Journal of Agricultural Sciences (Agrosci)
e ISSN 3074-2423
p ISSN 3032-7547

The Effect Of Soaking Time And Seed Location In The Fruit On The Growth Of Papaya Seedlings

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Abstract
Background. Papaya plants are annuals and one of the most important tropical fruits with high economic value. They can be consumed fresh or processed. The increase in income has also increased the demand for fruit, such as papaya.
Aims. This study aims to determine the effect of soaking time and seed location in the fruit on the early growth of California papaya cultivar plants.
Methods. The study used an experimental method carried out in the Arjawinangun area, Cirebon Regency, from March to June 2023.
Result. Based on the study's results on the effect of soaking time and seed location in the fruit on the growth of California papaya cultivar seedlings, the following conclusions can be drawn: **Conclusion.** The difference in the combination of soaking time and seed location in the fruit gives a difference to the initial growth variables, and good early growth of papaya plants is obtained from the combination of 24-hour soaking time and seed location at the base.
Implementation. The combination of a 24-hour soaking treatment and the location of the seeds at the base results in good initial growth of papaya plants.

Keywords: Soaking Time, Seed Location, California Papaya

INTRODUCTION

Papaya plants are annual plants and are one of the most important tropical fruits with high economic value and can be consumed in the form of fresh fruit or processed. The increase in people's income has also increased the demand for fruit consumption such as papaya. The increase in demand for papaya is in line with the increasing public awareness of consuming fruits to support nutrition for health. Papaya plants (*Carica papaya* L.) have many benefits, therefore efforts are needed to quickly increase papaya plants so that their production value is maintained to meet the needs of papaya fruit.

Papaya commodity production and productivity fluctuate. The variation in papaya yields can be caused by the lack of intensive handling in papaya cultivation, uneven rainfall conditions throughout the year, pest and disease attacks, and improper planting processes during papaya plants' early growth (Imanda & Suketty, 2018).

This requires efforts to increase papaya plant production through improving plant cultivation techniques. One effort to increase the value of papaya plant production is to pay attention to the nursery process or early growth process, because a good nursery process is expected to help increase the productivity and quality of papaya plants.

Papaya seeds are the most frequently used planting material when a nursery starts. However, the problem faced in using planting material with seeds is the length of the germination process caused by the seed mesocarp, which is difficult to penetrate with water. As a result, the seed coat experiences a dormancy period. Factors that cause dormancy loss in seeds vary widely, namely: low temperatures during winter, the presence of microorganisms, and others (Sutopo, 2010).

Seeding is done by sowing seeds from papaya fruit that are physiologically ripe, in good condition, and not attacked by pests or diseases. Before being sown, papaya seeds are first cleaned from the outermost watery layer, namely the sarcotesta layer, and from the flesh of the still attached fruit, washed with clean water, and then dried. According to Sebayang, drying the seeds removes the phenolic or natural antioxidant content in papaya seeds. This is because the phenolic content in papaya seeds can inhibit the seed germination process.

One of the factors that can affect the initial growth process is the soaking process because there is an imbibition process in the seeds, or the process of water entering the seeds through the pores, and the availability of water around the seed environment. Physically, water plays a role in softening the seed coat through the imbibition process. Seed treatment by soaking is carried out to increase the speed of initial growth through the imbibition process.

In addition, in cultivating papaya, the thing that needs to be considered is the use of sound and healthy seeds. The right nursery method is also needed to get good seeds. Seeds of good quality can be influenced by the selection of seeds that will be used as seeds. The germination process is very dependent on the internal condition of the seeds or endosperm of the seeds themselves. The resulting metabolism, such as fat, protein, and carbohydrates contained in the endosperm, functions as food reserves for embryo growth.

The location of the seeds in the fruit will also affect the growth of the papaya seedlings that will be produced. The location of the seeds in the fruit in the middle has a larger and more homogeneous size than the seeds in the fruit located at the tip and base of the fruit. Generative propagation through seeds usually uses seeds from the middle, so the seeds' location at the tip and base is often not utilized.

According to research by Kernick (1978), Ina et al. (2022) state that seeds located in the part close to the stalk or base have more assimilatory material than seeds that are far from the stalk, namely the middle and tip. However, each plant has different recommendations for using seeds from seeds based on their location, for example, in land kale plants, it is more advisable to use seeds from the base to the middle because the seeds are fuller in that part. However, in chili and tomato plants, taking seeds from seeds located at the base of the fruit is not recommended. This shows that each plant has different seed conditions in various seed locations in its fruit. For this reason, research is needed to determine the effect of seed location in the fruit on the growth of papaya plants (*Carica papaya* L.).

Several studies have shown different results regarding the location of seeds in the fruit and the growth of the sprouts. Papaya seeds with the IPB-9 genotype originating from the base of the fruit have a better growth rate than seeds originating from the middle and tip of the fruit.

According to research by Lisarini (2011) *in* Ulu et al. (2019), papaya seeds soaked in warm water for 24 hours showed better germination. Soaking in water for 24 hours can also increase the percentage of jelutong seed germination by up to 93% (Naemah, 2012 in Mizan et al., 2018).

Marliah et al. (2009), in Ina et al. (2022), claimed that the location of the seeds within the fruit significantly affects how quickly plants grow. Considering the background mentioned above, the study was conducted to determine the ability of papaya seeds (*Carica papaya* L.) California cultivars to grow with the treatment of seed location in the fruit.

LITERATURE

To increase seed growth, a pre-planting treatment called invirogation is needed. This treatment aims to break the dormancy of the seeds so that the seeds can grow well, quickly, stimulate rooting, and prevent attacks by plant-disturbing organisms during early growth (Nigam, 2018). Investigation of seeds can be done by soaking them in water or with various solutions. Papaya seeds have a relatively short storage time, so a way is needed to break the dormancy or stop-growing state of the plant through one of the methods, namely by soaking them in warm water at a certain temperature and for a certain duration.

Research by Lisarini (2011) *in* Ulu et al. (2019) showed that papaya seeds soaked in water at 50 °C for 1 day showed better germination and growth. According to Pancaningtyas et al. (2014), Atdwiyani et al. (2017) said that soaking seeds using warm water can increase the length of the radicle in the initial growth or nursery process.

According to research by Naemah (2012) *in* Mizan et al (2018), soaking in water for 24 hours can also increase the percentage of jelutong seed germination by up to 93%, in addition to other factors that influence, such as the physiological conditions and viability of the seeds themselves. According to the study's results (Asiyah, 2017), soaking jackfruit seeds for 24 hours affects the initial growth of jackfruit seedlings. Other studies also show that the effect of soaking lamtoro seeds in water has a significant effect on seed viability, simultaneity of germination, but has no significant effect on plumule length and radicle length (Tarim et al. 2015)

Papaya seedling growth is also influenced by where the seeds are located within the fruit. The growth of the created papaya seedlings will depend on where the seeds are located within the fruit. The location of the seeds in the fruit in the middle has a larger and more homogeneous size than the seeds in the fruit located at the tip and base of the fruit. In general, large seeds are considered better than tiny seeds. This is related to the amount of food reserve content. Larger seeds have more food reserve content than tiny seeds.

The location of seeds in the fruit has a significant effect on the growth process in plants. According to the results of Branco's research (2007) *in* Afyka (2020), seeds from the base of the fruit have a better growth rate of 8.99% compared to the middle part, which is 8.07%, and the tip, which is 7.42%. This aligns with research (Ina et al., 2022), which states that seeds located at the base have more assimilates than those located in the middle and tip. According to Yulian (2021) from his book entitled Cultivation of California Papaya, good seeds to use for candidate seeds are at the base of the fruit because they can produce perfect plants with a percentage of 70-80%, while at the end they produce perfect plants with a percentage of only 50-65%.

So, to increase the productivity of papaya plants, the length of seed soaking can be treated and the location of the seeds in the fruit determined, as can be seen in the following framework.

METHOD

The research method used is an experimental method using a Completely Randomized Design (CRD). This experiment consisted of nine combinations of soaking time treatments (12, 24, 36 hours) and seed location in the fruit (base, middle, tip). Each treatment consisted of 10 polybags and was repeated thrice, so there were 300 polybags. The implementation of the experiment included the preparation of planting media, planting, plant maintenance (watering, weeding, replanting, pest and disease control).

The observed response variables include: Germination Percentage, Percentage of Live Seeds, Germination Rate, Relative Growth Rate, Plant Height, Stem Diameter, Number of Leaves, Root Length, Root Volume, Fresh Weight, and Dry Weight of Plants. The observation data were analyzed using analysis of variance with the F Test, then continued using the Scott-Knott Cluster Test at a significant level of 5%.

DISCUSSION

Papaya seedlings start to grow at 7 days after sowing (DAS), then start to grow leaves at 11 days after sowing (DAS). Nursery cultivation is carried out until 56 days after planting (DSS), and then the seedlings can be planted on agricultural land.

The normal germination percentage of papaya seedlings of the California cultivar in this study was 100%. Thus, the germination percentage in this study is included in the good criteria. Sprouts that grow usually indicate the potential to develop into good plants in a good and optimal environment, with soil conditions, humidity, temperature, and water content.

The survival percentage of California papaya cultivar seedlings in this study was 90%. Of the 300 seedlings planted, the number of seedlings that survived and grew well until the end of the study was 270. Seedlings that did not grow well or died partially, apart from their age, were still susceptible to damage and could be caused by seedlings that were exposed to too much water during the watering process, causing root rot, which resulted in stunted growth, so that the seedlings wilted and died. According to Yulian (2021), good seedlings can produce perfect plants with a percentage of 70% to 80%. Thus, the percentage of living papaya seedlings in this study is included in the good criteria.

Germination Rate

The statistical analysis's findings indicate that the germination rate is significantly impacted by the placement of the seeds within the fruit and the variation in soaking time.

(Table 1). The results of the Skott-Knott cluster test in Table 1 show that a high germination rate was obtained in the 24-hour soaking treatment at various seed locations. This shows that a 24-hour soaking time is more effective than a 12-hour and 36-hour soaking time. This is in line with the opinion of Sutopo (2010) that the germination rate is influenced by the time of seed soaking as an effort to help soften the seeds so that water can enter the cotyledons. The soaking treatment for several hours is one of the seed invitrogenation techniques with controlled water imbibition and a specific duration.

Table 1. Results of Germination Rate Analysis

Treatment	Germination Rate (sprouts/day)
A (time 12 hours, base)	0,65 a
B (time 12 hours, center)	0,65 a
C (time 12 hours, tip)	0,63 a
D (time 24 hours, base)	0,76 b
E (time 24 hours, center)	0,74 b
F (time 24 hours, tip)	0,74 b
G (time 36 hours, base)	0,63 a
H (time 36 hours, center)	0,62 a
I (time 36 hours, tip)	0,61 a

Notes: According to the Scott-Knott Cluster Test at the 5% significance level, mean numbers in the column accompanied by letters show that they are not substantially different.

According to Tarim et al. (2015), germination will occur if the seed coat is open and the oxygen pressure around it increases. According to Sutopo (2010), the optimal temperature and soaking time can affect the seed's need for water and oxygen supply. Soaking in warm water for 24 hours is more effective in accelerating seed germination in some plants. Soaking with an initial temperature of 50 oC to 70 oC can increase the germination power of root length, plant height, and number of leaves. Soaking with water can help the initial growth process and reduce pressure on the environment (Hotima et al., 2024; Pancaningtyas et al., 2014). According to the study by Kartasepura (1992) and Marthen et al. (2013), seeds with a high germination rate will produce plants resistant to environmental conditions.

Growth Rate

Statistical research findings show that the difference in soaking time and seed location in the fruit will produce significantly different plant growth rates (Table 2). High results in the growth rate variable were obtained in the combination of 24-hour soaking time treatments at various seed locations (treatments D, E, F).

The combination of seed location in the fruit and soaking time has a significant effect because the base of the fruit seeds has more assimilates and sufficient food reserves. This is under the research of Santoso and IGM Arya, (2017) which states that the location of seeds in the fruit affects the rate of seed growth which is caused by differences in the quality of nutrients in the seeds during fruit development so that the nutrient content in each seed location in the fruit can be different. Seeds in the base location look better for getting nutrients and having a better growth rate.

Table 2. Result of Growth Rate Analysis

Treatment	*Growth Rate* (cm/day)	
	28 DAP	56 DAP
A (time 12 hours, base)	0,046 a	0,052 a
B (time 12 hours, center)	0,047 a	0,052 a
C (time 12 hours, tip)	0,042 a	0,051 a
D (time 24 hours, base)	0,056 b	0,058 b
E (time 24 hours, center)	0,054 b	0,057 b
F (time 24 hours, tip)	0,053 b	0,056 b
G (time 36 hours, base)	0,045 a	0,052 a
H (time 36 hours, center)	0,041 a	0,052 a
I (time 36 hours, tip)	0,040 a	0,051 a

Notes: According to the Scott-Knott Cluster Test at the 5% real level, mean numbers in the column that are accompanied by letters show that they are not substantially different.

Plant Height

Considering the findings of statistical research, that there is a significant effect of the treatment combination of soaking time and seed location in the fruit on the height of plant seedlings at the ages of 28, 42, and 56 HST, the results of the analysis are presented in Table 3.

Table 3 shows the average plant height at 28 HST and 56 HST in treatment D (soaking for 24 hours, seed location at the base of the fruit) produced the best plant height, while the combination that produced the lowest plant height was the combination of seed location at the end with a soaking time of 36 hours (I). This is under the results of Branco's research (2007), which showed that papaya seeds of the California cultivar originating from the base of the fruit had a higher plant height than seeds originating from the middle and tip of the fruit.

Table 3. Results of Plant Height Analysis

Treatment	Plant Height (cm)			
	14 DAP	28 DAP	42 DAP	56 DAP
A (time 12 hours, base)	5,62 a	7,55 b	13,87 b	18,92 d
B (time 12 hours, center)	5,33 a	7,23 a	10,71 a	16,50 c
C (time 12 hours, tip)	5,83 a	7,33 a	11,18 a	14,26 b
D (time 24 hours, base)	5,57 a	8,05 c	15,04 b	21,33 e
E (time 24 hours, center)	5,83 a	7,33 a	12,16 a	17,00 c
F (time 24 hours, tip)	5,00 a	7,22 a	11,08 a	15,33 b
G (time 36 hours, base)	5,43 a	6,87 a	12,29 a	17,03 c
H (time 36 hours, center)	5,67 a	7,96 b	14,33 b	18,62 d
I (time 36 hours, tip)	5,00 a	6,69 a	8,92 a	12,08 a

Notes: According to the Scott-Knott Cluster Test at the 5% significance level, mean numbers in the column accompanied by letters show that they are not substantially different.

Zulchi and Puad (2017) stated that plant height is a genetic character that is influenced by the environment, especially temperature. The combination of seed location in the fruit and soaking time has a significant effect because in addition to the seeds at the base of the fruit which have more assimilates and food reserves, seeds soaked in warm water for one day have good water content to support plant height growth during the nursery process. According to Raza et al., (2017), each cultivar has a different growth rate depending on its genetics and results in differences in plant height.

Plant height is a growth parameter used to observe the effects of the applied treatment. This is because plant height is the most easily observed indicator of plant growth (Lakitan 1996 in Salamah et al. 2009). The activity of the apical meristem causes plant height growth, so the plant will continue growing taller. Good apical meristem activity is influenced by photosynthesis to support cell division (Sulistyo, 2011, in Ratnawati et al., 2014).

Number of Leaves

The analysis showed that the difference in the combination of soaking time and seed location in the fruit gave a significant difference in the number of leaves per seedling at the ages of 14, 28, 42, and 56 HST (Table 4). In various observation periods, the combination of the seed location at the end with various soaking times (treatments C, F, and I) obtained the least number of plant leaves. On the other hand, the combination that produced the most leaves at 14 HST and 56 HST was the combination of the middle seed location with soaking for 24 hours.

Table 4. Results of Number of Leaves Analysis

Treatment	Number of Leaves (leaves)			
	14 DAP	28 DAP	42 DAP	56 DAP
A (time 12 hours, base)	3,97 b	7,81 b	10,67 a	13,08 a
B (time 12 hours, center)	4,20 b	7,48 b	11,92 b	15,33 b
C (time 12 hours, tip)	3,67 a	5,52 a	11,08 a	13,50 a
D (time 24 hours, base)	4,43 c	7,23 b	12,57 b	16,58 c
E (time 24 hours, center)	4,03 b	7,43 b	11,92 b	12,67 a
F (time 24 hours, tip)	3,17 a	6,66 a	11,00 a	13,50 a
G (time 36 hours,base)	4,57 c	7,65 b	13,08 b	14,25 b
H (time 36 hours, center)	4,60 c	7,25 b	13,90 b	14,43 b
I (time 36 hours, tip)	3,70 a	6,08 a	9,67 a	11,83 a

Notes : According to the Scott-Knott Cluster Test at the 5% significance level, mean numbers in the column accompanied by letters show that they are not substantially different.

The seeds located at the base of the fruit are larger and contain more food reserves than those in the middle and tip of the fruit, and can help the photosynthesis process, thereby helping to accelerate the growth of the number of leaves in the early growth of plant seedlings.

The right combination of treatments will have a good effect on the growth of the number of leaves in plants. Seeds at the base location have a better chance of getting nutrients, which improves seed viability. Soaking with warm water can also speed up the imbibition process because temperature plays an important role by providing pressure for water to enter the seeds (Marthen et al., 2013).

Stem Diameter

Considering the findings of statistical research, there was a significant effect of the combination of different soaking times and seed location in the fruit on the stem diameter of plant seedlings at the ages of 42 and 56 HST (Table 5). The combination that produced the best stem diameter at the ages of 42 HST and 56 HST was the combination of the seed location at the base with a soaking time of 24 hours. Meanwhile, at the end of the observation at the age of 56 HST, the combination that produced the lowest stem diameter was the combination of the seed location at the tip with a soaking time of 36 hours (I).

The seeds located at the base of the fruit are larger in size and contain more assimilates than those in the middle and tip of the fruit, so they can support the development of the diameter of the plant stem in the photosynthesis process.

Table 5. Results of Number of Stem Diameter Analysis

Treatment	Stem Diameter (cm)			
	14 DAP	28 DAP	42 DAP	56 DAP
A (time 12 hours, base)	1,13 a	2,09 a	2,97 a	4,37 b
B (time 12 hours, center)	1,20 a	2,19 a	3,17 a	4,08 b
C (time 12 hours, tip)	1,40 a	2,48 a	3,98 b	3,79 b
D (time 24 hours, base)	1,27 a	2,39 a	4,33 c	5,10 c
E (time 24 hours, center)	1,29 a	2,18 a	3,07 a	4,07 b
F (time 24 hours, tip)	1,21 a	2,24 a	2,94 a	3,93 b
G (time 36 hours,base)	1,25 a	1,90 a	3,03 a	4,19 b
H (time 36 hours, center)	1,06 a	2,32 a	3,67 b	4,50 b
I (time 36 hours, tip)	1,18 a	2,04 a	2,53 a	3,00 a

Notes : According to the Scott-Knott Cluster Test at the 5% real level, mean numbers in the column that are accompanied by letters show that they are not substantially different.

Root Length

Considering the findings of statistical research, it shows that there is a significant effect between the difference in soaking time and the location of seeds in the fruit on the number of leaves of plant seedlings at the ages of 28, 42 and 56 (Table 6).

The combination of treatments that produced the highest root length at the age of 56 HST was the combination of the location of the seeds at the base with soaking for 24 hours. While the combination that produced the lowest root length was in treatment I, namely seeds at the tip with soaking for 36 hours.

In an effort to increase plant growth, invirogation treatment is needed. One of the seed invirogation techniques can be done by soaking in warm water (Arief & Koes, 2010). Soaking in warm water is one way that is easy to apply at the community level. In this study, the invirogation technique used was to soak the seeds first using warm water and select the location of the seeds that have a lot of food reserves, namely at the base.

Table 6. Results of Number of Root Length Analysis

Treatment	Root Length (cm)		
	28 DAP	42 DAP	56 DAP
A (time 12 hours, base)	1,13 a	2,09 a	2,97 a
B (time 12 hours, center)	1,20 a	2,19 a	3,17 a
C (time 12 hours, tip)	1,40 a	2,48 a	3,98 b

D (time 24 hours, base)	1,27 a	2,39 a	4,33 c
E (time 24 hours, center)	1,29 a	2,18 a	3,07 a
F (time 24 hours, tip)	1,21 a	2,24 a	2,94 a
G (time 36 hours,base)	1,25 a	1,90 a	3,03 a
H (time 36 hours, center)	1,06 a	2,32 a	3,67 b
I (time 36 hours, tip)	1,18 a	2,04 a	2,53 a

Notes : According to the Scott-Knott Cluster Test at the 5% real level, mean numbers in the column that are accompanied by letters show that they are not substantially different.

In accordance with the opinion of Nigam (2018) who stated that to break the dormancy of seeds, it is necessary to choose good seeds so that the seeds can grow quickly and stimulate rooting so that the seeds can grow well and healthily and avoid pests and diseases at the beginning of their growth period. Ani (2006) stated that soaking with an initial temperature of 50o to 70o C can have a real effect on increasing the length of roots in plants.

Root Volume

Considering the findings of statistical research, it shows that the combination of soaking time and seed location in the fruit has a significant effect on the root volume of plant seedlings at the ages of 42 and 56 HST (Table 7).

The combination that produced the highest root volume was at the age of 56 HST, namely the combination of the location of the seeds at the base and soaking for 24 hours (treatment D).

To break the dormancy of seeds, it is necessary to select good seeds so that they can grow quickly and stimulate the roots to grow well and healthily and avoid pests and diseases at the beginning of their growth period (Nigam, 2018). Soaking with an initial temperature of 50 oC to 70 oC can have a real effect on increasing growth in plant roots (Ani, 2006).

Table 7. Results of Number of Root Volume Analysis

Treatment	Root Volume (ml)		
	28 DAP	42 DAP	56 DAP
A (time 12 hours, base)	0,83 a	2,00 a	4,67 b
B (time 12 hours, center)	1,00 a	2,83 b	3,67 a
C (time 12 hours, tip)	1,17 a	1,67 a	3,33 a

D (time 24 hours, base)	1,17 a	3,17 b	6,00 c
E (time 24 hours, center)	0,83 a	1,67 a	3,67 a
F (time 24 hours, tip)	1,17 a	1,67 a	3,33 a
G (time 36 hours,base)	0,83 a	2,00 a	3,67 a
H (time 36 hours, center)	0,83 a	2,67 b	4,00 a
I (time 36 hours, tip)	0,83 a	1,83 a	3,00 a

Notes : According to the Scott-Knott Cluster Test at the 5% real level, mean numbers in the column that are accompanied by letters show that they are not substantially different.

Fresh Weight of Plants

Considering the findings of statistical research, it shows that differences in soaking time and seed location in the fruit will provide significant differences in the fresh weight of plants at the ages of 28, 42 and 56 HST (Table 8).

Table 8. Results of Number of Fresh Weight of PlantsAnalysis

Treatment	Fresh Weight (g)		
	28 DAP	42 DAP	56 DAP
A (time 12 hours, base)	0,67 a	2,03 a	3,53 b
B (time 12 hours, center)	0,70 a	2,17 a	2,90 a
C (time 12 hours, tip)	0,67 a	1,83 a	2,57 a
D (time 24 hours, base)	0,87 b	2,70 b	4,53 c
E (time 24 hours, center)	0,63 a	1,70 a	2,87 a
F (time 24 hours, tip)	0,70 a	2,03 a	2,87 a
G (time 36 hours,base)	0,60 a	1,90 a	2,70 a
H (time 36 hours, center)	0,83 b	1,93 a	3,63 b
I (time 36 hours, tip)	0,70 a	1,57 a	2,20 a

Notes : According to the Scott-Knott Cluster Test at the 5% real level, mean numbers in the column that are accompanied by letters show that they are not substantially different.

Based on Table 8, the fresh weight of plants with the highest average fresh weight value at the ages of 28, 42 and 56 HST was obtained from the combination of the treatment of the base seed location with soaking for 24 hours.

Seeds located at the base of the fruit have more food reserves than the middle and tip of the fruit so that they can support plant development in the process of photosynthesis. Fresh weight is a picture of the results of photosynthesis in plants that are influenced by the availability of nutrients during their growth.

Plant Dry Weight

The analysis's findings indicate that differences in soaking time and seed location in the fruit will provide significant differences in plant fresh weight at the ages of 28, 42 and 56 HST (Table 9).

Table 9. Results of Number of Plant Dry WeightAnalysis

Treatment	Dry Weight (g)		
	28 DAP	42 DAP	56 DAP
A (time 12 hours, base)	0,43 b	0,93 b	1,90 a
B (time 12 hours, center)	0,43 b	0,87 b	1,77 a
C (time 12 hours, tip)	0,40 a	0,73 a	1,70 a
D (time 24 hours, base)	0,57 b	1,00 b	2,27 b
E (time 24 hours, center)	0,47 b	0,90 b	1,70 a
F (time 24 hours, tip)	0,33 a	0,73 a	1,67 a
G (time 36 hours,base)	0,37 a	0,77 a	1,60 a
H (time 36 hours, center)	0,47 b	0,80 a	1,87 a
I (time 36 hours, tip)	0,33 a	0,63 a	1,47 a

Notes : According to the Scott-Knott Cluster Test at the 5% real level, mean numbers in the column that are accompanied by letters show that they are not substantially different.

The combination that produced the highest dry weight was at the age of 56 HST, namely the combination of the location of the seeds at the base and soaking for 24 hours (treatment D).

Since dry weight represents the accumulation of organic chemicals that plants have effectively manufactured from inorganic components, specifically water and CO_2, it is employed as a measure of plant growth.. Dry weight is also a reflection of photosynthesis during the plant's growth process. Sitompul and Guritno (1995) in Salamah, et al. (2009) stated that calculating dry weight of plants is important because dry weight is used to see plant metabolism.

The dry weight of the plant shows the results of plant metabolites because leaves and other organs contain metabolites. Seeds located at the base of the fruit are larger and have more food reserves than other parts so that they can support the increase in plant weight. The combination of selecting the location of seeds in the fruit and soaking in warm water can increase the average fresh weight and dry weight of the plant (Salamah, et al. 2009). According to research by Wahyu, 1994 in Tarim, 2015) that seeds with high viability can produce high dry weight.

CONCLUSION

According to the findings of the study on how California papaya cultivar seedling growth is impacted by soaking time and seed location in the fruit, the following conclusions can be drawn: the difference in the combination of soaking time treatments and the difference in seed location in the fruit give differences to the initial growth variables, and good initial growth of papaya plants is obtained from the combination of soaking time treatment of 24 hours and the location of the seeds at the base.

BIBLIOGRAPHY

Afyka, F. G. (2020). Pengaruh Kombinasi Letak Biji Pepaya dan Metode Pematahan Dormansi Terhadap Viabilitas Benih Pepaya (*Carica papaya* L.) Varietas Callina. Universitas Siliwangi.

Ani, N. (2006). Pengaruh Perendaman Benih dalam Air Panas Terhadap Daya Kecambah dan Pertumbuhan Bibit Lamtoro (*Leucaena leucocephala*). Jurnal Penelitian Bidang Ilmu Pertanian, 4(1), 24–28.

Atdwiyani, A., Setyastuti, P. & Sri, M. (2017). Pengaruh Perendaman Air pada Benih Nangka (*Artocarpus heterophyllus* Lamk.) dengan Berbagai Posisi Tanam Benih terhadap Pertumbuhan Bibit. Vegetalika, 6(1), 1–11.

Branco, L. M. (2007). Pengaruh pemangkasan pohon dan letak benih dalam buah terhadap peningkatan produksi dan mutu benih pepaya (*Carica papaya* L.). IPB Bogor.

Hotima, H., Syukri & Yenni, M. (2024). Pengaruh Letak Biji Pada Buah Dan Posisi Semai Benih Terhadap Perkecambahan Dan Pertumbuhan Bibit Kakao (*Theobroma cacao* L.). Jurnal Cakrawala Ilmiah, 2(10), 2753–2765.

Imanda, N. dan S. K. (2018). Pengaruh Jenis Media Tanam Terhadap Pertumbuhan Bibit Pepaya (*Carica papaya* L.) Genotipe IPB 3, IPB 4, dan IPB 9. Buletin Agrohorti, 6(1), 99–111.

Ina, NSS. Bagus, PU. I Made, S., Komang, DA, & I Made, S. (2022). Pengaruh Letak Biji Pada Buah Terhadap Viabilitas dan Pertumbuhan Tanaman Pepaya (Carica Papaya l.). AGROFARM, 1(2), 41–47.

Marthen, M., Elizabet, K. & Herman, R. (2013). Pengaruh Perlakuan Pencelupan Dan Perendaman Terhadap Perkecambahan Benih Sengon (*Paraserianthes falcataria* L.). Jurnal Ilmu Budidaya Tanaman, 2(1). https://doi.org/http://dx.doi.org/10.30598/a.v2i1.273

Mizan, S., Tundjung, T. H., Zulkifli, Z., & Yulianty, Y. (2018). Pengaruh Perendaman dan Letak Posisi Biji dalam Buah terhadap Perkecambahan dan Pertumbuhan Kecambah Biji Kakao (*Theobroma cacao* L.). Jurnal Biologi Eksperimen Dan Keanekaragaman Hayati, 5(1), 27–36.

Nigam, N. S. (2018). Achieving sustainable cultivation of grain legumes : Volume 2: Improving cultivation of particular grain legumes. BURLEIGH DODDS.

Nigam, S. N. (2018). Improving cultivation of groundnuts. Achieving Sustainable Cultivation Of Grain Legumes. Improving Cultivation Of Particular Grain Legumes, 1–25. https://oar.icrisat.org/11211/1/ Improving cultivation of groundnut.pdf.

Pancaningtyas, S., Teguh, I.S. & Sudarsianto, S. (2014). Studi Perkecambahan Benih Kakao Melalui Metode Perendaman. Pelita Perkebunan, 30(3), 190–197.

Ratnawati, Sukemi, I. S. & Sri, Y. (2014). Waktu Perendaman Benih Dengan Air Kelapa Muda Terhadap Pertumbuhan Bibit Kakao (*Theobroma cacao* L.). Jurnal Online Mahasiswa Fakultas Pertanian Universitas Riau, 1–7.

Raza, A., Z. Hayat Khan., Kamran Khan., M. Mehran Anjum., Nawab Ali, M. Owais Iqbal., & H. U. (2017). Evaluation of Groundnut Varieties for the Agro-Ecological Zone of Malak and Division. International Journal of Environmental Sciences & Natural Resources, 5(5).

Salamah, Z. Suci, T. W. & Listiatie, B. U. (2009). Pemanfaatan Limbah Cair Industri Tempe Untuk Meningkatkan Pertumbuhan Tanaman Kangkung Darat (*Ipomea reptans* poir.). Prosiding Seminar Nasional Penelitian, Pendidikan Dan Penerapan MIPA, b280–b286.

Santoso, B. B. dan IGM Arya, P. (2017). Viabilitas Biji dan Pertumbuhan Bibit Kelor (*Moringa oleifera* Lam.). Sains Teknologi Dan Lingkungan, 3 (2), 1–8. https://doi.org/DOI: https://doi.org/10.29303/jstl.v3i2.18

Sutopo, L. (2010). Teknologi Benih. Universitas Brawijaya. Rajawali Press.

Tarim, T., Umi, T. & Achmad, H. S. (2015). Pengaruh Perendaman Benih dalam Berbagai Suhu Air Terhadap Vigor dan Viabilitas Benih Lamtoro Gung (*Leucaena leucocephala*. L). Agrijati, 29(3).

Ulu, M.Roberto I.C.O. Taolin, & Regina, S. (2019). Pengaruh Jenis Media Tanam dan Lama Perendaman Benih dalam Air Hangat terhadap Bibit Pepaya (*Carica papaya* L.). Savana Cendana, 4(4), 64–66.

Yulian, H. (2021). Kandungan dan Manfaat Buah Pepaya untuk Kesehatan Tubuh. https://momsmoney.kontan.co.id/news/

Zulchi, T., dan Puad, H. (2017). Keragaman Morfologi dan Kandungan Protein Kacang Tanah (*Arachis hypogaea* L.). Plasma Nutfah, 23 (2), 91–100. https://media.neliti.com/media/publications/227847-none-a688a904.pdf