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The Influence Of Delay Time And Pile Thickness Of Seed Drying On Seed Viability And Growth Of Rice (*Oryza sativa* L.) Using Innovated Drying Floor

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Abstract.

Seeds were susceptible to drying injury in several ways i.e the delay time and the pile thickness of seed drying . The research was carried out to found the maximum delay time and the pile thickness to obtain the best seed viability and growth of rice using Innovated Drying Floor. This research was done from June to September 2019 at UPT Barongan Balai Benih Pertanian, Barongan, Sumber Agung Village, Bantul, Yogyakarta. The experiment was arranged on Split Plot design with two factors. The main plot was delay time of drying process: 2, 4 and 6 days. The subplot was the seed pile thickness: 3, 5, 7, and 9 cm. The treatments were repeated 3 times. Data were analyzed by analysis of variance 5% and test further with DMRT 5% (Duncan's Multiple Range Test). The results showed that there was not interaction between the delay time and seed pile thickness on all parameters. The delay time of drying process: 2, 4 and 6 days and the seed pile thickness: 3, 5, 7, and 9 cm showed no significantly different on germination capacity and the growth of rice seed. The delay time of drying process until 6 days can be tolerated on the germination capacity and growth rice. The seed pile thickness until 9cm also can be tolerated on the germination capacity and growth rice.

Key words: delay time, pile thickness, innovated drying floor, seed viability and growth of rice

1. Introduction

Rice (*Oryza sativa* L.) is a staple crop in Indonesia because most Indonesians consume rice as a staple food. The need for staples in Indonesia is increasing along with the increasing population growth. Low rice production in Indonesia requires to make improvements in the seed system so that it can produce high crop production. One example of low seed production is in Bantul Regency. Since 2005, Bantul Regency government has released and developed Bantul Seed Center program. Through this program, Bantul Regency government as a producer of certified rice seeds guarantees and improves the service of certified superior rice seeds.

However, around 30% of rice farmers in Bantul Regency still use uncertified rice seeds. In addition, the availability of certified rice seeds in Bantul Regency has not been able to meet the needs. At present, 60% of the requirement for certified rice seeds has been fulfilled by Bantul Regency itself, and the remaining 40% is fulfilled from other Regencies in DIY and surrounding areas.

The Technical Service Unit (UPT) of Barongan Agricultural Seed Office is a provider of certified rice seeds in Bantul Regency under the auspices of the Agriculture and Forestry Department of Bantul Regency. UPT BBP Barongan is one of the seed producers in Bantul

Regency which is believed by farmers to produce superior rice seeds at low prices, so that almost most farmers buy seeds here. However, to produce rice seeds according to the target needed by farmers, in this Barongan BBP UPT there are also some obstacles in the implementation of the seed processing that is in the drying process. The condition of the land for a limited drying area, the rainy season, and the grain yield of farmers who must be dried in the sun is one of the problem factors so that the prospective seeds encounter a delay in drying. Setting the seed layer thickness on the drying floor in order to make the water level drops quickly is also a major problem at Barongan UPT.

After harvesting the seeds, the rice must be dried immediately because if there is a delay in drying, the seeds will experience a decrease in seed quality. Delay of drying time will cause nonstandard water content and humid storage space and the accumulation of grain in the container/chilling ahead of the processing which will cause high respiration. Limitations on the location of drying, drying in the rainy season and limited labor is one of the important issues in seed producers that resulting in a delay in the process of drying the grain, as well as a decrease in the quality of the dried grain produced.

Drying is one of the important postharvest activities, with the aim that the grain moisture content is safe from the possibility of the proliferation of insects and microorganisms such as fungi and bacteria. In the drying process, one of them needs to be considered is drying time after harvest. Drying should be conducted immediately after the prospective seed is removed because if there is a delay in drying the seeds will experience a decrease in seed quality. If the conditions do not allow the prospective seed must be spread out and aerated. Drying must begin as soon as possible from the time of harvest. If drying cannot be conducted, try to keep the unhusked rice from being piled up but spread out to avoid the possibility of fermentation.

Stated that the difficulty of drying in the rainy season can cause grain damage. Delay in drying up to 3 days can cause grain damage by 2.6%. The accumulation of wet rice in the field for 3 days can cause grain damage 1.66% - 3.11%, depending on the thickness of the pile. Thus, it is clear that it can be detrimental to farmers economically, both qualitatively and quantitatively which ultimately reduces income for farmers. Therefore, after harvesting the harvest, it is necessary to immediately secure the grain by drying so that grain damage can be avoided.

Uneven drying because the drying media/drying floor is not suitable will cause cracks in the grain and vice versa which is too dry grain will break easily when ground. Meanwhile, in conditions that are still too wet besides difficult to grind, it is also not good in terms of storage because it will be easily attacked by warehouse pests and fungi. To avoid the grain becoming cracked, a layer of rice paddy is not too thin when it is being dried. Drying from a moisture content of 25.5% to 14.7% with an area of 1 m^2 stretches takes 4.5 and 16 hours for 1 and 7 cm thick overlays [2], but the volume of seeds with a thickness of 1 cm is lower.

In order to maintain the quality of crop yields and reduce the number of losses to farmers, UPT Sumberagung Bantul Agricultural Seed Institute created a drying method/system that is practical, efficient and effective that is by making drying techniques. This engineering is a drying technology innovation that has been created by the UPT BBP Bantul which is with the concept of making a rice-drying floor to form a tent that uses a cover over it. By using this system, farmers will be more profitable because farmers can still dry even in the rainy season. The sale value will be higher than when the harvest takes place.

Therefore, it is necessary to conduct research on the Treatment of Various Delays in Drying and Seed Layer Thickness Using Innovative Drying Floors on Viability and Growth of Rice Plants (*Oryza sativa* l.). The purpose of this study is to determine the time for drying and the maximum thickness of the seed layer which produced the best viability and growth of rice seeds (*Oryza sativa* L.).

2. Methods

The study was conducted at the UPT Barongan Agricultural Seed Office, Bantul. UPT Barongan Agricultural Seed Office (BBP Barongan) is a hall of quality superior seed providers under the Department of Agriculture and Forestry of Bantul Regency. Seed quality testing was conducted at the Plant Breeding Laboratory of the Agrotechnology Study Program, Faculty of Agriculture, UPN "Veterans" Yogyakarta from June to September 2019.

The research method used was a laboratory experiment arranged in a Split Plot Design which was arranged in a Completely Randomized Design with two factors. As Main Plot, there are 3 levels of delaying drying time which are W1 = 2 days after harvest, W2 = 4 days after harvest and W3 = 6 days after harvest. Sub plot is the seed pilethickness. There are 4 levels including K1 = 3 cm from the drying floor, K2 = 5 cm from the drying floor, K3 = 7 cm from the drying floor, and K4 = 9 cm from the drying floor. There are 12 treatment combination which each of which were repeated 3 times.

After harvesting the rice seeds delay the drying process for 2, 4 and 6 days. Then, drying the rice seeds on seed pilethickness 3, 5, 7 and 9cm from the drying floor. The drying process stopped after the seed mouisture content reached 10%, and then cleaned the rice seed using cleaner/blower. Stored the the clean rice seed until the seeds broke their dormancy. The sample of seed can be evaluated their viability and their growth.

Observation parameters include: Seed germination (%), Plant height at 14 days after planting. The number of tillers aged 14 days after planting and the dry weight of plants aged 14 days after planting. The seed quality test method according to. Analysis of variance was performed to determine the effect of treatment at the 95% confidence level, followed by Duncan's multiple range test (DMRT) to discover which treatment was significantly different (Gomez and Gomez, 1983). Data analysis was performed using the SPSS 10.0.5 program

3. Results and Discussion

3.1 Seed Germination

The results of the analysis of variance showed that the treatment of seed pile thickness and the treatment time of delayed drying did not have a significant effect and there was no interaction with seed germination. The average percentage of seed germination power is presented in Table 1.

Table 1 shows that the average percentage value of germinating capacity at the time of the 2, 4, and 6 day drying delay was not significantly different, as well as the seed thickness treatments of 3, 5, 7 and 9 cm. Seeds have very good germination capacity, the average percentage is 92.28% even when drying is delayed for up to 6 days with thickness up to 9 cm.

Table 1. Seed germination rate (%)

Delay Time	Seed Pile Thickness				Average	
	K1 (3 cm)	K2 (5 cm)	K3 (7 cm)	K4 (9 cm)		
W1 (2 days)	95.33	93.33	92.00	92.67	93.33	P
W2 (4 days)	92.67	93.33	90.67	91.33	92.00	P
W3 (6 days)	94.00	92.67	90.00	89.33	91.50	P
Average	94.00	95.33	90.89	91.11	92.28	
	A	A	a	A	(-)	

Note: The mean followed by the same letter in the same column and row in one treatment category shows no significant difference in DMRT level of 5%. Sign (-) indicates that there is no interaction.

Germination is a measure of seed viability, that is, the ability of seeds to germinate normally under favorable conditions. The minimum limit of passing the seed certification test for germination is 80%. Drying using an innovative drying floor allows water levels that have fallen during the day not to increase again at night because at night the seeds also still experience drying under the tarpaulin as a result of heating in the sun during the day so that the process of reducing water content up to 10% faster reached. Increased seed moisture content will cause seed viability to fall due to fungal attack.

Non-standard water content and humid storage space and the accumulation of grain in the container/cage before processing will cause high respiration so that the longer the storage or stacking in a place will have an effect on increasing the grain water content. It also causes the growth of fungi in the grain because the water content after harvest is still high around 20-26%, so that the grain is not fit to be a seed. Seed water content is the main factor that determines the shelf life of seeds. Seed damage during storage is largely influenced by the water content in the seed.

3.2 Plant Height 14 Days After Planting

The results of the analysis of variance showed that the treatment of seed pile thickness had no significant effect, but the drying time delay had a significant effect and there was no interaction with plant height at the age of 14 days after planting. The average plant height is presented in Table 2.

Table 2. Average Plant Height 14 Days After Planting (cm)

Delay time	Seed Pile Thickness				Average	
	K1 (3 cm)	K2 (5 cm)	K3 (7 cm)	K4 (9 cm)		
W1 (2 days)	26.33	25.67	26.45	25.84	26.07	p
W2 (4 days)	23.89	24.94	25.28	25.56	24.92	q
W3 (6 days)	25.00	26.00	25.28	24.56	25.21	q
Average	25.08	25.54	25.67	25.32	25.40	
	A	a	a	a	(-)	

Note:The mean followed by the same letter in the same column and row in one treatment category shows no significant difference in DMRT level of 5%. Sign (-) indicates that there is no interaction.

Table 2 shows that the mean height of plants aged 14 days after planting at the 2 day drying delay time was significantly higher than the 4 and 6 day drying delay, while the treatment of seed pile thickness of 3.5.7 and 9 cm did not show any difference in the plant height at 14 days after planting. Delays in drying for 4 and 6 days are thought to cause a longer increase in seed water content because the seed water content when harvest is still high so that the respiration rate increases resulting in H_2O and heat which allows the growth of fungi and results in lower plant height at 14 hst. The thickness of the 3 cm seed layer where the seeds are dried in a thinner layer than 5 cm, according to [2], conditions when the seeds exposed to the sun's heat with higher temperatures so that it can result in seed cracking and result in lower seed viability including plant height. Tents in the afternoon and at night on the drying floor innovation allows aeration in the tent to run well so that the 3 cm seed layer does not damage the seeds..

3.3 Number of tillers 14 days after planting

The results of the analysis of variance showed that the thickness of the seed layer treatment and the time delay for drying did not have a significant effect and there was no interaction with the number of tillers at 14 days after planting. The average number of tillers aged 14 days is presented in Table 3.

Table 3 shows that the average value of the number of tillers at the time of the 2, 4, and 6 day drying delay was not significantly different, nor was the treatment of seed pile thicknesses of 3, 5, 7 and 9 cm. It shows that the delay of drying for up to 6 days and thicknesses of up to 9 cm can still be tolerated by the innovative drying method.

The drying method using the innovative drying floor allows the drying process to be evenly distributed throughout the seed so that it does not cause seed damage due to fungal attack reflected by the high seed viability which is reflected by the germination rate of the seeds which reaches (92.28%) exceeding the minimum standard of passing certification by 80%. High viability will also correlate with plant growth in the field represented by the number of tillers parameter.

Table 3. Average Number of Tillers Age 14 Days After Planting

Delay time	Seeds Pile Thickness				Average	
	K1 (3 m)	K2 (5 cm)	K3 (7 cm)	K4 (9 cm)		
W1 (2 days)	6.67	7.78	6.55	7.56	7.14	p
W2 (4 days)	6.89	6.78	7.22	7.11	7.00	p
W3 (6 days)	6.89	6.89	7.11	7.67	7.14	p
Average	6.82	7.15	6.96	7.45	7.09	
	a	A	a	a	(-)	

Note: The mean followed by the same letter in the same column and row in one treatment category shows no significant difference in DMRT level of 5%. Sign (-) indicates that there is no interaction

3.4. Plant Dried Weight 14 Days After Planting

The results of the analysis of variance showed that the treatment of seed pile thickness and the treatment of drying time did not have a significant effect and there was no interaction with the plant dry weight parameters at 14 days after planting. The average dry weight of plants aged 14 days after planting is presented in Table 4.

Table 4. Average Dry Weight of Plant Age 14 Days After Planting (g)

Delay time	Seeds Pile Thickness				Average	
	K1 (3cm)	K2 (5 cm)	K3 (7 cm)	K4 (9 cm)		
W1 (2 days)	0.71	0.88	0.76	0.87	0.81	P
W2 (4 days)	0.70	0.87	1.05	0.64	0.82	P
W3 (6 days)	1.00	0.73	0.83	1.04	0.90	P
Average	0.80	0.82	0.88	0.85	0.84	
	a	a	a	a	(-)	

Note: The mean followed by the same letter in the same column and row in one treatment category shows no significant difference in DMRT level of 5%. Sign (-) indicates that there is no interaction.

Table 4 shows that the mean dry weight value of plants aged 14 days after planting at the drying time delay of 2, 4, and 6 days was not significantly different, as well as the treatment of seed pile thickness of 3, 5, 7 and 9 cm. It shows that the delay of drying for up to 6 days and thicknesses of up to 9 cm can still be tolerated by the innovative drying method. The drying method using an innovative drying floor allows the process of drying evenly throughout the seed and sufficient aeration/air flow so that it does not cause the seed to be damaged/cracked or attacked by fungus.

4. Conclusion

The treatment of the drying time delay of up to 6 days and the thickness of the sun drying layer up to 9 cm can be tolerated with an innovative drying floor.Treatment time of 2.4 and 6 days delay of drying does not show differences in seed germination, number of tillers and dry weight of plants aged 14 days after planting.The treatment of seed drying pile thickness 3,5,7 and 9 cm by using the innovation drying floor does not show differences in seed germination, plant height, number of tillers, and dry weight of plants aged 14 days after planting. The treatment of 2 days delay of drying showed the highest plant age of 14 days after planting.

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