Pest Management Considerations in South American Tree Fruit Systems

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Tree fruit production in Chile, Argentina and Brazil is characterized by several factors that impact the way pests are managed at the commercial level, beginning with the ambient environmental conditions. Most of the fruit production regions we visited in the January-February 2003 IDFTA tree fruit study tour are subject to weather patterns that are considerably warmer than tree fruit regions of the northern US and southern Canada.

Mean maximum temperatures for representative portions of each country are often much higher, at least during the winter months, than those during the corresponding seasons in the Northern Hemisphere:

- Central Chile (Santiago): 85˚F (January)/37˚F (July).
- Western Argentina (Bariloche): 70˚F (January)/43˚F (July).
- Southern Brazil (Curitiba, estimated): 70˚F (January)/40˚F (July).

Rainfall in most of these places tends to be quite low, particularly during the summer months when the growing season occurs. This affects general disease incidence, so that there is very little apple scab or powdery mildew and fire blight simply does not occur in these regions, so the pest management strategy in this regard is automatically simplified from the outset. Also of significance is the absence of some of the northern hemisphere's key insect pests such as plum curculio, apple maggot, obliquebanded and redbanded leafrollers, tufted apple budmoth, spotted tentiform leafminer and European apple sawfly.

> ***Styles of pest management are influenced mostly by the specifics of each country's market destinations.***

To be sure, these countries do share some key cosmopolitan arthropod pests with the rest of the fruit-growing world (Table 1): codling moth (*Cydia pomonella*), San Jose scale (*Quadraspidiotus perniciosus*) plus others, woolly apple aphid (*Eriosoma lanigerum*), mites such as European red mite (*Panonychus ulmi*), twospotted spider mite (*Tetranychus urticae*) and pear rust mite (*Epitrimerus pyri*), oriental fruit moth (*Grapholita molesta*), spirea aphid (*Aphis spiraecola*), green peach aphid (*Myzus persicae*), and pear psylla (*Cacopsylla pyricola*).

Also, there are various pest species present that do not occur in North America, so a number of the same ecological niches are effectively filled by native species: *Proeulia auraria* leafroller (Chile), obscure mealybug, *Pseudococcus affinis* (Chile, Argentina), grape snout beetle, *Naupactus xanthographus* (Chile, Argentina), *Oiketicus platensis* bagworm (Argentina) and South American fruit fly, *Anastrepha fraterculus* (Brazil).

Styles of pest management are influenced mostly by the specifics of each country's market destinations. Of the three countries, Chile is the one whose production is most intended for the international export market, so it can be instructive to examine some of the factors responsible for insect pest management decisions there. Well over 90% of Chile's tree fruits are grown for export to the US, Canada, Europe, the Far East, Middle East and other Latin American countries. The fruit business is dominated by a relatively small number of large fruit export companies, many of which are foreign owned (e.g., the US, Italy, Saudi Arabia).

Most of these companies own and operate large corporate farms but also contract with smaller "independent" growers on an exclusive basis. The export companies employ technical experts (*tecnicos*) to oversee their pest management needs which include everything from monitoring to spray application decisions. These *tecnicos*, in turn, generally rely on consultants, who often are university researchers, to fine-tune their pest management decisions. Unlike in the US and Canada, there is no real extension service to provide this type of information to commercial agricultural users. Moreover, the technology behind the university consultants tends not to be generated domestically; usually it is copied from researchers in the US, Europe, Australia, etc., and adapted for use locally.

Unlike the common practice in most US and Canadian commercial operations, the export destination country of the crop from a given block or farm is often known at the start of the growing season, or at least the two or three most likely choices for the intended market have been identified. This allows the spray program to be tailored to the import regulations of the intended market country; every company maintains a large book with all the pest and pesticide regulatory restrictions of each potential buyer country. So, for instance, the *tecnicos* know from day one that the European PHI for azinphosmethyl (Guthion) is 40 to 45 days, for phosmet (Imidan) is 50 days and that suitable alternatives need to be used if necessary.

Because of this strategy, the sale of the crop

TABLE 1

Key arthropod pests in South American pome and stone fruits.

Species occurring in North America	
Codling Moth	Oriental Fruit Moth
San Jose Scale; others	Spirea Aphid
Woolly Apple Aphid	Green Peach Aphid
European Red Mite	Flower Thrips
Pear Rust Mite	Pear Psylla
Twospotted Spider Mite	
•Species not occurring in North America	
Proeulia Leafroller (Chile)	
Obscure Mealybug (Chile, Argentina)	
Grape Snout Beetle (Chile, Argentina)	
Oiketicus bagworm (Argentina)	
South American Fruit Fly (Brazil)	

is all but assured through standing contract orders; for this reason, most pest management decisions tend to be relatively conservative. Disposal of substandard or culled fruit is not too much of a concern to the crop managers, as the local domestic market is often able to absorb the small amounts obtained.

The companies are willing to spend what it takes to ensure a clean crop and invest in options that include the newest chemistries (i.e., selective materials, to favor biocontrol of mites), newer management technologies that may be more practical in larger scale operations (such as pheromone mating disruption) and high labor inputs (for handgun sprays in certain cases, hand-thinning, extensive tree-training efforts and multiple pickings). In general, there is little ground for the commonly voiced complaint that other countries have access to some of the "good old products" that have been banned here.

It is true that the US does tend to have stricter pesticide restrictions than do these countries, but this is largely because of a greater emphasis on environmental and worker safety considerations here rather than food safety concerns. Newer products, on the other hand, nearly always receive registrations for use in South America years ahead of their approval in the US and Canada.

A look at the typical spray program for a Chilean apple orchard reveals that most sprays are to control codling moth and San Jose scale, the two most serious direct pests of the fruit. For codling moth, the typical grower has to contend with three generations per year, with peak flights in mid-October (before the pink bud stage), mid-December (end of bloom to petal fall) and late January (about one month before the harvest period). The treatment strategy is to time sprays for 175 degree days (base 50°F) after the trap catch average first reaches 4/trap. There are generally two sprays applied per generation, using an organophosphate (OP) material such as Guthion, Imidan, Lorsban, Supracide, or even Diazinon, dimethoate or fenitrothion. Some insect growth regulators such as tebufenozide (Confirm) also are beginning to be tested.

Recently there has been a significant increase in the number of acres on which mating disruption is being used at some level; currently this is estimated at roughly 10,000 out of the country's 110,000 acres of tree fruits. One new type of dispenser ("RAK," marketed by BASF) represents an important advance in this technology, as it has a long residual life in the field that allows it to be applied once before the first flight, at lower rates than other products, and still retain effectiveness up to harvest. As in many other fruit regions of the world where mating disruption is used, this is not a standalone tactic in Chile; some level of pesticide use is always maintained.

Orchards are first classified as to their risk level, based on their past history. This classification is used to set a trap catch threshold that signals the need for some pesticide use. In "low risk" blocks, for instance, a border spray might be applied when the trap catch exceeds 20 moths per trap per week. In "moderate" or "high" risk blocks, the thresholds would be lower (10 or 5 per trap, respectively), and the sprays would be applied to the entire orchard once they are exceeded.

San Jose scale has three full generations per year, with peak flights in mid-September, mid-December and in March. Its management strategy often entails four spray periods: oil (with or without Supracide) in late winter and then OP applications in late spring, midsummer and postharvest. Because of the warmer winter temperatures, woolly apple aphid tends not to be completely restricted to a dormant underground population during the off-season months, so inactive colonies often can be found at the base of the trunk year-round, which increases their infestation potential and duration.

The other countries we visited also had pest concerns specific to their respective situations. In Argentina, codling moth has three and sometimes a partial fourth generation per year, resulting in a potential period of pest exposure to the crop of 160 days. Unlike in Chile, some codling moth populations show resistance to the synthetic pyrethroids and a diminished sensitivity to the OPs, which results in typical management programs of 10 to 12 sprays per season used in combination with mating disruption. Principles of resistance management suggest that this approach should not be sustainable over the long term.

In Brazil, codling moth is sometimes present, but it is more likely to be oriental fruit moth that poses the greatest threat of fruit damage in apples, particularly at the end of the growing season and into the harvest period. Even more troubling is the occurrence in Brazil of the South American fruit fly, a relative of the apple maggot. However, instead of the single generation per year that northern apple growers are used to, the S.A. fruit fly has three generations, which means it is present for most of the season, and problem orchards require continual sprays to protect the fruit. Also, unlike apple maggot, there is no good specific trapping lure available for this species. Pest managers must use a general bait trap that catches large numbers of nontarget insects, which makes it very difficult to implement an effective monitoring strategy.

Overall, we found that the pest populations and their management programs in these countries differ in important ways from those in the US and Canada, but the biological determinants of how best to perform this task in South America have many common elements to those employed elsewhere. The climate, production styles and political trade issues all combine to create unique challenges to the task of supplying pest-free pome or stone fruits to the available markets.