



We create chemistry

Inscalis™ Insecticide

Worldwide Technical Information Brochure

Preface

This technical brochure provides general information about Inscalis™ insecticide—a new active ingredient under development from BASF. Inscalis™ is not currently registered for use anywhere in the world.

Disclaimer

This technical and educational material is provided for informational purposes only and is not intended to promote the sale of the product.

Any sale of this product after registration is obtained shall be solely on the basis of approved product labels, and any claims regarding product safety and efficacy shall be addressed solely by the label.

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Introduction

Inscalis™ insecticide is a pioneer solution that has been classified by the Insecticide Resistance Action Committee (IRAC) as the only member in the new mode of action subgroup 9D. It provides effective control of devastating piercing and sucking insect pests, such as aphids, whiteflies, leafhoppers, certain psyllids and scales, including those that have developed resistance to other insecticides.

This new insecticide has been submitted for use on a broad range of row crops, such as cotton, soybeans and wheat; specialty crops, including citrus, pome fruit, stone fruit, tree nuts, leafy and fruiting vegetables, brassica, cucurbits, tuberous and corn vegetables as well as ornamental plants.

Inscalis™ boasts a favorable environmental profile with low acute toxicity to mammals, fish, birds and important beneficial arthropods, including insect predators and pollinators. Derived from a fungal metabolite that occurs in nature, it provides an alternative mode of action in many segments with no known cross resistance to commercial insecticides.

Regulatory dossiers have been submitted for Inscalis™ in 2016 in the USA, Canada, Mexico, Australia, India and Brazil. BASF plans to register Inscalis™ in more than 20 countries worldwide, with first registrations and product launches anticipated by 2019.



Exceptional Activity

Inscalis™ delivers high efficacy with long-lasting control of problematic insect pests, such as aphids, whiteflies and certain psyllids, scales and leafhoppers.



Fast Acting

Inscalis™ provides rapid feeding cessation of insect pests, which in turn reduces virus transmission.



New Resistance Management Tool

Inscalis™ offers a unique mode of action and control of labeled piercing and sucking insect pests that have developed resistance to other insecticides, providing a valuable new tool for resistance management.



Favorable Environmental Profile

Derived from a natural process, Inscalis™ exhibits a favorable environmental profile with low acute toxicity to mammals, fish, birds and important beneficial arthropods, including insect predators and pollinators, such as honeybees.

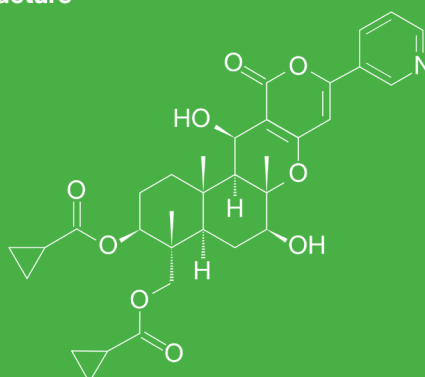


Inscalis™ registrations are proposed for use on key crops such as citrus, tomato, cotton and soybean.

physical and chemical properties

Active Ingredient	Afidopyropen
Trade Name	Inscal TM
Chemical Family	Pyropenes
Chemical Name (IUPAC)	[(3S,4R,4aR,6S,6aS,12R,12aS,12bS)-3-(cyclopropanecarbonyloxy)-6,12-dihydroxy-4,6a,12b-trimethyl-11-oxo-9-(pyridin-3-yl)-1,2,3,4,4a,5,6,6a,12a,12b-decahydro-11H,12H-benzo[f]pyrano[4,3-b]chromen-4-yl]methyl cyclopropanecarboxylate
Chemical Name (CAS)	[(3S,4R,4aR,6S,6aS,12R,12aS,12bS)-3-[(cyclopropylcarbonyl)oxy]-1,3,4,4a,5,6,6a,12,12a,12b-decahydro-6,12-dihydroxy-4,6a,12b-trimethyl-11-oxo-9-(3-pyridinyl)-2H,11H-naphtho[2,1-b]pyrano[3,4-e]pyran-4-yl]methyl cyclopropanecarboxylate
CAS Number	915972-17-7
CIPAC Number	[(3S,4R,4aR,6S,6aS,12R,12aS,12bS)-3-(cyclopropylcarbonyloxy)-1,2,3,4,4a,5,6,6a,12a,12b-decahydro-6,12-dihydroxy-4,6a,12b-trimethyl-11-oxo-9-(3-pyridyl)-11H,12H-benzo[f]pyrano[4,3-b]chromen-4-yl]methyl cyclopropanecarboxylate
Molecular Formula	C ₃₃ H ₃₉ NO ₉
Molecular Weight	593.7 g/mol
Melting Point	>150 °C (302 °F)
Appearance	Odorless, solid powder at 21 °C
Relative Density	Approx. 1.07 g/cm ³ (20 °C / 68 °F)
Log Pow	3.45 at 25 °C
Vapor Pressure	<9.9x10 ⁻⁶ Pa at 25 °C (77 °F)
Henry's Law Constant	2.31E-09 Atm·m ³ /mol
Solubility in Water	25.1 mg/L at 20 °C (68 °F)
Solubility in Solvents	n-hexane 0.0076 g/L at 20 °C toluene 5.54 g/L at 20 °C methanol >500 g/L at 20 °C dichloromethane >500 g/L at 20 °C acetone >500 g/L at 20 °C ethyl acetate >500 g/L at 20 °C

Chemical Structure



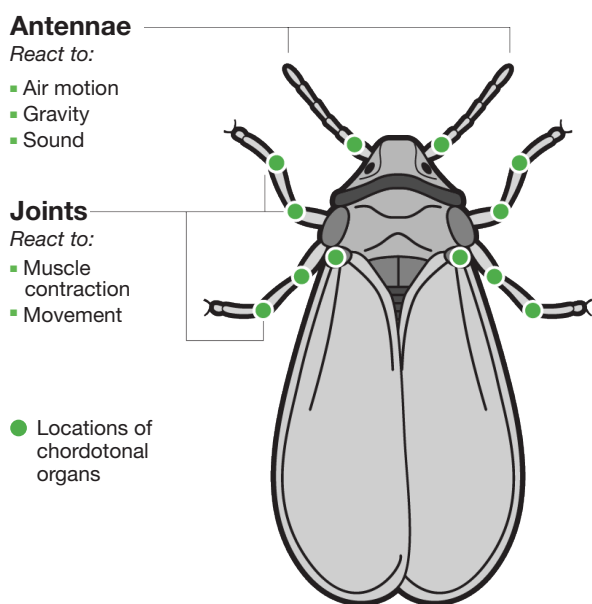
Biological Profile

Mode of Action

Inscalis™ insecticide is a novel member of a group of insecticides known as chordotonal organ TRPV channel modulators and has been classified by the Insecticide Resistance Action Committee (IRAC) as the only member of the new mode of action subgroup 9D.

The chordotonal organs, present in insects and crustaceans but not found in any other class of animal, are biological stretch sensors. They may be located in the antennae, mouth, legs, wings or thorax. By sensing position and movement in the antennae under the influence of sound and gravity, these stretch sensors provide insects with their senses of hearing, orientation and balance. In leg joints, the same sensors are critical for coordinated movement. Inscalis™ acts selectively on these stretch sensors.

Chordotonal Organs in Insects

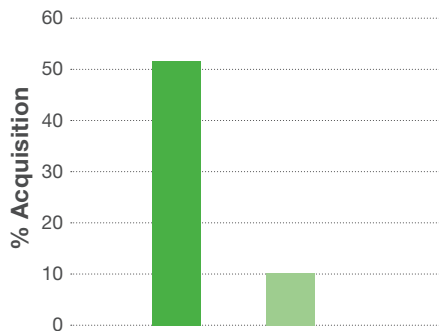


The molecular target of Inscalis™ is the TRPV ion channel, which only occurs in chordotonal organ sensory nerve cells. Inscalis™ selectively binds to the TRPV channels, causing them to open and generate continuous chordotonal nerve signals independently of joint movement. This false stretch signaling makes it impossible for the brain to detect sound, gravity and the movement and position of body parts. Deaf, disoriented and uncoordinated, Inscalis™-treated insects rapidly cease feeding and die from dehydration and starvation.

Virus Transmission

Many important piercing and sucking pests cause significant economic loss in production systems worldwide. Crop damage can be contributed to direct pest feeding injury or to the spread of vector-borne plant diseases. Inscalis™ insecticide has been shown to reduce the primary and secondary spread of insect pest-vectored viruses by causing rapid feeding cessation that leads to impairment and death of the insect pest.

Inscalis™ effectively limits spread of aphid vectored viruses



Virus acquisition by aphid from plant

Virus: Turnip yellow virus (TuYV)

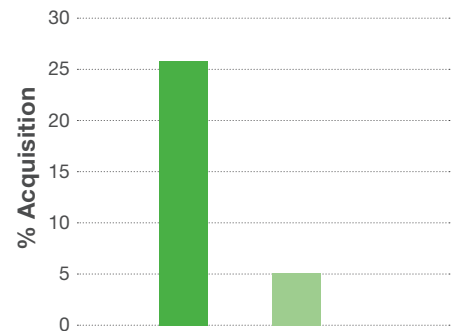
Plant: *Physalis floridana*

Vector: *Myzus persicae*

■ Untreated Control

■ Inscalis™ (10 g ai/ha)

Inscalis™ effectively limits spread of whitefly vectored viruses



Virus acquisition by whitefly from plant

Virus: Tomato yellow leaf curl virus (TYLCV)

Plant: *Solanum lycopersicum*

Vector: *Bemisia tabaci*

*Dash was added to Inscalis™

■ Untreated Control

■ Inscalis™* (50 g ai/ha)

Tomato Leaf Curl Virus



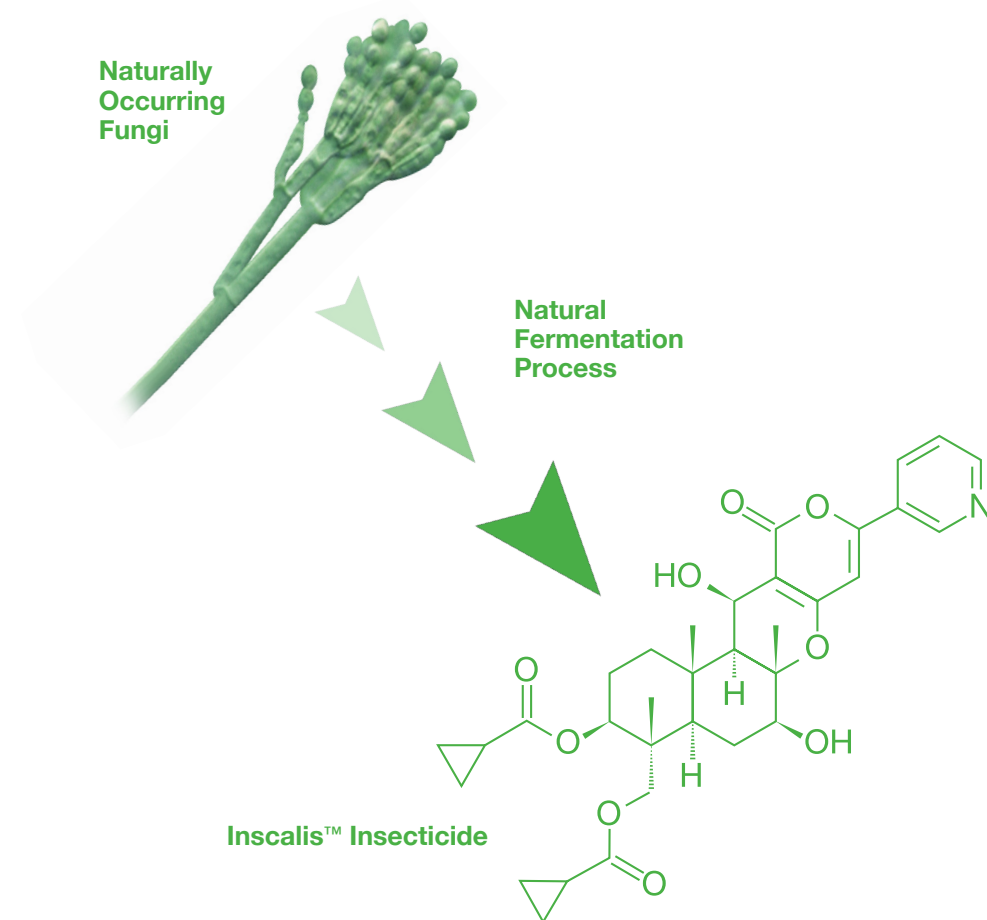
Favorable Environmental Profile and Low Toxicity to Beneficials

Inscalis™ insecticide meets the high regulatory standards for modern crop protection compounds featuring low acute toxicity to mammals, fish, birds and important beneficial arthropods.

Inscalis™ has been shown to exhibit no negative impact on bee populations, including colony health and development, and has been found to be compatible for use in the presence of many common beneficial arthropods including predatory mites and parasitic wasps.

Derived from Nature

The synthesis of Inscalis™ insecticide is a process whereby a naturally occurring fungus goes through a fermentation process followed by a drying process to extract the natural compound. The final step occurs when nature unites with science to further synthesize and refine the material into the active ingredient, Inscalis™ insecticide.



Inscalis™ insecticide demonstrates low toxicity to key beneficial arthropods including, from top to bottom, ladybird beetles, green lacewing larvae, parasitic wasps and green lacewings.

Insects Controlled by Inscalis™ Insecticide

Many piercing and sucking insect pests contained within the order Hemiptera contribute to significant economic loss to crop production systems worldwide. Crop loss can be attributed to direct pest feeding damage or through the transmission of vector-borne plant diseases. The following table, not intended to be all-inclusive, illustrates the specific activity of Inscalis™ on key target pests.

Aphid



Scientific name	EPPO code	Common name
<i>Aphis craccivora</i>	APHICR	Cowpea aphid
<i>Aphis glycines</i>	APHIGY	Soybean aphid
<i>Aphis gossypii</i>	APHIGO	Cotton/melon aphid
<i>Aphis pomi</i>	APHIPO	Apple aphid
<i>Aphis spiraeicola</i>	APHISI	Spirea aphid
<i>Aulacorthum solani</i>	AULASO	Foxglove aphid
<i>Brevicoryne brassicae</i>	BRVCBR	Cabbage aphid
<i>Dysaphis plantaginea</i>	DYSAPL	Rosy apple aphid
<i>Eriosoma lanigerum</i>	ERISLA	Woolly apple aphid*
<i>Hyalopterus pruni</i>	HYALPR	Mealy plum aphid
<i>Hysteroneura setariae</i>	HYSTSE	Rusty plum aphid
<i>Macrosiphum euphorbiae</i>	MACSEU	Potato aphid
<i>Macrosiphum rosae</i>	MACSRO	Rose aphid
<i>Monellia caryella</i>	MONLCA	Blackmargined aphid
<i>Monelliopsis pecanis</i>	MNLSPE	Yellow pecan aphid
<i>Myzus cerasi</i>	MYZUCE	Black cherry aphid
<i>Myzus nicotianae</i>	MYZUNI	Tobacco aphid
<i>Myzus persicae</i>	MYZUPE	Green peach aphid
<i>Myzus sp.</i>	MYZUSP	Aphid
<i>Nasonovia ribisnigri</i>	NASORN	Lettuce aphid
<i>Schizaphis graminum</i>	TOXOGR	Spring wheat aphid
<i>Sitobion avenae</i>	MACSAV	English grain aphid
<i>Toxoptera aurantiae</i>	TOXOAU	Black citrus aphid

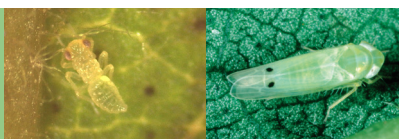
* Labeled for suppression only

Whitefly



Scientific name	EPPO code	Common name
<i>Bemisia tabaci</i>	BEMITA	Sweetpotato whitefly
<i>Bemisia argentifolii</i>	BEMIAR	Silverleaf whitefly
<i>Trialeurodes vaporariorum</i>	TRIAVA	Greenhouse whitefly

Jassid/Leafhopper



Scientific name	EPPO code	Common name
<i>Amrasca devastans</i>	EMPODV	Indian cotton leafhopper
<i>Empoasca</i> sp.	EMPOSP	Leafhopper
<i>Empoasca biguttula</i>	EMPOBI	Indian cotton jassid

Asian Citrus Psyllid



Scientific name	EPPO code	Common name
<i>Diaphorina citri</i>	DIAACI	Asian Citrus Psyllid

Scale

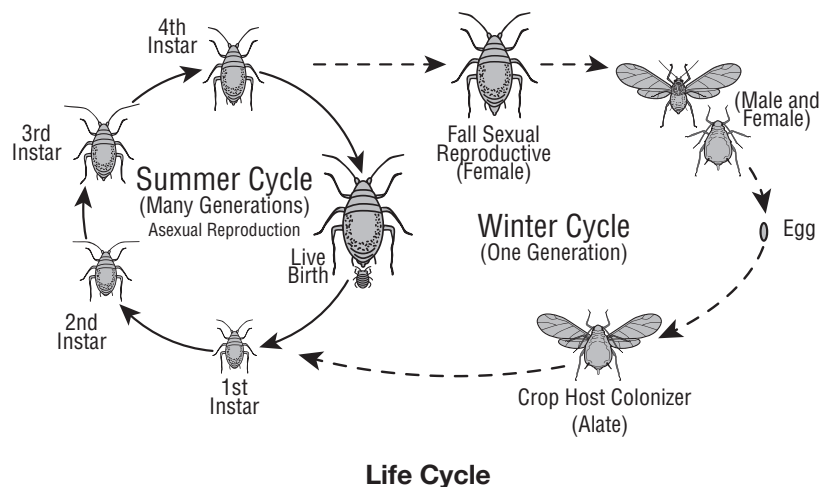
Scientific name	EPPO code	Common name
<i>Aonidiella aurantii</i>	AONDAU	California red scale*
<i>Coccus pseudomagnoliarum</i>	COCCPS	Citricola scale*
<i>Unaspis citri</i>	UNASCI	Citrus snow scale

* Labeled for suppression only



Key Insects Controlled by Inscalis™ Insecticide

APHID



Distribution: Cosmopolitan

Host Range: Many agricultural and non-crop hosts

- Alternate between perennial winter host and secondary summer host

Life History: Varied

- Parthenogenetic throughout year
- Sexual reproduction in fall (overwinter as egg) and asexual on summer host
- Extremely high reproductive rate
- Winged aphids can disperse great distances

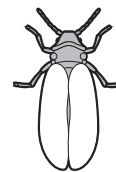
12 days after application



Untreated Control

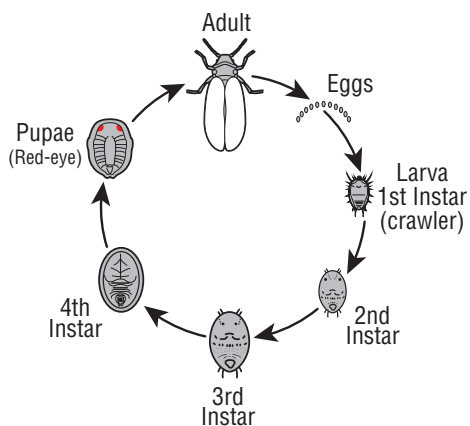


Inscalis™ Insecticide @ UV (10 gai/ha)
+ Agridex (0.5%)



Key Insects Controlled by Inscalis™ Insecticide

WHITEFLY



Life Cycle

Distribution: Cosmopolitan throughout Europe, Asia and the Americas

Host Range: >500 plant varieties, including many vegetable and ornamental varieties

Life History:

- Parthenogenetic reproduction occurs continuously
- Adults capable of significant dispersal
- Populations can persist year-round under suitable conditions

7 days after application



Untreated Control

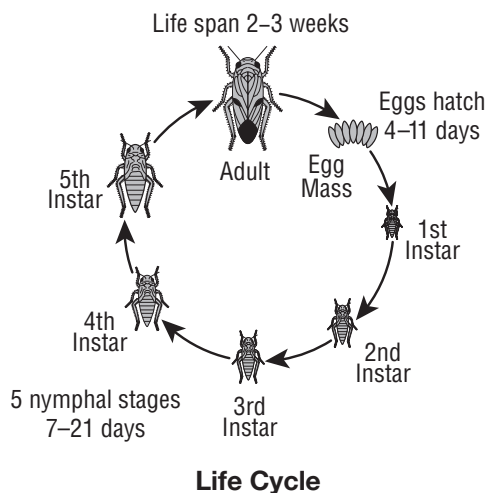


**Inscalis™ Insecticide @ 50 g a.i./ha
+ Silwet 0.05%**



Key Insects Controlled by InscalTM Insecticide

JASSID



Distribution: Cosmopolitan throughout Asia

Host Range: Malvaceae and solenaceous crops

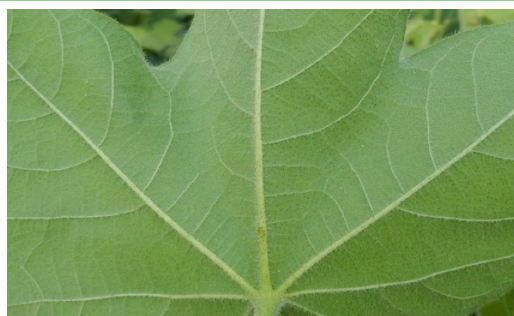
Life History:

- Female inserts ~30 eggs into leaf tissue
- Adults capable of significant dispersal
- 4 to 5 overlapping generations per year

21 days after application

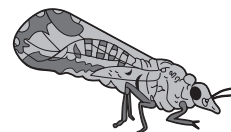


Untreated Control

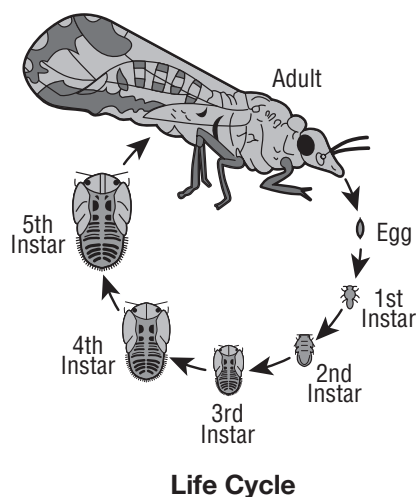


InscalTM Insecticide @ 35 g a.i/ha

Key Insects Controlled by Inscalis™ Insecticide



ASIAN CITRUS PSYLLID



Distribution: Citrus growing regions in N. America, C. America, S. America, Mexico, Arabian Peninsula, Tanzania and Reunion Island in Africa, and tropical and subtropical Asia

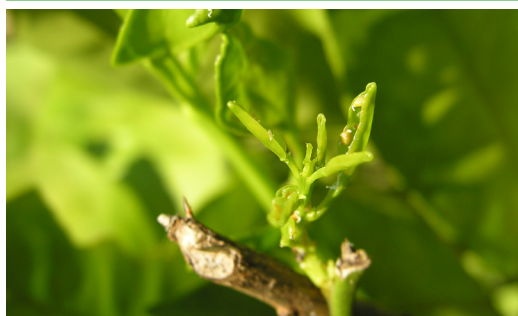
Host Range: Citrus and other Rutaceae

Damage: Vector of bacterium that causes citrus greening (Huanglongbing); direct feeding causes curling of new leaves

Life History: Varied

- Parthenogenetic throughout year
- Sexual reproduction in fall (overwinter as egg) and asexual on summer host
- Extremely high reproductive rate

15 days after application



Untreated Control

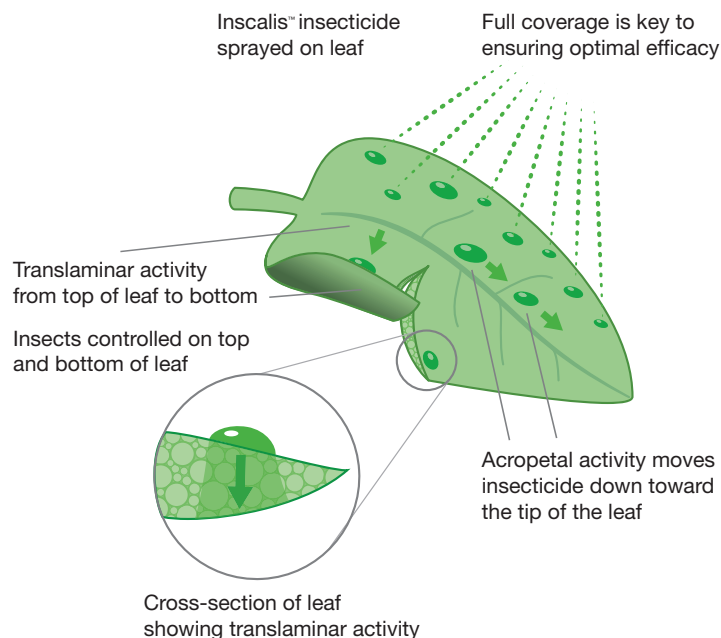


**Inscalis™ Insecticide @ SC (35 gai/ha)
+ NR 415 (1% v/v) X 3 appl**

Formulation and Use

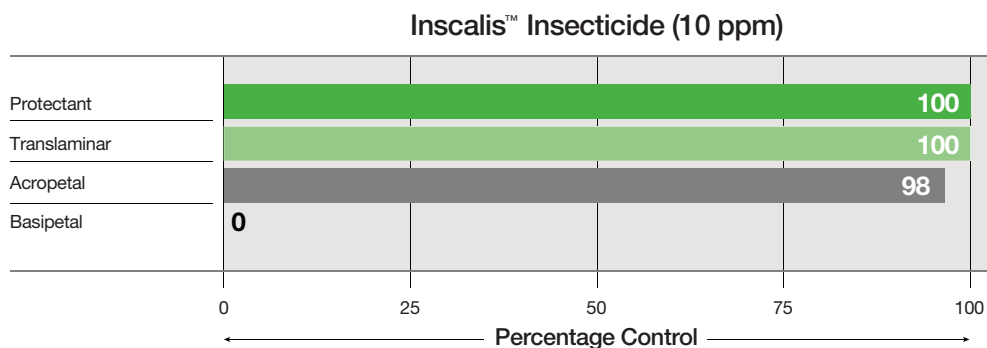
Translaminar Activity

Inscalis™ insecticide exhibits excellent translaminar movement but is not fully systemic. The insecticide moves through to the bottom of the leaf and also exhibits acropetal activity as it moves to the tip of the leaf. Therefore, utilizing spray volumes that result in full coverage of plant surfaces is recommended to achieve optimum performance.



Compatibility

Under some conditions, the use of additives or adjuvants may enhance the performance of Inscalis™. While there are no known issues with compatibility of Inscalis™ with other insecticides, the crop safety of all potential tank mixes on all crops has not been tested. If using the product in tank mixtures, observe all directions for crop use, use sites, use rates, dilution ratios, precautions, and limitations that appear on the proposed product label.



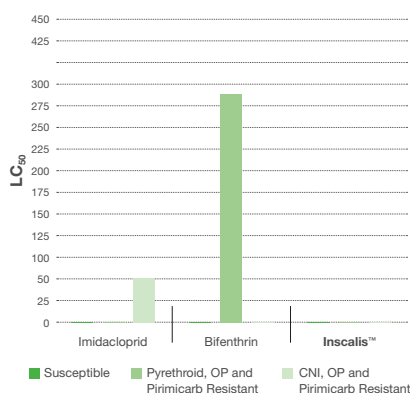
Resistance Management

Inscalis™ is an excellent resistance management tool, controlling labeled insect pests that are resistant to other insecticides, including neonicotinoids, pyrethroids, organophosphates and carbamates. This makes Inscalis™ an ideal candidate for use in insecticide resistance management (IRM) programs where it is necessary to rotate insecticide classes in order to slow or prevent the development of insecticide resistance, or as a replacement product where metabolic resistance exists.

There is no known cross resistance to other classes of commercial insecticides such as organophosphates, carbamates, neonicotinoid insecticides and pyrethroids.

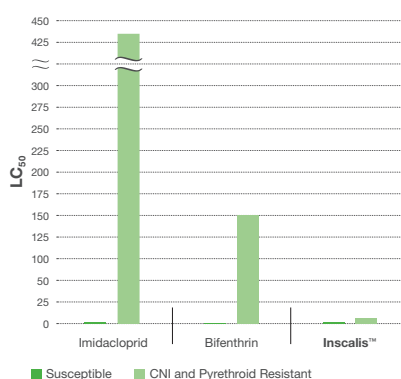
No cross resistance has been observed to CNIs, OPs, carbamates or pyrethroids

Myzus persicae Strain



No cross resistance has been observed to CNIs, OPs, carbamates or pyrethroids

Bemisia tabaci Strain



Laboratory studies were conducted to examine the efficacy of Inscalis™ insecticide against populations of *Bemisia tabaci* (sweetpotato whitefly) and of *Myzus persicae* (green peach aphid) with documented resistance against key classes of commercial insecticides such as organophosphates, carbamates, neonicotinoid insecticides and pyrethroids. In all cases, Inscalis™ insecticide provided similar levels of efficacy against these resistant strains and laboratory susceptible populations. Because the results of these studies demonstrate a lack of cross resistance, Inscalis™ is an ideal candidate for resistance management.

IRAC Classification*

Main Group and Primary Site of Action	9	Chordotonal organ TRPV channel modulators — Nerve action
Chemical Sub-group or Exemplifying Active Ingredient	9D	Pyropenes
Active Ingredient	Afidopyropen	

*Contact your local university or government experts or the Insecticide Resistance Action Committee (IRAC) for more information about the effective management of insecticide resistance in a particular pest or crop situation.



Toxicological Profile

Toxicity to Mammals

Species	Study	Effect Level
Rat	Acute oral LD ₅₀	>2000 mg/kg bw
Rat	Acute dermal LD ₅₀	>2000 mg/kg bw
Rat	Acute inhalation LC ₅₀	>5.48 mg/l
Rabbit	Eye irritation	Not irritating to eye
Rabbit	Skin irritation	Not irritating to skin
Guinea Pig	Skin sensitization	Not sensitizing to skin



Toxicity to Avian Species

Inscalis™ has minimal toxicity to birds through oral administration and dietary exposure for short- and long-term exposures.

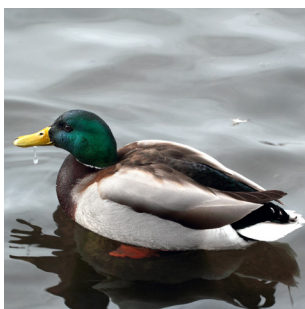
Species	Study	Effect Level
Northern bobwhite quail	Acute oral LD ₅₀	802 mg a.i./kg bw
Mallard duck	Acute oral LD ₅₀	>2000 mg a.i./kg bw
Northern bobwhite quail	Acute dietary LC ₅₀	527 mg a.i./kg bw
Mallard duck	Acute dietary LC ₅₀	>5000 mg a.i./kg bw
Northern bobwhite quail	Reproduction NOEC	6.7 mg a.i./kg/day



Toxicity to Aquatic Organisms

Inscalis™ has low acute toxicity to fish and aquatic invertebrates.

Species	Study	Effect Level
Fathead minnow	96-hour acute LC ₅₀	18.3 mg a.i./L
Carp	96-hour acute LC ₅₀	18 mg a.i./L
Daphnia magna	48 hour acute EC ₅₀	8 mg a.i./L
Chironomus tentans	10-day LC ₅₀	> 264.5 µg a.i./L



Inscalis™ has minimal toxicity to mammals such as rats, rabbits and guinea pigs as well as to avian species, including mallard ducks.

Toxicity to Saltwater Organisms

Species	Study	Effect Level
Sheepshead	96-hour acute LC ₅₀	31 mg a.i./L
Mysid shrimp	96-hour acute EC ₅₀	4.4 mg a.i./L
Eastern oyster	96-hour acute LC ₅₀	2.2 mg a.i./L

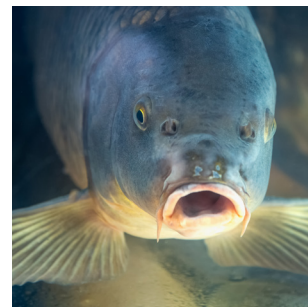
Honeybees

Inscalis™ has low toxicity to earthworms and honeybees.

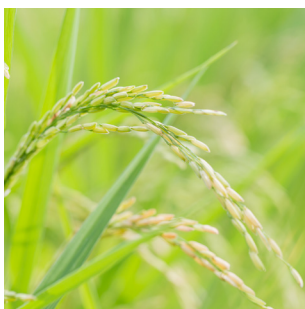
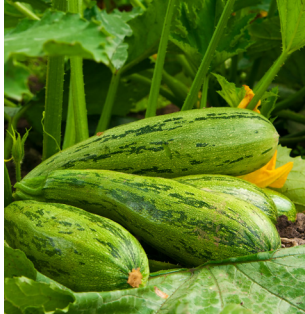
Species	Study	Effect Level
Honeybee	48-hour acute oral LD ₅₀	>100 µg consumed a.i./bee
Honeybee	48-hour acute contact LD ₅₀	>200 µg a.i./bee

Earthworms

Species	Study	Effect Level
Earthworm	14-day acute LC ₅₀	>1000 mg a.i./kg soil



Inscalis™ has low toxicity to organisms such as carp, oysters, honeybees and earthworms.



Zucchini squash, chili,
lettuce, rice

Environmental Profile

Inscalis™ is nonvolatile and readily soluble in water. Stable to hydrolysis at acidic and neutral pH, slow hydrolysis does occur at alkaline pH. The presence of light promotes degradation of the active ingredient in aqueous systems but not on soil surfaces. Due to a favorable combination of moderate sorption and ready degradation in soil, Inscalis™ has a low leaching potential as confirmed in field dissipation trials. Following application to the water phase of natural water/sediment systems, redistribution into the sediment and steady degradation in the overall water/sediment system is observed.

Environment	Study	Endpoint
Air	Vapor pressure	<9.9x10 ⁻⁶ Pa at 25 °C
	Degradation in air	DT ₅₀ : 0.055 days (Atkinson calculation)
Soil	Degradation in soils (aerobic)	DT ₅₀ : 2.7–18.6, mean = 8.8 days
	Degradation in soils (anaerobic)	DT ₅₀ : 26.3–65.8, mean = 44.0 days
	Soil adsorption	K _{OC} : 516–2439, median = 1151 mL/g
	Soil photolysis (sterile soil)	DT ₅₀ : light = 43.8 days, dark = 40.7 days
	Terrestrial field dissipation	DT ₅₀ : 1.5–7.9 days, mean = 4.7 days
Water	Hydrolysis	pH 4 = stable at 50 °C pH 7 = stable at 50 °C pH 9 = 133 days at 25 °C
	Aqueous photolysis	DT _{50 pH 7 buffer} : 17–28, mean = 22 days at 40 °N DT _{50 natural water} : 10–12, mean = 11 days at 40 °N
	Degradation in water-sediment (aerobic aquatic)	DT _{50 total system} : 76–86, mean = 81 days at 20 °C
	Degradation in water-sediment (anaerobic aquatic)	DT _{50 total system} : 35–45, mean = 40 days at 20 °C



Inscalis™
Insecticide

REDEFINE
pest management with
precision and flexibility

BASF
We create chemistry



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This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Safety, Stewardship and First Aid Instructions

Safety Instructions

- Handle in accordance with good industrial hygiene and safety practice. No special measures are necessary if stored and handled correctly.
- Avoid contact of the product with eyes and skin. Protective overalls (heavy-duty cotton fabric with linen reinforcements), gloves (impermeable to water, mineral oil and organic solvents) and protective safety goggles with safety shields should be worn when applying the product.
- Do not breathe the vapors or spray mist of the product.
- Do not eat, drink or smoke while working with the product.
- Immediately change work clothing contaminated by the product.
- Take off protective clothing immediately after use; wash face and hands with soap and water.
- Keep product out of surface water.
- When handling the concentrated product, use a fume hood or adequate ventilation.
- Use additional protective equipment or handling precautions as required by local conditions, ordinances or laws.
- Use suitable chemical resistant safety gloves (EN 374).
- Use suitable fire-fighting measures, including water spray, carbon dioxide, foam and dry powder. For safety reasons, do not use a water jet to extinguish fire containing this product.

Cleaning of Spray Equipment

- Before application, start with clean, well-maintained application equipment.
- Following spray application, thoroughly clean all application equipment.
- Drain application equipment of any excess product. Thoroughly rinse application equipment and flush hoses, boom and nozzles with clean water.
- Clean all other associated application equipment.
- Take all necessary safety precautions when cleaning equipment.
- DO NOT clean equipment near wells, water sources or desirable vegetation.

Storage Notes

- Store above 5 °C.
- Store in a cool, dry place away from children, animals, food, feed and/or fertilizers.
- Keep container tightly closed in a dry and well-ventilated place.
- Keep unused product in resealed original container(s).
- Protect from direct sunlight.
- Avoid formation of dust and aerosols.
- Keep packages dry at all times.
- Keep packages out of rain.
- Keep packages away from heat.
- Keep packages from freezing.

Disposal

- Must be disposed of or incinerated in accordance with local regulations.
- Destroy and dispose of empty product containers at an authorized waste disposal site.
- In case of leakage, prevent spills from spreading and clean up the spilled chemical.
- Fill into a sealable container and take to an incineration plant.

First Aid Measures

If swallowed:

- Have person sip a glass of water if able to swallow.
- DO NOT induce vomiting unless told to do so by a poison control center or doctor.
- DO NOT give anything to an unconscious person.

If in eyes:

- Hold eye open and rinse slowly and gently with water for 15 to 20 minutes.
- Remove contact lenses, if present, after first 5 minutes; then, continue rinsing.

If on skin:

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15 to 20 minutes.

If inhaled:

- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance; then give artificial respiration, preferably by mouth to mouth, if possible.

In any case, call a poison control center or doctor for further treatment advice.

Directions for the Physician

- Decontamination
- Supportive and symptomatic treatment
- No specific antidote known

Poison Information Center at BASF

Information on symptoms of poisoning or injury incurred while using BASF plant protection products may be obtained from the following address:

BASF Contact Information Technical Emergency Center
Carl-Bosch-Strasse 38
D-67056 Ludwigshafen Federal Republic of Germany
Telephone: +49 621 60 43333 (day and night)
Fax: +49 621 60 9 26 64



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