A branch dieback on a second-year tree. Leaves wilt without falling. Dead areas are clearly separate from living areas.

How to reduce Bingo tree loss to stem dieback

By Christopher Vincent, Megan Dewdney and Liliana Cano

Bingo mandarin hybrid is a variety with many promising characteristics, but it brings specific challenges to profitable production. One challenge identified early in the push to plant Bingo was stem dieback that led to tree loss. After looking into this problem for the past four years, University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) researchers now have a general idea of the nature of dieback and how growers may reduce incidence in groves and nurseries. The main recommendations are to avoid injury and excessive canopy moisture.

Bingo is attractive to Florida growers because it yields high-quality fruit in an ideal market window. The fruit has excellent flavor and few seeds and ripens in October. Although Bingo's response to HLB is not well understood, trees tend to grow rapidly and most appear healthy under Florida's endemic HLB conditions, though the oldest plantings in the state are only five years old.

These attributes caused a very high initial demand for Bingo trees, while supply from nurseries was relatively low. So, growers planted small trees early, rather than waiting for trees to achieve standard size in the nursery.

PROBLEMS REPORTED

Around this time, some nursery managers began to notice a high rate of tree loss to stem dieback. When growers planted these trees in the field, they also lost a high proportion of trees. In some new plantings, as much as 20% of trees were lost in the first year.

The symptoms of this dieback were consistent with a sudden loss of xylem function. Leaves and soft stems would wilt without falling off, resulting in branch loss. Small trees were often lost to the dieback because they consisted of little more than a single branch. Once trees grew a branching canopy, dieback was still observed, but it only killed branches and not whole trees.

Often, the stem death would begin at a point where the stem had been injured. Typical injuries observed were small, such as pierced bark from a staple when taping the trunk to a stake or pruning along the trunk.

Nursery managers reported a wide range of results with Bingo, from almost no dieback issues to economically significant plant loss. Nurseries with overhead irrigation had the most problems; those without overhead irrigation observed less dieback. Meanwhile, dieback occurred most noticeably when plants were pruned or moved to new houses or benches.

> *Do not cut trees back any more than necessary, including not heading the trees back at planting.*

RESEARCH PERFORMED

UF/IFAS researchers performed many experiments in hopes of understanding how dieback happens and how it might be controlled. They discovered that dieback could be induced chemically. When Bingo trees were sprayed with ethephon, which induces ethylene production, the trees defoliated, and the stems died back. Valencia trees that received the same treatment only dropped a few leaves and did not die back. Ethylene is a hormone associated with injury, extreme stress and attack of some pathogens.

In the search for pathogens, no clear culprit was found. Fungi were recovered from the wounds and dead branches, but these were mostly saprophytes, which are fungi that feed on dead or dying tissues. Likewise, re-infecting was very difficult.

Eventually, it was discovered that if the plants were kept in a humid environment and wounded, inoculation with a very large amount of some fungi would result in dieback. However, these fungi were typically not recovered back from the dead tissues.

Table 1 (page 20) shows how certain *Colletotrichum* species led to dieback when they were inoculated by pruning the branch and kept in a mist bed to keep the plants wet. When

Table 1. Proportion of Bingo plants with dieback in response to wounding inoculation and incubation in a mist bed.

Inoculated species	Proportion of plants with dieback	Proportion of plants with pure culture isolations (with mixed cultures)	Average lesion length [cm] (from samples with pure isolations)
Colletotrichum fructicola	0.53	0.45 (0.53)	0.92 ± 0.4 (1.27 ±0.8)
C. plurivorum	0.45	0.31	0.75±0.3 (0.59±0.5)
C. siamense	0	0.17	0.58±0.5 (0.1±0)
Agar plug control	0.25	0	0

inoculation occurred without keeping plants wet or without injuring the tissues, there was no consistent dieback. No fungicide treatment was found that reduced dieback in the field.

Bingo plants have a unique set of responses to conditions often found in Florida production. It appears they are very sensitive to ethylene and the presence of saprophytic fungi. These fungi do not appear to kill plant tissues.

Instead, Bingo responds to the combination of injury and fungi with a reaction that closes off its xylem and often kills the tissue above it. Humidity likely provides the environment the fungi need to grow and makes the injury-fungus combination more likely. Fungicides are not likely to eliminate any of these fungi.

PRACTICES RECOMMENDED

Based on these studies and experiences, three practices are recommended that can reduce the likelihood of problems with dieback:

1) Avoid overhead irrigation during nursery production. This may reduce the quantity of water on the plant surfaces that spores need to germinate.
2) Avoid unnecessary injury. This includes care in tying and wrapping. Do not cut trees back any more than necessary, including not heading the trees back at planting.
3) Plant large trees. If the tree has a branched canopy and a strong trunk, dieback might not be reduced, but it will make the tree more likely to survive any dieback that occurs.

With these practices, Bingo tree loss to dieback may be reduced.

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