AG1306

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Southern IPM Center

MSEWG
Mid-South Entomologist Working Group

What You Need to Know...

To Successfully Use Viruses for Control of Corn Earworm in Soybean and Sorghum

Keys to Success

1. *Helicoverpa* NPV only kills corn earworm and tobacco budworm.

Identification is key!

2. *Helicoverpa* NPV only kills larvae less than 0.5 inches.

Do not use on large larvae!

3. *Helicoverpa* NPV takes 4 to 6 days to cause death.
4. USE A REDUCED action threshold of:

2 to 5 SMALL larvae in 25 sweeps

5. DO NOT USE when more than 5 large larvae are present in 25 sweeps.
6. Do not leave *Helicoverpa* NPV in direct sunlight or store at temperatures above 77˚F.
7. Always read the label thoroughly.

Introduction

Helicoverpa NPV is a relatively inexpensive ($3 to $6 per acre) viral bioinsecticide. The currently registered tradenames are Heligen, Helicovex, and Gemstar. *Helicoverpa* NPV specifically targets Heliothines including the tobacco budworm and the corn earworm (i.e., cotton bollworm, soybean podworm, sorghum headworm, and tomato fruitworm). ***Helicoverpa* NPV DOES NOT KILL OTHER INSECTS (PESTS OR BENEFICIALS)!**

Target Population and Threshold in Soybean

Once ingested, *Helicoverpa* NPV kills the larvae by replicating within the host cells. Small larvae (less than 0.5 inch) will die within 4 to 6 days after infection. When they die, they will liquefy and release millions of viral particles back into the crop canopy. Larger larvae (greater than 0.5 inch) will cause significant damage even when infected with *Helicoverpa* NPV. **DO NOT USE *Helicoverpa* NPV FOR CONTROL OF LARGER LARVAE!** We recommend applying *Helicoverpa* NPV when the larval population reaches **2 to 5 SMALL larvae/25 sweeps**. See *Helicoverpa* Growth Stage Identification for more information on small or large larval size.

Figure 1: Three small larvae infected with *Helicoverpa* NPV.

Scouting

When you sample a field with a sweep net, count the number of corn earworm and tobacco budworm larvae separate from other larvae present. Determine if the majority of larvae present are small or large. If corn earworm/tobacco budworm larvae are present, answer the following questions to determine if *Helicoverpa* NPV is an option for control:

- **Are you below the normally recommended action threshold?**
- **Are the larvae mainly small?**

If you are below the normally recommended action threshold AND the larvae are small, *Helicoverpa* NPV is an option for control. Otherwise, consider alternative methods of control.

Rates for Labeled Products

Product	Concentration	Rate
Heligen	$7.5x10^9$ a.i./mL	1–1.6 oz/a
Helicovex	$7.5x10^9$ a.i./mL	1–2.5 oz/a
Gemstar	$2x10^9$ a.i./mL	4–10 oz/a

Post-Application Scouting

After an application of *Helicoverpa* NPV, scouting should be done by looking for active feeding rather than counting live larvae. Soon after infection, larvae stop feeding even though they are still alive. Also, keep an eye out for dead or dying larvae in the crop canopy (Figures 2-6).

Symptomology

Not much difference between diseased and healthy larvae can be observed during the early stages of infection. As the infection progresses, larvae will stop feeding. Eventually they will begin swelling and shrinking as liquefaction begins. Before death, they will migrate to the top of the canopy and begin secreting viral droplets, giving the appearance of sweating. Then, the prolegs and anus of the larvae adhere to the leaf surface before complete liquefaction and death (Figures 3-5). This liquid contains millions of viral particles that will be released back into the environment where infection of healthy larvae can occur.

Residual Time and Spread

Helicoverpa NPV has the potential to spread long distances and remain active in the crop for several generations IF the conditions are right. In 3 days, *Helicoverpa* NPV can spread up to 200 feet, possibly further, by several insects including minor pests and beneficial arthropods (Figure 6). Residue of *Helicoverpa* NPV can remain viable on leaves in the crop canopy for several weeks without larval hosts present, but the biocontrol agent is most effective when fresh corn earworm or tobacco budworm larvae are continually present. One application of *Helicoverpa* NPV is capable of infecting multiple generations of corn earworm and tobacco budworm when sustained flights of moths, deposition of eggs, and new hatching larvae are occuring.

Figure 2: Larva dead from *Helicoverpa* NPV attached to a soybean leaf.

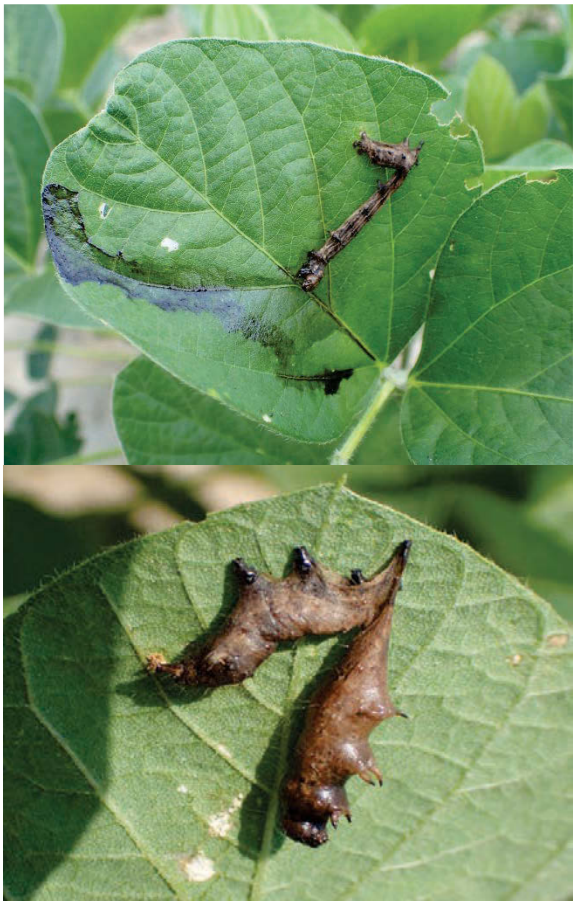

Figure 3: Larvae dead from *Helicoverpa* NPV.

Figure 4: Larva dead from *Helicoverpa* NPV hanging from a leaf.

Helicoverpa NPV Storage

Helicoverpa NPV viral activity decreases the longer it is stored. To ensure viral activity at the time of application, the product should be stored at the lowest temperature possible. Temperatures below 59˚F are necessary if kept for longer than 6 months. It can be stored at room temperatures (77˚F or less) for up to 6 months, and should never be kept at temperatures above 86˚F. Don't put *Helicoverpa* NPV in direct sunlight for longer than 2 hours or leave *Helicoverpa* NPV in the application tank for extended periods of time before application as this will inactivate the virus.

Figure 5: Two liquefied larvae with a healthy larva.

Tank Mixes and Application Information

Remember, **ONLY apply *Helicoverpa* NPV when there are 2 to 5 SMALL larvae/25 sweeps.** *Helicoverpa* NPV should be applied by either a ground applicator or aerial applicator at a minimum volume of 10 gallons per acre or 3 to 5 gallons per acre, respectively. If applied in water, *Helicoverpa* NPV can be tank-mixed with herbicides, fungicides, foliar fertilizers or other insecticides as long as the mixture does not exceed a pH of 8. *Helicoverpa* NPV should not be tank-mixed in an oil solution (according to Heligen label).

Do not apply *Helicoverpa* NPV if heavy rain is expected within an hour of application, but application can occur in light rain. There is no pre-harvest interval (PHI), and the re-entry interval (REI) is 4 hours.

Target Population and Threshold in Sorghum

Remember, *Helicoverpa* NPV only kills corn earworm and tobacco budworm larvae smaller than 0.5 inch (see chart below). *Helicoverpa* NPV should be applied in reproductive sorghum when the threshold of **ONE larva PER HEAD** is reached and in situations where the majority of larvae are small. *Helicoverpa* NPV can be tank-mixed with midge applications or other insecticides as long as the mixture does not exceed a pH of 8.

Helicoverpa Growth Stage Identification

Instar	Age days	Size category	Length mm	Actual size	NPV Timing
1st	0 - 2	Very Small	1 - 3		✔✔
2nd	2 - 4	Small	4 - 7		✔✔
3rd	4 - 8	Medium (small)	8 - 13		✔
4th	8 - 11	Medium (large)	14 - 23		✖
5th	11 - 14	Large	24 - 28		✖
6th	14 - 18+	Large (snake)	29 - 40+		

Table Credit: AgBiTech

Aaron Cato

Figure 6: Carriers of *Helicoverpa* NPV.

How to Identify Bollworm and Tobacco Budworm

Since *Helicoverpa* NPV is specific to corn earworm and tobacco budworm, proper identification is vital. It is difficult to separate corn earworm and tobacco budworm larvae, but easy to distinguish them from other larvae found in soybean fields. Corn earworms and tobacco budworms have four prolegs, black spines on their body, an orange head capsule (Figure 7 (A)), and are highly variable in color. Four pairs of prolegs distinguish corn earworms and budworms from green cloverworms (3 pairs) and loopers (2 pairs) ('B' and 'C' respectively, in Figure 9), but not from velvetbeans (4 pairs). However, velvetbean caterpillars will thrash violently like green cloverworms when disturbed, unlike the corn earworm which will sometimes curl into a ball or bite.

How to Separate From Armyworms

Armyworms have four black dots on the last abdominal segment which are lacking in the corn earworm/tobacco budworm (Figure 8). Fall armyworms also have a black spot on each side above the third pair of true legs that readily separates them from corn earworm/tobacco budworm (Figure 9). They also have an inverted "Y" on their head capsule lacking in the corn earworm/tobacco budworm, and armyworms lack the black spines present on the corn earworm/tobacco budworm (Figure 8). Yellow-striped armyworms have a prominent yellow stripe down both sides that is lacking in the corn earworm/tobacco budworm.

Figure 7: A corn earworm (A) with four pairs of prolegs compared to a green cloverworm (B) with three pairs of prolegs, and a looper (C) with two pairs of prolegs.

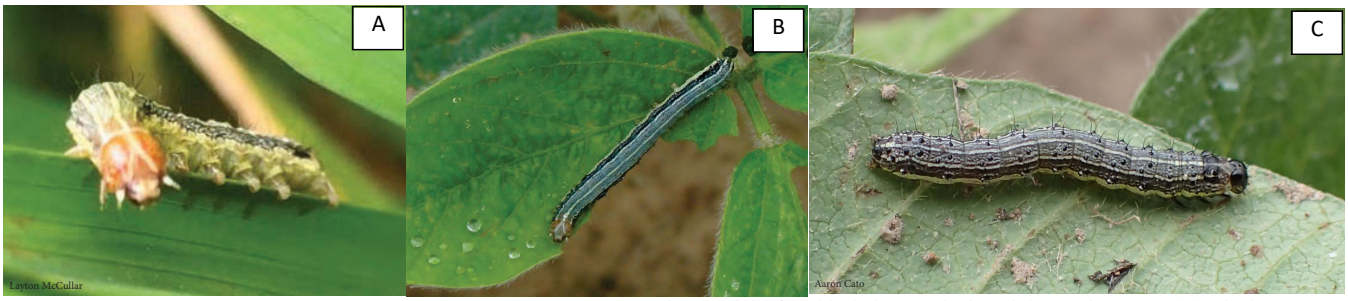

Figure 8: Presence of an inverted "Y" on the head of the fall armyworm (A and B), and the four black dots on the last abdominal segment (C) which distinguish fall armyworms.

Figure 9: The corn earworm (A) does not have a single black spot above the third pair of true legs, while the fall armyworm (B) and yellow-striped armyworm (C) do.

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