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Considerations for Vegetables as Rotational Crops Following Citrus

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In the past decade, the combination of tristeza virus, low fruit prices and canker have made citrus production challenging. The appearance of seemingly “new” available cropland as a result of tree destruction has generated interest among vegetable growers seeking hard-to-find “new land”. In the past 16 months, more than 64,000 acres of citrus have been removed in Florida due to citrus canker. With increasing urbanization, growers are finding it more difficult to find land for rotation crop use or purchase, and are thus watching with interest as these parcels become available.

In the past few months, several issues have come to light in terms of problems associated with planting vegetable crops on land that was in citrus production before canker put an end to that use. The most obvious issue that immediately comes to mind is that of herbicide residue. This is a very valid concern, but not the only thing that should be considered. A potential lessee or buyer needs to take a hard look at the property and ask a number of questions about management of the previous crop in order to make informed decisions.

One thing to consider is that in recent years, citrus prices have not been good; thus, many groves have not been managed as intensively as in past years. This may mean that the herbicide program was a straight post-emergence program using glyphosate or a similar material, in which case the concern would be much less for future crops. The problem arises when the previous owner used various pre-emergence herbicides. This is often the case in a well maintained grove where canker was found suddenly. Some of the more commonly used pre-emergence herbicides in citrus would include Krovar® (bromacil + diuron), Princep® or Princep Caliber 90® (simazine), Solicam® (norflurazon) and Direx® or Karmex® (diuron). Some of these may pose very real concerns if sensitive crops are planted too soon after the last application of herbicide.



(Solicam herbicide injury on tomato)

General considerations would include the application method, frequency of application, and environmental conditions since the last application, especially temperature and rainfall. Higher temperatures generally mean faster breakdown of herbicides. Increased rainfall means more herbicide may have leached to lower levels beyond the root zone. Keep in mind, however, that the type of irrigation system utilized for the vegetable crop may affect the chances of injury. Drip irrigation pushes water down. Seep irrigation brings water up and with it any solubilized chemicals that may have leached down to the spodic layer. Also, since one of the main methods of herbicide breakdown in the soil is by microbial action, fumigation prior to planting a vegetable crop will kill more microorganisms, thus leaving fewer to help degrade the herbicide.

Residues that cause crop phytotoxicity also will likely show up in a non-uniform pattern, as most herbicide applications in groves are banded applications; thus, residues will likely be much higher in those banded areas and, even after disking operations, patterns will likely not be uniform across the field. Also, many groves on flatwoods soils are bedded. Disking and other operations to level the soil often involve movement of soil from the bedded areas into the 'ditch' areas. In this case, soil compaction will likely vary and this will affect water movement, particularly in seep irrigation fields, which may in turn influence the damage pattern from soil residual herbicides. Since weeds also vary in their sensitivity to herbicides, the presence of weeds does not insure that herbicide residues are gone.

Research has indicated that some herbicides, principally the triazines (atrazine and simazine), are affected by soil pH. Smaller amounts of these herbicides are adsorbed to the soil at higher pH, so they remain in the soil solution. Herbicides in the soil solution are more available for plant uptake. Chemical and microbial breakdown are often slower in soils of higher pH. Thus, vegetable growers may want to pay attention to the soil pH and avoid over-liming in these situations.

Samples from commercial sites in central Florida where bromacil and diuron had been applied in combination for 7-8 years showed low levels of both at various soil depths to 60 cm. Only a small amount of bromacil was detectable one year after application, but diuron levels were higher.

Another consideration is that when citrus trees are pulled, it is almost impossible to the entire root system, particularly when trees were in poor condition. Tillage operations may actually spread root residue and herbicides that may be present in this residue. Many pre-emergence herbicides sprayed in a citrus grove are not incorporated. While incorporation by disking exposes the herbicide to more soil particles, it also makes it less susceptible to losses by volatilization and photodecomposition.

Testing for herbicide residues usually involves either soil testing or bioassays. The limitation of soil testing is first the expense and secondly, even when you get a result in lbs./acre there are few guidelines that are available to translate this amount of residue into potential crop injury. The only really useful information a test can provide is that there is no soil residue. Bioassays may be done in the field or in pots utilizing soil taken from the field. Use sensitive plants that will show injury quickly. For triazine herbicides, oat or ryegrass plant bioassay is a good choice. Injury symptoms should be apparent within 10-14 days after emergence and will vary depending on the herbicide. If the site of action of the herbicide is known, then a procedure can be developed utilizing this information. The desired rotational crop is also a good bioassay plant to include, and it is best to compare growth of bioassay plants in the suspect soil versus untreated soil of the same type.

One final but very important consideration is the fact that most vegetable crops do not have residue tolerances for many citrus herbicides. If a residue is found in a routine residue inspection analysis, the crop may then be unmarketable. With many citrus herbicides in Florida soils, a waiting time of one to three years may be sufficient, depending on the herbicide, application methods, soil type and environmental conditions, particularly temperature and rainfall. Growers must take into consideration the above factors, ask questions and possibly conduct bioassays in order to make an informed decision to minimize damage to vegetable crops.

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