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MAYHAW SEED GERMINATION STUDIES AT OVERTON

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INTRODUCTION

The number of small, commercial Mayhaw (Crataegus opaca) plantings in East Texas, Louisiana, Georgia, Alabama and Mississippi is increasing. There have been problems with commercial nurseries in obtaining adequate germination of collected seeds for growing rootstock in containers or in the fields.

Low seed germination and erratic seedling emergence are major problems in Crataegus breeding. Seeds of all Crataegus species exhibit embryo dormancy and generally require treatment in a moist medium at low temperature before germination will occur. Seeds are enclosed in a thick, bony endocarp that could translocate germination inhibiting substances to the embryo during seed drying processes similar to those occurring in bramble seeds (Ke, et al., 1985).

The recommendation for Mayhaw germination is to place seed in concentrated sulfuric acid treatments followed by warm and cold stratification. (Brinkman, 1974). Only seed dried for several weeks may be used.

Elimination of the scarification and stratification requirements of Mayhaw seeds could improve the breeding potential by reducing generation time. This study was initiated to examine the feasibility of using fermentation of open pollinated ripened fruit as a method for increasing germination.

METHODS AND MATERIALS

Five different fruit selections were made from plants growing in the Neches River Bottom, Angelina County, Texas, in April and May, 1990. The effects of fermentation duration, whole fruit and seed storage time, in a freezer (28°F) and liveability of germinated seedlings were measured.

The five naturally occurring Mayhaw selections evaluated were:
1) a 1 inch (2.5 cm) diameter fruit, red color, prolific fruiting, thorns on new and old growth, large glossy foliage, 2) a 1.2 inch (3.1 cm) diameter fruit, red color, prolific fruiting, spurtype on branches, thornless, large glossy foliage, 3) a 1.2 inch (3.1 cm) diameter fruit, pink color skin and red fleshed fruit, thorns on new growth only, large

glossy foliage, 4) a 1.1 inch (2.8 cm) diameter fruit, red/yellow color, prolific fruiting, spurtype on branches, thorns on new growth, large glossy foliage, 5) a 1 inch (2.5 cm) diameter fruit, red/yellow color, prolific fruiting, spurtype on branches, thornless, large glossy foliage. Fruits were obtained from each selection to represent time periods from pollination to development of mature fruits. Four bulks of 200 well developed fruit containing approximately 5 mature seed each were uniformally sampled from each of the trees selected. The fruits were either immediately prepared for treatment or frozen for later use. Frozen samples were tested at 10, 20, 30, 40, 60, and 90 days. (Figure 1.)

Seed and pulp from each fruit bulk were mixed thoroughly in 10 separate zipper type plastic bags. One-fourth of the slurry was pureed and washed with distilled water to separate pulp from seed. The remainder of each bulk was placed in 10 glass jars in a 77^0 F incubation chamber and allowed to ferment. At 1, 4, 8 and 12 days of fruit incubation, the slurry was mixed and a representative sample of seeds collected and washed. Seeds were weighed to compare seed weight to embryo viability.

Twenty washed seeds were placed in a closed Petri dish on filter paper moistened with deionized water containing Thiram. Filter paper was moistened to capacity with deionized water daily. Petri dishes with lids were placed in an incubator with 24 h flourescent lighting and maintained at 72^0 F with ambient humidity. Number of germinated seed were recorded daily. Sampling was repeated for frozen fruit tests after fermentation. Germination was defined as recognition of radicle protrusion. Data were recorded until germination had ceased for 3-days. Treatments were replicated four times and randomized within the incubator.

RESULTS AND DISCUSSION

Germination percentage results are presented in Fig. 1-3. The fermentation treatments for days 1 through 8 showed improvement over non-fermentation treatments as reported by Brinkman (1974). For both fresh and frozen fruits comparing non-fermented to fermented treatment, it appears fermentation may inhibit substances present in the embryo which impair germination. Since germination occurred within 3 to 12 days without cool-moist stratification, drying Mayhaw seeds may tend to induce dormancy.

The average percent germination observed with fermentation including all frozen fruit was 68.23%. Embryos of whole seed exhibited deleterious response to long fermentation times. Percent germination for frozen fruit held 10-90 days and fermented 4, 8 and 12 days, was 73.5%, 73.3% and 57.9% respectively.

All selections exhibited increased germination for fresh seedlots with 1-8 days fermentation compared to 12 day fermentation (Figure 2). The average percent germination for non-frozen fermented fruit at varying fermentation times was: 1 day-85.6%; 4 days-92.8%; 8 days-93.4%; and 12 days-57.0%.

Fresh, cleaned seed (non-frozen) exhibited fast germination requiring 3 to 7 days for 60% germination and 10 days for 76% germination (Figure 3). After the seed with pulp (non-frozen) was fermented germination was enhanced by up to 8 days fermentation.

Fermentation and other seed germination enhancement treatments of Mayhaw, as reported in Vines, 1960 and Phipps, 1988, were evaluated. Low seed germinability and erratic seedling emergence are major problems in Crataegus species breeding. Fruit from the 5 selections that was frozen then fermented for up to 12 days showed a lower percent germination than seed from fermented fruit non-frozen. For the 5 selections the percent germination for the days frozen with days fermented respectively were: 87.2%, frozen 10, fermented 4; 83.8%, 20,4; 74.4%, 30,8; 72.6%, 40,4; 70.2%, 60,4; and 60.8%, 90,8. Positive responses to short fermentation durations (<8 days) were observed, but longer fermentation durations were deleterious. Embryo dormancy requiring acid treatment or stratification and problems with germination inhibiting substances were possibly minimized by fermenting fresh ripened fruit containing large embryos. The fruits and seed were not allowed to dry and they were either prepared immediately or frozen for later use.

SUMMARY AND CONCLUSIONS

The treatments differed in their response to fermentation durations. Seed did exhibit increases in germination for fresh seed lots with a 2 or 8 days fermentation. Reduced germination percentages were demonstrated under the same treatments from seedlots frozen 10, 20, 30, 40, 60 and 90 days. Seedlots of fruits with seed frozen 3 months exhibited > 50% germination with fermentation treatments of 1, 4 and 8 days.

Less than 50% of seed germinated with 90 day frozen storage and fermentation of 12 days.

Germination rates for incubated seeds were accelerated for all selections over nonincubated seeds. A 3 to 7 day fermentation period increased germination percent and shortened germination time over fresh fruit receiving no fermentation. Further investigations into the effects of fermentation of Mayhaw seed on emergence behavior and seed longevity would be helpful.

In developing a procedure to select for Mayhaw germination percentage or germination rate, viable seed harvesting should be maximized by: a) proper seed harvesting of mature fruit; b) seed cracking to check for empty seed; and c) seed weight comparisons for size of embryos. Additional study of seed treatments are needed to ensure prompt and adequate germination of Crataegus opaca (Mayhaw) for the nursery industry.

Well-rooted seedlings from this experiment in 1990 are now growing in 1 and 2 gallon pots containing peat/perlite mix. Germinating seeds of Mayhaws in May or June will produce seedlings capable of surviving fall field transplanting in the same year.

LITERATURE CITED

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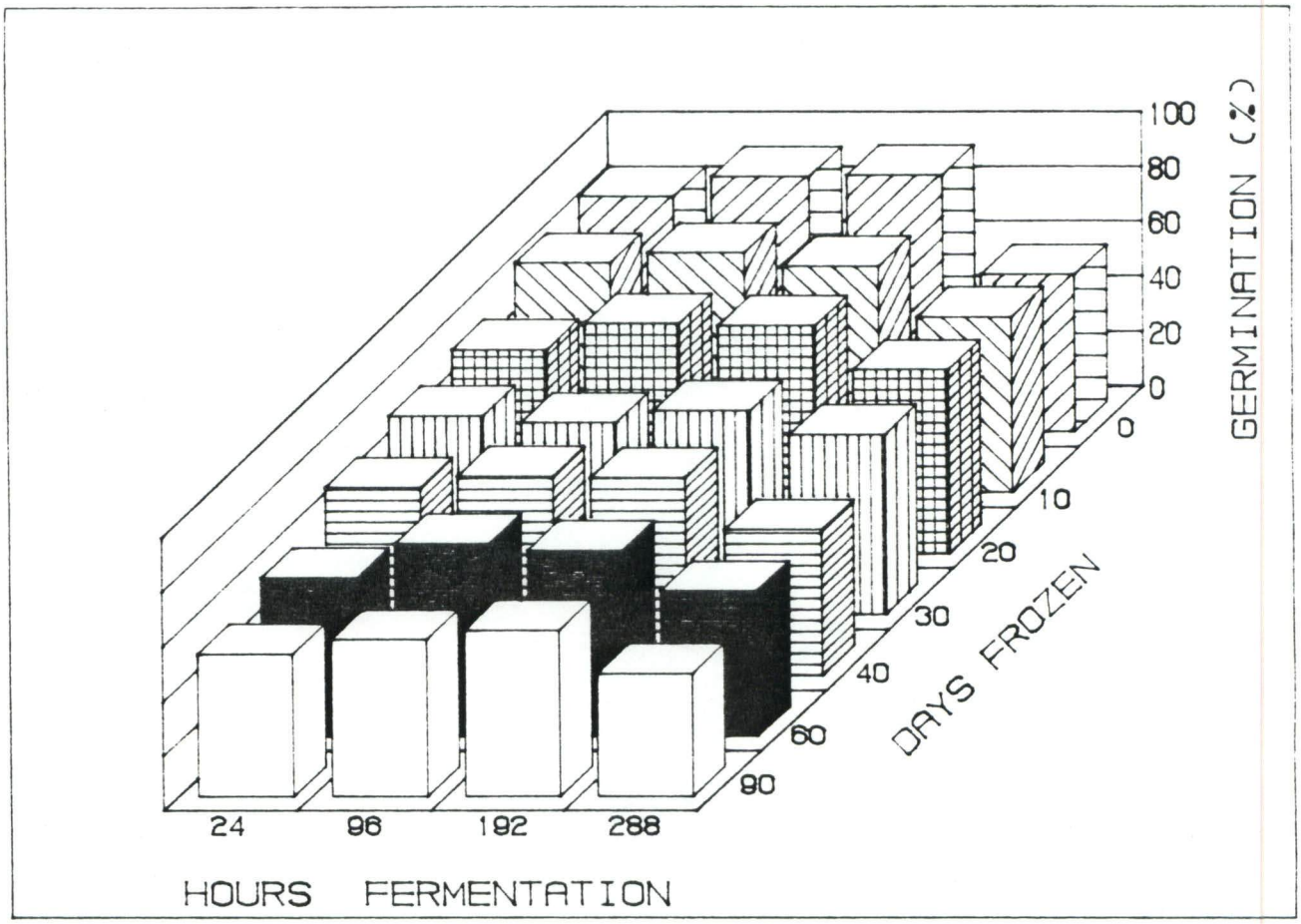
TABLE 1

5 Mayhaw Selections With Viable Seeds
Weights of Moist Seed Utilizing A Mettler PE 3000

10 seeds Crataegus opaca = .3 grams or .4 grams
40 seeds Crataegus opaca = 1.2 grams
50 seeds Crataegus opaca = 1.4 grams
70 seeds Crataegus opaca = 2.0 grams
80 seeds Crataegus opaca = 2.3 grams
90 seeds Crataegus opaca = 2.5 grams
100 seeds Crataegus opaca = 2.7 grams
10 seeds weighing .1 grams were cracked to disclose empty seeds from a 6th Mayhaw selection.
10 seeds weighing .2 grams were cracked to disclose empty seeds from a 7th Mayhaw selection.

FIGURE 1.



Percent Germination of Seeds Frozen In Fruits and Fermented From 1 to 12 Days

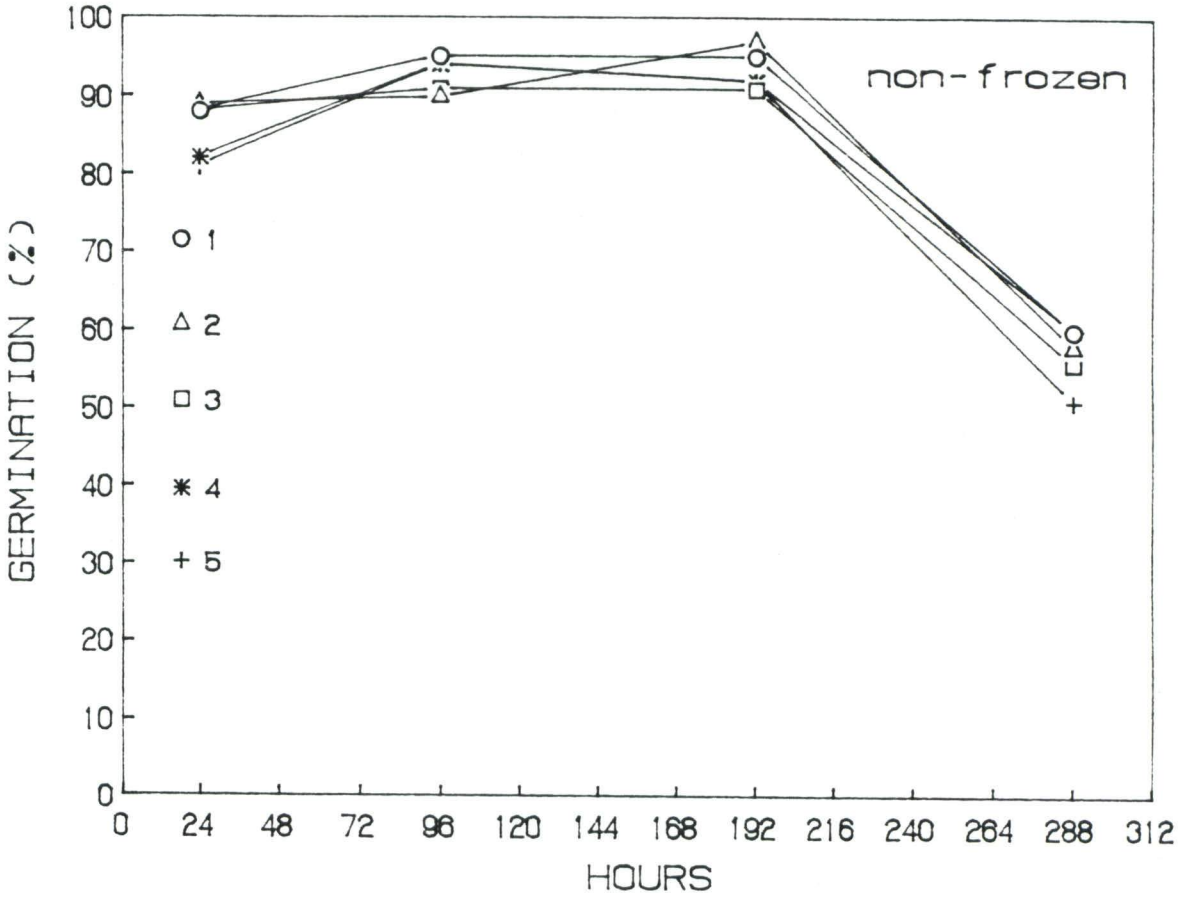
Days of Fermentation (DF)

1-DF = 68.17% germination/average of all fruit frozen from 10 to 90 days

4-DF = 73.53% germination/average of all fruit frozen from 10 to 90 days

12-DF = 57.9% germination/average of all fruit frozen from 10 to 90 days

FIGURE 2. **FIVE (5) MAYHAW SELECTIONS**



Percent Germination of Seeds Fermented
in Non-Frozen Fresh Fruit From 1 to 12 Days

Day of Fermentation (DF)

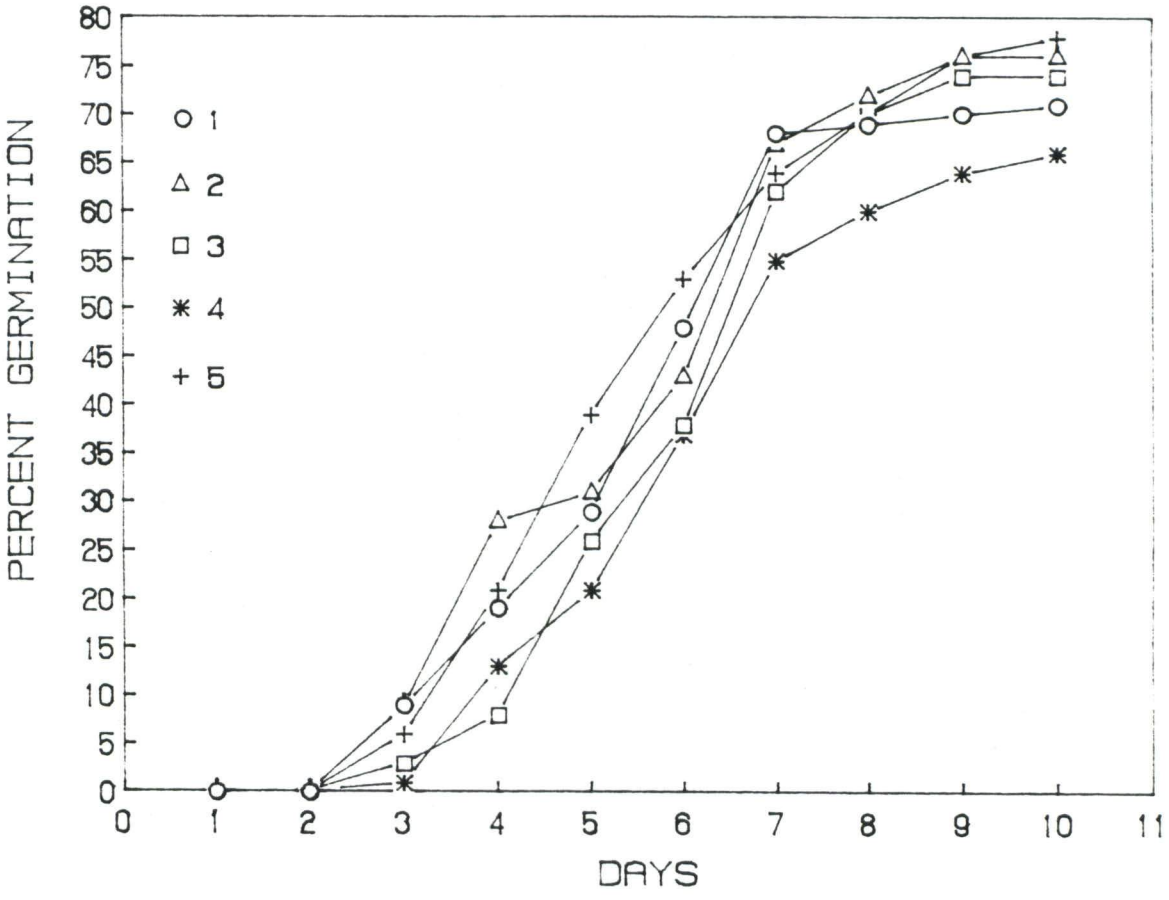
1DF = 85.6% germination/average of all 5 Mayhaw selections of fruit

4DF = 92.8% germination/average of all 5 Mayhaw selections of fruit

8DF = 93.4% germination/average of all 5 Mayhaw selections of fruit

12DF = 57.0% germination/average of all 5 Mayhaw selections of fruit

FIGURE 3. FIVE (5) MAYHAW SELECTIONS



Fresh, cleaned seed (non-frozen) exhibited very fast germination at 72°F, requiring 3 to 7 days for 60% germination and 10 days for 76% germination.

Percent Germination of Seeds Frozen In Fruits and Fermented From 1 to 12 Days

Days of Fermentation (DF)

1-DF = 68.17% germination/average of all fruit frozen from 10 to 90 days

4-DF = 73.53% germination/average of all fruit frozen from 10 to 90 days

12-DF = 57.9% germination/average of all fruit frozen from 10 to 90 days