

Contans[®] WG

the force of nature

Biological fungicide
for the control of
Sclerotinia sclerotiorum
and *Sclerotinia minor*.



technical guide

Contans® WG

- A water dispersible granule for the control of sclerotia of *Sclerotinia sclerotiorum* and *Sclerotinia minor* when used as a soil treatment prior to planting or post harvest, of any edible or non-edible crop
- Contains 5% Coniothyrium minitans, strain CON/M/91-08
- Concentration : 1×10^{12} viable spores/kg
- Storage temperature, below +4 °C (temperature range: minus 18 °C to plus 4 °C)
- Registered trademark of PROPHYTA Biologischer Pflanzenschutz GmbH

Table of contents

Chapter one	Contans® WG : Identification	4
Chapter two	Production and formulation	7
Chapter three	Biology of sclerotinia	8
Chapter four	Mode of action	11
Chapter five	Activity spectrum on sclerotinia	12
Chapter six	Plants sensitive to Sclerotinia spp.	13
Chapter seven	Integration into a rotation	14
Chapter eight	Working with Contans® WG	18
Chapter nine	Recommendations	19
Chapter ten	Adjacent field contamination	21
Chapter eleven	Storage	22

Identification

Contans® WG is a naturally occurring fungicide containing *Coniothyrium minitans*, a fungal pathogen of the sclerotia (the black resting bodies) of *S. sclerotiorum* and *S. minor*. Contans® WG is applied as a soil treatment that infects and destroys the Sclerotia thereby preventing attack directly from mycelia or from ascospores.

Characteristics:

Product containing *Coniothyrium minitans* loaded onto a glucose carrier

- Strain (CON/M/91-08)
- Concentration: 1×10^{12} viable spores/kg
- Formulation: water dispersible granules (WG)



Toxicological characteristics

The acute toxicity of Contans® WG is very low. Moreover, long-term exposure studies (prolonged and repetitive exposure) show no adverse effects on the tested organisms. Contans® WG is not mutagenic, not carcinogenic, and not teratogenic. The product does not have any effect on the reproductive system.

Acute toxicity of Coniothyrium minitans

Oral LD ₅₀ (rat)	> 2500 mg/kg (OECD 401)
Dermal LD ₅₀ (rat)	> 2500 mg/kg (OECD 402)
Inhalation LC ₅₀ (rat)	> 12.74 mg/l of air during 4h of exposure
Skin sensitization (guinea-pig)	Non-sensitizing
Skin irritation (rabbit)	Non-irritating
Eye irritation (rabbit)	Non-irritating





Ecotoxicological characteristics

Contans® WG has a low toxicity with regard to the acute and chronic toxicity of water organisms. In the same way, soil fauna studies (e.g. spiders...) show that Contans® WG has no effect on these organisms.

Contans® WG also has no effect on bees or earthworms.
(Source: Prophyta).

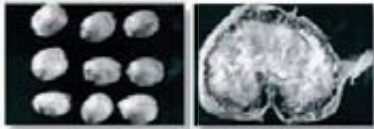


Aquatic Toxicity

Acute toxicity (fish)	> 100 mg of ai./l in 96 h (OECD method 203)
Acute toxicity (daphnia)	> 100 mg of ai./l in 48 h (OECD method 202)
Acute toxicity (alga)	> 100 mg of ai./l in 72 h (OECD method 201)

Production and formulation

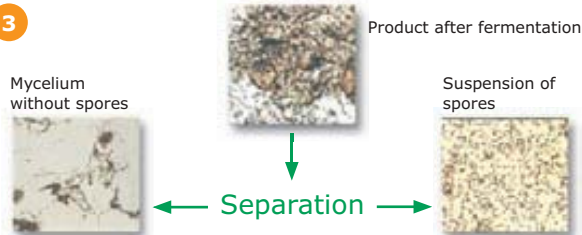
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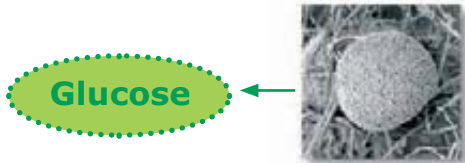
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3



4



1. Cereal grains inoculated with the *Coniothyrium minitans* strain.
2. Development of *Coniothyrium minitans* (mycelia and conidia) in fermentors.
3. Separation of the conidia and mycelia to produce a clean suspension of spores.
4. Conidia of *Coniothyrium minitans* applied to a glucose carrier.
5. Packaging and storage to keep cool.



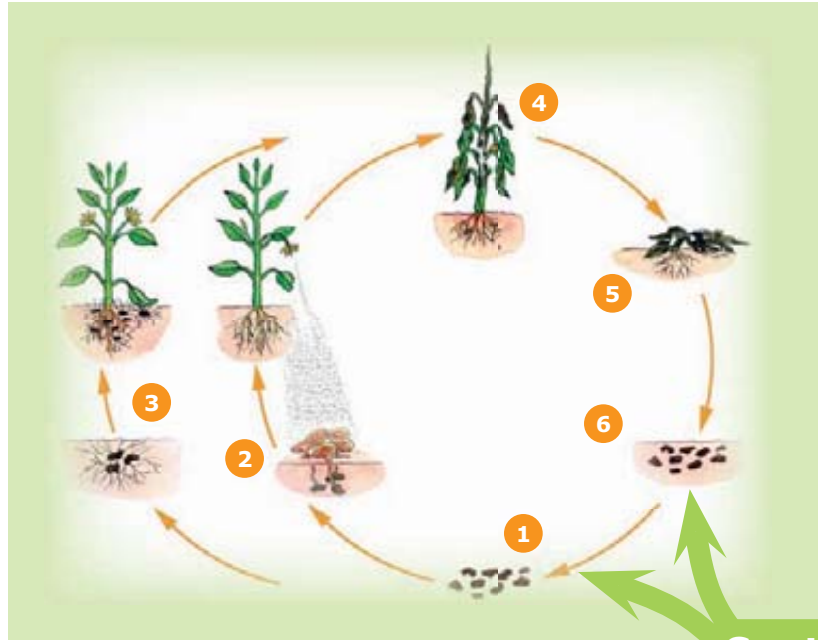
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Biology of sclerotinia

Source: Paul V.H. (1988):
Krankheiten und Schädlinge
des Rapses.
Verlag Th. Mann 121 Seiten.
ISBN 3-7862-0077-7, S. 31.

Sclerotinia spp. life cycle

- 1 Sclerotia in the soil
- 2 Formation of apothecia and subsequent infection by ascospores.
- 3 Mycelial infection of the plant
- 4 The plant starts senescing and dies
- 5 Black sclerotia reach the soil
- 6 Sclerotial resting bodies in the soil.



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Life cycle of *Sclerotinia sclerotiorum* and *S. trifoliorum*

Sclerotia of *Sclerotinia* can survive in the soil for many years (1). When within 5 cm of the surface of the soil, the sclerotia germinate and develop apothecia. These apothecia produce and release ascospores that attach to the senescent parts of the plant such as fallen petals. If the climatic conditions (temperature and moisture) are favourable, these spores then germinate and infect the plants. The infection reaches the leaves, fruit and stems near to the ground (2).

The mycelia resulting from the sclerotial germination in the soil can infect the roots of certain host plants, symptoms of infection vary between plant species but can be rapid in their appearance (3). Eventually cottony white mycelia develop and new sclerotia appear on the infected plant parts or inside the stem. The plant starts senescing and dies (4). The black sclerotia reach the soil (5), where they lie on the surface prior to being cultivated back into the soil (6).





Life cycle of *Sclerotinia minor*

Sclerotia of *Sclerotinia minor* can survive in the soil for many years.

Sclerotinia minor is a form of sclerotinia that particularly infects lettuce, chicory, carrots and endives (1). *Sclerotinia minor* develops apothecia very rarely and contamination does not occur via ascospores (2). The sclerotia germinate in the soil and the mycelia infect the roots, the base of the stem and the parts of the plant in contact with the ground (3). The stages (4), (5) and (6) are identical to those of the life cycle of *Sclerotinia sclerotiorum* and *S. trifoliorum*.

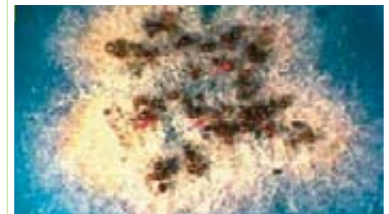
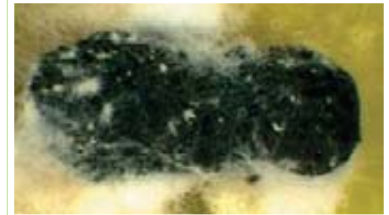
Mode of action

Sclerotinia can infect plants by two methods :

- via mycelia growing directly from the sclerotia
- via ascospores produced from apothecia (formed from sclerotia)

In contrast to “traditional” fungicides, *Coniothyrium minitans* attacks the sclerotic phase of the fungus, which is the resting stage.

1. Following the application and incorporation of Contans® WG into moist soil, the spores of *Coniothyrium minitans* germinate to produce mycelia.
2. On contact these mycelia attack the chemical elements of the sclerotia and destroy their enzyme processes.
3. The infected sclerotia are then unable to generate apothecia or to produce mycelia. Total destruction generally takes 2-3 months (the length of time is a function of the temperature conditions and moisture). The spores and the mycelium of *Coniothyrium minitans* do not seek out the sclerotia in an active way; they attack only those sclerotia surrounding them, so thorough incorporation of the product is crucial.



Activity spectrum on sclerotinia



The activity of Contans® WG is very specific and restricted to a few sclerotinia species. Field trials confirmed the efficacy against *Sclerotinia sclerotiorum*, *S. minor* and *S. trifolium*, but showed limited activity on other species such as *S. cepivorum* (White rot).

Plants sensitive to *Sclerotinia* spp.

Globally more than 400 species of plants are sensitive to *Sclerotinia* spp.

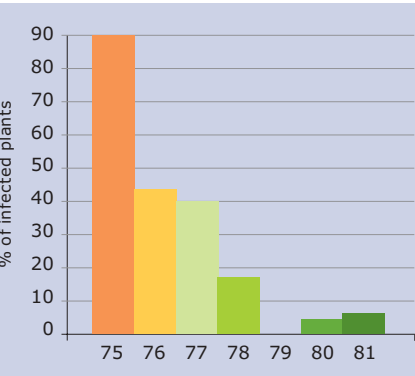
Field crops	Vegetable crops	Herbs	Ornamental crops
Oilseed rape	Artichoke, Asparagus	Dill	Aster
Alfalfa	Avocado, Aubergine	Chive	Begonia
Mustard	Broccoli, Carrot	Fennel	Chrysanthemum
Pea	Celery, Chicory	Coriander	Poppy
Potato	Cabbage, Cucumber	Parsley	Fuchsia
Soya	Endive		Gerbera
Sunflower	Bean, Kiwi		Calendula
Clover	Lettuce, Melon		Lupin
Tobacco	Turnip, Onion		Pelargonium
Lupin	Pea, Sweet pepper		Petunia
Bean	Radish		
	Tomato		
	Fennel		



Integration into a rotation

Contans® WG provides a long term solution to Sclerotinia by removing the source of the disease, the sclerotia. Contans® WG should therefore be integrated into the crop rotation and combined with cultural and traditional foliar fungicide applications to achieve and maintain long term control of the disease.

[1] Result of a 4 year programme of *Conithyrium minitans* use in a sunflower monoculture.



1975 : 90 % of plants of sunflower are infested by *sclerotinia sclerotiorum*

1976 : 2 kg application of *C. minitans* in PPI*

Important reduction of the sclerotia pressure

1977 : 2 kg application of *C. minitans* in PPI*

1978 : 2 kg application of *C. minitans* in PPI*

1979 : 2 kg application of *C. minitans* in PPI*

1980 : no application of *C. minitans*

Sclerotia development and infection due to stopping the treatments with Contans® WG

1981 : no application of *C. minitans*

Contans® WG

*PPI : Pre-plant Incorporation

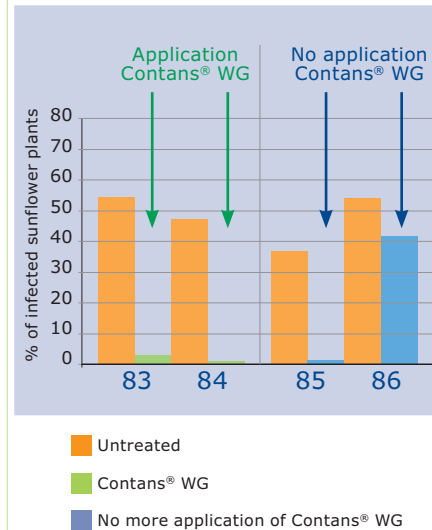
Canadian research institute.
Plot size 30 x 60 m, 3 replicates

[2] Sclerotia evolution after stopping the Contans® WG treatment

Monoculture of sunflower (1983-86)
McLaren, Huang, Kozub & Rimmer, Canada, 1994

- 1983:** test set up - inoculation of the complete trial with sclerotia - half of the trial is treated with Contans® WG
- 1984:** new inoculation of the complete trial with sclerotia - an application of Contans® WG is carried out again on the treated plot in 1983
- 1985:** inoculation of the complete trial with sclerotia
No application of Contans® WG
- 1986:** inoculation of the complete trial with sclerotia
No application of Contans® WG

The application of Contans® WG to a sclerotia contaminated soil significantly reduces the attack level of infection on this plot. The repeated application of Contans® WG increases the total level of efficacy despite artificial recontamination. When soil treatment with Contans® WG is stopped, the first results show a low infection level on the plot: one effect of Contans® WG remaining in the soil. However, as the culture of *Coniothyrium minitans* fell considerably in the soil the sclerotia developed again in the second year, leading to infection.

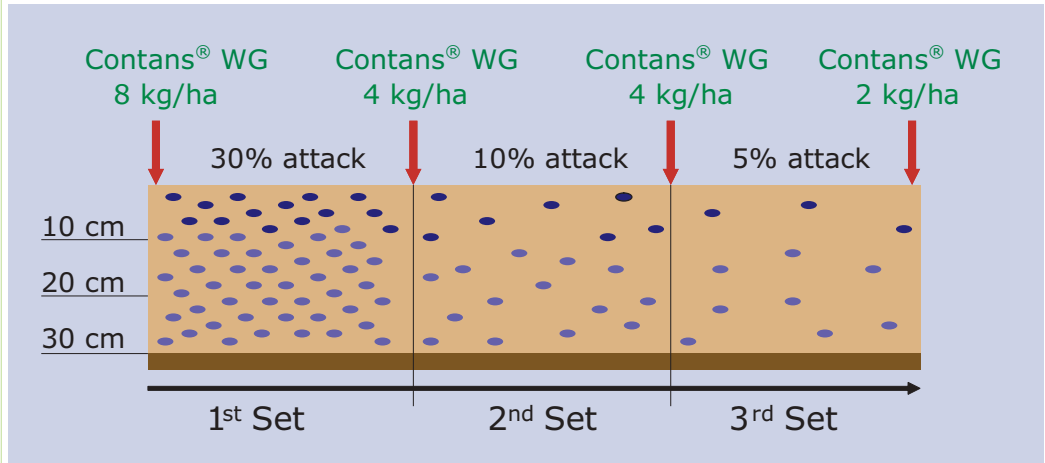


It is important to continue to apply maintenance treatments of Contans® WG to prevent build up of sclerotia.



[3] Nonstop Lettuce

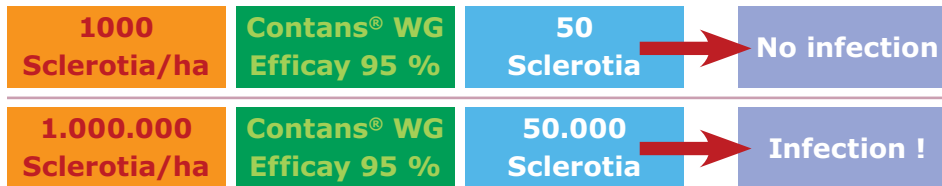
Initial infestation: 40 % loss of crops caused by *Sclerotinia spp.*



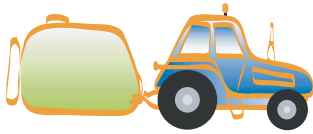
When soil is highly contaminated by sclerotia, a number of applications of Contans® WG throughout the crop rotation are required to reduce the level of potential inoculum in the soil to an acceptable level. When the inoculum source has been reduced to a low risk threshold level, it may be necessary to continue maintenance treatments of Contans® WG at a lower rate, to prevent further build up of sclerotia. In the case of the sunflower trials, the results show that crop infections all but ceased. However, infections began to build again when Contans® WG applications were stopped, allowing inoculum build up.



Inoculum level in perspective



Working with Contans[®] WG



The product has to be dissolved in water, sprayed onto the soil surface and incorporated into the soil.

Contans[®] WG sprayed onto soil or stubbles must be quickly incorporated into the soil prior to the establishment of the sensitive crop. The objective is to destroy the sclerotia present in the layer of the treated soil before they have a chance to infect the crop. The applied dose depends on a number of factors such as: inoculum level in the soil, crop rotation, depth of incorporation, timing of use. For maximum destruction of the sclerotia, multiple applications of Contans[®] WG should be applied throughout the rotation.

The first application of Contans[®] WG should ideally be carried out pre-planting of the crop preceding the susceptible crop as it takes 2-3 months for Contans[®] WG to destroy the sclerotia. A subsequent application should then be made pre-planting of the susceptible crop. Treatment of post harvest residues following a sclerotinia infection prevents reintroduction of sclerotia into the soil.

Recommendations

- **Approved uses**

Contans® WG is approved for use pre-planting or post harvest of any edible or non-edible crop. There are no rotational crop restrictions following the use of Contans® WG. Contans® WG is approved for use in organic crops.

- **Weather conditions and incorporation**

Contans® WG must be used immediately after adding to the spray tank. Ideally apply on a cool day and onto moist soil. Incorporate quickly, (within half a day) to the depth appropriate to the dose applied: 2-4 kg/ha incorporate to maximum 10 cm: 4-8 kg/ha incorporate to maximum 20 cm. Avoid application to hot and dry soils, ideal soil temperatures are 12°-20°C although Contans® WG is still active, although slower at the temperature extremes, within the range of 5°-27°C.

Incorporate thoroughly, using rotary cultivations but not below the recommended depth or the dilution will be too great and efficacy will be reduced. Take care that any subsequent cultivations prior to planting a susceptible crop are not below the depth of incorporation of the Contans® WG or sclerotia may be brought up from untreated soil lower in the profile.



Contans® WG



- **Compatibility**

As a biological product, Contans® WG is susceptible to breakdown by acidic and alkaline materials. Avoid tank mixing with any pesticide product or liquid fertiliser.

- **Clean the spraying equipment before any application**

Avoid spray solution remaining at the bottom of the tank as this may destroy the spores of *Coniothyrium minitans*. Clean the spray equipment including nozzle filters etc.

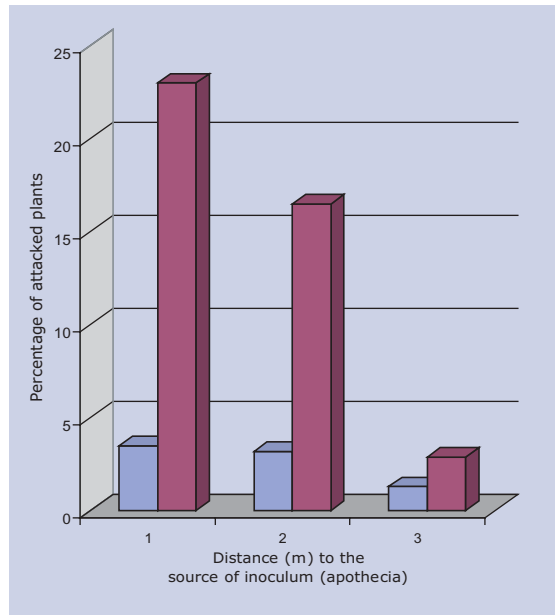
- **Sclerotinia fungicide sprays**

It is important, particularly when first using Contans® WG, to integrate the use with a normal programme of sclerotinia foliar sprays until the level of soil inoculum is reduced to a low level. Field margins and headlands should always be sprayed if adjacent fields are not treated and infection risk is high.

Adjacent field contamination

Dispersal of ascospores causing Sclerotinia stem rot of soybean from an adjacent untreated field into a Contans® WG treated Field.

This study demonstrates that generally ascospores do not facilitate widespread infection from one field to the next other than perhaps on adjacent headlands.



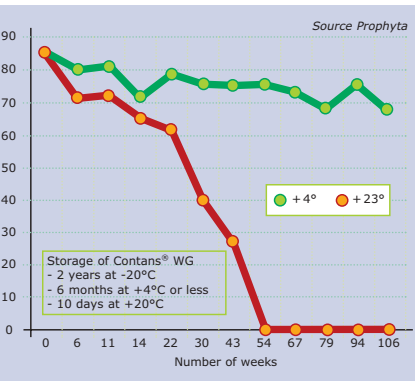
Wegulo, Martinson, Xang

Proceedings of the 1998 International Sclerotinia Workshop

Inoculum = Ascospores in a soybean field

Contans® WG

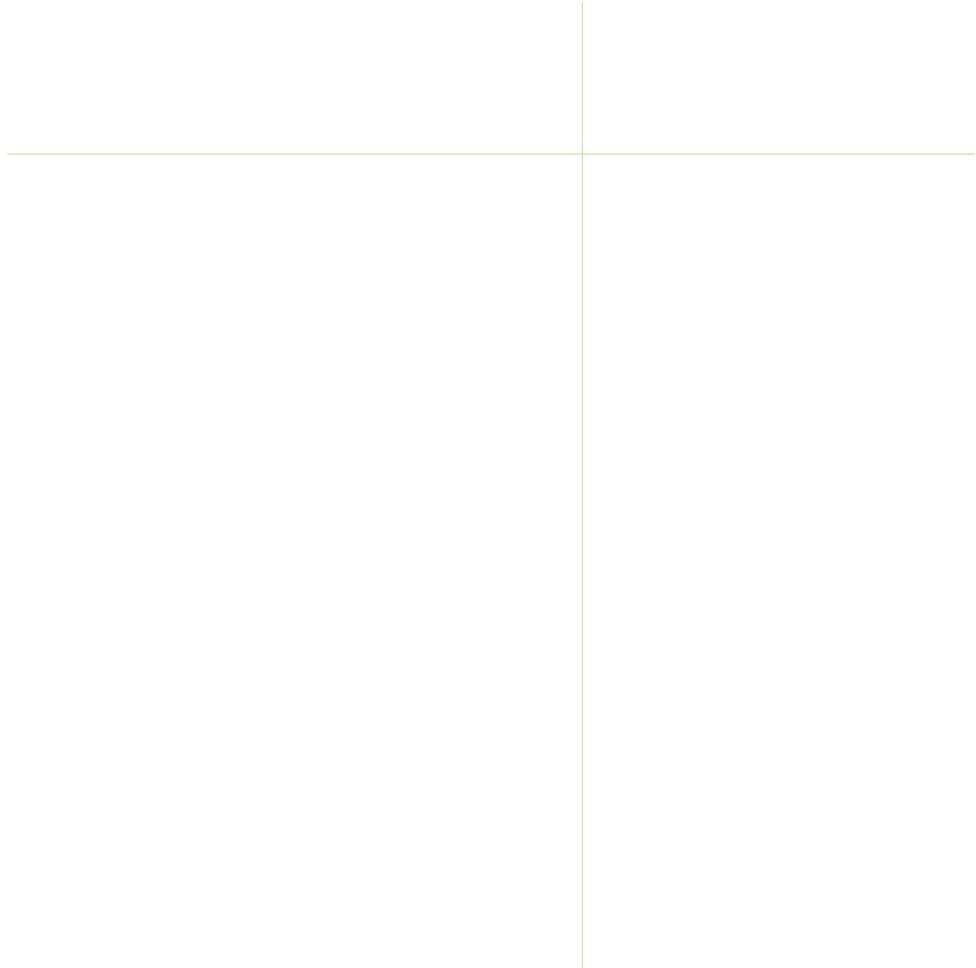
Storage



Contans® WG contains viable conidia and requires special handling and storage in order to preserve the viability of the spores and optimise the efficacy of the product.

On receipt of the product, store in the coolest place possible:

- Ideal storage: refrigerator, cold room, at a temperature of around 4°C (shelf life = 6 months).
- It is also possible to freeze Contans® WG at -20°C (shelf life = 2 years).
- It is possible to store at up to maximum 15°C for a limited period (shelf life = 2 weeks).



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Belchim Crop Protection Ltd.
Suite 2, Unit 3, Phoenix Park
Eaton Socon, St Neots
Cambridgeshire, PE19 8EP

Tel. 01480 403 333
Fax 01480 403 444