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**SEED QUALITY AND STORAGE PERFORMANCE IN
MUNGBEAN AND PEANUT**

A thesis presented in partial fulfilment
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ABSTRACT

SEED QUALITY AND STORAGE PERFORMANCE IN MUNGBEAN AND PEANUT

Five seedlots of mungbean and three seedlots of peanut were assessed for seed quality using six standard laboratory tests *ie.* purity analysis, seed moisture content, germination, seed health, and two vigour tests (accelerated ageing, and conductivity (electrolyte leakage)). These testing methods were valuable as the results allowed distinction of quality differences between seedlots which were used to explain the possible cause or causes of poor quality in each seedlot, eg. high seed moisture content, low viability or vigour, mechanical damage, or fungal infection. The three highest quality seedlots of mungbean (lot 1 cv. Chinese, lot 2 cv. Berken, and lot 3 cv. Regur) and one seedlot of peanut (cv. Spanish White) were identified (germinations 88, 94, 94 and 72 percent before, and 55, 51, 66 and 67 percent after accelerated ageing), and selected to use in a subsequent seed storage experiment. Seeds were stored under different conditions involving two seed moisture contents (8.6% and 13.4% for mungbean, and 6.6% and 11.5% for peanut), two storage containers (in aluminium foil packets representing sealed storage, and muslin cloth bags representing open storage) and various temperature/ relative humidity regimes (30°C/95%RH and 20°C/75%RH for mungbean, and 30°C/50%RH, 20°C/75%RH, 5°C/85%RH, and 30°C/95%RH (open storage only) for peanut). Effect of initial seed moisture content or relative humidity, packaging and temperature on seed moisture content, germination percentage, conductivity leachate and seed health of each lot was studied at two monthly intervals during an up to eight months storage period.

In all cases, deteriorative changes were higher in open storage at high relative humidity (95%) at 30°C than at lower level relative humidity and temperature regimes. At 30°C/95%RH, seed moisture content of both mungbean and peanut seed open stored initially at low and high moisture content increased markedly to equilibrium with the

prevailing relative humidity (15-18.4%SMC in mungbean and 12.4-12.7%SMC in peanut at 2 months storage). Under these conditions all seed all seedlots lost germination after one month (peanut) or six months (mungbean) and loss of electrolytes from seeds into steep water also increased markedly with increasing storage time. Levels of infection by field fungi decreased rapidly with a concomitant rapid increase in invasion of storage fungi, such as *Aspergillus glaucus*, *A. flavus*, *A. candidus*, *A. ochraceus* *A. niger* and *Penicillium spp.*

Open stored dry and wet seedlots at lower temperatures/relative humidities of 20°C/75%RH for mungbean, and 30°C/50%RH, 20°C/75%RH, or 5°C/85%RH for peanut, reached equilibrium moisture contents of 11.3-12.7%, 3.8, 6.5, and 7.2% after 8 months storage, respectively. Mungbean seed germination and vigour was maintained appreciably for 8 months, while peanut seed stored at an initially high moisture content showed a marked decrease in quality, particularly at 30°C. Fungal infection was generally low.

Throughout the storage period seed moisture content in sealed storage at all temperatures did not change from initial levels (8.6% or 13.4% in mungbean and 6.6% or 11.5% in peanut). Initial seed moisture content greatly affected seed germination, conductivity leachate and fungal infection, particularly in peanut seeds. Loss of peanut seed germination and seed vigour both increased with increasing seed moisture content and storage temperature. Peanut seeds stored at a higher initial level (11.5%SMC) lost all germination after 2 months storage at 30°C, after 6 months at 20°C and retained near initial levels of germination after 8 months at 5°C. In mungbean seeds stored at 13.5% SMC, seed germination and vigour were affected after 8 months storage at 30°C, particularly in poorer quality lots. The main storage fungal infection was *A. glaucus* but at low levels in all cases.

Deteriorative changes were more rapid in initially poorer quality lots than in initially higher quality lots of both mungbean and peanut seed.

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CHAPTER 1

INTRODUCTION

Mungbean and peanut are important legumes which are widely grown in many countries in subtropical and tropical climates. In Thailand, these crop species are grown as a cash crop after rice and other maincrops such as maize, or cotton. Estimated planting areas of mungbean in Thailand are about 450,000 hectares (Chainuvati and Charnnarongkul, 1990) and about 118,000 hectares (Jogloy, *et al.*, 1991).

Yield and quality of these legumes is generally low due to the planting of poor quality seed. Although high quality seed is produced by the official government agencies such as the Seed Division of the Department of Agricultural Extension, the amount available is generally insufficient to meet planting requirements. Therefore many growers are forced to purchase poor quality seed for planting from local merchants which often results in low financial returns from the subsequent crop.

Poor seed quality is due mainly to seed deterioration during storage since, mungbean and peanut seeds are normally required to be stored for about 6-8 months from harvest to the next planting season. Such storage is usually under ambient conditions of high temperature (around 30°C) and relative humidity (above 85 %).

The deterioration rate of seed is caused by its inherent characters (Delouche *et al.*, 1973). In peanut seed in particularly high oil content makes it difficult to successfully prolong seed viability (Woodroof, 1973). Moreover, pre-storage history and storage conditions also influence seed storability (Delouche, *et al.* 1973; Justice and bass, 1978; Roberts, 1986) since adverse environmental conditions eg. high temperature and high relative humidity or frequent rainfall during seed development, and maturation, and at harvest result in 'seed weathering' and high seed moisture contents which lead to increased susceptibility to infection by pathogens and to bruising during mechanical harvesting. The

traditional sun drying of seed to very low moisture contents can also lead to seed cracking damage during threshing and processing, particularly where inappropriate methods, for example, high cylinder velocity mechanical threshing systems are used (Justice and Bass, 1978; Heslehurst *et al.*, 1987). These factors can all contribute to poor seed viability prior to storage, a situation which continues in storage, particularly if seed is stored at high temperature and high relative humidity or high seed moisture content (Barton, 1961; Delouche *et al.*, 1973; Justice and Bass, 1978). Under adverse storage environments storage fungi also play an important role in speeding up the processes of seed deterioration (Christensen, 1972, 1973; Neergaard, 1977; Agarwal and Sinclair, 1987).

Under tropical humid climates (of high temperature and relative humidity) such as that experienced in Thailand, these leguminous orthodox seeds require dry and cool conditions for viability preservation. Thus, in ambient storage conditions seeds may become non-viable in a short time and often well before the next sowing season. In some cases, seeds are stored at lower temperatures, but dehumidified cold storage is a much better solution. The compromise is often considered to be storage in an air conditioned room at 20°C, as a compromise but cheap for seed storage system (Hill, 1995b). Moisture-proof packaging such as the storage of seed in aluminium foil packets can be an improved option to maintain low seed moisture content under high ambient relative humidity and to protect seeds from pest invasion (Justice and Bass, 1978; Arvier, 1983). However, it is not always appreciated that the level of seed moisture content for moisture-proof packaging needs to be considerably lower than for open storage to be effective (Hill, 1995b). Safe sealed storage moisture levels vary depending on crop species, as well as storage temperature and duration. The question is "what options are most suitable for short-term storage of mungbean and peanut seed in Thailand".

Since pre-storage history remains an important factor influencing the preservation seed viability, the present study was carried out in an attempt to evaluate laboratory seed testing methods to determine initial quality of different seedlots of mungbean and peanut

and to explain the likely causes or causes of differential pre-storage quality of different seedlots. Similar work on maize has been carried out by Sakunnarak (1985), and maize and soybean by Koolkaew (1991). Understanding more about the relationships between seedlot differences, initial seed moisture content and quality, and of the packaging and storage environment on mungbean and peanut seed performance during storage will help to select appropriate storage conditions for these legumes in Thailand. Therefore, the present study aimed to :

1. determine the value of different laboratory methods for assessing pre-storage history.
2. determine the effects of different storage conditions on seed deterioration rate.
3. compare relative storability differences between mungbean and peanut seed.
4. establish recommendations which could be implemented to increase seed storage life of mungbean and peanut seed in Thailand.