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OPTIMUM MATRICONDITIONING TREATMENTS FOR IMPROVING PEPPER SEED GERMINATION

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Abstract. **Pepper (*Capsicum annuum* L.) is the second most valuable vegetable crop in value grown in Florida. Therefore, enhancement of pepper seed germination is vital to the Florida agriculture industry. Non-uniform germination of pepper seeds may be a problem in seedling establishment. Matriconditioning is a promising presowing seed hydration technique to improve seed germination. The objective of this study was to determine the optimum duration, temperature, and ratio (seed: carrier: water) of matriconditioning pepper seeds for improved germination percentage and mean germination time. Pepper cv. Long red cayenne seeds were selected due to their most favorable response to MC treatments. Seeds were matriconditioned using synthetic calcium silicate (Micro-Cel E) as a carrier at different matric potentials by altering the water content of the conditioning mixture. Beneficial effect of matriconditioning was most prominent at 30°C for five days. Seed, carrier (Micro-Cel E), and water ratio was 1 g, 0.5 g, and 1.5 mL respectively. Matriconditioning increased final germination to 96.7%, compared with 82% in the control seeds. Furthermore, matriconditioning decreased mean germination time 10-fold, compared with a non-primed control. Matriconditioning treatment is recommended to improve seed germination performance of pepper.**

Florida is the nation's second leading horticulture state and pepper is the second most valued vegetable species in Florida (Olson and Simonne, 2004). Several species of bell, hot, and cubanella peppers are produced on over 1000 hectares with sales of $235 million (Hochmuth, 2003).

Non-uniform germination of pepper seeds can cause problems in seedling establishment in the field. Rapid, uniform and complete germination are essential for high yield and quality crop production (Heydecker, 1974). Seed enhancement techniques can speed up germination of pepper seeds. Several different seed hydration treatments have been used to improve seed performance including prehydration, osmoconditioning, and matriconditioning. Matriconditioning, also known as solid matrix priming, is a popular priming technique using solid carriers to improve seed performance (Khan, 1992). Effects of matriconditioning have proven highly beneficial for improving emergence of vegetable seeds including tomato (*Lycopersicum esculentum* Mill. and eggplant (*Solanum melongena* L.) (Khan, 1992). In a field trial with "Super marmande" tomatoes, matriconditioning reduced the time of emergence (Khan et al., 1995).

It is reported that matriconditioning increased the rate and uniformity of seed germination and seedling emergence in the field (Khan, 1992). There are many advantages for using matriconditioning as a seed enhancement technique including: ease of handling, fit for various sizes of seeds, as well as potential usage with biological agents (Khan, 1992).

Carrying out matriconditioning at optimum conditions has significant effect on the success of this hydration technique. The main objective of this study was to determine the optimum duration, temperature, and ratio (seed: carrier: water) of matriconditioning pepper seeds for improved germination percentage and mean germination time of pepper seeds.

Materials and Methods

A seed lot of 'Long red cayenne' pepper was obtained commercially (Gempler's, Madison, Wis.) and stored at 6°C, 33% RH, and small batches were removed as needed. Seeds were matriconditioned as described in Khan (1992). Briefly, seeds were mixed with synthetic calcium silicate (Micro-Cel E, World Minerals, Lompoc, Calif.) at different matric potentials by altering the water content of conditioning mixture. Matriconditioning was carried out in 453 g glass jars by mixing seeds, water and synthetic calcium silicate at 25-30°C for up to 5 d. After matriconditioning, seeds were washed for 20 sec and dried back by air at 25°C for 2.5 h. The moisture content was determined by drying in an oven at 130°C for 1 h.

For germination, four replicates of 50 seeds were placed on filter paper (Whatman, Atlanta, Ga.) in 9 cm Petri dishes, moistened with 3 ml deionized water at 25°C and continuous light. Seed germination was counted daily until no further germination occurred.

The mean germination time (MGT) was determined using the following formula:

$$MGT = \Sigma(ni * ti) / n$$

where n*i* was the number of newly germinated seeds at time of t*i* after imbibing (Khan et al., 1995).

Experimental Design and Data Analysis. The experiments were set up in a complete randomized design with four replicates, and the variation within means is presented as the standard error. Experiments were repeated three separate times. Regression analysis was performed using Sigma Plot (SPSS Inc., Chicago, Ill.) as described in Hacisalihoglu et al., 2004). Student *t*-test was used to statistically test the difference between the means. Statistical test were conducted at $P = 0.05$.

Results and Discussion

The effect of matriconditioning on the final germination percentage and mean germination time was significant (Fig. 1, Table 1). Overall best results were obtained when matriconditioning media mixture was 1 g seed, 0.5 g synthetic calcium silicate and 1.5 mL water at 30°C for 5 d (Table 1).

Final germination was highest (96.7%) with 5 d-30°C matriconditioned, while lowest (82%) with non-primed seed. Furthermore, mean germination time was lowest for 5 d-30°C MC (1.07 d), while non-primed control treatments resulted in the highest (10.2 d) (Table 1).

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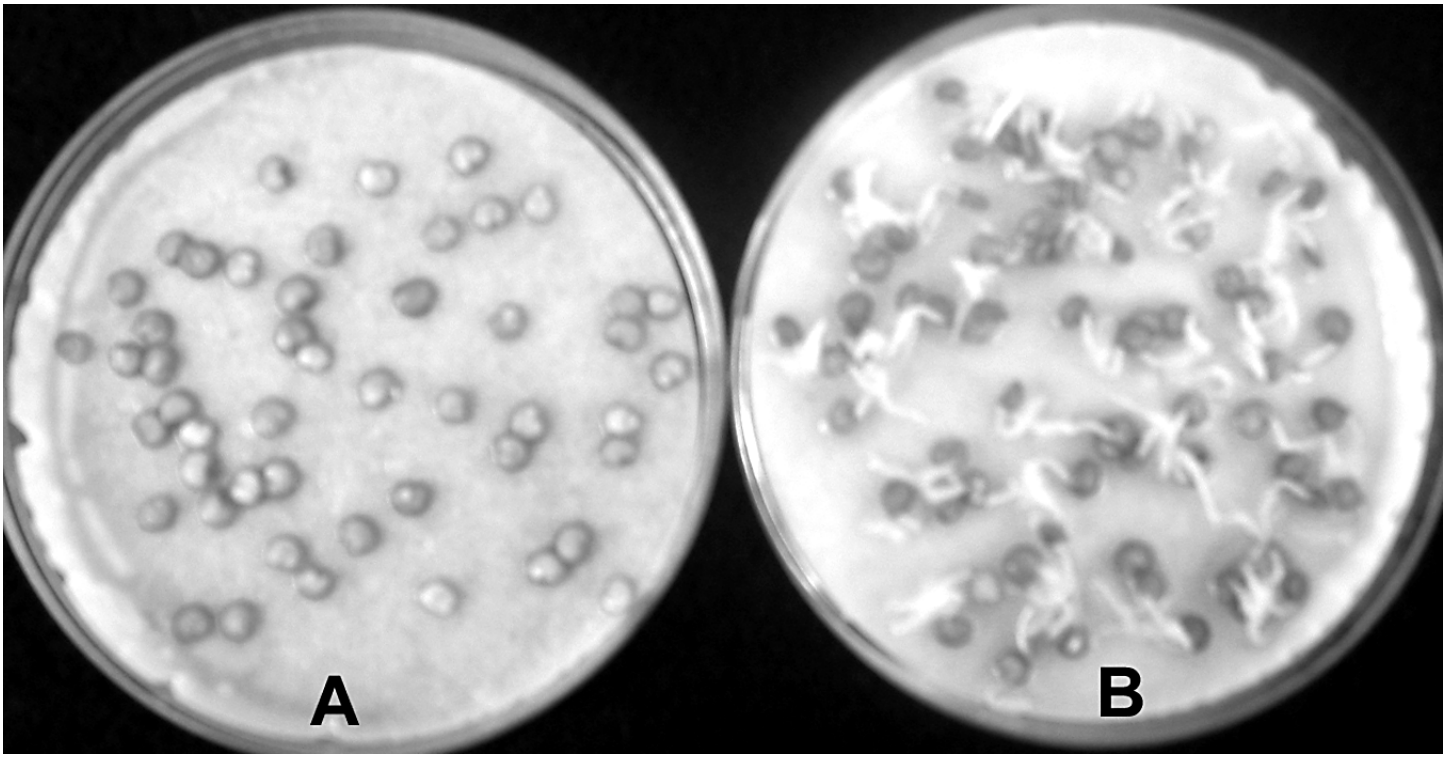

Fig. 1. Control (A) and matriconditioned (B) pepper seeds germinating at 4 d in petri dishes.

Table 1. Effect of duration, temperature, and ratio of priming pepper seeds on final germination and mean germination time (MGT = sum ni*di/n where ni = # seeds germinated at day di, n = total # seeds germinated at 15 d).

Matriconditioning (MC) (day at temperature)	MC Ratio (seed: carrier: water)	Final germination (%)[z]	Mean germination time (days)[z]
5d at 25°C	1 g: 0.3 g: 1.3 mL	91.3 ± 3.33 a	4.11 ± 2.22 a
5d at 25°C	1 g: 0.5 g: 1.5 mL	90.0 ± 2.31 a	2.33 ± 0.84 a
5d at 30°C	1 g: 0.3 g: 1.3 mL	88.0 ± 5.77 a	1.85 ± 1.23 a
5d at 30°C	1 g: 0.5 g: 1.5 mL	96.7 ± 2.55 b	1.07 ± 0.11 b
Nonprimed control	—	82.0 ± 2.00 c	10.2 ± 0.24 c

[z]Data are presented as means ± SE, n = 4 replicates. For each column, the values with the same letter are not significantly different (P = 0.05).

Overall, final percentage germination was always higher with matriconditioned pepper seeds compared with control seeds. Furthermore, matriconditioned seeds had the fastest germination in all treatments tested (Fig. 1, Table 1).

These results showed that the rapidity and percentage of germination of 'Long red cayenne' pepper seed was significantly increased by matriconditioning. Similar results have been reported with tomato (Khan et al., 1995), and lettuce (Hacisalihoglu et al., 1999).

In addition, a 5-d matriconditioning at 30°C with 1 g seed: 0.5 g synthetic calcium silicate: 1.5 ml water media mixture was the most suitable to improve germination of pepper seeds. These results showed that matriconditioning enhanced the quality of seeds by improving germination and seedling establishment. Further research is needed to evaluate the performance of matriconditioned pepper seeds under stress conditions including, cold and heat stress.

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Literature Cited

Hacisalihoglu, G., A. G. Taylor, D. H. Paine, D. B. Hilderbrand, and A. A. Khan. 1999. Embryo Elongation and Germination Rates as Sensitive Indicators of Lettuce Seed Quality. HortScience 34:1240-1243.

Hacisalihoglu, G., L. Ozturk, I. Cakmak, R. M. Welch, and L. V. Kochian. 2004. Genotypic Variation in Common Bean in Response to Zn Deficiency in Calcareous Soil. Pl. Soil 259:71-83.

Heydecker, W. 1974. Germination of an idea. The priming of seeds. Univ. Nottingham School of Agriculture Report, pp. 50-67.

Hochmuth, G. 2003. Fertilization of Pepper in Florida. Univ. Florida/IFAS Extension (EDIS).

Khan, A. A. 1992. Preplant Physiological Seed Conditioning. Hort. Reviews 13:131-181.

Khan, A. A., S. Ilyas, and W. Ptasznik. 1995. Integrating low water potential seed hydration with other treatments to improve cold tolerance. Annals of Botany 75:13-19.

Olson, S. M. and E. Simonne. 2004. Vegetable Production Handbook for Florida. Univ. Florida/IFAS Extension.