# THE EFFECTS OF DRYING METHODS AND STORAGE CONDITIONS ON PEA SEED (*Pisum sativum* L.) QUALITY AND THE RELATIONSHIP BETWEEN HIGH TEMPERATURE DRYING AND MAIZE SEED (*Zea mays* L.) STRESS CRACKS.

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**NGUYEN XUAN THUY**


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Dedicated to my parents and my lovely children

# ABSTRACT

High temperature and high relative humidity adversely affect the quality of seeds, and are features of tropical climate. Seed drying and storage are being used increasingly in developing countries to improve seed storage and quality. This study was undertaken to evaluate a range of seed drying methods and storage conditions with the view to selecting an appropriate method(s) for use in tropical countries.

Pea (*Pisum sativum* **L.**) seeds at three initial seed moisture content (m.c.) of 23.8, 18.0 and 14.5% were dried to 10% seed m.c. before storage. The performances of four different drying methods: artificial dryer (Kiwi Mini) set at 30°C or 45°C, natural sun drying, and in-bin natural ventilation drying were evaluated. Natural sun drying, and in-bin natural ventilation drying were conducted from March to May, 1997, when mean temperature and relative humidity during sunny days were 17°C and 60% respectively. The dried seeds were stored under two conditions: open storage at 20.5°C and 55% relative humidity (r.h.), and closed storage at 25°C and 90% r.h. for 20, 40, and 60 days.

Time and energy consumed for drying by the different methods were determined to compare the drying efficiency when combined with quality of the seed. Deterioration of the seed due to storage conditions and drying methods used was determined by assessing their effects on seed germination, abnormal seedlings, dead seed, hollow heart percentages, and conductivity.

Seed samples dried by the Kiwi Mini dryer set at 45°C took 7 hours and those set at 30°C took 17 hours. It took 54 hours with natural in-bin ventilation drying, while sun drying took 37 hours. However, energy consumed when drying seeds at 30°C was 17 kWh, which was more than twice that at 45°C. Seed germination was not significantly different between drying methods, but averaged only 75% because of

sprouting damage of the crop prior to harvest. Germinations after open and closed storage for 20 days did not differ, although some differences appeared after 40 days of storage. However, open and closed storage for 60 days significantly reduced seed germination to 54 and 33% respectively.

Because seeds are heat-sensitive, drying air temperature and drying rate are particularly important to avoid internal seed breakage, cracking and splitting, fungal growth, and loss of germination and vigour. Selected studies have shown that seed can be dried at high temperature for a short time, followed by tempering to re-distribute moisture and temperature inside the seed, thus reducing the percentage of cracking.

Thus, a second experiment was conducted with maize (*Zea mays* **L.**) to study the impact on seed viability of high temperature drying followed by tempering. Maize at 28.5% initial seed m.c. was dried at 60°C for short periods of 5, 10, 15, 20, or 25 minutes, followed by tempering for 45 minutes at either 30°C or 21°C. This cycle was repeated until maize seeds were dried to 13.0% m.c.. The percentage of cracked seeds, germination immediately after drying, and after an accelerated ageing test, did not differ between 30°C and 21°C tempering. Drying exposure times of upto 10 minutes per cycle at 60°C caused vertical cracks in up to 50% of seeds, but seed germination remained over 90% and seed vigour was also maintained. The percentage of seeds with stress cracks due to high temperature drying (5 - 25 minute cycles) at 60°C followed by tempering had polynomial relationships with seed germination and vigour. Seeds dried at the same temperature without tempering had their germination reduced from 99 to 20%.

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