

Influence of Preconditioning Temperatures on Papaya Seed Germination

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ABSTRACT

Germination of papaya (*Carica papaya* L.) seeds increased when preconditioned at 24°C before transfer to 32°C. Increasing the period of preconditioning at 24°C before transfer to 32°C increased germination, however, preconditioning at 32°C followed by transfer to 24°C did not increase germination. A 2 staged dormancy mechanism controlling papaya seed germination is proposed.

INTRODUCTION

Germination percent and rate were improved when papaya (*Carica papaya* L.) seeds were sown into heated beds under greenhouse conditions (Furutani and Nagao, 1987). However, when control and KNO₃ treated seeds were sown in vermiculite and kept in a growth chamber at constant 24°C or 32°C, germination was less than 16% (Furutani and Nagao, unpublished data). While some seeds require a minimum threshold for germination (Sachs, 1977), alternating (preconditioning) temperatures can improve germination of other seeds (Wagenvoort et al., 1981). The objective of this study was to observe the effect of preconditioning temperatures on papaya seed germination.

MATERIALS AND METHODS

Seeds were collected from fully ripe papaya *Carica papaya* L. 'Kapoho Solo' fruits (406 to 609 g) grown in the Puna district of Hawaii. Seeds were cleaned (sarcotesta removed), washed in distilled water for 10 minutes and blotted dry with absorbent paper towels. Seeds were preconditioned by placing in 3 cm (diameter) x 2 cm perforated, clear plastic containers and incubated in 45 x 5 cm clear plastic columns containing aerated distilled water. The column water temperature was maintained with thermostatically controlled heaters

within $\pm 1.00^\circ\text{C}$. The seeds were treated with 3 preconditioning temperatures. The treatments were (1) preconditioning for 0, 1, 3, 5, 7, and 30 days at 24°C and maintained at 32°C for germination, (2) preconditioning for 0, 1, and 7 days at 32°C and maintained at 24°C for germination or (3) preconditioning for 1 or 7 days at 32°C followed by a second preconditioning at 24°C for 29 or 23 days and finally maintained at 32°C. Following preconditioning, seeds were maintained in the aerated water columns during germination. The experiment was arranged in a completely randomized design with 4 replications (50 seeds/rep). Distilled water in the columns was replaced at 3 day intervals and germination (seed with 1.0 mm radicle) was monitored daily for at least 10 days after the last germinated seed.

RESULTS AND DISCUSSION

Longer preconditioning duration at 24°C resulted in increased germination upon transfer to 32°C (Table 1). Longer preconditioning duration at 32°C however, had little effect on germination at 24°C.

Germination at 32°C increased when seeds were first preconditioned at 32°C followed by further preconditioning at 24°C (Table 1). Higher germination occurred when

Table 1. Effect of preconditioning temperature(s) and duration on papaya seed germination.

Preconditioned at 24 °C and germinated at 32 °C		
Preconditioning duration (days)		Total germination (% + Sd)
0		9 ± 2.8
1		4 ± 1.0
3		13 ± 0.7
5		16 ± 3.3
7		29 ± 1.6
30		60 ± 13.8

Preconditioned at 32 °C and germinated at 24 °C.		
Preconditioning duration (days)		Total germination (% + Sd)
0		0
1		4 ± 1.3
7		2 ± 0.7

Preconditioned at 32 °C then 24 °C and germinated at 32 °C.		
Preconditioning duration (days)		Total germination (% + Sd)
32 °C	24 °C	
1	29	70 ± 6.1
7	23	45 ± 10.1

seeds were preconditioned 1 day at 32°C and 29 days at 24°C (70 %) compared to 7 days at 32°C and 23 days at 24°C (45 %).

A dormancy mechanism that is responsive to temperature appears in part to be responsible for the poor germination of papaya seeds. Preconditioning seeds at 24°C

prior to germination at 32°C releases seeds from dormancy. Seeds maintained at constant 32°C temperature exhibit poor germination. The preconditioning temperature is lower than that required for germination indicating that papaya seed germination is a 2 staged process. The internal changes occurring during preconditioning at the lower temperature are not known and are presently under investigation.

LITERATURE CITED

Furutani, S.C. and M.A. Nagao. 1987. Influence of temperature, KNO₃, GA₃ and seed drying on emergence of papaya seedlings. *Scientia Hort.* 32: 67-72.

Sachs, M. 1977. Priming watermelon seeds for low temperature germination. *J. Amer. Soc. Hort. Sci.* 102: 175-178.

Wagenvoort, W.A., A. Boot and J.F. Bierhuizen. 1981. Optimum temperature range for germination of vegetable seeds. *Gatenbau Wissenschaft* 46: 97-101.