Principes, 33(4), 1989, pp. 191–194

Influence of Temperature on Germination of Sabal causiarum Seed

WILLIAM J. CARPENTER

University of Florida, Ornamental Horticulture Department, Gainesville, FL 32611

ABSTRACT

Sabal causiarum seeds have no dormancy when fruit are harvested at maturity, the pericarp removed, and seed cleaned and planted immediately. Temperature governs the length of the germination period and the total percent of germinated seeds. Constant 25°, 30°, 35° or alternating 20°–30°, 25°–35° or 30°–40° C promote 97% to 100% germination. Less favorable temperatures of 20° and 40° C gave 48% and 16% germination respectively. The number of days required to 50% of final germination varied greatly with germination temperature. Seeds at constant temperatures of 20°, 35° and 40° C require 52 to 87 days for germination while at constant 25°, 30° and alternating 20°–30°, 25°–35° or 30°–40° C only 12 to 22 days were required. Seed viability was unchanged after dehydration removed 13% to 73% of total water contents of freshly harvested seeds, but reducing seed water content to 7.2% significantly increased the days to 50% of final germination. Seed storage for 21 days at 5° to −20° C did not reduce viability, however −10° and −20° C hastened germination by reducing the number of days required to achieve final germination.

Sabal causiarum, Puerto Rican hat palm, native of Puerto Rico and the Virgin Islands, is a cold tolerant palm with massive trunk diameter and maximum height of 50 feet (Fig. 1). Its growing range in the U.S.A. includes the coastal areas of the Gulf of Mexico, the south Atlantic states and southern California. Propagation and plant production are increasing in Florida's nurseries as demand increases for cold tolerant palms. Limited propagation research has been conducted using this palm genus. Basu and Mukhernice (1972) reported that *Sabal blackburnia* and *S. mexicana* require 120 days to germinate, but gave no information regarding the temperature or the germination percentages. Sento (1976) found the optimum germination temperature for *Sabal minor* was 25° C and most seeds germinated between 20 and 60 days. He also reported *S. minor* seeds need a few months for after-ripening prior to germination. Both Brown (1976) and Carpenter (1987) reported best germination of *Sabal palmetto* seeds at a constant 25° and 30° C with germination within 28 to 35 days. Carpenter (1988) reported that 93% to 98% of *Sabal etonia* seeds germinated at 25°, 30° and 35° C constant temperatures and found 13 to 31 days required for 50% of final germination. This research was conducted to provide recommendations for the handling and germination of *S. causiarum* seeds.

Seeds of *S. causiarum* were collected from an established planting on the University of Florida campus in November 1987 and used in this series of studies. After removal of the pericarps and cleaning, seeds were soaked in deionized water for 48 hours, surface dried, and dusted with Captan before planting in moist Canadian peatmoss in 10-cm petri dishes. Four replications of 25 seeds each, were placed in incubators at constant 20°, 25°, 30°, 35°, 40° and variable 20°–30°, 25°–35°, or 30°–40° C. Variable temperatures were alternated at 12 hour intervals. Germination counts were made weekly of seeds with radicle emergence. Total germination percentages and days required to 50% of final germination were calculated, and data were statistically analyzed in this and subsequent studies by Tukey's honestly significant difference test at the 5% level.

1. *Sabal causiarum* palm on the campus of the University of Florida.

Germination of 97% to 100% resulted when temperatures were at constant 25°, 30°, 35° or alternating 20°–30°, 25°–35°, 30°–40° C (Table 1). Germination percentages were greatly reduced at 20° (48%) and 40° C (16%). The temperature treatments had large differences in the number of days to 50% of final germination (Table 1). Constant temperatures of 20°, 35° and 40° C required 52 to 87 days to 50% of final germination, while constant 25°, 30° and alternating 20°–30°, 25°–35° or 30°–40° C only required 12 to 22 days. These results indicate *S. causiarum* has a broad optimum temperature range from 25° to 35° for maximum germination, and a range of alternating daily temperatures promote germination. This agrees with Hartmann and Kester 1983 that alternating diurnal temperatures promotes increased germination.

A study was initiated in November 1987

Table 1. Effect of alternating and constant temperatures on total seed germination and days to 50% of final germination of Sabal causiarum.

Temperature °C	Germination	
	Total Percent	Days to 50%
20	48	64
25	99	22
20–30	99	12
30	98	16
25–35	97	18
35	100	52
30–40	100	14
40	16	87
HSD,* 5% level	12	15

* Tukey's honestly significant difference test.

to determine the effect of reduced seed moisture content on seed viability. Four replications of 50 seeds each, were weighed and placed in open petri dishes in 40° C forced-draft drying ovens for 0, 6, 12, 24, 48 or 72 hours. Immediately following dehydration, seeds were reweighed and sealed in screw-capped 25-ml glass vials, 50 seeds per vial. Following 3 weeks storage, the dehydrated 50 seed replicates were reweighed, soaked in deionized water for 24 hours, and germinated in constant 30° C incubators in 10-cm petri dishes containing moist peatmoss. Germination counts for treatment replicates were made weekly and data statistically analyzed. Three days following seed collection and cleaning, four 50 seed lots were weighed, dehydrated at 105° C for 48 hours, and reweighed after cooling to determine seed initial total moisture content.

Viability of *S. causiarum* seeds was unchanged by dehydration removing 13% to 73% of total moisture contents of freshly harvested seeds (Table 2). Seeds of all dehydration treatments had 96% to 100% germination. Reducing seed moisture contents from 26.6% to 10.5% had no effect on the numbers of days to 50% of final germination, but reducing the moisture

Table 2. Seed moisture content and total germination and days to 50% of final germination.

Dehydration Hours	Moisture Content %	Germination Total Percent	Germination Days to 50%
0	26.6 ± 1.9	100	17
6	23.1 ± 1.3	99	16
12	20.4 ± 1.4	99	19
24	14.8 ± 1.1	100	19
48	10.5 ± 0.7	98	23
72	7.2 ± 0.5	96	31
HSD,* 5% level		5	7

* Tukey's honestly significant difference test.

content to 7.2% delayed germination (Table 2). No visible signs of shriveling or damage to cells or tissues were found during microscopic examination of excised embryos from seeds dehydrated for 72 hours at 40° C.

A third study was initiated to determine the effects of temperature during seed storage on seed viability. Four replications of 50 seeds for each of 5 treatments were placed in 50 ml sealed glass vials. The vials were immersed in polyethylene glycol-water (v/v) in controlled temperature water baths (Guy and Carter 1984) for 21 days at 5°, 0°, −5°, −10° and −20° C. Following low temperature treatment, seeds were germinated in moist peatmoss in 10-cm petri dishes at 30° C. Germination counts were made weekly and data statistically analyzed.

S. causiarum seed germination was unaffected by storage for 21 days at 5° to −20° C and all treatments had 96% to 99% germination at 30° C (Table 3). The 12 or 13 days required for 50% of final germination following −10° or −20° C storage were similar to the germination period for seeds receiving alternating 20°–30° and 30°–40° C germination temperatures (Table 1). Prior to freezing, seeds in this study had 25% to 28% moisture contents. Hartmann and Kester (1983) report seeds must be in equilibrium with

Table 3. Effect of low temperature on seed storage of Sabal causiarum.

Temperature °C	Germination Total Percent	Germination Days to 50%
5	99	17
0	96	20
−5	98	16
−10	97	13
−20	97	12
HSD,* 5% level	4	4

* Tukey's honestly significant difference test.

70% RH or lower prior to storage at subfreezing temperatures or seed viability will rapidly be lost.

Seed quality, as affected by fruit maturity at harvest and postharvest handling, can greatly affect germination percentages of palm seed (Broschat and Donselman 1987, Caulfield 1976). Improper storage of palm seed prior to planting can greatly decrease germination percentages (Broschat and Donselman 1986). In this study, we found seeds of *S. causiarum* have no dormancy when harvested from mature fruits and pericarps are removed immediately following harvest. The mature embryos in seeds permit germination immediately following harvesting and cleaning. Almost 100% germination can be achieved at constant 25° to 35° C or alternating germination temperatures of 20°–30°, 25°–35° or 30°–40° C. This germination temperature range is much broader than for most palm species (Carpenter 1988, Sento 1976). Loomis (1958) reported seeds of many palm species lose viability when dehydrated. Loss of seed moisture content to 7.2% had no effect on the germination percent of *S. causiarum*, but seed moisture content at this level delayed germination. Seeds tolerated low temperature storage without losing viability. Seeds stored at −10° or −20° C for 3 weeks had faster germination after than before storage, and required fewer days then seeds stored at other tempera-

tures. Our results indicate the long term storage of *S. causiarum* seeds may be possible since seeds retain viability at relatively low moisture percentages and −10° or −20° C storage temperatures promote germination in fewer days.

LITERATURE CITED

BASU, S. K. AND D. P. MUKHERNICE. 1972. Studies on the germination of palm seeds. Principes 16: 136–137.

BROSCHAT, T. K. AND H. M. DONSELMAN. 1986. Factors affecting storage and germination of *Chrysalidocarpus lutescens* seeds. J. Amer. Soc. Hort. Sci. 111: 872–876.

——— and ———. 1987. Effects of fruit maturity, storage, presoaking and seed cleaning on germination in three species of palms. J. Environ. Hort. 5: 6–9.

BROWN, K. E. 1976. Ecological studies of the cabbage palm, *Sabal palmetto*: III. Seed germination and seeding establishment. Principes 20: 98–115.

CAULFIELD, H. W. 1976. Pointers for successful germination of palm seed. Intl. Plant Prop. Soc. Proc. 26: 402–405.

CARPENTER, W. J. 1987. Temperature and imbibition effects on seed germination of *Sabal palmetto* and *Serenoa repens*. HortScience 22: 660–661.

———. 1988. Temperature affects seed germination of four Florida palm species. HortScience 23: 336–338.

GUY, C. L. AND J. V. CARTER. 1984. Characterization of partially purified glutathione reductase from cold hardened and nonhardened spinach leaf tissue. Cryobiology 21: 453–464.

HARTMANN, H. T. AND D. E. KESTER. 1983. Plant propagation principles and practices. Prentice-Hall, Englewood Cliffs, N.J.

LOOMIS, H. F. 1958. The preparation and germination of palm seeds. Principes 2(3): 98–102.

SENTO, T. 1976. Studies on the germination of palm seeds. Memoirs of the College of Agr., Ehime Univ. 21: 1–78.

Principes, 33(4), 1989, pp. 194–195

NEWS OF THE SOCIETY

Nominations and Elections

The Bylaws of the Society provide that:

ARTICLE IV, Sec. 2—The slate of candidates prepared by the Nominating Committee shall be made known to the membership in time to permit the nomination of additional candidates to appear on the final ballot. Such additional nominations must be made in writing to the Secretary of the Society (Lynn McKamey) by a member in good standing. The nomination must be accompanied by the written consent of the proposed candidate to serve if elected, and must be seconded, in writing, by another member. If the above conditions are met, the Secretary shall forward the candidate's name to the Nominating Committee for inclusion on the final ballot.

Sec. 3—Voting shall be by mail only. Ballots shall be mailed in time (with the January 1990 issue) for the results to be announced at the Biennial Meeting (June 1990 in Hawaii).

For Directors 1990–1994:

Mr. Paul Anderson, Australia
Dr. John Dransfield, U.K.
Mr. Bob Egge, Hawaii
Mr. Don Evans, Florida
Mr. Walter Frey, California
Mr. Jules Gervais, Hawaii
Mr. Edward Hall, Florida
Mr. Lynn Mier, California
Mrs. Tamar Myers, Pennsylvania
Mr. Richard Phillips, Fiji
Mr. David Tanswell, Australia
Dr. Natalie Uhl, New York

Properly qualified nominations from members must be sent to the Secretary LYNN MCKAMEY, P.O. Box 287, Gregory, Texas 78359 USA by December 15th, 1989.