

# Investigation of Optimum Storage Conditions for Bare-root Fruit Trees

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Preliminary findings after the first season are as follows:

- Freezing temperatures of root and bud tissue of walnut, almond, peach/almond and Thompson seedless grape grafts were measured (see table below) and used to select storage temperatures.

	Root Tissue		Bud Tissue	
	Highest Freezing Point	Lowest Freezing Point	Highest Freezing Point	Lowest Freezing Point
Walnut	- 3.31°C	- 3.7°C	-5.93°C	- 6.50°C
	26.0°F	25.3°F	21.5°F	20.3°F
Almond	-3.6°C	-4.0°C	-6.6°C	-6.74°C
	25.5°F	25°F	21°F	20°F
TSG	-5.71°C	-6.98°C	-5.18°C	-5.48°C
	21.7°F	19.4°F	23°F	22°F
TSG - Thompson Seedless Grapes				

- Trees were stored at -0.9°C (30.3°F), -0.4°C (31.3°F) for 36 to 38 days for the 1<sup>st</sup> planting on April 5, 2001, and an additional 41 days at -1.8°C (28.8°F), -0.9°C (30.3°F), 2.3°C (36.1°F), 2.6°C (36.7°F), for the 2<sup>nd</sup> planting on May 15, 2001.

- In general, plants stored at colder temperatures took longer to break bud and leaf out than did the plants stored at warmer temperatures.
- Polyethylene bags protected against desiccation when stored both above and below freezing.
- Trees stored in polyethylene bags above freezing appeared to have similar desiccation rates to those stored in conventional commercial conditions of being open to the air and frequently watered. This suggests that storage in polyethylene bags may save costs by reducing labor and water needed to tend the plants while in storage.
- Greatest desiccation occurred when stored below freezing and not kept in polyethylene bags.
- Desiccation appeared to occur rapidly. Trees stored at the temperatures that caused high desiccation rates lost large amounts of weight by the 1<sup>st</sup> planting. Weight losses by the 2<sup>nd</sup> planting were generally not much different than those measured in the 1<sup>st</sup> planting.
- Almost all plants stored at 32°F or lower and not kept in polyethylene bags died, virtually none broke any

buds after planting. The walnuts did not break buds above the graft unions, although some had suckers grow out of the roots. The roots made up the bulk of the walnuts and may have had less desiccation than the trunks above the grafts.

9. Survival rates for plants in the other treatments were generally high.
10. Thompson seedless grape stored below freezing in polyethylene bags for the longer period (May 16) had higher mortality (37.5%) than those stored for the shorter period and planted April 5, 2001 (0%). Desiccation rates were little different than other treatments. This indicates that Thompson seedless grapes are sensitive to extended periods of storage at below freezing temperatures.
11. Peach/almond grafts broke bud before the almond grafts and grew faster in the 1st planting.
12. In the 2<sup>nd</sup> planting almond grafts broke bud marginally faster than peach/almond.
13. Peach/Almond grafts and Almond grafts suffered high mortality in the 2<sup>nd</sup> (May 16) planting. This mortality appeared to have 2 causes, damage done in cold storage and damage done by summer heat. Peach/almond appears to have a higher initial mortality in the 2<sup>nd</sup> planting.
14. Findings 11, 12, & 13 indicate that peach rootstock may be active at

lower temperatures than almond rootstock. This may make peach roots more sensitive to longer periods of cold storage, able to start growth earlier in spring and more sensitive to summer heat than almond roots. This may be useful for selecting whether to use almond grafts and peach/almond grafts at given locations and in specific climates.

15. Longer cold storage resulted in higher mortality of the grafts. Initial survival rates of the plants were higher for the 1<sup>st</sup> planting than for the 2<sup>nd</sup> planting. Peach/Almond grafts were the same for both plantings. Almond, Thompson seedless grape, & Walnut graft survival rates were lower in the 2<sup>nd</sup> planting.

**Percent Survival Rates**

	<b><u>Planting</u></b>	
	<b><u>1<sup>st</sup></u></b>	<b><u>2<sup>nd</sup></u></b>
Almonds	75.0%	63.5%
Peach/Almonds	75.0%	75.0%
TSG.	75.0%	63.5%
Walnuts	84.4%	75.0%

16. Summer heat killed grafts in the 2<sup>nd</sup> planting. The end of season growth rates are needed to quantify those mortality rates. Qualitative observations indicated that peach/almond suffered the highest mortality, almonds suffered high mortality, Thompson seedless grape and walnuts suffered much lower mortality rates.

17. Growth completed by the end of the growth season is not quantified yet.
18. Qualitative observations indicate that Walnuts and Thompson seedless grape grafts grew at higher temperatures than the almond and peach/almond grafts.
19. End of season growth will be measured and compared between treatments.
20. Mid-summer elongation measurements indicated mixed results due to storage temperatures. Almonds stored in polyethylene bags below freezing elongated faster than those stored above freezing. Thompson seedless grape stored above freezing elongated faster than those stored below freezing. Walnuts and Peach/Almond grafts had mixed results, with some above freezing treatments elongating faster and some below freezing treatments growing faster.
21. End of season elongation and caliper measurements are needed to further analyze the effect of storage temperatures on growth rates.