

EARLY PRIDE REPORT

AN INFORMAL DISCUSSION
OF DIEBACK SYMPTOMS,
DIAGNOSIS AND MANAGEMENT

MARCH 12, 2017



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Variety

‘US Early Pride’
‘Bower’ (Citrus reticulata Blanco x (C. paradisi Macf. x C. reticulata) x ‘Temple’)

Licensing

Released under patent by USDA in 2009

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‘US EARLY PRIDE’ PLANTING OBSERVATIONS AND MANAGEMENT OPTIONS

01

WELCOME



RECOGNIZE DIEBACK SYMPTOMS AND DIFFER THEM FROM SIMILAR-APPEARING PROBLEMS

YOU HAVE TO BE ABLE TO RECOGNIZE DIEBACK SYMPTOMS AND DIFFERENTIATE THEM FROM SIMILAR-APPEARING PROBLEMS. UP-CLOSE SYMPTOMS, WHICH I'LL SHOW THROUGH THE PHOTOGRAPHY ON THE NEXT PAGE, IS A HELPFUL DIAGNOSTIC

From a cursory point of view, Early Pride dieback can appear to have different causes. But over several surveys, we found most of our dieback could be traced to some sort of physical trauma. See illustrations on Page 4.

Sometimes this trauma was obvious, as in the case of a large wound (Page 4, Fig. 3). I think the trauma can also be unnoticeable, as could be the case with a slitting of the bark when a tree is whipped about in the wind (Page 4, Fig. 6). Working along with the USDA, we also found infection by secondary pathogens seemed to have exacerbated the issue. We provide a published paper to discuss scientific considerations related to managing this variety.



Fig. 1. Initial discovery and distribution of dieback in a 'US Early Pride' planting in Central Florida.

We discovered it's important to act quickly after you first see dieback if you are to intervene and successfully treat the physical injuries leading to more dieback. Acting quickly is relative and depends to some extent on how widely spread and severe is the problem. If the problem is pervasive, you may want to act right away, but you have a little more time if the problem has just appeared on only a few trees. The distribution of dieback in our Early Pride planting is shown above in Fig. 1. Over time, the problem progressed as shown in Fig. 2, above.



Fig. 2. Eventual spread of dieback in an Early Pride planting in Central Florida. White (118 points): Nov. 12, 2013; Red (94 points): Feb. 27, 2014; Green (72 points): Sep. 1, 2014.

I doubt you can completely eliminate dieback in young Early Pride groves, but the framework outlined below could help others from ending up with a problem worse than it has to be. Note that this information will not apply to everyone. All things considered, though, I believe initial tree planting size may be one of the most important factors in preventing the problem from rearing its ugly head in the field. **The rest of this discussion applies solely to the dieback we observed in our 'US Early Pride' planting and does not address any other potential issue (HLB, etc.).**

ABOUT US EARLY PRIDE

As discussed in our paper published in the Proceedings of the Florida State Horticultural Society from 2015, Early Pride is a low-seeded mutant of the Fallglo mandarin hybrid {'Bower' [Citrus reticulata Blanco × (C. paradisi Macf. × C. reticulata) × 'Temple']}. The variety originates from budwood Dr. Jack Hearn irradiated in 1991. Since Early Pride is licensed, you have to contract with the New Varieties Management and Development Corporation (NVDMC) for propagation and planting. You can find more information about Early Pride in the USDA's description of the variety.

Because of its Fallglo heritage, Early Pride seems to have similar dieback issues as does Fallglo. Dr. Greg McCollum from the USDA in Ft. Pierce provided me photographic examples of dieback on Fallglo from his lab, which turned out to be similar to what we observed in



“The patterns of dieback that appeared may be due to the same ultimate cause—physical trauma.”

our planting. (These photos were Fallglo and not Early Pride, but the symptoms are similar.) Several growers are dealing with the dieback issue in new Early Pride plantings, but it looks like the extent of the disease varies from grower to grower. Some growers hardly consider it an issue, while others are dealing with significant dieback and tree attrition. One purpose for my report is to look into the reasons why this seems to be the case.

SYMPTOM OVERVIEW

I'd like to give a general overview of the symptoms. The gallery on Page 4 shows several examples of dieback representative of what we saw. What's interesting is that the necrotic areas in the twigs seem to be clearly delineated from the healthy areas. This gives us an advantage in pruning, because it makes the area easy to identify and cut out. Sometimes the entire branch would be chlorotic or necrotic (Page 4, Fig. 1), while in other cases, the necrotic areas would be more confined and even alternate with the healthy areas (Page 4, Fig. 2). Both these extremes as well as intermediate examples are shown in the gallery.

VARIATIONS IN EARLY PRIDE DIEBACK SYMPTOMS

As I showed in my earlier post from December 9, 2013 on grovetracks.com, dieback symptoms can vary from tree to tree. It can appear on first survey as if the dieback is due to different causes. We, in fact, thought ours was due to something related to a flush out valve since that was where most of the trees were clustered. Dieback can show up on some trees, but not others. And it can be worse on some trees more so than others on those on which it appears.

Over time, I surveyed our grove on different dates for changes in tree appearance (Page 3, Fig. 2), so I began to pick up on the different kinds of dieback symptoms that can develop. The seven photos on Page 4 give you an example of the range of symptoms that we observed.

Eventually, the patterns of dieback developing appeared most likely due to the same ultimate cause—physical

trauma. But the manifestations of the disease can vary quite a bit. In some trees, the dieback was constrained to the outer twigs. Some trees had only few leaves decline. And other trees had dieback extending all the way from outer branches down into the trunk. Nevertheless, almost all the symptoms I saw ultimately seemed have the same basic cause of being related to some sort of physical trauma. In some cases this trauma was easily recognized, as was the case with girdling due to tight ties (Page 4, Fig. 3). In other cases, the reason for the trauma was less obvious, but it was trauma nonetheless (Page 4, Fig. 4).

At this time, I have some reason to believe the dieback symptoms on Early Pride are a little different than the ones on Fallglo, but this is a preliminary opinion. For example, there seems to be less “gumming” in Early Pride as compared to that of Fallglo (Page 4, Fig. 3). Also, I seem to recall that dieback and gumming on Fallglo was more difficult to relate to specific physical traumas. It's possible that while some (but not all) symptoms of dieback on the two varieties show differently, the basic causes on both will be traceable back to some sort of injury. We'll need more information before we can determine how different Fallglo and Early Pride dieback symptoms really are from each other.

DISCUSSION OF CAUSES

As outlined on grovetracks.com, I conducted several surveys to document the distribution of dieback in this grove. Basically, we were able to attribute dieback to the general causes and percentages shown in the graph below. We were unable to attribute dieback symptoms to a specific cause in over 50% of the trees we examined. This might have been due to the possibility that the injury was not visible, or it might represent a manifestation of some kind of physiological disorder. In about 18% of the cases, we noted dieback was associated with a suspected physical injury of some type. In these instances, injury was found near the dieback, but it may not have been clear at the time whether or not the injury appeared before or after the dieback. In about 4% to 5% of the cases we looked at, dieback and tree attrition could be traced back to some kind of girdling event.

TYPES OF SYMPTOMS AND MANAGEMENT

Girdling from Tapes, Ties and Staples Overall, girdling seems to have accounted for about 3% to 4% of the dieback we saw in our grove. It appears that Early Pride is sensitive to scraping injuries such as what you get when little trees scrape against a tape or a tie. Further, it appears that Early Pride, unlike other citrus trees, is unable in some cases to force ties outward as they grow, resulting in the trunk being girdled (Page 4, Fig. 2).

Perhaps this is due to trees being too small when they were secured with the ties. But I don't recall other citrus varieties showing this extent of injury from tapes and ties before. Girdling obviously prevents movement of nutrients and water up and down the tree, and thus the stem, branch, and leaves the distal to the injury will die. The gallery on Page 4 shows several examples of injuries and died back that we could trace directly to injuries from tapes, ties and Staples.

Irritation from Planting Stakes One interesting manifestation of disease in the Early Pride dieback we saw was a kind of irritation that seemed to result from planting stakes (Page 4, Fig. 3). In the example shown, I have illustrated injuries to the trunk at the point of contact between the stake and the tree. Both bamboo and metal seemed to cause the same sort of injury. It looks like there may have been some kind of puncturing or scraping of the trunk that occurred during handling or transport of the trees. This resulted in a wound, which looks like it became infected, and this ultimately led to dieback in the upper part of the trees on the stems and leaves.

Miscellaneous Physical Injuries In addition to the injuries outlined above, there were a number of other types of physical trauma. These types of injury are illustrated in more detail on grovetracks.com. The bark and the trunk seemed to have sustained some kind of splitting or wound (Page 4, Fig. 4), and we could trace dieback in these trees directly back to the injuries we illustrated there. It's not clear how these injuries developed, but we speculate that they might have been caused by rough handling when we transported or planted the trees, when they were battered about by the wind at some point, or some such similar cause. Because we can't specifically identify the nature of these wounds, it is difficult to come up with a specific practice to help minimize them.

Unidentified Causes of Dieback Finally, a reasonable percentage of dieback we saw was difficult to attribute to any specific visible cause. These trees may have sustained some kind of unnoticeable injury, which subsequently became infected by secondary pathogens, leading eventually to die back. We inspected such trees closely, but it was difficult to see a particular wound or point of entry where this would have occurred. However, based upon the above overwhelming evidence that physical trauma is a primary cause of the type of dieback we saw in our Early Pride trees, we have to think that even the trees with unidentified causes of dieback were due to some kind of physical injury we could not see. Time will tell if this is true.

HOW WE MANAGED EARLY PRIDE DIEBACK

This section covers practices we used to intervene with the dieback problem in our grove. Perhaps if caught early, Early Pride dieback can be managed and trees can recover. Again, time will tell and more experience is needed before this can be determined with certainty. This is not to say the techniques we developed below will work for everyone. Nevertheless, I think what we arrived at should be a good starting point for others to troubleshoot their dieback issues and arrive at appropriate interventions to contain the disease in their groves. Regardless of how light or severe a dieback problem is, it's important to not delay taking action.

Here are some of the most important practices and safety precautions we worked out to help contain our dieback in Early Pride. These suggestions are based on observations from our first Early Pride planting. I'll update this list later as I get more information about what works and what doesn't, and what's needed and what isn't.

- ▶ In the nursery, avoid ties that are too tight.
- ▶ Don't plant trees in the grove that are too small. Trees should be of sufficient size to avoid being easily injured.
- ▶ Look for well-wooded bark on nursery trees before taking delivery.
- ▶ Handle your trees carefully when loading and picking them up at the nursery to minimize physical injury.
- ▶ When transporting trees from the nursery to the grove, secure them so they don't get blown or

MANAGEMENT, CON'T

knocked about by the wind (in the back of a truck, for example).

- ▶ Immediately remove binding ties that are too tight when the trees are set in the grove. Re-tie with looser ties, if necessary.
- ▶ If trees need to be staked in the field, avoid tight ties.
- ▶ Prune dead tissue in the field at the time of planting.
- ▶ Avoid trunk wraps that are too tight and that don't allow moisture to escape. If using trunk wraps of any kind, make sure the trunk can be aerated and stay dry.
- ▶ Trees should be inspected for signs of dieback at 2, 4 and 6 weeks after planting, and then on some regular schedule after that. Note that initial stages of the dieback can be difficult to see, especially if the dieback is a small proportion of the canopy.
- ▶ Prune parts of the tree showing dieback as soon as possible after a thorough inspection.
- ▶ Disinfect pruning shears when moving from tree to tree.
- ▶ Burn or dispose of pruned debris off site. (This is a safety precaution.)
- ▶ Treat with a broad-spectrum fungicide (such as Helena ProPhyt or a similar material) after the trees are set in the grove. I think this is a good prophylactic measure. Use a surfactant, such as Helena Dyne-Amic, with the fungicide. (We didn't do this initial fungicide treatment step as we weren't fully aware of the dieback issue at first.)

- ▶ Also treat with a broad-spectrum fungicide, such as Helena ProPhyt, after any pruning on small trees. We spot treated using a hand sprayer.
- ▶ Periodically inspect the trees for additional dieback and prune as needed. Do this at least for the first 6- to 9 months the trees are in the grove. The proportion of dieback to healthy canopy decreases as the trees get larger.
- ▶ It's possible on larger trees that small amounts of twig dieback might be the norm. (I'm not sure how aggressive removal of tissue dieback needs to be on larger trees.)
- ▶ Apply sufficient fertilizer, including liquid and slow release, to coerce the canopy to "grow out" of the problem.
- ▶ Although root problems don't seem to be correlated with the dieback we saw, I think soil-applied products such as Ridomil, KPhite, AgPhite or similar materials may be helpful.

Once we realized that physical injuries were related to much of the dieback issue, it became clear what kinds interventions would help prevent the problem from getting worse. I'll emphasize again that it might not be possible to completely eliminate dieback in this variety, but it seemed to be greatly reduced by minimizing injuries and treating as needed.

Helena ProPhyt A systemic biofungicide for the control of several foliar and soil-borne diseases of field crops, grapes, herbs, orchards, pecans and vegetables

ACTIVE INGREDIENT:	
Potassium phosphite*	54.50%
OTHER INGREDIENTS:	45.50%
TOTAL	100.00%
*Phosphorous acid equivalent: 34.30% (4.2 lbs/gal)	
KEEP OUT OF REACH OF CHILDREN CAUTION	
FIRST AID	
IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to by a poison control center or doctor. Do not give anything to an unconscious person.	
IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a poison control center or doctor for treatment advice.	
IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.	
HOT LINE NUMBER 1-800-424-9300	
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-424-9300 for emergency medical information.	
SEE INSIDE BOOKLET FOR ADDITIONAL PRECAUTIONARY STATEMENTS AND FOR DIRECTIONS FOR USE	
FOR CHEMICAL SPILL, LEAK, FIRE OR EXPOSURE CALL TOLL FREE: 1-800-424-9300	
AGRICULTURAL CHEMICAL: DO NOT SHIP OR STORE WITH FOODS, FEEDS, DRUGS OR CLOTHING	
EPA Reg. No.: 42519-02-9005	
EPA Est. No.: 42519-05R-002	
Net Contents: 2.5 Gallons	
Manufactured for: HELENA CHEMICAL COMPANY 225 Schilling Blvd., Suite 300 Collierville, TN 38017, USA, Tel: 901-761-0050	
<small>MADE IN ISRAEL</small>	

Helena recommended one quart per acre. No surfactant was needed for Prophyt but if one is in the tank it won't hurt anything.

DISCLAIMER: Grovetracks and the author of this article do not recommend the use of any particular products for any purpose whatsoever. This report simply presents our experiment in managing dieback in 'US Early Pride'.



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ABOUT

Dr. Rogers is a researcher, third-generation citrus grower and web services provider based in Florida. His Ph.D. is in Plant Pathology from the University of California at Berkeley, followed by post-doctoral studies at the University of Florida. Dr. Rogers is co-editor of **Florida Citrus: A Comprehensive Guide**. He also served as Scientific Coordinator of the Florida Citrus Production Research Advisory Council in 2004 to 2008. His commercial and research interests in his company, Ecostat, Inc., include data, statistics, visual design, web marketing and artificial intelligence using cloud- and web-based platforms. With background in intellectual property, licensing and negotiation, he specializes in innovative business solutions using new data technologies, stewardship, discovery and presentation. In the mid- to late-1990s, he and his company invented one of the first handheld PDA applications with data aggregation and cloud-like analytics used in large-scale commercial agriculture. Dr. Rogers volunteers as Marketing Coordinator for the Florida State Horticultural Society. More information about his projects is on his website at rsteve.com/resume.



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- **ARTIFICIAL INTELLIGENCE** / Cooperator: University of Florida
Rootstock Expert System - developing a web-browser application of artificial machine intelligence.
- **INFORMATION ARCHITECTURE** / Client: Various
Scientific and Economics Reporting Platforms - developed reporting systems for stakeholders in citrus research and industry.
- **CORPORATE WEBSITES** / Client: Various
Web Design and Communications - Florida Department of Citrus, Citrus Research and Development Foundation, Packers of Indian River, and others.
- **STATISTICAL ANALYSIS** / Client: Various / Private Sector
Statistical Analysis - Experiment planning/design (power, effect, sample size), web analytics, business optimization.

EDUCATION

- **PH.D.** / University of California at Berkeley 1991
Plant Pathology - Microbial genetics, ecology, cloning and characterization of copper resistance genes in ice nucleating bacteria.
- **POST-DOC** / University of Florida 1995
Insect Ecology and Computer Modeling - Mathematical modeling, computer simulation of population dynamics.

PROFESSIONAL SKILLS

- Web Communications
- Science Administration
- Statistics / Experimental Design
- Photography / Photoshop® CC