



## The Effect Of Sawdust And Chaff Media Storage On Cocoa (*Theobroma Cacao* L.) Seeds Viability

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**Abstract:** The objective of the research is to determine the effect of sawdust and chaff media storage on viability of cocoa (*Theobroma cacao* L.) seeds. Cocoa seeds' viability need to be maintained during storage/shipment to planting destination. The research uses simple group randomized design (RAK) consisting of five (5) treatment with three (3) replicates. Assignment of treatment is carried out in randomized trial plots. The varieties tested is F1 hybrid varieties obtained from Indonesia Coffee and Cocoa Research Center. The parameters observed included percentage (amount) of germination, rate of germination, and gross weight of sprouts. The result indicates shows that media storage treatment using sawdust and chaff provides significant effect on the percentage (number) of seeds germinate, sprout and speed or rate of gross weight of cocoa seed sprouts. In addition, control treatment (storage without chaff or sawdust) resulted in the highest percentage (number) of germinated seed, while the highest germination rate and gross weight of sprouts is indicated by treatment of storage with chaff of 100% although not significantly different statistically with 50% chaff.

**Keywords:** *Cocoa Seed, sawdust and chaff, , RAK.*

### 1. INTRODUCTION

Cocoa is one of the superior commodities of plantation. The role of cocoa is quite important for the national economy, particularly as a provider of employment, sources of income and foreign exchange. In addition, cocoa plays a role in promoting regional development and agro-industry. In 2002, cocoa plantation has provided employment and income source for 900 thousand head of farm families mostly located in Eastern Indonesia (KTI) and contributed the largest income to the three plantation sub-sectors after rubber and palm oil.

Most of cocoa beans from Indonesia are exported, although there are some cocoa processing industries into semi-finished products in Indonesia. The development of cocoa seed exports shows an increase from year to year. In 1997, a cocoa export was estimated to have reached approximately US \$ 378 million. While the value is an estimated figure, it was is higher than the previous year of US \$ 377.5 million.



The main obstacle faced by exported cocoa commodities is viability of seeds. Cocoa is a crop with recalcitrant seeds. Recalcitrant seed viability can only be maintained until a few weeks or a few months, even if stored in optimum conditions (Bewley and Black, 1994 in Rachmawati Hasid, 2010). Cocoa seeds are recalcitrant seeds, which have no dormancy and high water content. Cocoa seeds need to maintain its viability during storage/shipment to planting destination. In conventional seed production, cooling process still face fear of moisture content that leads to uniformity of the moisture level as it depends on workers performance.

Decrease in water content of cocoa recalcitrant seeds may lead to a decrease in seed quality. Moisture content of seeds in storage can still be maintained to some extent by using a storage medium. One effort to maintain the seed water content to remain optimal is to store the seeds in a room or container with high humidity using a moist storage medium. Air humidity seed store room or container can be set using a damp solid media such as sawdust (Rahardjo, 2001 in Rachmawati Hasid, 2010).

A previous research by using sawdust with quantity of 20 grams, 40 grams, and 60 grams was conducted by D.M.F. Sumampow (2011) and the results shows that the storage of cocoa seeds on sawdust media does not affect viability of cocoa seeds. Based on this condition the authors are interested to conduct a research with higher amount of sawdust and other storage media in the form of chaff that it is expected to provide good results.

## 2. MATERIALS AND METHODS

This study used a simple randomized block design (RAK) consisting of five (5) treatments with three (3) replicates. The assignment of treatment in the experimental plots was performed randomly. The material used in this research is cocoa seed (*Theobroma cacao L.*) with varieties of F1 Hybrids obtained from Indonesian Coffee and Cocoa Research Center as treatment object, chaff and sawdust as storage media, Styrofoam size 19 x 12 x 7 cm as a place of storage and germination media, sand as germination media, label as marker of each treatment and each sample, 95% alcohol as liquid for storage media sterilization. The tools used in the study are stationery and paper for recording data, hand sprayer for watering, germinator for germination process, oven for sterilizing storage media, and other tools that support the implementation of research.



### 3. RESULTS AND DISCUSSION

#### 3.1. Percentage (Amount) Germination

The result of variance analysis shows that the use of storage media in the form of chaff and sawdust has significant effect on observation of germination percentage during cocoa seed growth at 10 days after planting.

Table 1. Average Percentage of Germination (%) in Storage of cacao seed in chaff and sawdust media

Treatment	Average Number of Sprouts	Average Growth Percentage (%)
K0 = Controls or without chaff or sawdust	3.33 b	66.6
K1 = Storage with sawdust 50%	2.00 a	40.0
K2 = Storage with sawdust 100%	2.67 ab	53.4
K3 = Storage with chaff 50%	2.33 a	46.6
K4 = Storage with chaff 100%	2.67 ab	53.4
5% BNT:	0.81	

Description: The figures followed by the same letters in the same column are not significantly different at 5% of BNT test.

Table 1 shows that the increasing doses of storage on a storage media of sawdust or chaff results in increase in the percentage of cocoa seed germination. The highest percentage of germination was shown by treatment without chaff or sawdust (66.6%) and significantly different from storage treatment using either sawdust or chaff storage media. Most seeds or the smallest percentage is achieved with 50% sawdust storage treatment with an average sprout number of only 2 seeds or 40%, this is not significantly different from the storage treatment with 50% chaff with an average sprout only 2.33 seed or 46.6%. Both these treatments are statistically different from storage treatment using other storage media.



### 3.2. Rate of Germination

Analysis of variance shows that the use of storage media by using chaffs or sawdust has very significant effect on observation during the growth of cocoa seed germination rate at 10 days after planting.

Table 2. Average Growing Rate (days) on Cocoa Seed Storage on Sawdust and Chaff Media

Treatment	The average rate of germination (days)
K0 = Controls or without chaff or sawdust	6.13 c
K1 = Storage with 50% sawdust	6.00 bc
K2 = Storage with 100% sawdust	5.77 bc
K3 = Storage with 50% chaff	5.17 b
K4 = Storage with 100% chaff	4.17 a
5% BNT:	0.84

Description: The figures followed by the same letters in the column is not significantly different at 5% BNT test.

Table 2 shows that the increasing doses of storage on sawdust or chaff storage media is followed by an increase in the rate of the cocoa seed germination. The fastest germination rate is indicated by storage treatment with 100% chaff with an average germination rate of 4.17 days and statistically very different from the storage treatment using either sawdust or other chaff storage media. The slowest germination rate at the latest it tended to is achieved by control treatment or without chaff or sawdust with average germination rate of 6.13 days, statistically different from storage treatment using other storage media.

### 3.3. Sprouts Gross Weight

Analysis of variance indicates that the use of chaffs or sawdust storage media has significant effect on gross weight of cocoa seed germination at 10 days of planting. Table 3 shows that the increasing doses of storage on sawdust or chaff media, the



higher the gross weight of cocoa seed sprouts. The highest gross weight of sprouts was indicated by storage treatment with 100% chaff with the average gross weight of the sprouts reaching 8.70 gram, although not significantly different from storage treatment with 50% chaff with average wet weight of 7.73 gram.

Both treatments are statistically different from storage treatment using other storage media. The lightest gross weight tend is achieved by control treatment or without chaff or sawdust with average gross weight of only 5.27 grams, the treatment was significantly different from storage treatment with other storage media.

Table 4. Average Gross Weight of Sprout (gram) on Sawdust and Chaff Storage Media

Treatment	Average Sprouts Gross Wight (gram)
K0 = Controls or without chaff or sawdust	5.27 a
K1 = Storage with 50% sawdust	6.73 ab
K2 = Storage with 100% sawdust	6.93 ab
K3 = Storage with 50% chaff	7.73 b
K4 = Storage with 100% chaffs	8.70 b
5% BNT:	2.03

Description: The figures followed by the same letter in the same column is not significantly different in 5% BNT test

#### 4. DISCUSSION

Observation on cacao seed germination after 10 days of storage using sawdust or chaff indicates that K0 treatment (treatment without chaff or sawdust) is the best treatment to obtain high germination value. It is maybe influenced by genetic factors. According to the Hasidic (2010), water content of cocoa seeds determines the vigor condition. If the water content is above critical value, the vigor value is still tolerable. However, if the water content is below the critical value, the vigor is very low.

Observation on cacao seed after germination at 10 days after storage using sawdust or chaff indicates that chaffs storage of 100% K4 has a value of 4.17 days as the fastest treatment to germinate. It is suspected that the dose of chaff storage using 100% is the optimum dose for



cocoa seed storage. In other words, the increasing dose of media store using chaff 100% does not lower seed moisture content to below 26%, thus the seeds do not deteriorated quality (due to reduced moisture content) as there is no degradation of the trigger mechanism in seed germination.

In general, when water content of the seeds decreases rapidly by about 20%, the seed has also reached physiological cooking or functional cooking and at that moment the seed gains maximum dry weight, maximum vigor and maximum sprout ability (viability) or the highest quality (Kamil, 1979). This is in accordance with Sutopo (2004)'s opinion stating that condition that in too wet media, aeration will be inhibited, occurrence of disease and rot of seeds will be stimulated due to fungus or bacteria.

Observation on cacao seed after germination at 10 days after storage using sawdust or chaff shows that that K4 (with chaffs Storage 100%) has a value of 8.70 grams which is the best treatment to obtain high gross weight of germination. This is presumably because the storage on chaff medium is good enough to control cocoa seed water content during the storage process. This is in line with the research conducted by Sumampow (2011) on sawdust storage media, stating that the higher the dose of storing media, the better the viability of cocoa seeds as evidenced by the greater the power and the weight of the sprouts.

## 5. CONCLUSION

Storage treatment using sawdust and chaff had significant effect on the percentage (number) of germinated seeds, velocity or sprout rate and gross weight of cocoa seed sprouts. K0 treatment (control or storage without the chaff or sawdust) resulted in the highest percentage (number) of germinated seeds, while the highest germination rate and gross weight of is indicated treatment K4 (storage with chaffs 100%) although not significantly different from K3 treatment (Storage with chaff 50%).

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