

Keeping Roses Clean

Thanks to the passage of the 2014 Farm Bill, funding for roses was recently added to the USDA's National Clean Plant Network, resulting in stepped-up research to provide clean stock for the industry.

By David C. Zlesak

The National Clean Plant Network-Roses (NCPN-R) was recently added to the greater National Clean Plant Network (NCPN), a program begun with the 2008 Farm Bill and administered by the United States Department of Agriculture. It provides resources to develop, maintain and distribute virus and other pathogen-indexed plant material (plant material clean of known viruses) to propagators of important clonally propagated cultivars of key plant commodities valuable to U.S. agriculture. Most of the crops included under the NCPN efforts are fruit crops (grapes, raspberries, strawberries, stone fruits, etc.), but root and other specialty crops like sweet potatoes and hops are also included. With the most recent Farm Bill in 2014, roses became the seventh group of plants added to NCPN efforts;

this represents the first ornamental commodity.

Ensuring healthy plants are being propagated and used in U.S. agriculture will aid in sustaining and improving yield and quality and ultimately protect our national security. With increased international barriers and stricter quarantines, it is becoming increasingly difficult to get new varieties into and out of the U.S., and sometimes even across state lines. The primary role of the USDA and associated state agencies has been to test for problematic diseases at strategic check points and destroy plant materials found to be infected. The NCPN is a proactive effort allowing the USDA to participate, helping generate and make available clean propagation material of valued cultivars to growers.

A few years ago Dr. Deborah Golino, director of Foundation Plant Services (FPS), enlisted the help of Dr. David Byrne at Texas A&M, and together

they started the process to include roses in the NCPN. Byrne now serves as NCPN-R chair and Golino serves as vice-chair. The first of the funding to directly support rose efforts was released fall 2015. Stakeholder representatives—including rose breeders, nursery producers, public garden curators, plant disease clinic directors, university researchers, the USDA and the American Rose Society—have met to establish the framework for funding and research priorities, and I'm grateful for the opportunity to serve on the board representing university researchers and breeders.

Testing and distribution of clean stock

Foundation Plant Services, located on the University of California-Davis campus, has supported an extensive clean stock rose program since the 1960s through the pioneering efforts of Dr. George Nyland. FPS likely has

the largest clean plant collection for roses in the world with eight rootstock varieties and more than 500 cultivars. Over the years the FPS research team has been conducting valuable rose research characterizing new rose viruses, optimizing tissue culture methods to clean infected roses of virus, and documenting the impact virus infection (a single virus or multiple viruses in combination) has on rose propagation rates for industry and plant performance.

Before a new rose can be entered into the clean stock block, the rose needs to pass three kinds of testing. First, roses undergo molecular tests (PCR/ELISA) to determine if they are positive for the rose viruses that have been well characterized and detection protocols are readily available. If they pass that test, then there are two biological tests they will also need to pass. One is being bud-grafted onto a virus sensitive rootstock called *R. multiflora* 'Burr's Multiflora' that shows strong symptoms when infected. The rootstock is checked for symptoms over two years. The other biological test is bud-grafting the rose in question onto 'Shirofugen' cherry, another virus sensitive indicator plant.

The biological tests are very helpful, but do not tell us which virus(es) are present, just that there appears to be a virus or virus-like pathogen of some kind. In addition, there may be a virus present that the indicator plant may

not show symptoms for. That is partly why two different indicator plants are used. Passing all three tests offers strong peace of mind that the rose is practically clean and FPS can feel comfortable including it in the clean stock collection.

For more information on the actual testing procedures performed at the Foundation Plant Services facilities, please visit www.amerinnursery.com.

What specific outcomes will be realized because of NCPN-R?

- *Repropagate and expand the Nyland block.* The current clean rose stock block is 8 acres and has been funded by ongoing support of the Garden Rose Counsel (GRC). This counsel is made up of key U.S. rose growers that contribute funds to put toward efforts that support the rose industry. The funds needed to maintain the 8-acre clean stock block (about \$125,000 per year) has come from a combination of annual donations from the Garden Rose Counsel and user fees for budsticks and cuttings (between 10,000-70,000 buds/cuttings are prepared and distributed each year). Due to financial limitations, 8 acres was determined to be the maximum size the GRC could sustain. Initially, 20 plants of each cultivar were planted. As more clean cultivars were ready to include within the 8-acre constraint, less popular

cultivars were reduced to 10 plants and some now to five.

The current Nyland clean stock block was planted 20-plus years ago. Many of the plants remain from that initial planting and are in need of rejuvenation. Mike Cunningham, FPS Rose Program Coordinator, initially planted the Nyland block in 1995. He is now semi-retired and has started working proactively this past year to take cuttings of all the cultivars in the Nyland block to get plants ready for the new clean stock rose block.

- *Include more rose cultivars into the clean stock plant collection.* The current collection of roses was assembled over the years and was based on a number of factors and priorities. The primary goal was to include roses of value to industry. This led to All-America Rose Selections winners being continually added along with strong selling, non-patented roses. Additional proprietary roses important to specific nurseries were also included with fees for testing and maintenance charged to those nurseries.

It takes a minimum of two years for roses to go through all the testing needed to be deemed clean and included in the clean stock plant block. If roses are found to be virus-infected, cleanup through therapy can take significantly longer. Cleanup at FPS is most commonly

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done using meristem culturing in tissue culture—taking just the very tip of the shoot that virus hasn't yet infected and regenerating a new plant. How long cleanup takes depends on factors like how well the rose responds in tissue culture and how tenacious the virus(es) are that need to be removed.

NCPN-R funding will help expand the FPS clean rose collection to include many more non-patented roses important to the U.S. rose industry. Mike Shoup from the Antique Rose Emporium has already donated a number of popular old garden roses to FPS for testing/cleanup, and there are lists of other, more recent roses to include as well (for example, Earth-Kind® designated roses not already in the collection, key miniatures, and so on). Dr. Malcolm Manners will also provide propagation material from the old garden and other roses he has worked to clean of viruses at Florida Southern College.

- *Improved diagnostics protocols.* There have been several newly characterized rose viruses over the past decade. NCPN-R funding will help pool this information and develop streamlined, effective and uniform protocols to test for these viruses for use not only by FPS, but to share the information so it can also be used by private and university-based diagnostics laboratories.

NCPN-R does not fund

efforts to characterize new viruses (scientists can hopefully find other sources of funding for that), but to help with technology transfer so what is already known can be tested for and that information can benefit stakeholders. Dr. Kevin Ong (director of the Texas A&M Plant Disease Clinic) and Dr. Mahar Al Rwahnih and his colleagues at FPS are leading the diagnostics efforts. They are working toward multiplex PCR (polymerase chain reaction) detection. In a single reaction the goal would be to efficiently test for a number of viruses simultaneously.

PCR is very sensitive and able to detect even low levels of virus DNA/RNA. ELISA is an older technology that uses antibodies specific to protein coats of viruses and results in color changes when the virus protein adheres to the specific antibody (comparable to how a typical pregnancy test is conducted). There may be instances where ELISA tests may still be useful in these ongoing efforts due to their ease.

Improved diagnostics tests will not only help FPS test their whole collection for the more recently described viruses and roses in the process of entering the collection, but also be of benefit to growers or anyone wishing to have their roses screened by one of several plant disease clinics in the nation.

Concluding thoughts:

NCPN-R is great news for the rose industry and rose lovers. NCPN-R will support technology transfer to optimize and make available diagnostics for especially the more

recently characterized rose viruses; rejuvenation of the Nyland clean rose collection; and inclusion of additional older and newer cultivars important to the greater rose community.

The key to ensure positive impact is for rose industry members to take advantage of NCPN-R resources and use clean stock for propagation. Fortunately, FPS is not only here for large rose propagators, but for all of the U.S. to take advantage of their vast collection of cultivars (minimum orders of budsticks or cuttings is \$25). If a rose in the collection has an active patent or trademark, one would need to secure written permission from the owner before FPS could send the material. Fortunately, most of the more than 500 cultivars are not patented.

Some nurseries already heavily support and rely on FPS. One nursery even has its cultivars on a rotating schedule to secure new propagation stock from FPS every few years in case virus is inadvertently reintroduced. Unfortunately, some nurseries do not routinely take advantage of clean stock and/or manage it well when they get it to help keep it clean once at their facility.

Hopefully the multiple benefits of having clean stock will someday persuade all nurseries to care about clean stock in order to benefit themselves, the greater industry—and ultimately consumers. Breeders are encouraged to submit their new cultivars as soon as possible to FPS for testing and inclusion, because the earlier in the process roses are submitted, it is more likely their cultivars would be clean. It is much more affordable—and faster—to get new cultivars tested and into the collection if they are clean coming in than if they need therapy.

NCPN has fortunately become a permanent part of the Farm Bill with bipartisan support. We have a lot to look forward to regarding NCPN-R activities and impacts in the years ahead. 🌱

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Clean roses for distribution

Breeders and growers can obtain virus-tested stock from Foundation Plant Services; varieties available for distribution are listed at: <http://fps.ucdavis.edu/roseselections.cfm>.

FPS has also recently launched a new resource called The FPS Rose Encyclopedia, which lists roses in the collection, along with background information and an ever-growing number of photographs; visit <http://fps.ucdavis.edu/roses/>.