OKRA PEST MANAGEMENT STRATEGIC PLAN (PMSP)

February 2, 2005
Homestead, FL

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Executive Summary

In 2004, Florida okra production was estimated at 1,500 acres of commercial production. The majority is planted in southern Florida in the summer, but okra production occurs ten months of the year in the state. Retail sale occurs in small scale throughout the state during the summer months. Okra is a "scavenger" crop. It is planted in beds or fields where more valuable crops had been previously cultivated to scavenge any fumigation benefits or residual fertilizer. Yields range from less than 18,000 pounds/acre to over 30,000 pounds/acre. Prices range as high as $18 per 30 pound bushel. Okra can be grown throughout the state, but commercial production is concentrated in the Miami-Dade County area and bordering counties. Okra requires warm weather to flourish. Consequently, it is grown throughout the state during the summer, but only in southern Florida during the spring and autumn. Harvest extends from March through November, but most of the production occurs in the summer months.

Okra does well in Florida throughout the majority of the year and the crop can be grown in any season except winter. Although it is a hardy crop, okra does have several primary pests. The following pest concerns were placed on the "To Do" list.

Research Design and conduct trials for promising seed treatments to manage damping off organisms.

Determine if southern armyworm has begun to develop resistance to spinosad.

Education Design and conduct an education program for nematode sampling, identification, and interpretation.

Design a seed treatment fact sheet for strategies to reduce damping off.

Regulation Continue ongoing registrant/IR-4 registrations (flonicamid, carfentrazone, sethoxydim).

Place okra in a crop group and publish the revision.

Investigate possible registration of abamectin, hexythiazox, pyridaben, bifenthrin, lambda-cyhalothrin, diflubenzuron, oxamyl, terbufos, s-metolachlor, bensulide, or fluazifop for okra.

Okra PMSP List of Attendees

Okra Scouts/Distributors

Loren Horsman - Glades Crop Care (representing Torbert Farms, Ledford Farms, and Super Six)

Juliano Ibarra - United Agri-Products

Julian Flores - United Agri-Products

Extension Personnel

Mary Lamberts, Vegetable Pest Management Specialist, Miami-Dade County Extension Office, 18710 SW 288th St., Homestead, FL 33030

Teresa Olczyk, Vegetable Production Specialist, Miami-Dade County Extension Office, 18710 SW 288th St., Homestead, FL 33030

Advisors Not Able to Attend

Mark Mossler, UF/IFAS FL Pest Management Center, PO Box 110710, Gainesville, FL 32611. Tel. (352) 392-4721, mamossler@ifas.ufl.edu

Wilfred Burr, USDA/OPMP, 1400 Independence Ave. SW, Washington, DC 20250-0315. Tel. (202) 720-8647, wburr@npa.ars.usda.gov

Charlie Meister, IR-4, PO Box 110720, Gainesville, FL 32611. Tel. (352) 392-2399 ext. 412, cwmeister@ifas.ufl.edu

Mike Aerts, Florida Fruit and Vegetable Association, 800 Trafalgar Ct. Suite 200, Maitland, FL 32794-8153. Tel. (321) 214-5200

Introduction

In 2004, Florida okra production was estimated at 1,500 acres of commercial production. The majority is planted in southern Florida in the summer, but okra production occurs ten months of the year in the state. Retail sale occurs in small scale throughout the state during the summer months. Okra is a "scavenger" crop. It is planted in beds or fields where more valuable crops had been previously cultivated to scavenge any fumigation benefits or residual fertilizer. Yields range from less than 18,000 pounds/acre to over 30,000 pounds/acre. Prices range as high as $18 per 30 pound bushel. Okra can be grown throughout the state, but commercial production is concentrated in the Miami-Dade County area and bordering counties. For this reason, a Pest Management Strategic Plan (PMSP) meeting for the Florida okra industry was conducted at the Extension Office in Miami-Dade County, Florida, by vegetable pest management specialists Dr. Mary Lamberts and Teresa Olczyk on February 2, 2005. These agents, who have worked with okra growers for many years, as well as the scouts and distributors, represented the majority of Florida okra growers' concerns and desires. These agents have also worked to include okra into the fruiting vegetable crop group, which will hopefully provide more pesticide tools in the future.

Okra is grown as an annual crop in Florida, but it can be "held" for numerous months by mowing the plants and allowing regrowth. This is done only if the price received for okra is at the high range. In Florida, okra can be started by seed as early as January or as late as September, but it is generally stagger-planted from March through May. Seed are used almost exclusively for planting. Although the seed may be planted in cooler weather (generally not less than 55°F), okra requires warm weather for optimal growth. Growers who try to "rush" or "push" the window of okra planting often incur failures due to plant stress in the colder weather. With row spacing of 36 inches and between plant distance of two inches (not recommended but practiced) to one foot, plant densities range from 15,000 to over 88,000 plants per acre. Seeds are generally sown at a depth of one-half to one inch, which may require from two to twelve pounds of seed per acre. It generally takes two months for okra to bear harvestable pods.

Fertility practices for okra depend on whether the plants are grown on mulch or bare ground. Generally, nitrogen and potassium are split two or three times throughout the season to account for rapid loss under Florida conditions. These mid-season fertilization procedures are accomplished with a fertilizer wheel or by fertigation. Irrigation is supplied by water cannon or by drip.

Worker Activities

Since okra is a secondary crop, minimal worker activities are necessary. The ground is either directly seeded (the vast majority) or transplants are set. Transplants are set by workers by hand. Workers setting transplants (approximately three days for a forty-acre farm) often wear latex gloves. The only remaining hand labor includes harvest. Okra can be picked every other day during the fruiting period (approximately two weeks), and several times more if the crop is mowed and allowed to regrow.

Mites

Mites (broad, red, and twospotted) were regarded as increasing pests of okra production; however, economically damaging outbreaks of spider mites occur only sporadically, and are generally weather-influenced (encouraged by dry conditions). Although bifenazate (Acramite®) is registered for use in Florida okra, other rotational materials (abamectin, hexythiazox, pyridaben) are needed for resistance management.

For okra miticides, there are no carbamate, organophosphate, carcinogen, PHI, or REI concerns with the currently registered materials.

Insects

The lepidopteran larvae responsible for plant and pod damage (beet/southern/fall armyworm, corn earworm, cabbage looper) are managed early in their life cycle by materials such as methoxyfenozide (Intrepid®), spinosad (Spintor®) and *B.t.* products, but growers lack tools to manage these pests as they grow larger. It has also been noted by scouts that spinosad seems less efficacious against southern armyworm when applied at historically effective rates. Although no research is actively tracking this observation, spinosad resistance has been observed in melon thrips (another key pest which is often targeted with spinosad). If resistance is occurring, a larger proportion of the larvae will grow to later instar stages. Consequently, the several more acutely toxic materials such as methomyl, bifenthrin, or lambda-cyhalothrin to control older caterpillars are desired, as the caterpillars can inflict total leaf defoliation and/or pod loss if uncontrolled. Diflubenzuron was also an active ingredient discussed that may have good fit into an okra IPM program (i.e., as soft of materials as possible in the beginning of the season).

Whitefly (usually silverleaf whitefly), melon thrips, and stinkbugs are big concerns for Florida okra growers. The extension specialists reported that these pests are increasingly reported by growers as increasing in prevalence. Flonicamid registration is pending, and this material provides control of sucking insects such as thrips and whiteflies, as well as stink bugs.

Leaf feeding coleopterans such as cucumber beetle (striped and six-spotted) and sugar cane weevil were noted by the group as sporadically problematic (< 5 percent damage in any one year). Since okra is not a host of the larval stage of sugar cane weevil, only the adult feeding is a consideration. Adult feeding by cucumber beetles is also the primary consideration. Diflubenzuron was again mentioned as material that may be appropriate for these pests.

For okra insecticides, there are no carbamate, organophosphate, carcinogen or REI concerns with the currently registered materials.

Nematodes

Okra is very susceptible to sting, root-knot, and reniform nematodes. Most of the commercial okra acreage is grown on soil that has been treated previously with some type of fumigant or sterilant, even though it is grown after the primary crop (such as tomato or pepper or eggplant). Growers in the commercial area would like to have access to active ingredients such as oxamyl (through fertigation **only** to decrease any chance of non-target resistance) or terbufos, while growers planting on bare ground generally avoid nematicidal treatment due to the costs.

As agents recounted, okra growers don't have much confidence in cover crop rotation as a means to reduce nematode pressures, and generally leave a field fallow rather than plant it with a cover crop. With the loss of methyl bromide, meeting participants felt this was an area that needs active extension education, especially with regard to sampling, identification, and interpretation. Through a program such as this, the magnitude of nematode pressure should be become more apparent to growers.

For okra nematicides, there are no carbamate, organophosphate, carcinogen, PHI, or REI concerns with the currently registered materials.

Diseases

Because of the natural climatic difference between north and south Florida, differences exist in degree of vigor incorporated in the disease control programs by growers in different parts of the state. Disease control efforts also interact with market dynamics. Southern growers normally get higher prices because of early marketing but without these higher prices they could not afford to practice the disease control program necessary for that area. Northern growers, on the other hand, usually get lower prices for okra because of market conditions, but fortunately, they do not need a spray program as do the growers in south Florida.

Diseases are generally more of a pest problem than other considerations, largely due to loss of grade when pods are affected. The key diseases reported by agents and scouts at the PMSP meeting were those listed in the crop profile, namely *Cercospora* and powdery mildew, as well as root diseases caused by *Rhizoctonia* and *Pythium*. Unfortunately, extension efforts to reduce the high seeding rate of okra (several seeds per inch) have not been adopted by commercial growers. Consequently, damping off and seedling root rot are quite prevalent. While standard seed treatments such as thiram may be effective at lower seeding densities, this is not the case for summer planted okra in southern Florida. Although mefenoxam is available as a seed treatment, growers may not use it because the seed may already be treated (usually with thiram) or they may not be aware mefenoxam is labeled (or that they can double-treat seed).

In addition to seed treatment, group participants expressed interest in foliar application of mefenoxam to manage seedling root rots. Foliar and mid-season diseases are largely managed with existing materials or left unmanaged.

Another affliction of the okra pods is a "black-spotting" that occurs after harvest. This appears to be a physiological reaction when the pods are left in the sunshine during field packing. Shading of the pods tends to minimize these effects, and extension outreach was mentioned as one way to educate growers.

For okra fungicides, there are no carbamate, organophosphate, carcinogen, PHI, or REI concerns with the currently registered materials.

Weeds

Because okra is a crop often established from seed, competition from early season weeds can lead to loss of yield. Weeds late in the season can reduce the efficiency of harvest, but yield loss from competition is less of a consideration when weeds emerge later in the growth of the okra crop.

There are very few herbicides labeled for use in okra, in great part due to the current exclusion of this crop from any of the crop groupings. Placement of okra into the fruiting vegetable crop group will add to the number of herbicides (and other pesticides) available to okra growers.

Many growers use sweeps or rolling cultivators for weed control, often to the detriment of the crop. Currently, only glyphosate, trifluralin, and pelargonic acid are labeled for use in okra. Since trifluralin is a preemergence herbicide, it often fails in mid-season and is weak on large-seeded broadleaf weeds. Glyphosate and pelargonic acid (not seriously used due to cost) cannot be used due to their non-selective mode of activity. Consequently, herbicides are needed to control mid and late season weeds. Both carfentrazone and sethoxydim registrations for okra are pending, but extension research has also shown that such herbicides as s-metolachlor, bensulide, and fluazifop provide selective weed control without okra phytotoxicity.

For okra herbicides, there are no carbamate, organophosphate, carcinogen, PHI, or REI concerns with the currently registered materials.

Crop Groupings

Because okra has historically been placed in the miscellaneous EPA crop grouping, very few pesticides are available to this minor crop. The current status is that okra will be placed in the fruiting vegetables (except cucurbits) crop group (Crop Group 8) the next time the groupings are published in the *Federal Register*. This action is scheduled to take place in 2005, and the

publication of this, along with relabeling, will provide many new pest management tools to okra growers.

Summary

Based on the input of the members of the Florida okra PMSP, the following items have been placed on the "To Do" list.

Research

1. Design and conduct trials for promising seed treatments to manage damping off organisms.

2. Determine if southern armyworm has begun to develop resistance to spinosad.

Education

1. Design and conduct an education program for nematode sampling, identification, and interpretation.

2. Design a seed treatment fact sheet for strategies to reduce damping off.

Regulation

1. Continue ongoing registrant/IR-4 registrations (flonicamid, carfentrazone, sethoxydim).

2. Place okra in a crop group and publish revision.

3. Investigate possible registration of abamectin, hexythiazox, pyridaben, bifenthrin, lambda-cyhalothrin, diflubenzuron, oxamyl, terbufos, s-metolachlor, bensulide, or fluazifop for okra.

Table 1. Efficacy ratings for management tools against invertebrate pests - Florida okra

Pests / Pest Management Tools	Mites	Thrips	SM	Aphids	FAW	CL	CEW	BA	SMC	GC	TB	WF	CB	Leafminer	WFB	Beetles	MC	Bugs
Registered materials																		
Azadirachtin (Neem)	F			F	F		F		G			P						
Bacillus thuringiensis					G	G	G		G									
Bifenazate (Acramite®)	E																	
Imidacloprid (Admire®)				E								E						
Kaolin (Surround®)																		
Malathion	P			F	F	F	F											
Methoxyfenozide (Intrepid®)																		
Oils												G						
Permethrin (Ambush®)					F							F						
Pyrethrins + Rotenone	P																	
Pyrethrins + PBO				F	P		P		G			P						
Soaps												F						
Spinosad (Spintor®)		G			G	G	G											
Sulfur	G																	

Abbreviations:
SM = seedcorn maggot
FAW = fall armyworm
CL = cabbage looper
CEW = corn earworm
BA = beet armyworm
SMC = saltmarsh caterpillar

Abbreviations:
GC = granulate cutworm
TB = tobacco budworm
WF = whiteflies
CB = cucumber beetles
WFB = white-fringed beetle larvae
MC = mole cricket

Rating scale:
E = excellent;
G = good;
F = fair;
P = poor;

Rating scale:
? = research needed;
… = not used;
***** = used but not a stand alone management tool

Table 1. Efficacy ratings for management tools against invertebrate pests - Florida okra

Pest Management Tools \ Pests	Mites	Thrips	SM	Aphids	FAW	CL	CEW	BA	SMC	GC	TB	WF	CB	Leafminer	WFB	Beetles	MC	Bugs
New Chemistries - Pending																		
Flonicamid (Turbine®)																		

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Cultural/Non-chemical																		
Certified pest-free plants	EF			F														
Crop rotation																		
Removing ripe fruit from field																		
Resistant varieties	EF																	
Sanitation	G											G						
Traps																		
Weed control	G																	
Biological controls																		
Beneficial mites	E	G		P								P						
Damsel bugs				P	P	P	P	P	P			F						
Big-eyed bugs	P			P								F						
Ground beetles					P	P	P	P	P			P						
Lacewings	P			G	P	P	P	P	P			G						
Ladybird beetles	F			E								G						

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Minute pirate bugs	P	E		F	P	P	P	P	P			F						
Predatory mirids												G						
Parasitic wasps	P	P		G	P	F	F	F	F			E		E				
Predatory midges	P			G														
Predatory thrips	F																	
Spiders	P				P	P	P	P	P									
Syrphid fly larvae	P			G														

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Table 2. Indications for disease management products used on Florida okra.

Disease Management Product	Damping Off	Cercospora Leafspot	Southern Blight	White Mold	Blossom Blight	Alternaria Leaf Spot	Verticillium Wilt	Powdery Mildew
Azoxystrobin (Amistar®)			X	X				XX
Bacillus subtilis (Serenade®)								
Mefenoxam (Apron®)	X							
Potassium bicarbonate								
Potassium phosphite								
Petroleum oil								XX
Sulfur		X				X		X

X = effective for control of indicated disease, XX = highly effective for control of indicated disease

Table 3. Indications for weed management products used on Florida okra.

Weed Management Product	Texas Panicum	Goosegrass	Crabgrass	Pusley	Pigweeds	Nutsedges	Purslane	Morningglory
Glyphosate (Roundup®)	X	X	X		X	X		
Pelargonic acid (Scythe®)				S	X		S	S
Trifluralin (Treflan®)				X	X		X	
PENDING								
Carfentrazone (Aim®)				X	X		X	X
Sethoxydim (Poast®)	X	X	X					

X = used for control of indicated weed
S = for suppression only of indicated weed

Table 4. Pending okra pesticides from the New Pest Management Technologies (NPMT) database.

CHEMICAL NAME	PESTICIDE TYPE - PESTS
Carfentrazone (Aim®)	Herbicide - numerous broadleaf weeds
Flonicamid (Turbine®)	Insecticide - aphids, thrips, leafhoppers, plantbugs
Sethoxydim (Poast®)	Herbicide - grasses