### Proposal for a Chestnut Breeding Cluster in the Oldham County Area:

Although Oldham County is not thought of as the classic American chestnut range, recent experience at the Backcross Orchard at Meades Landing shows that American chestnut grows well on well-drained soil types such as Crider Silt Loam.

**Backcross Breeding for Blight Resistance**:

The TACF Backcross Breeding program is designed to incorporate substantial genetic variation from different ecological regions into a final American chestnut that captures full Chinese level resistance to chestnut blight.

The intermediate first generation of breeding for the TACF Chapters is the B3F1 or B4F1 generation. Each tree group is the product of a parent from the Meadowview advanced hybrid, which has been selected for blight resistance This moderately resistant parent is outcrossed to a pure Kentucky American chestnut parent. Two or three “lines” from unrelated Meadowview blight resistant trees and unrelated KY American trees are sited in each Backcross orchard (approximately 100 trees per each line, so 200 or 300 trees per orchard). At about 5-6 years, these trees are selected for blight resistance and for American traits and then are intercrossed. If 100 nuts were planted, and 80% survive to 5 years, then about 10 trees (1/8) for each line will carry moderate blight resistance. All other trees are removed from that first backcross orchard.

Intercrossing: The B3F2 generation and the Seed Orchard

If there are eight independent lines in a cluster, there are theoretically 55 independent pairwise breeding that could be done with controlled pollinations. The simplest intercross generation is to let single pairwise breeding occur within a given Backcross Orchard. In a three line orchard, this would be three pairings (HA, HB, HC can give HA&HB, HA&HC, and HB&HC.)

These nuts from the intercross are called B3F2s. It is desirable to have about 150 nuts from each pairwise cross. Trees from these nuts will concentrate high levels of resistance by inheriting blight resistance from each parent. All these seeds are brought into the same orchard together and planted at tighter spacing (3 ft apart) and selected earlier than the previous generation. The seed orchard allows for quickly removing the low resistance trees, and then tests the remaining highly resistant parents for their ability to transmit high levels of resistance. Fully resistant trees from selected B3F2s crossing with each form the B3F3 generation, and should breed true for blight resistance. This cluster would represent convergence of 8 to 10 genetic contributions to the B3F3 trees.

It is often easier to understand Breeding by looking at the Implementation plan:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Year | Orchard | Crosses (#Planted) | Hybrid Line # | Selection Year | Intercross Year(s) | Selection B3F2 | Intercross |
| 2008 | ML | JB216 x KYHART1 (95) | H1 | 2015 | 2017-2018 | 2021 | H1 x H2 |
| 2009 | ML | GL239 x KYFLEM1 (44)  GL239 x KYFLEM1 (11) | H2 | 2015 | 2017-2018 | 2021 |  |
| 2010 | ML |  |  |  |  |
|  |  |  |  |  |  |  |  |
| 2012 | Ash1 | SC267 x KYELLI1-A (120) | H3 | 2017 | 2018-2019 | 2022 | H3 x H4 |
| 2012 | Ash1 | KYMETC1 x MVB3 (50) | H4 | 2017 | 2018-2019 | 2022 | H4 X H5 |
| 2012 | Ash1 | KYPMT1-46A x B3119 (35) | H5 | 2017 | 2018-2019 | 2022 | H5 x H3 |
|  |  |  |  |  |  |  |  |
| 2013 | Site 3 |  | H6 | 2018 | 2019-2020 | 2023 | H6 x H7 |
| 2013 | Site 3 |  | H7 | 2018 | 2019-2020 | 2023 |  |
|  |  |  |  |  |  |  |  |
| 2014 | Site 4 |  | H8 | 2019 | 2020-21 | 2024 | H8 x H9 |
| 2014 | Site 4 |  | H9 | 2019 | 2020-21 | 2024 |  |
|  |  |  |  |  |  |  |  |

Notes:

* The earliest that most trees are of a size where they would tolerate inoculation to test blight resistance is about 5 years of age. The trees at Meades Landing from 2008 are being delayed in inoculation so that the younger trees can catch up in size.
* Trees do not bloom profusely in the first years, so two years are allowed to collect 100-150 nuts for the intercross.
* Trees in an orchard where open pollination occurs (two lines) have greater numbers of nuts generated than sites where controlled pollinations might be used. To make the crosses between three lines in Ash1 would require controlled pollinations.
* The KYPMT line is also planted in the Morgan County nursery, but the line is from a Meadowview tree that transmits Phythopthora root rot resistance, and therefore makes a unique contribution to the overall population.
* Site 3 might well be River Farm. Pat Carey was interested in participating but didn’t feel he could provide the oversight needed. This problem would be alleviated if we have a Breeding Orchard Manager.

### Tasks in Establishing and Maintaining Breeding Orchards:

There are two phases to orchard establishment:

**Planting**:

* Site preparation: removal of perennial invasives and control of competing grasses and herbaceous layer.
* Laying out orchard. Establishing rows and staking planting sites.
* Creating orchard map and tagging sites.
* Putting in such structural components as deer fencing and irrigation.
* Securing materials needed: soil mix, tools, BlueXs, stakes.
* Data Recording: Checking and recording germination, removing clothespins in 3 weeks after planting. Final count of germination is done around end of June.

**Maintenance**:

* Monitoring soil conditions and irrigation needs.
* Weed and invasive control and suppression: Typically involves herbicide sprays three time the year with glyphosate. Manual weeding within BlueXs may be needed. Mulching may be also be used.
* Fertilizing with Osmocote yearly in May.
* Pruning: Corrective pruning to remove dead wood, crossing branches. Structural pruning to create and encourage a single leader.

**Disease Management**:

In the Southern orchards, two other major foreign pathogens have become major problems and all orchards require management for these problems.

**Asian Ambrosia Beetle monitoring (AAB monitoring).**

* + Establish traps in February and monitor once a week.
  + When beetle activity is detected begin spraying with Permethrin on bark at two week intervals in March, April, and May, then monthly thereafter until traps no longer indicate activity.
  + Trees attacked by AAB need to be cut down at the ground, and burned.

**Phytophthora cinnamoni treatment (Phytophthora root rot (Prr) ink disease):**

* Yearly soil drench with Subdue Maxx
* Spraying with Agri-Fos three times a year
* Soil samples and root systems to Steven Jeffers (Clemson) in suspected sites.

**Chestnut Blight**: Monitoring and Recording of natural blight presence and spread.

**Yearly Data Monitoring (recorded on standardized TACF sheets):**

* + Maintain tags yearly.
  + Yearly recording of mortality, heights, and dbh (once tree are over 4.5 ft.)
  + Beginning Year 3, record bloom (male, and female)
  + Beginning Year 4, record bud break record.

Data forms are submitted to KY-TACF data manager for analysis.

Year 5 and 6: Inoculation and Selection of Moderately Resistant Trees

Year 7: Removal of susceptible trees and preparation for B3F2 intercrosses.