

FY08 Application for Nursery Research Funding
Washington State Department of Agriculture - Nursery License Surcharge
(Please use one application packet including the Progress Report page for each proposal.
You must use our form - failure to do so may result in not funding your project.)

Project Title: Improving Budbreak on Nursery Apple Trees Budded on M.9 and M.26 Rootstocks

Project Leader: Don C. Elfving, Horticulturist

Institution (if any): WSU Tree Fruit Research and Extension Center

Mailing Address: 1100 N. Western Avenue, Wenatchee, WA 98801

Project Phone Number: (509) 663-8181 FAX Number: (509) 662-8714 Cellular/Pager Number: ()

Note: Project leader or his/her designee must be available at above project phone number on March 2, 2007 between the hours of 10:00-12:00 and 1:00-3:00.

Amount Requested for (FY08) July 1, 2007 to June 30, 2008: \$5,050

Start Date: July 1, 2007 Completion Date: June 30, 2010

(Check One) New Project Continuing

If this is a multiple year project, please estimate and list the following information for each future July 1 - June 30 period listed below through project completion:

Fiscal Years (FY)	July 1, 2008 to June 30, 2009	July 1, 2009 to June 30, 2010	July 1, 2010 to June 30, 2011	July 1, 2011 to June 30, 2012	July 1, 2012 to June 30, 2013
\$ Amount Needed	\$5,300	\$5,570			

If you are increasing the above amounts since your last application, please explain why:

*Please list all other sources and amounts of funding for this project for the current year only: (Please notify us by February 15 if other funding has been approved and from where.)

Source	\$ Amount Applied For	Approved	Pending Date of Notification
None			

Total Amount Needed to Fund Project (Include all sources) \$ 5,050

If total amount from all sources is not granted, will you be able to complete the project? No

Explain: No other funds available for this project.

Submit **15 copies** of this proposal to: Tom Wessels, Plant Services Program Manager, P.O. Box 42560, Olympia, WA 98504-2560. All applications must be postmarked by December 31, 2006.

Please summarize the purpose of this research: (you may attach additional sheets if necessary or submit this summary in your own format)

See attached project proposal.

Methods of research:

See attached project proposal.

Expenditure Breakdown:

(Please include salaries, supplies, travel, etc.)

See attached project proposal.

The information requested on this page will have a direct bearing on whether your research request is approved or denied. Letters of support by the industry are also encouraged.

Note: Funding is not available for general overhead cost.

**WSDA LABORATORY SERVICES DIVISION - NURSERY RESEARCH
APPLICATION**

December 2006

Project title: Improving Budbreak on Nursery Apple Trees budded on M.9 and M.26 Rootstocks

Investigator: Don C. Elfving, Horticulturist

Affiliation: WSU Tree Fruit Research and Extension Center, Wenatchee, WA

Justification:

Nurseries in the Columbia Basin producing commercial apple trees on M.9 and M.26 rootstocks are experiencing problems with failure to grow of some of the buds inserted in these rootstocks the previous August. Almost nothing is known about this problem. The observed results reported by nurserymen are quite variable; in some cases up to 30-40% of buds fail to develop or experience significant delays in initiating growth, although those buds show no outward signs of death or of failure to heal in properly. The problem is limited to the very dwarfing M.9 and M.26 rootstocks, which may suggest some unknown but critical factor inherent in these genotypes. At this point there are too few documented observations to be able to say with confidence that one apple scion cultivar appears to be more sensitive than another or to be able to connect any environmental or anatomical factor with the observed delay or failure of buds to grow.

Initiation of apple bud growth in the spring is induced by increases in temperature that trigger natural development and movement of growth-promoting hormones, such as cytokinins, to the buds. Recently we initiated a study of bud development in the cultivar "Scifresh" (Jazz[®]). This cultivar is prone to failure of buds on feathers (lateral branches induced in the nursery during tree development). Initial results in our trials show that bud development failure can be overcome by topical applications of cytokinins, such as thidiazuron, around the time of budbreak. The failure of buds to develop from dwarfing M.9 and M.26 rootstocks may prove similarly responsive to topical applications of bioregulators at the time of early spring growth initiation. Research many decades ago in England demonstrated that the bud unions on rootstocks such as M.9 are not as well connected vascularly as compared to unions of more vigorous rootstocks. It may be that during that first growing season after budding, limited vascular connection prevents or delays adequate levels of growth-promoting hormone reaching the bud to expeditiously initiate bud development. Since nursery tree quality and salability are based on total growth in that first year, any delay in growth initiation will be associated with a poorer grade-out of salable trees at the end of the growing season.

Objectives of this research program:

1. Make trial topical applications of cytokinins to the buds of first-year budded nursery trees in early spring to evaluate whether budbreak can be improved with such supplementary treatments.

2. Test various concentrations of cytokinins and the presence or absence of gibberellic acid as possible factors that can beneficially affect budbreak and development.
3. Carry out follow-up studies to determine if induced budbreak is followed by satisfactory development of that cultivar bud into a well-structured nursery tree.
4. Test concentration/application timing relations of treatments that demonstrate effectiveness.
5. Assess cultivar susceptibility to both the bud-failure problem and its resolution with treatments that are found effective for inducing budbreak on M.9 and M.26 rootstocks.

Methods of research:

Specific projects will be established in cooperating fruit tree nurseries. Trials will be laid out according to randomized complete-block designs with appropriately randomized treatment arrangements based on the specific treatments to be used. Plot size will be no less than 10 trees per plot and will likely be larger depending on the specific trial and the objectives for that trial. Data to be collected include percent budbreak, percent of trees developing an acceptable top, and possibly some additional measurements, such as tree caliper.

Proposed schedule of accomplishments:

2007-2008: Trials will focus on:

- a. determination of whether cytokinin treatments that have proven successful for inducing budbreak on blind wood of "Scifresh" apple can stimulate budbreak on budded nursery liners;
- b. conduct a survey of cultivars to determine which ones appear susceptible to the problem;
- c. if any bioregulator products appear to have outstanding results, initiate discussions with the appropriate company regarding registration for nursery use.

2008-2009: Trials will focus on:

- a. evaluation of timing and concentration of application(s) of effective products in relation to improvement of budbreak and quality of the canopies that develop from induced buds;
- b. evaluation of the contribution of gibberellic acid, either separately or combined with cytokinins, on the percentage of budbreak produced;
- c. testing of additional cultivars that appear to be susceptible to this bud-failure problem;
- d. if any products appear to have outstanding results, initiate discussions with the appropriate company regarding registration for nursery use.

2009-2010: Trials will focus on:

- a. confirmation of results from previous years to develop confidence in the efficacy of treatments that show benefit;
- b. testing of optimized multiple-spray strategy(ies), if any, to demonstrate reliability of the results;
- c. provision of adequate information for nursery tree producers and growers to effectively utilize this technology;
- d. if any products appear to have outstanding results, initiate discussions with the appropriate company regarding registration for nursery use.

Anticipated benefits:

M.9 is now the most widely grown and planted apple rootstock in Washington State. Because of the volume of trees needed for high-density plantings of this type of tree, any losses due to poor budbreak and/or development create production delays that are costly to both nurseryman and grower. An effective solution to this problem would improve the efficiency of production of nursery trees and would help reduce the pressure to raise tree prices. Our initial results in orchard trials suggest that it may be possible to resolve this problem with topical applications of the appropriate bioregulators. Nurserymen in the Columbia Basin have expressed interest in cooperating in such studies.

Literature review:

Abnormalities in the development of graft unions occur in a variety of fruit-tree species, including apple (1,2,3,4). The swelling typically observed in the development of apple bud unions on dwarfing rootstocks such as M.9 or M.26 may indicate some degree of difficulty in establishing full vascular connection (4) and may be associated in some way with the dwarfing effects of these genotypes (2). Almost nothing is known about the problem of budbreak failure observed by nurserymen in the Columbia Basin. This project proposal is founded on our experience with bioregulators for inducing bud development and the knowledge that growth-promoting hormones play critical roles in the breaking and development of dormant buds in spring (5,6). As long as the buds have not died, they should be subject to stimulation into growth by the appropriate treatment with currently available bioregulators.

1. Bradford, F.C. and B.G. Sitton. 1929. Defective graft unions in the apple and the pear. Tech. Bull. Mich. Agric. Expt. Stn. 99.
2. Mosse, B. 1962. Graft-incompatibility in fruit trees. Commonwealth Agricultural Bureaux Tech Publ. 28.
3. Mosse, B. and M.V. Laburn. 1960. The structure and development of vascular nodules in apple bud-unions. Ann. Bot. 24:500-507.
4. Ritter, C.M. and L.D. Tukey. 1959. Growth and fruiting of various apple varieties in response to several clonal rootstocks. Bull. Pa. Agric. Expt. Stn. 649.
5. Sachs, T. and K.V. Thimann. 1967. The role of auxins and cytokinins in the release of buds from dominance. Nature 201:939-940.
6. Wickson, M. and K.V. Thimann. 1958. The antagonism of auxin and kinetin in apical dominance. Physiol. Plant. 11:62-74.

Budget:

Planned project duration 3 years

Current year request: \$5,050

Year	Year 1 (2005-2006)
Total	5,050

Current year breakdown:

	Year 1 (2007-2008)
Salaries (Technical and Temporary) ¹	4,150
Equipment and mis. ²	200
Supplies ²	200
Travel ³	500
Total	5,050

¹Technical and time-slip help to set up trials, apply treatments and collect data as needed.

²This category includes a variety of miscellaneous supplies, non-capital equipment, consumables, etc. that are needed to carry out the research project.

³These funds will be used to defray costs of vehicle lease-to-purchase costs, operation, maintenance, and personnel travel costs for travel to and from research plots in cooperator nurseries.