

## Success\* 480 SC – New Class of Insecticide for Use in Potatoes

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### Abstract

Spinosad, the active ingredient in Success 480 SC, is derived from the metabolites of the naturally occurring bacteria, *Saccharopolyspora spinosa*. Spinosad is active on insect species from the orders Lepidoptera, Diptera, Hymenoptera, Thysanoptera, and a few Coleoptera. Spinosad is highly effective at low application rates and has a unique mode of action with no known cross-resistance to other insecticide classes. Spinosad has an excellent human safety profile with reduced risk to the applicator. It also has a very good environmental safety profile, and is safe on most beneficial insects. Spinosad has been classified as a reduced risk pesticide by the U.S. EPA.

Success 480 SC was sold to Manitoba potato growers for the first time this year. It offers growers a new resistance management tool for Colorado potato beetle control. Success 480 SC should be applied at first egg hatch to larvae ¼ inch long. Depending on the severity of the infestation a second application may be required 7 to 10 days later. Success 480 SC is harmful to bees if sprayed directly on them, but has no adverse effect once dried on foliage. The active ingredient is considered rainfast and will resist wash-off once it has dried on the plant surface (1-2 hours).

### Discovery and Development

In 1982 a scientist from the natural products division of Eli Lilly collected several soil samples from an abandoned rum still in the Caribbean. These samples were returned to the laboratory to determine the presence of biological activity. Three years later the fermentation products from these samples were shown to have insecticidal activity. In 1986 scientists identified the organism producing the biologically active substances. They determined that this was a new species of actinomycete bacteria and named it *Saccharopolyspora spinosa*. There have been over 30 metabolites characterized from this organism and the two most active compounds have been identified as Spinosyn A and Spinosyn D. A highly effective formulation of these two metabolites was developed through five years of extensive testing around the world. The name spinosad is derived by combining the species name, spinosa, with the two metabolites, A and D. In 1995, because of its favorable environmental and toxicological profile, spinosad was classified by the U.S. Environmental Protection Agency (EPA) as a reduced risk product and granted an accelerated registration review. Less than two years later during early 1997, the first spinosad products were approved and launched in the U.S. for use on cotton, turf and ornamentals.

Today spinosad is produced in a state-of-the-art fermentation facility in Harbor Beach, Michigan. *S. spinosa* colonies are grown using natural products such as soybean and cottonseed meal. Computers are used to control the temperature, oxygen and nutrient levels to ensure maximum production of spinosyns A and D. Spinosad products are now registered on over 250 crops in more than 60 countries. Spinosad is highly active on insect species from the orders Lepidoptera, Diptera, Hymenoptera, Thysanoptera, and a few Coleoptera. In 2003, Success 480 SC was registered in Canada for use in potato production to control Colorado potato beetle, *Leptinotarsa decemlineata*.

### Safety to Beneficials

Spinosad displays a high level of selectivity toward most beneficial insects, and use of spinosad is compatible with integrated pest management (IPM) programs. Spinosad has low impact on many predacious insects such as lady beetles (*Coccinellidae*) and lacewings (*Neuroptera*) which can be important for reducing aphid populations. Honeybees and bumblebees are sensitive to direct applications of Success. However, dry residues of spinosad on potato foliage is harmless to foraging bees.

Therefore the risk to bees will be negligible if applications are made when bee activity is low or if bees are allowed to reenter treated areas only after the spray deposits have dried.

### **Environmental Toxicology**

Spinosad is not acutely toxic to terrestrial birds and wildlife or to fish and most aquatic invertebrates. Spinosad is 1000 to 10000 times less toxic to fish than most synthetic insecticides. In the soil environment spinosad degrades readily and is non-persistent. Spinosad has a low vapor pressure so the probability of contamination of air is very low. Primary mechanisms of degradation are sunlight photolysis and microbial breakdown. Under field conditions spinosad dissipates rapidly from soil surfaces with observed half-lives of less than 1 day. Spinosad present in deeper soil layers or shaded soil also degrades rapidly with a half-life of 9-17 days at 25 C. Spinosad and its degradates are not a concern from a groundwater quality standpoint. Spinosad is moderately to strongly sorbed by soil particles (Kd sorption coefficients of 4 to 337 ml/g). In natural water systems spinosad degrades rapidly by sunlight photolysis with a half-life in water columns of less than one day. Trace residues of spinosad that may be absorbed from food or water by terrestrial wildlife have been found to be readily metabolized and excreted. Consequently, spinosad will not biaccumulate in meat, milk or eggs.

### **Mammalian Toxicology**

Spinosad is not acutely toxic to mammals and is essentially non-hazardous by oral, dermal, ocular, and inhalation routes. In intermediate-term (90-day) and long-term (1-2 years) feeding studies involving rats, mice and dogs; spinosad has not been found to cause tumors, neurotoxicity, embryotoxicity, fetotoxicity or teratogenicity. Precautions on the Success 480 SC label state “avoid contact with eyes, skin and clothing. During mixing, loading, application, and cleanup and repair activities, wear long-sleeved shirt, long pants, shoes plus socks and chemical resistant gloves”. Spinosad has been classified by the World Health Organization (WHO) as an insect control product “unlikely to present acute hazard” which represents the most favorable of 5 classifications recognized by this advisory body.

### **Mode of Action**

In insects, the mode of action of spinosad is associated with the excitation of the insect nervous system (Salgado 1998). Spinosad uniquely alters the function of nicotinic and GABA-gated ion channels at the synapse between nerve cells. However, spinosad does not interact with known binding sites for other nicotinic or GABAergic insecticides such as neonicotinoids, fiproles, avermectins and cyclodienes. These data indicate that spinosad acts through a unique insecticidal mechanism.

Colorado potato beetle larva exposed to spinosad exhibit general paralysis accompanied by a loss of body fluids resulting in flaccid paralysis. The onset of paralysis is quite rapid (1-2 hours), however intoxicated larva may remain on the plant for 1 to 3 days without feeding.

### **Resistance Management**

The novel mode of action of spinosad makes it ideal for resistance management programs. It has shown no cross-resistance with existing chemistries and can be rotated with all other classes of existing products. In order to ensure that spinosad products continue to be viable control options for many years to come, resistance management recommendations must be followed. Success 480 SC must only be applied to one generation of Colorado potato beetle each year. In Manitoba there are generally two generations of CPB.

### **Application**

Apply 50-67 mls per acre in a minimum of 45 L per acre (10 gal/ac) of water. Spray tank water should have a pH greater than 6.0. At this application rate a one liter container of Success 480 SC will treat 15-20 acres of potatoes. Tank mixes with other products are not registered with Success. Apply Success at approximately 25-40% egg hatch or when larva are up to ¼ inch (3<sup>rd</sup> instar). The product is rainfast when dry on the plant foliage (1-2 hours) but it is suggested to wait 12 hours before overhead irrigation is

started if possible. Scout the field 3-5 days after application since intoxicated pests may remain on the plants for 2-4 days but will not feed. Generally a grower can expect 5-7 days of residual activity. Performance is strong in high temperature conditions. Success is not systemic and does not have soil applied efficacy. Make a second application of Success within 7-10 days after the first application if required. Do not apply Success to more than one generation of CPB per year.

## References

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