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Vacuum Seal and Drying for Better Viability and Storage of Soybean Seed.

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Abstract
Soybean seed, S.J.4 variety, was processed and dried by closed circuit dryer to 12, 10, 9 and 8 percentage moisture contents. Seeds were bagged in plastic bags, in laminated-nylon plastic bags by vacuum sealing, in plastic bags by heat-sealing and woven-polyethylene plastic bags by machine bagging. They were stored under ambient conditions for 8 months. The results of moisture content of seeds stored in plastic bags and laminated-nylon plastic bags at each initial moisture level remained constant. Seeds in heat-sealed plastic bags slightly changed but were lower than seeds in woven-polyethylene plastic bags, which at each initial moisture level increased and had the highest moisture content throughout the storage period. The germination results of soybean seeds in plastic bags and laminated-nylon plastic bags by vacuum-sealing were 70 per cent when stored at the moisture content of 8 to 9 percent but at a moisture content of 12 per cent, they decreased in viability rather rapidly to 49.75 germination percentage within 5 months. Seeds in heat-sealed plastic bags, at levels of 8, 9 and 10 percentage moisture, had 70 per cent germination after 6 months, but when stored at a moisture level of 12 per cent, germination dropped to 67 per cent only within 2 months. Seeds stored in woven-polyethylene plastic bags at each initial moisture level dropped in viability most rapidly. Particularly seeds stored at 12 percent moisture content could not germinate at all after 4 months in storage.

Introduction
Seed storage condition plays an important role in seed production system. Good storage condition can reduce deterioration rate of seed. Tropical region has high relative humidity that affects on seed storage quality. Seed can be stored only in 3-4 month in uncontrolled atmospheric condition. Seed moisture content, Relative humidity and temperature during storage are responsible for the main effect on seed storage quality (Minor, 1982; Klassen 1983; Chistensen and Kaufmann, 1974). In high relative humidity, seed moisture content can be increased to equilibrium moisture content by absorbing moisture from the air (Clark and Bass, 1975; Bass, 1975). The high moisture content seed result high respiration rate, biochemical activities and degradation of food storage (Delouche and Welch, 1975; Bass and Clark, 1974). Preamjit (1975) found that seed storage at 20^{O}C could maintain their 90 percent germination in 9 months storage while stored the seed at 30^{O}C had only 5-10 percent germination. Effect of moisture content and temperature can regulate the storage ability of the seed. Soybean seed with 7% moisture content in sealed package maintained germination by more than 70 % in

comparison to atmospheric storage (Nangju *et al*., 1980). Plastic bin and sealed plastic bag had no significant effect in soybean seed quality during 10 months storage (Sorachat *et al*, 1977). Therefore in order to find the optimum pre-storage seed moisture and suitable seal package, this experiment was conducted.

Material and method

SJ4 variety soybean obtained from Lampang province at 3rd Seed Center, Thailand. The experiment was design in 4^2 Factorial designs in CRD. Seed moisture content was 14% before drying. Seeds were dried by closed circuit dryers at 105^{O}F and 8000 ft^3/min in order to reduce moisture content into 4 levels: 12%, 10%, 9% and 8% Seeds from each moisture content level were filled in 4 package as follow: the first was 4 mm. 2 layer vacuum sealed plastic bag (VPB), the second was laminated-nylon plastic bags (LNPB), the third was 4 mm. heat sealed plastic bag (HSPB) and the last was woven-polyethylene plastic bags (WPB). Seeds were stored for 8 months and each month evaluated the seed moisture content, germination percentage and seed vigor by accelerated aging test.

Results

From this study it was found that the type of package had significant effect on seed moisture content (figure 1-3). For seed moisture content during storage, seed moisture content and packaging had high significant interaction. LNPB bag was lowest change followed by VPB and HSPB bag. However WPB bag was highest significant change among all level of seed moisture content.

Pre-storage seed moisture content showed highly significant effect on germination percentage. At 12% moisture content, WPB and HSPB bag lost viability with in 4 and 6 months after storage while LNPB and VPB bag had 70% germination at the third months of storage and had 17.50-23.50 % germination after 8 months. Seed moisture content lower than 12%, the germination percentage from LNPB, VPB and HSPB bag showed higher than 72% at the end of storage. Soybean seed with 9% and 10% moisture content, WPB bag was lost viability within 6-7 months. Using LNPB and VPB bag with 8 % seed moisture content showed germination percentage higher than 80% after 8 months storage and higher than 70% in soybean seed with 9% and 10% moisture content while seed with 12% moisture content was not suitable for storing in all packages.

Regarding seed vigor, effect of seed moisture content found to be highly significant. At 12% moisture content, all seed packages lost their vigorous with in 4 months. Packaging and seed moisture content showed highly significant interaction. Using 10 % seed moisture content with LNPB, VPB, HSPB and WPB seed package, resulted seed vigor more than 70% after 2, 4, 5 and 7 months storage while at 8% and 9% seed moisture content showed vigor level more than 70% after 8 months storage. HSPB package could be stored for 6-7 months while WPB package could be stored for 2-3 months.

Pre-storage moisture content of soybean seed

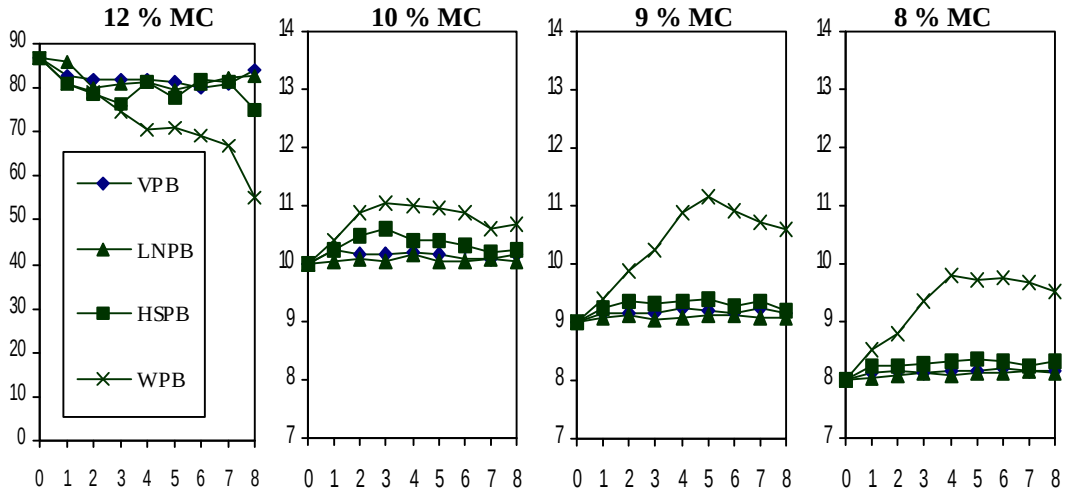


Figure 1-4 Showed moisture content of seed during storage of 8 months

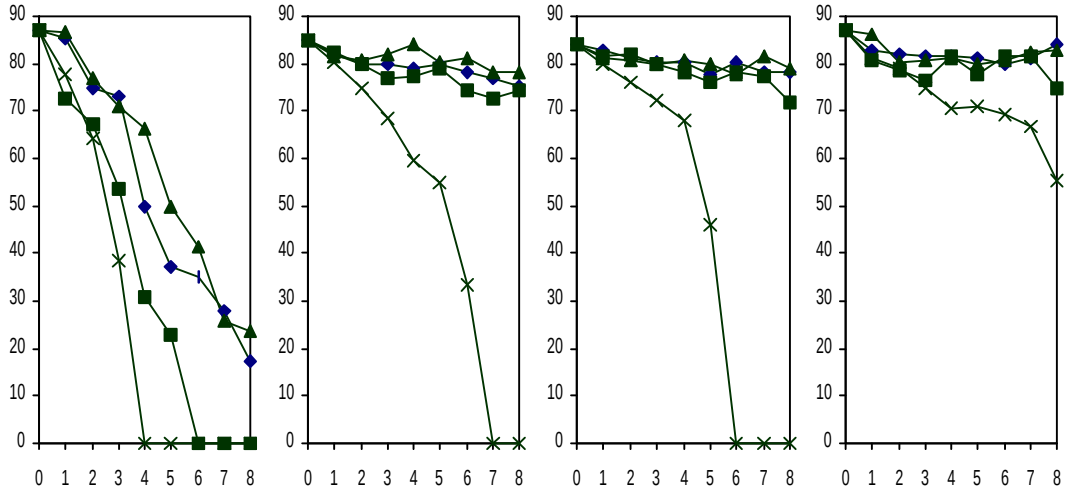
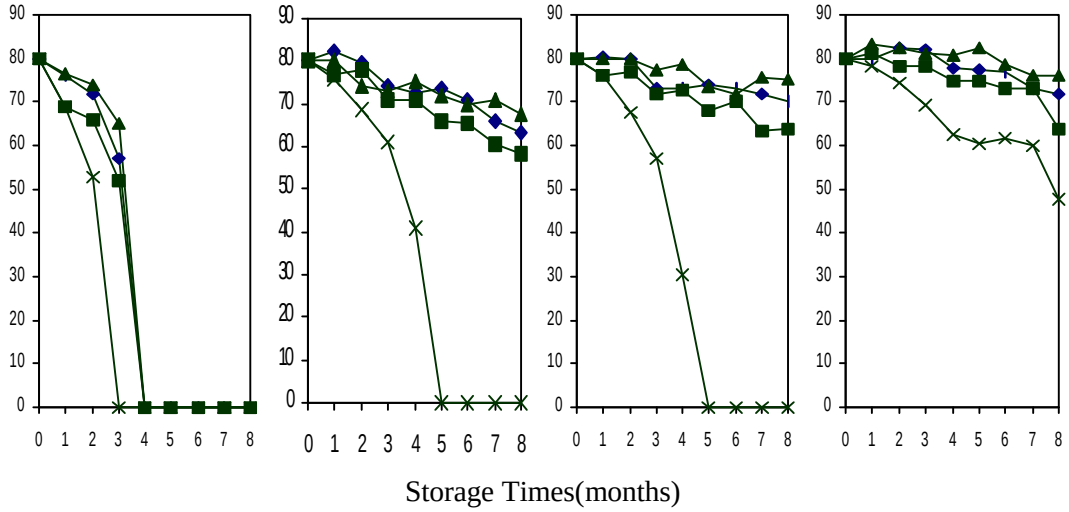


Figure 5-8 showed germination of seed during storage of 8 months



Storage Times(months)

Fig 9-12 showed seed vigor during of 8 months storage

Discussion

This study showed that the type of package had effect on storage ability. Cost of package and handling were considered as reasonable cost for seed storage. Moisture

content of seed had effect on seed storage quality in uncontrolled atmospheric condition. Seed in LNPB bag is appropriate for 8 months storage. VPB and LNPB are also suitable for high germination and vigor at 8 months storage. However, VPB is costly and need to be careful of handling during storage to prevent leak of package. For short-term storage (2-3 months), seed with 9% moisture content in WPB bag is suitable and can reduce the cost of package.

Conclusion

Pre-storage moisture content of soybean seed has effect on storage ability. More than 10 % pre-storage seed moisture content are able to reduce germination and vigor of seed. Plastic bag of 70 micron vacuum-sealed with 15-micron nylon coating has high efficiency for long term storage.

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References

Christensen C. M. and Kaufmann H. H. 1974. Storage of cereal grains and their products. The University of Minnesota Press. 238 page.

Klaassen G. 1983. Seed storage. International course on seed technology. University of Phillippines. Los Banos college, Laguna. 58 page.

Minor H. C. 1982. Variation in storability of soybeans under simulated tropical condition. Seed Sci. and Technol. 10, 131-139.

Preamjit D. 1975. Effect of temperature and storage time to 9 varieties of soybean seed. Department of Agriculture, Experimental and research annual report 1975. Pp. 85-87.