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Update on Use of Swingle Citrumelo Rootstock[1]

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Introduction

Although Swingle citrumelo resulted from a cross made in 1907, Florida use of this rootstock didn't become widespread until the mid to late 1980s. Swingle's tolerance to blight, Tristeza, citrus nematodes, and Phytophthora foot and root rot, coupled with its reputation for cold-tolerance, made it very popular following the freezes of the 1980s. By 1990, more than 50% of the citrus trees being propagated in Florida were on this rootstock and that is unchanged.

There are now a few groves of trees on Swingle approaching 25 years of age, and many groves that are 10 to 20 years old. Various problems are recognized with this rootstock after years of commercial experience. Swingle is an excellent rootstock under the right circumstances but some soil types and scion varieties may not be appropriate for Swingle. This document was prepared to inform citrus growers about the conditions where Swingle can be used with confidence, and where caution or selection of another rootstock is advised.

Possible Problems Related to Propagation or Early Confusion with Other Citrumelos

Swingle was in great demand in the1980s, but the supply of seeds and nursery trees was limited because of quarantines related to citrus bacterial spot disease. The temporary shortage of Swingle seeds was partly accommodated by use of rooted Swingle cuttings as rootstocks. Unfortunately, no studies have assessed performance of trees planted on Swingle cuttings compared to seedlings, so the effect of this practice is not known. During this period of nursery stock shortages it also appears that some seed of other citrumelos were used for propagation and mistakenly identified as Swingle. The extent of these practices is not known, but may explain the unexpectedly poor performance of some groves on Swingle that were planted in the 1980s.

Soil Problems Related to Calcareous Materials

Trees on Swingle are generally not suited to calcareous soils, and are even less suited to such soils than trees on most citrange rootstocks. In a Gulf Coast study, the size of young grapefruit trees on Swingle declined 60% as the total soil $CaCO_3$ increased from none to only 2%, and yields declined sharply with increased soil calcium even when $CaCO_3$ concentrations were below 0.25% (Obreza, 1995 Proceedings of the Fla. State Hort. Society).

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When Swingle seedlings were grown in Immokalee fine sand soil amended with $CaCO_3$ levels up to 6%, the best growth occurred with no additional $CaCO_3$ (0.4% total $CaCO_3$ in the native soil) (Nunnallee, unpublished). These studies suggest that the performance of trees on Swingle may be compromised by even small amounts of soil $CaCO_3$.

Field observations suggest that while Swingle usually performs poorly on calcareous soils, there are instances where trees on Swingle grow reasonably well and are productive on soils with high levels of $CaCO_3$. Researchers are trying to discover why trees on Swingle grow in some calcareous sites. Tree responses may differ with the types of $CaCO_3$ materials (e.g., rock, shell, and marl) present, and their distribution in the soil profile. Since calcareous soils are generally only found in Florida citrus areas with bedded groves, the bedding or rebedding process can greatly influence the distribution of calcareous materials within the root zone. Additional study is needed to reveal if a $CaCO_3$ maximum threshold exists for successful use of Swingle, and if higher thresholds should be used when only part of their root system is in calcareous soil.

Possible Soil Problems Unrelated to Calcareous Materials

Frequently, trees on Swingle citrumelo and Carrizo citrange decline at about 5 to 8 years of age when grown in certain soils. The reasons for this decline are not clear, but a preliminary survey suggests that problem soils are generally those in the Winder and Riviera series. Soils in both series occur in the coastal regions of Florida usually in slough landscape positions, but they also are found in depressional areas. These soils are partly characterized by an argillic (clay) horizon that begins about 20 inches below the soil surface and extends to 40 inches. In depressional areas, the thickness of the sand layers above the clay can be as little as 10 inches.

Carefully distinguishing the bounds of Swingle's soil adaptation, or developing cultural practices to effectively grow Swingle on problem soils, are particularly important because we do not have proven rootstocks with good production and high fruit quality suited to such soils. So, what might be done in the meantime? Trees on Swingle do not withstand chronic wetness even though they are quite tolerant to Phytophthora; therefore, in sites already planted to Swingle, greater attention should be paid to drainage in the problem soils.

When Winder and Riviera soils are planted, it seems sensible at the present time to avoid using Swingle, particularly in places mapped as depressional. If Swingle still seems the best choice, rethinking site preparation may enhance success with this rootstock. Some Indian River growers have returned to the use of single-row beds to reduce the soil volume needed for bed formation. In this approach, the calcareous clay layer is not added to the beds, and Swingle trees are grown largely in top-soil. While this approach appears reasonable, it isn't known whether tree performance will be adequate for economic production.

Diaprepes and *Phytophthora palmivora*

Dr. James Graham and colleagues have shown that the damage caused by the feeding of *Diaprepes* larvae is commonly associated with *Phytophthora spp*. and refer to this relationship as the Phytophthora-Diaprepes Complex. Larval feeding generally reduces rootstock tolerance to Phytophthora infection. Swingle is tolerant to *Phytophthora nicotianea* (which causes most foot and root rot in Florida citrus), but when *Diaprepes* is present in the types of soils described in the preceding section, Swingle readily succumbs to the less common *P. palmivora*.

Incompatibility of Scions with Swingle

Many scion varieties are grown successfully on Swingle, but a few incompatibilities have been observed. A notable example is the Brazilian cultivar, 'Pera', which is incompatible with Swingle and apparently all trifoliate orange selections and hybrids. In Florida, there is an apparent genetic incompatibility between Swingle (or Carrizo) with 'Murcott' and 'Roble' orange. Symptoms begin on some trees when they are typically 6-8 years old.

Tree canopies begin to decline, and when a strip of bark is removed across the budunion, a crease or groove can be observed in the wood, which is often accompanied by a brownish-yellow stain on the wood or the inner face of the bark. Experience suggests that these trees will continue to decline and will not return to a productive state. Planting 'Murcott' and 'Roble' on Swingle (or Carrizo) is risky. Whether these scion varieties have the same risk on other citrumelos and citranges is being investigated.

There are two instances in which Swingle budded with a nucellar navel budline have declined with many of the same symptoms observed with 'Murcott' on Swingle. The most severely affected trees display rootstock overgrowth of the scion, which apparently causes a “mechanical pinching” that disrupts tree function. No other instances of apparent incompatibility have been noted for navel orange on Swingle, and this remains a very popular scion / rootstock combination. There is little reason to avoid this combination unless apparent compatibility becomes more widespread.

Blight, Stunting, and Decline Problems

Swingle is basically a blight-tolerant rootstock. Some loss does occur although the cumulative loss is often less than 10% after15 to 20 years. In a very few instances, higher rates of loss have been observed and confirmed with the blight protein test. There are other declines and changes in tree growth that appear to be peculiar to trees on Swingle and may or may not be blight-related; also, these declines are apparently unrelated to soil factors or pathogens (Steve Garnsey, 1998 F.A.C.T.S. Proceedings). For example, there are a few groves on the Ridge and in the Gulf area in which low numbers of trees on Swingle display stunted growth which was evident before trees were 5 years old. In other instances, the trees are typically Valencia on Swingle, and a high proportion of trees display blight-like symptoms without evidence of stunting. Neither situation is associated with a disturbance at the bud union or other obvious incompatibility symptoms. Tree response is superficially similar to that observed from blight, but the decline characteristics are also not entirely consistent with this disorder. It may be that these trees are budded on off-type seedlings, or on a citrumelo other than Swingle. Previous research showed that trees on Swingle off-type seedlings were stunted. Growers should report new observations of blight-like symptoms in Swingle, so that better recommendations can be developed.

Confusing Copper Toxicity and Sting Nematode Damage for Swingle Decline

The possible presence of excess soil copper or high populations of sting nematodes should not be overlooked when trying to diagnose conditions of poor growth among trees on Swingle citrumelo. In soils with excess copper or sting nematodes, growth is sluggish and may continue that way for several years. Trees affected by excess soil copper generally have dark-brown, brittle fibrous roots, and show iron chlorosis. This problem is usually resolved by maintaining soil pH above 6, and even without this measure trees often resume normal growth.

Sting nematodes have been found throughout Florida, but the deep sandy soils of the Ridge appear to produce higher populations and show more evidence of nematode damage. Sting nematodes feed on fibrous root tips causing them to divide and take on a characteristic stubby-root appearance. Since trees are particularly susceptible when they are young, and the distribution of sting nematodes can be patchy within a grove, a grower might suspect a Swingle-specific decline when stunting or slow-growth in replants is actually caused by sting nematode damage. Check the roots for sting nematodes, and as with excess copper, be patient since trees often outgrow the problem. Note also that this is really not a Swingle issue since virtually all rootstocks are susceptible.

Are There Problems with Valencia on Swingle Citrumelo?

There is increasing concern about low yield among Valencia trees on Swingle. It should first be recognized that Valencia grows more slowly, produces a smaller tree, and is less productive than other round orange cultivars. These Valencia characteristics are even more apparent when the

rootstock is Swingle, but the combination of Valencia on Swingle is basically a good choice. Nevertheless, the somewhat slower development of Valencia on Swingle may be interpreted as poor performance in some groves even though differences in growth and yield between trees on Swingle and other rootstocks like Carrizo often do not become apparent, especially in the flatwoods, until after several years in the grove.

Recent surveys (see Roka, Rouse, and Muraro: 1997 Proc. Fla. State Hort. Society) showed that Valencia trees on Swingle in Southwest Florida were similar in boxes/acre to those on Carrizo when planted at about 150 trees/acre, but there clearly are cases where Valencia trees on Swingle are producing disappointing yields. We are now beginning to understand how to avoid such situations. Some factors to consider are the following:

Tree Spacing

One explanation for low yields/acre is improper planting distance. Valencia on Swingle planted in Ridge sand at 15 ft x 25 ft will not bear 500 boxes/acre; 8 ft x 22 ft is more reasonable and this spacing is also appropriate for most flatwoods groves.

Scion Clone or Budline

Tree spacing is not the explanation for low yields observed in some flatwoods groves. It appears that inferior budlines may have been used, and although they are routinely removed from the Budwood Registration Program, trees are still occasionally propagated with these budlines. Unfortunately, in such groves, trees are unlikely to become substantially more productive. Growers should assess grove economics and consider replanting.

For recommended Valencia budlines, there is little information on interaction with different rootstocks. The most popular Valencia budlines over recent years have been the Hughes nucellar selections, V-S-SPB-1-14-31, 1-18-31, 1-14-19, and a young nucellar selection,V-S-F-55-4. Experience has shown that, in general, there is little difference among these budlines; however, it is possible that one or more of these selections performs better on Swingle than the others. Likewise, 'Rohde Red' Valencia has been extensively planted in recent years despite persistent concerns about whether it yields as well as the popular Hughes nucellar selections. Recent evidence from the Gulf region indicates no difference.

Soil Physical and Chemical Traits

In addition to problems with Swingle on calcareous soils, there is evidence that Swingle often produces very small trees when planted in "sand ponds," which are areas with low-organic matter content, and other impoverished soils with low CEC and water-holding capacity. The inherently less vigorous trees produced on Swingle make this rootstock inappropriate for most poor soils, and more vigorous rootstocks should be considered.

Alternative Rootstocks for Trees on Swingle in the Flatwoods

The primary problem in any grove on relatively poor sites is generally tree vigor. Therefore, in poor sites not troubled with tree decline, select rootstocks that give more vigorous trees than those on Swingle and also provide good yields. Some appropriate choices among established rootstocks are Volkamer lemon and Carrizo citrange, but they have known limitations. Several new rootstocks with consistent Valencia performance in several field trials are Benton citrange, C-32 citrange, and 1584 (trifoliate orange x Milam). Rootstocks that look promising in less extensive field trials are Rusk citrange (smallish tree), and citrumelos F80-5, 9, and 18. In Winder and Riviera soils in depressions, and other places where trees decline on Swingle, consider Kinkoji or Smooth Flat Seville. Ongoing research should provide strong recommendations for new rootstocks in the next 5 to 10 years.