Seed Germination of *Prunus persica* as Influenced by Gibberellic Acid Application, Endocarp Removal, and Stratification

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Significance to Industry: The peach (*Prunus persica)* is Texas' primary deciduous fruit crop. Although possessing a steady stance in the Horticulture industry, late spring frosts continue to be the leading factor affecting orchard profitability (Kamas et. al 1998). Therefore, improved germination of *P. persica* may benefit the industry. *Prunus persica* seeds treated with Nemaguard may provide nematode resistance and vigorous growth in areas of the U.S. where sandy soils and root-knot nematodes are prevalent. Improving the germination rate of *Prunus persica 'Nemaguard'* peach seeds through stratification and endocarp removal would result in more efficient propagation, thereby enabling growers to expand production.

Nature of Work: Studies of dormancy requirements in seeds of hardy plants, such as *Prunus persica 'Nemaguard'* may helpful when attempting to identify ways to potentially increase seed germination (Lipe et. Crane, 1966). Many studies have shown that peach seeds are often dormant at the time of fruit harvest and typically require some type of stratification (Martins et. al., 2013). By determining the effects of endocarp removal and gibberellin applications on germination of *Prunus persica "Nemaguard'* seeds, one can work towards a more uniform germination and emergence, therefore increasing the germination percentage.

Seeds of *Prunus persica 'Nemaguard'* were collected on February 6, 2018 for this experiment. The experiment measured the following parameters: Stratification periods of 3 and 10 week duration. Presoaking 24 hr. in 3000 ppm gibberellic acid with K+ salt formulation (GA3-K+). Removal of the endocarp, pitted and non-pitted conditions during pregermination treatments and germination. There were 8 treatments total, and 10 seeds per treatment were used. There were two control groups, one control group with the endocarp removed and one control group with the endocarp intact. There were four stratification treatments; one stratification treatment consisted of stratification for three weeks with the endocarp removed. The second stratification treatment was stratification for three weeks with the endocarp intact. The other two stratification treatments were stratification for 10 weeks with the endocarp removed and stratification for 10 weeks with the endocarp intact. There were two gibberellic acid treatments. One gibberellic acid treatment of GA 3000 ppm with the endocarp removed and another GA 3000 pm treatment with the endocarp intact. The *P. persica "Nemaguard'* seeds were planted on February 6, 2018. The seeds were sown in plastic planters and the growth medium used was a commercial mix of peat and perlite. The planters were placed in a greenhouse for germination and were checked on daily for watering needs. On March 25th, 2018 final germination percentage and seedling height measurements were taken and the experiment was terminated. Data was pooled from all laboratory sections involved in this experiment (reps 1, 2, 3, etc.). Data from my laboratory group (Group 2) and for the class average will be provided and examined below.

Results and Discussion: All of the treatments which involved keeping the endocarp intact resulted in 0% germination, whereas those involving endocarp removal all showed at least 20% germination. The only instance when endocarp removal did not show a significant difference in germination was with the control group (Table). This suggests that some barrier(s) most likely occur in the seed coat of *P. persica 'Nemaguard'*. The 10-week stratification treatment on *P. persica 'Nemaguard'* seeds

(endocarp removed) showed the highest percent germination rate for Group 2 (Table 1) and for the class average (Table 2). The 10-week stratification (endocarp removed) treatment resulted in 70% germination for Group 2 and 67.2% germination for the class average. These results are significantly different than the results from the other treatments, which further suggests that the endocarp presents some type of barrier to germination. The 3-week stratification treatment (endocarp removed) resulted in 34.5% germination for the class average and 30% for Group 2. Similarly, the GA 3000 ppm treatment (endocarp removed) resulted in 28.2% germination for the class average and 30% for Group 2. Therefore, both the 3-week stratification (no endocarp) and the GA 3000 ppm (no endocarp) are statistically the same.

The treatments that resulted in the greatest heights, both for Group 2 and for the class average were the GA 3000 ppm (no endocarp) and the 10-week stratification (no endocarp). For the class average, GA 3000 ppm (no endocarp) resulted in 13.6'' and for Group 2 the same treatment resulted in 13.5'' for seedling height. The 10-week stratification treatment (no endocarp) resulted in 11.3'' for the class average seedling height and 11.0" for Group 2-seedling height. The 3-week stratification treatment (no endocarp) had the second best results for seedling height. The 3-week stratification treatment (no endocarp) resulted in 6.65'' seedling height for the class average and 6.50'' seedling height for Group 2. Similar to the results concerning germination rate, treatments involving removal of endocarp showed the best results for seedling height. Treatments, which involved keeping the endocarp intact, all resulted in 0.00'' seedling height (both for Group 2 and for the class average), again suggesting that endocarp removal is recommended if one wants optimal germination and seedling height when planting *P. persica 'Nemaguard'* seeds.

Barriers to germination of *P. persica 'Nemaguard'* appeared to be due almost entirely to the presence of an intact seed

The seed coat of P. persica 'Nemaguard' appeared to be the main barrier to germination. Other experiments done with very similar parameters showed very similar results to that of Group 2 and the class average. A study done by members of the Department of Pomology at UC Davis on peach seeds of 'Nemaguard' and 'Halford' also showed that chilling resulted in favorable seed germination and seedling height. In this study, 'Nemaguard' seeds that were treated with gibberellin germinated at 80%, and those subjected to 2 weeks' chilling at almost 100%. Researchers involved in this study hypothesized that GA content increased with chilling treatment, but they state that they do not believe endogenous hormones are the primary controlling agents in seed dormancy. This is due to the fact that in their experiment, they found that a primary factor involved in seed germination was sensitivity of the seed tissues to the growth hormones. They found the chemical changes in the embryo during chilling control the seed's sensitivity to growth hormones (Mehanna et. al., 1985). Similarly, a study done by the USDA Crops Research Division showed similar results. Their study focused on the effects of constant and alternating germination temperatures on subsequent development of dwarfing in Elberta Peach Seedlings. They found that a self-duplicating system controls the processes of cellular growth leading to either a normal or dwarf growth habit of the seeds. They were not able to find an obvious explanation for the limited period of sensitivity in the Elberta seeds, but did hypothesize that the seed most likely possesses a sensitizing agent in the non-afterripened condition. They stated that this sensitizing agent is not the same as a direct growth inhibitor. Their seeds were able to germinate through removal of part of the seed coat and endosperm tissue (Pollock B. 1962). A study done by researchers at the Plants, Soils, and Biometeorology Department and Utah State University also had very similar results and conclusions. Their study focused on the chilling of endodormant peach propagules and their effect on initial seedling growth. They found that seedling growth of the P. persica Batsch seeds increased and became more normal when the seeds were stratified for longer durations at chilling temperatures (Frisby et. al.,

1993). Finally, a study done by the members of the Florida State Horticultural Society found that peach seeds (no endocarp) planted under field conditions in Florida had a significantly better germination rate than those whose endocarp was still intact. They were able to prove this by testing them in the laboratory. The laboratory test showed that seeds with the endocarp removed required a much shorter chilling period in order to permit germination.

Therefore, after examining the results from our experiment and comparing them to that of similar experiments done by other departments, it is likely that barriers to germination of P. persica are due to the seed's sensitivity to certain growth hormones and the presence or absence of the endocarp. Optimal conditions for germination of P. persica seeds would be a 10-week stratification period and an application of GA 3000 ppm, with a removed endocarp. Furthermore, for a grower seeking optimal germination and seedling height, it would be beneficial to remove the endocarp, as it appears to be the main barrier to germination.

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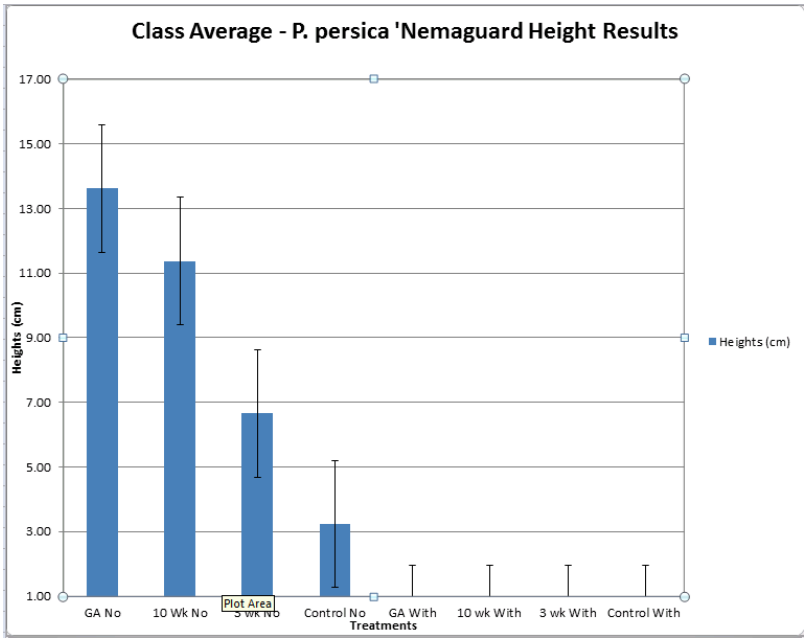
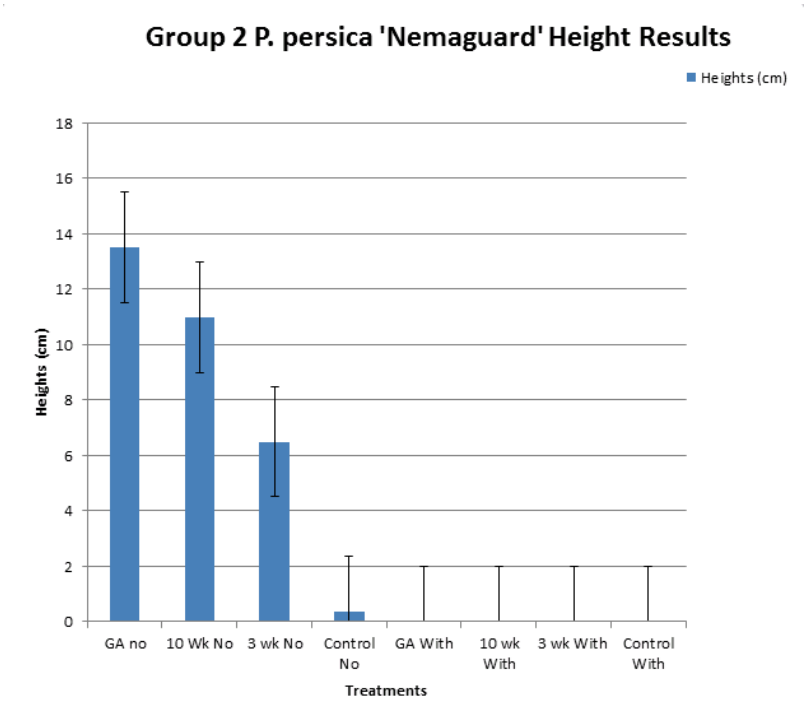
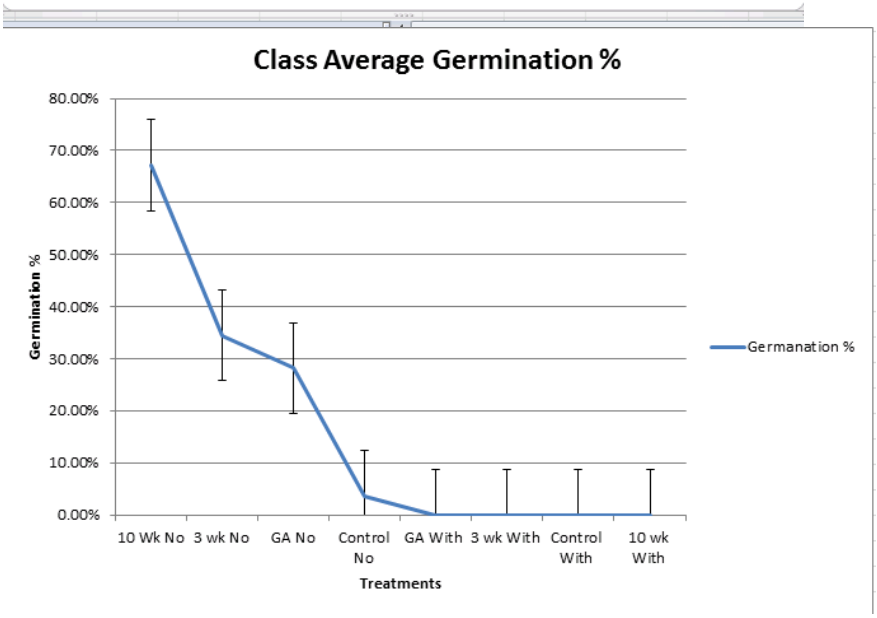
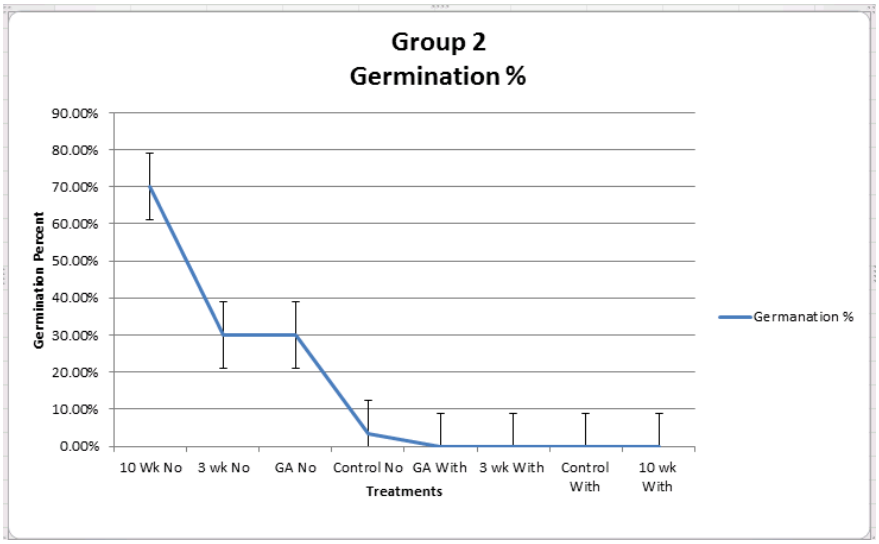



Group 2 P. persica 'Nemaguard' Height Results
Heights (cm)
18
16
14
12
10
8
6
4
2
0
Heights (cm)
GA no
10 Wk No
3 wk No
Control No
GA With
10 wk With
3 wk With
Control With
Treatments


Class Average Germination %
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Germination %
10 Wk No
3 wk No
GA No
Control No
GA With
3 wk With
Control With
10 wk With
Treatments
Germanation %


Group 2
Germination %
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Germination Percent
10 Wk No
3 wk No
GA No
Control No
GA With
3 wk With
Control With
10 wk With
Treatments
Germanation %