SPODOVIR®

Natural Efficacy that is Reliable

Technical Information

Target Pest
Spodoptera frugiperda; common name: Fall Armyworm

Crops
Row Crops (Corn, Sorgum, Cotton, Soybean)

Formulation
Wettable Powder containing >6x10^{12} OBs (occlusion bodies) *Spodoptera frugiperda* nucleopolyhedrovirus (SfMNPV) per kilogram

Standard Dosage
Depending upon crop and pressure: 50-100g/ha

Timing
For optimal timing, target first application at the beginning of moth flight, ensuring to continue to cover egg laying and 1st instar presence

Mode of Action
Larvae need to ingest the virus particles sprayed onto the plant Surface in order to become infected.

Water Volume
200-1600L/ha. This should be adjusted according to the canopy density. Repeat applications every 7 days until larvae hatching period is over.

Pre-harvest (PHI) and Re-entry Interval (REI)
No residues. PHI and REI are defined according to the national registration regulations

Toxicity Profile
Contains no chemical ingredients. No residue on the crop. Complies with international guidelines for organic farming. No side effects on mammals, beneficial insects, bees, aquatic organisms and other non-target organisms. No max-residue levels (MRLs) are defined for Spodovir.

Compatability
Compatible with most insecticides, fungicides and fertilizers. **A pH level between 5 and 8.5 in the tank mix must be respected.**

Storage
Excellent storage stability:>2 years at -18°C, 2 years at 5°C. Avoid temperatures above 25°C

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High Selectivity and Safety

The active substance of Spodovir® is a *Spodoptera frugiperda* nucleoploy hedrovirus (SfMNPV). This virus belongs to the family of Baculoviruses that only occur in arthropod species (mainly lepidopteran species) and generally have a narrow host range. Baculoviruses are safe and cause no hazards to human health (OECD, 2002).

Compatibiity

Spodovir® can be used in tank-mixes with other pesticides, like wettable sulphur, chemical fungicides and insecticides but not with copper products. A pH level between 5 and 8.5 has to be respected, when tank-mixed with other products. Otherwise the protective protein capsule will be destroyed and the active ingredient deactivated. Spraying of copper a few days before or after a Spodovir® application has no adverse effect on its performance.

No Side Effects

Spodovir preserves natural antagonists due to its specific host range. Aquatic species, birds and mammals are not affected. It is also safe for bumble bees, predatory mites, parasitoids, and insects in general.

- Narrow host range, high selectivity, very host specific
- No effects on plants, mammals, or humans
- No production of metabolites or toxins
- Baculoviruses are safe and cause no hazards to human

Storage and Handling

Avoid temperatures above 25°C during storage and transport. Temporarily sub-optimal storage conditions (>25°C) during transport or at the end-user may be acceptable for a few days. At -18°C the product remains stable and can be immediately used for spraying. Once opened, the package can be stored further at low temperatures without loss of quality.

High temperatures after application are not a limiting factor for the virus efficacy, because temperatures on the plant surface rarely rise above 40°C. At high temperatures the pest activity is also reduced.

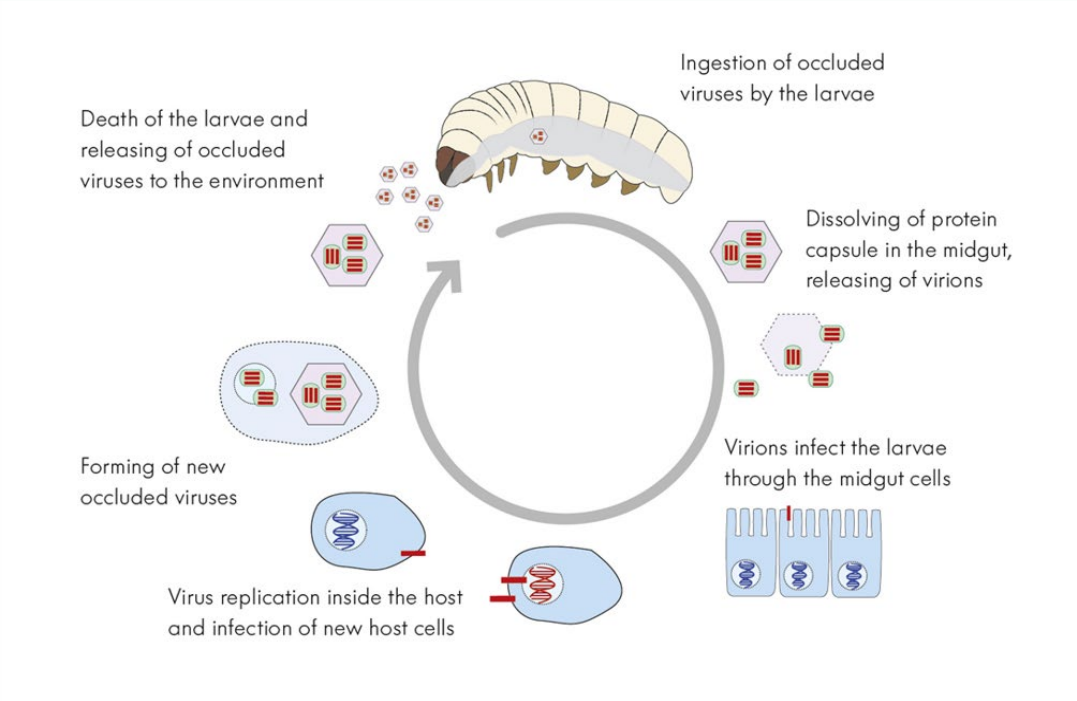
Optimal storage conditions are -18°C for >2 years and at 5°C, Spodovir is stable for 2 years.

Mode of Action

Young larvae that are actively moving and feeding on the crop will ingest the virus that was sprayed onto the plant surface. Following ingestion, the virus particles enter the larval midgut where the protein capsules dissolve due to the high pH level (pH higher than 10). The virion is released and infects the midgut cells. The genetic information of the virus is incorporated into the host genome, resulting in the production of new replicate copies of the virus. The host cells get destroyed and the new viruses infect new host cells. Within 2 – 4 days, the viruses infest most organs of the host and the larva stops feeding. Upon death, the larval body deteriorates and releases millions of new viruses into the environment, infecting other larvae. Under laboratory conditions, only 1 ingested virus particle is sufficient to kill a first instar larva.

Older larvae (older than L3) are not instantly killed and may therefore cause further damage before getting killed in later larval instars. They can also pass on the virus infection to the next generation, where it may develop due to biotic or abiotic stress.

Larvae infected with an NPV turn black and then liquify. Eventually decomposing and releasing virus particles to their friends



Virus replication inside the host and infection of new host

Information about *Spodoptera frugiperda*

Fall armyworm, *Spodoptera frugiperda*, are an important agricultural pest with an exceptionally broad geographical range. Fall armyworm can be found throughout the Americas, but are especially prevalent in South America. Recently, Fall armyworm have been found in Africa, Asia and Australia. In warmer climates, fall armyworm can have up to 4-6 generations per year.

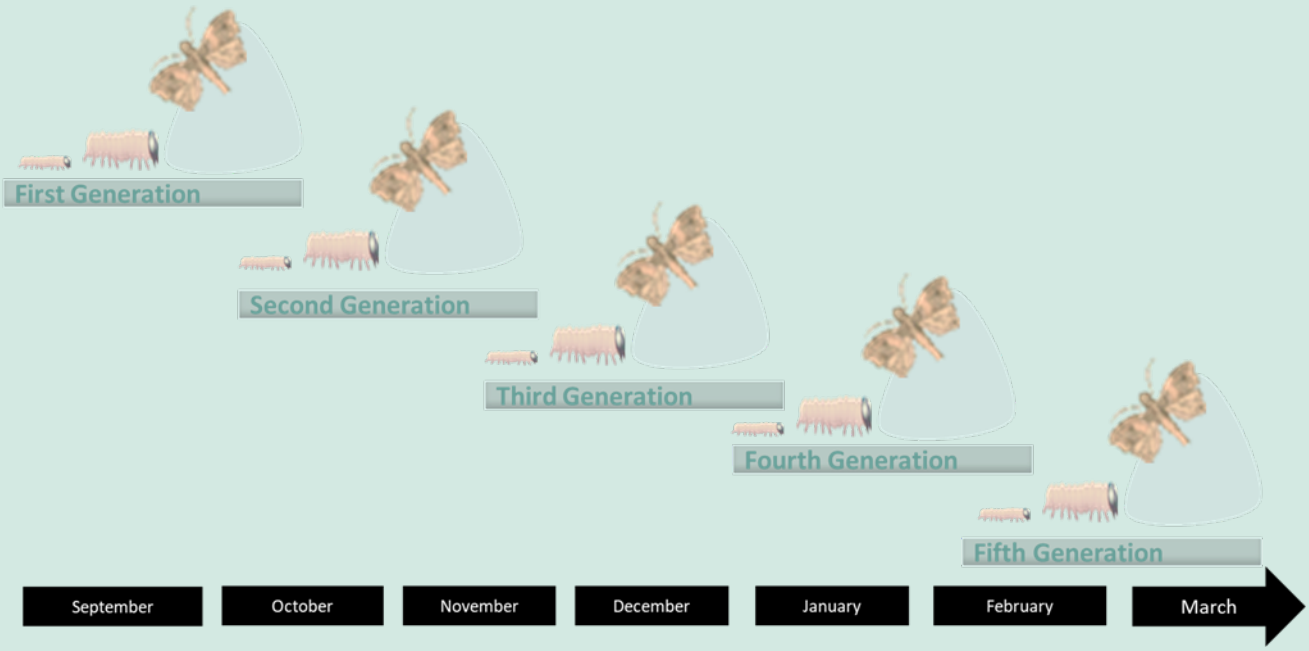
Eggs are laid on the underside of leaves. In corn, smaller larvae feed deep in the corn whorl, creating a skeletonizing effect. Smaller larvae can also skeletonize the leaf lamina. Larger larvae cause more conspicuous damage. Plants up to 30 days old can be severely damaged, reducing plant vigor and yield.

Worldwide Distribution

Common Host Crops

- Maize/Corn
- Sorgum
- Rice
- Potato
- Sugarcane
- Tomato
- Brassicas
- Eggplant
- Groundnuts
- Cotton
- Many More….

Life Cycle of *Spodoptera frugiperda*



The fall army worm can have up to 4-5 generations in South America. Adult female moths will start to lay eggs a few days after eclosion. Each female moth is capable of laying 900-1000 eggs which are normally in clusters of 100-300 eggs. Egg masses are commonly found on the under side of leaves but under high pest pressure, any surface can be used.

Fecundity of adults and mortality of young larvae is negatively affected by high temperature and low humidity. The life cycle length and number of eggs per female can differ to a great extent, depending on host plant and climatic region. The larvae normally pass through six instars. On maize, the young larvae feed together deep in the whorl, causing a characteristic skeletonizing or 'windowing' effect. In following instars larval behavior changes, larvae become cannibalistic and disperse onto neighboring plants, thus only very few older larvae per plant are typically found.

Their life cycle can be completed in as little as 20 days at 32°C. This results in up to 5 generations of fall armyworm in South America during prime growing seasons. Adults have the ability to fly for many kilometers prior to laying their eggs and therefore have the ability to migrate and expand their populations.

Developmental Thresholds

- Min. Developmental Threshold: 12°C
- Max. Developmental Threshold: 38°C

General Information

- Up to 5 generations in South America
- Up to 1000 eggs per adult female
- L1-L3 feed together
- Older Larvae become cannibalistic

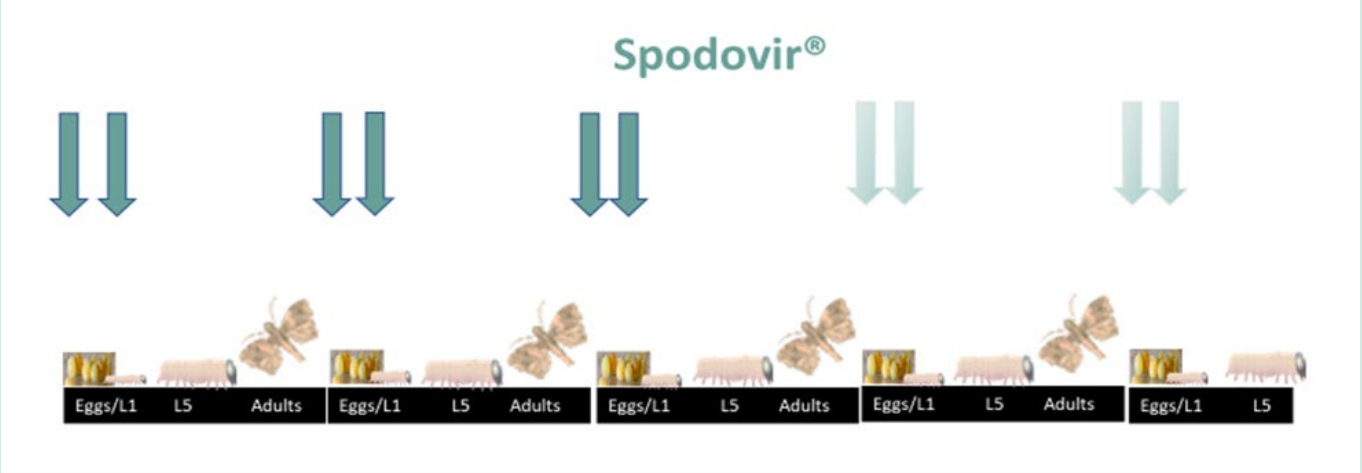
General Instructions

Weekly monitoring of *Spodoptera* activity, by using pheromone traps for monitoring the arrival of adults and also scouting for eggs and larvae, is **essential**. Application timing for Spodovir° is crucial to provide optimal control over fall armyworm. The first application of Spodovir° should target eggs and first instar larvae. Spodovir° can provide 75-100% efficacy against fall armyworm if applied correctly and at the optimal time to target eggs and small larvae. Good coverage of the feeding area is essential, as the larvae need to ingest the virus to get infected. Young infected larvae may survive a few days until they die, but feeding activity will be reduced. Older larvae require longer to succumb to the viral infection and it is therefore essential to apply Spodovir° when larvae are still small and not yet hidden within the crop.

Large *Spodoptera frugiperda* larvae are responsible for creating the most damage within the crops. This highlights the importance of targeting the smaller larvae with Spodovir°, prior to their ability to cause economic damage to the crop.

***S. frugiperda* damage**: Late instar damage caused by fall armyworm. Targeting small, early instar FAW larvae with Spodovir° will reduce this type of damage.

Application timing and spray intervals



For best crop protection, the first Spodovir® application is applied just prior to first egg-hatch. The young larvae will consume part of the egg shell during hatching, and therefore can become infected at the earliest possible time point of their development. As baculoviruses are sensitive to UV radiation, spray applications should have an interval of every 6-8 days to assume the full coverage of the larval hatching period. For crops with a high leaf area index, such as cotton, maize and sorghum, application should be repeated after every 8th day with a water volume from 200-600L/ha.

Spray volumes

Ensuring good leaf coverage improves the efficacy of the application of baculoviruses. Baculoviruses need to be ingested to control larval populations and therefore application equipment should guarantee a good coverage. For ground application, application spray volumes may vary between 200-600L/ha of water.

Application Strategies

Use in Integrated Pest Management

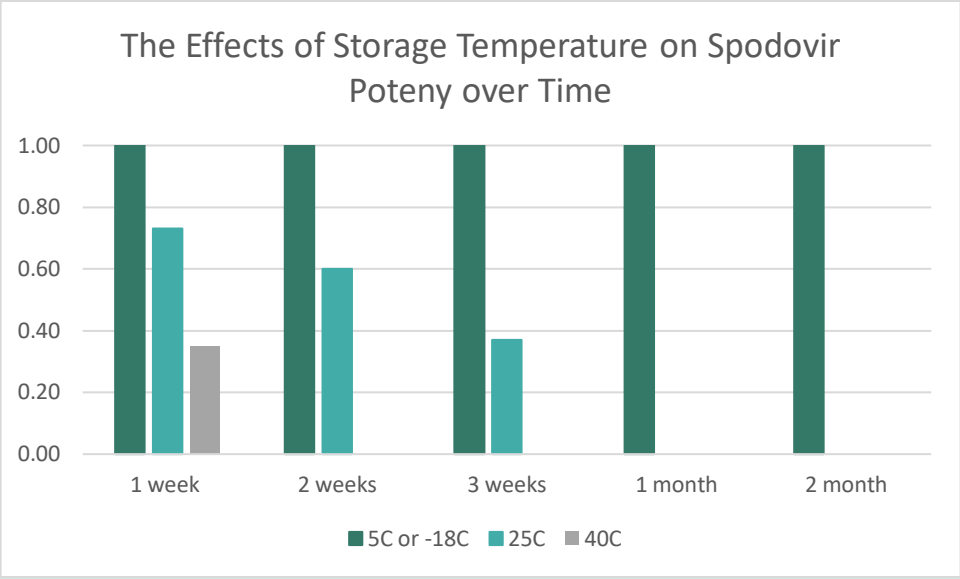
Spodovir® can be used as a part of a successful Integrated Pest Management (IPM) program, which may include chemical and cultural practices, aimed at preventing economic pest damage. IPM principles and practices include field screening and monitoring systems (pheromone traps), correct target pest identification, population monitoring, rotation of insecticides with different modes of action and treating when target pest populations reach determined economic thresholds.

Resistance Management

S. frugiperda has the ability to develop pesticide resistance to numerous control products. To effectively control *S. frugiperda* populations and to delay development to resistant populations to new active substance, a spray program incorporating the most efficacious insecticides and alternating modes of action against consecutive pest generations is recommended. Resistance management in South America is an important factor as *S. frugiperda* can have up to 5 generations per growing season. Alternating modes of action is very important to reduce the potential of resistance development.

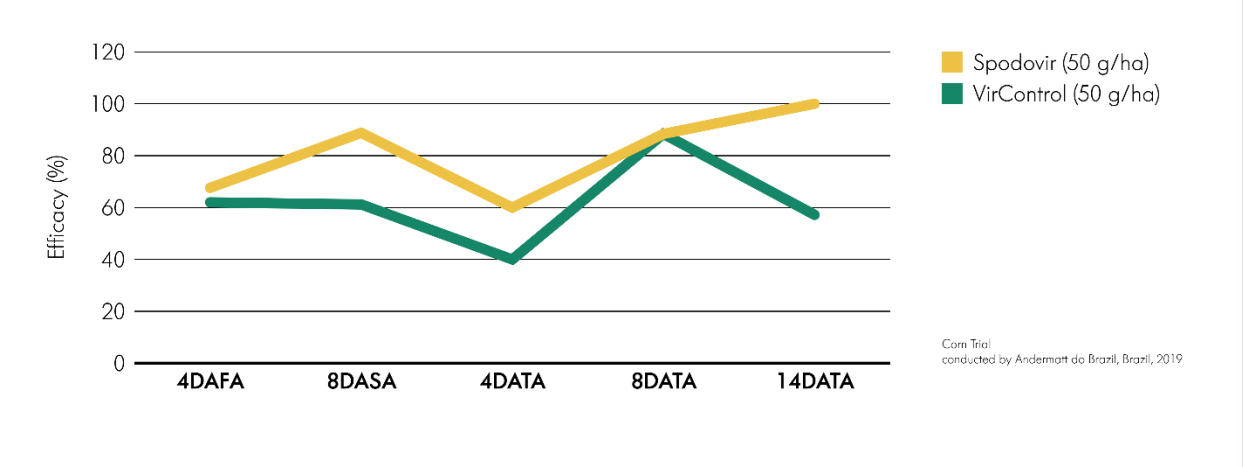
Storage Stability

Temperature is an important factor which can influence the viability of a baculovirus product. The degradation of occlusion bodies can occur at high temperatures therefore proper storage is essential and will prolong the life of any baculovirus product. Proper storage, at 5°C or -18°C, will ensure the product can maintained its efficacy against its target host. Storage at 25°C for one week will still target the susceptible host, however, the potency and efficacy of Spodovir® will be slightly reduced. We do not recommend storing baculovirus products above 25°C for any length of time. Exposure to high temperatures over a period of time has a negative effect on the viability of Spodovir®. **The optimal storage temperature for Spodovir® is 5°C or -18°C.**

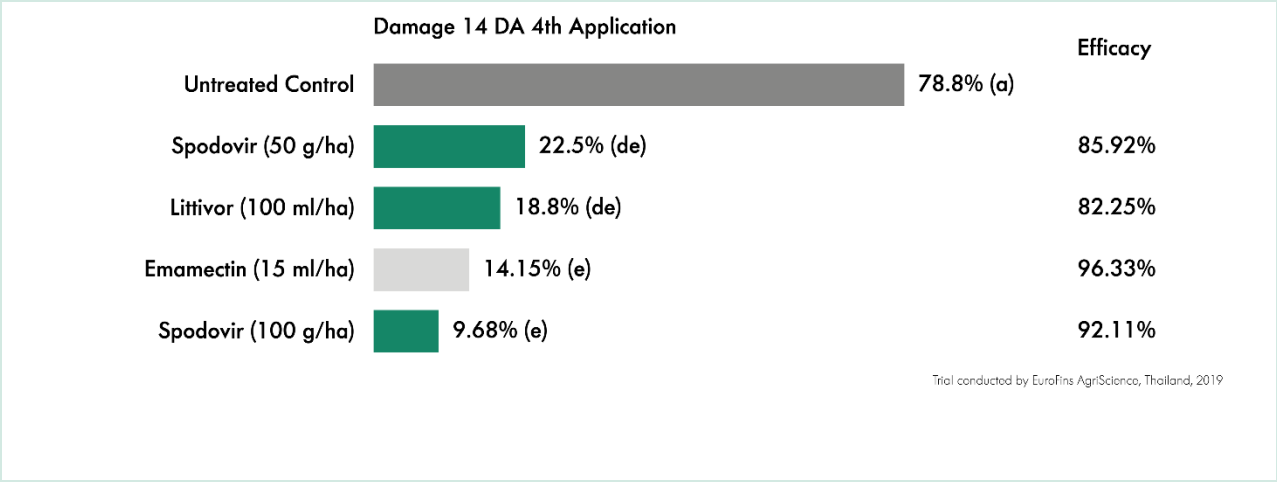


Spodovir® Efficacy Trials

Control of *Spodoptera frugiperda* in corn, Brazil 2019
2 applications of Spodovir® compared to VirControl at 50g/ha.



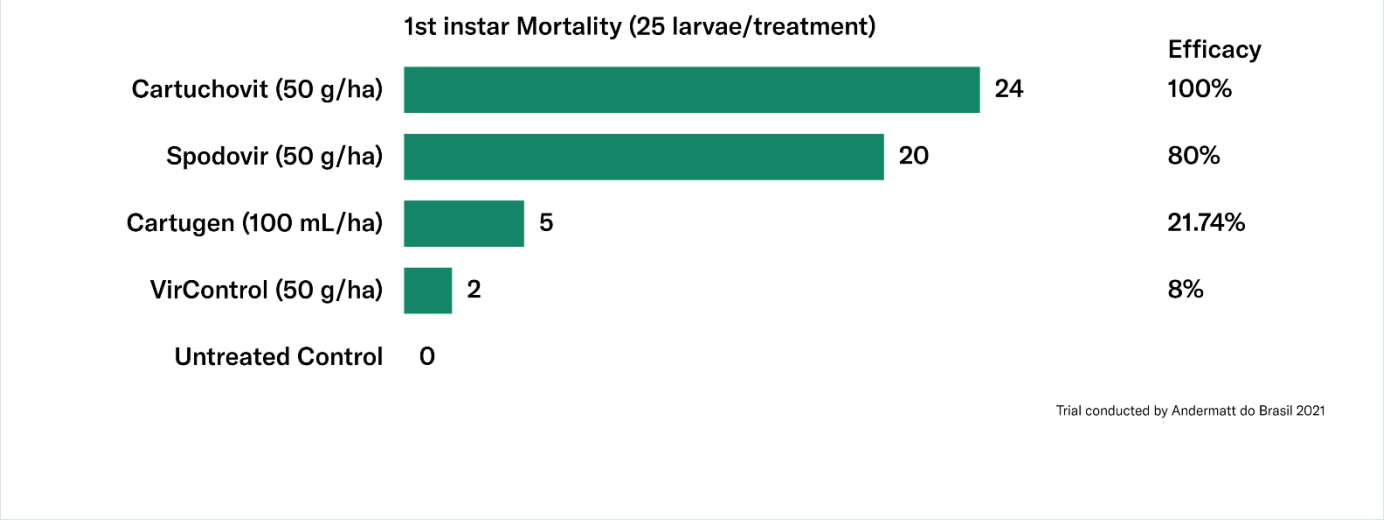
Control of *Spodoptera frugipdera* on maize, Thailand 2019
Conducted in the north of Thailand, Chiang Mai Province with sweet corn Hibrix 59. Performance of Spodovir at highest rate (100 ml-g/ha) was excellent and very similar and some point of time a bit better than the standard treatment, Emamectin.



Spodovir® Laboratory Trials

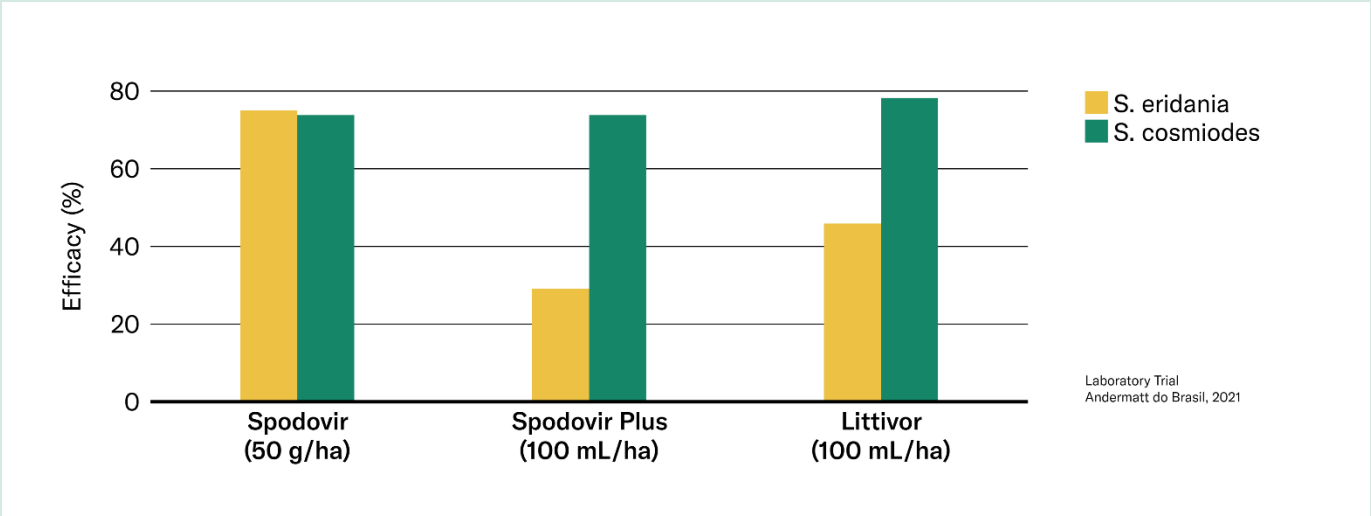
Laboratory Studies vs. Market Competitors

Conducted by Andermatt do Brasil in 2021. Performance of Spodovir at recommended rate (50 g/ha) was excellent and very similar and some point of time a bit better than other competitors standards.



Laboratory Studies against additional *Spodoptera* species

Conducted by Andermatt do Brasil in 2021. Performance of Spodovir at recommended rate (50 g/ha) provides excellent control over 2 additional Spodoptera species.



Spodovir® - Canadian Made

Spodovir® is produced by Andermatt Canada Inc. in Fredericton, New Brunswick, Canada. Spodovir® has been produced since 2018.

Andermatt Canada Inc., is committed to highest quality of it products. Every batched of Spodovir® which is produced undergoes a systematic bioassay process. The virulence of each batch is tested against the standard reference batch within the Andermatt Canada laboratories. Only batches which fulfill the high quality standard criteria will be released into the market.

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