THE UNIVERSITY OF GEORGIA
COOPERATIVE EXTENSION
Colleges of Agricultural and Environmental Sciences & Family and Consumer Sciences

Land Management

GEORGIA FARM*A*SYST

FARM ASSESSMENT SYSTEM

COTTON INTEGRATED PEST MANAGEMENT

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PRE-ASSESSMENT:

Why Should I Be Concerned?

Integrated Pest Management (IPM) incorporates a variety of cultural, biological and chemical methods to efficiently manage a cropping system while lowering dependence on chemicals. IPM, through its multi-tactical approach, may 1) help diminish pest *resistance* to *pesticides*, 2) reduce chemical costs, 3) limit personal exposure to chemicals (through mixing, spraying, etc.) and 4) lower the environmental impact of your crop.

Pesticides, though integral to today's agriculture, have come under increasing scrutiny in the past few years. Implementing a variety of pest management tactics can help pesticides remain effective and reduce chances of pest resistance to chemicals. Also, with the diminished chemical dependence of IPM, these same chemicals are less likely to be taken off the market due to their perceived negative environmental impacts.

Integrated Pest Management takes an individualized approach to each farming system or crop to maximize pest management and profit. It serves the dual purpose of being more environmentally sound while maintaining profitability by striving to keep pest populations below economically damaging levels. IPM is a growing trend in agriculture, and many state and governmental agencies are lending research and financial support to increase adoption of this method of farming.

How Does This Assessment Help Protect Drinking Water and the Environment?

- This assessment allows you to measure the level of IPM on your farm.
- The assessment asks a series of questions about your use of pesticides and the cultural and biological pest management practicesused on your cotton crop.
- The assessment evaluation uses your answers (rankings) to identify practices that use IPM and practices that might be modified to help reduce environmental impact and limit pest resistance to pesticides.
- The IPM facts (pg. 11-14) give an overview of IPM strategies that can be applied to your farm. If applied, they can help reduce environmental impact and pest resistance influenced by your use of pesticides and cultural and biological pest management practices.
- You are encouraged to complete the entire document and use all six areas when completing the assessment.
- You are encouraged to develop an action plan based on your needs as identified by the assessment. The IPM facts, references and publication lists can provide alternatives to current practices.
- Farm*A*Syst is a voluntary program.
- The assessment should be conducted by you for your use. A professional from UGA Cooperative Extension can provide assistance in completing the assessment.

* *Italicized words are defined in the glossary.*

ASSESSMENT:

Assessing Your Pesticide Use and Cultural and Biological Pest Management Practices.

For each category or statement listed on the left, read across to the right and circle the statement that best describes conditions on your farm. If a category does not apply (for example, it asks about early season insect damage and you don't have high risk for damage) then simply skip the question. Once you have decided on the most appropriate answer, look above the description to find your rank (4, 3, 2 or 1) and enter that number in the "RANK" column. The entire assessment should take less than 45 minutes. A glossary is on page 16 to clarify words found in italics throughout this assessment.

COTTON IPM					
	HIGH IPM (rank 4)	**MOD IPM (rank 3)**	**LOW IPM (rank 2)**	**NO IPM (rank 1)**	**RANK**
INSECT MANAGEMENT					
Cotton scouting techniques:	Fields are systematically checked and sampled from side to side, front to back and along the edges, with notes taken on beneficial insects, weed and disease problems and crop growth and development.	Fields are systematically checked and sampled.	Fields are only generally observed while performing routine tasks in the field.	Fields are not scouted.	
Cotton fields are scouted for insect pests:	Twice per week from pin head square to cut out and once per week the rest of the season.	Twice per week from pin head square to cut out and less than once per week the rest of the season.	About once per week throughout the season.	Never, or scouted less than once per week.	
Spraying for insect pests is based on scouting reports for both beneficials and pests:	Always.	Usually.	Sometimes.	Not usually or never.	
Hotlines, cotton newletters and other current information are used to influence pest management decisions:	Always.	Usually.	Sometimes.	Not usually or never.	
Beneficial insects and spiders, along with their life stages, are taken into account when choosing an insecticide:	Always, and the pest threshold for spraying is raised if they are present.	Always, but the pest threshold for spraying may not be raised.	Sometimes, but the pest threshold for spraying is not usually raised.	Never.	

COTTON IPM					
	HIGH IPM (rank 4)	**MOD IPM (rank 3)**	**LOW IPM (rank 2)**	**NO IPM (rank 1)**	**RANK**
Insecticides are rotated within the growing season with respect to insecticide class and mode of action (if available):	Always.	Usually.	Sometimes.	Not usually or never.	
To prevent or minimize early season insect damage such as thrips, in areas where there is high risk:	An at-planting systemic preventive insecticide is used and fields are scouted until pin-head square stage.	An at-planting systemic preventive insecticide is used.	Only foliar sprays are relied on.	No early season preventive use of insecticides is made.	
When considering whether to spray for postseedling insects, factors such as the most recent scouting report, weather and economic ("action") thresholds are used:	Always.	Usually.	Sometimes.	Not usually or never.	
Destruction of cotton stalks (In event of boll weevil outbreak):	Completed soon after harvest and before first frost.	Completed soon after harvest.	Completed later after harvest but before February 1st.	Cotton stalks are not destroyed before February 1st.	

Number of Areas Ranked _____
(Number of insect management questions answered, if all answered, should total 9.)

Ranking Total _____
(Sum of all numbers in the "RANK" Column)

COTTON IPM					
	HIGH IPM (rank 4)	**MOD IPM (rank 3)**	**LOW IPM (rank 2)**	**NO IPM (rank 1)**	**RANK**
WEED MANAGEMENT					
To select the most effective herbicides and rotation crops, field surveys of weed populations:	Are done for each field, and maps and notes are recorded.	Are done for each field and notes are recorded.	Are done for each field and only mental notes and maps are made.	Are not done.	
Carry-over, or residual effects, of a herbicide are considered with respect to other crops likely to be planted in the same field:	Always.	Usually.	Sometimes.	Not usually or never.	
Herbicides are rotated within the growing season with respect to herbicide class and mode of action (if available):	Always.	Usually.	Sometimes.	Not usually or never.	
Pre-emergence herbicides are applied by banding:	Always.	Usually.	Sometimes.	Not usually or never.	
When weed problems vary significantly in a <u>crop</u>, weed control is tailored for each crop:	Always.	Usually.	Sometimes.	Not usually or never, despite weed variance in the crop.	
When weed problems vary significantly in a <u>field</u>, weed control is tailored for each crop:	Always.	Usually.	Sometimes.	Not usually or never, despite weed variance in the field.	
Row-middle weed control is achieved by banded spraying or cultivation.:	Always.	Usually.	Sometimes.	Not usually or never.	

COTTON IPM					
	HIGH IPM (rank 4)	**MOD IPM (rank 3)**	**LOW IPM (rank 2)**	**NO IPM (rank 1)**	**RANK**
To control the spread of weed seeds, rhizomes and tubers, equipment is cleaned between fields and weedier fields are harvested after less weedy fields:	Always.	Usually.	Sometimes.	Not usually or never.	
Turn rows are cleaned prior to harvest:	Always.	Usually.	Sometimes.	Not usually or never.	

Number of Areas Ranked _____
(Number of weed management questions answered, if all answered, should total 9.)

Ranking Total _____
(Sum of all numbers in the "RANK" Column)

COTTON IPM					
	HIGH IPM (rank 4)	**MOD IPM (rank 3)**	**LOW IPM (rank 2)**	**NO IPM (rank 1)**	**RANK**
DISEASE AND NEMATODE MANAGEMENT					
Soil samples for parasitic nematodes are taken for most of your cotton fields:	From August until mid-to late November (before the first frost).	From August until mid-to late November (before the first frost) every other year.	From late November (or after the first frost) through July.	Never.	
Number of soil samples taken to test for parasitic nematodes:	One soil sample for every 25 or fewer acres.	One soil sample for every 26-60 acres.	One soil sample for every 61-100 acres.	One soil sample for every 100 or more acres or no samples.	
Nematode control with non-host rotation crops:	Cotton usually grown every third year or in a longer rotation.	Cotton usually grown every other year.	A non-host crop grown about every third or fourth year.	Cotton rarely or never rotated to a non-host crop.	
Nematode and disease management programs are based on:	Observations of crop growth, root symptoms and soil samples.	Observations of crop growth and root symptoms.	Observations of crop growth.	No observations.	

COTTON IPM					
	HIGH IPM (rank 4)	**MOD IPM (rank 3)**	**LOW IPM (rank 2)**	**NO IPM (rank 1)**	**RANK**
Cotton is planted:	When the 4-inch soil temperature reaches 65° F for three days and warming conditions are projected over the next several days. Care is taken to plant seeds to the appropriate depth for weather conditions.	When the 4-inch soil temperature reaches 65° F for three days and warming conditions are projected over the next several days.	In less than optimal conditions (too damp or cool.)	Too early (weather is too damp and cool) or too late in the season (increases exposure to detrimental pests.)	
The Seedling Point System, which includes information about soil moisture, temperature and field history, is used to help make fungicide application decisions:	Always.	Usually.	Sometimes.	Not usually or never.	
NUTRIENT MANAGEMENT					
Nutrient applications are tailored within your cotton crop:	Always.	Usually.	Sometimes.	Not usually or never.	
Most fields are sampled for standard or routine soil nutrient tests:	Every year during late summer or fall.	About every two years during late summer or fall.	Less often than every two years during the late summer or fall, or fields are tested more frequently but during winter, spring, early summer or mid-summer.	Never.	
Choosing the most judicious applications of nitrogen and other nutrients, petiole and/or tissue sampling:	Is done starting the week before first bloom and then once per week. Factors such as field history, soil type, irrigation management and reasonable yield are also taken into account.	Is done less than once per week, but factors such as field history, soil type, irrigation management and reasonable yield are taken into account.	Is not done, but factors such as field history, soil type, irrigation management and reasonable yield are taken into account.	Is not done. Nitrogen is applied according to fixed rates.	

COTTON IPM					
	HIGH IPM (rank 4)	**MOD IPM (rank 3)**	**LOW IPM (rank 2)**	**NO IPM (rank 1)**	**RANK**
CULTURAL AND SOIL QUALITY MANAGEMENT					
Spray pattern and application rates of applicators are calibrated under field conditions at the beginning of each season, and needed adjustments are made:	Weekly.	Monthly.	Once per season.	Never, and/ or applicatiors are not calibrated at the beginning of each season.	
Appropriate strainers and nozzles are used based on what is being applied and are cleaned and replaced in a timely manner:	Always.	Usually.	Sometimes.	Never.	
To control drift, anti-drift nozzles, spray boom height and weather conditions are taken into consideration:	Always.	Usually.	Sometimes.	Never.	
Cotton variety selection is based on such factors as genetic resistance to fungal, viral and insect pests (e.g. Bt cotton) and local data and experience:	Always.	Usually.	Sometimes.	Never. Cotton variety is selected based only on yield potential.	
Production practices are based on local data and experience:	Always.	Usually.	Sometimes.	Never.	
Crop rotation:	Cotton is usually grown every third year or in a longer rotation.	Cotton is usually grown every other year.	A non-host crop is grown about every third or fourth year.	Cotton is rarely or never rotated to a non-host crop.	

COTTON IPM					
	HIGH IPM (rank 4)	**MOD IPM (rank 3)**	**LOW IPM (rank 2)**	**NO IPM (rank 1)**	**RANK**
How many of the following methods are carried out on most of your fields? **1) Strip-till or conservation till** **2) Properly maintained terraces** **3) Properly maintained filter strips or grass waterways on down slope edges of fields** **4) Fall cover crop**	3-4	2	1	0	
To minimize or reduce formation of compacted soil layers ("hard pans"), how many of the following methods are used? **1) Subsoiling** **2) The same traffic lane is used for each operation** **3) Operations are combined or avoided when possible** **4) Machinery is not operated in wet fields**	3-4	2	1	0	

COTTON IPM					
	HIGH IPM (rank 4)	**MOD IPM (rank 3)**	**LOW IPM (rank 2)**	**NO IPM (rank 1)**	**RANK**
Management strategies (insect, weed, etc.) are based on the most current information from Extension or other reputable sources:	Always.	Usually.	Sometimes.	Not usually or never.	

***TOTAL* Number of Areas Ranked _____**
(Number of questions answered, if <u>all</u> answered, should total 36.)

Ranking Total _____
(Sum of all numbers in the "RANK" Column)

NOTES:

ASSESSMENT EVALUATION:

What Do I Do With These Rankings?

STEP 1: Identify Areas That Have Been Determined to be Low and No IPM

High IPM practices (4s) are ideal and should be your goal. Moderate IPM practices (3s) provide reasonable reduction in environmental impact and pest resistance to pesticides. Low IPM practices (2s) provide inadequate reduction in many circumstances. No IPM practices (1s) are inadequate and pose a high risk for causing environmental, health, economic or regulatory problems, plus increasing the threat of pest resistance.

No IPM practices (rankings of "1") require immediate attention. Some may only require little effort to correct, while others entail major and/or costly changes and may require planning or prioritizing before you take action. All activities identified as "No IPM" or "1s" should be listed in the Action Plan (page 17). Rankings of "2" should be examined in greater detail to determine the exact level of IPM and attention given accordingly.

STEP 2: Determine Your IPM Rankings

The IMP Rankings provide a general idea of how your cotton IPM selection and use might be affecting your ground and surface water, soil and air quality and pest resistance mangement. Use the results determined from the questionnaire portion of this assessment and the following formulas to find your IPM rankings.

INSECT MANAGEMENT TOTAL (Page 3) ÷ # OF AREAS RANKED = INSECT IPM RANKING

_____ ÷ _____ = _____

WEED MANAGEMENT TOTAL (Page 5) ÷ # OF AREAS RANKED = WEED IPM RANKING

_____ ÷ _____ = _____

OVERALL RANKING TOTAL (Page 9) ÷ TOTAL # OF AREAS RANKED = OVERALL IPM RANKING

_____ ÷ _____ = _____

IPM RANKING	LEVEL OF RISK
3.6 to 4	High IPM
2.6 to 3.5	Moderate to High IPM
1.6 to 2.5	Low to Moderate IPM
1.0 to 1.5	No to Low IPM

These rankings give you an idea of how your cotton IPM selection and use might be affecting your crop's environmental impact and pest resistance to pesticides. The rankings should serve only as a very general guide, not as a precise diagnosis, since it represents the average of many individual rankings with no consideration given to the relative importance of each ranking. Your goal should be to continue improving the average overall ranking by improving areas ranked 1 and 2.

STEP 3: Read the IMP Facts Section (pages 11-14) for Suggestions on Improving Your Cotton IPM

While reading, think about how you could modify your practices to address some of your low and no IPM areas. If you have any questions that are not addressed in the IPM Facts portion of this assessment, consult the references in the back of this publication or contact your county Extension agent for more information. Use this information to develop your action plan.

IPM FACTS:

Reducing Environmental Risk and Pest Resistance to Pesticides

Six Areas of Integrated Pest Management will be discussed:

- Insect Management
- Weed Management
- Disease and Nematode Management
- Nutrient and Soil Quality Management
- Cultural Management
- Education

INSECT MANAGEMENT

Scouting

Scouting is an integral part of cotton insect management. Spraying insecticides based primarily on thresholds can reduce the amount, expense, time and the environmental and health risks of chemical applications. In addition, minimizing insecticide sprays may reduce input costs and lower the chance of pest resistance development.

Scouting a cotton crop throughout the entire growing season is important. It is most vital, however, from pinhead square to *cut out*. Bollworms and tobacco budworms can cause significant damage during this time. Delay in spraying can make further control even more difficult. A scouting rate of twice per week throughout this period is highly recommended. Scouting once per week before and after this point should be sufficient to monitor for potentially damaging pest populations.

To be most effective, scouting should be done according to Extension guidelines set out in the **Cotton Scout Handbook**. The guidelines include appropriate field scouting patterns, scouting frequency, number of samples to be taken, crop growth stage and beneficial insect information. The procedures for scouting also include square retention counts, terminal counts for insects (beneficials and pests) and damaged square counts. To avoid unnecessary sprays, your insecticide applications should be based on the most recent scouting reports and on *economic ("action") thresholds*.

Using the insect pest history of the field is not a useful way to make spray decisions. The pest populations in a field can change dramatically from year to year. Hotlines, cotton newsletters and other current information are valuable resources for helping make insect management decisions.

Choosing an Insecticide

Beneficial insects and spiders and their respective life stages should be taken into consideration when choosing an insecticide. These organisms are helpful to the farmer since they attack and reduce populations of crop-damaging insect pests. When beneficials are present, less toxic chemicals reduce the range of non-targets affected. They may be either more selective or generally less toxic while maintaining an acceptable level of pest management. Weigh the short- and long-term effects of selective versus non-selective insecticides on target and non-target insects and spiders.

Your Extension agent or Extension IPM specialist can provide information about the effects of various insecticides on non-target insects and spiders. A publication called **Recognizing the Good Bugs in Cotton** from the Texas Extension Service is a good reference for identifying beneficial insects and the pests they prey on.

In addition to choosing pesticides that are less toxic to beneficial species, raising spray thresholds when these natural enemies are present can significantly improve your IPM rating. In many circumstances, tolerating low

levels of some pests may be more profitable than spraying costly insecticides.

Practice Insect Resistance Management (IRM) when selecting and applying insecticides. To slow or prevent pest resistance to chemicals, insecticides should be rotated during the season with respect to mode of action and chemical class. If feasible, spot treatments are suggested for patchy outbreaks such as those that often occur with spider mites.

Preventative Insecticide Use

While preventative use of insecticides is not typically encouraged in an IPM program, early season insect control against thrips, where there is high risk, is almost essential to ensuring a strong, healthy stand of cotton. Economically significant losses could be expected in most years in Georgia if this is not done. One of the most important factors in a cotton IPM system is a vigorous initial stand, which is more competitive against weeds for resources and is less susceptible to diseases and insect damage.

Applying insecticides at planting, which protects the emerging seedling, can decrease the need for post-emergence foliar insecticide and herbicide sprays. At-plant treatments tend to have less impact on beneficial species than post-emergence sprays. In addition, they are more persistent and tend to produce higher yields. Once the seedlings have emerged, considerations for spraying should include the most recent scouting report, weather and economic ("action") thresholds.

Stalk Destruction

Previously, in compliance with Georgia Department of Agriculture regulations and enforced by the Boll Weevil Eradication Foundation, cotton stalk destruction was completed by February 1st. Destroying cotton stalks soon after harvest eliminated an overwintering food source and refuge for nematodes and insects, particularly boll weevils. Tilling soon after harvest to destroy cotton roots may limit nematode population growth in the fall, particularly root-knot nematodes (RKN). The smaller the stalk pieces are cut up, the fewer refuges the insects and nematodes have for overwintering. With the eradication of the boll weevil, there is no current mandate to destroy cotton stalks, although it may still be a beneficial IPM practice on your farm. Stalk eradication may be enforced in the event of a boll weevil outbreak.

WEED MANAGEMENT

Weed History

Knowing the weed history of your cotton fields and having clearly drawn out "weed maps" or written descriptions can help determine pre-emergence herbicide treatments and locate trouble spots within a field. Many farmers rely on memory or mental notes; however, the larger the area farmed, the less reliable this technique becomes.

Weed Resistance Management

Resistance management is a well-known term in regard to insect pests. While Georgia farmers typically have not experienced significant weed resistance to herbicides, the potential exists for it to occur in the future. It is recommended that pesticides in the same class or with similar modes of action are not sprayed more than once in the same field during a two-year period, if possible. This ensures that currently available herbicides remain effective for the longest amount of time.

Banding herbicide applications and tailoring herbicide treatments within a crop and/or field for areas of patchy weed problems not only reduces the threat of resistance, it also cuts down on herbicide usage. This

can result in less financial output for chemical control and lowered personal exposure. Early recognition and action against potential resistance development ensures that future outbreaks of such events may be avoided or at least significantly reduced.

Herbicide Carry-Over or Residual Activity

If you rotate your cotton crop with other crops, it is important to note the carry-over potential of certain herbicides. Carry-over or residual activity of an herbicide can cause mild to severe damage to subsequent crops. Weakened crops are more susceptible to disease, insect damage and adverse weather. Common carry-over problems are associated with such herbicides as Cadre, Pursuit, Command Zorial and Staple. Read individual herbicide labels carefully to determine the possibility of carry-over or residual activity.

Cultural Weed Management

Using basic sanitation and cultivation techniques reduces the amount of viable weed seeds, rhizomes and tubers present in a field. Cleaning equipment between fields, cleaning turn rows prior to harvest and harvesting weedier fields after fields with fewer weeds are simple and inexpensive ways to reduce the spread of undesirable vegetation. Row middle weed control is best achieved by either banded spraying or cultivation, depending on your soil type and conservation practices.

DISEASE AND NEMATODE MANAGEMENT

Nematode Sampling and Control

Nematodes cause damage to a cotton crop, especially in conjunction with fungal diseases such as Fusarium. When nematode populations are well controlled, damage from disease is greatly reduced. Soil sampling for plant parasitic nematodes, taken according to techniques set out by your County Extension Agent, is recommended during the fall of the year before the first frost. A sampling rate of about one sample for every 25 or fewer acres can help you identify nematode problems early to make control easier.

Avoid moving soil from one field to the next via farm equipment, implements and vehicles to reduce the likelihood of contaminating "nematode-free" fields. Preventing the movement of nematodes into a field is much easier and less expensive than controlling already-established populations. Rotating cotton to a non-host crop is another nematode management practice. Planting cotton only every third year or in a longer rotation significantly reduces populations of many parasitic nematodes.

Your nematode management program should be based on observations of crop growth, root symptoms and soil samples. Cotton should not be stunted, roots should be free of brown, water-soaked streaking and soil samples should be checked for types of nematodes and *threshold* levels before treating your crop with nematacides.

Timely Crop Development

One of the best ways to protect your cotton from nematodes and disease is to ensure conditions for timely crop development. Begin by planting seeds in optimum conditions for growth. The soil should be neither too dry nor too wet. Raised beds often help the soil warm up more quickly and promote drainage. Prime planting conditions are: moist, but not wet, 4-inch soil temperatures of 65° F for three days, and warm, dry conditions predicted for the next several days. The seedling disease complex proliferates and large-scale seedling loss can occur in cool, moist weather and soil. Check with your Extension agent for local data on the best time to plant a particular variety of cotton in your area.

In-furrow Fungicide Application

The decision of whether to make an in-furrow fungicide application is simplified by using the Seedling Disease Point System. It can be found in the UGA Cooperative Extension bulletin called **Cotton Diseases and their Control.** This point system takes into account field history, soil moisture and temperature, 5-day forecast, planting date, tillage practice, irrigation, nematode populations and rotation crops.

NUTRIENT MANAGEMENT

Importance of Nutrient Management

Nutrient management directly influences the productivity and quality of a cotton crop. For example, excess nitrogen can cause rank growth, which reduces the yield and quality of the cotton produced. It may also provide habitats for undesirable cotton pests. Inadequate or excessive fertilizer applications can cause such problems as phosphorus buildup, rank growth, boll rot and defoliation.

The best IPM practice for cotton is ensuring a fast start, rapid development and early maturity. This can be facilitated through nutrient management. Identifying areas within a crop where certain nutrients are needed more than in other areas can help you tailor your nutrient applications and avoid over- or under-applying.

Nutrient Sampling

Nutrient sampling lets you know if you are applying the appropriate rates and kinds of fertilizers. By understanding the specific needs of your crop, fertilizers can be applied in the most judicious manner possible. In this way, you can achieve the highest economic yield and lowest environmental impact.

The two types of sampling techniques recommended here are petiole/tissue and soil nutrient sampling. Petiole/tissue sampling allows for in-season correction of problems. The recommended weekly sampling can allow detection of excesses or deficiencies of nitrogen, boron, potassium and phosphorus up to two weeks in advance. Tissue sampling indicates magnesium, sulfur, manganese and zinc levels. Both tests are available through the University of Georgia testing programs and through private companies. Contact your Extension agent for the correct techniques and timing of these two sampling methods and for information about the available testing programs.

In addition, soil samples can be taken to test for pH (5.8-6.3 is an ideal range for cotton) and other nutrients. Take these samples during the late summer or fall for accurate evaluation of the soil status. Yearly sampling is highly recommended.

CULTURAL AND SOIL QUALITY MANAGEMENT

Calibration

Improper or lack of *calibration* of insecticide sprayers causes a waste of chemicals and money. Additionally, it may increase economic and/or environmental risk due to inappropriate application rates. Applying either too much or too little of a pesticide can be costly. At a minimum, you should calibrate pesticide sprayers/applicators at the beginning of each season. Regular adjustments are recommended, especially when you switch chemical formulations.

When calibrating, check all nozzles to find worn tips. Generally, output for each nozzle should be within 5-10% of the average output for all of the nozzles. It is important that the appropriate nozzles and strainers are used for individual applications. Clean and replace them in a timely manner.

Check ground speed of the applicator regularly. Speedometers can often be inaccurate, resulting in misapplication of pesticides or fertilizers. Typically, the sprayer ground speed is determined by how long it takes a sprayer, under a load in field conditions, to travel a known distance. A list of Extension documents providing detailed guidelines for proper calibration of sprayers and spreaders can be found in the publication section at the end of this document.

To control damage caused by drip, anti-drip nozzles can be used. Also, take into account spray boom height and weather conditions. Damage from drip can weaken susceptible crops and make them more prone to diseases and inset damage and less resilient in adverse weather.

Cotton Variety Selection

Appropriate seed selection is a vital preventive step you can take to ensure a good cotton stand and maximum productivity. Choosing cotton varieties that are *genetically resistant* to such fungal diseases as *Verticillium* and *Fusarium* and to viral diseases and nematodes is important. Despite the controversy surrounding *genetic resistance* to insects, planting such varieties as Bt cotton has been shown to reduce the amount of insecticides applied. The best way to discover the optimum variety of cotton and the best production practices for your growing area is to find out through local data and experience.

Crop Rotation and Winter Cover Crops

Planting winter cover crops and rotating crops are practices that can affect your cotton crop in many positive ways. Leguminous winter cover crops can enhance soil quality, add nitrogen, decrease soil loss and reduce populations of crop-damaging nematodes. Planting cotton only every three years or in a longer rotation can have many of the same positive benefits, including increasing beneficial organisms, reducing disease and further reducing the number of parasitic nematodes and other insect pest populations.

Benefits may also occur when an alternate crop is planted only every other year. Rotations such as cotton/sorghum/cotton, cotton/small grain/cotton, or cotton/sorghum/small grain have been particularly effective.

Cultural Management

Along with conservation or strip tillage, there are many other cultural management techniques that can improve and preserve soil and protect surface water from the sediment present in the run-off. One of the major long-term benefits of consistently applied conservation tillage is the build up of organic matter that increases soil tilth and fertility. The longer you apply conservation tillage on your farm, the greater the benefits to soil structure and composition.

Practices such as contouring, properly maintaining terraces, filter strips or grass waterways on downslope edges of fields, and planting a fall cover crop are ways to protect soil and water quality. Some of these techniques are not as important if you have land with less than a 2-4% slope, depending on soil type and field conditions.

Soil Compaction

Soil compaction results from repeated trips across a field, not adhering to established traffic lanes for each operation and/or operating machinery in wet fields. This can result in yield reduction. An in-row straight shank subsoiler ("ripper") can be used in the spring to break up compacted layers known as "*hard-pans*" whereas a winged or bent-shank subsoiler ("V-ripper") is more suitable in the fall. Most Coastal Plain cotton fields in Georgia will probably require subsoiling every 1-2 years. To reduce the number of trips across a field, some innovative farmers are subsoiling and planting in the same pass. Field tests with a penetrometer or other suitable hand probe tool can help to determine the necessity of breaking up a hardpan. Deep tillage or in-row subsoiling can be expensive operations. Therefore, the best management practice is to delay the formation of compacted soil layers.

GLOSSARY:

Reducing Environmental Impact and Pest Resistance

Banding: Applying pesticides in narrow bands only to the areas that require treatment (ex. between cotton rows), as opposed to broadcast treatments of an entire field.

Beneficial Organisms: Pollinators and insect, spider, mite, bacterial, fungal and nematode predators or parasites of pests that have a positive impact on the crop in which they are present.

Calibration: A test measurement of the output of pesticide application equipment under typical operating conditions. Calibrations should be done: 1) before using equipment, 2) when you dilute or change the pesticide product, and 3) at regular intervals to check for signs of wear.

Carry-over: The tendency for a herbicide to remain active in the soil.

Crop Rotation: Planting different crops in the same field, instead of growing the same crop year after year in the same field. Crop rotation can improve yields and make it easier to control some pests. If legumes are included in the rotation, nitrogen will be carried over to the next crop.

Cultivar: A particular type or variety of a plant endowed with unique characteristics.

Cut out: Cotton growth stage that usually occurs when fewer than five nodes or mainstem leaves remain above the uppermost white flower at first position.

Economic ("action") threshold: Relates to the cost/benefits of using pesticides or other pest management options. Applying control measures below this level of damage cannot be justified economically. Any damage above this level requires control.

Genetic Resistance: An organism's genetic "make up" that allows it to better withstand the negative effects of diseases, pests, herbivores, parasitism, certain chemicals, etc.

Herbicide Class: Herbicides grouped according to chemical structure and mode of action.

Integrated Pest Management (IPM): A system of managing pest populations that integrates all methods of controlling a pest, including resistant host plants, natural enemies, cultural methods, pesticides, etc.

Pesticide: Any substance or mixture of substances intended for preventing, destroying, repelling or mitigating insects, rodents, nematodes, fungi or weeds.

Pin head square: Cotton growth stage that typically occurs within 35-45 days of planting.

Resistance: A reduction in pesticide effectiveness due to genetic selection that occurs when organisms are repeatedly exposed to one control mechanism or chemical. Using various means of mechanical, chemical and biological control and/or chemicals from different classes can significantly reduce resistance development.

Scouting: Monitoring pest management sites (fields, greenhouses, animals, etc.) for the presence of pest and/or beneficial organisms (pollinators, predators/parasites of pests.)

Threshold: The level of a pest population at which control is necessary to prevent damage greater than the cost of control.

ACTION PLAN:

An action plan is a tool that allows you to take the needed steps to modify the areas of concern as identified by your assessment. The outline provided below is a basic guide for developing an action plan. Feel free to expand your plan if you feel the need for detail or additional areas not included. Consult the list of references at the end of this self assessment tool if additional assistance is needed to develop a detailed action plan.

Area of Concern	Risk Ranking	Planned Action to Address Concern	Time Frame	Estimated Cost

REFERENCES:

CONTACTS AND REFERENCES			
Organization	**Responsibilities**	**Address**	**Phone Number**
Agricultural Pollution Prevention (AgP2)	Questions regarding regulation or pollution prevention practices.	BAE Department University of Georgia Driftmier Engineering Ctr. Athens, GA 30602	706-542-9067
County Extension-UGA	Information about management of crops, pastures and livestock.	Local County Extension Office	Check your local telephone directory blue pages under "County Government" or call 1-800-ASK-UGA1.
National Resource Conservation Service (NRCS)	Information on how to conserve, improve and sustain natural resources and the environment.	Local county or multi-county Field Office	Local - check your local telephone directory blue pages under "U.S. Government."
State Soil and Water Conservation Commission	Information on agricultural best management practices.	P.O. Box 8024 Athens, GA 30603	706-542-3065
Chemtrec	Technical assistance for fires, spills or pesticide-related medical emergencies.	1300 Wilson Blvd. Arlington, VA 22209	800-424-9300 Available 24 hours
University of Georgia IPM Program	IPM references.	University of Georgia 413 BioSciences Athens, GA 30602	706-542-9035
National Pesticide Telecommunication Network	General pesticide information answered. Hours: 9:30 am-7:30 am EST.	NPTN Ag. Chemical Extension Oregon State University 333 Weniger St. Corvallis, OR 97331	800-858-7358

PUBLICATIONS:

University of Georgia Cooperative Extension
Athens, Georgia 30602

- Calibration Method for Sprayers and Other Liquid Applicators, Circular 683
- Calibration of Manure Spreaders, Circular 825
- Cotton Growth and Development, Bulletin 1252
- Georgia Pest Management Handbook, Special Bulletin 28

The following publications can be purchased from the University of Georgia:

- Agricultural Plant Pest Control
- Apply Pesticides Correctly (General Standards)

College of Agriculture, Business Office
Conner Hall, Room 203
The University of Georgia
Athens, Georgia 30602
706-542-8999

Georgia Soil and Water Conservation Commission
P.O. Box 8024, Athens, GA 30603

- Best Management Practices for Georgia Agriculture

Texas Cooperative Extension
P.O. Box 1209, Bryan, TX 77806-1209

- Field Guide to Predators, Parasites and Pathogens Attacking Insect and Mite Pests of Cotton: Recognizing the Good Bugs in Cotton, B-6046

Web Sites

http://wiki.bugwood.org/Archive:SEIPM
http://nrcs.usda.gov
http://agp2.org
http://www.gaswcc.org/docs/ag_bmp_Manual.pdf
http://www.caes.uga.edu/publications

The Georgia Farm Assessment System is a cooperative project of the Pollution Prevention Assistance Division, Georgia Department of Natural Resources, the University of Georgia, College of Agricultural and Environmental Sciences, Cooperative Extension Service, the State Soil and Water Conservation Commission and the USDA, Natural Resources Conservation Service.

This bulletin is a revision of "Cotton IPM" developed by Paul Guillebeau and Gretchen Van De Mark.

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