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A STUDY OF DRYING, THRESHING AND STORAGE CONDITIONS ON THE VIABILITY OF SOYBEAN SEEDS WITH A SUPPLEMENTARY STUDY OF THE EFFICIENCY OF A SIMPLE DRYING METHOD DEVELOPED.

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF AGRICULTURAL SCIENCE IN SEED TECHNOLOGY AT MASSEY UNIVERSITY NEW ZEALAND

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ABSTRACT

This study was designed to investigate the relevance of post-harvest factors in maintaining the viability and storability of soybean seeds. In order to obtain high quality seeds for the drying and storage aspects of the experiment, the sequence of seed development and physiological maturity of the crop was investigated to ascertain maximum viable seed yield. The soybean cultivar 'V-53' was sown and plants were randomly sampled at 32 days after peak flowering, and subsequently every 5 days until the seeds reached physiological maturity. The changes in seed moisture content, fresh weight, dry weight, percent germination and maximum viable seed yield in relation to time after peak flowering were measured. The soybean crop achieved a maximum viable seed yield of 1344.1 kg/ha 77 days after peak flowering. The development of the crop was prolonged by adverse weather conditions. After soybean seeds reached physiological maturity, the crop was harvested at a seed moisture content of 49.2% and germination of 96%.

Further studies were carried out to investigate those factors that affect seed viability before and during storage. The drying effect on seed viability was made by comparing the effect of 6 different drying methods i.e. dehumidification, refrigeration, ambient air and heated air at 30^{o}C, 40^{o}C or 50^{o}C. Seeds were dried to 8% moisture content in each case. Delays between harvest and the commencement of drying operations result in a decline of seed germinability, particularly in seedlot which was later used in the refrigeration drying system. Although drying method had no immediate effect on seed viability during drying, drying seed by refrigeration method was time consuming the drying rate being too slow and resulting in subsequent seed deterioration. The heated air methods were most efficient in assisting removal of moisture from the seed. Following drying, seeds were threshed from the pods by hand threshing or beating threshing methods. Seeds from different drying and threshing treatments were stored under 20^{o}C - 40%RH or 35^{o}C - 90%RH conditions for 16 weeks. The threshing of seed using a beating method caused a significant reduction in seed germinability when compared to the hand system used to remove seed

from the pod. Drying method had no significant effect on seed storability when seeds were stored under good storage conditions i.e. 20°C - 40%RH. However, when seeds were stored under poor storage conditions i.e. 35°C - 90%RH, seeds previously dried at 40°C and 50°C using heated air showed a more severe drop in germination after only 2 weeks when compared to seeds dried by 30°C heated air. The effect of unheated air on seed storability was possibly not detected since there was wide variation in the results and the storage conditions of 35°C - 90%RH had severely affected seed viability after only 4 weeks storage. Seeds stored under 35°C - 90%RH conditions rapidly gained moisture to a relatively high level. This high moisture content in seeds accelerated the rate of deterioration and favoured the growth of storage fungi which were greatly responsible for loss of viability. Although there was a reduction in the germination capacity of seed stored under 20°C - 40%RH conditions after 16 weeks, these conditions were vastly superior to storage conditions of 35°C - 90%RH. In the present study, the effect of drying method was not as important as storage conditions in maintaining seed viability. However, with proper harvesting, drying and threshing the problems of maintaining high level of seed viability could be eliminated.

A separate drying experiment was carried out to evaluate the possible use of the 'Kiwi' drier and its efficiency in drying various seed crops. The 'Kiwi' drier was designed at the Seed Technology Centre and consists of a cylindrical metal drum containing 2 metal tubes filled with silica gel as a dessicant. As presently constructed the drier resulted in very slow and inefficient drying of barley, pea and Tama ryegrass seeds. However, results suggest that by redesigning certain features in the 'Kiwi' drier to improve air circulation and increase the area of close contact between the silica gel and the seeds it's seed drying efficiency could be greatly improved. In addition, the 'Kiwi' drier provides an ideal storage container for seeds in tropical climates.

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GENERAL INTRODUCTION

Soybean is one of the major cultivated legume crops grown in the North, Central Plain and Northeast of Thailand. Demand for soybean grains has increased rapidly over recent years due to the expansion of domestic feed and oil extracting industries and new market development in neighbouring countries. Although government policy has been to encourage expansion of the soybean acreage, its production has not met the market demand. The rapid expansion of soybean acreage resulting in a great demand for high quality seeds has become a major problem confronting local farmers in their efforts to commercialise the crop. To overcome problems arising from an insufficient supply of high quality seeds produced under government seed production schemes, farmers have been forced to store their own seed stocks. However, the traditional seed saving practices used by farmers does not retain the viability of seed from harvest until the next planting season.

The present study was undertaken to obtain more information of the problems involved in handling soybean seed after harvest. Investigations were made on seed drying aspects, the effects of threshing method and the influence of the storage environment on the viability of stored soybean seed. To produce high quality seed for the experiment, physiological maturity of soybean seeds were produced, seeds being harvested at maximum viable seed yield. Comparisons were made between the effects of 3 different heated air systems and also the use of unheated air, refrigerated air and the chemical dehumidifier drying systems.

Storage performance of seed samples which had been subjected to different drying and threshing treatments was studied over a period of 16 weeks in both good (cool and dry) and bad (hot and humid) storage environments.