

TECHNICAL NOTES FOR NATURALIS-L®

SUMMARY

An approved fungal based insecticide containing insect pathogenic spores in a vegetable oil. The spores germinate on contact with the insect cuticle and the fungus proliferates inside the insect, disrupting feeding. Insect death typically follows within 3-5 days.

Labelled for control of whitefly and reduction of thrips activity. Activity is also reported against spider mite, capsid, sciarid, leafhopper and shore fly but experience on some of these pests is limited, see page 3.

Approved for use on all edible crops (protected) and ornamental plant production (protected).

Formulated in a vegetable oil and does not require an additional wetter.

NATURALIS-L should be applied as a fine spray, ensuring complete coverage of the plant to just before point of run-off. The label rate is 3 litres per hectare in 1000 litres of water.

Trials have also shown excellent activity at 3 litres per hectare in 2000 litres of water for tall glasshouse crops and 1.5 litres per hectare in 1000 litres of water for smaller crops, giving a knapsack sprayer rate of 15ml per 10 litres of water. See page 6.

Best applied in the early morning or evening when there is more humidity, less insect flying and less UV light.

Spore activation prior to application can be beneficial by mixing the required quantity of NATURALIS-L in a small quantity of water 2-3 hours before application, see page 6.

The minimum spray interval is 5 days, with a maximum of 5 treatments per crop.

A harvest interval is not applicable.

The shelf life is 12 months at 20°C, longer if kept at 4-7°C.

Optimum use conditions are between 20 and 30°C at over 60% relative humidity. See page 5.

For compatibility with pesticides or beneficial insects, see page 7, 8, 9, 10 & 11.

Use plant protection products safely. Always read the label and product information before use. Further product information, including warning phrases and symbols is included in the main product manual and product label.

VERSION CONTROL

Version	Publication Date	Main changes from previous version
07/19	July 2019	Minor updates and format change.
03/21	March 2021	Revised compatibility list in table 1.
01/23	January 2023	Revised compatibility list in table 1.

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These notes are designed to support the main product manual insert or label information on NATURALIS-L and advise on how to obtain the best possible pest control from the product.

INTRODUCTION

DESCRIPTION

NATURALIS-L is a biological insecticide (biopesticide) containing spores of a specific unique strain (ATCC 74040) of the naturally occurring fungus *Beauveria bassiana*. It is used to control foliar pests in protected edible and ornamental crops. It is formulated in a vegetable oil for spore stability and ease of use.

BACKGROUND

The fungus *B. bassiana* was discovered by Agostino Bassi in 1835 causing disease in domestic silkworm. NATURALIS-L contains the specific strain ATCC 74040 of *B. bassiana* which was isolated from the cotton boll weevil. This strain was included in annex I of EC 91/414 and NATURALIS-L is approved in the UK and Ireland as a crop protection insecticide. This strain is naturally occurring and not genetically modified. NATURALIS-L is sold in Italy, Greece, Switzerland, Germany, Slovenia, Spain, Turkey, Morocco and Austria and is used throughout these countries to control a wide range of insects and mite pests.

TARGET PESTS

NATURALIS-L has label recommendations for the control of whitefly and reduction of numbers of adult and larval stages of thrips. It has activity on a range of other pest species.

Whitefly: Including glasshouse whitefly (*Trialeurodes vaporariorum*), tobacco whitefly (*Bemisia tabaci*) and honeysuckle whitefly (*Aleyrodes Ionicerae*).

Thrips: Western flower thrips WFT (*Frankliniella occidentalis*). High levels of control can be achieved in cucumber, but in trials only partial control (c.30%-50%) was achieved in strawberry, where thrips are concealed inside flowers. Starting a treatment sequence may be critical.

Spider mites: Including two-spotted spider mite (*Tetranychus urticae*), carmine mite (*Tetranychus cinnabarinus*) and tomato russet mite (*Aculops lycopersici*). Trials have shown good control of these pest species with adult, nymph and ovicidal activity (egg stage).

Capsids (*Lygocoris*): Reasonable levels of control have been reported in independent trials.

B. bassiana is also reported to have activity against aphids, caterpillars, leafhoppers, shore flies and sciarid flies, but experience is limited and control cannot be relied upon.

WHY USE NATURALIS-L?

- **Within a conventional pest control programme:**
NATURALIS-L has a unique mode of action and can be part of an insecticide resistance management programme.
As another means of pest control where pests have developed chemical resistance.
Where a chemical pesticide could leave a residue.
Where there is no approval for use of a conventional chemical pesticide on the crop.
To minimise environmental problems from use of chemical pesticides.
- **As part of a chemical pesticide reduction strategy.**
- **Within integrated pest management (IPM) or biological pest control programmes:**
NATURALIS-L can be used as a second line of defence when pest/predator ratios become out of balance.
As an early-stage prevention treatment, particularly in propagation units.

HOW DOES NATURALIS-L WORK?

MODE OF ACTION

The active agent within NATURALIS-L is a naturally occurring soil-borne fungus, *B. bassiana*. Spores germinating on the insect cuticle will enable fungal penetration and proliferation within the insect, causing desiccation and death. Insect activity is disrupted soon after infection, although death would be later (typically 3-5 days). Mobile pests can pick up the infective spores from the leaf surface. Dead insects tend to fall to the floor and thus infections from sporulation tend not to be self-sustaining, although localised infections (epizootics) can occur. Additionally, against pests, like some of the flies, NATURALIS-L has demonstrated repellent properties when applied in preventative treatments.

WHAT ARE THE SYMPTOMS OF AN INFECTED INSECT?

The first indication of death of sedentary insects, such as whitefly scales, is usually a change of colour. Subsequently, under the correct environment, a creamy white spore mass may be produced on the dead insect. There is a tendency for dead insects to fall off the plant, although heavily infested plants may be left showing dead insect bodies.

HOW FAST DOES IT WORK?

Under optimum conditions, infection takes 24-48 hours, death 3-5 days and spores are produced which persist for about 3 days.

WHERE MAY NATURALIS-L BE USED?

CROPS

NATURALIS-L may be used on all edible crops (protected) and ornamental plant production (protected).

Little phytotoxicity has been seen but before making applications it is advisable to test NATURALIS-L on a small area of crop.

ENVIRONMENT FOR ACTIVITY

WHAT ARE THE BEST ENVIRONMENTAL CONDITIONS?

NATURALIS-L contains a living organism and as such the environment affects activity. There will be activity between 10 and 37°C within the relative humidity range of 50-100%.

Optimal conditions are temperatures between 20 and 30°C, with a relative humidity over 60%. Sporulation occurs at over 80% humidity. Note that what is important is the humidity on the bottom of the leaf, where most of the target pests are located. Studies have shown that relative humidity remains high on the bottom surface of the leaf within a 2mm layer, even in dry conditions.

WHAT IS THE EFFECT OF SUNLIGHT?

Sunlight (ultra-violet light) can reduce viability of the spores, although the oil within the formulation offers some protection.

APPLICATION MIXING AND SPRAYING

WHEN TO USE NATURALIS-L

NATURALIS-L may be applied at first signs of the pest as a spot application or whole crop treatment. It may also be applied as a corrective measure at any time during the growing season.

TYPE OF SPRAY

NATURALIS-L should be applied with a fine spray, ensuring complete coverage of the plant to the point just before run-off. NATURALIS-L can be applied to the crop with conventional spraying equipment, including knapsack sprayers.

TIME OF APPLICATION

Applications should be carried out in the morning or in the evening when adult insects fly less and the relative humidity is higher.

WHAT INTERVAL SHOULD BE LEFT BETWEEN SPRAYS?

The minimum interval between applications is 5 days and the manufacturer recommends for best results to reapply after 5 days.

WHAT IS THE MAXIMUM NUMBER OF TREATMENTS ALLOWED?

A maximum of 5 treatments is allowed per crop.

HARVEST INTERVAL

There is no latest time of application, so NATURALIS-L can be used up to harvest.

WHAT IS THE APPLICATION RATE?

The label rate for NATURALIS-L is 3 litres in 1000 litres of water per hectare. However, trials have shown that a concentration of 1.5 litres per 1000 litres of water provides similar control in most situations. Different crops and crop growth stages require different water volumes to achieve adequate crop coverage. To meet efficacy and regulatory requirements, the following rates are recommended by the manufacturer:

1.5 L/ha where a water volume of 500-1000 L/ha is used.

3.0 L/ha where a water volume of 2000 L/ha or above is used.

By increasing the water volume above 2000 L/ha (whilst maintaining the NATURALIS-L rate at the permitted maximum of 3 L/ha), the solution becomes diluted below the desired target concentration of 0.15% v/v (150ml/100litres). Under these circumstances, the need for repeat applications is likely.

Knapsack sprayer rate: 15ml/10 litres of water.

APPLICATION WITH ULV EQUIPMENT

Trials with low volume air-assisted sprayers have been successful. The efficiency of the spraying equipment in achieving good crop coverage at reduced water volumes (i.e. 300 L/ha) is critical to control. Users of this equipment need to satisfy themselves as to the legality of this technique. If in doubt, always use high water volumes (over 1000 L/ha).

ARE THERE ANY SPECIAL REQUIREMENTS WITH REGARD TO SPRAY PREPARATION?

Ensure that spraying equipment is clean and free of residues particularly fungicides which may be harmful. Before measuring the product, gently rotate the bottle to ensure that spores are evenly distributed within the concentrate. Initially, make a solution in half the final volume of water. Once the product is completely dispersed, make up the final volume of water. Maintain continuous agitation of the spray tank to prevent spore sedimentation.

SPORE ACTIVATION

It may be beneficial to activate the spores in the formulation prior to spray application. To do this, measure out the required quantity of NATURALIS-L, mix this with a small quantity of water in a bucket (typically 300ml in 10 litres) and leave for 2-3 hours prior to final dilution and spraying.

Spores that have been in water too long may become very soft and liable to damage in the sprayer. Therefore, ensure that spray solutions have been used within a maximum of 5 hours after mixing with water.

After application, rinse the sprayer several times with water and leave to air dry before returning to store.

ADDITIONAL WETTERS

Because of the oil-based formulation, additional wetters would not normally be required.

SHELF LIFE

NATURALIS-L has a 12-month shelf life when stored at room temperature (20°C). To retain maximum spore viability, it would be best to store at 4-5°C. When opened, ideally store at fridge temperature (4-7°C). The production date is stamped on each individual bottle.

COMPATIBILITIES

BIOLOGICAL CONTROL AGENTS

NATURALIS-L can be used within biological pest control programmes.

NATURALIS-L has been classified as non-toxic (less than 25% mortality) to the following beneficial organisms:

Amblyseius, *Aphidius*, *Diglyphus*, *Encarsia* and *Phytoseiulus*. There is limited data to show it is compatible with *Chrysoperla*, *Steinernema*, *Anthocoris*, *Orius* and *Macrolophus* in some situations.

A gap of 2 days is advised between application and new releases.

SAFETY TO BUMBLE BEES

Use the bee lock to prevent bees entering the crop when spraying. Bees can be released after spray deposits have dried.

FUNGICIDE AND INSECTICIDE COMPATIBILITY

See Table 1.

Table 1: Compatibility with fungicides and insecticides

The label says that NATURALIS-L should not be tank mixed with any other product and an interval of at least 48 hours should be left before applying a fungicide.

NATURALIS-L contains spores of a fungus, so care is required in the application of other products particularly fungicides. However, laboratory tests, which may not have been carried out on UK formulations, have given us this additional information which may help in planning a crop protection programme.

Active	UK example	¹ Rate tested g or ml/100L	Key
FUNGICIDES			
amisulbrom	Shrinkon / Leimay	60	Y
<i>Ampelomyces quisqualis</i> strain AQ10	AQ 10	5	Y
<i>Aureobasidium pullulans</i> strain DSM 14940 & DSM 14941	Botector/ Blossom Protect	100	Y
azoxystrobin	Amistar	75	N
<i>Bacillus amyloliquefaciens</i> strain D747	Amylo-X	250	Y
<i>Bacillus subtilis</i> strain QST 713	Serenade (test not UK formulation)		P
Continued on page 8			

Continued from page 7			
boscalid	Filan		Y
boscalid + pyraclostrobin	Signum	180	P
bupirimate	Nimrod	100	N
captan	Captan		N
Cerevisane	Romeo	500	Y
chlorothalonil	Bravo		N
copper oxychloride ²	Cuprokylt		Y ²
COS-OGA	Fytosave	270	Y
cyazofamid	Ranman (test not UK formulation)		Y
cyflufenamid	Takumi	30	Y
cymoxanil	Curzate		N
cymoxanil + famoxadone	Tanos (test not UK formulation)		P
cyproconazole	-		N
cyprodinil	-		Y
cyprodinil + fludioxonil ³	Switch ³ (apply Naturalis L 10-12 days apart)	30	N ³
Difenoconazole	Plover	400	Y
Dimethomorph	Paraat	40	N
dithianon + potassium phosphonate	Delan pro	300	N
dodine	Syllit/Radspor		N
fenhexamid	Teldor (test not UK formulation)		Y
fenpyrazamine	Prolectus		N
fluazinam	Shirlan / Tizca		N
fludioxonil	Geoxe		P
fluopicolide + propamocarb	Infinito		N
fluopyryram	Luna Privilege (test not this formulation)		Y
fluxapyroxad	Sercadis	15	P
folpet	-		N
fosetyl-aluminium	Aliette		Y
isofetamid	Kenja	200	Y
kresoxim methyl	Stroby	200	N
mancozeb	Many		N
mandipropamid	Revus	60	N
mepanipyrim	Frupica	80	N
metalaxyl-m	SL567A / Subdue (test not UK formulation)		Y
metrafenone	Vivando	30	Y
myclobutanil	Systhane		N
penconazole	Topas	30	N
Continued on page 9			

Continued from page 8			
penthiopyrad	Fontelis		N
potassium hydrogen carbonate	(test not UK formulation)	500	Y
potassium hydrogen carbonate	(test not UK formulation)	2000	N
propamocarb	Proplant	200	N
proquinazid	Justice / Talius	20	Y
pyrimethanil	Scala	75	N
<i>Pythium oligandrum</i> M1	Polyversum		Y
sulphur	Microthiol Special	175	N
sulphur	Thiovit Jet (not UK approved at time of compilation)		Y
tebuconazole	(test not UK formulation)		N
thiophanate-methyl	Cerobin		Y
trifloxystrobin	Flint	10	N
zoxamide	(test not UK formulation)		N
INSECTICIDES			
abamectin	Dynamec	50	Y
acetamiprid	Gazelle (test not UK formulation)	50	Y
acequinocyl	Kanemite	180	Y
bifenazate	Floramite (test not UK formulation)		Y
chlorantraniliprole	(test not UK formulation)		Y
fatty acids	Flipper	2000	Y
flonicamid	Mainman / Teppeki	25	Y
flupyradifurone			Y
garlic extract	Nemguard SC	200	Y
maltodextrin	Majestik/Eradocoat	2500	N
physically acting	SB Plant Invigorator		N
spinosad	Tracer		Y
spiromesifen	Oberon		P
spirotetramat	Batavia/Movento (test not UK formulation)		Y
sulfoxaflor	Sequoia	40	P
OTHER			
Rape oil fatty acids (adjuvant)	Addit	250	Y
Key Y = YES. Compatible in tank mixture without any significant reduction in spore germination. ¹ The tank mix rate tested. This is not necessarily related to a UK rate of use. ² Lowest fungicide rate mentioned on copper oxychloride. ³ Apply Naturalis L 10 – 12 days before or after the fungicide treatment. P = PARTIAL. Can be applied in tank mix only by using the lowest rate of product and applying just after mixing. N = NOT COMPATIBLE. Apply NATURALIS-L 4 days before or after the fungicide treatment. Continued on page 10			

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N.B. All the products were tested at the recommended rate of the product in its country of origin, which may be different to UK recommendations.

The UK equivalent trade name of the fungicide tested is provided, but formulations in the country of test may have been different and the actual product tested may be more or less harmful than that available in the UK. Only those products *known* to have been tested with a different formulation from that in the UK are marked (test not UK formulation).

A number of the products listed may not yet be approved in the UK, or not approved for protected plant production and their inclusion on this list does not infer any recommendation.

No liability will be accepted for any loss or damage as a result of using products listed in this table. Tank mix compatibility should not be considered a recommendation, see restrictions on label.

WARRANTY

The seller makes no warranty, expressed or implied, with regard to the use of this product other than that indicated on the label. The purchaser and user shall assume all risk associated with use and/or handling and/or the storage of the product, if this use/or handling and/or storage are carried out contrary to the instructions on the label.

NATURALIS-L is an oil dispersion formulation containing 7.16% w/w *Beauveria bassiana* ATCC 74040 (2.3×10^7 CFU ml⁻¹). MAPP 17526. PCS 04187.

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