

## Pecan Breeding Overview – Part 3

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In the previous two issues of the Pecan Grower I began a series of articles discussing the pecan breeding program at the University of Georgia. In the first article I discussed the first steps of the breeding process which included choosing parents, making crosses, and collecting the seed from those crosses. In the second article I discussed growing the seedlings to maturity and selecting the few superior trees that we wish to test more thoroughly. In this final section I will review how we test selections and the process for releasing a new cultivar.

In the seedling orchard the trees are planted at a very tight spacing, 10 feet x 15 feet, which means that by the time the seedlings are old enough to begin flowering they are very crowded with a lot of shading. This is necessary in order to grow a large number of seedlings on a limited amount of land, but makes it impossible to evaluate the yield potential of the seedlings. When we find a promising tree in the seedling orchard, our next step is to propagate that seedling for more thorough testing.

Once we have decided to propagate a selection for yield trials we have two options, we can either topwork a more mature tree to the selection, or we can graft a small tree to the selection. There are advantages and disadvantages to each option. If you topwork a mature tree, you will have a larger tree in a shorter amount of time. Topworked trees quickly regrow their canopy, and in 3-4 years you can hardly tell the tree was topworked. This means that you may save years getting to the performance of a mature tree. The disadvantage is that it is harder to assess yield data. At what point can you compare the yield of a topworked tree to an unworked tree? Another confounding factor is that when you have a topworked tree, the original cultivar is essentially acting as an interstock. This means you have three different cultivars in your tree: the rootstock, the original cultivar, and the new top worked selection. This may or may not affect your results, but definitely introduces some variability into the test. Another disadvantage is that you have to have multiple trees of the correct age to top work. Once trees have reached a certain size, it becomes more difficult to topwork and requires larger amounts of graftwood and time to perform.

The second option is to graft a small seedling to your new selection and plant it as you would a new orchard. This method most closely mirrors the results a grower would achieve with the cultivar. You will have less variability due to grafting issues and can follow early yields in young trees. The disadvantage of this method is, of course, that it takes longer to perform the test. Newly grafted trees will take a few years to begin bearing, and several more years until they are large enough to perform as a mature tree. However, this method allows you to plant standard cultivars at the same time and provides a cleaner test of yield potential.

In practice, we have used both of these methods. We have several selections that we have topworked into a yield trial at the Ponder Farm. We are also beginning a larger trial into the same orchard where we will graft seedlings that were planted 2 years ago to another group of selections. In general, I would have to say that I favor grafting small seedlings to topworking larger trees, and I would guess that the majority of our trees will be tested in this way.

Trees in the yield trial are planted at a 40 foot spacing. This spacing gives us about 17-20 years before there is significant crowding in the orchard. Most cultivar tests would be discontinued at this point so that new selections can be planted and evaluated. Yields are obtained from every tree in the test for as long as it is being tested. In addition to yield we also monitor budbreak, bloom type and date, scab and aphid resistance, shuck split, and nut quality. The number of trees we evaluate for each selection varies somewhat, but is usually 4-6 trees. We feel this gives us enough trees to have some replication, but still allows us to test a large number of selections. Generally when a selection shows serious faults that would prevent it from being released as a cultivar the tree is then topworked or replanted so that a new selection can be tested in its place.

We have different testing locations for our new selections. The majority of our yield trials take place in UGA orchards in Tift County. We also have yield trials at grower orchards in Albany and in south Georgia. Because of the time and expense incurred by the grower in conducting these trials, we have restricted our grower testing to relatively few locations. We also like to have a large enough grower that several selections can be tested in one location so that our travel time is used efficiently. This also enables us to look at selections side by side to gauge their performance in a similar environment.

Aside from yield trials we also have scab resistance trials. Scab resistance is a major focus of our breeding program and we have several selections which have not scabbed in our seedling trials. However, this is only one location and the seedling may have simply not been exposed to the scab race which is capable of infecting it. In order to expose seedling selections to a larger number of scab races, we have three scab screening orchards. One is located at the Ponder Farm, one in Albany, and one at Attapulgus. The trees at these locations are not sprayed with fungicides. In addition, at the Albany location the scab test is located in a large pecan orchard next to a low spot where scab pressure should be high. At the Attapulgus location the trees are under overhead irrigation which provides a good environment for scab infection. Trees are maintained in these plots for several years and monitored for the presence and severity of scab.

After we have evaluated trial trees for several years we face the decision of whether to release the selection as a new cultivar. This is usually not a black and white decision as all selections have strong and weak points. The basic choice that must be made in the release of a new cultivar is whether to continue the testing of the cultivar so that we are sure of its worthiness for release, or do we get it out into the industry where it can do some good? Generally what happens is that the better the selection looks, the sooner it gets released. A selection with large nut size, early harvest, and high scab resistance is going to get released sooner than a midseason selection that appears to have slightly better scab resistance than what is currently grown. In order to get approval for release, any new cultivar must have sufficient data indicating that it is superior to what is currently available. This data is then reviewed by a committee of UGA plant breeders to determine if the potential cultivar is suitable for release, or whether additional data is required. Advice from the pecan industry is also actively sought in the breeding program. New selections are evaluated by growers and shellers prior to release. In addition, nurseries must be willing to propagate the new cultivar or it will never reach the grower. So, while the breeder gets the ball rolling, there are a number of hurdles a selection must pass before it becomes a new cultivar.

No matter how thoroughly a cultivar is tested, the only way to be sure of never having a failure is to never release a new variety. We simply can't test new selections for enough years and in enough locations to guarantee success. This is why new cultivars are usually recommended for trial, rather than fully recommended. Only as we observe a cultivar for several years in different locations do we feel confident enough of how that cultivar will perform to recommend it fully. The amount of any new cultivar a grower should plant depends upon the risk they are willing to incur. In general, we recommend small trial blocks until the grower is comfortable with how the cultivar performs in their location. As more growers plant the new cultivar its true value will become apparent.

A final thought about the cultivar release program at UGA. Most new cultivars released from UGA are patented cultivars. The patent process allows UGA to restrict the propagation of these cultivars and charge a royalty fee for each tree sold. This is quite a change from the past where new cultivars were released into the industry free of charge and restrictions. The reason we have this new system is simply the University is under a new mandate from the taxpayer that requires it make the best use of its limited funds. Without these royalty fees, it is doubtful that many plant breeding programs except those in the very biggest crops would survive. Plant breeding is a labor intensive (expensive) undertaking which is not well funded by federal research grants. By charging royalty fees for its cultivars, UGA funnels that money back into its plant breeding programs so that we can continue to produce new cultivars in the future. Luckily for us in the pecan program, money from high value commodities like peanuts is shared with smaller value crops like pecan. This has been our single biggest source of funds to conduct our breeding program, and the system UGA uses to support its plant breeding programs is among the best in the nation. I would like to thank all of the growers who have provided advice and support to our program and look forward to working with more of you as our breeding program moves forward.