Glades Crop Care, Inc.'s PESP Strategy

Describe your Organization's Five-Year Goals Related to Pesticide Risk Reduction

Our long-term approach to pesticide risk reduction involves, as it has since our company's founding in 1973, continually educating our large client base and the grower community at large about advances and new and improved tools for pest management. We will stress continuing progress toward profitable, biologically based IPM by redirecting pesticide choices away from high-risk chemicals whenever possible, and implementation of multiple IPM preventive practices. A priority is to use beneficial organisms, cultural practices and other non-chemical approaches to effectively mitigate the pest problem.

The major threats to clients' crops are pests resistant to commonly used pesticides or whose habits make them difficult to manage. Two primary pests, the silverleaf whitefly (Bemisia tabaci) and the western flower thrips (*Frankliniella occidentalis*) threaten multiple crops, both through direct feeding damage and by vectoring destructive virus diseases, Tomato Yellow Leaf Curl Virus and Tomato Spotted Wilt Virus, respectively. Chilli thrips, *Scirtothrips dorsalis*, is a recent invasive introduction threatening vegetable and ornamental crops throughout Florida. Glades Crop Care has a rigorous and constantly updated educational program to train our staff and our clients about new and potentially destructive pests. Our staff is trained in recognition, survey procedures and yield loss potential.

Over the five-year period our goal is to provide clients with information necessary for economical and profitable management of these pests, while minimizing risks of further resistance development and avoiding frequent applications of "high risk" pesticides. We plan to continue our participation in monitoring pesticide resistance through regular submission of sample populations to University of Florida entomologists.

What do you envision doing (broadly) to try to resolve your major issues?

Current grower practices have resulted in effective management of our important pests when these practices are conscientiously and scientifically implemented. Management failures and subsequent economic losses occur when growers fail to use sound preventive practices such as proper field site selection, prompt crop destruction, or wise pesticide choices.

Because of the need to promote proper pest management practices among both clients and non-clients, a major focus of our efforts over the five year period will involve region-wide crop management programs with participants from the grower community, and university, USDA and associated industry researchers. A current example is our involvement in a region-wide effort to define silverleaf whitefly population dynamics of and the spread of Tomato Yellow Leaf Curl Virus in cooperation with researchers from the University of Florida, USDA and several of Florida's major tomato producers.

As an agricultural consulting company, gathering and disseminating technical and scientific information is our core mission. We will maintain our position as a leader in technical and timely information delivery through detecting, evaluating and accurate reporting of pest and crop issues and devising action plans and solutions for managing them. Outreach to the grower community and to researchers and regulatory personnel will continue as an important part of our efforts, specifically through our annual newsletter, *Looking Ahead*, and through presentations at grower meetings and local, state and national conferences.

Goal 1 and Tactics

Implementing region-wide management through identification of and education about the movement of important insect and disease pests of vegetable crops has been a cornerstone of Glades Crop Care's integrated pest management programs for many years. Our educational efforts stem from many years of consultation with our clientele, and are validated by as many years of field observations by our professional field staff. To disseminate important pest and crop information, GCC makes regular use of its own and UF annual and occasional newsletters and presentations at meetings, both at the local grower level and at national and regional professional levels. Written and oral reports are presented to clients twice each week during the growing season. Examples of our published materials are available at our website (http://www.gladescropcare.com).

Development of a hand-held GPS-enabled scouting tool was an important step in accumulating data on the incidence and distribution of diseases such as Tomato Yellow Leaf Curl Virus (TYLCV), Southern Bacterial Wilt and Fusarium Wilt in tomato crops. While this tool is effective in providing individual growers with "snap-shots" of their crops, critical limitations exist, most notably, restrictions on the ability of scouting personnel to survey large acreage in a timely and cost effective manner and, in the case of Glades Crop Care, the inability to obtain data from non-client fields.

Because of these limitations, GCC is investigating the use of aerial imaging as a means of detecting and analyzing these and other diseases. We are investigating the merits of two imaging systems using near- and far- infrared wavelengths. We also plan to use the hand-held GPS scouting tool in verifying the infrared images. Once the optimal imaging system has been verified, analysis of disease incidence in many fields should be more timely and efficient than collecting the disease incidence data "by hand". We currently have preliminary test results using near-infrared (reflectivity) imagery, which may not be sufficiently sensitive, and are working with a company using far-infrared (emissivity) imagery as a diagnostic tool. We are attempting to receive some grant monies to pursue our imaging goals further.

Perhaps more important than having the technological capability to collect and analyze large amounts of data, is the ability to put it to effective use. For several years, GCC has encouraged clients and non-clients alike to cooperate in managing important pest

complexes, especially TYLCV and its vector, the silverleaf whitefly. We are providing education on the merits of this effort, and six large southwest Florida tomato growers along with researchers from the University of Florida, Institute of Food and Agricultural Services, and USDA/ARS are participating. A cooperating USDA scientist is establishing a mechanism for information exchange of among participants to minimize the risks of damaging, widespread epidemics of TYLCV. While important privacy issues, primarily involving proprietary information, still need to be ironed out, we now have six highly competitive farming operations willing to share important data relating to controlling the TYLCV epidemic. Information exchange programs and timetables are being developed.

How does this activity reduce pesticide risk?

The desired result of these activities is for growers to better coordinate planting schedules and other important decisions, such as where to locate new plantings and when to destroy crops after harvesting is completed. The primary goal of optimizing these decisions is to minimize TYLCV economic losses. TYLCV incidence is directly tied to a reduction in the number of insecticide applications for control of TYLCV's whitefly vector, especially during the period when new spring plantings are being established and harvested fall plantings are being destroyed. This frequently results in mass emigration of viruliferous whiteflies from recently destroyed fields into the new plantings, causing high levels of whitefly infestation and TYLCV transmission. This period is also one of intensive hand labor in southwest Florida's vegetable fields. Any preventive practice that can eliminate the need for one or more insecticide applications will reduce risks of pesticide exposures among workers involved in harvesting and other cultural activities. The benefits of reducing applications in managing pesticide resistance development are discussed in further detail under Activity 3.

How will you measure the risk reduction gained from this activity?

The success of this activity will be measured by:

- Participation level in the growing community and the quality of epidemiological data exchanged,
- interviewing growers to determine the relevance of exchanged information for improved decision making,
- upgrading the type of information collected and exchanged to provide the greatest impact on decision making, and
- monitoring pesticide practices to record changes in the number and types of applications, especially during the crop establishment, early growth periods and crop destruction.

Goal 2 and Tactics

Recommendation and implementation of biologically based non-chemical preventive practices by Glades Crop Care has proved surprisingly effective in managing several important pests in southwest Florida vegetable crops. During the upcoming seasons, as in years past, GCC will promote the use of such practices as improving nightshade control during the off-season to enhance control of pepper weevils in the upcoming season's pepper plantings.

As part of our planned resistance management activities, we are especially interested in promoting the use of companion and/or nursery crops to enhance the activity of minute pirate bugs, important thrips predators, a subject of GCC research funded by grants from the USDA Pest Management Alternatives Program. These research projects led to development of a specific sunflower use recommendation, which has proved effective in increasing the activity of these beneficial insects in commercial pepper crops monitored for over two years by GCC. Interest has been expressed in widespread use of sunflowers in an intensively farmed area of Palm Beach County where economic losses to the highly damaging pest, western flower thrips, have occurred over the past two seasons. A serious limitation at this point is that only one insecticide, spinosad, is effective in controlling this pest. In fact, a larger problem is the lack of resistance management rotation partners for spinosad. We intend to monitor:

1. the level of use of this companion planting,
2. its effectiveness in reducing or eliminating insecticide applications, and
3. impacts on the incidence of the yield-reducing Tomato Spotted Wilt Virus, which is vectored by this thrips species.

How does this activity reduce pesticide risk?

Efforts to conserve or augment beneficial insect populations will require either a reduction in pesticide application frequency or a shift away from insecticides that are highly toxic to them. The resulting "softer" pesticide regimens should reduce farm worker and environmental pesticide risks.

How will you measure the risk reduction gained from this activity?

We will measure this educational program's success through interviews and actual data collection. We will first monitor the number of acres where sunflower companion plantings have been made. Currently, the very first sunflower planting has been made in the targeted area. Where sunflowers have been planted, we will collect data to determine whether economic losses are lower than in previous seasons, and what changes in pesticide applications to manage western flower thrips have occurred.

Goal 3 and Tactics

Resistance to pesticides in critical pest species poses a serious threat to profitable Florida vegetable production. One pest of particular importance is *Frankliniella occidentalis*, the western flower thrips (WFT), a Tomato Spotted Wilt Virus vector in pepper and tomato crops.

Historically, WFT has been problematic in northern Florida and throughout the southeast United States in general. During the past two seasons, this pest caused significant feeding damage to these crops in southeast Palm Beach County. The apparent development of resistance to spinosad, a reduced risk insecticide and the mainstay in recent years in controlling WFT, led in 2006 to a cooperative program involving GCC, Dow AgroSciences and a major pepper grower. The objective of this program was to investigate whether WFT could be economically managed while attempting to restore, at least in part, the spinosad efficacy by reducing its frequency of use. The results of the team effort were promising; the grower reduced insecticide applications, and, remarkably, incurred less crop damage than in the preceding season.

At the same time, bioassays of field collections of WFT for spinosad resistance, conducted by Dr. Joe Funderburk, University of Florida, Institute of Food and Agricultural Sciences, indicated that resistance ratios in the WFT populations from the grower's fields had decreased relative to those found during the preceding season. Importantly, resistance ratios from these fields were generally lower than those found in fields of adjacent commercial operators.

Aside from direct crop injury from WFT feeding, a major driver in the resistance management of spinosad is the WFT's role as a vector of the yield eliminating Tomato Spotted Wilt Virus (TSWV). Presently the TSWV reservoirs are increasing, and predictably within one or two years the combination of WFT and TSWV could have a devastating impact unless effectively managed.

Glades Crop Care's plans for managing WFT pesticide resistance for the upcoming seasons will take several approaches. Of principal importance will be monitoring the WFT populations' distribution throughout the south Florida growing regions to detect signs of dispersal from Palm Beach County's multi-farm hotspot. Surveys made at the end of the 2007 spring crop indicate that WFT were more extensively distributed than ever before, but that control problems occurred in only a few locations. Considering the need to monitor potential population shifts from the normal species mixture to domination by WFT, Glades Crop Care has made available to interested growers a service where periodically collected samples of thrips are analyzed for species composition. We anticipate that as growers become aware of this impending problem, this service will be an important and invaluable tool.

Our second focus in this effort is to promote the use of proper scouting techniques and effective use of economic thresholds for WFT control. These have been developed and used by GCC for over two decades. Careful monitoring of infestation levels and timing

control applications to only when biologically justified are the most likely reasons for the success of the initial cooperative program. GCC's approach to promoting the proper use of these basic IPM tools will be to offer the services of our professional staff to growers throughout south Florida, and educating them about this highly damaging pest.

GCC will pursue research into alternative insecticides to use as spinosad rotation partners. Input from Palm Beach County pepper growers and consultants, along with GCC's observations during the past season, indicate that the local WFT population exhibits a high level of resistance to most, if not all, of the commonly used insecticides. Our efforts will, therefore, focus on testing new or soon-to-be registered products as well as tank mixes of older products with potential synergists.

How does this activity reduce pesticide risk?

Observations throughout Florida indicate that once WFT have appeared, they quickly become the dominant species. This occurs through the elimination of the common, more pesticide susceptible local species from insecticide applications to control insect pests present in the field, regardless of type. However, through conservation and augmentation of beneficial insects, proper scouting and the use of economic thresholds, and effective use and rotation of spinosad and alternative insecticides, the overall insecticide load in affected vegetable fields can be reduced. Our experience with a large grower with widely distributed fields during the past season indicates this is a potential solution. The critical issue will be implementing the program in as many fields in the WFT infested growing region as possible.

How will you measure the risk reduction gained from this activity?

Success in this educational and monitoring effort will be demonstrated by stabilized or decreasing resistance ratios of WFT tested in bioassays using spinosad. The data obtained during 2005-2007 by Dr. Joe Funderburk will be used as a baseline for evaluating the effectiveness of implementing the integrated approach to managing WFT in slowing or reversing the decrease in the efficacy of spinosad. Other measures of success will include grower input regarding economic damage levels caused by WFT as well as evaluation of pesticide usage trends in tomato and pepper crops. We anticipate that development of an effective pesticide rotation program will be achieved by the end of the next growing season, and that there will be further improvements over the succeeding years. Full use of GCC's educational services and implementation of recommended practices is likely to occur over the course of the following seasons.