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Secretariat CFCS
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or from:

CFCS Treasurer
Agricultural Experiment Station
Jardín Botánico Sur
1193 Calle Guayacán
San Juan, Puerto Rico 00936-1118

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INFLUENCE OF PAPAYA SEED AGE ON VIABILITY

J.E. Bernier, C. Montilla, and T.W. Zimmerman. University of the Virgin Islands Agricultural Experiment Station, USVI

ABSTRACT: Papaya (*Carica papaya*) has a gelatinous sarcotesta surrounding the seed that can reduce germination due to inhibition of oxygen to the seed. However, removal of the sarcotesta allows the seeds to dry quicker and more exposure to oxygen. The viability of the clean seeds, sarcotesta removed at harvest, and held under refrigerated storage was not known. The objective of this research was to study the viability and germination of seven papaya lines, with seeds from 2006 to 2012. Seeds were imbibed in vitro for one week and a tetrazolium test for seed viability was applied. Seeds held in storage from 2006, 2008, and 2010, and fresh harvested seed from 2012 were planted (replicated) under greenhouse conditions. Germination was recorded over a 33-day cycle. There was great variability in germination between lines. For all papaya lines, the 2008 seed had the poorest germination, ranging from 10% to 60%. Papaya seed loose viability over time under refrigerated storage. This research was supported by USDA-Hatch and USDA-NIFA-Insular Tropical Grant funds.

Keywords: sarcotesta, *Carica papaya*, heat drying seed desiccation

Introduction

Papaya fruits contain a great number of seeds in the middle cavity; however, some of these seeds may lack embryos (Nagao and Furutani, 1986). High rates of germination and development of healthy seedlings can be obtained by using seeds from ripe or over-ripe fruits from which the sarcotesta is removed (Sangakkara, 1995). Sarcotesta is a fluid filled membrane surrounding the papaya seed. Removal of the sarcotesta, followed by rinsing and drying, results in increased germination (Angeline and Ouma, 2008; Salomao and Mundim, 2000; Yahiro, 1979). Seed germination is affected by many factors, which include type of substrate used, environmental factors such as oxygen, water, temperature, light, and variety (Hartmann et al., 2001). The objective was to evaluate papaya seed germination and viability of seeds from 2006-2012, stored at 4^{o} C.

Materials and Methods

Seven different papaya seed lines were used for this germination trial. The seeds were from the papaya lines 'Maradol', MarxT5, MarxY, T5, TNG5, TW, TWxT5 that were collected and cleaned in 2006, 2008, 2010 and 2012. Some of the 2012 seeds, TWxT5, TNG5 and MarxY, were dried at 33^{o} C in a food desiccator for 24 hours to speed drying, while the other seeds were air-dried on paper towel for four days. Fifty seeds were isolated from each papaya line and year from stocks stored at 5^{o} C. The seeds were divided into groups of 25 for planting in 10 cm square pots that were 7.5 cm deep containing ProMix™ potting media. Each pot was labeled and watered thoroughly. The pots were placed on a bench in a greenhouse and watered when the surface indicated dryness. Germination was when the seedling broke through the surface of the potting mix. Data on the papaya seed germination was collected four times a week and inputted into an Excel spreadsheet for data analysis. Tetrazolium was used to test fresh seeds for viability. A solution of 0.5% was used on imbibed seeds in the laboratory.

Results and Discussion

After treatment with tetrazolium the seeds became pink and some red after 24 hours. A microscope was used to obtain a closer look of the seeds that stained different colors from the tetrazolium. All the seeds in the greenhouse trial began germinating after the thirteenth day. The T5 seeds from the year 2012 had 100% germination while the others had decreased germination based on age (Figure 1). There was no change in germination after day 25 (Figure 1). For T5, seed age had a strong influence on seed germination. It is an expected trend that seed viability decreases with age. The 'Maradol', MarxT5 and TW varieties showed similar trends as T5 for germination and seed age.

The 2012 TWxT5 variety showed a poor germination rate, similar to that of the MarxY variety (Figures 2 and 3). Germination of the 2012 TWxT5 seed stopped at 40%, whereas MarxY only reached 32% (Figures 2 and 3). These poor germination trends in the fresh papaya seed may be due to the use of the food desiccator method which could have over-dried the seeds in 24 hours at 33^{o} C. The rapid drying at 40^{o} C temperature was thought to cause damage to the papaya seed, affecting the embryo and/or the endosperm reserves (Saomao and Mundim, 2000; Sangakkara, 1995). The difference between the sets of MarxY seeds can be seen in the density of the seedlings in the tray of one replicate taken three weeks after germination (Figure 4). MarxY year 2010 germinated the best with 95% germination (Figure 3). After two years of storage, seed germination rate was 85% or above for all papaya lines. The 2008 seeds of MarxY had a lower germination rate than 2006 seeds. The seedlings that germinated for the MarxY variety were healthy and green (Figure 4). The photograph for MarxY clearly indicates 2012 seed as the lowest in germination, with few seedlings (Figure 4).

Conclusion

Tetrazolium indicates cell membrane activity but germination is needed for true indication of viability. Papaya seed viability decreases with age over six years. Seed viability can be maintained for seeds that are air-dried and stored in the refrigerator at 4^{o} C. Seeds stored for six years, when properly cleaned and dried at ambient temperatures prior to storage, can have 40-60% viability. Drying cleaned seed at ambient temperature maintains viability while placing seeds in a food desiccator at 33^{o} C for 24 hours can significantly decrease seed viability.

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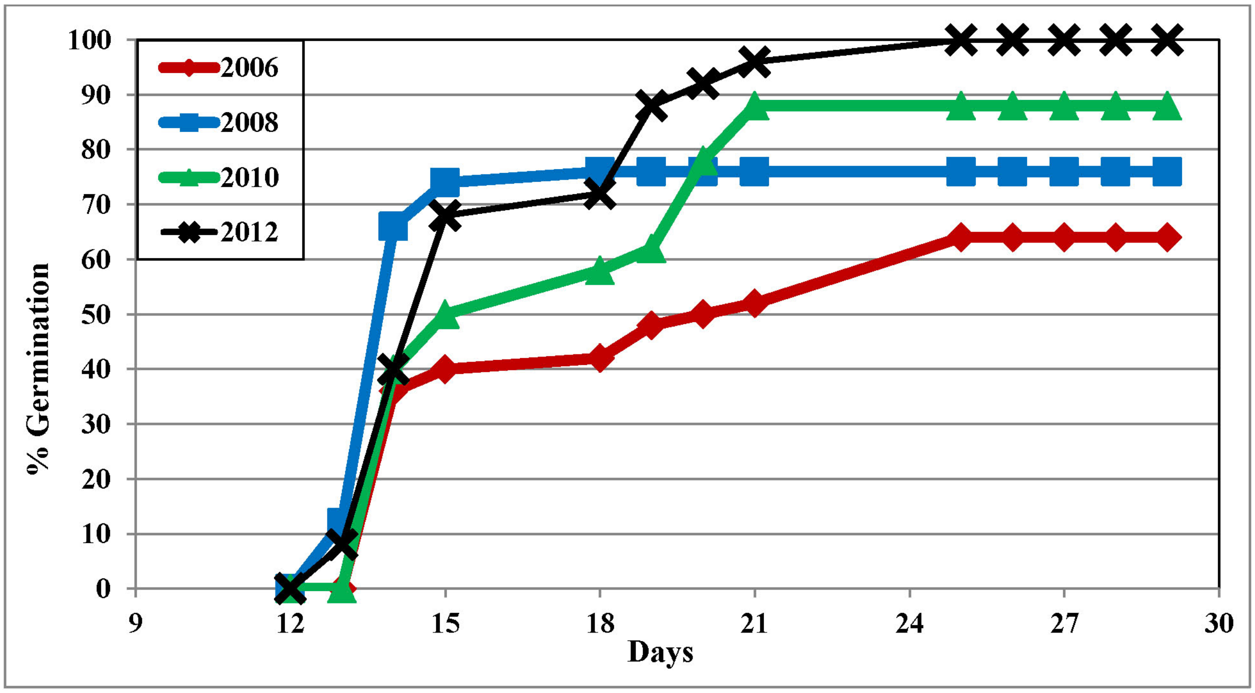

Figure 1. Papaya seed germination over time for four ages of line T5.

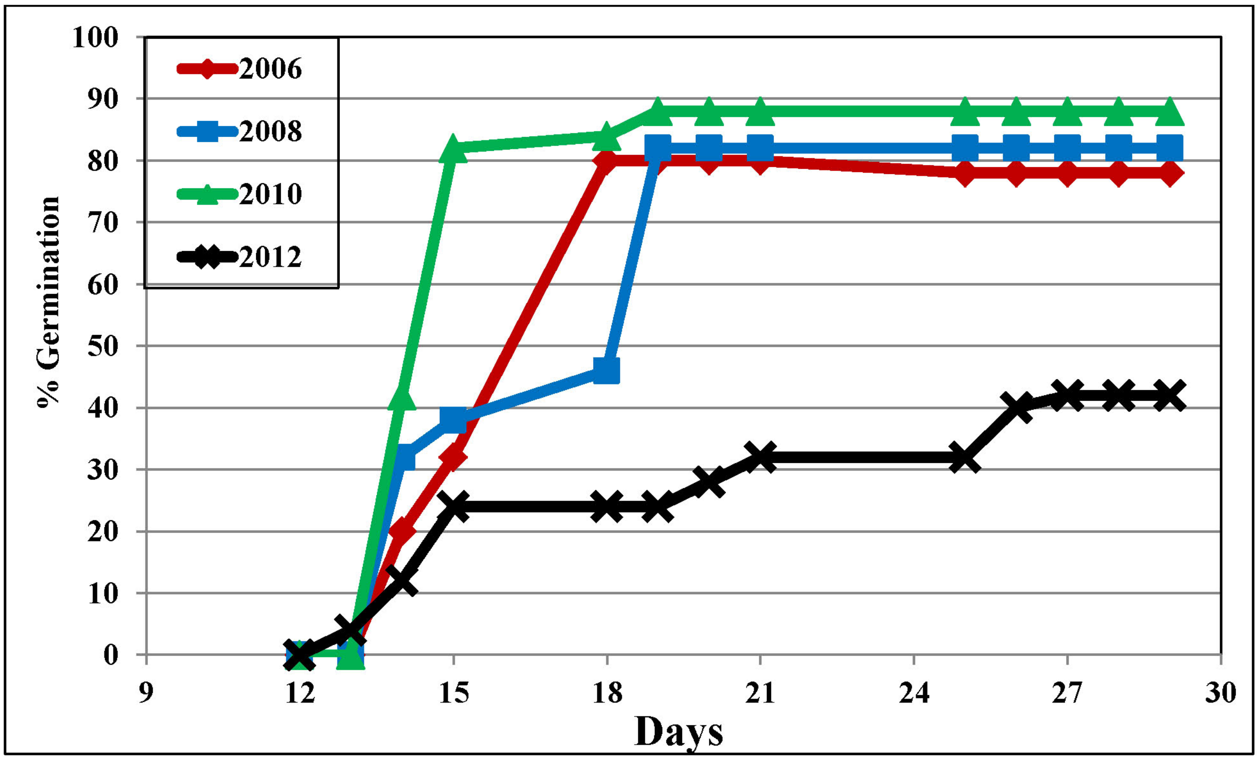

Figure 2. Papaya seed germination over time for four ages of line TWxT5.

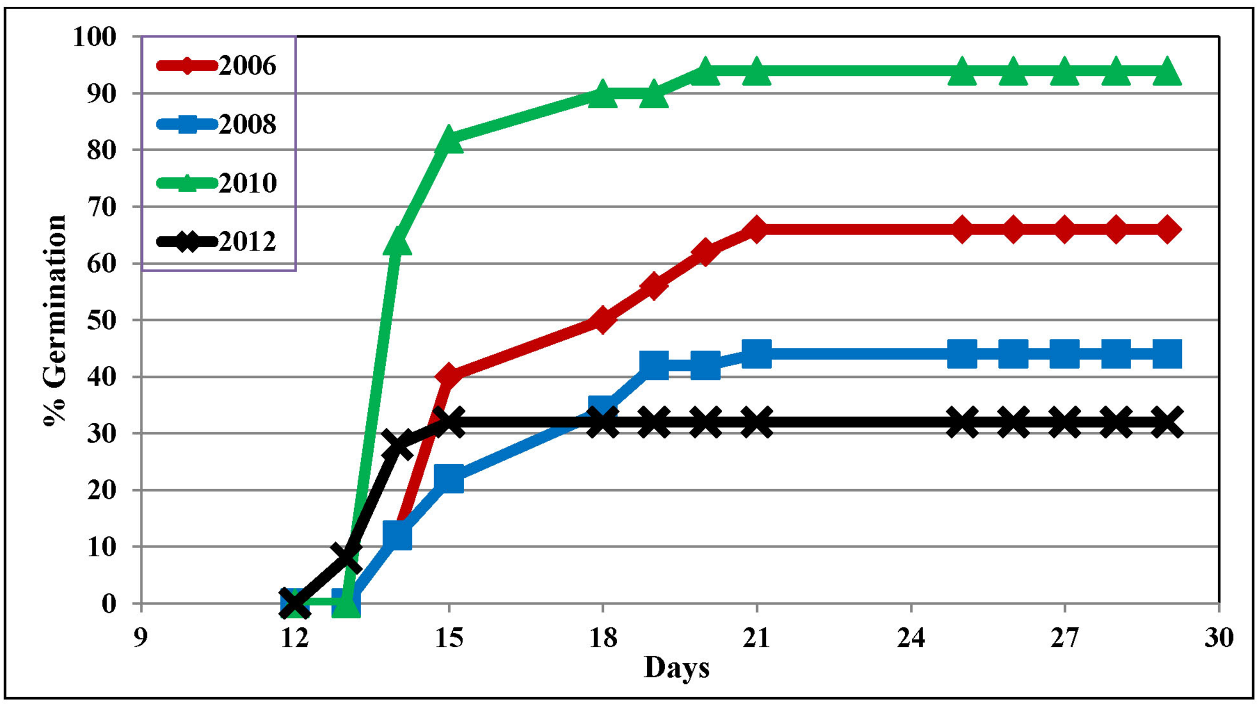

Figure 3. Papaya seed germination over time for four ages of line MarxY.

Figure 4. Papaya seedlings three weeks post germination for four ages of line MarxY.