



NEMATICIDE



ADAMA

NIMITZ®

REVOLUTIONARY NEMATODE CONTROL

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NIMITZ®

REVOLUTIONARY NEMATODE CONTROL

A unique new tool for nematode management providing:

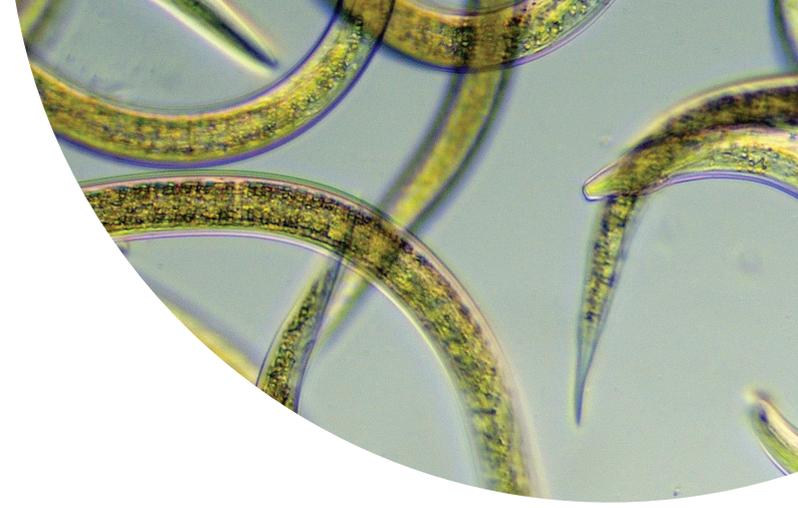
- Real nematode control through rapid contact action.
- Simple, safe and effective application options.
- Maximised crop potential and greater grower returns.
- Minimal impact on beneficial and non-target species.

Nimitz® - a new solution for nematodes

Nimitz® is a novel nematicide developed globally by ADAMA. Nimitz® has been extensively trialled around the world since 2007 with more than a thousand trials conducted across 23 countries, on every continent, in multiple crops and on various nematode types and species.

In field trials, Nimitz® has consistently demonstrated equivalent or better nematode control when compared with the registered standard nematicide and, in many trials, the greater nematode control achieved by Nimitz® has resulted in a significant increase in marketable yield.

Nimitz® is registered in South Africa for use in potatoes, tomatoes and cucurbits.



Active Ingredients

Fluensulfone (Heterocyclic fluoroalkenyl sulfone)

Registration no.

Act 36 of 1947: L10436

Address of registration holder

99 Jip de Jager Drive, The Vineyards Office Estate, Simeka House | De Bron 7530, South Africa



Nematodes (roundworms or eelworms)

Nematodes – also known as roundworms or eelworms – are the most numerous multicellular animals on the planet, numbering more than 28 000 known species.

With soil samples often containing in excess of millions of individual nematodes per square metre, it is estimated they account for around 80% of all individual animals on earth.

Nematodes may be saprophytic (feeding on broken down organic matter), predaceous (feeding on other nematodes, bacteria, fungi or even smaller organisms), entomopathogenic (feeding on insects) or parasitic (feeding on plants). Plant parasitic nematodes are among the most destructive and problematic pests for growers around the world, severely impacting crop development and yield. These nearly invisible killers affect a variety of crops globally and are responsible for an estimated \$125 billion in annual plant losses.

The impact of plant-parasitic nematodes

Because these organisms are unseen, they can often appear to be less of a threat than they really are. Nematodes typically do most of their work, and damage, invisibly beneath the soil. By interfering with the roots and reducing the plant's ability to extract water and nutrients, crop productivity is invariably affected. In addition to the direct damage they cause to crops, even in low populations, nematodes make it possible for other soil diseases to easily penetrate the roots, further exacerbating problems for the plant.

Besides reducing crop yields, nematodes can affect the external appearance of the harvested crops. For instance, nematode infected potatoes appear lumpy, and fruiting vegetables can be left vulnerable to scalding from the sun - all becoming unsuitable for sale.



Frequently Asked Questions

Would I know a nematode if I saw one?

Nematodes can't be seen by the naked eye. They live in the free water that surrounds soil particles but even though they are microscopic, some nematodes can move up to a metre in soil in a year. They are attracted to the root exudates of plants and can migrate from untreated areas in between rows into the root zone during the growing season.

How will I know if nematodes are a problem for me?

The most prominent nematode pests of vegetable crops locally are members of the *Meloidogyne* genus. In South Africa, there are two relatively widespread root-knot nematodes (RKN), *M. javanica* and *M. incognita*.

RKN juveniles enter plant roots which induces root cells to expand and form "giant cells" on which the RKN feed. The giant cells enlarge and visible galls are formed from tissue that surrounds these cells. These galls can be seen if you remove an affected plant and inspect its roots.

Galls disrupt the xylem vessels and the roots cannot function normally with respect to water and nutrients, resulting in above-ground symptoms of nutrient deficiency and/or disease and most likely poor water uptake efficiency and yield loss.

The use of nematode monitoring techniques is an important step in understanding

what threat RKN pose and what action to take. Manual testing can be carried out using traditional sampling techniques and laboratory analysis. Detected RKN populations should then be compared to acceptable thresholds and a management action plan implemented if required. Fields should later be re-sampled to check that the control measures have been effective.

What is Nimitz®?

Nimitz® is a contact nematicide applied prior to the planting of potatoes, cucurbit seeds or seedlings and tomato seedlings. It is intended for use in fields where nematode damage is preventing growers from reaching the full potential of a crop, whether fields were previously untreated or as replacement for current nematicides.

Nimitz® provides an unmatched combination of safety and efficacy, thereby simplifying several aspects of nematode management.

What is fluensulfone?

Fluensulfone is the active ingredient in Nimitz® - a new molecule from a new chemical class known as heterocyclic fluoroalkenyl sulfones.



Who discovered fluensulfone and when?

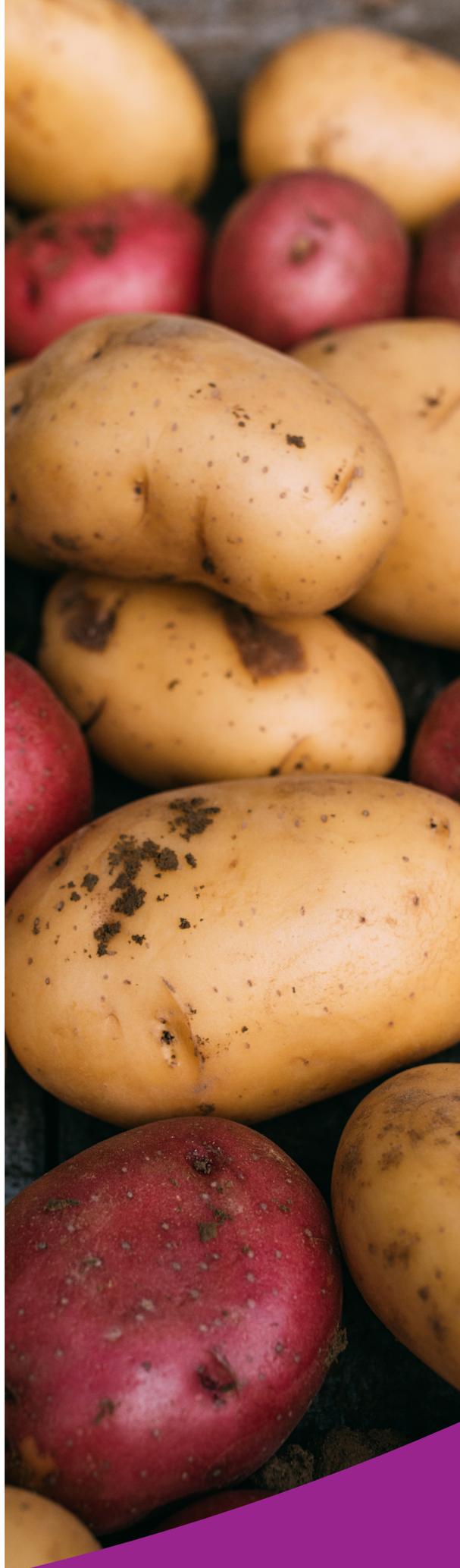
Fluensulfone was discovered in Japan and quickly showed significant promise for use as a replacement to outdated carbamate and organophosphate nematicides. The development project was taken on by ADAMA (formerly Makhteshim-Agan) in 2006. After thousands of trials, conducted in 23 countries over all continents, fluensulfone has consistently demonstrated equal or better nematode control when compared to the best commercial standard.

Is Nimitz[®] a fumigant like some other nematicides?

Unlike some older chemistry, Nimitz[®] is not a fumigant. The active ingredient is distributed through the soil and into contact with nematodes through water movement via irrigation or rainfall following application.

Is Nimitz[®] already registered and in use around the world and if so, which countries?

Nimitz[®] is now registered in the USA, Israel, Brazil, Mexico, India and Australia for use prior to transplanting solanaceous and cucurbitaceous crops. Many other countries are currently working toward registration, including Canada and Japan.





Using Nimitz®

On which crops is Nimitz® registered for use in South Africa?

Nimitz® is currently registered for use on potatoes, tomatoes and cucurbits (specifically baby marrow, butternut squash, melon, muskmelon, pumpkin and squash).

How does Nimitz® control plant-parasitic nematodes?

The fluensulfone in Nimitz® acts quickly and within 1 hour of contact, target nematodes cease feeding and quickly become paralysed. Within 24 - 72 hours complete mortality is achieved, rather than nematostatic or temporary paralysis. Unlike activity seen when using other chemical nematicides – which allow nematodes to “unfreeze” when the nematicide passes through the soil profile in time – the action of Nimitz® is irreversible.

Why is the 480 EC formulation chosen for South Africa?

We have chosen an emulsifiable concentrate liquid in South Africa for its effectiveness and to allow Nimitz® to be simply applied as per current practices for many growers here. Nimitz® is likely to be available in several formulations around the world, engineered to accommodate local agricultural practices in different crops and countries.

Is Nimitz® safe for users and the environment?

Nimitz® has a “caution” warning (i.e. blue band) on its label meaning it should be treated with respect when handled. It requires less Personal Protective Equipment when compared to organophosphate or carbamate nematicides, which usually have “very toxic” (i.e. red band) on their labels. Always read and follow all safety instructions on the Nimitz® label.

Nimitz® has a very favourable toxicological and ecotoxicological profile and is considered non-toxic to birds, bees and aquatic life.

Is there a minimum re-entry interval when using Nimitz®?

In general, you should not enter a treated area until spray deposits have dried unless you are wearing protective clothing. Preferably a 24-hour re-entry period should be allowed.

Which nematode life cycle stages does it affect?

Nimitz® affects all active stages of the nematode life cycle by inhibiting the feeding and motility of adults and juveniles, and the laying, hatching and development of eggs.



Is soil temperature a factor to be considered when applying Nimitz®?

Nematode species become active at different soil temperatures. *Meloidogyne incognita* becomes active when soil temperatures reach 15.6°C. Below this temperature, the immobile nematode does not absorb Nimitz® and may not be affected. Soil temperatures should be monitored, particularly in winter or early spring when temperatures may be insufficient for nematode activity and thus reduce efficacy.

Which nematode species will be controlled by Nimitz®?

Nimitz® is registered for the control of root-knot nematodes.

What effect on other soil microflora does Nimitz® have?

Nimitz® is unique among nematicides in that it only targets plant-parasitic nematodes without disrupting the balance of the soil ecosystem. Healthy, fully functioning soil is balanced to provide an environment that sustains and nourishes plants, soil microbes and other beneficial organisms. Managing for soil health is one of the most effective ways to increase crop productivity, profitability and sustainability.

How long does Nimitz® control nematodes for?

The aim of nematicide treatment for vegetables is to reduce the initial nematode population in the root zone and allow plants to develop a vigorous root system that can withstand later-season migration of nematodes without affecting crop yield or quality.

Nimitz® has been proven to control the nematodes in the treated zone long enough for crops to establish and thrive and to improve fruit yield despite later incursions from untreated areas.

Does residual control last longer on lighter soils or heavier soils? Is pH a factor?

The half-life (DT_{50}) of fluensulfone varies from 7 – 17 days, according to soil type. The length of effectiveness in light soils is slightly shorter than in heavy soils.

The activity of Nimitz® is not affected by soil pH and there is no need to adjust the pH of water used to apply Nimitz®.



Resistance Management

What pressure is currently on nematicides in terms of resistance developing around the world and here in South Africa? What is “accelerated degradation” and how does it affect current nematicides in soil?

Whilst it is the generally held opinion that the development of nematode populations significantly resistant to existing nematicides and fumigants has not been observed under field conditions to date, the occurrence of “accelerated degradation” of these compounds in soil has been well documented.

Accelerated degradation refers to the breakdown of these active ingredients and their metabolites at rates that are faster than those commonly seen and high enough to significantly reduce or totally eliminate the usefulness of the nematicide when applied to a particular soil.

Accelerated degradation may occur as a result of an increase in soil pH – when lime is applied to soil for instance – or via “enhanced biodegradation” where microorganisms have adapted – after long term exposure through repeated applications to that soil – and are able to metabolise the product.

Whilst fluensulfone is not prone to accelerated degradation due to pH, in order to minimise the potential of Nimitz® efficacy

being reduced by enhanced biodegradation, Nimitz® should not be used as the only nematode control measure and should be limited to one application per crop, with a maximum of 8 L/ha in total per year. Fluensulfone provides an important tool for the management of parasitic nematodes when used in an Integrated Management Strategy, and may assist in extending the usefulness of other traditional nematicides whilst they are still available.

Will Nimitz® form part of a Resistance Management Strategy?

As always, an integrated approach should be adopted to reduce the pressure on any one management practice. Relevant measures include the use of healthy seedlings (insect, pathogen and nematode-free), planting nematode-resistant varieties when available, rotation with alternative crops that do not favour the survival of root-knot nematodes, removal and destruction of volunteer seedlings from susceptible crops and other weeds, avoiding carryover of nematode contaminated soil between sites and the promotion of optimal growing conditions for the crop to increase tolerance to nematode infections.

Compatibility

Which soil applied insecticides, fungicides and herbicides is Nimitz® compatible with if any?

If tank-mixing of Nimitz® with other products is required, a physical compatibility test has to be conducted before application to confirm compatibility of the mixture, as well as a biological assay to verify that application of the mixture will not have harmful effects on the crop.

To determine compatibility, pour the recommended proportions of the product(s) into a suitable container. After mixing, wait 30 minutes and check to see if the product remains mixed. If the product remains mixed, it is considered physically compatible. Read and carefully observe the most restrictive labelling limitations and precautions of all products used in any tank mix.

Can I mix Nimitz® with liquid fertilisers? Will any mixtures have adverse crop effects?

A list of compatible mixing partners is presently being considered, however, due to the variable nature of some liquid and soluble fertiliser products, a physical compatibility test as above should be performed.

The effect Nimitz® application, and any subsequent irrigations to incorporate and dissipate the Nimitz® prior to transplanting, on the efficacy of soluble fertiliser must also be considered.



NEMATOCIDE



Application Timing and Crop Safety

When do I apply Nimitz®?

In potatoes Nimitz® should be applied 3 days before planting.

Transplanted cucurbits and tomatoes are most vulnerable just after planting, when the plant is not yet established and any damage to the roots can cause a delay in crop development or make roots vulnerable to disease infection.

Once parasitic nematode species have penetrated a root, control with any nematicide is more difficult. By applying Nimitz® to a well-prepared, weed-free bed 7 days prior to transplanting seedlings (or planting cucurbit seeds), growers are able to effectively target the pest.

What else must be done after applying Nimitz®?

In potatoes the product must be incorporated on the day of application, either mechanically or by irrigation, to a depth of 15-20 cm.

In cucurbits and tomatoes the irrigation guidelines in Table 1 must be followed to wash Nimitz® sufficiently from the root zone before planting of seeds or transplanting of seedlings. Note that the amount of water required will vary, depending on soil type and existing soil moisture. Excessive moisture such as rainfall or irrigation immediately after application may cause the product to move past the target zone in the soil.

Pre-transplant irrigation required on the indicated number of days after application (DAA). Calculations are based on delivery of effective irrigation to a depth 20 cm.

Application type	Irrigation type	Soil clay %	Irrigation (mm)	
			3DDA	5DDA
Broadcast or banded spray application	Overhead sprinkler	<5 %	8	-
		≥5 %	8	8
	Surface drip ¹	<5 %	6	-
		≥5 %	4	4
Drip application	Surface drip ¹	<5 %	5	-
		≥5 %	5	5

¹ Surface drip: for transplanting up to 10 cm from the irrigation line.



What rate of Nimitz® should I choose?

Based on extensive testing, a rate range of 4 to 8 litres per hectare of Nimitz® 480 EC is registered to control root-knot nematode (RKN) in potatoes.

Suitable efficacy has been achieved with rates of Nimitz® at the lower end of the range when used under low to moderate RKN infestation in soils that have been prepared well in conjunction with a thorough nematode management strategy.

When RKN numbers are likely to be higher, it is recommended that the 8 L/ha rate of Nimitz® is chosen.

A maximum of 8 L/ha of Nimitz® may be used per year in any one treated area.

In cucurbits and tomatoes, 8 litres per hectare was established as the effective rate.

Which application method provides the best results in terms of nematode control?

The aim of any Nimitz® application is to create a nematode-free zone within the bed for the early season root system to grow uninhibited by nematode attack. The most effective application method is therefore that which is capable of incorporating Nimitz® throughout this zone at the required use rate for the area being treated.

The application options for Nimitz® have been developed to accommodate preferred grower practice – which usually takes into account soil type, machinery available and irrigation method among other factors.

All application methods have been thoroughly tested and proven to be effective. However, when performed correctly, broadcast application followed by incorporation is perhaps the most effective means of ensuring that Nimitz® is distributed where it should be.

Does the Nimitz® stay in this area indefinitely? How long does it work for and what is its half-life in the soil?

Nimitz® has a half-life of 7-17 days in soil, so it does its job and moves on. This relatively short half-life is one reason why fluensulfone is ecologically friendly.

What if it rains after I have applied Nimitz® as a broadcast spray? Do I still need to mechanically incorporate it?

For optimal performance, all applications must be incorporated by water and/or mechanical means to a depth of 15 to 20 cm.

Soil moisture must be adequate for uniform mechanical incorporation and to support plant growth. While the amount of moisture will vary with soil type, irrigation or rainfall of 20-25 mm 1-5 days after application will increase movement of Nimitz® in the soil, thus increasing efficacy and crop safety.

Heavy rain that moves Nimitz® through the soil profile too quickly, or washes it away from the bed will reduce the efficacy of the application. Do not apply if heavy rainfall is expected within 72 hours.



Application Timing and Crop Safety

When is the preferred application timing? Is it possible to apply too early – too far ahead of the planting process?

Trials have shown no significant difference in nematode control between applications of Nimitz® at 7 days, 14 days and 28 days before transplanting. The interval of 7 days prior to transplanting has been chosen to allow time for adequate incorporation through the bed, sufficient time for Nimitz® to effectively treat the nematodes prior to introducing the crop and a safety buffer to eliminate any risk of seedling damage.

How quickly do I need to incorporate Nimitz® after broadcast or banded application to ensure that its nematicidal activity is not compromised?

Incorporation is best done immediately to ensure no lost efficacy. Individual circumstances will vary, but Nimitz® has been left for up to 5 days after application without significant loss in nematode control.

Consult the Nimitz® label for precautions and other important instructions. Contact your ADAMA field team for more information.

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Application rates and remarks

WARNING: always refer to the product label and read it in its entirety before using Nimitz®.

CROP AND TARGET	DOSAGE	REMARKS
<p>Cucurbits (Seeds, seedlings)</p> <p>(Baby marrow (zucchini), butternut squash, melon, muskmelon, pumpkin, squash)</p> <p>Root-knot nematodes (<i>Meloidogyne spp</i>)</p>	<p>8 L per treated hectare</p>	<p>Apply 8 L of Nimitz® per treated hectare as a broadcast or banded spray application in at least 200 L of spray volume per hectare.</p> <p>Banded spray application allows a targeted application to seed or seedling beds, reducing the overall volume of product required.</p> <p>Ensure that soil is moist at application. Refer to the specific instructions above for broadcast and banded application and incorporation of Nimitz® into the soil.</p> <p>If cucurbit seeds are planted, Nimitz® must be incorporated mechanically.</p> <p>Do not apply at planting or transplanting. As germinating seeds and cucurbit seedlings could be sensitive to Nimitz®, the product should be applied at least 7 days before planting of seeds or transplanting of seedlings. The post-application irrigation requirements indicated in Table 1 should be implemented prior to planting or transplanting.</p> <p>Seedlings must be in at least the true two-leaf stage at the time of transplanting.</p> <p>After transplanting, resume normal irrigation practices.</p>



CROP AND TARGET	DOSAGE	REMARKS
<p>Potatoes Root-knot nematodes (<i>Meloidogyne</i> spp)</p> <p>WARNING: Only use Nimitz[®] when planting high-quality seed potatoes that have not been damaged or impaired in any manner.</p>	4–8 L per treated hectare	<p>Apply Nimitz[®] between 7 and 3 days before planting. Ensure that the soil is moist at application.</p> <p>Assess the risk of nematode damage and re-infestation related to the particular site with the assistance of a qualified advisor, and/or an ADAMA SA (Pty) Ltd technical advisor. Factors to consider include history of nematode infestation or damage, soil type, crop rotation and other agronomic practices, soil fumigation and other nematode control measures, nematode tolerance of the crop or variety, and market and phytosanitary requirements.</p> <ul style="list-style-type: none">· Apply Nimitz[®] at a rate of 4 to 6 L/ha on sites with a low to medium risk profile.· Apply Nimitz[®] at a rate of 6 to 8 L/ha on sites with a medium to high risk profile. <p>Note that Nimitz[®] is to be applied at the rates indicated per treated hectare in a minimum spray volume of 200 L of water per hectare as a broadcast or banded spray application.</p> <p>Apply the normal irrigation practices following planting.</p> <p>Incorporate the product on the day of application, either mechanically or by irrigation, to a depth of 15 to 20 cm. If incorporating by irrigation, apply sufficient water to distribute the product evenly, up to the indicated soil depth, but do not over-irrigate.</p> <p>NOTE: In instances where severe nematode infestation is expected, an additional nematicidal treatment, such as a preceding soil fumigation, is recommended.</p> <p>WARNING: Use Nimitz[®] only when planting high-quality seed potatoes that have not been impaired by pests, fungal, bacterial or viral infections, contact with herbicides, unfavourable growing conditions, storage and handling practices, or any other factors that could influence the quality of tubers.</p>



CROP AND TARGET	DOSAGE	REMARKS
Tomatoes (Seedlings) Root-knot nematodes (<i>Meloidogyne</i> spp)	8 L per treated hectare	Apply 8 L of Nimitz® per treated hectare through the drip irrigation system. Ensure that soil is moist at application. Refer to the specific instructions for drip irrigation application on the label. Do not apply at transplanting. As tomato seedlings could be sensitive to Nimitz® , the product should be applied at least 7 days before transplanting and the post-application irrigation requirements indicated in Table 1 should be implemented prior to transplanting. Seedlings must have two true leaves at the time of transplanting.

Irrigation requirements between application of Nimitz® and planting of seeds or transplanting of seedlings for cucurbits and tomatoes.

Table 1. Pre-transplant irrigation required on the indicated number of days after application (DAA). Calculations are based on delivery of effective irrigation to a depth 20 cm.

Application type	Irrigation type	Soil clay %	Irrigation (mm)	
			3DDA	5DDA
Broadcast or banded spray application	Overhead sprinkler	<5 %	8	-
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