

# FPMS FRUIT & NUT TREE NEWSLETTER

Number 1, June 2000

Mike Cunningham

Program Manager

Foundation Plant Materials Service

University of California

One Shields Avenue

Davis, CA 95616-8600

Phone: 530-752-3590 FAX: 530-752-2132

Email: [fpms@ucdavis.edu](mailto:fpms@ucdavis.edu)

World Wide Web: <http://fpms.ucdavis.edu>

## Fruit Tree Budwood and Seed Allocations

Disease-tested fruit and nut tree propagating material may be purchased from FPMS from early May through January each year. An order form, price list and list of cultivars maintained in the FPMS Foundation Orchard can be obtained by calling the FPMS office at (530) 752-3590, by email request to [fpms@ucdavis.edu](mailto:fpms@ucdavis.edu), or by downloading them from our Web site at <http://fpms.ucdavis.edu>.

Available material for each distribution period will be allocated among all who request it by the ordering deadlines listed below. After the initial allocations, any remaining material will be sold on a first-come, first-served basis.

<b>June (green) budwood</b>	<b>May 1<sup>st</sup></b>
<b>Fall scion buds</b>	<b>August 1<sup>st</sup></b>
<b>Fall rootstock cuttings</b>	<b>October 15<sup>th</sup></b>
<b>Dormant wood</b>	<b>November 15<sup>th</sup></b>
<b>Cherry, peach &amp; plum seed</b>	<b>August 1<sup>st</sup></b>
<b>Betulaefolia pear seed</b>	<b>November 1<sup>st</sup></b>

To place an order, please submit a completed and signed FPMS Order Form along with 50% prepayment to Ginnie Dixon in the FPMS business office. If you have questions about placing an order, you can contact her at (530) 752-3590. For technical or cultural questions about the materials in our tree collection, you can call our tree program manager, Mike Cunningham, at (530) 752-3888.

## 1999-2000 Tree Material Sales

It's been a good year for fruit and nut tree material sales at FPMS, due in substantial part to some established nurseries moving into the fruit tree business for the first time. To date this fiscal year, which began on July 1, 1999 and ends on June 30, 2000, FPMS has distributed approximately 137,425 fruit and nut tree buds. It is encouraging that so much of the material we maintain every year for the industry is being used this year. Also distributed to date are: 4,056 graftsticks, budsticks, and cuttings, 152 pounds cherry and plum seed, and 125,800 peach seeds. Dormant budwood of the new UC prune cultivar 'Tulare Giant' (formerly known as 3-6E-13) was distributed to the 14 new licensees in March, and FPMS expects to have additional material of 'Tulare Giant' available for early Summer 2000 distribution. If all goes as hoped, initial licensing and release of the other new UC prune cultivar 'Sutter' (formerly 4-6W-53) will also occur in late May/early June 2000. If you are interested in becoming licensed for either of these cultivars, you should contact Diana Castillo at the UC Office of Technology Transfer to initiate the licensing process. You can reach her by phone at (510) 587-6000 or Email at [diana.castillo@ucop.edu](mailto:diana.castillo@ucop.edu).

---

Then be sure to place your budwood order with FPMS before the appropriate FPMS ordering deadline.

## **New “Provisional” Tree Status**

by Cheryl Covert, FPMS

Have you noticed a new “P” status appearing on your FPMS packing slips lately and wondered what it means? Beginning in the summer of 1999, FPMS began using a new status designation called “Provisional” to describe source trees in the Foundation Orchard that have passed all the CDFA-required disease tests for Foundation stock, but which have not yet been verified true to variety. This new FPMS designation was implemented to help our customers, FPMS and CDFA staff distinguish between healthy but officially-nonregistered materials that are expected to advance to Foundation status once identified and those which will not necessarily advance to Foundation status, including UC and USDA breeder selections whose future release status is unknown. One of the advantages of using this new status designation is in providing the option for an earlier initial release of propagating material of new UC cultivars to those nurseries who are willing to take the risk of buying materials whose trueness to type has not yet been verified. It should be noted that the “Provisional” status is an FPMS designation only, and is not an official CDFA registration status category.

When (if) FPMS Provisional source trees fruit and are verified true to variety, they become officially Registered and, upon request, California Foundation stock tags can be issued retroactively for propagating material purchased from them. Provisional material can be planted in a California registered scion block prior to receiving the certification tags, but the nursery must first notify CDFA Nursery Services of the special “Provisional” status of these materials before planting them in a CDFA increase block. The customer assumes all risk associated with the purchase of Provisional materials. In the event Provisional source trees are later found to be incorrectly identified, their nonregistered status becomes permanent, the trees are removed from the Foundation Orchard, and retroactive Foundation stock tags cannot be issued. CDFA may require that incorrectly identified materials be removed from increase blocks. FPMS is not able to give replacements or refunds for Provisional materials later found to be incorrectly identified.

The latest edition of the “All FPMS Tree Accessions” booklet, available from the FPMS office, shows which Foundation Orchard accessions are Provisional.

## **FPMS Web Site Now Online!**

FPMS is pleased to announce that customers can now access FPMS program information, collection lists and ordering materials via its new site on the World Wide Web at <http://fpms.ucdavis.edu>. FPMS also has an E-mail address, [fpms@ucdavis.edu](mailto:fpms@ucdavis.edu), to which customers can direct inquiries by E-mail about FPMS programs, materials and services. E-mail inquiries will be directed to the staff member(s) best able to answer your questions. CDFA tree program participants who would like FPMS to include a link on its site to their company’s Web site can contact Cheryl Covert to request this. We hope these new resources will help to make our program information and staff more readily accessible and will encourage you to learn even more about FPMS.

Please visit our Web site and check it out for yourself! Any comments or questions regarding the site can be directed to webmaster Cheryl Covert at [clcovert@ucdavis.edu](mailto:clcovert@ucdavis.edu), or by phone at (530) 752-3590.

## **A Changing of the Guard**

After more than 10 years of service as Chair of the FPMS Fruit and Nut Tree Advisory Committee, Robert Woolley has stepped down from that position.

Robert has been a strong supporter of the California Clean Stock Program and has contributed hours and hours of his time helping to build on the relationships among CDFA, FPMS, and the tree nursery industry. His ability to

---

determine the requirements of his industry in relation to its need for readily available, healthy propagation materials, and to guide the University toward a role in filling that need, has gone a long way in making FPMS the viable entity that it is today. Coming out of a period of relative non use in the early 1980's, the FPMS fruit and nut tree program received the boost it needed thanks to Robert's leadership and his ability to mobilize other members of the Committee. He also played a key role in the planning and financing of the FPMS Grapevine Importation and Clean Stock Facility, which opened in 1994.

As we regretfully accepted Robert's resignation as Chair, we are excited to have Mr. Bill Burchell as his replacement. Bill, as with Robert before him, comes with a reputation of integrity and experience that can only serve well for FPMS and its clientele. He has a lifetime of knowledge of the tree nursery industry and is known and respected by University faculty and staff of all levels. Bill Burchell has also done a lot to facilitate communication among the many facets of the California Certification Program, and in his capacity as Chair of the FPMS Fruit and Nut Tree Advisory Committee he will continue his role as a liaison between private industry and FPMS.

### **A Nurseryman's Perspective** By Bill Burchell, Burchell Nursery

As a participant in the Foundation Plant Materials Service (FPMS) since its origin in the 1960's, The Burchell Nursery, as many other nurseries and growers, has benefitted greatly from the services that FPMS provides.

A primary function of FPMS is to maintain selected plant material within the requirements of the California Department of Food and Agriculture's clean stock certification program. This provides the foundation for California nurseries to have full confidence that propagation material maintained in the certification program will supply the state, the nation, and the world with nursery stock of unsurpassed quality.

The FPMS has been able to develop over the years to provide a practical service while still maintaining the requirements of a formal state certification program. One of the early benefits of FPMS was its ability to gather fruit and nut varieties in commercial demand, establish them in the certification program and then make available to the industry source material of the highest integrity.

The major varieties selected for inclusion in the FPMS program were originally supplied from University sources, nurseries or growers and had a proven record of commercial production. This gave the basis for known productivity and quality. The front-line benefactors of this program were the nurseries who are the primary disseminators of plant material. Virus tested material provided for a better bud-stand in the nursery and eliminated the spread of the known viruses by the nurseries.

The cherry and cling peach producers were hard-hit victims in the 1950's and 1960's because of the rampant spread of buckskin (X-disease of cherry and peach). As viruses were cleaned up, FPMS was a logical agent to support a clean stock program. There are many examples of the effects of viruses, from symptomless to fatal, and the role of FPMS is a valuable asset in providing the functions it does.

An extended responsibility that goes with the functions of FPMS is to be diligent in maintaining freedom from diseases and trueness to variety. Nurseries should and do have their own internal systems and methods of maintaining these basic nursery practices, but FPMS provides a forum for monitoring issues as they may arise. The industry is fortunate to have the University research and expertise with the ability to compare and evaluate genetic disorders such as almond Non-Infectious Bud Failure or Bull Mission Syndrome or concerns about variations within a variety such as different strains of Bing cherry. When questions arise, the objective evaluations and seeking of solutions with the University is a great asset.

---

The development of FPMS has progressed through the years to serve as a hub of service and information. There are few places in the world that provide such a controlled function for the distribution of plant material for the benefit of the fruit producers of the world.

## **Process for Release of New Accessions From FPMS** by Mike Cunningham, FPMS

There are currently two routes through which a candidate fruit or nut tree selection can qualify for planting in the FPMS Foundation Orchard.

If the selection is available from the National Research Support Project #5 (NRSP5) in Prosser, Washington (formerly known as IR-2), and has been successfully indexed negative for disease on the accepted panel of indicators there, material for propagation is requested and NRSP5 wood is budded to Foundation level rootstock in the FPMS nursery and subsequently planted in the Foundation Orchard. An article on the NRSP5 program appears later in this newsletter.

The alternate source of new selections is to obtain propagation materials from sources that have not yet been tested for disease, generally directly from a plant breeder. These are disease tested at FPMS and are then planted in the Foundation Orchard.

When the new selections are planted in the Foundation Orchard they are given a documented computer status of either “non-registered” or “provisional”. “Non-registered” selections are those that have passed all the required disease tests and are planted in the FPMS Foundation Orchard, but for which there are currently no plans to advance the accession to Registered status. Many of these are UC or USDA breeder selections that may or may not ever be released. Sometimes accessions are non-registered due to questions about disease status or identity, which if confirmed, result in removal of the trees from the Foundation block.

A “provisional” selection has passed all the required disease tests and is planted in the FPMS Foundation Orchard, but has not yet been verified true to variety. If/when these FPMS Foundation orchard source trees are later verified true to variety, the trees will become registered and, upon request, California Foundation stock tags can be issued for materials that were purchased from these trees. One of the advantages of the “provisional” category is that it provides the option for an earlier release of propagating material of new UC cultivars to nurseries who are willing to take the risk of buying materials whose trueness to type is yet to be verified.

One goal FPMS works toward in its fruit and nut tree program is a fair and equitable distribution of a significant amount of propagation material of new releases. For example, University plant breeders submit budwood to FPMS when a selection is determined to have some potential for public use. Up to three years is required for field disease testing, during which time field trials for the selection are concluded and paperwork for patenting and release is completed.

Based on information provided by both the plant breeder and FPMS nursery contacts, the number of trees of a new release can be increased beyond the four that are typically planted in the Foundation Orchard. The FPMS increase block, which is actually Foundation-level plant material, contains approximately 25 trees of each new selection. Currently the increase block contains ‘13-1’ almond, ‘Late Ross’ peach, ‘M 40’ plum rootstock, and ‘Nickels’ peach/almond hybrid rootstock. Trees of the Doyle/DeJong prune selections ‘Tulare Giant’ and ‘Sutter’ have been budded in the FPMS nursery row and will be added to the increase block when the trees are large enough.

When the mechanisms for distribution have been finalized and authority for release has been received by FPMS, an

information packet announcing the pending distribution is sent to individuals and nurseries who have shown interest in the cultivars. This packet includes a short description of the selection(s), licensing information, ordering deadline, and an FPMS order form and price list. Plant material is then cut, allocated, and made available to customers who have signed license agreements.

Every year, beginning in the Spring flowering season and continuing through the Summer months as the fruit and nuts ripen, Dr. Tom Gradziel of the UCD Pomology Department inspects the almond and cling peach portions of the FPMS Foundation Orchard to determine whether provisional trees can be verified true to variety. When an individual tree checks out true-to-variety for two consecutive seasons, the California Department of Food and Agriculture is notified and the tree is added to the list of those included in the Registration and Certification Program.

In 1999, Dr. Gradziel was able to verify the trueness to variety of the following peach cultivars:

Orange Cling peach	10-205-2-92
Strawberry Cling peach	10-207-2-92
Monaco peach	10-40-1-71
Reigels peach	10-71-1-70
Tufts peach	10-58-1-70
Halford peach	10-25-1-63
Halford peach	10-25-4-91
Starn peach	10-51-4-91
Bolinha peach	10-218-1-96
Late Ross peach	10-220-1-92
Eloise peach	10-87-1-76

Customers who have purchased budwood from these selections and would like certification tags can contact the FPMS office.

### **Plum Pox Virus (PPV) Discovered in Pennsylvania** by Jerry K. Uyemoto, USDA, ARS, Research Plant Pathologist, Department of Plant Pathology, UCD

On October 20, 1999, The USDA and the Pennsylvania Department of Agriculture (PDA) jointly announced the detection and identification of PPV in a peach orchard in Adams County, PA. This is the first known incidence of the virus in North America.

*Background:* In September 1999, culled peaches ('Encore') with ringspot symptoms from a packing house were forwarded to the PDA in Harrisburg. On September 23, the peach samples tested positive by ELISA for a potyvirus. The same samples were sent to APHIS, where the potyvirus was confirmed to be PPV. PPV is a member of the potyvirus group. On October 13, the PPV was identified as strain D. PPV causes plum pox disease in *Prunus* spp.

Beginning on October 12, all *Prunus* orchards in a 1- mile radius of the Encore peach orchard were surveyed for plum pox symptoms on the fruit and leaves, and leaves were collected. In each orchard up to 80 trees were sampled (as 8 bulk collections of 10 trees). A week later, additional surveys were continued beyond the original 1- mile radius with the last-collection of leaf samples on November 4 following the last major leaf drop. In addition to leaf symptoms on infected 'Encore' peach trees, a mixed planting of plum varieties also showed leaf symptoms. Of a total of 218 orchards/blocks sampled, 18 tested positive for PPV by ELISA.

---

Historically, plum pox (aka sharka) was first observed in southwest Bulgaria ca. 1918. From there, the causal virus was widely disseminated via infected planting material to most of Europe and the Mediterranean, where the disease became endemic. PPV strain D made a continental leap and was discovered in Chile in 1992.

Movement of infected planting material is required for long distance dissemination of PPV. Once established, localized virus spread is by several aphid species in a non-persistent manner.

In chronically infected trees, PPV causes losses in yields and in unsaleable fruit. Fruit losses may occur as premature fruit drop, up to 100% in certain plum varieties. All *Prunus* stone fruit and nut species, including ornamental species, are susceptible to, at least, one virus strain. Currently, four major strains have been designated. These are: strain D, strain M (most severe strain), strain C (from cherry), and strain Ea (El Amar, Egypt). Whereas strain M may be seed-borne, strain D is not.

In the U.S., PPV is a quarantine pest, an exotic pathogen. Hence, the Pennsylvania control program will be to eradicate the virus and the State of Pennsylvania has allocated \$2 million for compensation to growers who must destroy trees. More monies are being spent for surveys and tests. Strategies have been discussed and plans formulated in preparation for the Spring season. This will be an enormous undertaking and hopefully, they will succeed.

*Current situation in California:* PPV is not known to occur in California. All Foundation trees of our stone fruit and nut source trees were previously indexed onto sensitive indicator hosts and found free of known viruses and graft-transmissible agents. To maintain its elite status, the Foundation Orchard requires two annual (visual) inspections for virus and virus-like disease symptoms and yearly ELISA/Shirofugen flowering cherry indexings for *Prunus* necrotic ringspot virus and prune dwarf virus.

As a suggestive precautionary step, and until PPV is declared eradicated in PA, a portion (25 to 33%) of the Foundation Orchard might be specifically targeted for PPV testing on an annual basis by ELISA and/or a sensitive indicator host (e.g. *Prunus tomentosa*, common name Nanking cherry). In the process, the entire *Prunus* collection would thus be assayed in a 3- or 4-year period.

## **Two New UC Prune Cultivars Are Released** By Jim Doyle, UC Kearney Ag Center

The UC Pomology Department is announcing the release of two new prune cultivars from the department's "Prune Cultivar Development and Evaluation Program". This program, under the direction of Dr. Ted DeJong at UC Davis and James Doyle at the UC Kearney Ag Center, Parlier, was initiated in 1985 with substantial support from the California Prune Board. Prune variety development research is presently located at UC Davis, the Kearney Ag Center and at the Wolfskill Experimental Orchard at Winters, with over thirty field test plots in the principal prune growing counties of California. In 1999, Carolyn DeBuse joined the program and is the field manager of both the Winters and UCD research plots.

### **'Sutter' Prune**

The 'Sutter' prune is a new variety developed for the dried fruit market. The 'Sutter' is of the plum species *Prunus domestica* and is the result of a controlled cross made in 1987 between the 'Sugar' prune and the European prune variety *primacotes*. The new variety has been under test since 1994 at the UC Kearney Agricultural Center at Parlier and in grower plots in both the Sacramento and San Joaquin Valleys.

Date of maturity of the 'Sutter' prune in field plots in a normal year has ranged from early to mid-August, or from a

week to ten days ahead of the industry standard 'Improved French' prune. The fruit is large, dark purple in color covered with a medium waxy bloom and somewhat resembles 'Improved French' in shape. In early tests, the fruit ranges from 15 to as much as 20 percent larger than 'Improved French' in size and develops at least 2 degrees soluble solids higher than 'Improved French' at full maturity. The fruit hangs well on the tree with only minimal preharvest drop. Limited tests with mechanical harvesting of the fruit have been successful, with very little fruit damage.

The stone of the new variety is nearly free. Machine pitting has been successful, with easy and clean removal of the stone. Fruit of the 'Sutter' dries into a very high quality prune. Although the external appearance is similar, the dried flavor of the new prune is lighter than 'French', with a more complex fruity taste and higher sugar content.

The tree is similar in form and vigor to the 'Improved French'. The tree has been both productive and a regular bearer. The new variety has been propagated on both Myrobalan 29C and Marianna rootstocks with good results. Grafts on peach stock have not been successful, with substantial breakage at the graft union. Peach is presently not recommended as a rootstock for the 'Sutter' variety.

### **'Tulare Giant' Prune**

A second prune released by the UC Pomology Department has been named 'Tulare Giant'. This prune has been designated primarily for use in the fresh market. The 'Tulare Giant' is also of the plum species *Prunus domestica*. It is a result of a 1987 controlled cross between the plum variety 'Empress' and the European prune variety *primacotes*. Evaluation of the new variety has been carried on at Kearney and in grower test plots since 1993. Date of maturity in a normal year is in early to mid-July, nearly three weeks ahead of the most popular prune variety, 'Improved French'. The 'Tulare Giant' is large in size, substantially larger than the 'Improved French'. The 'Tulare Giant' is oval in shape and dark purple in color under a greyish colored and waxy epidermal bloom. In contrast, the 'Improved French' is somewhat necked in shape and is frequently lighter in color than the 'Tulare Giant'.

The tree of the 'Tulare Giant' is vigorous and highly productive. Unlike many other prune varieties, 'Tulare Giant' will bear many flowers and develop fruit from buds on one year old wood as well as older spurs. Substantial tree pruning and fruit thinning is necessary for the fruit to develop adequate sugar for fresh shipment. Test shipments of this new variety have been well received in Pacific Rim markets.

The new variety could be used for drying but the pit is quite large and only semi-free from the flesh. Because of the large fruit size, drying time exceeds twenty hours and the fruit can bleed, slab and stick to the drying trays. Quality of the dried flesh is good, but because of the above drying characteristics, utilization of the 'Tulare Giant' as a dried product is not recommended.

'Tulare Giant' has been propagated on Myrobalan 29C plum, Marianna 2624 plum and Nemaguard peach rootstocks. The new variety has performed well on both of the plum rootstocks. On Nemaguard peach, however, a substantial overgrowth has occurred at the graft union and the trees are distinctly smaller in size than those on plum root. Although no breakage has occurred at the union, propagation of 'Tulare Giant' on peach root is not recommended at this time.

The University of California has applied for plant patent protection for both the 'Sutter' and 'Tulare Giant' prunes. A license to propagate either or both of the new varieties can be obtained from the UC Office of Technology Transfer (OTT) in Oakland, CA. Both new varieties have completed the long index for viruses at the UC Foundation Plant Materials Service (FPMS). Once licensing has been completed with OTT, budwood of both cultivars can be purchased from FPMS.

---

## **Accelerating the variety development process for canning peach and almond and the role of the newly established 'Provisional' category for FPMS trees**

by Tom Gradziel, UCD Pomology Department

Public plant breeding/variety improvement programs have been a cornerstone to the continued advancement of the processing peach and almond industries in California. Historically, the process of tree variety improvement is characterized by the release of several new varieties, typically followed by a relatively quiescent period of 20 to 25 years when new genetic selections are generated and tested. An example can be seen in the development of most of the current processing clingstone peach varieties. The early 1940s saw the release of 'Andora', 'Carolyn', 'Carson', and 'Corona', following the transfer of the USDA clingstone peach breeding program under W.F. Wight to the then University of California research farm at Davis, California. The mid-1960s to early 1970s saw the release of several important varieties from the breeding program of L.D. Davis, including 'Andross', 'Everts', 'Klampt', 'Tufts' and 'Bowen'. The most recent group of UCD releases have occurred in the late 1980s and early 1990s, and include the varieties 'Ross', 'Dr. Davis', 'Dee-Six', 'Riegels', 'Hesse', and 'Rizzi'. A similar variety development cycle is also evident in the almond improvement program, though the longer field testing periods typically required, and the more recent efforts to "rehabilitate" the Bud-failure prone 'Nonpareil' and 'Carmel' varieties have somewhat extended the period between variety release. The 20-plus year interval between the initial breeding of a promising new selection and its release to industry as a dependable new variety largely results from the extensive field testing performed on these selections over the range of environments and production practices commonly encountered in Central Valley orchards, and from the subsequent propagation, FPMS virus testing (and when necessary virus elimination), and trueness-to-variety identification required before commercial nursery increase.

The demand for new varieties has recently accelerated, however, driven by the need to replace problem varieties now being removed from production, and from recent losses in traditional pesticides, increasing labor shortages, the movement of tree production areas to more marginal lands, and increasing demands by consumers for a safe, high-quality, and nutritious product. To meet these demands the breeding program is attempting to integrate a wider range of resistances to pests and adverse environments into new selections, to field test in fewer "standard" regional environments, and to more rapidly make advanced selections available for nursery increase. Field testing in fewer "standard" environments in major production regions (for example, Marysville, Modesto, and Kingsburg for processing peach), should identify major production problems in new selections when grown in these regions, but would depend on subsequent industry and grower testing to determine the appropriateness for the various microenvironments within those regions.

Delayed nursery access to new varieties has typically resulted from the long evaluation period required, particularly for trueness-to-variety identification which may not be possible until the fourth to sixth leaf in some *Prunus* species. To reduce this delay FPMS has recently instituted a "Provisional" category for trees in the Foundation Orchard which have passed required disease testing and visual observations and are lacking only the trueness-to-variety identification. The "Provisional" classification means that wood can be sold from these trees, and propagations can be planted in a certified nursery row or a registered scion block. When the tree is properly identified as true-to-variety, the FPMS tree is changed from "Provisional" to Registered and the nursery can request retroactive certification tags from FPMS.

While these changes can result in a reduction in variety development time from 20-plus to as few as 10 to 12 years, they also entail a greater assumption of risk by the growers (owing to a greater risk of poor variety performance in their particular environments) and by nurseries (since if the propagated trees are found to be not true-to-variety, trees will have to be removed).



---

Four processing peach and almond selections are now being accelerated through this “Provisional” route. A short description of these items is given below.

**‘Nickels’ almond rootstock.** An almond X peach hybrid rootstock for almond developed and tested as UCD 1-82, ‘Nickels’ has now completed the UC patenting and release process. ‘Nickels’ has many of the same characteristics as ‘Hansen 536’ including ease of propagation, uniformity, vigor, resistance to root knot nematodes, resistance to calcareous and possibly saline soils, and potential for deep rooting. Recent trials have shown that ‘Nickels’ is better adapted to nursery handling conditions, particularly cold storage and subsequent transplanting problems due, in part, to its higher dormancy and chilling requirements. Field trials have indicated that trees growing on this rootstock are longer lived than on ‘Hansen 536’ and have a broader adaptation to areas where crown rot is a problem. Propagation tests showed rooting successes of greater than 60% for hardwood cuttings of this selection when treated with rooting hormones and fungicides and planted directly into the nursery row in late Fall, as is common practice. As an unbudded plant, ‘Nickels’ is a large medium shape tree, more or less intermediate in growth form between the ‘Nemaguard’ and Almond *Selection 5-33* parents. Growth habit tends to be like the peach with long vigorous shoots which eventually develop shorter spurs. Flowers are borne laterally on long shoots, usually 2 to 3 at a node with a single vegetative shoot. Nuts produced have a very hard peach-like endocarp. Bloom and leafing-out period is in early to middle March in California, which is later than essentially all of the almond cultivars, and corresponding to about that of ‘Nemaguard’. It is much later in bloom than ‘Hansen 536’ and ‘Hansen 2136’, indicating a higher dormancy requirement. The tree also goes into Fall dormancy in late October to November, making it considerably earlier than that of other almond cultivars and the ‘Hansen 536’ and ‘Hansen 2136’ rootstocks.

**UCD *Selection 13-1* almond.** *Selection 13-1* was developed to provide a high production, high quality pollinizer for the early ‘Nonpareil’ bloom. The paperwork for naming, patenting, and release of this selection is now being processed. Since initial Regional Variety Trial (RVT) production in 1996, *UCD 13-1* bloom has consistently coincided with the targeted early ‘Nonpareil’ bloom despite the occurrence in 1998 and 1999 of unusual patterns in Winter chill and Spring heat units which have often pushed peak ‘Carmel’ bloom to later than ‘Nonpareil’. Tree production has been among the highest at Regional Variety Trials and nut quality has been comparable to or superior to ‘Carmel’. Nut shape is similar to ‘Carmel’ though more elongated and with a slightly redder color (Fig. 2). Trees are tall, large and somewhat spreading with moderate vigor, and with few tertiary branches with a medium foliage density. Crop is primarily borne on spurs with some on shoots and often on smaller fruiting wood. Damage from anthracnose, and to a lesser extent, scab and *Alternaria* leaf spot have been observed on this selection in the Butte RVT following the cool, wet Springs of 1998 and 1999. For this reason it is not presently recommended for planting in northern Sacramento Valley despite its high productivity in trials in this area. *Selection 13-1* has a thin, moderately sealed shell, which, while contributing to a high crack-out, has also led to higher levels of ant and Navel orangeworm damage at the Butte and Manteca RVT when compared to ‘Nonpareil’ and ‘Carmel’. Kernel quality is good, with low numbers of doubles, twins, or other nut distortions. Processing evaluations (i.e. blanching, dicing, etc.) have also been favorable.

**UCD *Selection Early #3* processing peach.** *Selection Early #3* was developed as a replacement variety with a critical ‘Dixon’-‘Andross’ period. The paperwork for naming, patenting, and release of this selection is now being processed. [Beginning in 1997, UCD advanced processing peach selections are identified by a Field Trial designation identifying the fruit maturity period followed by a sequential ID number, rather than the too-often confusing breeding record number. For example, in *Early #3*, “Early” refers to the targeted early cling peach ripening period (typically ‘Dixon’ to ‘Andora’ season) and “#3” identifies it as the third selection in this period to be advanced to Regional Grower Testing.] Field tests are located in Marysville, Winters, Davis, Modesto, and Parlier, California. Fruit ripens with or just after ‘Dixon’. Fruit is medium size with a slight fruit tip though free

from the elongated tip found on several cling peach varieties following mild winter and warm spring weather. Flesh is bright yellow to yellow-gold. Fruit flesh color, flavor and texture have been rated superior to both 'Dixon' and 'Andross' by grower and processor evaluators in 1997, 1998 & 1999. Fruit skin is slightly less fuzzy than 'Andross' with a more uniform golden-yellow color. Pit is small to medium in size and has remained free from the red color and pit fragments of 'Dixon' and 'Andross' even in environments promoting this problem. Some split-pits occur in high crop years though at lower rates than either 'Dixon' or 'Andross'. Tree is semi-upright with vigor similar to 'Andross'. Crop appears medium; being somewhat lower than 'Andross' and thus needing less thinning following a high-chill winter but possibly vulnerable to lower crops following low chill winters. Fruit hangers are similar to 'Andross' though a bit denser. Leaves are medium-to-dark green, similar in size to 'Andross' with reniform leaf glands, and pink, non-showy flowers.

**UCD Selection Late #1 processing peach.** The paperwork for naming, patenting, and release of this selection is now being processed. Field tests are located in Marysville, Winters, Davis, and Parlier, California. Fruit ripens with or just before 'Halford'. Fruit has good symmetry and is similar in size to 'Halford'. Flesh is bright yellow and firmer than 'Halford'. Fruit flesh color, flavor and texture have been rated superior to 'Halford' by grower and processor evaluators in 1997, 1998, & 1999. Fruit skin is less fuzzy (pubescent) than 'Halford' with a more uniform yellow-gold color. Pit is medium sized (smaller than 'Halford') and free from the red color and pit fragments which afflict 'Halford'. Tree is semi-upright like 'Halford'. Tree vigor is similar to 'Halford'. Leaves are medium sized and a lighter green than 'Halford'. Flowers are large and showy. No unusual disease susceptibility has been observed with either *Early #3* or *Late #1* when compared to the varieties they are targeted to replace.

## **New Insight Into Noninfectious Bud Failure (BF) Enhances the Control of BF Through Propagation** by Dr. Dale Kester

Those who attended the Almond Research Conference at Modesto in December, 1999 were treated to a "final report" of the Almond Budfailure project. Dale Kester, Warren Micke, Mario Viveros, Tom Gradziel and Ken Schackel had been painstakingly collecting BF data every March, from 1991 through 1998, on approximately 2700 trees of 'Carmel' and an equal number of 'Nonpareil' trees. These weren't just any trees, but those which had been propagated from specific individual source trees of eleven commercial nurseries. Identity of each source, down to individual bud positions on the budstick, had been preserved through the propagation and tree planting phases.

Two components of the BF syndrome were being studied. First was the *pattern of BF symptoms* ( $BF_{exp}$  for BF expression), which differed in individual trees by age and severity. By treating BF as a genetic trait (described on a scale of 0 to 4), we were able to describe the complete pattern of BF development in orchards. This pattern was based on the age at which BF first began to appear in individual trees.

The second component was *the inherent potential for BF* to develop from specific source trees, branches, and buds (referred to as  $BF_{pot}$ ). This was calculated as the *age at which BF first appeared in the progeny trees*. Analysis of this data gives a different perspective and provides a way to characterize the potential of a given source to produce bud-failure progeny. We have referred to this characteristic as the *heritability* of BF from given sources.

As we continued to analyze the entire seven years' data, a third component of the BF syndrome came to light (1999 after we had stopped taking data). We had noticed for a long time that BF was greater after some years than others. Subsequently we looked at the *rate of increase* in relation to year and determined that certain years (notably 1993, 1994, and 1996) were followed by significantly higher BF in the following season. When we compared the temperature patterns of different months, we found that essentially all of the change was incurred in June and to a

lesser extent July. Furthermore, the effective temperatures were not the "hot" temperatures (80oF or higher) but "growing" temperatures of 70 to 80oF.

When we began to look back at earlier research, suddenly bells began to ring and whistles to go off as separate pieces of information began to fit into a comprehensive understanding of the BF phenomenon. There is a third component of the BF syndrome whose importance had only been hypothesized before. This trait has been described previously as Stress Induced Summer Dormancy, a trait which adapted the almond to the deserts of southwestern Asia, its location of origin, and to the traditional nonirrigated Mediterranean culture. We believe that when grown under the irrigated cultural conditions of California, the almond has gradually lost the genetic control of this system and has converted into a system which produces a toxin instead of dormancy. What we call an increase in BF<sub>pot</sub> is in actuality a gradual decline which can occur every year. Since the decline is made up of many incremental annual "genetic" changes, we believe that BF should be called somaclonal decline. To understand how this process occurs, one must understand the different stages of bud development and how they relate to seasonal temperature patterns (see Chapter in Growth and Development in UC Almond Production Manual).

These results support the three main principles of budwood selection and management.

1. Select and test low BF potential single tree sources through at least five years of progeny testing.
2. Establish Foundation trees by some type of scion orchard or hedgerow management which involves annual pruning of budwood sources to renew the low BF potential of the source.
3. Multiply the budwood source through the use of scion orchards, nursery increase blocks or hedge rows. Do not use commercial orchards as budwood sources as these greatly increase the risk of BF propagation.

A major application of this new information is that it validates in a very large way the principles of propagation control being used at FPMS. We believe that one must manage the budwood source plant in such a way that budwood is collected in the "mature" (May) stage but not "bud scale formation" (June or later) stage, the point at which the annual somaclonal decline phenomenon apparently occurs. Second, one must renew the budwood shoots annually (pruning, dehorning, hedge-rowing) to stabilize the decline phenomenon at zero. The latter principles explain why collecting budwood from commercial orchards, where budwood supplies are not renewed annually but develop in consecutive annual sequences of shoot growth, will promote BF potential.

This report is a preliminary summary of the main findings of the study and provides information primarily to nursery members and clients of FPMS. A complete summary of the project is required by the Almond Board on May 1, 2000. In the meantime, we are working on up to nine research papers which will detail the different aspects of the research. At the same time we plan to prepare a popular summary probably in California Agriculture.

We particularly want to thank the nursery industry as well as the almond industry for their cooperation, support and patience as the course of the research has progressed.

## **National Research Support Project #5 and Its Relationship to the California Certification Program**

By Bill Howell, Manager NRSP5

The National Research Support Project #5 (NRSP5), formerly known as IR-2, is a major underpinning for state operated certification programs of pome and stone fruit crops. It is located in Prosser, Washington, and is federally, state and industry supported. This program has been operating since 1955. It is responsible for helping keep virus and virus-

---

like agents from causing problems in commercial plantings of deciduous fruit trees and in research plots. This goal is accomplished primarily by providing virus-tested startup material of commercially important cultivars to state certification programs.

NRSP5 supports the California certification program by supplying virus-tested cultivars to FPMS, by performing the 'long index' for California's variety qualification plan, and by conducting virus testing and therapy for the proprietary selections of individual nurseries. Since 1970, NRSP5 sent more than 600 virus-tested selections of budwood to FPMS for subsequent increase in their efforts to provide foundation grade material to the California nursery industry. Additionally, over 500 clones were virus-tested since 1992 by NRSP5 for California nurseries as part of the CDFA variety qualification plan (once known as the '10 step' plan). During this same time, 165 clones were also heat-treated to remove virus for FPMS, CDFA and their participating nurseries. An additional 40 proprietary clones were received directly from California nurseries, given therapy, virus-tested, and then returned directly to them for incorporation in the certification program under the auspices of CDFA. These numbers indicate that the California nursery industry has been, is, and likely will continue to be a heavy user of NRSP5 services and material.

NRSP5 also acts as an importation site for new fruit tree selections from around the world. Since 1988 when NRSP5 became the second legal importation and quarantine facility for deciduous fruit tree selections, nurseries and growers from many areas of the country have utilized NRSP5 for securing new clones from international sources. Nurseries from California alone have imported 74 clones through NRSP5 during this time.

NRSP5's mission is accomplished by successful implementation of reliable virus testing and therapy technology. NRSP5's virus-testing and therapy schemes are recognized worldwide for their effectiveness. The backbone of virus testing at NRSP5 is assaying on virus-sensitive woody plant selections. For example, new stone fruit clones are screened by grafting tissue from the candidate clone onto a range of indicators such as Bing sweet cherry, Shirofugen flowering cherry, *Prunus tomentosa* and six other virus sensitive hosts in NRSP5's greenhouse. These tests detect most of the viruses known to infect stone fruit trees (There are another 9 indicator selections for pome fruit cultivars). These assays are supported by serological tests (ELISA) for the common prune dwarf and *Prunus* necrotic ringspot viruses, for plum line pattern virus and for plum pox virus. PCR assays are used for phytoplasma detection and nucleic acid hybridization for viroids.

Therapy is required when virus is detected. For virus therapy, small trees are grown continuously at 100F for 5 to 7 weeks. Shoot-tips (approximately 1/4" long) are then excised from these plants and shoot-tip grafted to small virus-free seedlings. These are encouraged to grow and then are tested for virus to assure its elimination. Virus-tested trees are maintained in screenhouses prior to budwood distribution.

NRSP5 facilitates the international exchange of fruit tree cultivars. As a result of NRSP5's virus testing and elimination, propagation material from the program is accepted as elite material in most countries. Since NRSP5 also acts as an importation site for deciduous fruit tree material, the combined effect is that the project serves as an international hub for the exchange of fruit tree cultivars. For example, new varieties come from other countries such as New Zealand for introduction into the USA. While in NRSP5's screenhouses, they are shipped not only to destinations in the USA but also to cooperators in other countries. Similarly, new selections from the USA are sent to NRSP5 to qualify for certification. While here, owners of those selections have NRSP5 ship them to cooperators in other countries, allowing for safe and rapid shipment through various country's quarantine facilities.

Research is an important ingredient in keeping NRSP5's services current and practical. NRSP5 conducts research on virus detection and elimination, especially under greenhouse and growth chamber conditions. In cooperation with scientists from WSU, new laboratory techniques for detecting these pathogens are developed and refined. Other

---

virologists from around the country, including individuals located in California by the USDA, University of California and FPMS, conduct research that assists NRSP5 in improving its technology.

Funding for NRSP5 is complex. Funds come from 3 sources: federal, state and industry. Approximately half of the annual budget is from money distributed to the land grant universities from the federal government. The land grant universities set aside a portion of their individually allotted federal money to fund cooperative projects. NRSP5 is one of those cooperative or interregional projects. Industry also supports the program; it does so through service fees and research grants. Service fees, which account for approximately an eighth of the budget, include charges for propagation material, virus testing and virus therapy. Grants obtained by research personnel associated with the program secure another eighth of the funds. Washington State University provides a large portion of the support needed by the program; a quarter of the budget is supplied by WSU in terms of facilities, services, and research personnel.

This funding mechanism is a bit precarious. The federal funds are not necessarily secure. The project must be approved every 5 years and the budget each year by the agriculture research directors at all land grant universities, many of whom have little fruit tree experience and few have tree fruit industries in their state. Another concern with the budget is the large proportion of support provided by the state of Washington. Although NRSP5 is a national program with national support, over 1/3 of its budget emanates directly from WSU or Washington State growers. The concern with stability of federal funds and a continued disproportionate contribution by WSU has industry supporters of NRSP5 apprehensive and searching for alternative funding mechanisms.

These industry members see NRSP5 as a pivotal ingredient in the continued health of the fruit tree industry. The program serves a critical role in protecting the industry from virus and virus-like pests. Currently, with plum pox virus (PPV) now reported in the USA, the certification programs supported by NRSP5 are more important than ever for the soft fruit industry. These programs are the backbone for control of PPV and of any other virus problems of fruit trees, both now and in the future.

Anyone wishing more information on the NRSP5 Program can find much information at the NRSP5 Internet site at [www.nrsp5.prosser.wsu.edu](http://www.nrsp5.prosser.wsu.edu).

## **NAPPO and the Tree Nursery**

by Dr. Deborah Golino, FPMS Director

In February, 2000, the Fruit Tree Working Group of the North American Plant Protection Organization (NAPPO) met in Saanich, British Columbia, Canada. Dr. Jerry Uyemoto, USDA-ARS, and Robert Woolley, Dave Wilson Nursery, represented California tree fruit growers. This working group is involved in ongoing meetings to develop standards for both *Malus* and *Prunus* that will provide guidelines for the movement of nursery stock within the United States, Canada, and Mexico. These guidelines will also set an important precedent for standards for the movement of fruit tree nursery stock into the United States from the rest of the world. The February meeting provided an opportunity for tree nurseries and growers to understand the trade issues that are emerging as NAPPO attempts to develop the standards. Minutes of this meeting can be read on the NAPPO web site at [http://www.nappon.org/fruit\\_e.html](http://www.nappon.org/fruit_e.html).

NAPPO is a regional plant protection organization that is represented by members from the national plant protection organizations of Canada, the United States and Mexico. It is one of many regional plant protection organizations whose primary responsibility is to develop regional plant protection standards which would protect the member countries from the entry and establishment of pests, while facilitating trade. The Animal and Plant Health Inspection Service (APHIS), a regulatory branch of the United States Department of Agriculture (USDA), represents the United States in NAPPO.

NAPPO is engaged in the process of creating regional trade standards for North America for a number of important

---

nursery crops. A potato standard has recently been approved. The grape panel has been meeting for several years. In 1999, panels began meeting to develop standards for *Citrus* and fruit trees (*Malus* and *Prunus*). Panels for additional crops are planned for the near future. These standards are intended to meet new international guidelines for free trade. The American Nursery and Landscape Association is coordinating efforts between commodity groups to help provide industry input for U.S. participation.

As the NAPPO panels have worked to develop a standard for these crops, a common problem has arisen for U.S. panel members attempting to follow new global standards while protecting U.S. growers. U.S. clean stock programs depend heavily on the “umbrella” of our current U.S. quarantine regulations which are very strict. In addition, we have excellent voluntary certification programs which are run on a statewide basis. But we do not have national nursery certification programs for any horticultural crops.

For fruit trees, this creates a serious problem. Most participants in NAPPO are doubtful that our existing voluntary programs will constitute sufficient control to allow the existing state programs to set a standard for foreign nursery material entering the U.S. that will continue to provide U.S. growers with the level of protection they now enjoy against disease.

Discussions are just beginning about possible solutions to this dilemma. As work continues on NAPPO standards for these crops, potentially removing non-quarantine damaging diseases from the regional, and ultimately national quarantine lists, the tree nursery industry faces possible importation of damaging pests and diseases, resulting in a degradation of quality and a loss of farm productivity. Many growers, regulators, and researchers find this prospect unacceptable.

According to international standards, a national program of regulation, either through mandatory certification programs or official control programs for target diseases for each commodity, could allow classification of these economically important diseases as regulated non-quarantine pests. State or domestic regional mandatory regulations might also serve this purpose. By establishing domestic regulations, only imported nursery stock meeting high standards of freedom from specific domestic diseases could enter the country. However, the idea of a national mandatory certification program has no existing model in the U.S. Many nurserymen and growers find the idea intrusive and contrary to American ideals of free choice, trade and competition. Further, any program would require funding to enforce; this could come from industry, state or federal funds but is likely to be far more expensive than our current exclusionary system.

In the meantime, the current system has served us well. National standards under the voluntary system for tree nursery stock are very high; U.S. tree nursery products have ranked at the top of testing done by independent regulatory agencies. The current system is inexpensive; because very little tree stock enters the U.S., a large regulatory infrastructure to supervise imports is not needed.

It is unlikely that the international pressures on the U.S. nursery industry to clarify and harmonize standards will subside. Although it might be a number of years before a change in our current practices is forced by either a World Trade Organization (WTO) challenge or changes in U.S. regulations as a result of international agreements, it would be wise for the tree nursery industry to begin discussions of the issues, solutions and their implementation before that time comes.