PAPER BY INVITATION

CONSTRAINTS ON CITRUS PRODUCTION IN THE AMERICAS-SOME MAJOR CAUSES OF ECONOMIC LIMITATION

L. G. Albrigo
University of Florida, Citrus Research and Education Center. 700 Experiment Station Rd., Lake Alfred, Fl 33850. USA.

One of the major constraints in recent years has been over production in relation to demand. This was discussed in sorne detail during the Mexican Horticultural Congress by Dr. Thomas Spreen. The last two years have seen better prices, but the potential to over produce round oranges still exists and grapefruit have continued to be in over supply. The future production levels, in large part, depend on the status of several citrus diseases in the Americas

Two diseases, postbloom fruit drop (PFD) and greasy spot, are endemic and require standard control practices in most countries in most years in order to maintain reasonable yields. Dr. L. W. Timmer at our Center has published several papers on PFD incidence and control. This information includes a model based on past incidence and weather in order to detemine if a spray is required. This information is available in the Florida Pest Management Guide. Benlate and Ferbam are still the available chemicals for control. Under Florida conditions with infrequent use of Benlate, no resistance has been shown by *Colletotrichum acutatum,* the causil agent of PFD. Greasy spot is effectively controlled by oil or copper sprays or a combination of both. However, the difficulty is deciding on the proper time to spray to protect new leaves during the infection period. More work is needed in tropical climates where multiple flushes appear to lead to multiple infection periods. Dr. Timmer has one or two new chemicals under test in search of better control for greasy spot.

Other endemic diseases to the Americas are tristeza and citrus blight. These diseases do not have standard practices for control, except choosing a rootstock that is resistant or tolerant to the disease. Swingle or other citrumelos appear to be the best substitutes as long as soil pH is less than *7.5.* The recent introduction of the most efficient insect vector, *Toxoptera citricidus,* has put all sour orange rooted trees at risk in the Caribbean Basin. Essentially all countries now have this vector of tristeza established. Jamaica and Belize are now experiencing tree losses to tristeza, but have not reached peak loss rates. An added concem with tristeza is the possible dispersal of scion stem-pitting strains that will cause yield limitations and early tree decline no matter what rootstock is used. These strains are known to exist in Argentina and Peru and probably are in other countries as well.

Citrus blight is prevalent in most countries of the Americas. The causal agent is lot known and theories of either an infectious agent or a physiological basis exist. Trees with this disease in tropical climates developed symptoms and died in the matter of a few months over the dry season. In cooler climates and irrigated culture, trees do not readily die and take 2 or 3 years to develop to the severe decline stage. Venezuela has gone through the phase-out of sour orange from tristeza losses and then experienced the follow-up consequences of losses to citrus blight after replanting with vigorous rootstocks like Volckameriana. Less vigorous stocks reduce the risk of blight, but are often susceptible to bud transmitted diseases and require disease-free budwood for successful use. Efforts are underway in several countries to establish clean budwood, certified citrus nursery tree programs in order to meet this challenge.

Additional severe transmissible diseases exist in the Americas, but so far are limited to a few countries. Citrus canker spread in Brazil and Florida has been accelerated by the action of the citrus leafminer coupled with traditional actions of wet, windy weather. Injuries from leafliner larval feeding have made control of this disease much more difficult. Strategies are now being developed to deal with this increased spread from affected areas. Unfortunately, more man-power and cost are required to achieve control under these new conditions of spread.

Citrus variegated chlorosis (CVC) is now endemic in Sao Paulo State in Brazil. Essentially ever property has sorne CVC. The survey in 1998 estimated that 5% of the trees were severely affected. The causal agent, a strain of *Xylella fastidiosa,,* appears to be related to the strain of this organism that causes a similar disease in coffee. The vectors are affected budwood in nursery tree propagation and various leafhoppers (sharpshooters). CVC is much more severe in the northern part of the Sao Paulo citrus area, where it was first discovered. This may be due to its longer establishment in this area, but cooler temperatures to the south may be slowing disease development also There is general concem that if CVC were to spread or be

Received: April 19, 1999
Acepted: July 24, 2000

inadvertently introduced into a more tropical climate, it would spread rapidly and disease symptom development would be much faster, similar to the experience with citrus blight. Even if rates of spread and symptom development were no worse than in Brazil, this disease would probably make citrus production in tropical climates uneconomical.

Within citrus areas outside the Americas, there are two more diseases that would further reduce the potential for economic citrus production if these diseases were introduced into our hernisphere. The most serious is a decline caused by 2 different strains of a phloem limited bacterium, *Liberabactor asiaticum.* The Asian, warm temperature strain (yellow shoot disease) is transmitted by the psyllid, *Diaphorina citri.* The cool temperature strain (greening) is found in southem Africa and Reunion Island and is transmitted by *Trioza erytreae.* The vector for the Asían strain is already present in the Americas, but the disease has not been reported. This disease appears to cause decline in most types of citrus.

A second disease, witches broom, occurs in Ornan and perhaps other Middle Eastern countries and may be restricted to affecting lime cultivars. This would be a very serious invasion if this disease were to become established in the Caribbean or Colima, Mexico areas.

The potential destruction from all of these diseases should serve to emphasize the importance of good quarantine procedures, education of the public and citrus industry personnel as to the hazards of uncontrolled plant introduction and the need for clean stock, certified citrus nursery tree prograrns to keep each citrus industry free of new disease inoculum and minmize spread of current diseases from nursery tree dissemination. Clearly, there are too many diseases already in the Americas and the potential is there to have more diseases to deal with if these introductions are not stopped. The InterAmerican Citrus Network and FAO are promoting programs to improve quarantine functions and develop clean stock programs for the citrus industries in the Americas.

Unfortunately, diseases, as bad as they may be, are not the only constraints that face citrus industries in the Americas. Most growing areas from Argentina to Florida are infested with one or more species of weevils, whose larvae feed on and injure roots to the point of causing tree death directly or indirectly by promoting phytophthora invasion. Even phytophthora tolerant rootstocks may be affected if weevil damage girdles roots and they bose their tolerance due to limitation of carbohydrate movernent to the roots from the phboem injury. Severe tree declines as a result of weevil damage were observed in Florida during the dry season this past Spring. This was similar to previous observations in the Dominican Republic. Research on control of the *Diaprepes* sp. weevil in Florida has lead to a permit to use the product Brigade as a barrier treatrnent to kill neonates (personal communication from Dr. C. W. McCoy). Enzone appears to kill ah stages of *Diaprepes* (McCoy).

The citrus leafminer is another insect invasion that initially caused severe damage, particulary to young trees. In most locations, that level of damage has decreased to a non-economic level, but where citrus cancer is present, Sao Paulo, Brazil and South Florida, USA, leafrniner injuries have facilitated an increased incidence and spread of cancer.

The spread of *Toxoptera citricidus* ís nearly compete throughout the Americas. It has seldom been an economic pest on its own, but rnany strains of tristeza that were not spread previously by available aphids are now susceptible to spread.

The need to replace sour orange as a rootstock with the spread of tristeza will lead to use of less suitable rootstocks for the heavy soils with high foot-rot potential in Central America and many Caribbean citrus growing areas. Swingle may work fairly well, but more adaptable rootstocks are needed. As critical as disease and soil adaptability are for new rootstocks, their having a positive contribution to fruit quality in a manner similar to sour orange is also critical to successful production of juice oranges in more tropical climates. At best, climate limits quality for concentrated orange juice to a marginal level that causes its price to be down-graded in world markets.

The limits to quality for both fresh and processed use of oranges in more tropical climates requires better cultivars that rnaximize solids accumulation, minimize acidity decline and albows reasonable color development at least internally. Valencia strains have been the most successful cultivar in tropical climates, but the wide range of Valencia strains have not been examined adequately in tropical nor humid, warmer subtropical climates. Most citrus germplasm banks in tropical countries have himited collections of Valencia strains and should expand and evaluate the range of quality and yield potential available. In a Mediterranean subtropical climate, these strains can have more than a one month spread in maturity dates. Other selections are being made in genetic programs that will be more suitable for warmer climates.

Many new techniques are allowing breakthroughs in development of both rootstocks and scion cultivars. These are more likely to be patented and have restricted dissemination for royalty reimbursement. Development of clean stock programs producing certified citrus nursery trees will allow a mechanism for control of patented plant materials, a requirement for access to sorne of the new materials being developed. Sorne of this material may still not be available and sorne increased internal efforts to develop and screen rootstock and scion material is needed in order for citrus industries in more tropical climates to remain competitive with production in more suitable subtropical clirnates.

While citrus production in more tropical climates has its limitations, the major producers of oranges for processing have either cold climate, freeze, or disease problems not

currently in the warmer climates. Continued exclusion of these disease problems is an important part of remaining productive and economically competitive. A major effort of the InterAmerican Citrus Network is to facilitate efforts to control disease spread through projects to encourage in-country improvement of quarantine and clean stock programs.

Tropical climates are best suited to production of limes and grapefruit, but each has supply to demand limitations to overcorne before higher production can be absorbed by the world markets. Unless market expansion efforts are forthcorning and successful, the potential for expansion of these two citrus fruit is small. Overall, citrus production in the more tropical climates of the Americas and associated islands can still be profitable, but serious threats of diseases and insects must be kept in check for this to continue. Profitability would be greatly enhanced if more appropriate scion and rootstock cultivars adapted to these climates were available.