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Development of Better Seed Quality of Rice by Pre-drying in Wet Season

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Abstract
The effect of pre-drying on reduction of seed moisture in order to improve the quality of seed in early wet season of rice was investigated at the research field in San Pa Tong, Chiang Mai, Thailand, during April-July, 1997. The experiment was designed in Split-split plot with 4 replications. Main plots were 2 rice varieties Suphanburi60 (SPB60) and RD10, while sub plot were 4 harvested methods: harvesting and storing in the shade during day and night (Tr_1); harvest at field maturity (Tr_2); spraying rice at physiological maturity (PM) with Dimethipin (2,3-dihydro-5,6-dimethyl-1, 4-dithin1,1,4,4-tetraoxide) 500 ml/ha (Tr_3); spray rice at PM with Dimethipin 750 ml/ha (Tr4) and the sub-sub plots were the period during 28-40 days after 50% flowering. The seed moisture content should be reduced up to 14% (minimum requirement for cereal seed storage) at physiological maturity, which started around 30-33%. The treatment Tr_4 showed the best results in both rice varieties SPD60 and RD10 requiring 4.25 and 4 days, respectively. In term of seed quality, Tr_1 also gave the best results. Tr_1 had markedly higher seed germination percentages and higher seed vigor compared to the other treatments. Germination percentage of Tr_1 was 96.20 and 97.96% in SPB60 and RD10 respectively and vigor index was 24.83 and 27.98 in SPB60 and RD10 respectively. This therefore meant that RD10 was higher germination ability and vigor than SPB60. Besides that, Tr_1 resulted also significantly less percentage of cracking seeds than the other treatments.

Introduction
In Thailand, rice is harvested in rainy season with high moisture content, which causes the risk of yield loss and makes difficult to handle in high atmospheric humidity. Physiological maturity of rice reaches when ¾th of ear changes from green to yellow color. Rice seeds with more than 20 % moisture content, reduces the seed quality such as cracking and susceptibility for insects and diseases (Insompan 1988). Seed harvesting with 22-30 % moisture content is not suitable for harvest and storage. Rice seed drying up to 14% moisture content is good for storage, handling and processing (Shinasuwan *et al*. 1995). Dimethipin (2,3-dihydro-5, 6-dimethyl-1, 4-dithin 1,1,4,4-tetraoxide) increases harvesting efficiency and reduces the cost of harvest in rape, flex and potato (Costa and Intrieri 1981; Bohne 1977, Bell *et al*., 1975; Ames *et al*. 1982). Dimethipin can decrease rice seed moisture content from 20% to 11.8% in 2 days at the rate 1.5 l ml per ha (Araullo *et al*., 1976). According to Benyak (1987), Dimethipin is

able to accelerate maturity of sorghum without affecting on viability of seed when it is applied at the rate of 1.5 l ml per ha.

Materials and methods

The experiments were conducted at the research field in San Pa Tong, Chiang Mai, Thailand during April-July, 1997. The experiments were designed in Split-split plot with 4 replications. Main plots were 2 rice varieties namely Suphanburi60 (SPB60) and RD10, while the sub plot were 4 harvesting methods: harvesting and storing in the shade during day and night (Tr_1); harvesting at field maturity (Tr_2); spraying on rice at physiological maturity (PM) with Dimethipin (2,3-dihydro-5,6-dimethyl-1, 4-dithin1,1,4,4-tetraoxide) at the rate of 500 ml/ha (Tr_3); spraying on rice at PM with Dimethipin at the rate of 750 ml/ha (Tr_4) and the sub-sub plots were the period during 28-40 days after 50% flowering. Seeds were harvested and drying up to 12% MC for 6 months storage in sealed plastic bags at room temperature. The recorded parameters were: (1) seed moisture content (2) 100 seed weight (3) seed cracking percentage (4) germination percentage (5) Vigor Index = seedling of 1 day(S_1)/1+S_2/2+ S_n/n. Analysis of variance and comparisons of means were done by using least significant difference (LSD) test at 0.05 probability level.

Results

Seed moisture content resulted significant effects on used rice varieties. Harvesting method also affected significantly by seed moisture content. The highest MC was found in Tr_2 by 23.51 % followed by Tr_1, Tr_3, and Tr_4 whose MC was 22.13%, 19.11% and 18.83% respectively. Seed moisture content had significant effect from interaction between varieties and treatments. Changing of seed moisture content in SPB60 and RD10 varieties were showed in figure 1 and 2.

Table 1: Rice seed drying time duration and cracked seed percentage

Treatment	Varieties			
	SPB60		RD10	
	Drying time (days)	Cracked %	Drying time (days)	Cracked %
Tr_1	10.00 a	5.75 b	9.75 a	4.81 b
Tr_2	10.75 a	15.06 a	8.75 a	11.50 a
Tr_3	5.50 b	15.56 a	4.25 b	12.13 a
Tr_4	4.25 c	15.25 a	4.00 b	12.75 a
F-test	**	**	**	**
LSD 0.05	0.9621	0.7666	0.7657	1.4952

For seed moisture content decreased time from physiological maturity to reach 14 % MC. It was found that Tr_3 and Tr_4 took 5.5 and 4.25 days in SPB60, 4.25 and 4 days in RD10 while Tr_1 and Tr_2 took 10 and 10.75 days in SPB60, 9.75 and 8.75 days in RD10(Table 1). Regarding seed cracking percentage, significant difference was found among Tr_1 (5.76% in SPB60 and 4.81% in RD10), Tr_2, Tr_3 and Tr_4 (Table1). There was no significant difference among all treatments regarding 1000 seed weight. Similarly no any significant difference was noticed in yield of both rice varieties. The variety SPB60 showed better yield (average 5,257 kg/ha) than RD10 (3,506 kg/ha).

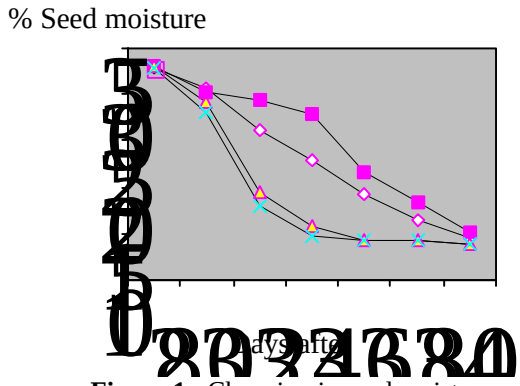

Figure 1: Changing in seed moisture content during PM at harvest in variety SPB60.

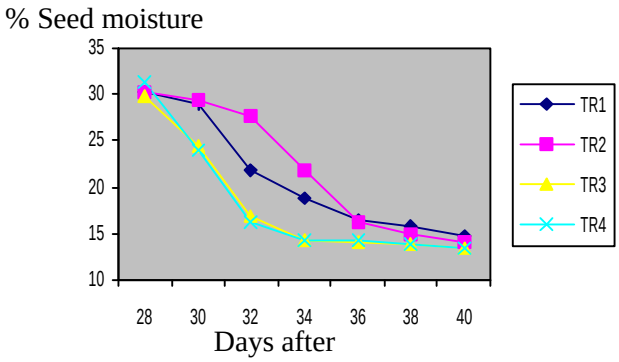

Figure 2: Changing in seed moisture content During PM at harvest in variety SPB60.

Regarding pre-storage quality (Table 2), Tr_1 showed significantly higher seed germination percentages and seed vigor including lower cracked seed compared to the other treatments. In Tr_1, the highest germination was found by 96.43% in SPB60 and 98.5 % in RD10, vigor index was 26.30 inSPB60 and 29.27 in RD10 and cracked seed was 5.87 % in SPB60 and 4.45 % in RD10.

Table 2 Pre-storage quality of rice seed.

Treatment	Varieties					
	SPB60			RD10		
	% germination	Vigor index	% Cracked	% germination	Vigor index	% Cracked
Tr_1	96.43 a	26.30 a	5.87 b	98.50 a	29.27 a	4.45 b
Tr_2	93.73 b	24.30 b	15.14 a	94.68 b	28.40 b	11.45 a
Tr_3	93.53 c	23.46 c	15.58 a	94.40 c	25.42 c	12.20 a
Tr_4	93.50 c	23.45 d	15.59 a	94.38 c	25.35 c	12.66 a
F-test	**	**	**	**	**	**
LSD 0.05	0.0472	0.0445	0.7666	0.0371	0.0299	0.8210

For storage quality, seed moisture content did not show any significant difference among the treatments during storage. Tr_1 also gave higher seed germination percentages and seed vigor compared to the other treatments (Figure 3, 4, 5 and 6). Germination of Tr_1 was 96.20 % in SPB60 and 97.96% in RD10 and vigor index was 24.83 in SPB60 and 27.98 in RD10. It means, RD10 had higher germination ability and vigor than SPB60. Besides that, Tr_1 resulted also significantly less percentage of cracking seeds compared to other treatments.

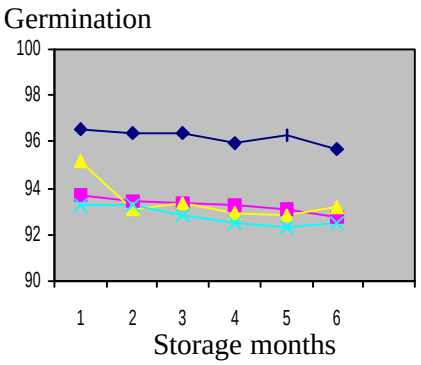

Figure 3: Germination percentage of SPB60.

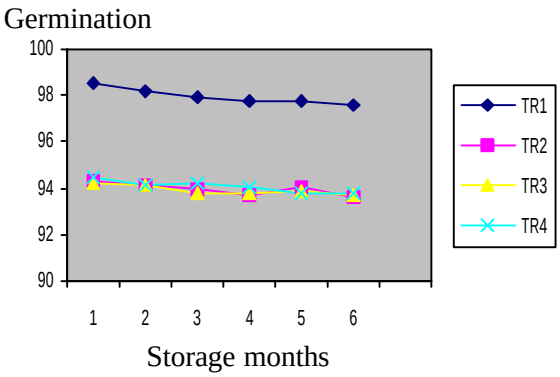

Figure 4: Germination percentage of RD10.

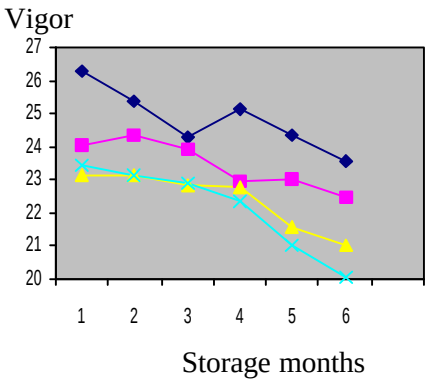

Figure 5: Vigor index of SPB60.

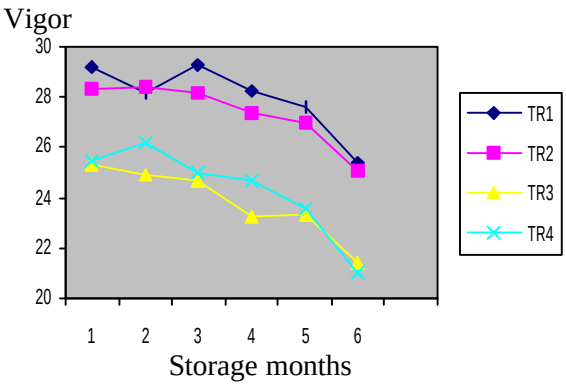

Figure 6: Vigor index of RD10.

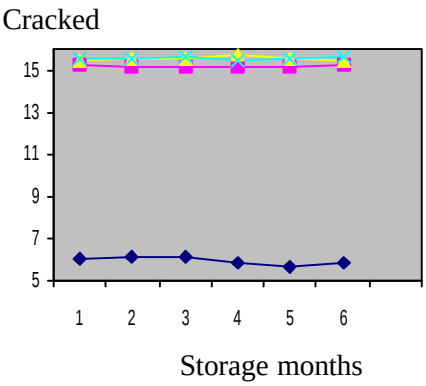

Figure 7: Cracked seed of SPB60

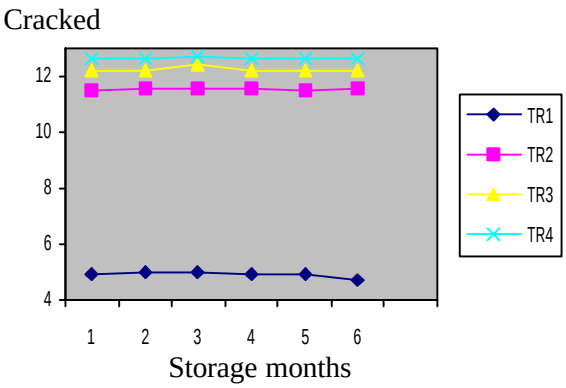

Figure 8: Cracked seed of RD10

Discussion

Genetic character showed high influence on seed qualities. After spraying Dimethipin physiological maturity can be increased by reducing the time of harvest and caused lowest moisture content in the seed. Dimethipin affects on guard cells, which controls stomata. As a result, stomata always remain open and rate of losing plant water increases (Benyak 1987). Spraying of Dimethipin did not show any influence on 1000 seed weight but it decreased germination percentage and vigor along with increasing cracked seed percentage, which resulted the decreasing the seed quality. Harvesting of seed at field maturity also affected on seed qualities. Harvesting the seed at physiological maturity and storage in the shade for drying the seed showed lowest effect on seed quality. Therefore, it was recommended to use this method for harvesting rice for seed production in tropical region.

Conclusion

Rice varieties had effect on seed moisture content, germination percentage and vigor. Dimethipin has advantages to reduce time to harvest, however it has got also adverse effect on seed quality. Nevertheless, harvesting and storage the seed in the shade can give the best quality seed.

Acknowledgments

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