Effect of Water Immersion Time and Planting Media Composition On The Initial Growth of Kemiri Sunan (*Reutealis trisperma* (Blanco) Airy Shaw)

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PENGARUH LAMA WAKTU PERENDAMAN AIR DAN KOMPOSISI MEDIA TANAM TERHADAP PERTUMBUHAN AWAL BIBIT KEMIRI SUNAN *(Reutealis trisperma* (Blanco) Airy Shaw)

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Effect Of Water Immersion Time And Planting Media Composition On The Initial Growth of Kemiri Sunan (Reutealis trisperma (Blanco) Airy Shaw)

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ABSTRAK

Kemiri Sunan (Reutealis trisperma (Blanco) Airy Shaw) merupakan tumbuhan tropis yang tersebar di berbagai tempat di Indonesia. Penelitian ini bertujuan untuk menentukan lama waktu perendaman air dan komposisi media tanam yang terbaik terhadap pertumbuhan awal bibit kemiri sunan. Penelitian ini dilaksanakan pada bulan April – Juli 2021 di Ds. Magersari RT 04 RW 01 Kecamatan Krian Kabupaten Sidoarjo. Penelitian menggunakan Rancangan Acak Lengkap (RAL) dua faktor yaitu suhu 60 ^{o}C dengan lama waktu perendaman air dan komposisi media tanam dengan 16 faktor kombinasi Treatment yang diulang sebanyak 3 kali. Faktor pertama yaitu lama waktu perendaman air dengan 4 taraf yaitu tanpa perendaman, perendaman suhu 60 ^{o}C selama 12 jam, perendaman suhu 60 ^{o}C selama 24 jam dan perendaman suhu 60 ^{o}C selama 48 jam. Sedangkan faktor kedua yaitu komposisi media tanam dengan 4 taraf yaitu tanah, tanah : pupuk kandang kambing dengan komposisi 1:1, tanah : arang sekam dengan komposisi 1:1 dan tanah : pupuk kandang kambing : arang sekam dengan komposisi 1:1:1. Hasil penelitian menunjukkan Treatment kombinasi terdapat interaksi pada parameter tinggi tanaman pada umur 44, 58, 72 dan 86 HST dan bobot kering. Treatment lama waktu perendaman air selama 12 jam dan 24 jam berpengaruh sama dan memberikan hasil terbaik pada jumlah daun, diameter batang, jumlah akar dan bobot basah. Treatment komposisi media tanam tanah, pupuk kandang kambing, dan arang sekam memberikan hasil terbaik pada jumlah daun, diameter batang, panjang akar, jumlah akar, dan bobot basah tanaman kemiri sunan.

Kata kunci: Kemiri Sunan, Lama Waktu Perendaman, Komposisi Media Tanam

ABSTRACT

Kemiri Sunan *(Reutealis trisperma* (Blanco) Airy Shaw) is a tropical plant that is spread in various places in Indonesia, but currently many grow naturally in West Java. This study aims to determine the length of time soaking water and the composition of the planting medium is best for the initial growth of seedlings kemiri sunan. This research was conducted in April-July 2021 in Magersari village RT 04 RW 01 Krian District Sidoarjo regency. This study uses a complete randomized design (RAL) two factors, namely the length of time soaking water and the composition of the growing media with 16 factors combination of treatments that are repeated 3 times. The first factor is the length of time the water immersion with 4 levels of without immersion, immersion temperature of 60 ^{o}C for 12 hours, immersion temperature of 60^{o}C for 24 hours and immersion temperature of 60^{o}C for 48 hours. While the second factor is the composition of the planting medium with 4 levels, namely soil, soil: goat manure with a composition of 1 : 1, soil:husk charcoal with a composition of 1 : 1 and soil : goat manure:husk charcoal with a composition of 1 : 1 : 1. The results showed that the combination treatment there is interaction on the parameters of plant height at the age of 44, 58, 72 and 86 HST and dry weight. Long treatment time soaking water for 12 hours and 24 hours gives the same result and best results on the parameters of number of leaves, stem diameter, number of roots and wet weight. Treatment of soil composition, goat manure, and husk charcoal gave the best results on the number of leaves, stem diameter, root length, the number of roots, and wet weight of plants**.**

Keyword: Kemiri Sunan, Water Immersion Time, Planting Media Composition

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The preparation of this research proposal is prepared as one of the requirements that must be completed by students study program agrotechnology faculty of agriculture Universitas Pembangunan Nasional "Veteran" Jawa Timur to obtain a bachelor's degree. The purpose of preparing this research proposal is to find out directly the situation in the field by applying the knowledge that has been obtained during lectures.

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Penulis

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I. INTRODUCTION

1.1 Background

Kemiri sunan (Reutealis trisperma (Blanco) Airy Shaw) is a tropical plant that is spread in various places in Indonesia, but currently grows naturally in West Java. The population of Sunan candlenut plants is concentrated in Garut and Majalengka Regencies, West Java and in 2008 began to spread to various places that have diverse agroecosystems such as Central Java, East Java, NTT, NTB, Riau, Jambi, Bangka and East Kalimantan.

According to the Ministry of Agriculture of the Republic of Indonesia (2011) Sunan candlenut plants are capable of producing seeds of 4 - 6 tons of dry seeds per hectare per year, equivalent to 2 - 3 tons of crude oil per hectare per year. Sunan candlenut seeds, when extracted, will produce vegetable oil which can be used as a raw material source for making biodiesel, paint, varnish, ink, wood preservative, cosmetics and pharmaceutical industries. Sunan candlenut oil also contains ∝-oleostearic acid, palmitic acid, oleic acid and linoleic acid which have the potential to become raw materials for the oleochemical industry such as soap, cooking oil and as a biopesticide ingredient. Thus, the development of Sunan candlenut plants has great potential and is strategic to do.

Cultivation of Sunan candlenut plants is hampered by the dormancy of the seeds. Obstacles still faced in providing sunan candlenut seeds include the unavailability of technology that can shorten seed dormancy. This is caused by the thick layer of the seed coat and the imbalance of stimulating compounds which are impermeable to water and gas, thus blocking the imbibition process into the seed.

The importance of breaking dormancy is to accelerate seed germination so that the germination percentage remains high, eliminate factors inhibiting germination and reactivate dormant seed cells to support seeding activities. Good quality seeds in a short time and large quantities are needed to support the cultivation of Sunan candlenut plants. The loss of the dormancy period can support the provision of deep seedlings can be implemented in a short time.

Some types of seeds are sometimes treated with soaking in hot water with the aim of facilitating water absorption by the seeds. Hot water temperatures can speed up imbibition, the hard structure of seeds can make it difficult for water and oxygen to penetrate the seed coat and make it difficult for the radicle and plumule to emerge. Soaking seeds in hot water can soften and open the pores of the seed coat, thereby increasing the imbibition process in the seeds.

The composition of the planting medium at the nursery level plays an important role considering that at this stage the Sunan candlenut plant is at the initial stage of root formation. The planting medium for candlenut sunan uses a mixture of top soil, manure, sand or husks. According to the research results of Sasmita and Haryanto (2015), it shows that the composition of the planting media has an effect on the number of leaves. At the age of 5 weeks after planting, the highest number of leaves of Sunan candlenut seedlings was found in the planting media composition treatment of soil, manure, husk charcoal (M4) at 7.95 but not different from soil, manure (M2) and soil, husk charcoal (M3) while the lowest value was found in soil treatment (M1) at 7.29. Based on this, the length of time of soaking in water to break the dormancy period and the composition of the planting media are expected to be able to help nursery activities for Sunan candlenut plants.

1.2 Research Problem

1. Can differences in the length of time soaked in water affect the breaking of the dormancy period for Sunan kemiri seeds?
2. Does the composition of the planting medium affect the initial growth of Sunan candlenut seedlings?
3. Is there a combination of the length of time soaking in water and the composition of the planting medium on the initial growth of Sunan candlenut seedlings?

1.3 Purpose

1. Determine the interaction between the length of time soaking in water and the composition of the planting medium on the initial growth of Sunan candlenut seedlings.
2. Know the correct length of soaking time in water to break the dormancy period of Sunan candlenut seeds.

3. Determine the appropriate composition of planting media for the initial growth of Sunan candlenut seedlings.

1.4 Benefit

This research was carried out with the hope of increasing knowledge regarding the length of time soaking in water to break the dormancy period of Sunan kemiri seeds and the composition of the planting medium.

II. LITERATURE REVIEW

2.1 Sunan Candlenut Plant

2.1.1 Classification of Sunan Candlenut Plant

Sunan candlenut (Reutealis trisperma (Blanco) Airy Shaw) is the name given to a type of poison candlenut plant which is native to tropical plants, spread in various places in Indonesia (PPVT, 2009). Widespread cultivation of sunan candlenuts in the form of plantations in Indonesia began around the 18th century by Chinese traders in the Cilongok and Karawaci (Tangerang) areas, West Java to meet the export of Chinese wood (*Chinese houtolie*) such as that produced from the Aleurites fordii plant from Central China and A montana originating from Southeast China (Burkill, 1966).

The systematics of Sunan candlenut plants according to (Wiriadinata, 2007) are as follows:

Divisi : Magnoliophyta
Class : Magnoliopsida
Ordo : Malpighiales
Famili : Euphorbiaceae
Sub Famili : Crotonoideae
Genus : Aleurites
Spesies : *Reutealis trisperma* (Blanco) Airy Shaw

2.1.2 Morphology Sunan Candlenut Plant

a. Root

Sunan candlenut roots grow and develop like dicotyledonous plants in general, having supporting roots and lateral roots that grow quite quickly with a wide and deep spreading area. The root system of the sunan candlenut (*R. trisperma*) is similar to the vegetable candlenut (*A. mollucana*), which is a family member of the Euphorbiaceae, where the roots develop progressively and can attract and absorb water and nutrients in a wide environment (Sunanto, 1994). The supporting roots that grow at the beginning of the growth period are followed by the growth of lateral roots with root hairs at each end. The supporting roots penetrate deep into the soil and the area of lateral root growth can reach twice the width of the canopy (Paimin, 1997).

b. Stem

The stem shape of the sunan candlenut plant is cylindrical with a rough grey to blackish bark surface. In young plants, the surface of the bark is smoother and slippery brownish in colour. Candlenut trunks grow towering with a tree height of up to 15 metres and a trunk circumference of 195 - 234 cm (Syafaruddin and Wahyudi, 2011).

c. Branching

The branching system in hazelnut is typical with the number of branches generally three, forming a symmetrical triangle. generally three branches forming a symmetrical triangle. Sometimes the number of branches can reach 4 or 5 branches laterally but generally only three branches. The branches of the hazelnut tree are generally 0.25 - 1 m apart at the age of 1 - 3 years. 1 m at the age of 1 - 3 years. The first primary branch will grow at the age of the plant about 8 - 12 months after being planted in the field, if the planting material comes from seeds (seedling), the number is 3 - 4 branches at a height of 75 - 100 cm from the ground (Herman, 2013).

d. Leaves

Candlenut leaves are supported by petioles with a length of about 7 - 37 cm which are attached to the stem or branch in an unpaired circular arrangement. The leaf shape is cordate (cordata) with pinnate leaf bones and a smooth leaf surface texture. Candlenut leaves have a length ranging from 14 - 21 cm and a width ranging from 13 - 20 cm depending on the age of the plant, the location of the leaves, and the variety (Hadad, Syafaruddin, Wahyudi, Pranowo, Supriadi, Herman, Wardiana, Ferry, Heryana Dani, Aunillah, Harni and Randriana, 2009). Leaves grow and develop on each twig at the end of the branch with a total of 13 - 21 strands. The colour of young leaves varies from red, brownish red and light green depending on the variety (Herman, 2013).

e. Flowers

Candlenut flowers grow and develop on each twig at the end of the stem in the form of a flower arrangement (infloresence). The arrangement of candlenut flowers includes a panicle type consisting of flower stalks, primary branches, and secondary branches as in mango flowers (Figure 2.3.). Pecan flowers are arranged in the form of panicles (infloresence), the corolla is white to reddish, the pistil is light yellow with green ovaries and yellowish white seeds (Ajijah, Wicaksono and Syafaruddin, 2009). In one flower arrangement consists of male and female flowers but sometimes there are only male flowers or only female flowers or there are both (Herman, 2013).

f. Fruit

The candlenut fruit forms after 3 - 4 months from blooming. Candlenut fruits reach maturity and will begin to fall after 5 months from the time of fertilisation. The number of fruits per cluster is between 5 - 13 fruits (Herman, 2013). The fruit is round to ovoid, soft hairy, slightly flattened. Each fruit has 3 - 4 chambers containing seeds (Herman and Pranowo, 2011; Syafaruddin and Wahyudi, 2011)). The fruit is green when young, after ripening it is yellowish green to brownish (Figure 2.1.). The fruit skin has a thickness of about 3 - 5 mm and encloses the seeds inside. Ripe fruit has a size of about 5 - 7 cm with a length of 5 - 6 cm (Herman, 2013).

Figure 2. 1. Fruit of the Sunan Candlenut Plant; A) Fruit bunch, B) Variation in the number of seeds per fruit (Herman, 2013)

g. Seed and Kernel

Sunan candlenut seeds are encased in a shell-like seed coat with a slightly slippery outer surface. The seed coat is about 1 - 2 mm thick and brown or blackish in colour. Candlenut seeds have a round shape with the diameter of the seed meat reaching 23-27 mm (Figure 2.2.). Inside the seed is a rigid white kernel (endosperm with cotyledons inside) (Herman, 2013). (Herman and Pranowo, 2011) found that the composition of hazelnut fruit components consisted of fruit skin 62-68%, shell 11-16%, and kernel 11-16%. 11-16%, and kernel 16-27%.

Figure 2. 2. Figure 2.2. Seeds of the Sunan Candlenut Plant; A) Shell, B) Seed, C) Kernel (Herman, 2013)

2.1.3 Growth conditions

a. Climate

Sunan candlenut can grow well up to 1,000 m above sea level. However, optimum seed production with high oil yield is obtained up to an altitude of 700 m above sea level. Candlenut sunan grows in areas with a slightly dry to wet climate with rainfall of 1,500 - 2,500 mm per year, air temperature of 24 ^{o}C – 30 ^{o}C, air humidity of 71-88% and sunshine duration of more than 2,000 hours/year. Candlenut sunan requires a climate with high rainfall, dry months (3 - 4 months) and firm (climate must be specific, because it will affect the flowering and fertilisation process). Candlenut sunan grows and produces well in areas with the lowest annual rainfall of 2,681 mm in Garut and the highest of 4,172 mm in Majalengka (Supriadi, Sasmita and Daras, 2009).

b. Soil

Candlenut sunan requires a rather deep soil solum (> 0.5 m), loamy to sandy loam soil texture, groundwater depth > 1 m, and good drainage. Candlenut can grow well on calcareous, podzolic, latosol, regosol, and alluvial soils. Candlenut will produce well on acidic to neutral pH with thick to slightly thick soil solum as long as it has good drainage. has good drainage. The distribution area of sunan candlenut in West Java, grows and produces well on latosol, podzolic, and andosol soils (Supriadi, et al., 2009).

2.2 Seedd Germination

Germination is the growth of the embryo that begins again after imbibition, in this case the seeds will germinate after experiencing a dormant period that can be caused by several internal factors such as the embryo is still in the form of rudiment (immature), impermeable seed coat or the presence of growth inhibitors (Hidayat, 1995). Physiological seed germination processes that occur during seed germination are: (1) imbibition, (2) activation of enzymes and hormones, (3) process of food reserves, (4) initial growth of the embryo, (5) rupture of the seed coat and the emergence of roots, and (6) growth of sprouts (Gardner, 1991). According to (Sutopo, 2004), factors that influence germination include internal and external factors. Internal factors that play a role in influencing germination include:

a. Seed maturity level, seeds harvested before their physiological maturity level is reached do not have high viability, and in some crops such seeds will not even germinate.
b. Seed size, in the seed storage tissue there are carbohydrates, proteins, fats and minerals. where these materials are needed as raw materials and energy for the embryo at the time of germination. It is suspected that large and heavy seeds contain more food reserves than small seeds. The larger or heavier the seed size, the more the protein content increases.
c. Dormancy, the dormancy period can last seasonally or for several years depending on the type of seed and the type of dormancy.

d. Germination inhibiting substances, many substances that are known to inhibit seed germination are known, among others: high osmotic solutions, substances that interfere with metabolism, herbicides, auxins and substances contained in fruit.

According to (Kuswanto, 1996) and (Santoso, 1990) external factors that affect germination are:

a. Water is the main basic need and very important for germination. The function of water is to soften the seed coat so that the embryo and endosperm swell which causes cracking of the seed coat, as a gas exchange so that oxygen supply into the seed occurs, dilute protoplasm, translocate food reserves to the point of growth that requires.
b. Temperature is an important requirement for seed germination. The temperature required in seed germination ranges from 26.5oC - 35oC.
c. Oxygen is used for respiration. The O2 concentration required for germination is 20%.
d. Light in general the best quality of light for germination is expressed by wavelengths ranging from 660 nm - 700 nm
e. A good medium for germination should have good properties such as loose, have the ability to store water and be free from disease-causing organisms, especially fungi.

2.3 Seed Dormancy

Seed dormancy is a condition when live seeds do not germinate until the time limit at the end of observation even though environmental factors are optimum for germination. The intensity of dormancy is influenced by the environment during seed development. The duration of dormancy and dormancy mechanisms differ between species and between genotypes (Ilyas 2012). Long seed dormancy periods can be shortened by several physical, chemical and biological treatments (Natawijaya and Sunarya 2018). The advantages of seed dormancy are a mechanism to maintain seed life, prevent germination in the field, and in some species become more resistant to storage, while the disadvantages are prolonging germination time, disrupting planting time, and causing problems in the interpretation of seed testing (Widajati, Murniati, Palupi, Kartika, Suhartanto and Qadir, 2013).

Widajati et al (2013) said that based on causal factors, dormancy can be classified into primary dormancy and secondary dormancy. Primary dormancy is dormancy caused by circumstances or conditions within the organs of the seed itself, while secondary dormancy is dormancy that occurs due to the obstruction of active growth due to unfavourable environmental conditions. Based on the mechanism in the seed, dormancy is further divided into physiological dormancy and physical dormancy. Physiological dormancy is dormancy caused by obstacles in physiological processes such as rudimentary embryos, physical dormancy is dormancy caused by structural barriers to seed germination, such as hard and impermeable seed coats that become mechanical barriers to the entry of water or gas into the seed.

One of the problems in the development of the sunan candlenut plant is that the sunan candlenut plant has a hard and impermeable seed coat layer, making it difficult for seedling activities. Dormancy that occurs in hazelnut seeds is physical dormancy due to the thick skin of hazelnut seeds so that water absorption is inhibited. Physical dormancy is dormancy caused by a structural barrier to seed germination, such as a hard and impermeable seed coat that becomes a barrier to the entry of water or gas into the seed. The intensity of dormancy is influenced by the environment during seed development. The length of dormancy and dormancy mechanisms differ between species and between genotypes (Ariyanti, 2017). According to (Razavi and Hajiboland, 2009) some species have dormancy as a strategy to defend themselves and spread their adaptation areas.

2.4 Dormancy Breaking Technique

Physical dormancy breaking techniques can be done by mechanical scarification, the use of hot water, heating or burning, treatment with chemical solutions, and biological methods. Of the five scarification methods for breaking physical dormancy, the mechanical scarification method (cracking and removing the seed coat) and treatment with chemical solutions are the most effective methods (Utomo, 2006).

According to Rahayu's research (2015), dormancy breaking carried out on kecipir seeds has a very significant effect on the benchmarks of vigour index and uniformity of growth, and has a significant effect on the benchmarks of germination, growth speed, and maximum growth potential.

Dormancy breaking treatment can be done through several methods, namely reducing the thickness of the skin or scarification, immersion in water, treatment with chemicals, storing seeds in humid conditions with cold and warm temperatures or called stratification. The choice of dormancy breaking treatment method on a seed depends on the type of dormancy in the seed, with the right dormancy breaking treatment, the dormant seeds will germinate faster and produce uniform growth. (Widajati et al, 2013).

Dormation breaking treatment is a term used for the process or conditions given to accelerate seed germination so that the germination percentage remains high. Dormation breaking treatment is given to seeds that have a high level of difficulty to germinate (Widhityarini, 2013). Preliminary treatment is aimed at the seed coat, embryo, and seed endosperm with the aim of removing factors inhibiting germination and reactivating dormant seed cells (Yuniarti, 2013).

Table 2. 1. Results of Research on the effect of dormancy breaking treatment on the viability of sugar palm seeds (Marung dkk, 2013)

Treatment	Averange
P = Water immersion 50 ^oC	0.92
K1 = 0.1% KNO_3	0.92
K2 = 0.3% KNO_3	0.91
K3 = 0.5% KNO_3	0.54
H1 = 0.1% HCl	0.79
H2 = 0.2% HCl	0.50
H3 = 0.3% HCl	0.79
C1 = Control Vs immersion	tn
C2 = Water 50 ^oC Vs Chemical material	tn
C3 = KNO3 Vs HCl	tn
C4 = antar KNO_3	*

C5 = antar HCl	tn

Information; *real based on contrast test at 5% level

The results of research by Manurung, Putri and Bangun (2013) showed that the effect of dormancy breaking treatment had a significant effect on the length of the embryo axis 5 mst, germination time, germination power, sprout length, stem diameter, number of roots, root length, wet weight of sprouts, dry weight of sprouts and had no significant effect on the parameters of sprout length 4 mst, normal sprouts, abnormal sprouts and total leaf area. From (Table 2.1.) it is obtained that when compared to the control with soaking does not show a significant difference. Between 50ºC water immersion with chemical is not significantly different. Between KNO3 and HCl treatments were also not significantly different. Between doses of KNO3 were significantly different, but between doses of HCl were not significantly different. The highest number of leaves was found in the 50ºC water immersion treatment and 0.1% KNO3 (0.92 strands) and the lowest treatment of 0.2% HCl (0.50 strands)

2.5 Effect temperature water on dormancy breaking

According to Sutopo (2004), some types of seeds are sometimes given soaking treatment in water with the aim of facilitating water absorption by the seeds. Thus the seed coat that blocks the absorption of water is lysed and weakened. In addition, it is also used for seed washing so that the seeds are free from pathogens that inhibit seed germination. Water also facilitates the entry of oxygen into the seeds.

The germination test is the most important function and determines the value of these seeds in their use in the field. Germination shows the number of normal sprouts that can be produced by pure seeds under certain environmental conditions within a predetermined period of time (Sutopo, 2004).

The results of research by Lubis, Riniarti, and Bintoro (2014) showed that the length of soaking time had a significant effect on the germination of trembesi seeds. Trembesi seeds that were not soaked with water at an initial temperature of 60°C (control) produced a germination rate of 63.50%, trembesi seeds soaked with an initial temperature of 60°C and then allowed to cool for 24 hours produced a germination rate of 66.00%, while trembesi seeds soaked with an initial temperature of 60°C and then allowed to cool for 48 hours produced a germination rate of 67.00% and seeds soaked for 72 hours reached 80.25% (Figure 2.3).

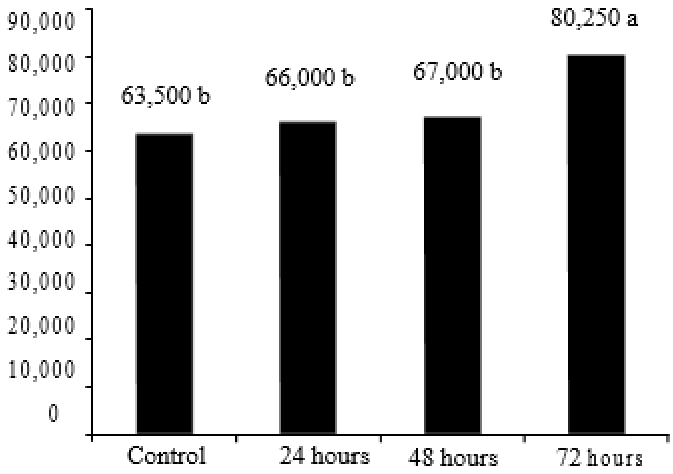

Figure 2. 3. Research Results on the Effect of Length of Soaking Time in Water On the Germination Power of Trembesi (Lubis et al, 2014)

According to Marsiwi (2012), hot water can break physical dormancy in Leguminoseae and non-leguminoseae through tension that causes rupture of the macroclereid layer or damage the strophiolar cap. This method is effective if the seeds are soaked in hot water instead of being cooked with hot water. Instant immersion is also good to prevent embryo damage. A common method is to pour the seeds into boiling water and allow them to cool and absorb water for 12-24 hours. Hot water temperature can accelerate imbibition. The hard seed structure can make it difficult for water and oxygen to penetrate the seed coat and make it difficult for radicle and plumula to emerge. Soaking the seeds in hot water can soften and open the pores of the seed skin, thus increasing the imbibition process in the seeds (Sandi, Indriyanto and Duryat, 2014).

The results of research by Nasrul and Fridayanti (2014) showed that the maximum growth potential in water temperature treatment has a different ability to sengon seeds. The highest maximum growth potential was found in the 60ºC water temperature treatment with a value of 65.77%. While the lowest maximum growth potential was found in the control water temperature treatment (no water temperature treatment) with a value of 38.11%.

2.6 Effect Growing Media Composition on Initial Growth of Seedlings

Planting media is one of the factors that need to be considered, because it affects the growth and development of plants to get optimal results. A good medium for plant growth must have good physical properties, be loose and have the ability to retain water. The physical condition of the soil is very important for the continuation of plant life into mature plants (Haryadi, 1986).The results of research by Febrianto, Hastuti and Umami (2018) showed that the composition of planting media had a significant effect on the height of your plants. The composition of planting media soil and goat manure ratio 2:1 produces the largest plant height of 33.20 cm while the lowest results are found in soil and goat manure planting media 1:1 ratio with a value of 28.60 cm. The composition of the planting media also significantly affected the fresh weight of the roots of your plants. The planting media of soil and goat manure in the ratio of 1:2 gave the highest result of 8.75 g while the planting media of soil and goat manure in the ratio of 2:1 gave the lowest result of 6.49 gr.

The results of research by Sarira, Tambing and Lasmini (2020) showed that the planting media of soil and husk charcoal in a ratio of 2:1 at a dose of goat manure 30 tonnes/ha (B1P3) produced the largest plant height compared to other treatments, namely 43.45 cm. The same thing was found in the parameter of the number of leaves, that at the age of 4 mst the planting medium of soil and husk charcoal in a ratio of 2: 1 at a dose of goat manure 30 tonnes/ha gave the highest number of temulawak leaves at 5.11 strands.

The results of research by Wardiana and Herman (2009) showed that planting media consisting of soil, organic matter manure and rice husk in a ratio of 1:1:1 (M5) on the parameter of the number of leaves produced the highest value of 8.49 strands while the lowest value was in the soil treatment (M1) of 7.41 strands. The diameter of the lower stem, the highest value is found in the treatment of M5 and M2 amounting to 0.75 mm of sunan candlenut plants showed a significant effect compared to soil media alone (M1). The same thing happened to the observation of fresh weight and dry weight of plants. The mixed planting media of 50% soil and 50% manure (M2) produced the highest value of 19.35

compared to the mixed media of 33.3% soil, 33.3% manure, and 33.3% husk (M5) of only 15.61.

Soil is the main medium in nurseries. Apart from soil, organic matter is a common material used as a soil mixture in making a growing medium at the nursery level. Organic materials such as manure in a soil and plant system can improve soil structure and assist in the development of microorganisms, increase available P content both directly and indirectly, and can even increase saprophytic organisms and suppress parasitic organisms for plants (Wardiana and Herman, 2009).

Planting media for sunan candlenut using a mixture of top soil, manure, sand or rice husk. Seeding carried out in the rainy season uses a mixture of soil, sand or rice husk and manure in a ratio of 1:1:1. If seeding is carried out in the dry season, the composition of the planting media used is soil and manure in a ratio of 1:1 (Ministry of Agriculture, 2011). The early growth of candlenut seedlings is important in achieving optimum productivity.

2.7 Hypotesis

1. There was an interaction between the length of water soaking time and the composition of the growing media. The treatment of 24 hours of water soaking time and the composition of soil, goat manure, and husk charcoal is the best combination.
2. Duration of water immersion for 24 hours is the best treatment.
3. The composition of soil, goat manure and husk charcoal is the best treatment.

III. METODE PENELITIAN

3.1 Time and Place

The research was conducted in Magersari Village RT 04 RW 01 Krian Subdistrict, Sidoarjo Regency in April 2021 - July 2021. Topographically, most of the Sidoarjo Regency area has an altitude between 0-25 metres above sea level. In general, the climate is tropical wet and dry with air temperatures between 21ºC - 34ºC.

3.2 Tools and Materials

The tools used in the research were analytical scales, germination tubs, thermometers, rulers, vectors, buckets, lamps, cardboard boxes, stationery, notebooks, cameras, picks, hoes, shovels, sand sieves, paddles, ovens, metres.

The materials used in the study were sunan candlenut seeds, planting media in the form of soil, goat manure, husk charcoal, sand, 20x20 polybags, water, and label paper.

3.3 Experimental Design

The research was conducted in a factorial completely randomised design (CRD) consisting of 2 factors and repeated 3 times.

Factor I: Length of Water Immersion Time (T) which consists of 4 levels,namely:

T0 : Control without soaking

T1 : Immersion temperature 60oC for 12 hours

T2 : Immersion temperature 60oC for 24 hours

T3 : Immersion temperature 60oC for 48 hours

Factor II: Composition of Planting Media (M) which consists of 4 levels, namely:

M1 : Soil

M2: (Soil: manure) with a composition of 1:1

M3: (Soil: husk charcoal) with a composition of 1:1

M4: (Soil: manure: husk charcoal) with a composition of 1: 1 :1

The two factors observed resulted in 16 combination factors. Repetition was done 3 times, so there were 48 experimental units. Each treatment in one combination had 3 plant samples, resulting in 144 plants. The arrangement of the combination treatment can be seen in Table 3.1.

Long Soaking Time	Growth Media Composition			
	M_1	M_2	M_3	M_4
T_0	T0M1	TOM2	T0M3	T0M4
T_1	T1M1	T1M2	T1M3	T1M4
T_2	T2M1	T2M2	T2M3	T2M4
T_3	T3M1	T3M2	T3M3	T3M4

Information:

T0M1: Without soaking with soil

T0M2 : No soaking with soil : manure (1:1)

T0M3 : Without soaking with soil: husk charcoal (1:1)

T0M4 : Without soaking with soil: manure: husk charcoal (1:1:1)

T1M1 : Soaking at 60 oC for 12 hours with soil

T1M2 : Soaking at 60oC for 12 hours with soil : manure (1:1)

T1M3: Soaking temperature 60oC for 12 hours with soil: husk charcoal (1:1)

T1M4: Soaking temperature 60oC for 12 hours with soil : manure : husk charcoal (1:1:1)

T2M1: Soaking at 60oC for 24 hours with soil

T2M2 : Soaking at 60oC for 24 hours with soil : manure (1:1)

T2M3 : Soaking temperature 60oC for 24 hours with soil: husk charcoal (1:1)

T2M4: Soaking temperature 60oC for 24 hours with soil : manure : husk charcoal (1:1:1)

T3M1: Soaking temperature 60oC for 48 hours with soil

T3M2: Soaking at 60oC for 48 hours with soil : manure (1:1)

T3M3 : Soaking temperature 60oC for 48 hours with soil: husk charcoal (1:1)

T3M4: Soaking at 60oC for 48 hours with soil: manure: husk charcoal (1:1:1)

3.4 Experimental Plan

Placement of experimental treatments was done randomly (random) and complete randomisation was done, i.e. all experimental units were placed randomly. Based on the number of experimental units and treatments. Based on the number of experimental units and treatments used, the experimental plot plan is presented as in Figure 3.1.

T1M1 (1)	T2M2 (1)	T0M4 (2)	T2M3 (2)
T3M1 (2)	T2M1 (3)	T3M2 (2)	T0M3 (1)
T0M2 (1)	T0M1 (1)	T2M4 (1)	T3M3 (1)
T1M2 (2)	T1M3 (2)	T0M2 (2)	T2M2 (2)
T2M1 (1)	T3M1 (1)	T1M1 (3)	T2M3 (3)
T1M4 (3)	T3M3 (2)	T1M4 (1)	T0M1 (3)
T0M1 (2)	T1M2 (1)	T3M2 (3)	T3M1 (3)
T2M4 (3)	T2M1 (2)	T1M3 (3)	T2M4 (2)
T3M4 (1)	T0M2 (3)	T3M4 (2)	T1M1 (2)
T1M4 (2)	T2M3 (1)	T1M2 (3)	T0M4 (1)
T3M2 (1)	T0M3 (3)	T2M2 (3)	T1M3 (1)
T0M4 (3)	T3M3 (3)	T0M3 (2)	T3M4 (2)

Figure 3. 1. Experimental Plan

Information:

(1), (2), (3): Repeat Conducting Research

3.4.1 Germination

Seeds of sunan candlenut that have been previously selected are soaked in water with an initial temperature of 60oC for several hours in stages starting from the longest treatment first, namely 48 hours then drained after that 24 hours and

12 hours then drained. Soaking is done in a bucket and then closed after that it is placed in a large cardboard box that has been installed with a 125 watt lamp so that the temperature is almost stable near 60oC. Next, the seeds were germinated in a germination tub containing ¾ of the sand. Seeds were planted 3 cm deep, then covered with sand and treated until germination. Each germination tub contained 50 sunan candlenut seeds so that the total number of seeds germinated was 600 sunan candlenut seeds.

3.4.2 Prepared of Growth Media

Prepare soil, goat manure and husk charcoal then mix each planting medium according to the treatment with a ratio based on volume. After mixing according to the treatment, it was put into polybags measuring 20x20 at ¾ of the height. Each polybag containing planting media was placed in the research site according to the experimental plot plan.

3.4.3 Transplanting

Before transplanting, seedlings were selected. Abnormal seedlings will be discarded and seedlings that grow uniformly in each treatment are moved to the available polybags. The characteristics of abnormal candlenut seedlings are radicle that does not grow completely, stunted and small, abnormal or damaged radicle, and sprouts attacked by pests or diseases. Transplanting is done carefully so as not to damage the prospective hazelnut roots into polybags. Seeding is carried out for 60 days after transplanting from the germination tub.

3.4.4 Maintenance

3.4.4.1 Watering

Watering is done every morning and evening (depending on soil conditions), watering is done from the beginning of planting. Watering helps the growth and development of hazelnut plants.

3.4.4.2 Replanting

Replanting is done if there are dead or poorly growing seedlings in polybags using plants with the same growth and the same soaking treatment. Replanting is done when there are dead candlenut seedlings (maximum 7 hst).

3.4.4.3 Weeding

Weeding is done at any time when there are weeds or weeds growing around the plants. Weeding is done manually by pulling weeds by hand.

3.4.4.4 Pest and Disease Control

Pest and disease control in sunan candlenut plants is carried out using pesticides according to field conditions.

3.5 Observation Parameters

3.5.1 Germination

Germination is the number of seeds that germinate from a number of seeds germinated under optimal conditions. Observation of germination is done when the seeds have germinated at the age of 14 hst. According to (Sadjad, Muniarti and Ilyas, 2004) how to calculate germination by using the following formula:

$$\frac{Number\ of\ Normal\ Sprouts}{Number\ of\ Seeds\ Germinated}\ x\ 100\%$$

3.5.2 Growing Speed (KcT) (%etmal-1)

Growing speed is the seed that germinates from the first to the last day of observation. The observation of growth speed starts when the seeds begin to germinate until the end of the observation, which is 60 hst, which is expressed in per cent per day. According to (Copeland and McDonald, 1985) calculating the speed of growth can be done by using the following formula can be done by using the formula:

$$KcT = \frac{N1}{W1} + \frac{N2}{W2} + \cdots + \frac{Nn}{Wn}$$

Information:

Kct = Growing speed

N = Persentase normal sprouts

W = Observation time (days)

3.5.3 Averange Sprouts Days

Average days to germinate is the average time required for seeds to emerge. Observations of average days to germinate were made from the beginning of planting until the emergence of sprouts expressed in days. Calculation of average days to germinate using the formula (Sutopo, 2002):

$$Averange\ Days = \frac{N1T1 + N2T2 + \cdots + NnTn}{Total\ Germinated\ Seed}$$

Information:

N = Number of germinated seeds

T = Days in germination process

3.5.4 Plant Height (cm)

Observations of plant height were made by measuring the height of the plant from the surface of the growing medium to the highest growing point using a meter/ruler in cm units, observations were made when the plants were 30 days old after transplanting with an interval of 2 weeks once for 60 days.

3.5.5 Number of Leaves

Observations of the number of leaves were made by counting the number of leaves that had opened completely from each plant, starting when the plants were 30 days after transplanting with an interval of 2 weeks once for 60 days. 30 days after transplanting at 2-week intervals for 60 days.

3.5.6 Stem Diameter

Observations of stem diameter were made by measuring the diameter of the plant stem using a caliper. Observations were made when the plants were 30 days after transplanting at 2-week intervals for 60 days.

3.5.7 Long Legth

Root length observations were made by measuring the longest plant support root starting from the base of the root to the tip of the main root. Observations were made at the end of the study.

3.5.8 Number of Root

Observation of the number of roots was done by counting the total lateral primary roots in each plant that grew. Observations were made at the end of the study.

3.5.9 Wet Weight

Observations of plant wet weight were made by weighing all parts of the plant formed using analytical scales. Observations were made at the end of the study.

3.5.10 Dry Weight

Observations of plant dry weight were made by weighing all parts of the plant that had been aerated and oven at 85oC until a constant weight was obtained. Observations were made at the end of the study.

3.5.11 Data Analysis

Data obtained from the experimental results were analysed statistically by analysis of variance or anova based on a factorial Randomized Complete Block Design (CRD). According to Gomez and Gomez (1995), the linear equation is as follows:

$$Yijk = \mu + \alpha i + \beta j + (\alpha\beta)ij + \varepsilon ijk$$

Information:

Yijk = Results of the kth group that obtained the ith level and jth level

μ = Mean value of treatment

αi = Influence of the length of time soaking in water at the ith level

βj = Influence of planting media composition factors at the jth level

(αβ)ij = Effect of interaction between the ith level and the jth level

Eijk = Effect of experimental error on the kth group that received the first level and j th level

If the treatment has a significant effect, then it is continued with a different test between treatment levels at the 5% test level (BNT 0.05)

IV. RESULT AND DISCUSSION

4.1 Research Result

4.1.1 Germination

The results of analysis of variance showed that the treatment of water soaking time did not significantly affect the germination of hazelnut seeds (Appendix Table 2). The average value of the germination of candlenut seeds against the treatment of water soaking time is presented in Table 4.1.

Table 4. 1. Speed Growing Sunan Candlenut Seed

Treatment	Germination Average
Long Soaking Time	
Without Soaking (Control)	24,00
12 Hours	29,00
24 Hours	30,00
48 Hours	21,00
BNT 5%	tn

Information: BNT test p = 0,05. tn = not significant

The average germination results (Table 4.1) due to the treatment of water soaking time did not give a real effect on the germination of hazelnut seeds. The treatment of water soaking for 24 hours resulted in 30% germination, 12 hours of water soaking for 29%, without soaking (control) reached 24% and 48 hours of water soaking resulted in a lower germination rate of 21%.

4.1.2 Growth Speed

The results of analysis of variance showed that the treatment of water soaking time did not significantly affect the growing speed of candlenut seeds (Appendix Table 3). The average value of the growing speed of candlenut seeds against the treatment of water soaking time is presented in Table 4.2. The average value of the growing speed of sunan candlenut against the treatment of water soaking time is presented in Table 4.2.

Table 4. 2. Speed Grow Sunan Cundlenut Seed

Treatment	Germination Average (%)
Long Soaking Time	
Without Soaking (Control)	4.85
12 Hours	4.97
24 Hours	5.12
48 Hours	4.70
BNT 5%	tn

Information: BNT test p = 0,05. tn = not significant

The average results of growing speed (Table 4.2) due to the treatment of water soaking time did not give a real effect on the growing speed of hazelnut seeds. The treatment of water soaking time for 24 hours produced a growing speed of 5.12%, water soaking for 12 hours at 4.97%, without water soaking (control) at 4.85% and water soaking for 48 hours produced a lower growing speed of 4.70%.

4.1.3 Averange Germination Day

The results of analysis of variance showed that the treatment of water soaking time did not significantly affect the average days to germination of hazelnut seeds (Appendix Table 4). The average value of days to germination of hazelnut seeds in the treatment of water soaking time is presented in Table 4.3.

Table 4. 3. Averange Germination Day Sunan Cundlenut Seed

Treatment	Germination Average (%)
Long Soaking Time	
Without Soaking (Control)	3.75
12 Hours	3.90
24 Hours	3.91
48 Hours	4.07
BNT 5%	tn

Information: BNT test p = 0,05. tn = not significant

The results of the average days to germinate (Table 4.3) due to the treatment of the length of time of water immersion did not give a significant effect on the average days to germinate the hazelnut seeds. The treatment without soaking (control) resulted in an average day to germinate of 3.75 days, water immersion 12 hours for 3.90 days, 24 hours of water immersion for 3.91 days and 48 hours of water immersion resulted in average days to germinate which tended to be longer at 4.07 days.

4.1.4 Plant Height

The results of the analysis of variance showed that the combined treatment of the length of time of water immersion with the composition of planting media had a significant effect on the height of hazelnut plants. The combined treatment of the length of time of water immersion with the composition of planting media gave a significant effect on plant height at the age of 44 to 86 HST. The treatment of the length of time of water immersion and the composition of .. of planting media composition did not give a real effect at the age of 30 HST. (Appendix

Tables 5-9). The average value of the height of sunan candlenut plants against the combined treatment of the length of time of water immersion with the composition of planting media is presented in Table 4.4.

Table 4. 4. Average Height of Sunan Candlenut Plants in the Combination Treatment of Water Soaking Time and Media Composition

Umur	Lama Waktu Perendaman	Tinggi Tanaman (cm)			
		Komposisi Media Tanam			
		Tanah	Tanah + Pupuk Kandang	Tanah + Arang Sekam	Tanah + Pupuk Kandang + Arang Sekam
44 HST	Without soaking	17,78 a	19,92 ab	21,88 ab	20,82 ab
	12 Jam	21,96 ab	23,56 b	22,38 b	20,66 ab
	24 Jam	19,74 ab	19,22 ab	19,54 ab	24,00 b
	48 Jam	20,24 ab	21,82 ab	19,99 ab	20,84 ab
	BNT 5%	4,51			
58 HST	Without soaking	24,70 a	27,28 ab	29,48 ab	29,13 ab
	12 Jam	27,76 ab	29,74 ab	30,06 b	28,52 ab
	24 Jam	26,89 ab	27,30 ab	28,90 ab	32,58 b
	48 Jam	28,60 ab	30,46 b	29,01 ab	26,18 ab
	BNT 5%	5,22			
72 HST	Without soaking	33,22 a	35,22 ab	37,62 ab	38,28 ab
	12 Jam	35,96 ab	38,22 ab	35,36 ab	38,50 ab
	24 Jam	34,90 ab	35,79 ab	37,66 ab	40,92 b
	48 Jam	38,48 ab	39,20 ab	35,50 ab	33,72 a
	BNT 5%	6,82			
86 HST	Without soaking	40,84 a	43,56 ab	44,22 ab	45,40 ab
	12 Jam	44,37 ab	47,49 b	43,16 ab	47,64 b
	24 Jam	42,97 ab	44,62 ab	47,07 ab	48,67 b
	48 Jam	46,60 ab	47,71 b	42,99 ab	42,56 ab
	BNT 5%	6.54			

Information: The average number accompanied by the same letter for the same age, column and treatment means that it is not significantly different in the BNT test, p = 0.05. HST (Day After Transplanting).

The results of the average plant height (Table 4.4.) due to the combined treatment of the length of time of water immersion with the composition of the planting media gave a real effect on the height of hazelnut plants at the age of 44 HST, 58 HST, 72 HST and 86 HST. The soaking time of 24 hours with the composition of planting media soil, manure and husk charcoal produced the best plant height at the age of 86 HST at 48.67 cm. Meanwhile, the treatment without soaking (control) with the composition of soil planting media produced the lowest plant height of 40.84 cm.

Table 4. 5. The average number accompanied by the same letter for the same age, column and treatment means that it is not significantly different in the BNT test, p = 0.05. tn = Not significant. HST (Day After Transplanting)

Treatment	Plant Height (cm)
	30 HST
Water Soaking Time	
No Water Soaking	13,31 ab
12 Hours	14,59 b
24 Hours	14,35 ab
48 Hours	13,03 a
BNT 5%	1,04
Komposisi Media Tanam	
Soil	13,82
Soil + Manure	13,38
Soil + Husk Charcoal	13,74
Soil + Manure + Husk Charcoal	14,34
BNT 5%	tn

Information: The average number accompanied by the same letter for the same age, column and treatment means that it is not significantly different in the BNT test, p = 0.05. tn = Not significant. HST (Day After Transplanting).

The results of the average plant height (Table 4.5) as a result of the treatment of the length of time of water immersion gave a real influence on the height of the hazelnut plants. The treatment of planting media composition did not give a significant effect on the height of hazelnut plants at the age of 30 HST (Appendix Table 8).The treatment of water immersion time for 12 hours produced the best plant height of 14.59 cm.While the treatment of 48 hours of soaking time produced the lowest plant height of 13.03 cm. The treatment of planting media composition of soil, manure and husk charcoal produced a better plant height of 14.34 cm. While the plant height tends to be lower in the treatment of soil and manure planting media composition of 13.38 cm.

4.1.5 Number of Leaves

The results of the analysis of variance showed that the combined treatment of the length of time of water immersion with the composition of planting media did not significantly affect the number of leaves of hazelnut plants. The treatment of the length of time of water immersion gave a real effect on the number of leaves of hazelnut plants at the age of 44, 58, 72 and 86 HST. The treatment of planting media composition gives The treatment of planting media composition gives a significant effect on the number of leaves of candlenut plants at all observation ages, namely 30, 44, 58, 72 and 86 HST (Appendix Tables 10-14).The average value of the number of leaves of hazelnut plants on the treatment of water immersion time and the composition of planting media is presented in Table 4.6.

Table 4. 6. Average Number of Leaves of Sunan Candlenut Plants Based on Long Water Soaking Time and Planting Media Composition Age 30 to 86 HST

Treatment	**Number of Leaves (sheet)**				
Water Soaking Time	---------------------- hst --------------------				
	30	44	58	72	86
No Water Soaking	1,31	2,61 b	2,11 a	2,31 a	2,36 a
12 Hours	1,33	2,42 b	2,53 ab	3,28 ab	2,69 ab
24 Hours	1,39	1,67 a	1,72 ab	3,42 b	3,44 b
48 Hours	1,58	2,31 b	2,94 b	2,81 ab	3,42 b
BNT 5%	tn	0,80	0,81	0,98	0,87
Growth Media Composition					
Soil	1,25 ab	1,97 a	2,31 a	3,06 ab	2,36 a
Soil + Manure	1,11 a	2,03 a	2,92 b	2,19 a	2,81 ab
Soil + Husk Charcoal	1,44 ab	2,83 b	2,78 ab	3,14 ab	3,31 b
Soil + Manure + Husk Charcoal	1,81 b	2,17 ab	2,33 ab	3,42 b	3,50 b
BNT 5%	0,58	0,80	0,81	0,98	0,87

Information: The average number accompanied by the same letter for the same age, column and treatment means that it is not significantly different in the BNT test, p = 0.05. tn = Not significant. HST (Day After Transplanting).

The results of the average number of leaves (Table 4.6) as a result of the length of time of water immersion and the composition of the planting media gave a real influence on the number of leaves of hazelnut plants at all ages of observation, but the treatment of the length of time of water immersion did not give a real influence on the number of leaves of hazelnut plants at the age of 30 HST. The treatment of the length of time of water immersion for 24 hours at the age of 86 HST produced a number of leaves that tended to be better at 3.44 strands. While the treatment without water immersion produced a number of leaves of 2.36 strands. The treatment of planting media composition of soil, manure and husk charcoal produced the best number of leaves at 3.50 strands. While the treatment of soil planting media composition produced the lowest number of leaves at 2.36 strands.

4.1.6 Stem Diameter

The results of the analysis of variance showed that the combined treatment of the length of time of water immersion with the composition of the planting media did not give a significant effect on the diameter of the stem of hazelnut plants. The treatment of the length of time of water immersion gives a real effect on the diameter of the stem of the candlenut plants at the age of 58, 72 and 86 HST. The treatment of the composition of planting media gives a real effect on the diameter of the stem of hazelnut plants at all observation ages except at the age of 30 and 44 HST. (Appendix Tables 15-19). The average value of the stem diameter of candlenut plants against the treatment of water immersion time and the composition of planting media is presented in Table 4.7.

Table 4. 7. Average Stem Diameter of Sunan Candlenut Plants Based on Long Water Soaking Time and Planting Media Composition Age 30 to 86 HST

Treatment	Stem Diameter (cm)				
	30 HST	44 HST	58 HST	72 HST	86 HST
Long Soaking Time					
Without soaking	0.35	0.44	0.68 a	1,03 a	1,46 a
12 Hours	0.39	0.49	0.80 ab	1,10 ab	1,56 ab
24 Hours	0.41	0.51	0.85 b	1,21 b	1,70 b
48 Hours	0.37	0.48	0.82 b	1.17 ab	1.65 ab
BNT 5%	tn	tn	0.12	0.13	0.21
Growth Media Composition					

Soil	0,35	0,46	0,74 a	1,08 a	1,50 a
Soil + Manure	0,40	0,49	0,78 ab	1,09 ab	1,57 ab
Soil + Husk Charcoal	0,37	0,47	0,78 ab	1,16 ab	1,63 ab
Soil + Manure + Husk Charcoal	0,41	0,50	0,84 b	1,19 b	1,67 b
BNT 5%	tn	tn	0.12	0.13	0.21

Note: The average number accompanied by the same letter for the same age, column and treatment means that it is not significantly different in the BNT test, p = 0.05. tn = Not significant. HST (Day After Transplanting).

The results of the average stem diameter (Table 4.7) as a result of the length of time of water immersion and the composition of planting media gave a real effect on the diameter of the stem of hazelnut plants except at the age of 30 and 44 HST. The treatment of water immersion time for 24 hours produced the best stem diameter at the age of 86 HST at 1.70 cm. While the lowest stem diameter was found in the treatment without soaking which was 1.46 cm. The treatment of planting media composition of soil, manure and husk charcoal produced the best stem diameter at the age of 86 HST at 1.70 cm. The best stem diameter at the age of 86 HST is 1.67 cm. While the treatment of soil planting media composition produced the lowest diameter of 1.50 cm.

4.1.7 Root Length

The results of the analysis of variance showed that the combination treatment of the length of time of water immersion with the composition of planting media had no significant effect on the length of the roots of hazelnut plants. The length of time of water immersion and the composition of the planting media gave a significant effect on the length of the roots of hazelnut plants (Appendix Table 20). The average value of the root length of hazelnut plants against the treatment of the length of time of water immersion and the composition of planting media is presented in Table 4.8.

Table 4. 8. Average Root Length of Sunan Candlenut Plants Based on Treatment of Length of Water Soaking Time and Planting Media Composition

Treatment	Root Length (cm)
Long Water Soaking	
Without Soaking	19,22 ab
12 Hours	23,08 b
24 Hours	17,91 a
48 Hours	23,96 b

BNT 5%	4.57
Growth Media Composition	
Soil	19,17 a
Soil + Manure	23,13 b
Soil + Husk Charcoal	19,85 ab
Soil + Manure + Husk Charcoal	20,57 ab
BNT 5%	4,57

Note: The average number accompanied by the same letter for the same age, column and treatment means that it is not significantly different in the BNT test, p = 0.05. HST (Day After Transplanting).

The results of the average root length (Table 4.8) as a result of the treatment of the length of time of water immersion and the composition of planting media gave a real influence on the length of the roots of hazelnut plants. The treatment of water immersion time for 48 hours produced the best root length of 23.96 cm. 48 hours produced the best root length of 23.96 cm. While the lowest root length was found in the treatment of water immersion for 24 hours at 17.91 cm. The treatment of soil and manure planting media composition produced the best root length of 23.13 cm. The best root length was 23.13 cm. While the treatment of soil planting media composition produced the lowest root length of 19.17 cm.

4.1.8 Number of Roots

The results of the analysis of variance showed that the combined treatment of the length of time of water immersion with the composition of planting media had no significant effect on the number of roots of hazelnut plants. The treatment of the length of time of water immersion and the composition of planting media gave a significant effect on the number of roots of hazelnut plants (Appendix Table 21). The average value of the number of roots of hazelnut plants on the treatment of the length of time of water immersion and the composition of planting media is presented in Table 4.9.

Table 4. 9. Average Number of Roots of Sunan Candlenut Plants Based on Treatment of Length of Water Soaking Time and Planting Media Composition

Treatment	Number of Roots (root)
Long Water Soaking	
Without Soaking	47,33 a
12 Hours	70,50 b

24 Hours	75,83 b
48 Hours	61,25 ab
BNT 5%	18.49
Growth Media Composition	
Soil	56,92 a
Soil + Manure	66,75 ab
Soil + Husk Charcoal	57,67 ab
Soil + Manure + Husk Charcoal	73,58 b
BNT 5%	18,49

Note: The average number accompanied by the same letter for the same age, column and treatment means that it is not significantly different in the BNT test, p = 0.05. HST (Day After Transplanting).

The results of the average number of roots (Table 4.9) as a result of the treatment of the length of time of water immersion and the composition of planting media gave a real influence on the number of roots of hazelnut plants. The treatment of water immersion time for 24 hours produced the highest number of roots at 75.83 roots. While the treatment without soaking produced the lowest number of roots at 47.33 roots. The treatment of planting media composition of soil, manure and husk charcoal produced the highest number of roots at 73.58 roots. While the treatment of soil planting media composition produced the lowest number of roots at 56.92 roots.

4.1.9 Wet Weight

The results of analysis of variance showed that the combined treatment of the length of time of water immersion with the composition of planting media had no significant effect on the wet weight of hazelnut plants. The treatment of the length of time of water immersion and the composition of the planting media gave a significant effect on the wet weight of hazelnut plants (Appendix Table 22). The average value of the wet weight of hazelnut plants against the treatment of the length of time of water immersion and the composition of planting media is presented in Table 4.10.

Table 4. 10. Average Wet Weight of Sunan Candlenut Plants Based on Long Water Soaking Time and Planting Media Composition

Treatment	Wet Weight (gr)
Long Water Soaking	
Without Soaking	42,46 a

12 Hours	54,49 ab
24 Hours	59,35 b
48 Hours	49,81 ab
BNT 5%	16.63
Growth Media Composition	
Soil	43,34 a
Soil + Manure	52,05 ab
Soil + Husk Charcoal	51,22 ab
Soil + Manure + Husk Charcoal	59,50 b
BNT 5%	16,63

Note: The average number accompanied by the same letter for the same age, column and treatment means that it is not significantly different in the BNT test, p = 0.05. HST (Day After Transplanting).

The results of the average wet weight (Table 4.10) as a result of the treatment of the length of time of water immersion and the composition of planting media gave a significant effect on the wet weight of hazelnut plants. The treatment of water immersion time for 24 hours produced the best plant wet weight of 59.35 g. While the treatment without soaking produced the lowest wet weight of 42.46 g. The treatment of soil, manure and husk charcoal planting media composition produced the best wet weight of 59.50 g. While the treatment of soil planting media composition produced the lowest wet weight of 43.34 gr.

4.1.10 Dry Weight

The results of analysis of variance showed that the combined treatment of the length of time of water immersion with the composition of the planting media had a significant effect on the dry weight of hazelnut plants. The treatment of the length of time of water immersion and the composition of the planting media gave a significant effect on the dry weight of hazelnut plants (Appendix Table 23). The average value of dry weight of candlenut plants is presented in Table 4.11

Table 4. 11. Average Dry Weight of Sunan Candlenut Plants for the Combination Treatment of Length of Water Soaking Time and Planting Media Composition

Dry Weight (gr)				
Treatment	Media Growth Composition			
Long Water Soaking	Soil	Soil + Manure	Soil + Husk Charcoal	Soil + Manure

				+ Husk Charcoal
Without Soaking	14,25 ab	16,42 ab	12,68 ab	12,25 ab
12 Hours	13,40 ab	13,36 ab	14,30 ab	13,03 ab
24 Hours	20,42 ab	10,73 a	16,05 ab	21,54 b
48 Hours	10,93 ab	10,96 ab	14,95 ab	13,55 ab
BNT 5%	7,89			

Note: The average number accompanied by the same letter for the same age, column and treatment means that it is not significantly different in the BNT test, p = 0.05. HST (Day After Transplanting).

The results of the average dry weight (Table 4.11) due to the combined treatment of the length of time of water immersion with the composition of planting media gave a real effect on the dry weight of hazelnut plants. The treatment of the length of water immersion time for 24 hours with the composition of planting media soil, manure and husk charcoal produced the best dry weight of 21.54 g. While the treatment of the length of water immersion time for 24 hours with the composition of planting media soil and manure produced the lowest dry weight of 10.73 g. The average dry weight of hazelnut plants (Table 4.11).

4.2 Discussion

4.2.1 The Effect of Combination Treatment of Length of Water Soaking Time with Planting Media Composition on Initial Growth of Sunan Kemiri Seedlings

The treatment of water soaking time for 12 hours, 24 hours, 48 hours and without soaking (control) did not give a significant effect on germination parameters such as germination, growth speed and average days to germinate. The treatment of water soaking time for 12 hours and 24 hours resulted in germination that tended to be almost the same at 29% and 30%, respectively. 30%. The value of germination tends to be lower in the treatment of 48 hours of soaking time with a value of 21%. Of the four lengths of soaking time tested, this is classified as low, the value of germination produced is below the SNI set by the National

Standardisation Agency (1995) which is 75%. The low value of germination is probably caused by the thick skin of candlenut seeds and external factors. The thick skin structure of sunan candlenut seeds can inhibit or slow down the germination process, because the initial stage in the germination process is the imbibition event or the process of entering water into the seed. According to Shaban (2013), the value of germination power produced can be caused by the genetic characteristics of the seed itself and can also be influenced by environmental conditions including soaking, seed age, and seed treatment during storage that is less than optimal for a seed. De Giorgi (2015) added that seeds have the ability to absorb water to be able to carry out cell division in plant growth so as to encourage seeds to germinate easily in optimal and suboptimal conditions.

The combined treatment of the length of time of water immersion with the composition of the planting media gives a real interaction on the hazelnut plants. The real interaction was found in the parameters of plant height at the age of 44, 56, 72, 86 HST, and dry weight. The combined treatment of soaking time for 12 hours and 24 hours with soil, manure and husk charcoal planting media produced notations that were not significantly different, indicating that the treatment had the same effect. Combination treatment of water immersion time Soaking time for 12 hours with the composition of soil, manure and husk charcoal resulted in a plant height of 47.64 cm then 24 hours soaking time with the composition of soil, manure and husk charcoal resulted in a plant height of 48.67 cm. The next real interaction is in the dry weight parameter. The treatment of soaking time for 12 hours with soil and husk charcoal planting media produced a dry weight of 14.30 g. The treatment of soaking time for 24 hours with the composition of soil, manure and husk charcoal produced a dry weight of 48.67 cm. 24 hours with the composition of planting media soil, manure and husk charcoal produced a dry weight of 21.54 g while the lowest dry weight was found in the treatment of soaking for 24 hours with the composition of planting media soil and manure at 10.73 gr.

This best combination is due to the treatment of the length of soaking time with a temperature of 60oC has fulfilled the amount of water needed by candlenut seeds. It can be seen in Table 4.4 that the treatment of soaking time for 12 hours and 24 hours with the composition of soil planting media, goat manure and husk charcoal produced plant height of 47.64 cm and 48.67 cm compared to the treatment without soaking (control) with the composition of soil planting media produced the lowest plant height of 40.84 cm. The length of soaking for 12 hours can meet the water needs of hazelnut seeds to break the dormancy period due to hot water which can soften the hard hazelnut seed skin so that it can facilitate the imbibition process and accelerate the germination process, with the entry of water into the hazelnut seeds, the cells will enlarge and cause the break of dormancy. The entry of water is carried out by the hazelnut seed coat through imbibition and osmosis events and the process does not require energy. The entry of water by the embryo and endosperm causes swelling of both structures, pushing the softened seed coat of the candlenut until it breaks and provides space for the exit of the roots. This is in accordance with the statement of Schmidt (2000), that soaking with water is a procedure to overcome physical dormancy, besides there is a risk that the seeds will die if left in water until the entire seed becomes permeable.

Therefore, it is necessary to obtain a length of soaking time that does not damage the seeds and can help break dormancy if combined with other treatments. By combining the composition of planting media such as soil, goat manure and husk charcoal, it is able to provide a supply of available nutrients, improve soil structure and assist in the development of soil microorganisms so as to support the initial growth of sunan hazelnut seedlings. While the lowest results were found in the treatment without soaking (control), this is likely due to the fact that without soaking the skin of the sunan candlenut seeds does not soften so that the skin of the sunan candlenut seeds remains impermeable to water and oxygen.

Planting media is one of the important factors that must be considered because it affects the growth and development of plants to get good results. Planting media serves as a place for roots to attach as well as a nutrient provider for plants. A good planting medium has the right composition, good aeration, free of pests and diseases, contains enough organic matter and is able to retain high water so that it can support the needs of hazelnut plants. According to Magagula and Ossom (2011), germination and seedling growth are strongly influenced by the amount of food reserves stored in the seeds.

4.2.2 The Effect of Long Water Soaking Treatment on the Initial Growth of Sunan Candlenut Seedlings

The treatment of the length of time of water immersion gave a significant effect on all observation parameters except germination, speed of growth, average days to germination, number of leaves at 30 HST and stem diameter at 30 and 44 HST. The treatment of soaking time for 12 hours and 24 hours gave an effect that was not significantly different, indicating that the treatment had the same effect. The treatment of 12 hours and 24 hours of soaking time showed no significant difference in the parameters of number of leaves, stem diameter, number of roots, and plant wet weight. Soaking time for 12 hours and 24 hours produced the number of leaves at the age of 86 HST of 2.69 strands and 3.44 strands. Treatment of soaking time for 12 hours and 24 hours resulted in stem diameters of 1.56 cm and 1.70 cm. In the parameter of the number of roots, the immersion time of 12 hours and 14 hours produced the number of roots of 70.50 roots and 75.83 roots while the treatment without immersion (control) produced the lowest number of roots of 47.33 roots. The same thing also occurred in the wet weight parameter, where the treatment of soaking time for 12 hours and 24 hours produced a wet weight of 54.49 g and 59.35 g compared to the treatment without soaking (control) which only produced a wet weight of 42.46 gr.

The treatment of water soaking time for 12 hours and 24 hours produced good values in almost all vegetative phase observation parameters. It is suspected that the treatment of soaking time is sufficient to fulfil the water needs of sunan candlenut seeds to start the germination process optimally in order to break the dormancy period. The treatment of the length of soaking time did not give a significant effect on germination parameters such as germination, growth speed and average days to germinate candlenut seeds. The value of germination showed the same results in the treatment of soaking time for 12 and 24 hours at 29% and 30% while the value of germination tended to be low in the treatment of soaking time for 48 hours at 21%. The value of germination in the treatment of soaking time for 48 hours decreased allegedly due to seeds that are soaked for too long will result in a lack of oxygen which causes the seeds to be difficult to germinate. This is supported by the research of Hastuti, Purwanti, Ambarwati (2015), showing that the length of water soaking for 24 hours on sawo seeds can increase germination up to 93% compared to the length of water soaking for 48 hours only produces germination of 79%.

Seed growth speed can indicate the strength of seed growth, seeds that have a high level of growth speed are more capable of growing quickly even in suboptimum field conditions (Lesilolo, Riry, and Matatula., 2018). The growth speed value of the 24-hour water immersion treatment produced a better value of 5.12% while the lower growth speed value was obtained in the 48-hour immersion treatment with a value of 4.70%. The same thing is supported by Sihotang's research (2008), showing the results of the highest germination index in Acacia mangium seeds is soaking the seeds with water for 24 hours with a result of 2.21% compared to the time of 16 hours with a germination speed value of 0.70%. 16 hours with a germination rate of 0.48%. This value is classified as very low, according to Ichsan et al. (2013) that the value of seed germination speed can be caused by seed aging during storage, so that seeds that have not experienced aging will have enough food reserves. The food reserves will cause the seeds to be able to activate the activity of growth enzymes at the beginning of germination (Parmoon et al., 2013).

The average days to germination is also related to the speed of seed germination. Germination speed is an illustration of seed vigour. Seeds with high vigour germinated under any conditions can germinate faster than seeds with low vigour. Vigour or growing power is indicated by seed growth observed from the beginning of planting until the emergence of sprouts.The results showed that the length of soaking time did not give a significant effect on the average days to germination of hazelnut seeds. This is evidenced in Table 4.3 that the treatment without water soaking produces an average of days to germinate tends to be faster than the other treatments which is 3.75 days while the average days to germinate tends to be longer in the treatment of 48 hours soaking time which is 4.07 days. The low value of germination, growth speed and average days to germinate is thought to be due to the hard structure of the impermeable hazelnut seed, so that water and oxygen are difficult to enter the seed which causes low water absorption in the seed and has an impact on the metabolic process of the seed not running well or slowly.

The mechanism of germination is the entry of water into the seed by diffusion or osmosis, after which the dry seed will absorb water through the micropyle and testa (seed coat). micropyle and testa (seed coat). The incoming water will trigger the active gibberellin hormone in the embryo, the hormone will trigger cells in the aleurone layer to produce amylase enzyme. Then, the amylase enzyme will work in the endosperm (food reserves) to convert starch into sugar then the seed will swell and burst followed by the formation of radicle, radicle will experience cell elongation eventually becoming a sprout then will experience primary growth starting from the growth of roots, stems and leaves.

The germination of sunan candlenut seeds begins with the process of water imbibition followed by the growth of the radicle on the seed. The position of the embryo in candlenut seeds is located in the middle of the seed belly with the characteristics of a round lip on the belly of the seed. Water imbibition in the hazelnut seed causes the seed to swell and then the radicle emerges to the surface (Figure Appendix 5) then the radicle will separate itself from the seed shell and become a seedling until it grows into an adult plant. Abnormal hazelnut sprouts are characterised by twisted radicle, non-sprouting roots, and slow growth (Appendix Figure 6). As stated by Pratiwi (2016), that abnormal sprouts are characterised by short primary roots, deformed sprouts, weak development of important parts such as radicle and coleoptile, bent or twisted radicle and coleoptile, stunted sprouts, damaged sprouts, weak sprout development, and soft sprouts.

Seed germination of sunan candlenut is determined by seed quality, vigour and germination ability, pretreatment (breaking dormancy) and germination conditions such as water, temperature, media, light, and freedom from pests and diseases. Genetic factors that influence germination are chemical composition, enzymes in the seed and the physical/chemical composition of the seed coat. The environmental factors that influence germination are water, gas, temperature and light. The speed or slowness of the germination process is very important to determine the quality of candlenut seeds that will be produced. Seeds that germinate faster will produce better quality candlenut seedlings than those that germinate slowly. Widya (2013) also added that seed germination is not only determined by its ability to absorb water, but also the conditions during imbibition. Excess water causes poor germination and can also encourage the development of microorganisms around the seed coat and which will compete with the embryo for oxygen.

Soaking using hot water is intended to facilitate the absorption of water by sunan candlenut seeds, so that the seed skin that blocks the absorption of water becomes lysed and weakened, in other words, it can accelerate the imbibition process of sunan candlenut seeds because temperature plays an important role in providing pressure for the entry of water into the seed. This is in line with the statement of Nuraeni and Maemunah (2003), that soaking with water encourages the ripening process of the embryo and increases the permeability of the seed coat so as to allow absorption or imbibition and gases needed in the germination process. Each plant seed has a certain range of time to germinate, in the process of germination the length of soaking with the right time is known to be enough to help seed germination.

4.2.3 The Effect of Planting Media Composition Treatment on the Initial Growth of Sunan Candlenut Seedlings

The treatment of planting media composition gave a significant effect on all parameters except for plant height at 30 HST, stem diameter at 30 and 44 HST and dry weight. The best results were found in the treatment of soil, goat manure and husk charcoal compared to the treatment of soil, soil and goat manure, soil and husk charcoal. Media treatments with the addition of organic materials such as goat manure and husk charcoal tend to produce good growth of sunan candlenut plants compared to treatments without a mixture of organic materials. Sufficient nutrient needs of candlenut plants both micro and macro elements will make the metabolism of candlenut plants run smoothly and then will be useful in spurring the growth of candlenut plants both in the vegetative and generative phases. The addition of organic materials such as manure and husk charcoal improves the soil structure of candlenut plants, helps in the development of microorganisms, increases the content of available P and N both directly and indirectly, can even increase saprophytic organisms and suppress parasitic organisms for candlenut plants. The addition of several materials for planting media must produce an appropriate structure because each type of media has a different effect on each plant.

The use of the composition of planting media in the form of soil, husk charcoal and goat manure is able to provide sufficient nutrients for the growth of sunan candlenut plants. The composition of the planting media has the ability to change various factors in the soil, so that they become factors that ensure soil fertility. The addition of organic materials such as goat manure and husk charcoal is used as a nutritional supplement to supply nutrients that can meet the growth needs of hazelnut plants. Organic materials have crumbly properties so that air, water, and roots easily enter the soil fraction and can bind water. This is very important for the roots of sunan candlenut seedlings because the planting media is closely related to root growth or properties in the roots of sunan candlenut plants. So that the combination of the composition of the planting media can meet the nutrient needs of sunan candlenut plants from the seedling level to become adult plants.

The results showed that the composition of planting media soil, goat manure and husk charcoal with a ratio of 1:1:1 tends to increase growth in the vegetative phase of sunan hazelnut plants. One of them is evidenced in Table 4.6 that the treatment of the composition of soil planting media, goat manure and husk charcoal produces the highest number of leaves compared to other treatments which is 3.50 strands while the lowest number of leaves is found in the treatment of soil planting media composition which produces a number of leaves of 2.36 strands.

Various compositions of planting media each have different contents. Types of planting media include sand, soil, manure, husk charcoal, sawdust, and coconut husk. These materials have There are different characteristics that need to be understood so that the growing medium is suitable for the type of plant. A good planting medium must have good physical properties, be moist, porous, and have good drainage. Organic materials have the potential to store water and many air-rich pores make the growth of seedlings at the germination stage very good, the soil will always be loose so that new roots grow faster and thicker. Providing the right composition of planting media into the soil can help the activity of microorganisms in breaking down nitrogen-source organic matter, so that the soil becomes loose, and increases the availability of nitrogen nutrients. Plants need the right combination of nutrients to grow, develop, and reproduce.

The use of goat manure contains organic matter that can provide nutrients for hazelnut plants through the decomposition process, this process occurs gradually by releasing organic matter that is simple for the growth of hazelnut plants. Goat manure has a higher nitrogen content, N content can increase the vegetative growth of candlenut plants. This is in accordance with the statement of Sutoro (2003), that the addition of organic matter such as goat manure plays a role in increasing soil fertility and will determine soil productivity, nutrient provision for plants, and improve physical, biological and other soil chemical properties such as soil pH, cation and anion exchange capacity, soil buffering power and neutralisation of toxic elements such as Fe, Al, Mn and other heavy metals including neutralisation against insecticides. Goat manure contains a C/N ratio of 21.12%. In addition, the nutrient content of goat manure contains N of 1.41%, P content of 0.54% and K content of 0.75%. Goat manure has the advantage of containing higher nitrogen and potassium compared to cow and buffalo manure but lower than manure derived from pig, chicken and horse manure. The element potassium plays a very important role in cell division and protein synthesis processes and plays a role in fruit formation for plants. Goat manure has a distinctive shape, namely granules that are rather difficult to break down. (granules) which are rather difficult to break down physically so that it greatly affects the decomposition process and the process of nutrient provision.

The use of husk charcoal as a planting medium has an important role as a soil companion organic material. Husk charcoal contains SiO_2 of 52%, C by 31%, K by 0.3%, N by 0.18%, P by 0.08% and Ca by 0.14%, besides that husk charcoal also contains other elements such as Fe_2O_3, K_2O, MgO, CaO, MnO and Cu in small amounts and several types of organic matter. High silicate content can be beneficial for plants because it becomes more resistant to pests and diseases due to hardening, husk charcoal is also used to increase potassium levels in the soil. This is in accordance with the statement of Binawati (2012), that the advantages of husk charcoal as a medium because it has many cavities so that drainage and aeration are good so as to facilitate the roots between the grains of husk charcoal, besides that husk charcoal can stimulate root and leaf growth because husk charcoal contains carbon and phosphorus.

The parameter of the number of leaves in the treatment of soil, manure and husk charcoal produced the best number of leaves at the age of 86 HST at 3.50 strands. While the lowest number of leaves was found in the treatment of soil planting media composition which produced a total of 2.36 leaves. It is suspected that the combination of soil composition with various organic materials has the ability to provide better nutrients for the growth and development of hazelnut plants. The most influential nutrient in the growth and development of leaves is nitrogen, a high concentration of nitrogen will produce a larger number of leaves. According to Ikhtiyanto (2010) that the element N plays a role for vegetative growth, namely the formation of buds, leaf formation and stem growth, and if the supply of N is available in sufficient quantities, the leaves of plants will grow and multiply so as to expand the surface available for the photosynthesis process. The number of leaves will affect the photosynthate that will be circulated to all parts of the plant because it is related to the interception of light received by the leaves. Appropriate application of organic matter to the soil can help to increase the yield of photosynthate. The activity of microorganisms in breaking down nitrogen-source organic matter, so that the soil becomes loose, and increases the availability of nitrogen nutrients.

The parameter of the number of roots in the treatment of planting media composition of soil, manure and husk charcoal produced the highest number of roots compared to the other treatments which was 73.58 roots. This is thought to be because the more diverse the mixture of organic matter in the growing media, the contribution of nutrients to the hazelnut plant is able to supply nutrients to form roots, because the planting media of soil, manure and husk charcoal have high water absorption and provide many nutrients so that the water content and nutrients needed by hazelnut plants are well stored for the needs of other plant organs such as roots and leaves. The composition of soil, manure and husk charcoal media that has been mixed evenly makes it easy for the roots of candlenut plants to grow and develop. Media consisting of soil, manure and husk charcoal showed better results because it has a high water absorption capacity, a balanced ratio between soil pores containing air and water and provides a lot of nutrients so that the water content and nutrients needed by candlenut plants are well stored for the needs and organs - other plant organs such as roots and leaves. Root growth, both the number of roots and root length, is strongly influenced by the physical structure of the soil. Loose, crumbly and porous soil supports optimal root development and better root distribution. The availability of many nutrients in this planting medium and the ability of the roots to absorb quickly, so that more nutrients and water can be absorbed.

Fresh weight is the result of plant growth obtained from the conversion of solar energy into chemical energy which is also related to the availability of nutrients and water in the soil. The highest wet weight parameter was found in the treatment of media composition of soil, manure and husk charcoal producing a wet weight of 59.50 g. It is thought that the composition of planting media soil, manure and husk charcoal has provided enough nutrients and water in the soil. The nutrient requirements needed by candlenut plants for physiological and metabolic processes, thus will spur the process of plant growth resulting in an increase in plant fresh weight. Soil, manure and husk charcoal planting media are also able to provide N intake as a nutrient needed to stimulate vegetative growth. This is supported by the statement of Ardiansyah (2013), that the availability of nutrients can affect the growth and development of plants, thus affecting the wet weight of plants. Harjadi (2007) added that the availability of nutrients plays an important role in influencing the biomass of a plant. Nitrogen can stimulate the formation of auxin which functions to soften the cell wall so that the ability of the cell wall increases followed by an increase in the ability of the water intake process due to pressure differences. This causes cell size to increase, then affects the increase in fresh weight and volume will increase in line with cell elongation and enlargement. Water is the main component in plant life, the fresh weight of plants consists of about 70 - 90% is water, which is a supporting medium for biochemical reactions.

The process of formation and development of candlenut plant organs is strongly influenced by the availability of water and nutrients in the soil. The formation and development of hazelnut plant organs such as leaves, stems and roots are related to the process of plant cells to enlarge. Candlenut plant cells will enlarge along with the thickening of the cell wall and the formation of cellulose in the candlenut plant. Another influence is related to the availability of water for candlenut plants in the form of nutrient and soil transport for plants. Nutrients in the soil are transported through water that is absorbed by the candlenut plants through the process of osmosis diffusion that occurs. The more nutrients absorbed by the candlenut plants, the better the availability of basic materials for the photosynthesis process. The process of photosynthesis that takes place well will spur the formation of carbohydrates and proteins in the body organs of the candlenut plant.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Research on the effect of water immersion time and the composition of planting media on the initial growth of candlenut seedlings (Reutealis trisperma (Blanco) Airy Shaw can be concluded as follows:

a. The combination treatment between the length of soaking time for 24 hours with the composition of soil, goat manure, and husk charcoal planting media gave a real interaction on plant height at the age of 44 to 86 HST and dry weight.
b. The treatment of water soaking time significantly affected all observation parameters except germination, growth speed, average days to germination, number of leaves at 30 HST and stem diameter at 30 and 44 HST. The treatment of water immersion time for 12 hours and 24 hours had the same effect and gave the best results on the number of leaves, stem diameter, number of roots and wet weight.
c. The treatment of planting media composition had a significant effect on all observation parameters except plant height at 30 HST and stem diameter at 30 and 44 HST. The treatment of planting media composition of soil, goat manure and husk charcoal gave the best results on the number of leaves, stem diameter, root length, number of roots, and wet weight.

5.2 Recommendations

The results of the study can be considered to use a combination of 12 hours of water soaking time with the composition of soil planting media, goat manure and husk charcoal to more quickly increase the supply of hazelnut seedlings. Further research is needed to determine the optimal length of soaking time in breaking the dormancy period of candlenut seeds.

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APPENDIX

Appendix 1. Description of the Sunan Candlenut Plant Variety

Descripstion	Information
Origin of candidate varieties	: Cinunuk, Garut
Name of origin	: Banyuresmi
Proposed name	: KEMIRI SUNAN 1
Tree age	: 70 - 80 years old
Tree height (m)	: 16 ± 1,80
Trunk circumference (cm)	: 213 ± 27,80
Stem shape	: Notched cylindrical
Leaf shape	: Cordate Leaf colour: Green Leaf length (cm): 14,30 ± 1,80
Flowering period	: May - July
Flower bloom	: Female flowers bloom earlier than male or hermaphrodite flowers with a difference of 1 - 2 days.
Total flowers/inflorescences	: 37,1 ± 18,55
Flower shape	: Jorong
Fruit weight (g)	: 65,25 ±12,16
Fruit shape	: Circle
Fruit skin colour	: Green
Seed coat colour	: Blackish brown
Number of seeds per fruit	: 2,64 ± 0,49
Seed thickness (cm)	: 2,1 ± 0,15
Seed weight/grain (g)	: 7,6 ± 0,84
Seed shape	: Oval - round
Seed production/tree/year (kg)	: 110,65 ± 16,9
Researchers	: Syafaruddin, Agus Wahyudi, M. Hadad EA, Dibyo Pranowo, Handi Supriadi, Maman Herman, Edi Wardiana, Yulius Ferry, Nana

	Heryana, Dani, Asif Aunillah, Rita Harni, Enny Randriani
Variety owner	: Regional Government of West Java Province a.n. Governor of West Java Province

Source: Annex to the Regulation of the Indonesian Minister of Agriculture No. 74.1/Permentan/OT.140/11/2011

Appendix 2. Analysis of Variance of Sprouting Power

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	3	166.33	55.44	0.88	tn	4.07	7.59
Error	8	501.33	62.67				
Total	11	667.67					

Note: tn = not significant

Appendix 3. Analysis of Variance of Growth Speed

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	3	0.29	0.10	0.03	tn	4.07	7.59
Error	8	27.36	3.42				
Total	11	27.65					

Note: tn = not significant

Appendix 4. Analysis of Variance of Average Days to Germination

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	3	0.15	0.05	0.10	tn	4.07	7.59
Error	8	3.79	0.47				
Total	11	3.93					

Note: tn = not significant

Appendix 5. Analysis of Variance of Plant Height Age 30 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	47.28	3.15	2.92	**	1.99	2.65
T	3	21.10	7.03	6.51	**	2.90	4.46
M	3	5.62	1.87	1.73	tn	2.90	4.46
TxM	9	20.55	2.28	2.11	tn	2.19	3.02
Error	32	34.59	1.08				
Total	47	81.87					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 6. Analysis of Variance of Plant Height Age 44 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	105.65	7.04	5.10	**	1.99	2.65
T	3	25.45	8.48	6.15	**	2.90	4.46
M	3	10.87	3.62	2.63	tn	2.90	4.46
TxM	9	69.32	7.70	5.58	**	2.19	3.02
Error	32	44.18	1.38				
Total	47	149.83					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 7. Analysis of Variance of Plant Height Age 58 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	156.32	10.42	5.64	**	1.99	2.65
T	3	14.03	4.68	2.53	tn	2.90	4.46
M	3	41.15	13.72	7.42	**	2.90	4.46
TxM	9	101.13	11.24	6.08	**	2.19	3.02
Error	32	59.14	1.85				
Total	47	215.46					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 8. Analysis of Variance of Plant Height Age 72 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	203.86	13.59	2.89	**	1.99	2.65
T	3	9.90	3.30	0.70	tn	2.90	4.46
M	3	31.53	10.51	2.23	tn	2.90	4.46
TxM	9	162.43	18.05	3.84	**	2.19	3.02
Error	32	150.60	4.71				
Total	47	354.45					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 9. Analysis of Variance of Plant Height Age 86 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	237.10	15.81	5.45	**	1.99	2.65
T	3	40.38	13.46	4.64	**	2.90	4.46
M	3	47.60	15.87	5.47	**	2.90	4.46
TxM	9	149.12	16.57	5.72	**	2.19	3.02
Error	32	92.77	2.90				
Total	47	329.87					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 10. Analysis of Variance of Number of Leaves Age 30 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	6.81	0.45	2.68	**	1.99	2.65
T	3	0.56	0.19	1.11	tn	2.90	4.46
M	3	3.27	1.09	6.45	**	2.90	4.46
TxM	9	2.97	0.33	1.95	tn	2.19	3.02
Error	32	5.41	0.17				
Total	47	12.21					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 11. Analysis of Variance of Number of Leaves Age 44 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	17.37	1.16	3.60	**	1.99	2.65
T	3	6.02	2.01	6.24	**	2.90	4.46
M	3	5.69	1.90	5.89	**	2.90	4.46
TxM	9	5.67	0.63	1.96	tn	2.19	3.02
Error	32	10.30	0.32				
Total	47	27.67					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 12. Analysis of Variance of Number of Leaves Age 58 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	13.74	0.92	2.77	**	1.99	2.65
T	3	4.48	1.49	4.51	**	2.90	4.46
M	3	3.46	1.15	3.49	*	2.90	4.46
TxM	9	5.80	0.64	1.95	tn	2.19	3.02
Error	32	10.59	0.33				
Total	47	24.33					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 13. Analysis of Variance of Number of Leaves Age 72 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	27.48	1.83	3.80	**	1.99	2.65
T	3	9.14	3.05	6.33	**	2.90	4.46
M	3	10.03	3.34	6.94	**	2.90	4.46
TxM	9	8.32	0.92	1.92	tn	2.19	3.02
Error	32	15.41	0.48				
Total	47	42.89					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 14. Analysis of Variance of Number of Leaves Age 86 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	27.44	1.83	4.79	**	1.99	2.65
T	3	11.06	3.69	9.65	**	2.90	4.46
M	3	9.47	3.16	8.26	**	2.90	4.46
TxM	9	6.91	0.77	2.01	tn	2.19	3.02
Error	32	12.22	0.38				
Total	47	39.66					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 15. Analysis of Variance of Stem Diameter Age 30 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	0.13	0.01	1.10	tn	1.99	2.65
T	3	0.02	0.01	0.94	tn	2.90	4.46
M	3	0.02	0.01	0.73	tn	2.90	4.46
TxM	9	0.09	0.01	1.28	tn	2.19	3.02
Error	32	0.24	0.01				
Total	47	0.37					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 16. Analysis of Variance of Stem Diameter Age 44 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	0.09	0.01	1.08	tn	1.99	2.65
T	3	0.03	0.01	1.49	tn	2.90	4.46
M	3	0.02	0.01	0.89	tn	2.90	4.46
TxM	9	0.05	0.01	1.00	tn	2.19	3.02
Error	32	0.19	0.01				
Total	47	0.28					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 17. Analysis of Variance of Stem Diameter Age 58 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	0.36	0.02	3.14	**	1.99	2.65
T	3	0.21	0.07	9.27	**	2.90	4.46
M	3	0.07	0.02	2.91	*	2.90	4.46
TxM	9	0.08	0.01	1.17	tn	2.19	3.02
Error	32	0.24	0.01				
Total	47	0.60					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 18. Analysis of Variance of Stem Diameter Age 72 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	0.34	0.02	2.45	*	1.99	2.65
T	3	0.22	0.07	8.11	**	2.90	4.46
M	3	0.10	0.03	3.51	*	2.90	4.46
TxM	9	0.02	0.002	0.22	tn	2.19	3.02
Error	32	0.29	0.01				
Total	47	0.63					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 19. Analysis of Variance of Stem Diameter Age 86 HST

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	0.67	0.04	2.00	*	1.99	2.65
T	3	0.40	0.13	5.99	**	2.90	4.46
M	3	0.20	0.07	3.02	*	2.90	4.46
TxM	9	0.07	0.007	0.33	tn	2.19	3.02
Error	32	0.71	0.02				
Total	47	1.38					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 20. Analysis of Variance of Root Length

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	578.16	38.54	3.71	**	1.99	2.65
T	3	309.89	103.3	9.95	**	2.90	4.46
M	3	139.18	46.39	4.47	**	2.90	4.46
TxM	9	129.10	14.34	1.38	tn	2.19	3.02
Error	32	332.18	10.38				
Total	47	910.34					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 21. Analysis of Variance of Number of Roots

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	10836.81	722.45	4.26	**	1.99	2.65
T	3	5607.90	1869.3	11.03	**	2.90	4.46
M	3	2272.73	757.58	4.47	**	2.90	4.46
TxM	9	2956.19	328.47	1.94	tn	2.19	3.02
Error	32	5424.67	169.52				
Total	47	16261.48					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 22. Analysis of Variance of Wet Weight

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	4204.72	280.1	2.05	*	1.99	2.65
T	3	1861.99	620.6	4.53	**	2.90	4.46
M	3	1571.23	523.7	3.82	*	2.90	4.46
TxM	9	771.50	85.7	0.63	tn	2.19	3.02
Error	32	4385.80	137.0				
Total	47	8590.52					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant

Appendix 23. Analysis of Variance of Dry Weight

SK	db	JK	KT	F-hit		F-tabel	
						5%	1%
Treatment	15	431.38	28.76	3.41	**	1.99	2.65
T	3	143.74	47.91	5.69	**	2.90	4.46
M	3	34.98	11.66	1.38	tn	2.90	4.46
TxM	9	252.67	28.07	3.33	**	2.19	3.02
Error	32	269.50	8.42				
Total	47	700.88					

Notes: T = length of soaking time ** = very significant effect
M = planting media composition tn = not significant