



## Botector®

Botector is Nufarm’s BioGro approved biological fungicide that contains a naturally occurring fungus, *Aureobasidium pullulans* (A. pullulans), that is commonly found in the environment. Botector works through competitive exclusion. It creates a physical barrier at potential infection sites, excluding pathogens from access to space and nutrients.

### Active ingredient

Contains  $5 \times 10^9$  cfu/g *Aureobasidium pullulans*.

### Formulation

Water dispersible granule.

### Benefits

- Stable international formulation.
- Up to 30-month shelf life.
- No adjuvant required.
- Crop safe even when applied over the flowering and fruit set period.
- Comprehensive compatibility list.
- Two strain A. pullulans (Strains DSM 14940 and DSM 14941).



### What is the benefit of two strains over one?

Different A. pullulans strains thrive under different environmental conditions. Having two strains in Botector provides broader protection and adaptability, as they can colonise and perform effectively across a wider range of temperatures. This means Botector can establish and remain active in conditions where other A. pullulans products may struggle.

### Sclerotinia

Sclerotinia is considered the second most economically damaging disease of kiwifruit after Psa. When conditions are warm, wet and humid during flowering, kiwifruit are at risk from sclerotinia.

During conducive weather conditions, sclerotia in the soil produce small mushrooms called apothecia which release ascospores that infect flower petals and stamens. Diseased flowers fall off or create a secondary infection at sites where infected petals stick to the surface of fruitlets, causing scarring, rotting and abortion. Infected flowers and fruit that fall to the ground then produce spores called sclerotia which continue the cycle. Break the cycle with Botector, a biological fungicide that offers proven control of sclerotinia.



Kiwifruit flowers with Sclerotinia



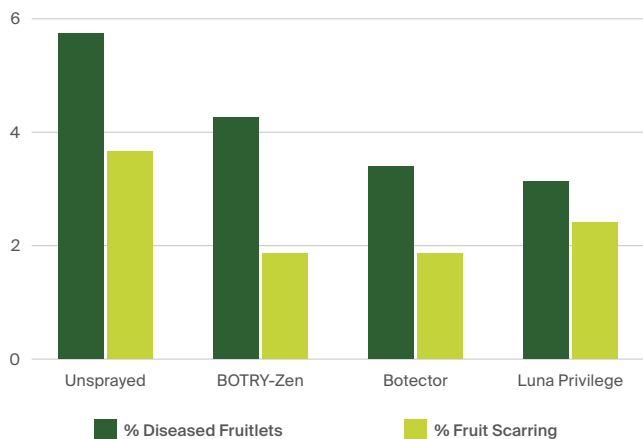
Severely infected fruit rotting



Kiwifruit scarring caused by Sclerotinia

## Incidence of diseased fruitlets and fruit with scarring

Mean of 4 trials 2018/19 and 2019/20



*“Evaluating the efficacy of Botector against sclerotinia in Hayward kiwifruit over two seasons”.*  
 Hoyte S; Phipps J & Hedderley D. *Plant and Food Research*, February 2021.

## Psa (*Pseudomonas syringae* pv. *actinidiae*)

Psa is the most economically damaging bacterial disease affecting kiwifruit in New Zealand. It enters the plant through natural openings or wounds and is spread by wind, rain splash, and contaminated tools or people. Once established, it can cause leaf spotting, shoot dieback, flower drop, cane collapse, and overall plant/vine death.

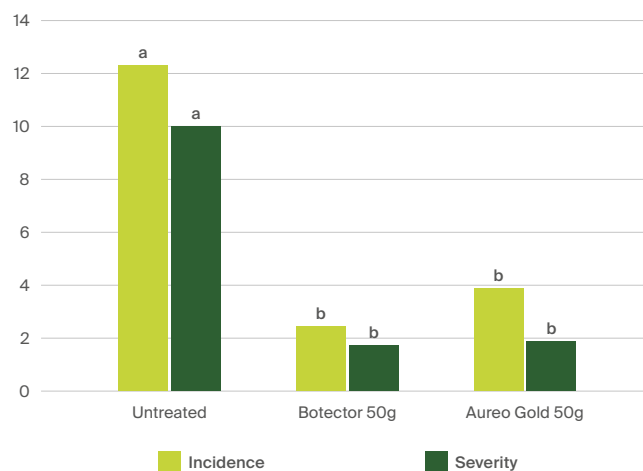
### Role of Botector in Psa Management

While Botector is not a bactericide, it is a yeast-like bio-fungicide. It rapidly colonises wounds and micro-scratches on plant surfaces and it helps reduce the number of open sites available for Psa infection. This is through a process called competitive exclusion.

Botector forms a physical barrier using its beneficial yeast-like fungus, *Aureobasidium pullulans*, which competes for space and nutrients, creating an inhospitable environment for pathogens, including Psa, on treated surfaces. Botector’s colonisation is rapid under the right environmental conditions (below 30°C with high relative humidity), making it a useful addition to integrated disease management programmes.

Apply Botector as a protectant following any activity that causes wounding (eg. pruning, frost events, mechanical damage) or during periods of high risk, particularly in spring and autumn. A 3-day application interval is recommended when alternating with incompatible treatments.

## Psa incidence and severity – % (41 DAT) NUNZ2343 (BOP)



Treatment means with the same letter are not significantly different to each other ( $P < 0.05$ ).

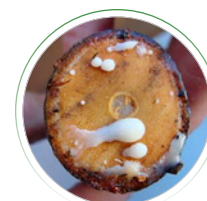
G.P. Mackisack, Peak Research Ltd, March 2024.



Leaf spot



Shoot dieback



White exudate from a freshly cut cane

### Colonisation of Botector

Once applied, Botector works quickly to colonise wounds. Consider colonisation by Botector as a dressing being applied or a scab forming on a wound. Damage and small micro-scratches on the fruit surface are colonised quickly in the right conditions.

For optimum colonisation, we recommend Botector is applied in conditions below 25°C, though colonisation is not negatively affected up to and including 30°C. This relates to environmental conditions and spray water temperatures at the time of application.

Botector will not actively proliferate at temperatures above 35°C; however, it remains viable on the fruit surface and will resume colonisation as temperatures return to more favourable levels. This persistence is due to its morphological plasticity, allowing the organism to survive under stress and reactivate when conditions improve.

Along with temperature, relative humidity can assist with colonisation rates. Colonisation rates of Botector can be enhanced when humidity levels on the plant surface exceed 70%. Humidity is not a limiting factor for colonisation rate but notable when considering ideal application conditions.

## Rainfast period

**24 hours.** The goal with incoming rain is to make sure Botector is there first. If you get rain too soon (within 2 hours) you may find some is washed off. When dried (4 hours) it helps Botector stick to the plant surface. The gum resists wash-off and helps seal micro-scratches on the fruit. Botector also produces an extracellular polysaccharide (EPS) which contains a gum called pullulan.

## Curative activity

**None.** Botector is considered a protectant fungicide.

## Tank mixing

Botector contains a living biological organism which can be negatively affected by some mixing partners. Caution should be taken when mixing more than one product with Botector and it is generally not recommended unless specifically noted as compatible. Botector can be mixed with Copper.

When using incompatible products, allow a 3-day interval before or after applying Botector.

A comprehensive compatibility guide is available on request from your local Nufarm Business Development Manager.

## Botector + Copper compatibility

Botector was first discovered in 1989, when researchers isolated microorganisms from apple leaves and fruit surfaces in an organic orchard. These microorganisms were evaluated for their ability to protect fruit from infection by postharvest pathogens.

Copper was regularly used as part of the orchard's spray programme. The *A. pullulans* strains that eventually became Botector naturally developed compatibility with copper. As a result, Botector can be safely mixed and applied with copper-based products – unlike other *A. pullulans* strains that did not originate from such environments.

## Resistance risk

As Botector acts as a competitor to sclerotinia or other diseases such as Psa and does not directly affect the mechanism of the pathogen, there is a very low risk of developing resistance.

## Product lifespan

From date of manufacture the product is stable:

- At room temperature (< 20°C) 18 months.
- At cold storage temperature (< 8°C) 30 months.

## Tank lifespan

Use the tank suspension within 8 hours. Do not leave unused spray in the tank overnight. Botector can multiply in the tank and block nozzles.

## Water rate

Ensure adequate water volumes are utilised with calibrated spray equipment to maximise spore coverage and colonisation.

## Application timing and use rates

CROP	DISEASE	RATE	NOTES
Kiwifruit	<i>Sclerotinia sclerotiorum</i>	Apply 75g/100L as a dilute spray to runoff	Apply 1–2 applications during flowering. Make the first application 5–8 days after the onset of flowering and a second application three days later if conditions favour disease development or flowering is extended. Thorough coverage is essential for good control. The addition of an adjuvant is not required.
	Psa <i>Pseudomonas syringae</i> pv. <i>actinidiae</i>	Apply 50g/100L as a dilute spray to runoff	Apply at 7–10 day intervals as required between budburst and 6 weeks post-flowering. Use the shorter interval under high disease pressure when vines are growing rapidly. Thorough coverage is essential for good control. Adjust water rate/ha to the canopy growth stage and density. The addition of a compatible wetting agent may be used to improve coverage.

Botector can be applied at flowering to supplement a pre-flowering sclerotinia fungicide.

The information contained is a quick reference only. Always consult the product label before use.



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