Scouting Protocol for Arthropod Pests of Cotton in the MidSouth

Scouting Protocol for Arthropod Pests of Cotton in the Midsouth

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Introduction

Scouting provides up-to-date information on which to make management decisions. It requires the systematic collection of data on arthropod pests and beneficial species in and near the cotton field, observations on plant growth and development, and an assessment of pest damage to the crop. The type and amount of information required for sound decision-making changes during the season because the pest species associated with cotton change with crop development. Not only does the pest complex change as the crop matures, but the location and abundance of individual species on the plant and in the field change.

There is no way of knowing exactly which pest species will be encountered in a particular field prior to sampling, where they will be located, or what their abundance will be. The job of the scout is to obtain this kind of information. Because cotton grows in a predictable manner (Elsner et al. 1979, Mauney and Stewart 1986), the scout should know the stage of the crop prior to going to the field. This knowledge provides an excellent foundation for organizing the scouting protocol.

A scout must possess certain skills in order to obtain the proper information at the appropriate time. He must be able to identify the arthropod species associated with cotton, recognize the type(s) of damage caused by the different pest species, and know when and when not to look for each species. The protocol assists in these tasks. It presents a **unified** plan for sampling all **principal** pest species that could be encountered at a given time. To accomplish this task, we divide the season into nine distinct periods, eight of which are associated with phenological events of cotton that have significance to pest population dynamics and management. The eight plant growth stages (PGS's) are listed in Table 1.

Table 1. Common and occasional arthropod pests of cotton by plant growth stage.

PLANT GROWTH STAGE	COMMON PESTS	OCCASIONAL PESTS
Preplant (PGS0)	none	none
Planting to emergence (PGS1)	none	none
Emergence to third true leaf (PGS2)	thrips, cutworms	aphids, spider mites, whiteflies, plant bugs, boll weevils
Third true leaf to pinhead square (PGS3)	none	aphids, whiteflies, spider mites, plant bugs, boll weevils, thrips, cutworms
Pinhead square to Pinhead square plus 7 days (PGS4)	boll weevils, bollworm/budworms, plant bugs	aphids, whiteflies, spider mites
Pinhead square plus 7 to first bloom (PGS5)	boll weevils, bollworm/budworms, plant bugs, aphids	whiteflies, spider mites, western flower thrips
Bloom to cutout (PGS6)	boll weevils, bollworm/budworms, aphids	plant bugs, beet and fall armyworms, western flower thrips, whiteflies, loopers, spider mites
Cutout to defoliation (PGS7)	boll weevils, bollworm/budworms, aphids	plant bugs, beet and fall armyworms, western flower thrips, whiteflies, loopers, spider mites
Defoliation to harvest (PGS8)	none	none

The primary and secondary pest species associated with each PGS are summarized in Table 1. These species are only *potential* pests; not all species will be found in a field at a particular time. At times, secondary pests will be more abundant than the primary pests. Other problems may develop on rare occasions that involve atypical species not listed in the protocol. If these species are encountered, they also must be identified and reported. Remember, the agroecosystem is very complex and dynamic, and unexpected events will occur. For these reasons, a scout must examine the crop carefully, reporting observations in a useful and unbiased manner. This process includes recording the absence of potential pests because this information is also important to decision-making. Data forms have been developed to assist in these tasks (provided starting on page 6).

Adherence to the protocol should provide quality data for decision-making; however, the application of this information alone will not guarantee that quality decisions are made. Sound decision-making involves the integration and analysis of information from sources other than just the scout. In recognition that scouting (data collection) is a necessary step to sound decision-making, we have designed and integrated this protocol with a computerized decision-aid for cotton pest management. This system is called WHIMS (Holistic Insect Management System). WHIMS integrates the knowledge and experience of multiple experts with supplemental information to analyze the data provided by the scout. It evaluates the simultaneous impact of multiple pest species on the crop, making pest management recommendations for 10 species over the entire growing season. WHIMS is a component of the computerbased cotton management system, GOSSYM/COMAX. This specific application of the scouting protocol does not exclude its use by extension entomologists or consultants who wish to make recommendations independent of WHIMS. In this case, the scouting data obtained from the protocol has to be standardized for decision-making. Appendix I provides appropriate examples.

Management Unit

No sampling protocol is complete without a discussion of the management unit. A management unit (MU) is a specified area of land on which decisions are made and actions taken. The actions taken on this unit are carried out uniformly over the entire area and include such activities as planting, cultivating, fertilizing, irrigating, spraying, and scouting. In agriculture, it is customary, but not necessarily correct, to think of a "field" as an MU. At times it is appropriate to subdivide a field into several units or consolidate several fields into one MU. The apportion-

ment of a farm into MU's is the primary responsibility of the farm manager, but others may influence this decision. This task has important implications to farm operations, including scouting and pest control.

The size, shape, and location of MU's are important because these characteristics influence the ability to implement decisions and take actions in a cost effective manner. Defining MU's on a farm depends on the land-use patterns over the farm and the specific management objectives for each land area. For example, the primary objective of cotton production is to promote the uniform growth and development of the crop in a manner that maximizes yields and minimizes production inputs (and thus costs). In this context, the crop MU should be easily accessed and worked, and have uniform soil type(s) and topography. The farm activities carried out on this unit (e.g., cultivation, fertilization, irrigation, etc.) will further promote uniform plant growth and development.

There are other secondary objectives of crop management that may place different constraints on the size and shape of the MU. Arthropod pest management is an excellent example, with its primary objective to maintain pest populations below damaging levels in a cost effective and environmentally sound manner. To minimize the potential impact of arthropod pests on the crop, pest population densities must be maintained at low levels (e.g., below thresholds). To accomplish this task, the spatial and temporal patterns of pest population dynamics must be understood.

Arthropod populations are generally clumped within a field. That is, patches of higher densities are scattered within a field that otherwise may have few individuals in it. If the population grows, there is an increase in density throughout the field, but the rate of population growth is greatest in areas of higher densities. As these patches of higher density enlarge, often rapidly in time, they encroach on more land area until the total population takes on a more uniform spatial pattern over the entire field. This situation is threatening to crop production and should be avoided, or at least monitored very closely.

Given that pest population densities can change dramatically in time and space, the challenge of pest management is to hold populations in check while preserving natural control agents and crop yields. Sound management attempts to maximize the benefits of natural control agents without assuming undue risks of pest outbreaks. Natural control agents can be a formidable and cost effective means of maintaining populations at low levels, but patience and restraint of direct control usage must be exhibited for them to work effectively. In general, direct control should be used only as a last resort, authorized when potential production losses incurred through no con-

trol outweigh the costs of control. Once direct control has been applied, the likelihood of its recurrent use will increase because of disruption to the ecosystem. A good scouting protocol should provide the proper information, at an appropriate level of detail, to keep the farm manager well informed of the status of the cropping system through time. With this knowledge, the manager can weigh the risks of pest losses and assess when direct control is needed. Greater restraint from action should result.

Pest populations that reach high densities have already inflicted losses on the crop. They are more difficult and costly to control, and direct control results in a negative impact on beneficial species that often increases the need for further intervention. Scouting provides a means to identify changes in pest populations, but areas of relatively high pest abundance must be located in the field prior to their enlargement. The key to accomplishing this task involves the number and placement of samples taken per unit area — the sampling intensity. Applying the same scouting protocol in a small field (e.g., 20 acres) will not provide the same quality of information obtained from a large field (e.g., 200 acres). Either the protocol must change as the size of the pest MU changes, or the MU must be relatively fixed. We prefer the latter choice, recommending pest MU's of 100 acres or smaller for use with this protocol. Small MU's are desirable from the standpoint of pest detection, suppression, and control.

Several changes will be required before these ideas become accepted by agribusiness. Producers must be willing to pay consultants more per acre to encourage more intensive scouting. More intensive scouting will provide better knowledge about the status of the crop and pests, which should lead to enhanced decision-making, reduced pesticide usage, and lower production costs. Consultants who offer an integrated package aimed at total crop management should be able to charge more for their services. Computer-aided management tools, such as GOSSYM/COM-AX/WHIMS, can assist in this task. Applicators must be willing to treat smaller more confined areas of fields, a practice which should be encouraged by increased pesticide costs, additional regulations placed on usage, and decreased product availability through failure to recertify. Until these changes become accepted, we recognize that small pest MU's may be impractical from the standpoint of time, labor, and the cost of sampling.

Resolution of this conflict is not easy, but historical information on pest population patterns within fields may assist in designating sensible pest MU's. Some pest species are more common in certain fields or parts of fields year after year. Once these "hot spots" are identified, they should be scouted first and with the greatest intensity. If no insects are found in these areas, only superficial examination of the rest of the unit may be necessary. Identification of "hot spots" provides an opportunity to evaluate the problem early, re-evaluate the problem before the next scheduled sampling date, or if needed, treat the isolated area(s) before the population enlarges. If a spray is applied only on this confined area, it will conserve money, beneficial species, and the environment compared to spraying the entire field. Remember, however, agroecosystems are very dynamic. Common sense should always be used in evaluating their status.

Scouting Protocol

The remaining sections describe the scouting protocol in detail. The foundation to the sampling procedures is based on the work of Willers et al. (1990). The arrangement of the protocol, by plant growth stage (PGS), should simplify its use in the field by scouts or its use as a training manual. A summary of the protocol is provided in Table 2.

References Cited

Elsner, J.E., C.W. Smith, and D.F. Owen. 1979. Uniform stage descriptions in upland cotton. Crop Sci. 19: 361-363.

Mauney, J.R., and J.M. Stewart (eds.). 1986. Cotton Physiology. Cotton Foundation Ref. Book Series No. 1. Cotton Foundation Publ., Memphis, TN. 786 pp.

Willers, J.L., D.L. Boykin, J.M. Hardin, T.L. Wagner, R.L. Olson, and M.R. Williams. 1990. A simulation study on the relationship between the abundance and spatial distribution of insects and selected sampling schemes, pp. 33-45. In Milliken, G.A. and J.R. Schwenke (eds.), Proc. Applied Statistics in Agriculture, Kansas State Univ., Manhattan.

Table 2. General sampling protocol by plant growth stage.

PLANT GROWTH STAGE	GENERAL SAMPLING PROTOCOL
Preplant (PGS0)	Check pheromone traps and use sweepnet to monitor insects adjacent to fields.
Planting to emergence (PGS1)	Check pheromone traps and use sweepnet to monitor insects adjacent to fields.
Emergence to third true leaf (PGS2)	Examine 5-10 plants in a section of row in each of 7-10 random locations in the pest management unit (MU). When cotton has two true leaves, sweep 25 times along 4 sections of row. Sweep weed species adjacent to fields.
Third true leaf to pinhead square (PGS3)	Examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations in the MU. Sweep 25 times along 4 sections of row. Sweep weed species adjacent to fields.
Pinhead square to pinhead square plus 7 days (PGS4)	Examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations in the MU. Sweep 25 times along 4 sections of row.
Pinhead square plus 7 days to first bloom (PGS5)	Examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations in the MU. Examine 5-10 green squares from the selected plants at each stop. Sweep 25 times along 4 sections of row.
Bloom to cutout (PGS6)	Examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations in the MU. Examine 5-10 green squares and 5-10 green bolls from the selected plants at each stop.
Cutout to defoliation (PGS7)	Examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations in the MU. Examine 5-10 green squares and 5-10 green bolls from the selected plants at each stop.

PREPLANT
(Figure 1, Trapping Form PGS0-3)

General Information. The period lasts about 30 days prior to planting. Insects are only potential pests at this time.

General Sampling Protocol. Use pheromone traps and a sweepnet to monitor insects.

Bollworm and Budworm Moths. Place pheromone traps at the edges of cotton fields as early as 30 days prior to planting (Appendix II). Distribute available traps accordingly:

(1) minimum of one trap/species/crop management unit, or

(2) adjacent to known problem areas.

Count and record the number of moths/trap every 5-7 days. If traps are unavailable, obtain counts from nearest source (e.g., local county agent).

Bollworm and Budworm larvae, Plant Bugs, Thrips, Aphids, Spider Mites, and Beneficials. Use a sweepnet to monitor weed species adjacent to cotton fields for plant bugs, aphids, and beneficials.

Make about 25 sweeps in one or more locations using a 15-inch net. Examine several plants (preferably legumes) for presence of bollworm and budworm larvae, thrips, and mites. Note the locations of insect "hot spots."

Classify plant bug and beneficial populations as:
Light — less than 10 insects/100 sweeps,
Medium — 10-20 insects/100 sweeps,
Heavy — more than 20 insects/100 sweeps.

Classify aphid populations as:
Light — less than 10 aphids/25 sweeps,
Medium — 10-50 aphids/25 sweeps,
Heavy — more than 50 aphids/25 sweeps.

Classify bollworm/budworm larval populations as:
Light — less than 3 larvae/5 plants,
Medium — 3-5 larvae/5 plants,
Heavy — more than 5 larvae/5 plants.

Classify thrips and mite populations as:
Light — less than 20 thrips or mites/plant,
Medium — 20-40 thrips or mites/plant,
Heavy — more than 40 thrips or mites/plant.

PGS 0

Figure 1. Preplant (PGS 0).

Trapping Form PGS0-3
(Planting to Pinhead Square)

Farm Name: _____   Field: _____   Date: _____

TRAPS

	Baited	1	2	3	4	5	6	7	8	9	10	11	Total
Bollworms													
Budworms													
Boll Weevils													

County Bollworm Avg. _____   Budworm Avg. _____   Boll Weevil Avg. _____

WEED CHECKS
(Levels of pests present in field edges)

	Aphids/ 25 sweeps		Mites/ Plants		Thrips/ Plant		Plant Bugs/ 100 sweeps		Bollworms/ 5 Plants		Beneficials/ 100 sweeps		
None	0		0		0		0		0		0		
Light	1-9		1-19		1-19		1-9		1-2		1-9		
Medium	10 - 50		20 - 40		20 - 40		10 - 20		3 - 5		10 - 20		
Heavy	> 50		> 40		> 40		> 20		> 5		> 20		

COMMENTS

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Scout: _____

PLANTING TO CROP EMERGENCE
(Figure 2, Trapping Form PGS0-3)

General Information. This period lasts about 8 days. Insects are only potential pests at this time. If crop emergence takes longer than 8 days, the crop may receive physiological and pathological injury. Plants of low vigor will have reduced growth and development, be exposed to pests longer, and may be at greater risk of attack.

General Sampling Protocol. Use pheromone traps and a sweepnet to monitor insects. Record the planting date.

Bollworm and Budworm Moths. Continue to check pheromone traps every 5-7 days.

Boll Weevils. Place pheromone traps at field edges, at or slightly before planting (Appendix II). Distribute available traps accordingly:
    (1) minimum of one trap/crop management unit, to a maximum of one trap/20 acres,
    (2) one trap/field in fields less than 20 acres, or
    (3) adjacent to known problem areas.
Count and record the number of weevils/trap every 5-7 days.

Bollworm and Budworm Larvae, Plant Bugs, Thrips, Aphids, Spider Mites, Beneficials. Use a sweepnet to monitor weed species adjacent to cotton fields for plant bugs, aphids, and beneficials. Make about 25 sweeps in one or more locations using a 15-inch net. Examine several plants (preferably legumes) for presence of bollworm and budworm larvae, thrips, and mites. Note the locations of insect "hot spots."
Classify plant bug and beneficial populations as:
    Light − less than 10 insects/100 sweeps,
    Medium − 10-20 insects/100 sweeps,
    Heavy − more than 20 insects/100 sweeps.
Classify aphid populations as:
    Light − less than 10 aphids/25 sweeps,
    Medium − 10-50 aphids/25 sweeps,
    Heavy − more than 50 aphids/25 sweeps.
Classify bollworm/budworm larval populations as:
    Light − less than 3 larvae/5 plants,
    Medium − 3-5 larvae/5 plants,
    Heavy − more than 5 larvae/5 plants.
Classify thrips and mite populations as:
    Light − less than 20 thrips or mites/plant,
    Medium − 20-40 thrips or mites/plant,
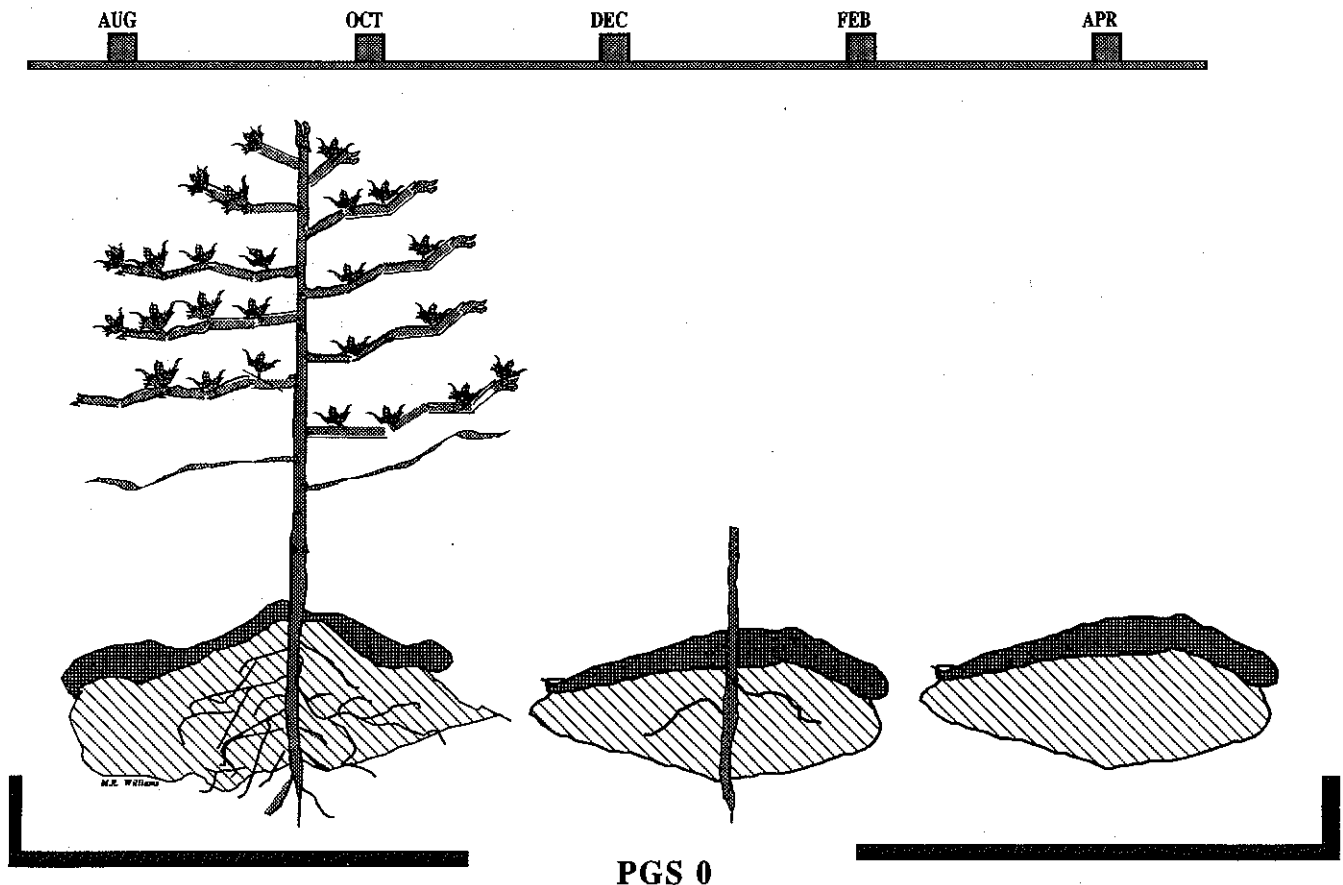   Heavy − more than 40 thrips or mites/plant.

PGS 1

Figure 2. Planting to crop emergence (PGS 1).

Trapping Form PGS0-3
(Planting to Pinhead Square)

Farm Name: _____   Field: _____   Date: _____

TRAPS

	Baited	1	2	3	4	5	6	7	8	9	10	11	Total
Bollworms													
Budworms													
Boll Weevils													

County Bollworm Avg. _____   Budworm Avg. _____   Boll Weevil Avg. _____

WEED CHECKS
(Levels of pests present in field edges)

	Aphids/ 25 sweeps		Mites/ Plants		Thrips/ Plant		Plant Bugs/ 100 sweeps		Bollworms/ 5 Plants		Beneficials/ 100 sweeps		
None	0		0		0		0		0		0		
Light	< 10		< 20		< 20		< 10		< 3		<10		
Medium	10 - 50		20 - 40		20 - 40		10 - 20		3 - 5		10 - 20		
Heavy	> 50		> 40		> 40		> 20		> 5		> 20		

COMMENTS

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Scout: _____

EMERGENCE TO THIRD TRUE LEAF
(Figure 3, Trapping Form PGS0-3, Form PGS2)

General Information. This growth stage lasts about 21 days. Prominent pests (-) are thrips and cutworms. Occasional pests are boll weevils, bollworms, budworms, aphids, spider mites, whiteflies, and plant bugs.

General Sampling Protocol. Record the crop emergence date. Select and examine 5-10 seedling plants in a section of row in each of 7-10 random stops throughout the management unit. Count and record the number of plants selected for insect sampling at each stop. When cotton has at least two true leaves, sweep 25 times along 4 different sections of row using a 15-inch net. Continue to check pheromone traps and sweep weed species adjacent to cotton fields.

*Early Season Thrips (Tobacco Thrips and associated species). Dislodge thrips by gently beating plants over a white paper, cloth, or cigar box. Count and record the number of adult and immature (pale green) thrips and the number of plants sampled at each stop.

Aphids, Spider Mites, Whiteflies. In a section of row adjacent to each sample location, examine the underside of leaves and terminal shoot on 5-10 plants. Count and record the number of plants infested with each species. Classify aphid and whitefly populations as:
Light − less than 2 aphids or whiteflies/plant,
Medium − 2-10 aphids or whiteflies/plant,
Heavy − more than 10 aphids or whiteflies/plant.
Classify mite populations as:
Light − less than 5 mites/plant,
Medium − 5-20 mites/plant,
Heavy − more than 20 mites/plant.

Plant Bugs (Tarnished Plant Bugs, Cotton Fleahoppers). While sampling aphids, count and record the total number of plants with terminal damage at each stop (plant bug flagging: terminal leaf dead or dying with petiole intact). After plants have two true leaves, estimate and record the number of bugs using one of the following methods:
1. Sweep 25 times with a 15-inch net in 4 random locations/management unit (preferred method).

2. Use a 3-foot drop cloth in at least 4 locations/management unit. Shake plants over the cloth and count the dislodged bugs. Care should be taken not to disturb bugs prior to shaking the plants. Nymphs are more easily counted by this method. Adults tend to fly off quickly and may not be seen on the drop cloth.

Beneficials. After two true leaves, count and record all beneficials in the sweepnet or drop cloth while sampling for plant bugs.

Boll Weevils. Continue to check pheromone traps every 5-7 days. If trap captures are high (above 20/trap), weevil damage should be anticipated (boll weevil flagging: terminal leaf dead or dying with petiole cut). While sampling for aphids, examine seedling terminals. Count and record the number of flags and live weevils.

*Cutworms (Black, Variegated, Granulate, Army, Pale-Sided). While moving from one sample location to the next, stay alert for areas containing seedlings that have been cut off at the stem. Pay particular attention to low, wet areas or areas that have had a cover crop. Delineate the infested areas, and make stand counts of damaged plants in 3-5 places (depending on area's size) on at least 25 feet of row. Record the number of damaged plants. Dig for cutworms within the areas, recording the number of larvae and number of row feet inspected. Cutworm larvae can usually be located underneath clods or trash within or near areas containing damage.

Bollworm and Budworm Moths. Continue to check pheromone traps every 5-7 days.

Plant Bugs, Thrips, Aphids, Spider Mites, Beneficials. Continue to sweep weed species adjacent to cotton fields. Classify abundance according to description in PGS1. If weeds have a high number of cotton pests, the pests probably will move into cotton when the alternate hosts decline. Alternate hosts generally begin to dieback at this time.

9
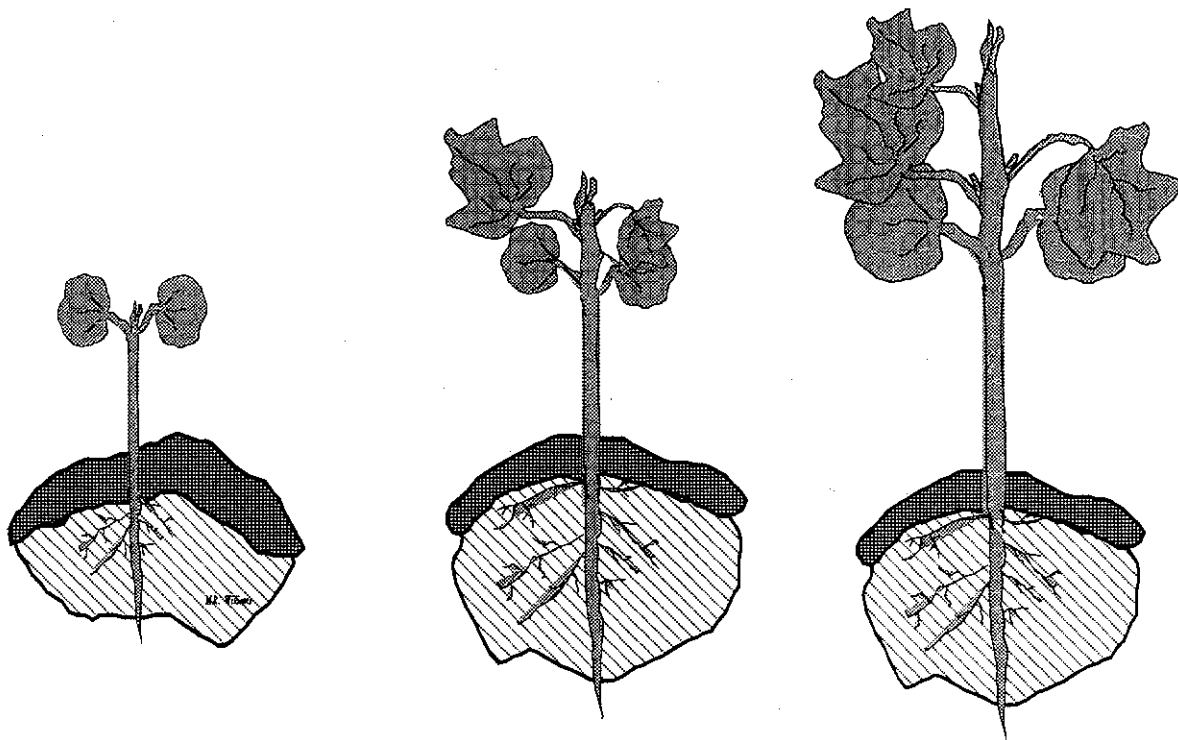
PGS 2

Figure 3. Emergence to third true leaf (PGS 2).

Trapping Form PGS0-3
(Planting to Pinhead Square)

Farm Name: _____ Field: _____ Date: _____

TRAPS

	Baited	1	2	3	4	5	6	7	8	9	10	11	Total
Bollworms													
Budworms													
Boll Weevils													

County Bollworm Avg. _____ Budworm Avg. _____ Boll Weevil Avg. _____

WEED CHECKS
(Levels of pests present in field edges)

	Aphids/ 25 sweeps		Mites/ Plants		Thrips/ Plant		Plant Bugs/ 100 sweeps		Bollworms/ 5 Plants		Beneficials/ 100 sweeps		
None	0		0		0		0		0		0		
Light	< 10		< 20		< 20		< 10		< 3		< 10		
Medium	10 - 50		20 - 40		20 - 40		10 - 20		3 - 5		10 - 20		
Heavy	> 50		> 40		> 40		> 20		> 5		> 20		

COMMENTS

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_____

Scout: _____

Form PGS2
(Emergence to 3rd True Leaf)

Farm Name:_____ Field:_____ MU:_____ Date:_____

Emergence Date: _____

STOP		1	2	3	4	5	6	7	8	9	10	Total
# Plants Checked												
# Swps or row feet sampled												
Boll Weevils	# Plants w/ Flags											
	# Adults on Plants											
Plant Bugs	# Plants w/Flags											
	In Swps or drp clth											
Aphids	# Infested Plants											
	Inf Level (L/M/H)											
White flies	Infested Plants											
	Inf Level (L/M/H)											
Mites	# Infested Plants											
	Inf Level (L/M/H)											
# Beneficials												
Cutworm	# Cut Plants											
	# Worms											
	Row Feet Counted											
Thrips	# Plants Checked											
	# Adults											
	# Immatures											

Comments

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_____

Scout: _____

12

THIRD TRUE LEAF TO PINHEAD SQUARE
(Figure 4, Trapping Form PGS0-3, Form PGS3)

General Information. This plant growth stage lasts about 14 days. Typically, arthropod pests are not a problem. The crop is usually growing vigorously but has not started to square. Occasional pests are plant bugs, boll weevils, aphids, spider mites, bollworms, and budworms. If thrips, cutworms, or other pests were heavy during the previous stage (PGS2) and the cotton is stunted, counts for these insects may be needed in this stage.

General Sampling Protocol. Select and examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations throughout the management unit. Count and record (1) the total number of plants in four, 40-inch sections of row to obtain the plant population, (2) the number of plants selected for insect sampling, and on these plants only, (3) the average number of nodes. Sweep 25 times along 4 different sections of row using a 15-inch net. Continue to check pheromone traps and sweep weed species adjacent to cotton field.

Aphids, Spider Mites, Whiteflies. Examine the underside of leaves and the terminal shoot of the selected plants. Count and record the number of plants infested with each species.
Classify aphid and whitefly populations as:
  Light – less than 5 aphids or whiteflies/plant,
  Medium – 5-15 aphids or whiteflies/plant,
  Heavy – more than 15 aphids or whiteflies/plant.
Classify mite populations as:
  Light – less than 10 mites/plant,
  Medium – 10-30 mites/plant,
  Heavy – more than 30 mites/plant.

Plant Bugs (Tarnished Plant Bugs, Cotton Fleahoppers). Count and record the number of plants with terminal damage at each stop (plant bug flagging: terminal leaf dead or dying with petiole intact). Estimate and record the number of bugs using one of the following methods:
  1. Sweep 25 times with a 15-inch net in 4 random locations/management unit (preferred method).
  2. Use a 3-foot drop cloth in at least 4 locations/management unit. Shake plants over the cloth and count the dislodged bugs. Care should be taken not to disturb bugs prior to shaking the plants. Nymphs are more easily counted by this method. Adults tend to fly off quickly and may not be seen on the drop cloth.

Beneficials. Count and record all beneficials in the sweepnet or drop cloth while sampling for plant bugs.

Boll Weevils. Continue to check pheromone traps every 5-7 days. Count and record the number of plants with terminal damage at each stop (boll weevil flagging: terminal leaf dead or dying with petiole cut). Count and record the number of live weevils captured in sweep nets while sampling for plant bugs. Concentrate sampling in known boll weevil hot spots if possible.

Bollworm and Budworm Eggs, Larvae, Moths. Examine the terminals in the top of the selected plants. Count and record the number of plants infested with eggs and larvae, and the number of damaged terminals containing no larvae. Continue to check pheromone traps every 5-7 days.

Cutworms (Black, Variegated, Granulate, Army, Pale-Sided). While moving from one sample location to the next, stay alert for areas containing seedlings that have been cut off at the stem. Pay particular attention to low, wet areas or areas that have had a cover crop or heavy weed infestation. Delineate the infested areas, and make stand counts of damaged plants in 3-5 places (depending on area's size) on at least 25 feet of row. Record the number of damaged plants. Dig for cutworms within the areas, recording the number of larvae and number of row feet inspected. Cutworm larvae can usually be located underneath clods or trash within or near areas containing damage.

Early Season Thrips (Tobacco Thrips and associated species). The time for injury from thrips should be passed, but if the cotton remains stunted and is not growing vigorously, thrips counts should be continued. Dislodge thrips by gently beating plants over a white paper, cloth, or cigar box. Count and record the number of adult and immature (pale green) thrips and the number of plants sampled at each stop.

Plant Bugs, Thrips, Aphids, Spider Mites, Beneficials. Continue to sweep weed species adjacent to cotton fields. Classify abundance according to description in PGS1. If weeds have a high number of cotton pests, the pests probably will move into cotton.
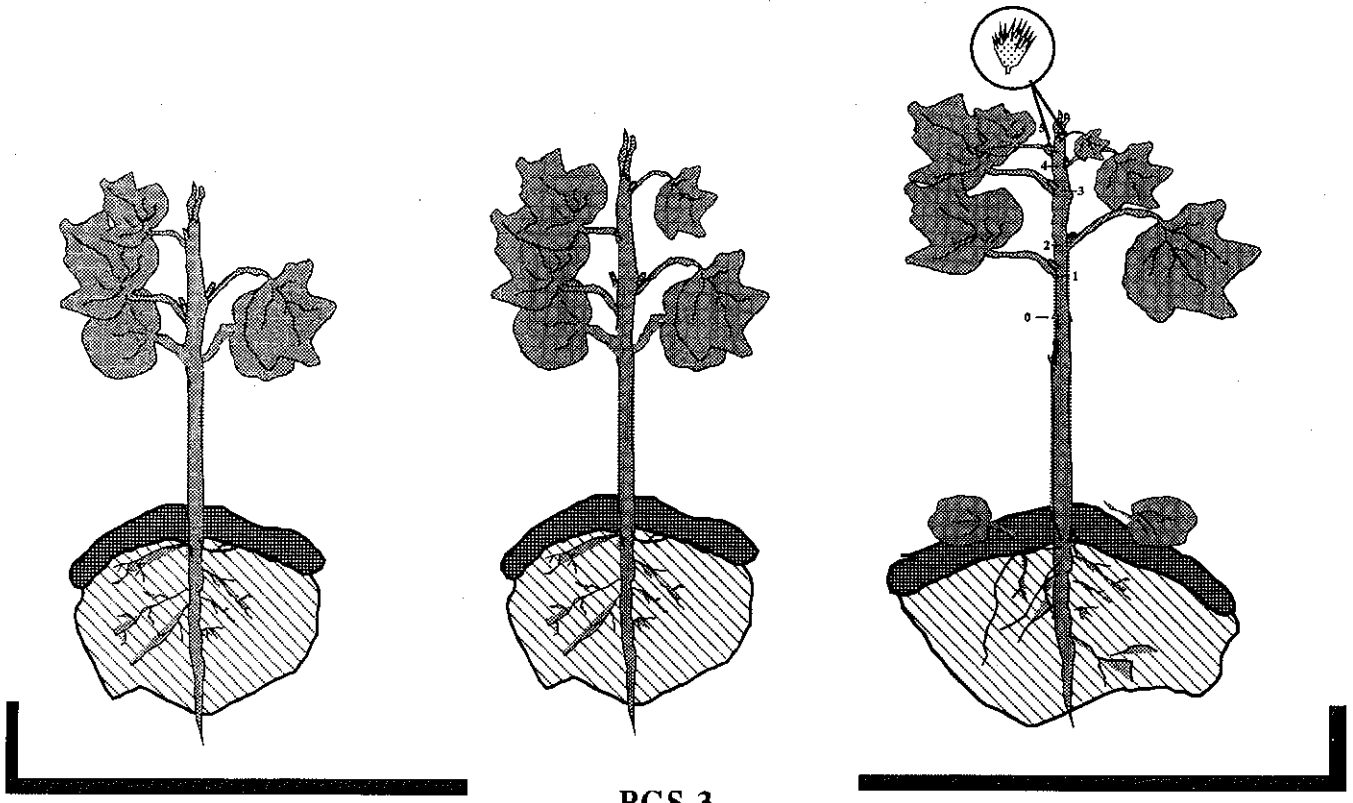
PGS 3

Figure 4. Third true leaf to pinhead square (PGS 3).

Trapping Form PGS0-3
(Planting to Pinhead Square)

Farm Name: _____ Field: _____ Date: _____

TRAPS

	Baited	1	2	3	4	5	6	7	8	9	10	11	Total
Bollworms													
Budworms													
Boll Weevils													

County Bollworm Avg. _____ Budworm Avg. _____ Boll Weevil Avg. _____

WEED CHECKS
(Levels of pests present in field edges)

	Aphids/ 25 sweeps		Mites/ Plants		Thrips/ Plant		Plant Bugs/ 100 sweeps		Bollworms/ 5 Plants		Beneficials/ 100 sweeps		
None	0		0		0		0		0		0		
Light	< 10		< 20		< 20		< 10		< 3		<10		
Medium	10 - 50		20 - 40		20 - 40		10 - 20		3 - 5		10 - 20		
Heavy	> 50		> 40		> 40		> 20		> 5		> 20		

COMMENTS

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Scout: _____

Form PGS3
(Third True Leaf to Pinhead Square)

Farm Name:_____ Field:_____ MU:_____ Date:_____

Location	1	2	3	4	Total/160 in			# Days to PHS
# Plants in four 40-in sections								Plants/stunted? Y/N

STOP		1	2	3	4	5	6	7	8	9	10	Total
# Plants Checked												
# Swps or row feet sampled												
Average # of Nodes/Plant												
Boll Weevils	# Plants w/ Flags											
	# Adults in Sweeps											
Boll/ Budworm	# Plants w/Eggs											
	# Terminals w/Larvae											
	Dmgd Trms w/out Larvae											
Plant Bugs	# Plants w/Flags											
	In Swps/drp clth/visual											
Aphids	# Infested Plants											
	Inf Level (L/M/H)											
White flies	# Infested Plants											
	Inf Level (L/M/H)											
Mites	# Infested Plants											
	Inf Level (L/M/H)											
# Beneficials												
Cutworm	# Cut Plants											
	# Worms											
	Row Feet Counted											
Thrips	# Plants Checked											
	# Adults											
	# Immatures											

Comments

_____

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Scout: _____

PINHEAD SQUARE TO PINHEAD SQUARE PLUS 7 DAYS
(Figure 5, Trapping Form PGS4-8, Form PGS4)

General Information. This growth stage lasts 7 days. Prominent pests (*) are plant bugs, bollworm and budworm, and boll weevils. Occasional pests are aphids, whiteflies, and spider mites.

General Sampling Protocol. Select and examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations throughout the management unit. Count and record (1) the total number of plants in four, 40-inch sections of row to obtain the plant population, (2) the number of plants selected for insect sampling, and on these plants only, (3) the average number of nodes. Sweep 25 times along 4 different sections of row using a 15-inch net and continue to check pheromone traps.

*Plant Bugs (Tarnished Plant Bugs, Cotton Fleahoppers, Clouded Plant Bugs, Stink Bugs). Count and record the number of squares and total number of fruiting sites in the top 5 nodes of 3-5 plants/stop (no less than 25 plants/management unit). Estimate and record the number of bugs using one of the following methods:
1. Sweep 25 times with a 15-inch net in 4 random locations/management unit (preferred method).
2. Use a 3-foot drop cloth in at least 4 locations/management unit. Shake plants over the cloth and count the dislodged bugs. Care should be taken not to disturb bugs prior to shaking the plants. Nymphs are more easily counted by this method. Adults tend to fly off quickly and may not be seen on the drop cloth.

Beneficials. Count and record all beneficials in the sweepnet or drop cloth while sampling for plant bugs.

*Bollworm and Budworm Eggs, Larvae, Moths. Examine terminals in the top of the selected plants. Count and record the number of plants infested with eggs and larvae, and the number of damaged terminals containing no larvae. Continue to check pheromone traps every 5-7 days.

*Boll Weevils. Continue to check pheromone traps every 5-7 days. Count and record the number of plants with terminal damage at each stop (boll weevil flagging: terminal leaf dead or dying with petiole cut). Count and record the number of live weevils captured in sweep nets while sampling for plant bugs. Concentrate sampling in known boll weevil hot spots if possible.

Aphids, Whiteflies. Examine the underside of leaves in the top, middle, and bottom of the selected plants. Count and record the number of plants infested with each species.
Classify populations as:
  Light — less than 10 aphids or whiteflies/plant,
  Medium — 10-100 aphids or whiteflies/plant,
  Heavy — greater than 100 aphids or whiteflies/plant.
Characterize honeydew production as:
  Light — sticky lower leaves,
  Medium — sticky lower and middle leaves,
  Heavy — entire plant sticky.

Spider Mites. Examine the first fully expanded leaf off the terminal for mites. Count and record the number of infested plants and classify populations as:
  Light — less than 10 mites/leaf,
  Medium — 10-100 mites/leaf,
  Heavy — greater than 100 mites/leaf.

PGS 4

Figure 5. Pinhead square to pinhead square plus 7 days (PGS 4).

Trapping Form PGS4-8
(Pinhead Square plus 7 Days to Harvest)

Farm Name: _____   Field: _____   Date: _____

TRAPS

	Baited	1	2	3	4	5	6	7	8	9	10	11	Total
Bollworms													
Budworms													
Boll Weevils													

County Bollworm Avg. _____   Budworm Avg. _____   Boll Weevil Avg. _____

COMMENTS

_____

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_____

Scout: _____

19

Form PGS4

(Pinhead Square to Pinhead Square plus 7 Days)

Farm Name:_____ Field:_____ MU:_____ Date:_____

Location			1	2	3	4	Total/160 in
# Plants in four 40-in sections							

STOP		1	2	3	4	5	6	7	8	9	10	Total
# Plants Checked												
# Swps or row feet sampled												
Average # of Nodes/Plant												
Boll Weevils	# Plants w/ Flags											
	# Adults in Sweeps											
Boll/ Budworm	# Plants w/Eggs											
	# Terminals w/Larvae											
	Dmgd Trms w/out Larvae											
Plant Bugs	In Swps/drp clth/visual											
	# Squares/top 5 nodes											
	# Sites/top 5 nodes											
Aphids	# Infested Plants											
	Inf Level (L/M/H)											
	Honeydew (N/L/M/H)											
White flies	# Infested Plants											
	Inf Level (L/M/H)											
Mites	# Infested Plants											
	Inf Level (L/M/H)											
# Beneficials												

Comments

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Scout: _____

PINHEAD SQUARE PLUS 7 DAYS TO FIRST BLOOM
(Figure 6, Trapping Form PGS4-8, Form PGS5)

General Information. This growth stage lasts about 15 days. Prominent pests (*) are plant bugs, bollworms, budworm, boll weevils, and aphids. Occasional pests are whiteflies, spider mites, and western flower thrips.

General Sampling Protocol. Select and examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations throughout the management unit. Count and record (1) the total number of plants in four, 40-inch sections of row to obtain the plant population, (2) the number of plants selected for insect sampling, and on these plants only, (3) the average number of nodes. Examine 5-10 green squares from the selected plants at each stop. Sweep 25 times along 4 different sections of row using a 15-inch net and continue to check pheromone traps.

*Plant Bugs (Tarnished Plant Bugs, Cotton Fleahoppers, Clouded Plant Bugs, Stink Bugs). Count and record the number of squares and total number of fruiting sites in the top 5 nodes of 3-5 plants/stop (no less than 25 plants/management unit). Estimate and record the number of bugs using one of the following methods:
1. Sweep 25 times with a 15-inch net in 4 random locations/management unit (preferred method).
2. Use a 3-foot drop cloth in at least 4 locations/management unit. Shake plants over the cloth and count the dislodged bugs. Care should be taken not to disturb bugs prior to shaking the plants. Nymphs are more easily counted by this method. Adults tend to fly off quickly and may not be seen on the drop cloth.

Beneficials. Count and record all beneficials in the sweepnet or drop cloth while sampling for plant bugs.

*Bollworm and Budworm Eggs, Larvae, Moths. Examine terminals in the top 6 inches of the selected plants. Count and record the number of plants in-fested with eggs and larvae, and the number of damaged terminals containing no larvae. Pull and examine 5-10 green squares (3/8-inch diameter or larger) at each stop. Count and record the number of squares inspected, damaged by worms, and containing a larva. Indicate worm size as:
Small – less than 1/4-inch long,
Medium – 1/4- to 1/2-inch long,
Large – greater than 1/2-inch long.
Continue to check pheromone traps every 5-7 days.

*Boll Weevils. Using the same squares as for worms, count and record the number containing a weevil oviposition puncture. Discontinue checking pheromone traps until PGS7.

*Aphids, Whiteflies, Late Season Thrips (Western Flower Thrips). Examine the underside of leaves in the top, middle, and bottom of the selected plants. Count and record the number of plants infested with each species.
Classify aphid and whitefly populations as:
Light – less than 10 aphids or whiteflies/plant,
Medium – 10-100 aphids or whiteflies/plant,
Heavy – greater than 100 aphids or whiteflies/plant.
Classify thrips populations as:
Light – less than 50 thrips/plant,
Medium – 50-100 thrips/plant,
Heavy – greater than 100 thrips/plant.
Characterize honeydew production as:
Light – sticky lower leaves,
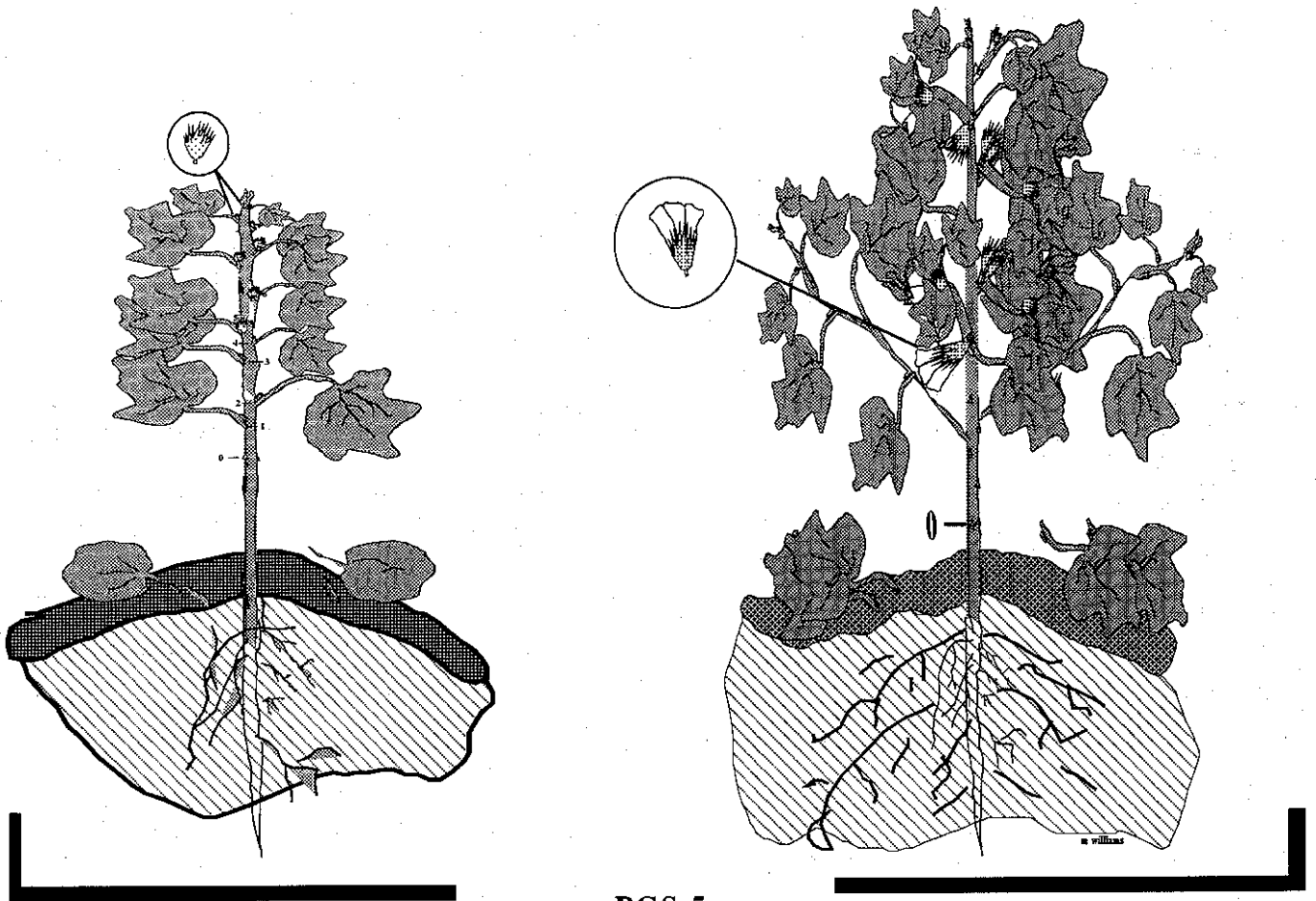Medium – sticky lower and middle leaves,
Heavy – entire plant sticky.

Spider Mites. Examine the first fully expanded leaf off the terminal for mites. Count and record the number of infested plants and classify populations as:
Light – less than 10 mites/leaf,
Medium – 10-100 mites/leaf,
Heavy – greater than 100 mites/leaf.

PGS 5

Figure 6. Pinhead square plus 7 days to first bloom (PGS 5).

Trapping Form PGS4-8
(Pinhead Square plus 7 Days to Harvest)

Farm Name: _____ Field: _____ Date: _____

TRAPS

	Baited	1	2	3	4	5	6	7	8	9	10	11	Total
Bollworms													
Budworms													
Boll Weevils													

County Bollworm Avg. _____   Budworm Avg. _____   Boll Weevil Avg. _____

COMMENTS

_____

_____

_____

_____

_____

_____

Scout: _____

Form PGS5
Pinhead Square plus 7 Days to First Bloom)

Farm Name:_____ Field:_____ MU:_____ Date:_____

Location	1	2	3	4	Total/160 in
# Plants in four 40-in sections					

STOP	1	2	3	4	5	6	7	8	9	10	Total
# Plants Checked											
# Swps or row feet sampled											
# Squares inspected											
Average # of Nodes/Plant											
Weevils # Sqrs w/Punctures											
Boll/Budworm # Plants w/Eggs											
# Terminals w/Larvae											
Dmgd Trms w/out Larvae											
# Squares Damaged											
# Squares w/Larvae											
Larval size (S/M/L)											
Plant Bugs In Swps/drp clth/visual											
# Squares/top 5 nodes											
# Sites/top 5 nodes											
Aphids # Infested Plants											
Inf Level (L/M/H)											
Honeydew (N/L/M/H)											
White flies # Infested Plants											
Inf Level (L/M/H)											
Mites # Infested Plants											
Inf Level (L/M/H)											
Thrips # Infested Plants											
Inf Level (L/M/H)											
# Beneficials											

Scout: _____

24

FIRST BLOOM TO CUTOUT
(Figure 7, Trapping Form PGS4-8, Form PGS6)

General Information. This growth stage lasts about 50 days. Prominent pests (*) are bollworms, budworms, boll weevils, and aphids. Occasional pests are plant bugs, beet armyworms, fall armyworms, western flower thrips, whiteflies, loopers, and spider mites.

General Sampling Protocol. Select and examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations throughout the management unit. Examine 5-10 green squares and 5-10 green bolls from the selected plants at each stop. Count and record the total number of squares and bolls on all plants in four, 40-inch sections of row. Continue to check pheromone traps.

*Bollworm and Budworm Eggs, Larvae, Moths. Examine terminals in the top 6 inches of the selected plants. If the weather is extremely hot, also check lower portions of the plants including stems, bloom tags, and fruit bracts. Count and record the number of plants infested with eggs and larvae, and the number of damaged terminals containing no larvae. Pull and examine 5-10 green squares (3/8-inch diameter or larger) at each stop. Examine but do not remove 5-10 green bolls. Count and record the number of squares and bolls inspected, damaged by worms, and containing a larva. Indicate worm size as:

   Small – less than 1/4-inch long,
   Medium – 1/4- to 1/2-inch long,
   Large – greater than 1/2-inch long.
Continue to check pheromone traps every 5-7 days.

*Boll Weevils. Using the same squares and bolls as for worms, count and record the number containing a weevil oviposition puncture. Note live weevils in blooms.

Plant Bugs (Clouded Plant Bugs, Stink Bugs). Using the same squares and bolls as for worms, count and record the number containing plant bug damage. This damage may be differentiated from other damage by blackened anthers in squares and necrotic areas in bolls. Bloom damage is also distinctive, showing necrotic areas in petals and blackened anthers. Estimate and record the number of bugs using one of the following methods:

1. Using visual observations from within the 2-row by 9-foot sample areas, count and record plant bug species, including stink bugs and clouded plant bugs. These species are often in blooms or low down in plants on fruit.

2. Use a 3-foot drop cloth in at least 4 locations/management unit. Shake plants over the cloth and count the dislodged bugs. Care should be taken not to disturb bugs prior to shaking the plants. Nymphs are more easily counted by this method. Adults tend to fly off quickly and may not be seen on the drop cloth.

Beneficials Count and record all beneficials observed while sampling for plant bugs.

Beet and Fall Armyworms. Check the underside of leaves throughout the canopy on selected plants. Count and record the number of plants infested with egg masses or larvae. Using the same squares and bolls for worms, count and record the number containing armyworms.

Aphids, Whiteflies. Examine the underside of a leaf in the top, middle, and bottom of the selected plants. Count and record the number of plants infested with each species. Classify populations as:

   Light – less than 10 aphids or whiteflies/plant,
   Medium – 10-100 aphids or whiteflies/plant,
   Heavy – greater than 100 aphids or whiteflies/plant.
Characterize honeydew production as:
   Light – sticky lower leaves,
   Medium – sticky lower and middle leaves,
   Heavy – entire plant sticky.

Spider Mites. Examine the first fully expanded leaf off the terminal for mites. Count and record the number of infested plants and classify populations as:

   Light – less than 10 mites/leaf,
   Medium – 10-100 mites/leaf,
   Heavy – greater than 100 mites/leaf.

Late Season Thrips (Western Flower Thrips). Examine blooms and lower leaves of the selected plants. Count and record the number of plants infested with immatures (on underside of leaves) and adults (in blooms). Classify populations as:

   Light – less than 50 thrips/plant,
   Medium – 50-100 thrips/plant,
   Heavy – greater than 100 thrips/plant.

Loopers. Check leaves throughout the canopy on selected plants, and count and record the number of plants infested with larvae.
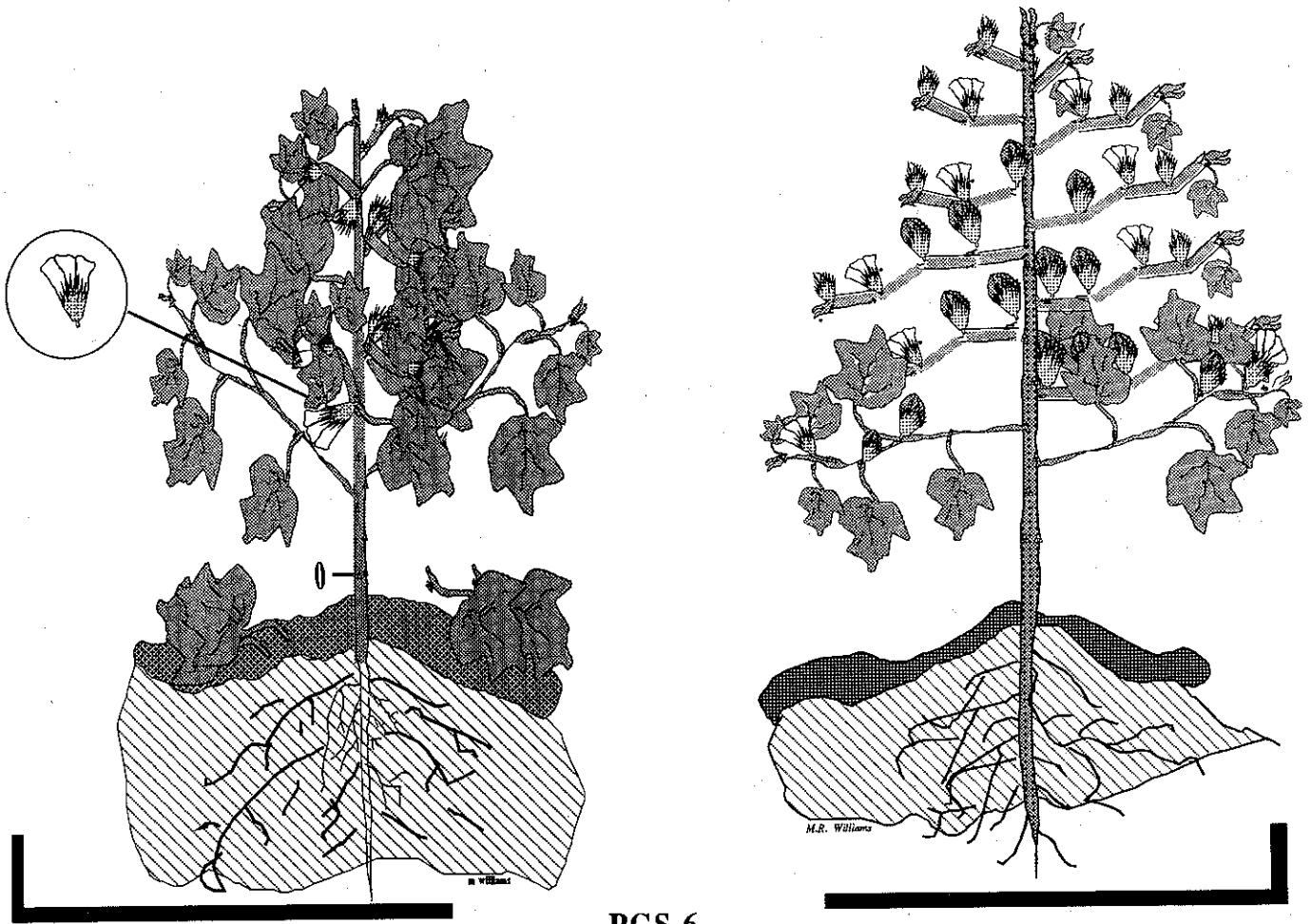
PGS 6

Figure 7. First bloom to cutout (PGS 6).

Trapping Form PGS4-8

(Pinhead Square plus 7 Days to Harvest)

Farm Name: _____ Field: _____ Date: _____

TRAPS

	Baited	1	2	3	4	5	6	7	8	9	10	11	Total
Bollworms													
Budworms													
Boll Weevils													

County Bollworm Avg. _____ Budworm Avg. _____ Boll Weevil Avg. _____

COMMENTS

_____

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_____

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Scout: _____

Form PGS6

(First Bloom to Cutout)

Farm Name:_____ Field:_____ MU:_____ Date:_____

Location	1	2	3	4	Total/160 in
# Plants in four 40-in sections					

STOP	1	2	3	4	5	6	7	8	9	10	Total
# Plants Checked											
# Squares Inspected											
# Bolls Inspected											
# Row Feet Inspected											
Boll Weevil — # Sqrs w/Punctures											
Boll Weevil — # Bolls w/Punctures											
Boll Weevil — in Blooms? (Y/N)											
Boll/Budworm — # Plants w/Eggs											
Boll/Budworm — # Terminals w/Larvae											
Boll/Budworm — Dmgd Trms w/out Larvae											
Boll/Budworm — Larval size (S/M/L)											
Boll/Budworm — # Squares Damaged											
Boll/Budworm — # Squares w/Larvae											
Boll/Budworm — Larval size (S/M/L)											
Boll/Budworm — # Bolls Damaged											
Boll/Budworm — # Bolls w/Larvae											
Boll/Budworm — Larval size (S/M/L)											
Plant Bugs — # Damaged Squares											
Plant Bugs — # Damaged Bolls											
Plant Bugs — # Bugs											
Aphids — # Infested Plants											
Aphids — Inf Level (L/M/H)											
Aphids — Honeydew (N/L/M/H)											
White flies — # Infested Plants											
White flies — Inf Level (L/M/H)											

Form PGS6 (continued)

STOP		1	2	3	4	5	6	7	8	9	10	Total
Mites	# Infested Plants											
	Inf Level (L/M/H)											
Thrips	# Infested Plants											
	Inf Level (L/M/H)											
Beet Armywrm	# Plants w/larvae											
	# Plants w/eggs											
	# Squares w/worms											
	# Bolls w/worms											
Fall Armywrm	# Plants w/larvae											
	# Plants w/eggs											
	# Squares w/worms											
	# Bolls w/worms											
# Beneficials												

Comments

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_____

Scout: _____

CUTOUT TO DEFOLIATION
(Figure 8, Trapping Form PGS4-8, Form PGS7)

General Information. This growth stage lasts about 45 days. Prominent pests (-) are bollworms, budworms, boll weevils, and aphids. Occasional pests are plant bugs, beet armyworms, fall armyworms, western flower thrips, whiteflies, spider mites, and loopers.

General Sampling Protocol. Select and examine 5-10 plants from two adjacent 9-foot sections of row in each of 7-10 random locations throughout the management unit. Examine 5-10 green squares and bolls from the selected plants at each stop. Count and record the numbers of green bolls and cracked or open bolls on all plants in four, 40-inch sections of row. Continue to check pheromone traps every 5-7 days.

*Bollworm and Budworm Eggs, Larvae, Moths. Examine terminals in the top 6 inches of the selected plants. If the weather is extremely hot, also check lower portions of the plants including stems, bloom tags, and fruit bracts. Count and record the number of plants infested with eggs and larvae, and the number of damaged terminals containing no larvae. Pull and examine 5-10 green squares (3/8-inch diameter or larger) at each stop. Examine but do not remove 5-10 green bolls. Count and record the number of squares and bolls inspected, damaged by worms, and containing a larva. Indicate worm size as:
  Small — less than 1/4-inch long,
  Medium — 1/4- to 1/2-inch long,
  Large — greater than 1/2-inch long.
Continue to check pheromone traps every 5-7 days.

*Boll Weevils. Using the same squares and bolls as for worms, count and record the number containing a weevil oviposition puncture. Note live weevils in blooms. Re-establish pheromone trap lines to assess diapausing populations.

Aphids, Whiteflies. Examine the underside of a leaf in the top, middle, and bottom of the selected plants. Count and record the number of plants infested with each species. Classify populations as:
  Light — less than 10 aphids or whiteflies/plant,
  Medium — 10-100 aphids or whiteflies/plant,
  Heavy — greater than 100 aphids or whiteflies/plant.
Characterize honeydew production as:
  Light — sticky lower leaves,
  Medium — sticky lower and middle leaves,
  Heavy — entire plant sticky.

Spider Mites. Examine the first fully expanded leaf off the terminal for mites. Count and record the number of infested plants and classify popuelations as:
  Light — less than 10 mites/leaf,
  Medium — 10-100 mites/leaf,
  Heavy — greater than 100 mites/leaf.

Late Season Thrips (Western Flower Thrips). Examine blooms and lower leaves of the selected plants. Count and record the number of plants infested with immatures (on underside of leaves) and adults (in blooms). Classify populations as:
  Light — less than 50 thrips/plant,
  Medium — 50-100 thrips/plant,
 Heavy — greater than 100 thrips/plant.

Plant Bugs (Clouded Plant Bugs, Stink Bugs). Using the same squares and bolls for worms, count and record the number containing plant bug damage. This damage may be differentiated from other damage by blackened anthers in squares and necrotic areas in bolls. Bloom damage is also distinctive, showing necrotic areas in petals and blackened anthers. Estimate and record the number of bugs using one of the following methods:
  1. Using visual observations from within the 2-row by 9-foot sample areas, count and record plant bug species, including stink bugs and clouded plant bugs. These species are often in blooms or low down in plants on fruit.
  2. Use a 3-foot drop cloth in at least 4 locations/management unit. Shake plants over the cloth and count the dislodged bugs. Care should be taken not to disturb bugs prior to shaking the plants. Nymphs are more easily counted by this method. Adults tend to fly off quickly and may not be seen on the drop cloth.

Beneficials. Count and record all beneficials observed while sampling for plant bugs.

Beet and Fall Armyworms. Check the underside of leaves in the canopy of the plants. Count and record the number of plants infested with egg masses and larvae. Check squares, blooms, and bolls for larvae and bracts and leaves for feeding.

Loopers. Count and record the number of plants that have been defoliated by larvae feeding. Estimate percent defoliation for plants and size of area (acreage) infested.
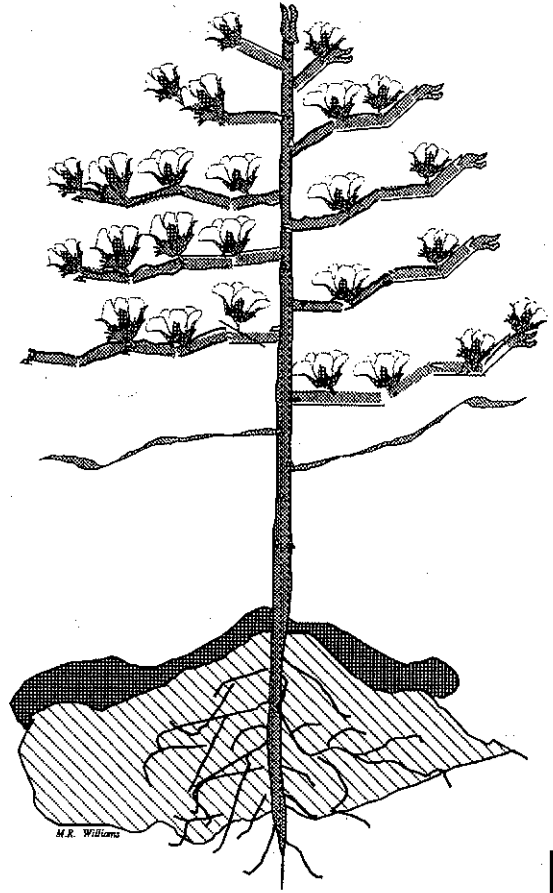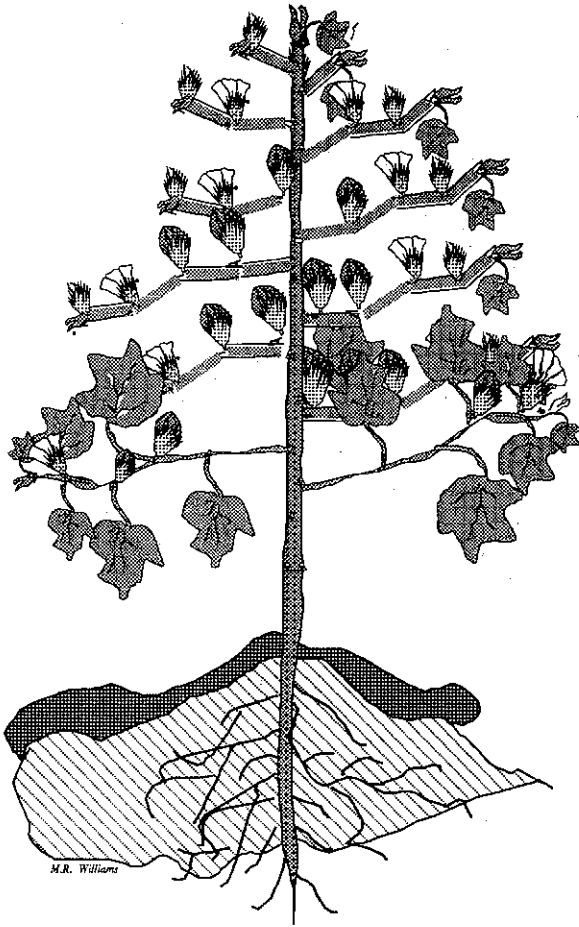
PGS 7

Figure 8. Cutout to defoliation (PGS 7).

Trapping Form PGS4-8
(Pinhead Square plus 7 Days to Harvest)

Farm Name: _____   Field: _____   Date: _____

TRAPS

	Baited	1	2	3	4	5	6	7	8	9	10	11	Total
Bollworms													
Budworms													
Boll Weevils													

County Bollworm Avg. _____   Budworm Avg. _____   Boll Weevil Avg. _____

COMMENTS

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_____

_____

Scout: _____

Form PGS7
(Cutout to Defoliation)

Farm Name:_____ Field:_____ MU:_____ Date:_____

Location	1	2	3	4	Total/160 in		# Days to Defoliation
# Green Boll/40 in							
# Open Boll/40 in							

STOP		1	2	3	4	5	6	7	8	9	10	Total
# Plants Checked												
# Squares Inspected												
# Bolls Inspected												
# Row Feet Inspected												
Boll Weevil	# Sqrs w/Punctures											
	# Bolls w/Punctures											
	in Blooms? (Y/N)											
Boll/ Budworm	# Plants w/Eggs											
	# Terminals w/Larvae											
	# Bolls Damaged											
	# Bolls w/Larvae											
	Larval size (S/M/L)											
Plant Bugs	# Damaged Squares											
	# Damaged Bolls											
	# Bugs											
Aphids	# Infested Plants											
	Inf Level (L/M/H)											
	Honeydew (N/L/M/H)											
White flies	# Infested Plants											
	Inf Level (L/M/H)											
Mites	# Infested Plants											
	Inf Level (L/M/H)											
Thrips	# Infested Plants											
	Inf Level (L/M/H)											

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Form PGS7 (continued)

STOP		1	2	3	4	5	6	7	8	9	10	Total
Beet Armywrm	# Plants w/larvae											
	# Plants w/Eggs											
	# Squares w/Worms											
	# Bolls w/Worms											
Fall Armywrm	# Plants w/Larvae											
	# Plants w/Eggs											
	# Squares w/Worms											
	# Bolls w/Worms											
# Beneficials												

Comments

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_____

Scout: _____

DEFOLIATION TO HARVEST
(Figure 9, Trapping Form PGS4-8, Form PGS8)

General Information. This period runs from late September through October. Note and record pest "hot spots" or other special problems.

Bollworm/Budworm Moths. Continue checking pheromone traps every 5-7 days until stalks are destroyed, then remove traps for storage.

Boll Weevils. Continue to check pheromone traps every 5-7 days until stalks are destroyed, then remove traps for storage.
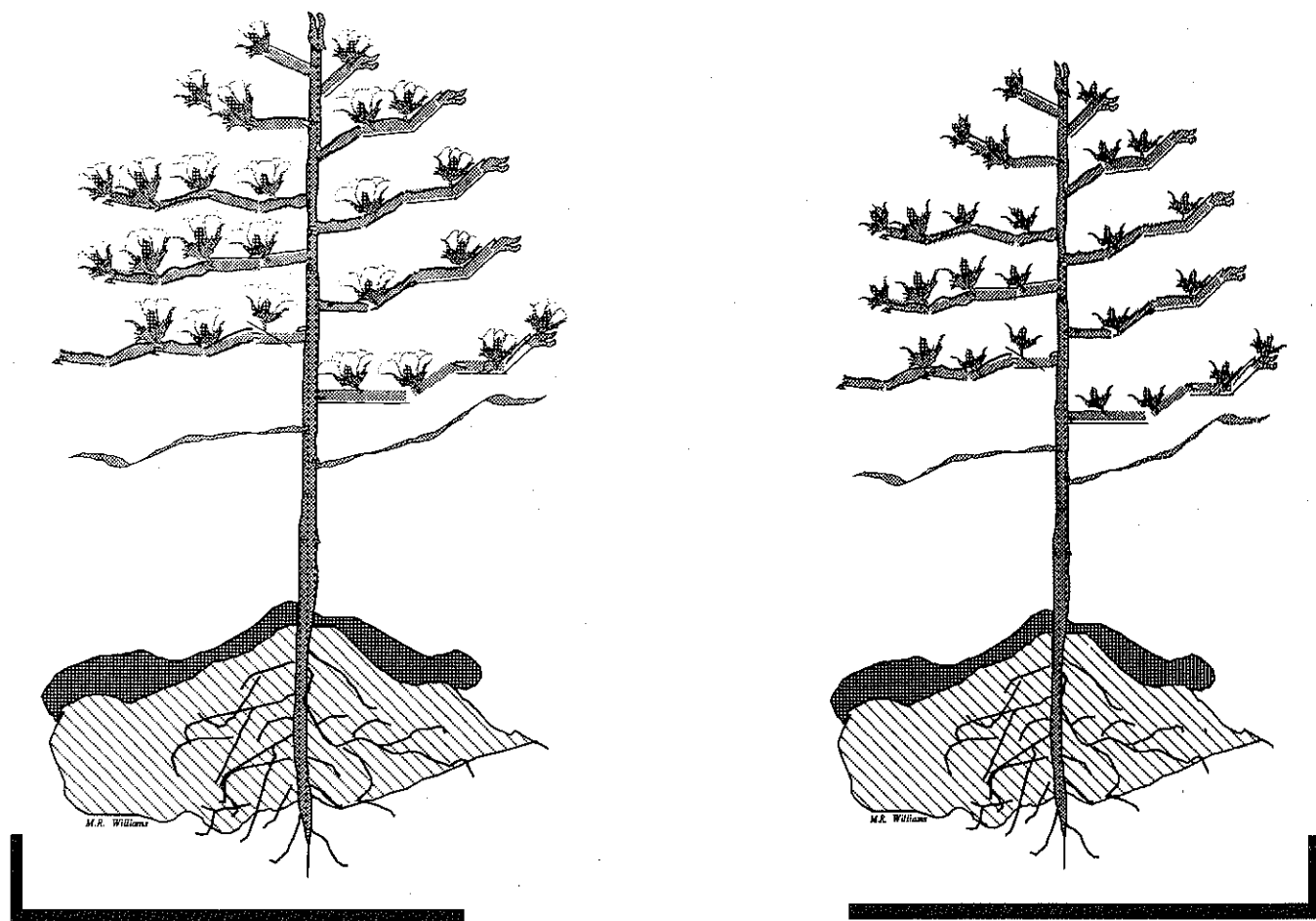
PGS 8

Figure 9. Defoliation to harvest (PGS-8)

Trapping Form PGS4-8

(Pinhead Square plus 7 Days to Harvest)

Farm Name: _____   Field: _____   Date: _____

TRAPS

	Baited	1	2	3	4	5	6	7	8	9	10	11	Total
Bollworms													
Budworms													
Boll Weevils													

County Bollworm Avg. _____   Budworm Avg. _____   Boll Weevil Avg. _____

COMMENTS

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_____

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_____

Scout: _____

Form PGS8
(Defoliation to Harvest)

Farm Name: _____   Field: _____   Date: _____

Number of spray applications: _____

Check the pests which were problems in this unit this season:

Boll Weevils		Aphids	
Boll/Budworms		Whiteflies	
Early-season Thrips		Spider Mites	
Late-season Thrips		Cutworms	
Tarnished Plant Bugs		Fall Armyworms	
Clouded Plant Bugs		Beet Armyworms	
Cotton Fleahoppers		Loopers	
Stink Bugs			

On the following diagram, indicate the location(s) of any problem pest(s) by placing the pest's initials and the date of occurrence in the rectangle that identifies its approximate location in the management unit. If the MU is not rectangular in shape, draw its outline in the comment section or on the back of the page. NOTE: square 1 is the northwest corner.

1	2	3	4
5	6	7	8

Comments

_____

_____

_____

_____

_____

Scout _____

APPENDIX I

Standardization of Data

Scouting data derived from the field needs to be converted to a standard measure for decision-making (e.g., unit per area). Three conversion methods are provided for converting raw data to numbers/acre.

EXAMPLE 1: Convert the numbers of insects found on four, 40-inch sections of row to numbers per acre:

1. Count the number of insects in four, 40-inch sections of row,
2. Sum the 4 insect counts,
3. Multiply the sum by 1,000.

Conversion factor: 160 inches of row (13.3 feet) equals approximately 1/1,000 of an acre.

EXAMPLE 2: Convert the number of insects (squares or bolls) found in any length of row to numbers per acre.

1. Count the number of insects on N feet of row,
2. Insects per acre = (INSECTS/N) × (linear ft per acre).

There are 43,560 square feet per acre, therefore 38-inch rows will have 13,756 linear feet per acre and 40-inch rows will have 13,068 linear feet per acre.

EXAMPLE 3: Convert the number of insects (squares or bolls) found on a given number of plants (N).

1. Insects per acre = (INSECTS/N) × (plants per acre).

DETERMINE PERCENT SQUARE SET:

Count the total number of squares in the top 5 nodes of each of 25 plants across the field (no more than 2 squares per fruiting branch). Assume that fruiting begins on the 6th node.

6th node cotton should have 25 squares/25 plants,
7th node cotton should have 50 squares/25 plants,
8th node cotton should have 100 squares/25 plants,
9th node cotton should have 150 squares/25 plants,
10th node cotton should have 200 squares/25 plants,
After the 10th node, maintain 200 squaring sites/25 plants.

Therefore:

(Actual number squares x 100) / (potential sites) = % SQUARE SET

APPENDIX II

Pheromone Trap Placement

Proper placement of pheromone traps is critical to obtaining useful information. The following are some simple rules for setting up and maintaining traps:

1. Set traps away from areas which will obstruct farm equipment or interfere with field operations.

2. Set traps in areas where air flow is not obstructed. Traps should not be placed under trees, behind hedgerows or under high voltage power lines.

3. Bollworm-budworm traps must be at least 50 yards apart. The *Virelure®* and *Zealure®* are similar in chemical makeup and cross contamination may occur. DO NOT HANDLE both baits at the same time.

4. Bollworm-budworm traps should be placed so that the bait is about 40 inches above the ground.

5. Empty traps and count insects in traps every 5 to 7 days. DO NOT RELEASE captured insects back into the field.

6. Re-bait traps according to the instructions on the pheromone package, usually every 2 weeks.

7. Traps not capturing insects over a 5-6 week period should be relocated, especially if other traps are capturing insects.

8. Keep vegetation clear of traps.

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