Final Report
WTFRC Project: PR-03-339 **Agricultural Research Foundation** #3740

Project Title: Introduction and propagation of pear rootstocks

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Objectives: The overall objectives of this project are: 1) help the flow of clonal rootstocks, from research programs towards commercial propagation, and 2) improve propagation of these clones.

Specifically, over the previous three years, we have: 1) propagated liners of ca. 450 Horner clones for field testing, 2) begun propagation of three rootstocks from Kazakhstan prior to release by APHIS, 3) propagated liners for advanced testing of rootstocks from the United Kingdom, France, Italy and the U.S., and 4) maintained 20 rootstock clones in tissue culture pending determination of the future of these clones.

Significant Findings:

General. This program propagates small quantities of high quality liners. 1) In most cases, these clones are not readily available from nurseries. 2) Nurseries are generally not interested in these clones at such an early, unproven stage of development. 3) Our liners, both micropropagated and cuttings, have grown extremely well in all situations, demonstrating that both are suitable methods for propagating pear rootstocks.

1) **Horner series**. About 450 clones are being tested as pear rootstocks:

- Cuttings from 294 clones were propagated at Corvallis in July, 2001. Two or more liners of each were sent to Fowler Nursery in February, 2002 for grafting to be returned to Hood River for testing.
- The remainder of the Horner series, 148 clones, were propagated in July, 2002. Liners of about 130 were sent to Fowler in February, 2003.
- 77 Horner clones were re-propagated in July, 2003. Liners of 64 were sent to Fowler in February, 2004.
- Horner 4 and Horner 51 were initiated in tissue culture. Horner 4 is propagating well, whereas Horner 51 gradually died out.
- Presumed-Horner 10 was initiated in tissue culture during summer, 2005.
- Grafted trees are now being planted at MCAREC for orchard evaluation.

2) **Kazakhstan clones**.

• In February, 2002, we received budwood from three clonal rootstocks, Q29857, Q29858, Q29859, from Kazakhstan. These were initiated into tissue culture. APHIS released these clones spring, 2005.

3) **Liners for advanced trial.**
• Liners of 20 clones were propagated for a same age trial at Hood River. The number of clones was subsequently culled to 11. These liners will be shipped to Hood River late winter 2006.

4) **Rootstock collection.**
• 17 pear rootstocks are currently in tissue culture at OSU awaiting requests for liners for research or transfer of cultures to nurseries. We have 26 rootstock clones at the Hort Farm.

Methods:

Softwood cuttings. Horner series. Cuttings were collected from the original seedlings growing at Hood River. These trees were pruned hard to induce vigorous shoot growth. All available cuttings from each stock plant were collected on July 14. Cuttings were prepared by removing the expanding shoot tips and then making 10" cuttings, except for dwarf clones for which 6" cuttings were made. The cutting bases were dipped for 5 sec in 100 mM IBA dissolved in 0.25 M KOH and planted in medium (perlite:peat, 3:1) in bands 2 ¼" squares by 5" deep at 22°C. The mist conditions were: 0700-0900 hours, 24 min interval, 0900 to 1000, 16 min interval, 1000 to 1700, 8 min interval, 1700 to 1900, 16 min interval and 1900 to 2000, 24 min interval. All mist applications were 10 sec duration.

Micropropagation. Cultures were established using vigorous shoot tips collected during active growth. These shoots were surface sterilized in 10% bleach solution and planted in individual tubes containing DKW medium consisting of 0.8% agar, 3% sucrose plus DKW salts and vitamins. Shoots which were sterile and still actively growing were transferred to a multiplication medium consisting of DKW medium plus 1 ppm benzylaminopurine (BAP). Every 4-6 weeks, shoot clumps were divided into single shoots and re-cultured on multiplication medium.

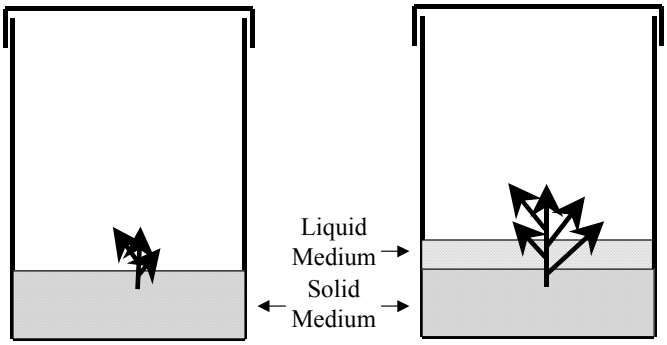

Figure 1. Single-phase vs. double-phase tissue culture.

When liquid medium is used in double-phase culture, enough liquid is added, about 25 ml, to nearly cover shoots that had just been divided and transferred (Figure 1).

When a sufficient number of shoots are available, the surplus is treated with indolebutyric acid (IBA) to stimulate rooting. Rooted shoots are transplanted into clean potting medium, grown under intermittent mist for two weeks and then transferred to the greenhouse. In the greenhouse, the shoots are grown to liner size and transferred to other research programs.

For transfer to commercial micropropagators, shoot cultures are sealed in sterile, plastic pouches containing a small amount of DKW solid medium and mailed to the nursery.

Results and Discussion:

1) **Horner series.** Small, preliminary studies found some promising rootstocks in this group of about 450 open-pollinated 'Old Home' seedlings. Further testing was warranted. In this situation, tissue culture of 450 clones is inappropriate. Because these are seedlings, however, and have been maintained as small, heavily-pruned trees, rooting potential of softwood cuttings of each clone should be near its maximum. Furthermore, since only 2-5 liners of each clone were required for the rootstock trial, low rooting percentage is not a serious short-term obstacle.

In 2001 and 2002, 451 clones were tested, some of them re-tests in 2002. 427 clones made the two liner minimum. In February, 2002 and 2003, the liners were shipped to Fowler Nursery, Newcastle, CA. Both sets of liners grew very well and were summer budded.

In 2003, we re-tested 77 clones that either rooted poorly the first time or were lost in the nursery. 64 of these made the two liner minimum and were shipped to Fowler in February, 2004.

Two promising rootstocks, Horner 4 and Horner 51 were initiated in tissue culture in July, 2003. Horner 4 is growing very well, Horner 51 gradually died out. Softwood cuttings of Horner 51 also rooted poorly. These experiences suggest that H51 is difficult to propagate. In 2005, we obtained shoots of presumed-Horner 10. The original seedling of H10 was lost. The rootstocks of the four trees on this presumed-H10 are being tested for genetic identity.

2) **Kazakhstan rootstocks.** Several years ago, three clonal pear rootstocks were imported from Russia by Californians Larry Rogers and Jim LaRue. They are purportedly dwarfing. APHIS was willing to make these available to us for preliminary propagation. With the assistance of Gene Milbrath, Oregon Department of Agriculture, to obtain the necessary paperwork, APHIS sent me budwood in February, 2002. We budded it on seedlings in the greenhouse and initiated cultures in late April, 2002. APHIS released these clones in January, 2005.

Table 1. Pear rootstock clones in tissue culture at OSU, December, 2005.

517-9*	OHxF 87*
708-13*	OHxF 97
96FI11*	Pyronia*
96FI12*	Q29857
Fox 11	Q29858
Fox 16*	Q29859
96FI15*	Horner 4*
OH11*	Horner 10
OHxF 40	

*Included in next field trial

Q29859 multiplies quickly, whereas Q29857 and Q29858 multiply slowly. Rooting of Q29859 is somewhat erratic, but averages about 70%. We will test rooting of the other two clones starting in January 2006 We are currently propagating liners for a trial at Hood River.

3-4) **Micropropagation and testing.** As we have provided rootstock liners for testing, we have maintained a small number of each clone in culture. We presently have 17 clones in culture. If a rootstock merits further testing or commercial propagation, these established cultures will enable us to respond quickly.

Clones 708-2, 12 and 36 from the East Malling, UK, breeding program have been dropped from the program, because of susceptibility to pear decline. 708-13 and 517-9 from that program are still being evaluated.

Eleven rootstocks will be in an even-age field comparison at Hood River. The Q-series and Horner 10 will be included if we can accelerate their growth sufficiently. The Q's are relatively difficult to propagate. Horner 10 was just established in culture summer 2005 and is doing well.

As described in the pre-proposal, we propose a system, whereby promising Horner clones are established in tissue culture at the earliest possible indication that a given rootstock has significant promise. As further evaluation takes place, these cultures can be culled or maintained. When a given clone merits further testing, cultures will be ready for liner production and distribution of cultures to interested commercial nurseries.

Budget:

Project Duration: 2003-05
Current Year: 2005
Project Total: $68,048

Year	2003	2004	2005
Total	$23,896	$23,896	$20,256

Details

	2003	2004	2005
Salary, Faculty Research Assistant[1]	$11,373	$11,373	$12,299
OPE	6,028 (50%)	6,028 (50%)	6,764 (55%)
Student Wages[2]	1900	1900	1900
OPE ($3.12/mo.)	95	95	75
Services and Supplies[3]	4,000	4,000	4,000
Travel[4]	500	500	500
Total	23896	23896	25538

[1]Luigi Meneghelli, Research Assistant
[2]Undergraduates maintain most of the cultures and field plots
[3]Tissue culture and greenhouse supplies
[4]Travel to plots at the Lewis-Brown Farm

Other support:
Oregon Hazelnut Commission