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OFF CAMPUS RESEARCH
REPORT PERIOD: 03/05/2013-12/31/2013

**PROGRESS REPORT
TO
NORTH CAROLINA PEANUT GROWERS ASSOCIATION, INC.**

TITLE: Breeding Peanuts for Multiple Disease Resistance

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DEPARTMENT(S): Crop Science

REPORT:

This project accelerates the process of development of multiply disease-resistant virginia-type peanut cultivars. Each year a new set of crosses is made, usually a set of agronomically good parents crossed with another set with the most disease resistance available. The program uses a winter seed nursery in Puerto Rico to achieve two generations per calendar year, and it uses early generation testing to identify the families most resistant to the four diseases that commonly have economic impact in North Carolina: early leaf spot caused by *Cercospora arachidicola*, Cylindrocladium black rot (CBR) caused by *C. parasiticum*, Sclerotinia blight caused by *S. minor*, and tomato spotted wilt (TSW) caused by *Tomato spotted wilt tospovirus*. We grow separate tests for the four diseases in separate trials called the "Disease Selection Test (DST)" series, each specially managed to promote a specific disease, but we score other diseases as opportunity allows. In each trial we grow the same set of families.

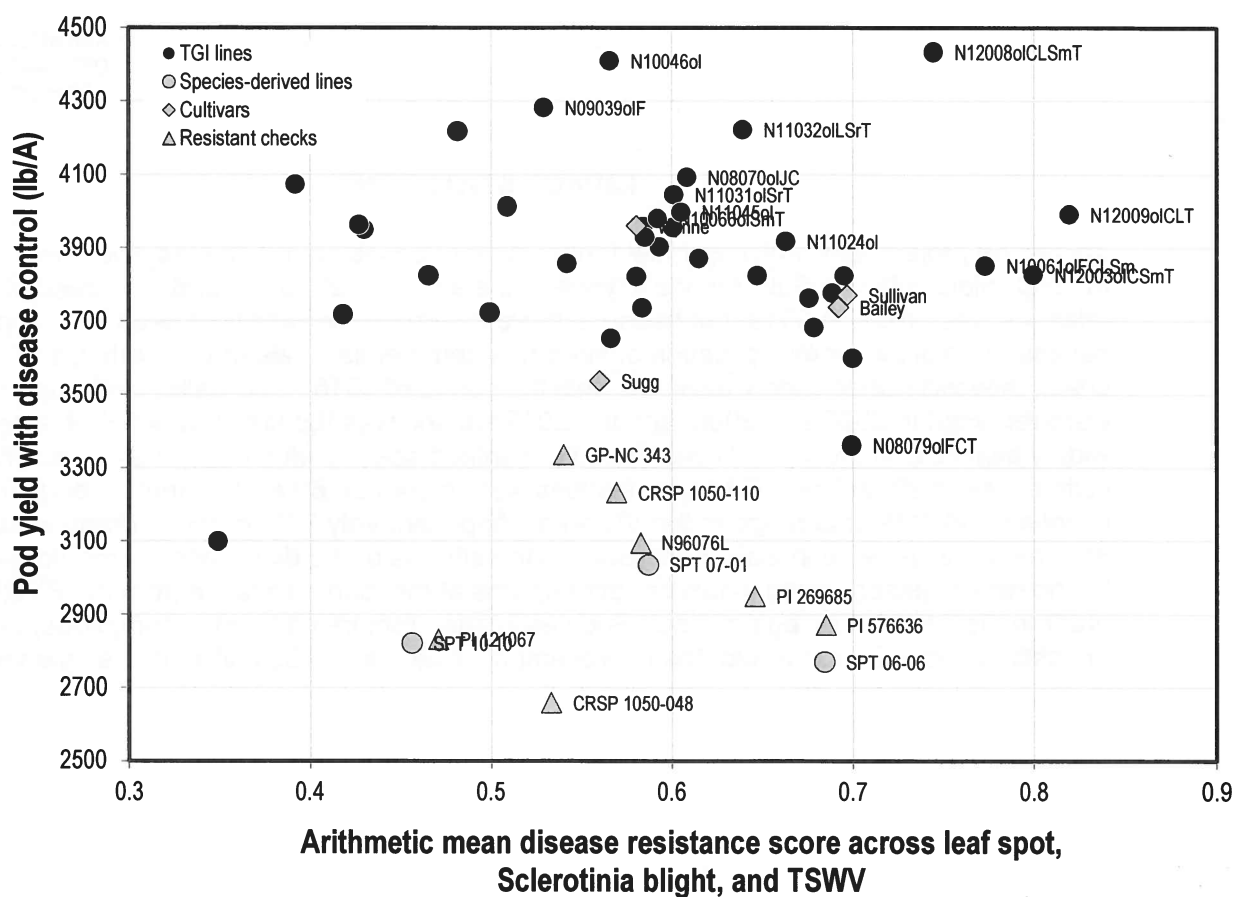
In 2013 we had 120 BC₁F_{2:4} (selected as BC₁F₂ plants two generations removed from the cross, tested as BC₁F₄ grand-progeny of those selected plants), 16 F_{4:6}, and 68 BC₁F_{6:8} families. As was the case in 2012, we did not see definitive symptoms of CBR in our plots at the NCDA Upper Coastal Plain Research Station on infested soil in an area managed to promote the disease. This in spite of having the cool wet conditions during the growing that should promote CBR development. We did get very good data on Sclerotinia blight, leaf spot, and TSW in 2013.

All of these families were either high oleic or carrying the gene for the high oleic trait. We consider the BC₁F_{6:8} families to be genetically stable "breeding lines," and we select the best among them but not within them. For the BC₁F_{2:4} and F_{4:6} family types, we selected good looking plants within the 20% most disease-resistant families, sent the progeny to the winter nursery, and will return enough seed to have our replicated trials and a selection nursery in North Carolina in 2014. In addition to the disease evaluations, the BC₁F_{6:8} families were tested in replicated trials for yield and grade at two locations in North Carolina.

Once a line has been tested for disease reaction as an F_{6:8} or BC₁F_{6:8} family, we "graduate" resistant families into our ongoing program of evaluating lines for reactions to the four diseases, our "Disease Advanced Line Test (DAT)" series, or we graduate high-yielding lines into our Advanced Yield Test (AYT) with yield trials conducted at three locations in North Carolina and leading to the multi-state Peanut Variety and Quality Evaluation program and ultimately to cultivar release. Most years there is some overlap of the sets of lines graduated to the DAT and AYT. From the 2012 DST series, 15 families graduated to the 2013 DAT and 18 to the 2013 AYT; there were 5 families that graduated to both. We moved other F₆-derived families from previous years' testing forward in the DAT and AYT programs. Note that we do test disease reactions of lines in the AYT starting in the second year of AYT testing, and that lines in the DAT can move into the AYT program if their performance so warrants.

Each year as the results of the disease trials of F_6 or BC_1F_6 -derived breeding lines are completed, the results are added to databases maintained separately for the four diseases, and then the multiple-year data are analyzed to identify the most disease-resistant lines in the program. This data is used not only to move lines forward in the program, but also to identify resistant parents to be used in the next set of crosses. This year, we examined disease reactions of the 57 lines that were tested in 2013 and had been tested for at least the past three years. It was evident that three of the high-oleic Bailey backcross derivatives, N12003olCSmT, N12008olCLSmT, and N12009olCLT, had excellent disease resistance "packages," and the N12008olCLSmT also had very high yield for the limited amount of testing it has received. Another very high yielding high-oleic line, N10046ol, did not have the high degree of disease resistance one would consider desirable, but as of the end of data acquisition in 2012, N10046ol averaged \$96 per acre more than Bailey in our in-state trials. If N10046ol's yield and value differential holds up as more data is acquired, then we must consider that line a candidate for release even if its disease package is not among the best in the program. Of course, neither were Bailey or Sugg's disease resistance arrays among the best in the program at the time, but they had agronomic performance superior to more resistant lines.

Bailey was released from this program in 2008, Sugg in 2009, Sullivan and Wynne in 2013. The area's shellers do not want to absorb a new cultivar every year, preferring them to come out every three to five years. We intend to replace Bailey with one of the high-oleic versions once we have collected sufficient disease, yield and grade data to warrant release. In the meantime, a number of lines that have passed through the NPB-funded program were tested by the end of the 2013 season although having released two lines in 2013; we do not anticipate releasing another before the spring of 2016. Our ultimate aim is to replace all the cultivars currently on the seed market with high-oleic, disease-resistant releases.



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IMPACT STATEMENT

This is the project from which our last four cultivar releases came: the last two releases were the high-oleic cultivars Sullivan and Wynne in the spring of 2013. Foundation seed of those two releases was grown in 2013, but because there is a lag in availability of seed following release, necessary to allow for multiplication of seed to a commercial scale in the North Carolina seed chain, they will not be widely available until the spring of 2016. The Bailey and Sugg cultivars were released in 2008 and 2009, and the 2012 season was the first in which that seed became widely available to growers. Using the 2012 certified seed production figures as estimates of cultivar use in 2013, North Carolina releases were grown on 82% of peanut acreage in North Carolina and 71% of acreage in the VC area. Approximately 72% of the acreage in-state and 61% region-wide were in Bailey and Sugg. An estimate of the difference in crop value achieved by the new releases, using value-per-acre figures at the loan rate taken from the PVQE program, is \$10 million region-wide. Such estimation requires a lot of assumptions, but even if the estimate is inflated twofold, the improvement would still be \$5 million in a single year.