IPM-10

Kentucky Sweet Corn Insect Integrated Pest Management

Scout Manual

KENTUCKY SWEET CORN INSECT

INTEGRATED PEST MANAGEMENT

SCOUT MANUAL

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INTRODUCTION

Agriculture is the world's most important industry because of rapidly expanding populations which demand increased amounts of food and fiber. Crop protection problems associated with this increased production have become more complex. A simplistic approach to pest control leads to serious environmental complications and economic losses. A truly successful pest management program must take a multi-disciplinary approach in order to supply the farmer with reliable pest control information. An approach to crop production based on economic, ecological, technical and social considerations is needed to assist the farmer to achieve the production and quality levels needed to satisfy increasing world demand.

Current economic conditions mandate that farmers be provided with the information needed to manage pests while maximizing profits. This manual describes the information the farmer needs to make important management decisions. Your sound judgment and dedicated effort will directly affect the success of this program. We welcome your participation and look forward to working with you in the coming growing season.

Much of the information in this manual was adapted from other sources, including scouting procedures from the Kentucky Integrated Pest Management program as well as from other states. Decision guidelines using pheromone trapping data for corn earworm, European corn borer, and fall armyworm were adapted from a similar program in Massachusetts.

PRODUCER-SCOUT RELATIONSHIP

In an Integrated Management Program, it is imperative that the scout enjoy a good relationship with the producer-cooperator. The farmer must have confidence that the scout is doing his or her job. In some cases hundreds or even thousands of dollars may rest upon the scout's report. The scout's report will weigh heavily on whether or not control measures for certain insects, diseases or weeds are employed.

The following points will assist scouts in developing a harmonious relationship between IPM scouts, cooperators and supervisory personnel. These points were developed during conversations between cooperators, the Pest Management Supervisor and a County Agent.

1. Let the grower know that you feel this job is important.
2. Be courteous and friendly.
3. Present a good appearance.
a. Dress appropriately for the job--short or long sleeve shirt, long pants, cap and shoes. No athletic shirt, cut off pants or sandals.
b. Be and look busy.
4. Go about your work in a businesslike manner.
5. Keep a neat legible record.
6. Do not be a "know it all". Be tactful.
7. Answer the grower's questions to the best of your knowledge. Do not be afraid to say "I do not know".
8. NEVER make a recommendation for control measures.
9. Do not discuss other grower's problems or control measures.
10. Do not block drives or lanes with your vehicle.
11. Keep all gates closed or open as the cooperator has left them. Do not ride down fences.
12. Do not trample or otherwise damage crop.
13. Let cooperator know the type vehicle or vehicles you will be using and approximate time that you will be on farm.
14. Place report in location agreed upon with cooperator.
15. Let the cooperator know where you can be reached by phone.
16. Use tact in dealing with cooperator's dog.
17. ALWAYS follow recommended sanitation practices in regard to disease, insects and weeds. Clean shoes are a must. Washable boots are preferred.
18. Remarks regarding the pest management program, fellow scouts, cooperators and supervisory personnel should be positive. If you cannot say anything good about the program and/or people involved, do not say anything
19. Always keep in mind that you are scouting his acreage. He expects you to do a good job.
20. Do not spend excessive time talking with the cooperator or others.
21. If asked to have lunch with the cooperator, do so, but make it clear that your time is limited.
22. Carry your own water supply so that you don't have to ask for water.
23. Keep vehicle on solid ground.
24. Be on time to begin work.
25. Do not get involved with jobs on cooperator's farm unless there is some emergency. STAY OFF MACHINERY.
26. You are not to scout crops not in program. Make sure you scout the right field.
27. You are not to take anyone with you while scouting unless instructed to do so by supervisory personnel.
28. You are not to be on farm after dark.
29. Do not go in farm buildings unless invited or caught in rain.

30. Do not scout when you are miring to shoe tops unless advised to do so by supervisor.

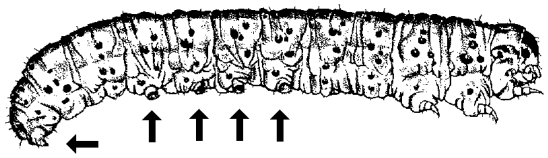
When in doubt about proper procedures, consult with supervisory personnel.

SCOUTING PROCEDURES FOR SWEET CORN INSECTS

How to scout a field

Specific survey procedures are described for each insect. In general, you will EXAMINE 20 PLANTS PER LOCATION and record the number of insects or percent of damaged plants. Select locations randomly so that they will be representative of the entire field. Don't survey along field margins unless specifically directed to do so. Don't limit surveys to one side or end of a field. IF YOUR SURVEY IS NOT RANDOM IT IS NOT REPRESENTATIVE OF THE WHOLE FIELD and you may find a lot of problems on your return visit. Because IPM in sweet corn is experimental in Kentucky for 1994, we will use 4 locations and restrict fields to less than 5 acres.

CUTWORMS



Occurrence: From planting through mid-June. Fields having one or more of the following characteristics should be watched very carefully:

- history of cutworm damage
- excess surface litter, especially soybean residue
- fair to poor drainage or overflow land
- late planted
- winter annual weeds prior to tillage

When to scout: Corn plants should be monitored twice weekly from emergence until they reach a height of 18 inches. Watch for leaf feeding, wilted plants or cut stalks. Infestations are often spotty so check carefully for damage. Make counts only if cutworm damage is noticed in the field. Continue to scout damaged fields once an infestation is found. It is vital to get planting dates so fields will not be overlooked during this critical period.

Description: Larvae are light gray to nearly black and may have a faint, narrow mid-dorsal stripe. Larvae vary from 1/4 inch long after hatch to 1-3/4 inches long when full grown.

Damage: Small cutworms chew small holes in the leaves. Larger worms (about 1/2 inch long) cut small plants and may pull parts into their burrow. Symptoms are cut or wilted plants.

Preventive management: Eggs and larvae are frequently in the field prior to planting. Prepare fields and eliminate weeds at least 14 days before planting to destroy eggs, larvae and egg-laying sites.

How to scout: Begin making counts as follows when cut or wilted plants are first seen. 1) Randomly determine a starting point and examine 20 consecutive plants per location and write down the number of cut plants. Determine the percent plants cut by dividing the total plants cut by the total number of plants inspected. Multiply this figure by 100 and record the percent infestation on the report form. 2) Look for live cutworms around freshly damaged plants. They will generally be covered or

underground during the day. First check under clods near the base of the plant. Then, dig up an area three inches in diameter and three inches deep around the damaged plant. Record the average number and length (inches) of "live" cutworms per 20 plant sample and whether they were found near the soil surface or deep. 3) Make stand counts in the field. These counts can be used in making a treatment decision.

Record: Record the number of cut plants found per 20 plants examined at each site. Record the average length of "live" cutworms found. Note if they were found near the soil surface or deep.

Economic Threshold: 3% or more cut plants and 2 or more cutworms (1 inch or smaller) per 100 plants. Inform the grower and supervisor immediately. If conditions are borderline, check the field again in 24 to 48 hours or until a final decision is made. Take stand counts during this time to help determine

if treatment may be necessary.

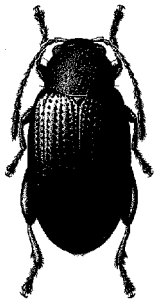
CORN FLEA BEETLE

Occurrence: Planting until mid-June.

When to scout: Check corn from emergence until 12 inches tall. Flea beetle stress may be great on late planted corn. However, early planted fields may also show noticeable damage.

Description: Corn flea beetles are very small, dark insects that jump readily when disturbed.

Damage: These beetles are leaf feeders. They make small feeding scars on the surface giving leaves a gray, frosted appearance. Damage is generally serious on plants less than six inches tall. Flea beetles transmit Stewart's wilt, also known as bacterial leaf blight on field corn.



P r e v e n t i v e Management: Use a Stewart's wilt resistant or tolerant variety following very mild winters or if the field has a history of Stewart's wilt.

How to scout: Examine 20 plants at each location and rate for feeding damage according to the following scale:

0 - no damage or scratch marks
1 - scattered scratch marks on less than 50% of plants; plants appear healthy
2 - feeding on new leaves of 50% or more of plants; some leaves whitish
3 - leaves browning, plant dying

Also, estimate the number of beetles on each of the 20 plants. This must be done carefully because the beetles will jump at the slightest disturbance.

Record: Record a rating of 0 to 3 for each group of 20 plants examined. Note an estimate of the average number of beetles on each 20 plant sample in your comments.

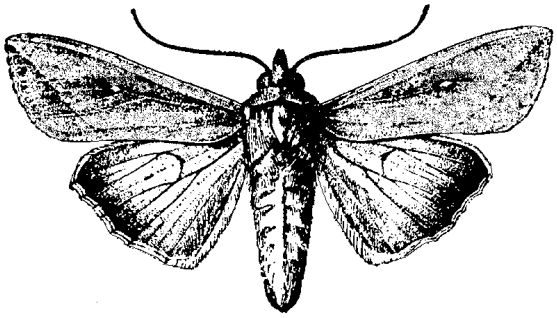
Economic Threshold: An average rating of 1; especially if field has a history of Stewart's wilt.

ARMYWORM

Occurrence: Mid-May through June.armyworm infestations usually develop in small grain or grass fields. Larvae can crawl into conventional till corn fields with damage

occurring first in border rows or along grassy waterways. Infestations may develop throughout no-till corn following small grains or grass. Cool, wet springs favor armyworm development.

When to scout: Corn should be surveyed from emergence to waist-high.



Description: Larvae are greenish brown with a narrow, mid-dorsal stripe and two orange stripes along each side. The yellowish head is honeycombed with dark lines.

Damage: Armyworms feed at night and damage corn by stripping the leaves. They also feed in the whorl and may destroy the bud.

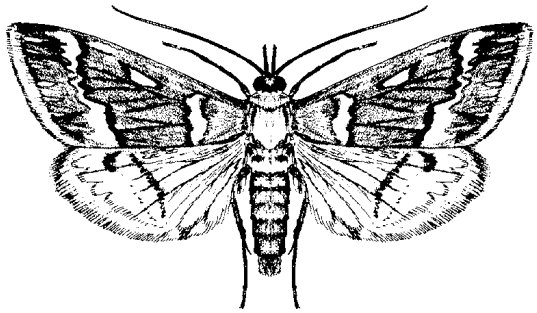
How to scout: 1) SURVEY FIELD EDGES where margins border small grains or large grassy areas and watch for damaged plants while walking through the field. 2) Examine 20 plants per location, within the field. Record number of damaged plants at each location. Figure your percent in the same manner as done for cutworms. Under scout comments note the average larval size (1/2"). Include field map if spot treatments are to be warranted.

Record: Of the 20 plants observed at each sample site, record the number of damaged plants observed at each site. Calculate and note the percent infestation. Note the average length of the larvae in your comments and mark heavily infested areas on your field map.

Economic Threshold: 1) 15% or more of plants in field are infested and 15% or more defoliation is seen on damaged plants and 2) Larvae average 1/2 to 3/4 inch long. Armyworms greater than 1-1/4 inch in length have completed most of their feeding.

Comments: Warm spring weather favors parasite and disease development. Small, oval, yellowish eggs behind the head of the larvae indicate a parasitized armyworm. Note the percentage of worms that appear to be parasitized or diseased. Remember that armyworms hide under debris or on the ground during the day.

EUROPEAN CORN BORER



Occurrence: First generation: late May to late June. Early planted corn has greatest potential for damage. Second generation: late June to August. Late planted corn is most attractive to this generation. Third generation: late July on.

When to scout: A computer model will accurately predict the dates to begin scouting. Your supervisor will tell you when to begin looking for European corn borer activity.

Description: Fifteen to 35 white eggs are laid in masses on the underside of corn leaves, often near the midrib. The individual eggs overlap each other much like fish scales. Prior to hatching, the mass darkens. The black head capsule of the larva is distinct about 24 hours prior to hatch. Larvae are flesh-colored and marked with small, round, brown spots. They vary from 1/8 inch long after hatch to about 1 inch long when full grown. The head may be red-brown to black. The moth has a wingspan of about 1 inch. The female is pale yellow to light brown with the outer third of the wing crossed with zigzag lines. The male moth is smaller, more slender, and darker than the female.

Damage: Results of feeding by small first generation borers appears as "window pane" or "shot holes" in the whorl leaves. Some borers enter leaf midribs and cause them to break. Often infestations restricted to the whorls are forced to move to the developing ear when the tassel begins to emerge. Second generation damage includes feeding on stalks, tassels, ear shanks, leaf collars and developing ears. Larvae may be found feeding on pollen and leaf tissue behind the leaf sheath and axil.

Preventive Management: Planting date greatly influences the potential for European corn borer infestation. Extremely early plantings are more susceptible to first generation attack. Late planted corn is potentially at greater risk to second and third generation European corn borer infestation.

How to scout: First generation: 1) Randomly select and examine 20 consecutive plants in each location in the field. 2) Look carefully into whorls and count and record the number of plants showing fresh "shot hole" (window pane) damage in the whorl. Small areas of fresh surface feeding may be seen before "shot holes" appear. 3) Pull out the whorls of two damaged plants from each location and carefully unroll the whorl looking for small whitish borers with distinct (black) heads. Note percentage of plants infested with live larvae and average size (1/8, 1/4, 1/2, 3/4 or 1+ inches in length). Percent damage is figured by dividing the total number of plants with "shot hole" and "window pane" feeding by the total number of plants examined. Multiply this number by 100 and record in the % infestation column on the report form. *Second generation:* Give special attention to late planted fields. 1) Survey 20 plants per location. 2) Check plants for egg masses and signs of borer feeding. Examine closely the lower surface of leaves and at the ear. When an egg mass is found, record the hatching stage according to the following: white, cream, black head, or hatched. 3) Check the middle one-third of each plant for damage and live larvae. Second generation larvae are usually found feeding at the base of leaf sheaths. Pull leaves from the ear zone of one plant per location and record number of larvae found in leaf axil and their size (1/8, 1/4, 1/2, 3/4 or 1+ inches in length). Percent damage is figured in the same manner as for first generation. 4) Examine pheromone traps for European corn borers. Remove and destroy moths on each visit. Traps need to be examined weekly.

Trapping: There are two strains of the European corn borer in Kentucky. They are often refered to as the "Iowa" and "New York" strains. Each of the strains has its own pheromone lure. Lures used for the "Iowa" will not capture "New York" strain moths, and visa versa. Both of these strains are thought to be able to reach ecomonic levels. In order to effectively monitor for European corn borers, both types of pheromone traps will need to be

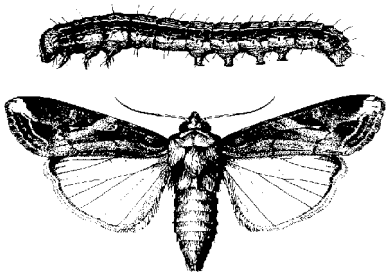
used and the total combined capture from both traps used for making management decisions.

Record: Of the 20 plants examined at each site, record the number showing fresh "shot hole" damage in the whorl. Record the percentage of plants infested with live larvae and the average length of the larvae. If an egg mass is found note the hatching stage as white, cream, black head or hatched. Note in your comments if borers have entered the stalk or not. Record numbers of European corn borers per trap (mark these entries with "PT").

Economic Threshold: First generation: Sweet corn controls should be considered if 15% of the plants show "shot hole" or "window pane" feeding damage and live larvae of European corn borer or fall armyworm are present. This is paricularly important just before tassel emergence. Once larvae have bored into the stalks treatment will not be effective. Second generation: If fewer than 5 corn earworm moths and fewer than 3 fall armyworm moths are captured per week and 1 or more European corn borer moths are captured, spray an insecticide at 7 day intervals.

See Appendix 3, "Decision guidelines using pheromone traps, for complete threshold information.

FALL ARMYWORM



Occurrence: Late June to frost. Late maturing fields are most likely to become infested.

When to scout: Begin checking in mid-June and continue throughout the season.

Description: Larvae vary from light tan to nearly black with three thin light yellow lines down the back. There is a wider dark stripe and a wavy yellow red splotched stripe on each side. They resemble both armyworms and corn earworms, but fall armyworms have a prominent white inverted Y mark on the front of the head. The spherical gray eggs are laid in clusters of about 150, usually on the leaves of host plants. Masses are covered with a coating of moth scales or fine bristles. The moth has a wingspan of about 1-3/4 inches. The hindwings are grayish white; the front wings are dark gray mottled with lighter and darker splotches. Each forewing has a noticeable whitish spot near the extreme tip.

Damage: Larvae feed on the leaves leaving "window pane" type damage and later burrow deep into the whorl. The tassel, leaves on the upper portion of the plant, and the ear may be partly or totally destroyed. The damage to the ear of corn may be far more important than the leaf damage. Often infestations in the whorl as forced to move to the developing ear when the tassel begins to emerge.

Preventive Management: Planting date greatly influences the potential for fall armyworm infestation. Early planting usually escape fall armyworm infestation, while late planted sweet corn is at high risk to fall armyworm.

How to scout: 1) Begin checking corn in mid-June for fall armyworm activity. Survey 20 plants from each location. Survey 20 consecutive plants from a random starting point. Small larvae will cause "window pane" damage. Record damage, number and size of fall armyworms. Collect specimens for verification. Feeding by small fall armyworms resembles corn borer damage. 2) A few days before tasseling and silking, check closely for infestations. Look for large larvae in the

whorls which will be pushed out by the emerging tassels. These larvae may then attack the very small ears. Egg and small larvae masses may be found on the leaves and behind leaf sheaths. Determine if an infestation of large larvae or small larvae will be present to attack the very small, developing ears. Continue to check closely for this insect until silks begin to dry. Examine pheromone traps twice a week for fall armyworm moths. During each visit, moths should be removed from the trap, counted, destroyed and removed from the field.

Record: Of the 20 plants examined at each site record the number of plants showing damage at each site. Note the average length of the larvae in your comments. Record numbers of fall armyworm moths captured in traps and mark these entries with "PT".

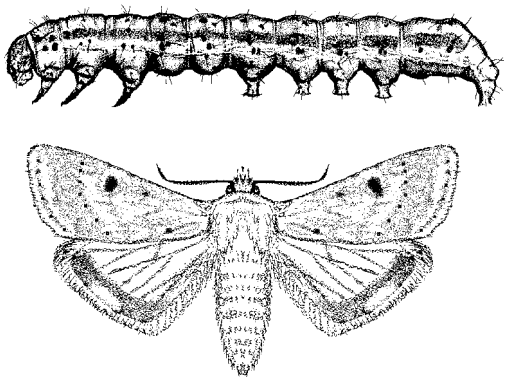
Economic Threshold: When 15% of plants are infested with larvae of either European corn borer or fall armyworm. This is particularly important just before tassel emergence. Treatment must be applied before larvae burrow deep into the whorls or enter ears of more mature plants. After the plants have tasseled, if less than 5 corn earworm moths are captured per trap and 10 or more fall armyworm moths are captured per trap, spray an insecticide at 5 day intervals. If less than 5 corn earworm moths are captured and between 3 to 9 fall armyworm moths are captured, spray an insecticide at 7 day intervals.

See Appendix 3, "Decision guidelines using pheromone traps, for complete threshold information.

CORN EARWORM

Occurrence: From June until harvest, when corn is silking. Moths lay eggs singly on green silks, as silks dry up, egg laying occurs on other hosts.

When to scout: Pheromone traps should be monitored twice a week beginning in June.



Description: Corn earworms are moderately hairy larvae that vary from yellow, to green, to red to brownish black. They may be found feeding in the ear tips following silking. The larvae are cannibalistic, rarely is their more than one per ear or whorl. The moth has a wing span of 1 to 1-1/2 inches. The front wings of the male are usually a light yellowish olive; those of the female are yellowish brown to pinkish brown. Each forewing has a dark spot in the center. The dome-shaped-egg is usually white when first laid but develops a reddish-brown band before hatching.

Damage: Corn earworm is potentially the greatest threat to sweet corn production. Corn earworm will attack the whorl as well as the ear of the corn plant. First generation larvae will feed on the unfurled leaves in the whorl resulting in numerous ragged whorl in the blades as the leaves emerge. In corn ears, damage is usually restricted to developing kernels in the tip of the ear.

Preventive Management: Planting date greatly influences the potential for corn earworm infestation. Early planting usually

escape corn earworm infestation, while late planted sweet corn is at high risk to corn earworm.

How to scout: Pheromone traps need to be examined twice a week for corn earworms. Special attention should be given to late planted fields and fields with green silks. Moths should be removed form trap, counted, destroyed, and removed from field during each visit.

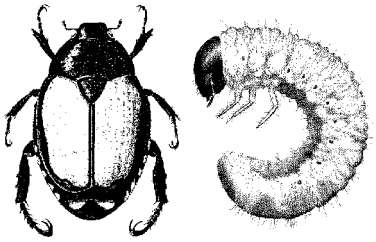
Record: Numbers of corn earworm moths per trap per visit as well as the stage of the corn (mark these entries with "PT"). Note if corn is silking or silks are still green.

Economic Threshold: When tassels emerge and silks are still green, numbers of corn earworm moths captured in pheromone traps will determine the frequency of insecticide applications.

Weekly Trap Catch	Treatment Frequency
350 or more	Every 3 days
11 to 349	Every 4 days
5 to 10	Every 5 days

When corn earworm weekly counts are less than 5, frequency of insecticide applications will be determined by fall armyworm and European corn borer pheromone trap catches. See Appendix 3, "Decision guidelines using pheromone traps, for complete threshold information.

JAPANESE BEETLE



Occurrence: From mid-June through mid-August.

Description: Japanese beetles are metallic green beetles about 1/2 inch long. There is a row of white tufts on the side of the body below the bronze wing covers.

Damage: These beetles feed on silks, but will feed in the whorl when silks are not available. An abundance of Japanese beetles at maximum pollen shed have the potential of interfering with pollination, but this is uncommon typically. More frequently, their feeding on silks opens up the tip of the ear exposing it to birds and sap beetles. They will also discolor the tip of the ear with their excrement, reducing the market quality.

How to Scout: Beginning when Japanese beetles are first observed, survey 20 consecutive plants per location weekly, initiating your count randomly. Note the numbers of beetles per ear and the average silk length. Corn silking during mid-July through August 1 is particularly vulnerable to Japanese beetle feeding.

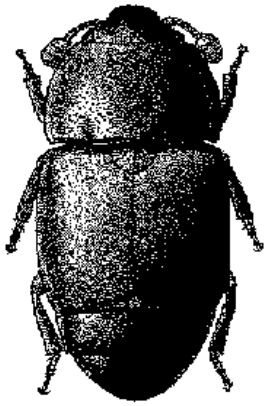
Record: The number of beetles found per 20 plant sample at each location and the growth stage of the corn. If corn is silking, record the average length of the silks.

Economic Threshold: Treatment may be necessary if silks have been clipped to 1/2

inch and there are 2 or more beetles per ear. Sprays to control corn earworms typically provide effective control of japanese beetles.

SAP BEETLES

Occurrence: Sap beetles are attracted to ripe, damaged, or cracked fruits and vegetables. They also feed on pollen as it ripens on the tassels or later as it lodges in the leaf axils. Any injury exposing plant sap that has a chance to ferment will attack sap beetles. Sap beetles are present throughout the season and frequently found in ears that have been damaged by other ear feeding pests. Sap beetles are first noticed as the tassels emerge.



Description: Several species of sap beetles will infest sweet corn ears. Sap beetles vary from small black or dark insects with a reddish tinge to brownish-yellow insects that are flattened and broadly oval. Most feed on plant sap that exudes from wounds on ripe and decaying fruit or fungi. A common sap beetle in Kentucky is the four spotted sap beetle known as the "picnic beetle". This beetle is 1/4 inch with four yellowish spots on its black wing covers. Larvae are cream colored insects with dark heads.

Damage: Sap beetles are secondary invaders and usually only cause minimal damage to sweet corn. They are attracted to ear damaged by other pests such as corn earworm and European corn borer. However, in some instances they enter the tips of undamaged ears, cause serious ear damage, and can spread rot causing organisms.

Preventive Management: Sweet corn varieties with poor tip coverage are more vulnerable to sap beetle colonization. Use varieties with good tip coverage. Limit damage by silk-feeding insects such as Japanese beetles and corn rootworm beetles.

How to Scout: During silking, examine silks for the presence of sap beetles. Survey 20 consecutive pants per location weekly. Note the numbers of beetles per ear.

Record: The number of beetles found per 20 plant sample at each location and the growth stage of the corn. If corn is silking, record the average length of the silks.

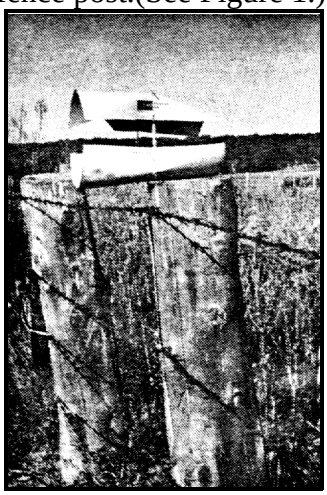
Economic Threshold: There are few guidelines regarding when to treat sweet corn for sap beetles. Treat when sap beetles are found in the silks. Typically, control measures for other insects will adequately control sap beetles. Poor control of other ear-feeding pests will make sap beetle control difficult. Early evening applications are usually more effective for controlling picnic beetles and other sap beetles than morning or midday applications.

APPENDICES

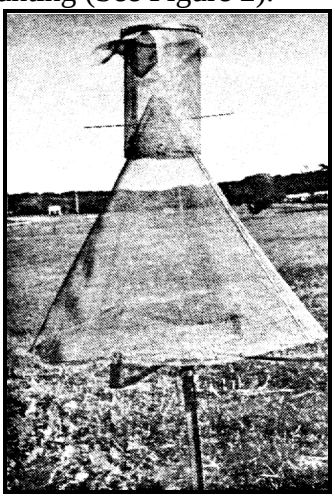
Appendix 1

INSECT TRAPS

The basic principle of pest management is that you do not take action against a pest unless you are certain the pest is present and will be a threat to your crop. Insect traps are a good method of determining if an insect is present and can also give an estimate of their concentration and distribution. Food, light, color or chemicals can be used to attract insects to a trap. However, if you are interested in only one species of insect, such as only the Corn Earworm or only European Corn Borer, a pheromone would be the best choice to attract the insect. A pheromone is a secretion from an unfertilized female insect that attracts only male insects of the same species. The male insects are attracted by the odor of the pheromone. The traps consist of a plastic top and bottom that are held together by a wire hanger. The tops of the traps can be reused and the disposable bottoms are coated with a sticky gel to hold the insects once they land in the trap. The trap can hang from a tree or be mounted to a fence post.(See Figure 1.)



Wire, cone shaped traps can be used to capture live insects. A pheromone is attached to the bottom of the cone to attract the insect. Once the insect enters the trap from the bottom of the cone, it is trapped since it will not fly down. Insects will fly up into the cone and into a smaller, removable top. The top can then be removed to collect the insects for identification or counting (See Figure 2).



We are interested in catching many insects when they are in the moth stage of their life cycle because this is when they will be laying eggs and males will be attracted by the odor of the pheromone. The moths lay eggs which develop into worms that feed on crops. To complete their life cycle the worms change to moths that in turn lay more eggs thus producing more worms. By knowing that the moth stage of a pest is present the farmer can be on the look out for damaging worms that are sure to follow. The presence of the first moth can also be used as starting point for calculating the number of day degrees before the emergence of the worms. This information can help the grower determine the best time to spray for insect control. An insect which follow his pattern of development is the European corn borer. Initial catches of either of these in their respective traps determines the timing and\or need of insecticide treatments against these pests.

Appendix 2

USING PHEROMONE TRAPS

The following are guidelines to be followed when using pheromone traps in sweet corn:

■ Store replacement lures in freezer or refrigerator when not in use. Lures can be stored from one season to the next in the freezer. Write the date the lures were placed in the freezer on each package.

■ Change gloves or wash when handling pheromones for different species of insects to prevent cross-contamination. Minute traces on one pheromone contaminating another will render the second completely ineffective.

■ Begin pheromone trapping May 15.

■ Be sure to place the correct pheromone lure into the correct trap.

■ Hang traps on field margins near silking corn. After the earilest plantings have reached the brown-silk stage, traps need to be moved to fields in the fresh-silk stage.

■ Use 1 trap of each type per each 10 acres.

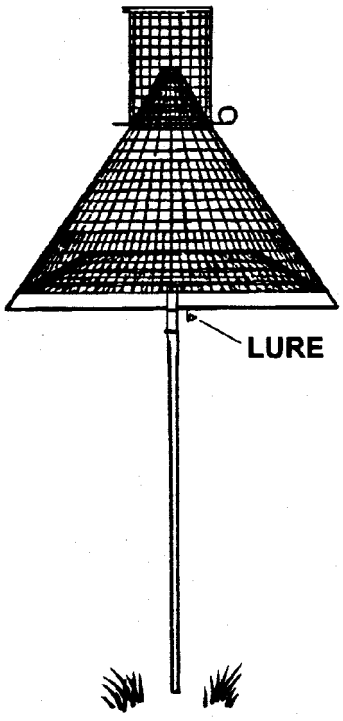
■ Monitor traps at least twice a week, particularly during peak flight periods of the mid summer.

■ Record trap catches on IPM scouting log. I find it helps to keep a running graph of the information.

■ Remove moths collected in trap during each visit and dispose of them away from field.

■ Change pheromone lures every 4 weeks. DO NOT dispose of any lures in the field, these will compete with the traps and affect trap catches.

■ If you cannot identify a particular insect in a trap, send it to your county CES office or to UK Lexington for identification.



Appendix 3

DECISION GUIDELINES WITH PHEROMONE TRAPS

Weekly pheromone trap catch counts for corn earworm, fall armyworm, and European corn borer are used to determine the frequency of insecticide applications during silking in sweet corn. The scout records the trap catches for corn earworm, fall armyworm, and European corn borer twice a week on the scouting form. Add the current catches to the previous catch to get the numbers of the moths collected in each of the trap types for the entire week. Use the following table as a guide to determine the frequency of insecticide applications. Note that insecticides to protect ears only need to be applied while the silks are green.

PEST	**Moths Captured per week**	**Application Frequency**
Corn Earworm	350 or more	Spray every 3 days
	11 to 349	Spray every 4 days
	5 to 10	Spray every 5 days
	0 to 4	See fall armyworm
Fall Armyworm (Check corn earworm first)	10 or more	Spray every 5 days
	3 to 9	Spray every 7 days
	0 to 2	See European corn borer
European Corn Borer (Check corn earworm and fall armyworm first)	1 or more	Spray every 7 days

Appendix 4

PLANS OF INSECT METAL TRAP

The plans of the insect metal traps (follow link above) were developed by **Drs. Doug Johnson** (Entomology) and **Sam McNeill** (Agricultural Engineering) at the Research & Education Center in Princeton. This trap design is often referred to as the 'Texas Cone Trap' and is the preferred trap design for monitoring for corn earworm, tobacco budworm, fall armyworm, and European corn borer. This plan is to provide you withe the necessary specifications to build traps in your own shop.

This plan is also available through the University of Kentucky Agricultural Engineering Department plan service.

Appendix 5

SWEET CORN INTEGRATED PEST MANAGEMENT FORM

COOPERATOR:	SCOUT:	FIELD #:
ADDRESS:		
CITY:	ZIP:	VARIETY:	ACRES:
COUNTY:	PHONE:	DATE PLANTED:

SOIL CONDITIONS	WEATHER	TIME:
WET MOIST DRY LOOSE HARD LIGHT CRUST	COOL WARM HOT SUNNY CLOUDY RAINY CALM LIGHT STRONG WIND	DATE:
PLANT HEIGHT:	STAND COUNT:	GROWTH STAGE:

INSECTS:	1	2	3	4	TOTAL	AVG.	% INFESTATION
1.							
2.							
3.							
4.							
5.							
6.							

PHEROMONE TRAP INFORMATION

LURE TYPE	# MOTHS LAST VISIT	# MOTHS THIS VISIT	TOTAL FOR WEEK (LAST + THIS VISIT)	DATE LURES CHANGED
CORN EARWORM				
FALL ARMYWORM				
EUROPEAN CORN BORER				

PESTICIDES APPLIED	RATE/ACRE	DATE APPLIED
FERTILIZER APPLIED	RATE/ACRE	DATE/APPLIED

COMMENTS:

Appendix 6

Taking Soil Test Samples

Appendix 7

PREDICTING EUROPEAN CORN BORER DEVELOPMENT

The European corn borer is a serious pest of corn and peppers in Kentucky. Corn borers overwinter as full-grown larvae in corn stubble. With the return of warm weather in the spring, development is resumed and the larvae pupate. Temperature plays a major role in determining the rate of corn borer development. The European corn borer has a 50 to 85 F temperature range at which it is most comfortable. Below 50 F it will now develop, and above 85 F development will slow dramatically. The rate of development of European corn borer can be predicted using this relationship. Dr. Grayson Brown at the University of Kentucky developed a degree day model which accurately predicts the occurrence of the different corn borer life stages. It is recommended that these predictions be used in combination with field scouting or pheromone trapping in order to make management decisions. These predictions will alert you to when it is necessary to monitor pheromone traps closely and scout fields for corn borers.

A degree day for European corn borer is one of degree above 50 F over a 24-hour period. For example, if the average temperature for a 24-hour period was 70 F, then 20 degree days would have accumulated (70 - 50 = 20) on that day. These accumulations can be used to predict when corn borers will pupate, emerge as adults, lay eggs, and hatch as larvae. With European corn borer, begin accumulating degree days January 1 of each year. Accumulated degree day totals can be compared with the values in the tables below that correspond to various corn borer life history stages. Tables are available for the first and second generation, in some years a third generation may also occur. Values for the third generation are not available. Values corresponding to initiation indicate when the earliest individuals of that stage may appear.

FIRST GENERATION

Percentage	Pupa	Adult	Flight	Egg	Larval Stages				
					1st	2nd	3rd	4th	5th
Initiation	250	420	550	610	750	970	1140	1290	1420
25%	340	540	690	790	920	1070	1220	1360	1490
50%	390	600	740	850	960	1110	1250	1390	1520
75%	450	650	790	900	1000	1140	1280	1420	1550
100%	560	760	900	990	1090	1210	1350	1490	1620

SECOND GENERATION

Percentage	Pupa	Adult	Flight	Egg	Larval Stages				
					1st	2nd	3rd	4th	5th
Initiation	1440	1620	1660	1740	1860	1970	2140	2250	2370
25%	1580	1730	1880	2020	2160	2280	2420	2540	2800
50%	1620	1780	1950	2110	2250	2370	2500	2630	2930
75%	1660	1830	2030	2190	2330	2440	2580	2700	3060
100%	1730	1940	2190	2360	2490	2590	2720	2840	3500

For example, a degree day value of 750 would indicate that nearly 100% of adults have emerged from pupae, of which slightly more than 50% have flown, egg laying has begun, but is less than 25% complete, and that the earliest first instar larvae may be present. This example illustrates the need to compare the accumulated degree day total with values in several columns of the table. During the growing season there is usually a mixture of different stages in a field. Because corn borers emerge at different times, not all corn borers will be in the same stage at any particular time.

Current degree day accumulations are available for European corn borer as well as other insects for various locations in the state through the Agricultural Weather Center maintained by the UK Department of Agricultural Engineering. Up-to-date European corn borer estimates are available through the World Wide Web using the following address "http://wwwagwx.ca.uky.edu/"

Appendix 8

REACTIONS OF SWEET CORN HYBRIDS TO DISEASES BASED ON DISEASE NURSERIES AT THE UNIVERSITY OF ILLINOIS FROM 1984 TO 1992

Common rust, Stewart's wilt, northern leaf blight (NLB), and common smut are diseases of sweet corn. Resistance or susceptibility varies among sweet corn hybrids. Dr. Jerald K. Pataky has evaluated hybrids for reactions to these diseases between 1984 and 1992 at his research nurseries at the University of Illinois. Hybrids have been classified resistant (R), moderately resistant (MR), moderate (M), moderately susceptible (MS), or susceptible (S). All ratings presented in this appendix are based on at least two years of testing.

Sweet corn hybrids rated resistant were among the best 10 to 20% of the hybrids. Hybrids rated as susceptible were among the worst 10 to 20%. The moderate ratings included hybrids that were within 10% above or below the average. Some disease can occur on hybrids rated R, but the amount of disease will be less than what would develop under the same conditions on hybrids rated MR, M, MS, or S. Likewise, disease development would be less on MR hybrids than on M, MS, or S hybrids under the same disease pressure.

Pataky, J. K. 1992. Reactions of sweet corn hybrids to common rust, Stewart's wilt, northern leaf blight, and common rust.

Hybrid	Maturity	Rust	Stewart's	NLB	Smut
YELLOW SHRUNKEN					
Butterfruit	72	M-S	S	MS-M	R-S
Candy Bar II	76	S	MR-MS	MS-S	S
Challenger	78	M-MS	R-MR	R-MR	M-S
Crisp n Sweet 710	85	MS	MR	R	M-S
Crisp n Sweet 711	85	M-S	R-MR	R	R-MS
Extra Early Supersweet	73	M	S	S	M
Fanciful	83	M	S	MS	MR-M
Flagship	85	MR-MS	MR	R-MR	MR-MS
Florida Staysweet	85	M-S	R-MR	R-MR	R-MS
Golden Gourmet	82	M-MS	R-M	MR-MS	R-MR
Illini Gold	79	M	M-S	MS-S	MR-MS
Landmark	75	MS-S	S	M	M
Maxisweet	82	MR-MS	R-M	M-MS	R-S
Natural Sweet 9000	87	R-MR	R	R-MR	MR-M
Northern Supersweet	72	M-S	MS-S	MR-M	MR-S
Paksweet	78	MR-M	MR-M	MR-MS	R-S
Pinnacle	77	M-MS	M-MR	R-MR	R
Polar Supersweet	74	M-MS	MS-S	M	MR-S
Quasar	75	M-MS	MR-M	MR	R-MR
Springsweet	80	M	M-MS	M-MS	M-S

Hybrid	Maturity	Rust	Stewart's	NLB	Smut
YELLOW SHRUNKEN					
SsuperSweet 7210	78	M-S	R-MR	R-MR	M-S
SsuperSweet 7410	81	M	M-S	MR	R-S
SsuperSweet 7500	83	MR-M	M-MS	MR	R-M
SsuperSweet 7620	82	M	R	R-MR	M-MS
SsuperSweet 7630	85	M-S	R	R	R-S
SsuperSweet 7710	83	M-S	R	R	R-S
SsuperSweet 7720	82	M-MS	R-M	R	M
Stylesweet	85	M-S	M-MS	S	R-M
Sucro	86	MR-R	MR-R	MR	-
Sugarcane	81	S	MS	S	M-S
Sunset	83	M-S	MR-M	MS-S	MR-M
Ssupersweet Jubilee	82	MR-MS	S	MS-S	M-S
Sweet Belle	86	MS-S	MR-M	MR-M	MR-M
Sweet Desire	79	MS	S	MS	MR-S
Sweet Dreams	81	MS-S	MS-S	M-MS	MR-S
Sweet Ears	76	M	MR-MS	M	M
Sweet Season	83	MR	R-MR	MS-S	R-MS
Sweet Treat	76	MS-S	MS	MR-MS	-
Sweetie 76	76	R	M	MR-M	R
Sweetie 82	82	R-MR	MR-M	MR-M	R-MS
Tribune	88	R	R-M	R	R-MR
Ultimate	83	M-S	R-MR	R	R
Upmost	72	MS-S	MS-S	S	M-MS
WI Natural Sweet	85	M-MS	R-MR	R-MR	-
Xtra Sweet 82	72	S-MS	M-S	M-MS	M-R
Yankee Belle	75	M-S	M-MS	M-MR	S
Zenith	81	MR	R-M	MR-M	M
BI-COLOR SHRUNKEN					
Butterfruit Bicolor	84	M	MR-MS	R	R-M
Candy Store	81	MR-M	MR	M	R-M
Crisp n Sweet 730 BC	87	M-S	MR-R	R	MR-MS
Dazzle	85	MR-S	MS	MR-MS	MR-S
Diablo	75	MR-M	S	M	MS
Domino	76	M	MR-M	MR-M	M
Escalade	82	M-MS	MR-M	R	M-MS
Harlequin	82	M	M	M	R
Honey and Pearl	76	MR-M	M	M-MR	M
Hudson	83	M	MR-MS	MR-M	R-M
Ivory and Gold	75	M-MS	MR-S	MR-MS	MR-M
Milk 'n Honey	80	M-S	M	M-MS	MR-M
Paragon	74	MR-M	M	M	S

Hybrid	Maturity	Rust	Stewart's	NLB	Smut
BI-COLOR SHRUNKEN					
Phenomenal	85	MS-MR	M-MS	MR-M	MR-M
SsuperSweet 7702	77	MR-M	MR-M	R-MR	MR-S
SsuperSweet 8102	81	MR-MS	MR	R	MR-MS
SsuperSweet 8502	85	M-S	R-MR	R-M	M-MR
Sugarbi	76	M	R-M	MR-M	M
Sweeter Bi Far	79	M-MR	M	R-MR	MR
Sweet Heart	74	S	M-MS	MS	R-M
Sweet Success	82	MR	R-MR	R-MR	R-MR
Top Notch	73	S	MR-MS	S	MS-S
WHITE SHRUNKEN					
Camelot	86	MR-M	MR-M	MR	R-S
Even Sweeter	86	M-S	MS-MR	MR-MS	R-M
How Sweet It Is	85	MR-MS	MR	MR	MR-MS
Pegasus	92	M	MS-S	MR-MS	MR-S
Silver Extra Sweet	85	M	MR-M	M-S	M-MR
Something Else	NA	S	M-MS	M	R-MS
SsuperSweet 7801	78	M	S	MS-S	MR-S
SsuperSweet 8501	85	M-S	R-M	R-M	R-M
Ssupersweet 8601	86	MR-M	R-M	R-M	R
Ssupersweet 8701	87	MR-S	MS-S	MS-S	MS-M
SsuperSweet 8801	88	MR-R	MR-M	MR-M	R-S
Sweet Tooth	82	MR-M	MR-M	M	MR-M
YELLOW SUGARY ENHANCER					
Allegro	78	M	S	M-S	M-R
Bodacious	75	R-M	MR-MS	M-MR	R-M
Celebrity EH	86	MR	S	S	-
Champ	72	MR	MR-MS	MS-M	R-M
Classic	79	MR-MS	R	R-MR	R-M
Esteem	81	R	MR-M	MR-M	R-MR
Extender	84	M	M	MS-S	MR
Flavor King	86	MR-M	R-MS	M-S	R-MS
Flavor Queen	85	MR	R-M	MS	R-MS
Incredible	85	MR-R	R-M	MR-MS	R-M
Kandy Korn EH	89	R-M	MR-MS	MR-M	-
King Arthur	77	M	S	MR	MR-M
Legend	72	MR-M	S	MS-S	MR
Maple Sweet	74	MS-S	S	MR-M	MR-M
Merlin	84	R-MR	R-MR	MR	R
Melody	85	R	MR	M-MS	R-MR
Miracle	84	R-MR	R	R-MR	R-M

Hybrid	Maturity	Rust	Stewart's	NLB	Smut
YELLOW SUGARY ENHANCER					
Precocious	70	MS	S	MS	S
Seneca Arrow	78	MR-MS	M	MR	MR-M
Seneca Sentry	88	MR-M	MR	MR-M	-
Sugar Ace	79	MR-M	MR-M	M-S	R
Sugar Buns	72	R-M	M-S	R-MR	M-S
Supreme	74	R-M	S	S	MR
Sweet Dawn	67	MR-M	MS-S	MS-S	MR-M
Sweet Pak	82	MR-MS	MR-MS	MR	R-M
Sweet Start	68	M	S	S	MR
Tastee Treat	87	R-MR	R	R-MR	R
Tendertreat EH	95	R-MR	MR-M	MS-S	-
Terminator	83	R	R	M	R-MR
Tuxedo	79	R-MR	R-MR	R-MR	R-MR
BI-COLOR SUGARY ENHANCER					
Ambrosia	75	MR-MS	R	M	R-S
Calico Belle	79	MR	MR-MS	M-S	R-M
Clockwork	77	MR-S	R-M	S	M-S
D'Artagnan	71	MS-S	M-S	MS-S	R-S
Diamonds and Gold	80	MR-MS	S-MS	S	R
Double Delight	87	M-S	R-MR	MR	-
Double Treat	84	M	M	M-MS	M
Gemini	79	M-MS	MS-S	MR	MR-M
Lancelot	83	R	MR	MR	R-M
Medley	73	M-MS	MS	MS-S	M-S
Pilot	90	M-MS	M-MS	M	R-MS
Seneca Brave	68	M-MS	MS	MS	M
Speedy Sweet	66	S	S	S	R
Tri-sweet	72	MS-S	MR-MS	MS-S	MR
WHITE SUGARY ENHANCER					
Alpine	79	M-MR	M-MS	MR-M	MR-M
Argent	86	MR	R	MR	R-MR
Coronation	77	MR-M	R	M	MR-M
Divinity	79	MR-M	MR-M	R-MR	R-M
Pristine	76	MR-MS	R-MR	M-S	MR-S
Seneca Starshine	71	MR-MS	MR-M	MR	R-M
Silverado	78	MR-MS	R-MR	MR	-
Silverette	79	MS	M-MS	MR	R
Snow Queen EH	87	M-MS	MS-M	S-MS	-
Snow Sweet	73	MR-MS	M	R	M-MS
Snowbelle	79	M-MR	MS-S	MS-S	M-S

Hybrid	Maturity	Rust	Stewart's	NLB	Smut
WHITE SUGARY ENHANCER					
Viva	78	M-S	M-MS	MS-S	R-M
Zest	79	MR-MS	MS-S	MS	M-S
YELLOW SUGARY					
aRRestor	84	R	MR-MS	R-M	-
Banner	85	MR-M	M-S	M	-
Bingo	77	R	MR-MS	S	R-M
Bonanza	82	M-S	M-MR	MR-R	-
Buttersweet	83	MS	R-MR	MR-M	R-S
Buttervee	70	R-MR	MS-S	S	M-S
Commander	89	MS	R-M	MR-MS	-
Cornucopia	85	R	MR-M	MS-S	MR-M
Earlivee	69	MS-S	MS-S	R-S	M-S
Earlivee II	69	M	S	S	S
Early Pak	71	MS	M-MS	M-MS	MR-M
Enforcer	78	MR-M	MR-M	MR-S	M
Excellency	85	R	M	R-M	MS-S -
Flavorvee	86	R-MR	R-MS	M	R
Gold Cup	78	MR-M	MR-M	MR-MS	-
Golden Queen	88	MS-S	R-M	MR-M	-
Honeycomb	80	MR	MR-MS	R-MR	-
Hypak	76	M	R-M	M	S
Insignia	86	R	MR	S	M
Jubilee	81	M-MR	S	MS-S	MR-MS
Merit	80	S-MS	M-MS	M-MS	MS
More	81	R-MR	R	R	R-M
NK 199	82	MR-M	MR	M-MR	-
Norgold	83	MR-MS	S	MS-S	MR-M
Norsweet	77	MR	MS-S	MR-M	R
Patriot	87	R	M-MS	MS-S	M
Precedent	79	M	M-S	M-MS	-
Prime Pak	82	MR-R	R-MR	R-M	R-MR
Reliance	76	M	MR-M	MR-M	MS
Rely	86	MR	M-MS	S	R-S
Rival	78	MR-MS	MR-MS	MS	MR-MS
Renown	85	R	R-MR	S	R-M
Reveille	68	S	MR-MS	S	R-MS
Savor	75	M-S	S	MR-MS	M
Seneca Chief	85	MS-S	M-MS	M-MS -	
Seneca Horizon	65	R-MR	MS-S	R-M	-
Shield Crest	85	R	R-MR	S	R-M
Spartan	71	MS-S	S	MS-S	S

Hybrid	Maturity	Rust	Stewart's	NLB	Smut
YELLOW SUGARY					
Springdance	76	M-S	S	MR-S	R-M
Stylepak	85	MR-MS	MR-M	MS-S	M
Sugar Loaf	83	R-MR	MR-M	R-MR	-
Sweet Tennessee	86	M-S	R-MR	MR	R-S
Viking	85	MR-M	M	MS	R-M
WHITE SUGARY					
Platinum Lady	81	MR-M	S	S	MS
Silver Bullet	67	MR	M-S	MR-S	M-S
Silver Queen	88	MS-S	MR	MR	-
BI-COLOR SUGARY					
Bi-Guard	77	M-MS	M-MS	R-M	M
Bi Queen	88	MS-S	R-M	MR-R	-
Calypso	82	MS-M	MR-S	MS-S	-
Honey n Frost	83	MR-M	R-MR	R-M	R-M
Metis Horizon	76	MS-S	MS	MS	R-M
Quickie	67	S	M-S	S	MS-S
Sweet Sal	80	M-MS	MR	MR-R	-
Sweet Sue	85	S	R-M	M-MR	-