Key Information about beet armyworm

Compiled by Dr. Lisa Myers
Senior Research Director Plant Protection
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Source MANAGEMENT OF THE BEET ARMYWORM (LEPIDOPTERA: NOCTUIDAE) IN COTTON: ROLE OF NATURAL ENEMIES JOHN R. RUBERSON, GARY A. HERZOG[2], WILLIAM R. LAMBERT, AND W. JOE LEWIS. *Florida Entomologist* 77(4) December, 1994
[1]

- First, *S. exigua* has a relatively brief developmental time under field conditions (Ali & Gaylor 1991), permitting rapid cycling of generations.

- Second, it has a high reproductive capacity, with average calculated fecundities ranging from 604.7 to 1724.7 eggs per female (Wilson 1934, Hogg & Gutierrez 1980, Chu & Wu 1992). A simple calculation illustrates this point.

    - Assuming a population sex ratio of 1 female to 1 male, a realized field fecundity of 200 eggs (approx. 2 egg masses) per female and restricted emigration and immigration, 99% mortality within a generation would be necessary to simply maintain the population at a constant size. Thus, suppression of this pest requires high levels of mortality to counterbalance its high fecundity.

- Third, these insects are highly mobile and are thus capable of colonizing wide-ranging areas (French 1969, Mitchell 1979).

- Finally, insecticides typically provide less than adequate control (e.g., Cobb & Bass 1975, Meinke & Ware 1978, Brewer & Trumble 1989, Wolfenbarger & Brewer 1993). This is due, at least in part, to the insect's innate tolerance of many insecticidal materials at recommended field rates.

- But the beet armyworm's ovipositional and feeding biology also influences insecticide efficacy. Females oviposit eggs in masses of 46 to 230 eggs ($\bar{x} \pm SD = 99.4 \pm 40.6$; n = 75 field-collected egg masses; J.R.R. unpubl.)

- Further, beet armyworm larvae feed in groups through the first and second instars, and then disperse as third instars (Poe et al. 1973). This feeding behavior concentrates a large proportion of the population into a relatively small area during the period when the larvae are most susceptible to insecticides. Thus, to kill a sufficient number of larvae to attain control, the material must contact a relatively small proportion of the plant canopy in the plant region most difficult to cover — a very difficult proposition when the plants are large and the canopy is closed. In the case of scallion if the larva bore into the leaf it makes it even more difficult for the insecticide to get to the larva.

- Despite its pestiferous potential, the beet armyworm has been historically a sporadic and minor pest of cotton in the southeastern United States (Smith 1989). In recent years, however, it has become a persistent and serious cotton pest in the Southeastern and mid-southern United States, especially in regions conducting the Boll Weevil Eradication Program (e.g., Fig. 1). However, the current ubiquity and consistency of the outbreaks, both inside and outside of active eradication zones, suggest that this pest has become a more widespread and serious cotton pest for reasons independent of the Boll Weevil Eradication Program. However, this program likely provides a ready opportunity for the beet armyworm to escape natural controls.

- The role of natural enemies in scallion systems is not clear; however in cotton natural enemies appear to be a key element in the management of the beet armyworm. Birds and insect natural enemies' aid in armyworm control, but may or not exert enough pressure to prevent yield loss, this is the case particularly in sweet corn.

- In 1973, Eveleens et al. demonstrated that beet armyworm outbreaks could be induced by applications of organophosphate insecticides in cotton. Cotton can support a large and diverse complex of beneficial arthropods (Whitcomb & Bell 1964, van den Bosch & Hagen 1966) (info lacking in scallion and in production systems receiving multiple treatments of highly toxic materials, such as organophosphates and pyrethroids, these complexes can be seriously disrupted for the remainder of the growing season. Subsequently, in the absence of the beneficial arthropods, production of an acceptable crop will require continued, repeated use of insecticides. [Granular formulations of several pesticides are available in the US that reduces the exposure to non-target organisms by concentrating the pesticides in the whorls and leaf axils, particularly when applied in tight bands over the rows].

- In one study dry weather and early season insecticide applications were the two factors which best correlated with BAW outbreaks; in another, outbreaks of beet armyworm were reported to be sporadic, occurring roughly every 2-5 years (Rabb & Kennedy 1979). These outbreaks typically occur one or two generations after favorable climatic conditions are accompanied by suppression of biological control agents by pesticides used for control of other pests.

- **Life cycle**
  - Life cycle can be completed in 24 days with 6 generations in five months during summer
  - Eggs laid in clusters; hatch in 2-3 days
  - There are usually 5 instars (takes 8- 10 days to reach 3rd instar)
  - 1st and 2nd instars are pale green to yellow; 3rd instar has pale stripes; 4th instar is darker dorsally with dark lateral stripes; 5th instar larvae are variable in color being green dorsally or pink or yellow ventrally with a white stripe laterally. Dark spots and dashes usually present
  - Pupation occurs in the soil – duration 6-7 days

- Mating occurs soon after emergence and egg laying commences within 2-3 days
- Oviposition extends over 3-7 days
- Moth die within 10 days

- **Host Plants**
  - The Beet Armyworm has a wide host range, occurring as a serious pest of vegetable, field, and flower crops. Among susceptible vegetable crops are asparagus, bean, beet, broccoli, cabbage, cauliflower, celery, chickpea, corn, cowpea, eggplant, lettuce, onion, scallion, pea, pepper, potato, radish, spinach, sweet potato, tomato, and turnip. Field crops damaged include alfalfa, corn, cotton, peanut, safflower, sorghum, soybean, sugar beet and tobacco. Weeds also are suitable for larval development, including such common plants as lambsquarters, *Chenopodium album*; mullein, *Verbascum* sp.; pigweed, *Amaranthus* spp.; purslane, *Portulaca* spp.; Russian thistle, *Salsola kali*; parthenium, *Parthenium* sp.; and tidestromia, *Tidestromia* sp.

- **Damage**
  - Larvae feed on both foliage and fruit and it is regarded as a serious defoliator of flower crops and cotton. Young larvae feed gregariously and skeletonise foliage. As they mature, larvae become solitary and eat large irregular holes in foliage. They also burrow into the crown or centre of the head on lettuce, or on the buds of brassica crops. Tomato fruit is most susceptible to injury, especially near fruit maturity. They feed in leaf whorls in scallion and burrow in the bulbs.

- **The most important BAW management practices to minimize crop loss are:**

  - Preservation of beneficial insects, thorough scouting, early detection and the use of treatment thresholds e.g 5 larvae per 25 plants scouted (0.2-0.3 larva per plant).
  - There are two general types of thresholds "early detection" and "remedial". The term, "early detection", refers to the scouting and discovery of unhatched and newly hatching egg masses only; while "remedial" refers to fields where scouting reveals relatively larger larvae that have dispersed to some degree from the egg masses and are generally distributed in the field. The time from early detection to a more generally developed infestation may only be a few days. Control efforts will be more effective when directed at newly hatched to 3rd instar larvae,

  - Treatment should be considered if the early detection threshold is reached or exceeded, and conditions are optimal for a BAW outbreak (i.e., many of the key outbreak factors exist). Ovicides alone apparently are not very

effective against BAW because the eggs are well protected by the cotton canopy and moth scales and hairs covering the eggs.

- Therefore timing of pesticide applications just when first instars appear is important. At this stage BT compounds alternated with Spinosad (Success® or Entrust®) Please note resistance development to Spinosad has been reported elsewhere. (Spinetoram a derivative of Spinosad from Dow Agro Science is available in the US for use in IPM of beet army worm). Care must be taken in using pyrethroids (eg Danitol ® and Karate®) and methomyl (eg Lanate®) since it has been shown that these disrupt natural enemy associations with the pest and favour resistance development if used extensively. For larger instars control is difficult even with synthetics due to the rapid development of resistance

- Spod-X is a viral product, which is specific for BAW, and has worked well in some trials. Multiple applications (3-4) on a 2-3 day interval may be required for this product.

- **Beetarmy Worm Mating Disruption Applications**

  Pheromones can also be used to disrupt mating and inhibit or eliminate reproduction. Saturation of the atmosphere around beet armyworm-susceptible crops has been estimated to reduce mating by 97% (Wakamura and Takai 1992).

  *Check Mate Flowable Formulations**.**

  - Convenient-to-use flowables can be applied with conventional or low-volume spray rigs. They're compatible with pesticide or fertilizer tank mixes and stay in suspension. Depending on weather conditions flowables are effective for 21 to 30-days. Suterra (www.suterra.com)

CheckMate BAWF: Mating Disruption Sprayable Pheromone for the Control of Beet Army Worm (*Spodoptera exigua)* in Vegetables

- Effective pheromone-based insect control
- Controls insecticide-resistant moths
- Reduced labour costs
- No residues on fruit
- No pre-harvest intervals
- No field re-entry delay
- No environmental hazards
- No effect on beneficial insects
- Highly pest selective

CheckMate BAW-F is a cost effective biorational control product for use against Beet Army Worm (***Spodoptera exigua).*** This product is undergoing development and is not yet commercially available in Europe.

CheckMate BAW-F is a patented liquid pheromone system designed to deliver sex pheromone for control of Beet Army Worm through mating disruption. When used as directed, this product saturates the crop environment with pheromone for an extended period of time (up to 30 days) so that individual males cannot locate female moths ready to mate.

CheckMate BAW-F is an ideal product for use in Integrated Pest Management strategies.

CheckMate BAW-F is specific for Beet Army Worm, leaving beneficial parasites and predators in the crop. These beneficials aid in control of the mites, aphids and other secondary pests.

Tips and Techniques

Monitoring traps must be placed in the crop early enough to detect the first moths

emerging from over-wintering. For best results apply Checkmate BAW-F early in the season, as soon as the first Beet Army Worm is detected by a pheromone monitoring trap, or by field inspection.

In crops subject to high levels of attack by Beet Army Worm in the previous year, or where damage to the fruit was above the tolerance thresholds, mating disruption should be integrated with chemical or other biorational product (e.g. BT's) treatments.

Mating disruption works best in the control of Beet Army Worm when used in crops of at least 2-3 hectares of surface.

Monitor Beet Army Worm infestations with pheromone traps and by visual inspection of fruit. Place one monitoring trap per 4 hectares with a minimum of two traps per block. Place additional traps on borders that are most subject to migrations from adjacent fields or host crops.

Pheromone mating disruption treatments will shut down trap catches of male moths. Pheromone lures, can not detect migration of Beet Army Worm females from adjacent fields or developing infestations of secondary pests.

Monitoring and Mass trapping

1. Bucket traps or unitraps (Trece, Inc., Salinas, CA; or Gemplers) can be used to trap the male moths. Bucket traps are to be baited with rubber septa beet armyworm pheromone lures (Trece, Inc., Salinas, CA) or other commercially available lures eg Hercon, or Scenturion. These lures are to be replaced every 2 weeks throughout the evaluation period. Each bucket trap can contain either a 2.5 x 7.5 cm strip of DDVP (Vaportape II, Hercon Environmental Co.,) or soap water to kill captured moths. The bucket traps can be supported by 1.25 m long x 0.65 cm diameter metal rods with a hook on the end. The bar is to be inserted into the soil, so that the bucket is suspended about 1 m above the ground. Moths are to be collected from the bucket traps every 5-7 days. Traps can be placed inside the fields approximately 50 m from the edge and at least 30m apart and uniformly spaced.

Reusable unitrap or bucket traps 8.5” H x 6.5 “ D
Please see attached file for details on traps

Delta traps used to trap large and small moths; lures not included; traps will have to be serviced more often then bucket traps. Please see attached file for details on Trece delta trap