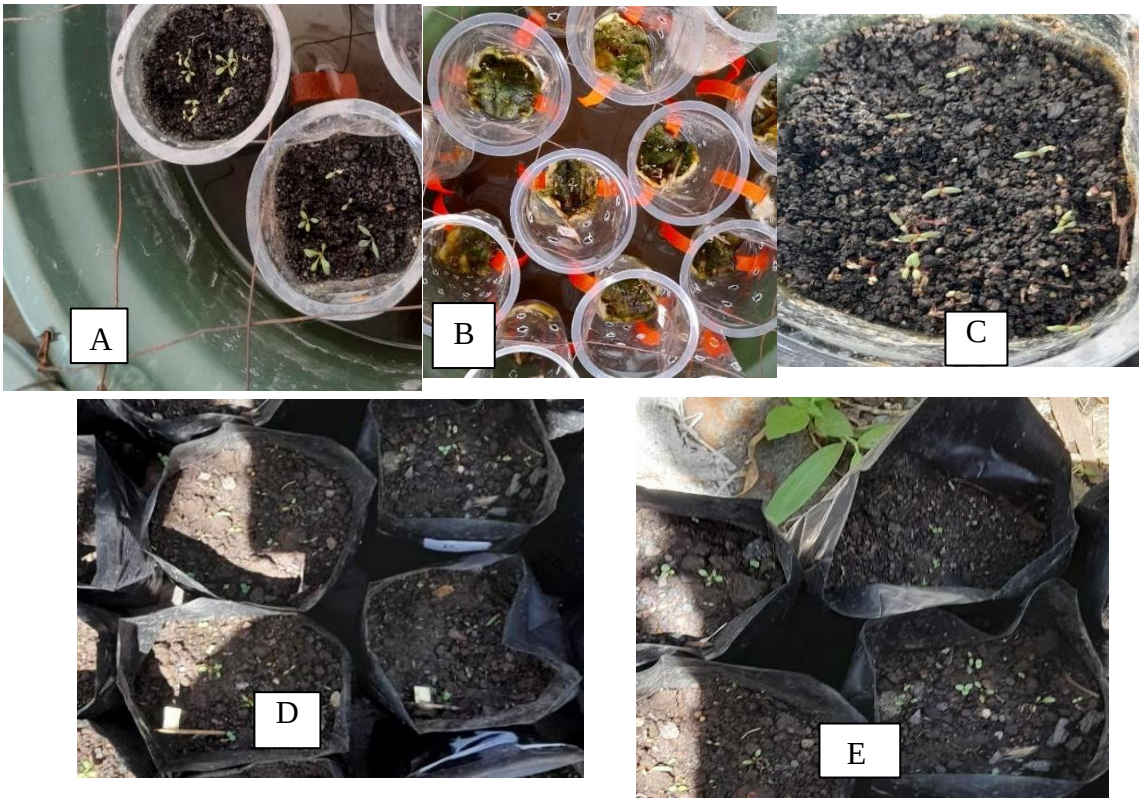


Figure 8. Sand and AB Mix media images one day after transplanting (8th day) at the growth stage (A), AB mix media images one day after transplanting (8th day) at the growth stage (B), Humus and Sand Soil media images (8th day) at the growth stage (C), Humus and Husk Soil media images (8th day) at the growth stage (D), Image of Sand and Wood Powder media (8th day) at the growth stage.

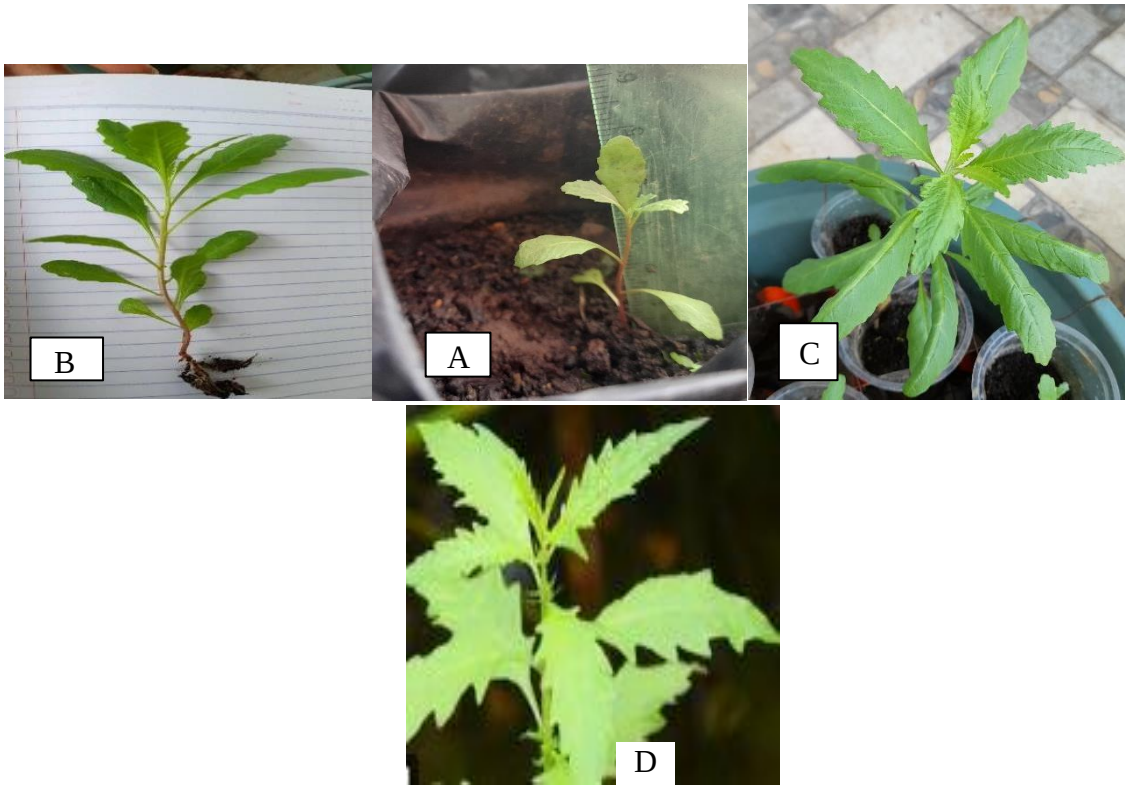


Figure 9. Leaf characteristics from day 28 (A), to day 28 where the growth is very optimal and undergoes changes in leaf morphology, the leaf is widening to the upper leaf and it can be seen that the leaf stem is getting more jagged at the tip (B) at the base while at the tip is serrated and wavy (C) the leaf edge is jagged until tapered (D).

The Pasote plant has serrated leaves, has a red stem that gradually becomes green, this plant is a plant that has complete leaves because it has petioles and leaf blades that are jagged, tapered, the base of the leaves is jagged[24]. It has parallel leaf bones that have one large bone in the middle, while the other leaf bones are small and appear to be parallel to the leaf bones, the color of the leaves is light green and there is also dark green [25].

Pasote has hairy petioles, alternately seated leaves (phylloticis), serrated edges of the leaves (serratus), besides that the veins on the leaves of the Pasote appear prominent, the base of the leaves is tapered. According to Sitinjak [19] explained that environmental factors in these locations greatly affect the growth and development of leaves. In addition, the intensity of light, air temperature, water availability and nutrients also affect the growth of the plant.

4. Cover

The conclusion from the study of the morphological characteristics of Pasote plants (*D. ambrosioides*) in several planting media from day 0 to day 28 is that the morphology of Pasote plants is different in each planting medium. The planting medium with the highest number of leaves is 15 leaves on M4 medium and the highest Pasote plant is also on M4 medium with a height of 6,596 cm. The highest percentage of germination was achieved in M4 of 100% and the fastest germination on the 2nd day occurred in Sand and AB Mix media. The results of this study support good growth in the future for germination for 28 days is Sand:AB Mix media with an average environmental temperature of $26^{OC,\ air}$ humidity of 3.3 and a media pH of around 6.6. The morphological character is the same as the morphological character when in

the field in the original both color, smell, morphological shape of the leaves, roots and stems. The best media can be used in sandy planting media and AB Mix media.

The recommendation for planting Pasote for nursery is to use sandy soil plus AB Mix. However, it should be used on large volume media so that larger growth can take place. Further research is still needed to determine the growth response of the morphological characteristics of the Pasote plant with other plants and be observed until the generative phase.

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