

FINAL PROJECT REPORT

Project Title: Support for a full time technician

PI: Nnadozie Oraguzie
Organization: Washington State University
Telephone: 509 786 9271
Email: noraguzie@wsu.edu
Address: 24106 N Bunn Road
Address 2: Dept of Horticulture
City: Prosser
State/Zip: WA, 99350

Cooperators: Dena Ybarra, Dave Allan, Jeff Cleveringa, Ines Hanrahan, Tom Auvil, Todd Einhorn, Lynn Long, Amy Iezzoni, Fred Bliss

Other funding sources

Agency Name: USDA-CSREES Specialty Crops Research Initiative
Amt. requested/awarded: \$3.4M plus equal matching Sept 2009-Aug 2013
Notes: A total systems approach to developing stem-free sweet cherry production, processing, and marketing system. PI: Whiting. Co-PI includes Oraguzie

Agency Name: USDA-CSREES Specialty Crops Research Initiative
Amt. requested/awarded: \$2.1M plus equal matching Sept 2009-Aug 2013
Notes: Tfr-GDR: Tree fruit genome resource database with Dorrie Main as PI and Oraguzie as Co-PIs.

Agency Name: USDA-CSREES Specialty Crops Research Initiative
Amount awarded: \$7.2 mil plus equal matching, Sep 2009 – Aug 2013
Notes: “RosBREED: Enabling marker-assisted breeding in Rosaceae”. PI: Iezzoni. Co-PI includes Oraguzie

Agency Name: WTFRC/OSCC
Amount awarded: \$442, 847 for 3 years from 04/01/2012 to 03/31/2014
Notes: PNW Sweet cherry breeding and genetics program

Total Project Funding: This project was funded in 2013 at \$28,749 but in 2014 it will merge with the Breeding project, CH-12-107, according to WTFRC board’s recommendation and the second year’s funds will be rolled over into the Breeding project.

Budget History:

Organization Name: WSU-Prosser
Telephone: 509 335 4564

Contract Administrator: Carrie Johnston
Email address: carriej@wsu.edu

Item	2013		
Salaries	18,633		
Benefits	10,062		
Travel	54		
Total	28,749		

Justification

One of the objectives of the WSU sweet cherry scion breeding project funded by the Washington Tree Fruit Research Commission and the Oregon Sweet Cherry Commission (WTFRC # CH-12-107) was to establish and implement a written protocol for best nursery and field management that will ensure optimal tree growth for trait selection. The breeding program has two phases, P1 and P2, while Phase 3 will be operational in two years with the planting of a fast-tracked advanced selection, FR001T007, in grower co-operator trials. Currently, there are two technicians in the program assisting the breeder in the day-to-day management of breeding operations. One FTE (Seyed Chavosi) is funded through WSU-ARC while the other (Sue Watkins) is funded from the sweet cherry breeding project, WTFRC # CH-12-107 (0.5 FTE) and another project 'Support for a full time technician,' WTFRC # CH-10-110 (0.5 FTE). WTFRC # CH-10-110 comes to an end at the end of March, 2013. This proposal seeks funds to support the 0.5 FTE that will expire next year to provide continuity in the program. The overall goal of this position is to ensure efficient horticultural manipulation of trees in the lath-house and field, field plot management, coordination of fruit sampling during harvest and tree planting and propagation, as well as bar coding to maintain tree identity in the field.

Objectives:

- To acquire support for a full time technician to ensure that healthy, vigorous seedlings of adequate size and precocity are produced and managed in all phases of the breeding program using best horticultural practices.

SIGNIFICANT FINDINGS AND ACCOMPLISHMENTS

- The PNWSCBP personnel are now in charge of tree pruning and training in the program with guidance from key BPAC members. The Central leader system is now the architecture of choice and older plantings in Phase 2 have been pruned and trained to conform to this architecture.
- Pruning and training procedures and improvements on seed germination, seedling establishment in the green house and field, cultural practices, in particular, promotion of early flowering and fruit sampling and evaluation techniques have been integrated in the 'Best Management Practice' document.
- Every tree in the Breeding blocks have been mapped and assigned a unique bar-code to facilitate identification. Harvested fruit samples are also barcoded and lab fruit analysis is automated to minimize error in data recording and analyses.
- In line with our policy of renovation and recycling of orchard blocks, we have pulled out over 1000 trees from the seedling blocks as well as 7 flawed advanced selections from Phase 2 blocks. New seedling plantings are located in warmer blocks to minimize the impact of frost damage on flowering.
- The Breeding personnel constructed 30 tree cages for bird control and also installed a Bird Gard unit that emits distress calls for 8 different bird species. This is additional to bird netting that already exists in the seedling blocks.

- Approximately 2000 trees on Gisela 6[®] including breeding parents, other cultivars and F₁ progenies were planted in the mother blocks this spring. These trees have been carefully chosen for traits of interest for use in controlled pollination and for genetic studies. This will ensure that we achieve the target seed number for different market classes following controlled crosses. Flowering is often erratic on own rooted trees and pollination usually results in poor fruit set.
- The Breeding Team hired 12 temporary assistants in spring months and 14 in summer to assist with the enormous task of hand-pollinations and fruit picking/evaluation, respectively.
- Three key industry members including Dena Ybarra, Dave Allan and Jeff Cleveringa worked with the PNWSCBP leader once a week for 2 months, taste-testing fruit from the seedling block and the advanced selection block. This industry input was key to identifying a total of 16 seedlings for advancement to Phase 2 in 2012 and 2013, one early advanced selection belonging to the ESM class to fast-track to Phase 3 in 2012, and 10 flawed advanced selection to pull out of Phase 2 in 2012 and 2013.

RESULTS AND DISCUSSION

a. Tree pruning and training

The Breeding staff had several meetings with Dave Allan, Dena Ybarra, Jeff Cleveringa, Lynn Long, Matt Whiting and Tom Auvil in the winter, of 2012/13, and with Dave Allan, Dena Ybarra, Jeff Cleveringa and some Oregon BPAC members, in the summer of 2013, to decide on a uniform, standardized pruning and training system which will align with the goals and vision of the PNWSCBP, especially with regards to Phase 2 of the program. In addition, the system must be simple, maximize early yields and easy to be communicated to anyone involved in the breeding program, including orchard workers. The consensus was to adopt a '*central leader*' architecture going forward with new plantings and to re-direct existing trees to conform to this architecture even if it means losing a fruiting year. The pruning workshop in the December of 2012 in Oregon organized by Lynn Long was also very helpful in taking on the pruning responsibility by the Breeding staff. We performed summer pruning after harvest to ensure that trees have time to harden off for winter. This procedure opens up a tight canopy to allow fruiting buds to intercept more light. The 'sucker woods' removed should also provide more light to the lower branches and will help to improve fruit set the following year. Summer pruning also helps to reduce the risk of bacterial canker infection. The plan in the coming years is to manage the existing large trees in the seedling block (rows 1-55) suffering from overzealous pruning in the previous years to save as much fruit-bearing wood as possible while opening up the canopy to allow light to penetrate to lower branches. Removal of vigorous growth and blind-wood and leaving behind weaker branches will encourage fruit production in the next year.

The written protocol for tree pruning and training has been incorporated in the updated 'Best Practice Management' handbook which you can obtain from the PNWSCBP staff.

b. Renovation of Seedling Blocks

Approximately 500 trees in the seedling block deemed of no value to the breeding program were removed in November 2012 by Trepanier Excavating, Inc. of Yakima. Selected trees were removed by bull-dozer, leaving valuable trees intact. An additional 400 trees were removed in August 2013 by chainsaw. Stumps were left in place and painted to discourage vegetative growth from roots. This exercise leaves behind only the mother trees of advanced selections already in Phase 2 as well as trees used for genetics/genomics studies out of 1300 trees originally planted in 2006/7/. In 2014, many trees planted in 2008 will be pulled out following fruit evaluations in summer.

c. Implementation of Sample Tracking System

Each tree in the seedling blocks is tagged with a unique plastic bar-code ribbon identifying the location of the tree. During harvest, the barcode is scanned and reproduced as a stick-on label which is fixed to the collection bag. Upon entering the fruit evaluation laboratory, each sample label is immediately logged into a universal data collection file via bar code scan, to provide a record of collection which includes the tree location and date. A reproduced label accompanies each individual fruit sample as it rotates through the evaluation stations, minimizing and/or eliminating hand-written errors. Evaluation results are entered into the data collection file by electronically scanning the unique label, which automatically locates the correct line (sample location/collection date) for data entry, eliminating mis-match errors.

d. Collection of Leaf Samples for Marker Assisted Seedling Selection

Leaf samples are collected from nascent seedlings still in the yellow cone-tainers in the growth room. Earlier collection and analysis limits transplantation of seedlings to those showing genetic potential. Seedlings are identified only by parentage until leaf samples are taken, at which time each sampled individual is collared with a barcoded tag identifying year of seed harvest, seed parents, stratification bag number (for cross reference, lending additional assurance for accurate heritage assignment) and individual seedling number. The barcodes are scanned directly into a spreadsheet matrix duplicating the configuration of the leaf collection plates so no handwritten collection sheets are generated. Spreadsheets for each collection plate are then sent in electronic format to the lab performing the DNA tests, again eliminating hand-written error.

e. Greenhouse Seedling Transplanting

Seedlings showing genetic promise are transplanted to smaller pots (2 gallons) at transplant time, saving money on potting soil, labor and greenhouse space. In the past, all seedlings (both favorable and inferior determined by genetic tests) were transplanted into 5 or 10 gallon pots before genetic tests are performed

f. Bird Control

In addition to the bird netting in the seedling block (Phase 1), individual trees particularly, early ripening genotypes, in both phases of the breeding program were enclosed in portable bird cages constructed by the Breeding staff. These cages were moved around and placed over mid-season or late genotypes as the season progressed to reduce the risk of bird damage. Further, a Bird-gard unit emitting eight different distress calls was mounted at the seedling block for additional control.

EXECUTIVE SUMMMARY

Renovation and recycling of seedling blocks are ongoing in the PNWSCBP. To date, we have pulled out ~1000 trees and plan to remove more in future. Because the current location of the seedling block is too cold and prone to frost damage, new seedling plantings have been re-located to warmer blocks to minimize the impact of frost damage during hand pollinations. We are also exploring alternative pollination strategies in combination with frost control measures to enhance pollination and fruit set. In addition, the use of propagated trees for controlled hybridization is poised to boost flower numbers and fruit set. New tree plantings in Phases 1 and 2 of the program conform to the central leader architecture adopted this year while trees planted previously were pruned and trained to adapt to this architecture. Summer pruning was introduced in the seedling blocks to open up the canopy of large trees for more light interception and to reduce the risk of bacterial canker. Unique bar codes have been assigned to each tree and bar-coding was also used to track fruit from the field to the lab to minimize error in data recording. Marker assisted breeding (MAB) has been used routinely since 2010 for parent selection, to establish genetic identity, re-assign/confirm parentage and to cull inferior seedlings before field planting. Genetic tests and culling of inferior seedlings are often performed prior to field planting. However, this was carried out this year while seedlings were ~2 months old in the growth room resulting in more cost effective seedling development prior to field planting. We are using a multi-pronged approach combining bird netting and a device that emits bird distress calls for bird control. We appreciate the partnership between PNWSCBP and the industry and hope that this will continue to ensure that new high quality cultivars with high consumer appeal are released in an efficient and timely manner to provide competitive advantage to the PNW industries.