

Testing Chestnuts for Resistance and American Character:

Field Traits

Canker Sizes



Leaf and Twig Morphology and Tree Form



Inoculation Procedure and Timing

- Inoculation is the process by which we judge the resistance of a chestnut tree. During the inoculation procedure, we take a plug of chestnut blight and insert it directly into the trunk of a chestnut tree.
- Before You Inoculate: 1) Tree shelters must be removed summer before to allow trunks to harden to a natural condition. 2) Tree must be in its fifth year of growth. 3) Mark trees to be inoculated in advance unless you experienced as an inoculator. 4) Early June is generally the time to inoculate.
- Inoculate your orchard when the majority of the trees average 1 1/8" DBH or higher. We sometimes recommend waiting until the average DBH approaches 1 1/2" DBH. Attempt to inoculate all trees in the same orchard at the same time in order to be able to select from an entire backcross line at once.
- Preliminary selections for resistance are made in the November following inoculation. Bud characteristic ratings are made in February or March. Final selections for both resistance and American character are made in May, almost 1 year following inoculation.

Canker Scoring

EP155	SG	Rating
Small	Small	1
Medium	Small	2
Large	Small	3
X-Large	Medium	4
XX-Large	Large	5

Chinese trees generally rate a 1 or 2, F1s usually rate a 3, and Americans typically rate a 4 or 5.

- For a tree to have a rating of 1, both SG and 155 cankers need to be very small, with complete closure of the wound by uninfected callus.
- A tree with a rating of 2 will have 155 cankers not as above (not small), but not sunken with abundant sporulation.
- A tree with a rating of a 3 will have sunken 155 cankers with abundant sporulation, but the SG cankers will be small (<3.5cm long)

- For a tree to garner a rating of 4, the SG cankers will not be small, but they will not be sunken with abundant sporulation.
- A highly susceptible tree will be given a rating of 5 -- cankers of both inoculum types will be sunken with abundant sporulation.
 - There are also intermediate grades given, e.g. 2.5, 3.5, etc.

Chinese Canker Ratings

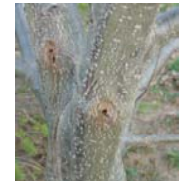
CHINESE: RATING 1



Chinese: Very small SG, 1.5"

CHINESE: RATING 2

Small SGs



Chinese: Very small EP155, 1.5"



Medium, superficial EP155

Moderate Resistance Reactions



BC1 rated 2.5 –
4 years after
inoculation

BC3 rated 2.5 -
3 years after
inoculation

BC3 rated 3 –
1 year after
inoculation

Bud Traits

- **1. Bud Color: Black, Yellow, Red, Brown**
- *Color is very difficult to define. You will find variation among the tree as a whole, as well as the same bud, and also depends on whether the bud is in the shade or in the sun. Generally, a darker or redder tint will be actualized on a stem toward the sun, whereas a paler color tends to characterize the shaded side of a stem.*



Susceptible Reactions



- SG replicant on BC3. Rated 4

- EP155 replications on BC3 – rated 5



Bud Tips and Shape

- **BUD SHAPE - round or cylindrical**
- **BUD TIP - pointed or flat**



Leaf Morphological Traits

- BOAT : are the leaves generally shaped like a canoe?
- ACUTE : is the leaf angle acute at the petiole?
- DULL : is the leaf wax on top (adaxial) is dull?
- BIG TOOTH : are the teeth on the leaf large?
- TAPERED TOOTH : do the teeth taper to a point? (alternatively, they are wedge-shaped)
- HOOK : do the teeth curve forward like a breaking ocean wave?
- STIPNARROW : are the stipules 1mm wide or smaller?
- STIPNOFLARE : are the stipules a uniform thickness top to bottom? (alternatively, they could flare out at the base like a Chinese)
- NO LH : are there no leaf hairs underneath the leaf?
- SPARSE VH : are the vein hairs sparse? (for more information, see: Hebard, FV. 1994. Inheritance of juvenile leaf and stem morphological traits in crosses of Chinese and American chestnut. The Journal of Heredity. Nov/Dec 1994. v. 85 (6) p. 440-446

Rate Leaf traits in the May following the year of inoculation. There is variation among leaves on the same tree – take note of leaves in both sun and shade and make the best average assessment possible.

Selection for Leaf Traits

Dull vs. Shiny



Teeth (dentation)



Note strong hook along leaf margin.

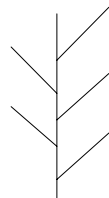


Note strong wedge-shaped in dentation of this Chinese chestnut.

Leaf Traits

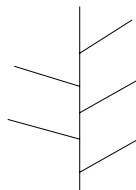
Acute vs. Wide Angle at Petiole

Canoe vs. Oval



Usually, American chestnuts exhibit acute branch and leaf angles.

But Chinese chestnuts have wider branch and leaf angles.



Stipules

- Stipules are best observed in the spring and early summer.



Thin, non-flared stipules on American



Wide, flared stipules on Chinese

Leaf Hairs

There should be no leaf hairs on the underside of the leaf (interveinal).

Along the veins, particularly the midvein, simple hairs should be sparse.

Under a microscope, over 40x, one can see star-shaped (stellate) hairs on the underside of a leaf.

With a hand lens, the presence or absence of hairs may be determined. Questionable specimens may be further examined.

OTHER CHARACTERS

- **BIG** : is the tree big?
- **NOT EARLY** : has the tree not been harmed by spring frost damage? This is usually assessed by branching at the same point around the crown in years with late spring frosts.
- **NICE BARK** : is the bark normal and American looking? (alternatively, it could have Clapper or other defect). If normal, are the lenticels small?

Nice bark vs. “squirrely” bark



Normal mature bark



Normal young bark



Deformed bark on B2F2

CONCLUSIONS

Note that all of these traits differ with environment, as well as other variables. The characteristics presented here are generalizations and, often, represent the best-case scenario when rating them.

Experience is one's best friend in rating these characters. Every November and May, selections are taking place. Contact Sara (whose contact information may be found on the last slide) to see if one of these events will be taking place in your area.

Early trees will exhibit dieback at tips



For More Information

Identification of chestnut species:

<http://chestnut.cas.psu.edu/Procedures/ID.htm>

- Inoculation and Selection procedures (also find a PDF of this presentation):

<http://chestnut.cas.psu.edu/Procedures/Inoculation.htm>

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