

Serifel[®]
Biological Fungicide

Technical guide

Break the mould



Totally
Biological
by **BASF**

BASF
We create chemistry

Breaking the mould

Serifel® Biofungicide will change the way strawberry and grape growers manage their botrytis programs. Its complementary multiple modes of action provide an alternative to conventional fungicides and will reduce total residues as it controls the disease – including strains with developed resistance – right up to harvest.

As a biological fungicide, Serifel can be used up to ten times each growing season and has no withholding period. Adding it to the rotation makes the total spray program much more flexible, reliable and sustainable.

Applying Serifel right up to picking is an attractive option because the formulation is much more concentrated than other biological fungicides. Achieving control with significantly less active ingredient means that Serifel is much less likely to leave visible spray deposits that could affect the marketability of fresh strawberries and table grapes.

General characteristics of *Bacillus amyloliquefaciens* strains

- Naturally occurring soil-borne bacteria
- Found all over the world
- Produce extremely stable spores
- Produce a unique combination of metabolites
- Are NOT toxic to human beings

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Product profile

Active ingredient	<i>Bacillus amyloliquefaciens</i> strain MBI600 (min 5.5 x 10 ¹⁰ cfu/g)
Mode of action	Group 44. Microbial disruptors of pathogen cell membranes.
Formulation	Wettable powder
Pack size	2 kg
Compatibility	Serifel can be tank-mixed with a range of other fungicides and other crop protection products. See page 7.
Rainfastness	Serifel shows excellent rainfastness.

Use profile

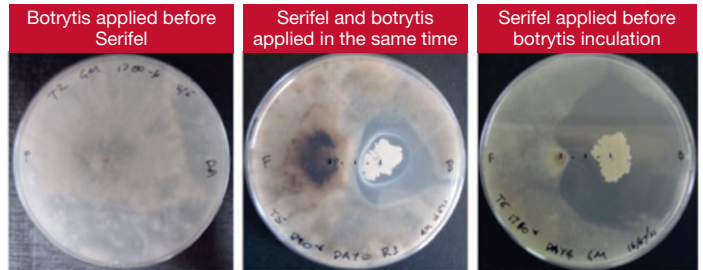
Target disease	<i>Botrytis cinerea</i> (Botrytis bunch rot/grey mould)
Crops	Strawberries Table grapes Wine grapes
Rates	Grapes: 50-75g/100L (dilute spraying) Strawberries: 500 g/ha
Maximum sprays per growing season	10
Spray intervals	3-14 days
Withholding period	None

MODES OF ACTION

Serifel's active ingredient – *Bacillus amyloliquefaciens* strain MBI600 – is a beneficial spore-forming, rod-shaped bacterium that colonises the leaf surface of plants.

Serifel works best as a preventative treatment. Application before disease pathogens have established on the plant gives Serifel time to germinate, colonise the plant surface and produce its disease-fighting metabolites.

As a contact biological fungicide, Serifel forms a 'shield of protection' against a broad spectrum of plant pathogens, including *Botrytis cinerea*, thanks to three modes of action:



1. Competition for space	2. Competition for sustenance	3. Production of antifungal metabolites
When the Serifel spores are the first to occupy the limited space on the plant, they physically exclude plant pathogens from occupying the same space.	Serifel depletes the supply of nutrients available to the pathogen spores on the plant surface.	Serifel produces specific metabolites – called iturin and surfactin – that prevent pathogens from germinating by disrupting their cell membranes.

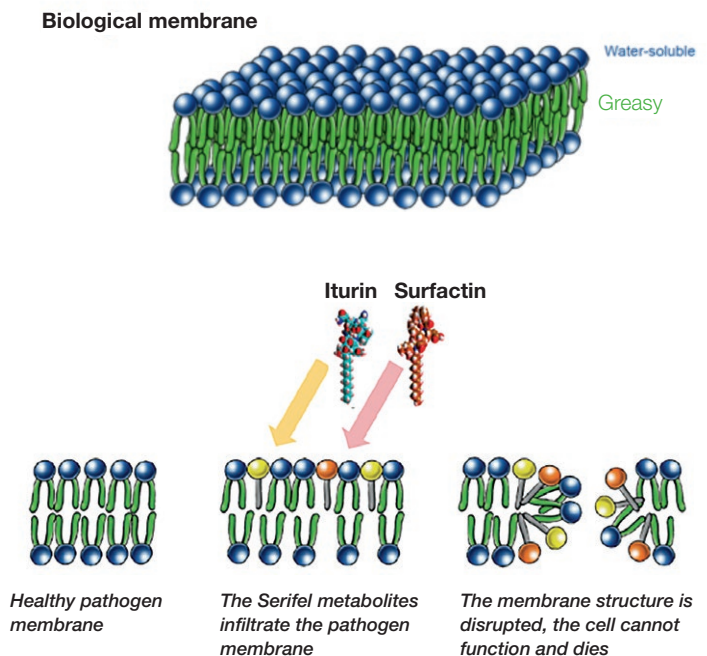
Membrane disruption

Serifel is a pure spore formulation. It doesn't contain metabolites, but they are produced by the bacteria that grow on the plant surface after application.

The metabolites produced are iturin and surfactin – lipopeptide metabolites that are able to penetrate into membranes and disrupt them.

The Serifel metabolites are similar enough to membrane building blocks to penetrate and disrupt the normal packing.

The altered membrane structure is less stable due to buckling and pore formation. The membranes begin to leach, the cell functionality is disrupted and the cell dies.



OPTIMAL CONDITIONS PRODUCE OPTIMAL RESULTS

Its unique modes of action mean Serifel needs to be used strategically and as recommended to achieve its full benefit.

When conditions are not ideal, the rates of growth and colonisation will be slowed and control may be reduced.

Agronomists and growers who understand how the factors listed below affect Serifel's performance will have the most success in creating fully integrated botrytis management programs.

Optimal environmental conditions

Temperature: 25–45° C

Serifel is able to grow under a wide range of temperatures (from 15° up to 50° C). At extremes, the rate of bacterial growth (and therefore efficacy) will be lower.

Leaf surface water: >90%

Moisture is needed for spore germination and growth of Serifel.

pH: 5.4–6.8

Serifel is effective across a broad pH range, but slightly acidic conditions are optimal for rapid growth.

Optimal application conditions

Timing: Pre-infection

Serifel needs to be used preventatively so it can occupy space on the plant surface and leave no room for pathogens.

Water volume: Point of run-off

Using sufficient water volumes will help distribute the Serifel spores, but spray run-off should be avoided because it reduces Serifel activity on the leaf.

Using adjuvants: Spreading or fixing agents with low impact on leaf water

In 82% of studies across four pathogen/crop systems, using an adjuvant improved Serifel's efficacy. Sticking agents may be used to increase retention on the plant surface. Spreading agents can be used to improve surface distribution, but may also result in a thinner water film on the leaf. The subsequent lack of moisture will potentially limit the growth of Serifel.

Disease pressure: Low

Serifel shows the highest efficacy when disease pressure is low.



TOXICITY AND ENVIRONMENTAL IMPACT

The active ingredient in Serifel is a naturally occurring strain of bacteria. Contact between non-target organisms and *Bacillus amyloliquefaciens* occurs constantly in nature with no negative effects.

Its low environmental impact and toxicity allows Serifel to be used in sensitive areas and in cropping systems where pollinating bees are present. Serifel can also be used in Integrated Pest Management (IPM) programs where beneficial insects and mites are used for insect control.

Serifel Biofungicide has organic certification.



SPRAY DEPOSITION

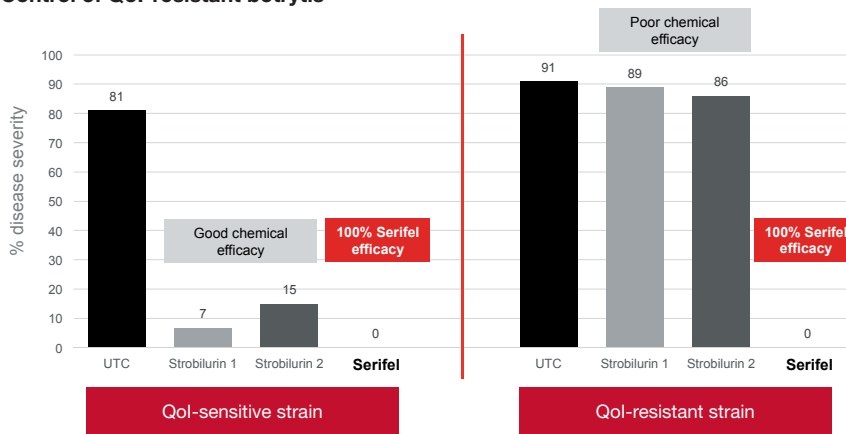
Serifel is one of the most concentrated biological fungicides available anywhere in the world. The high loaded, pure spore formulation allows effective application at lower rates compared to other biological products, normally leaving no detectable spray deposits.



RESISTANCE MANAGEMENT

There is no cross-resistance between Serifel and conventional chemical fungicides. Trials have shown that Serifel can control botrytis with resistance to both QoI and SDHI fungicides. However, a spray program including chemical fungicides to which there is tolerance may involve high disease pressure – making early, preventive application of Serifel even more critical.

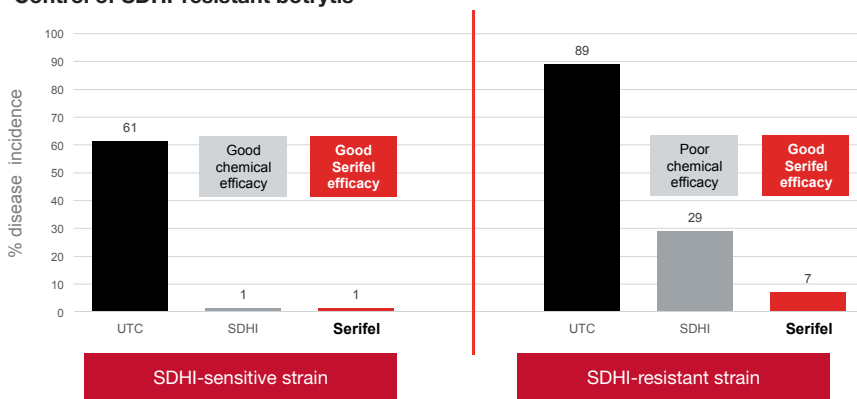
Control of QoI-resistant botrytis



UTC = untreated control

Application 6 days before artificial inoculation. Assessments 4 days after infection. Glasshouse experiment on lettuces, 2015

Control of SDHI-resistant botrytis



UTC = untreated control

Applications 1 day before artificial inoculation. Assessments 5 days after infection. Glasshouse experiment on tomatoes, 2015

COMPATIBILITY

Serifel is compatible with a range of potential tank-mix partners.

These tables are based on the testing of relevant mixing partners at label rates and a dilute water volume per 100L water.

Further testing is expected to increase the list of mixing partners.

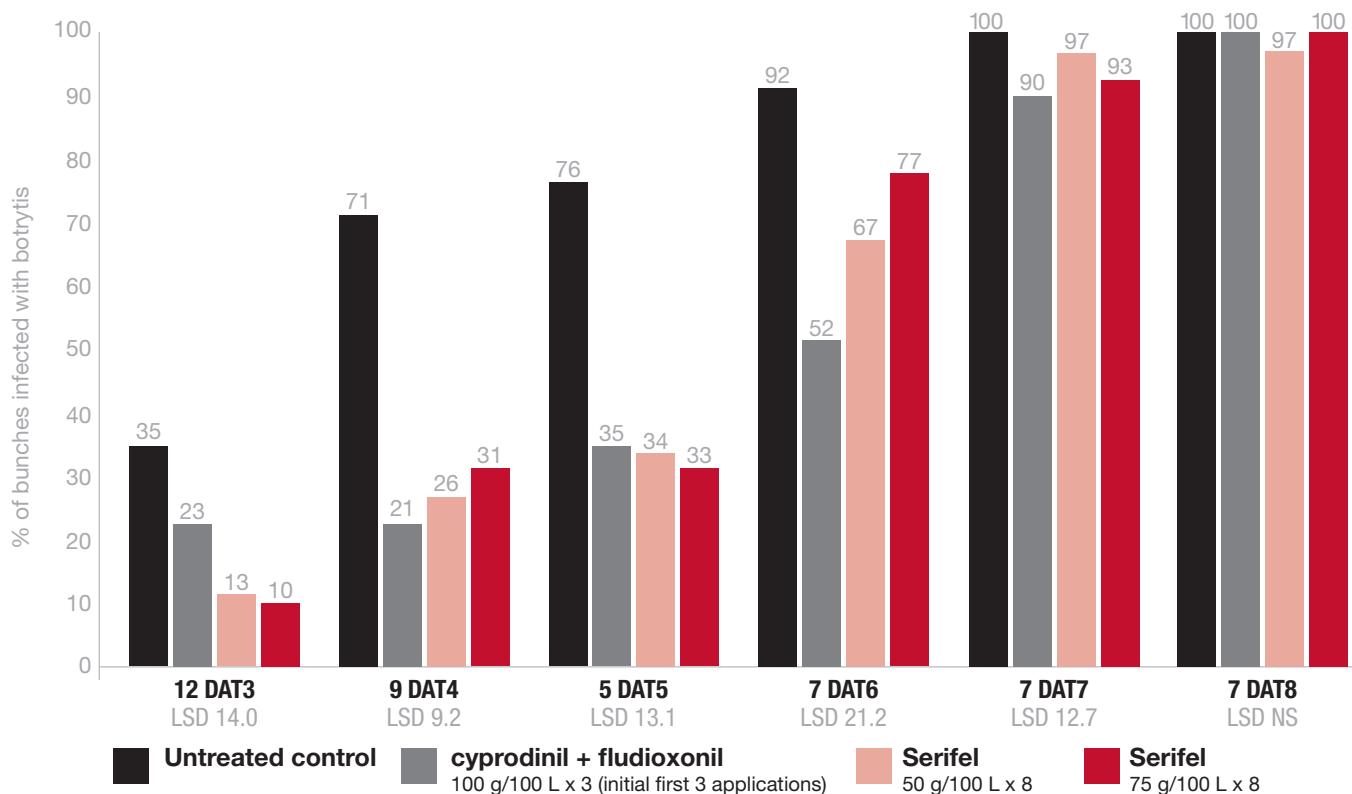
Compatible conventional fungicides		
azoxystrobin	difenoconazole	Kumulus DF
boscalid + pyraclostrobin	fenhexamid	myclobutanil
captan	Filan	pyrimethanil
copper hydroxide	fluopyram + trifloxystrobin	Sercadis REGISTRATION PENDING
cyprodinil	iprodione	Vivando
cyprodinil + fludioxonil		
Compatible insecticides		
chlorantraniliprole	dinotefuran	spirotetramat
cyflumetofen	spinosad	

Testing of further tank-mix partners is ongoing.

For information about compatibility with products and active ingredients not listed here, contact your local BASF representative.

SERIFEL IN GRAPES – TRIAL DATA

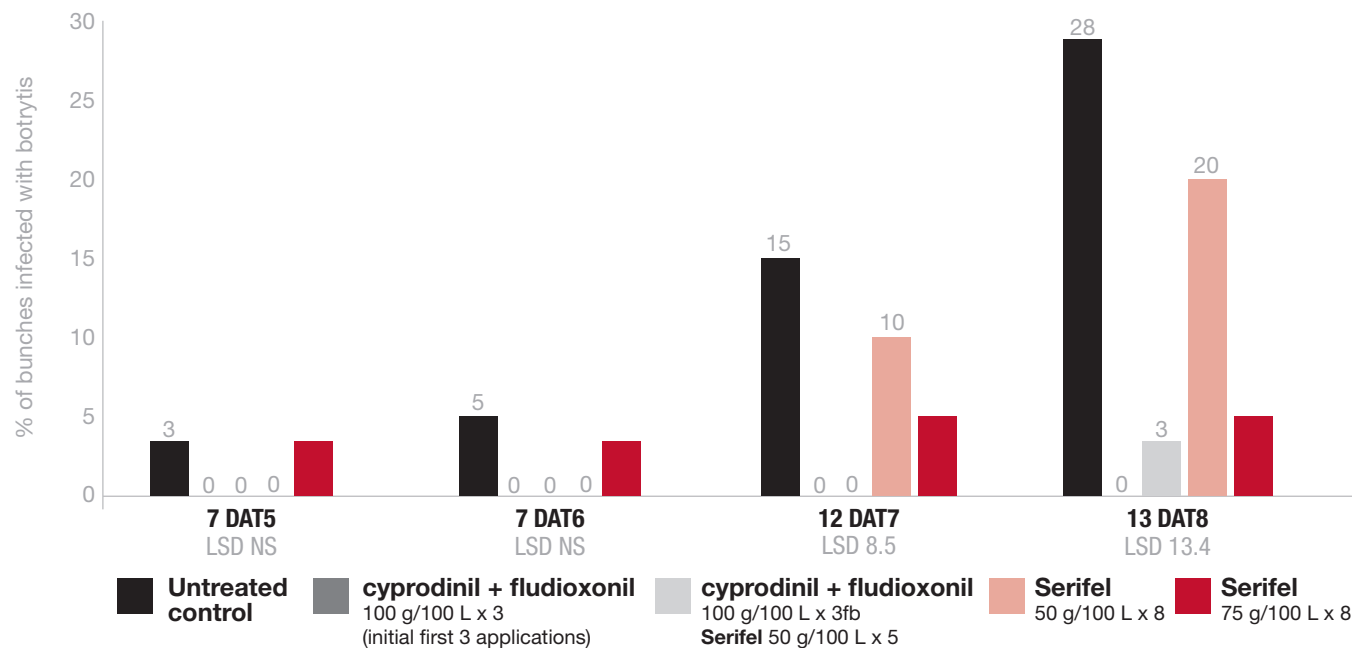
High disease pressure in chardonnay grapes



DAT = days after treatment LSD - least significant difference NS = not significant

Eurofins Agrisearch Blewitt Spring SA 2013–2014.
Chardonnay grapes sprayed at 1000 L/ha water volume.
8 applications from BBCH 61 (10% capfall)

Lower disease pressure in chardonnay grapes



DAT = days after treatment LSD - least significant difference NS = not significant

Eurofins Agrisearch Blewitt Spring SA 2013–2014
Chardonnay grapes sprayed at 1000 L/ha water volume
8 applications from BBCH 61 (10% capfall)

SERIFEL IN GRAPES – APPLICATION GUIDELINES

Serifel has no curative activity, so it must be applied preventatively. Applications should be at least 3 days and up to 14 days apart, but trial work suggests the spray interval should generally be no more than 7 days.

Serifel should only be applied when the temperature is unlikely to drop below 15°C.

Applying Serifel with spreader-type adjuvants that improve leaf and cluster coverage can stabilise Serifel's efficacy.

Using greater water volumes for optimal crop coverage will also help ensure reliable performance.

Serifel can be tank-mixed with conventional fungicides for application at the key crop stages (BBCH 68, 75, 81) and then used as a standalone spray for the final applications before harvest.

Application rates: 50–75 g/100 L

Application timing: Apply preventatively, before disease develops.

Key application timings include flowering, pre bunch closure, veraison and pre-harvest.

Suggested use patterns:

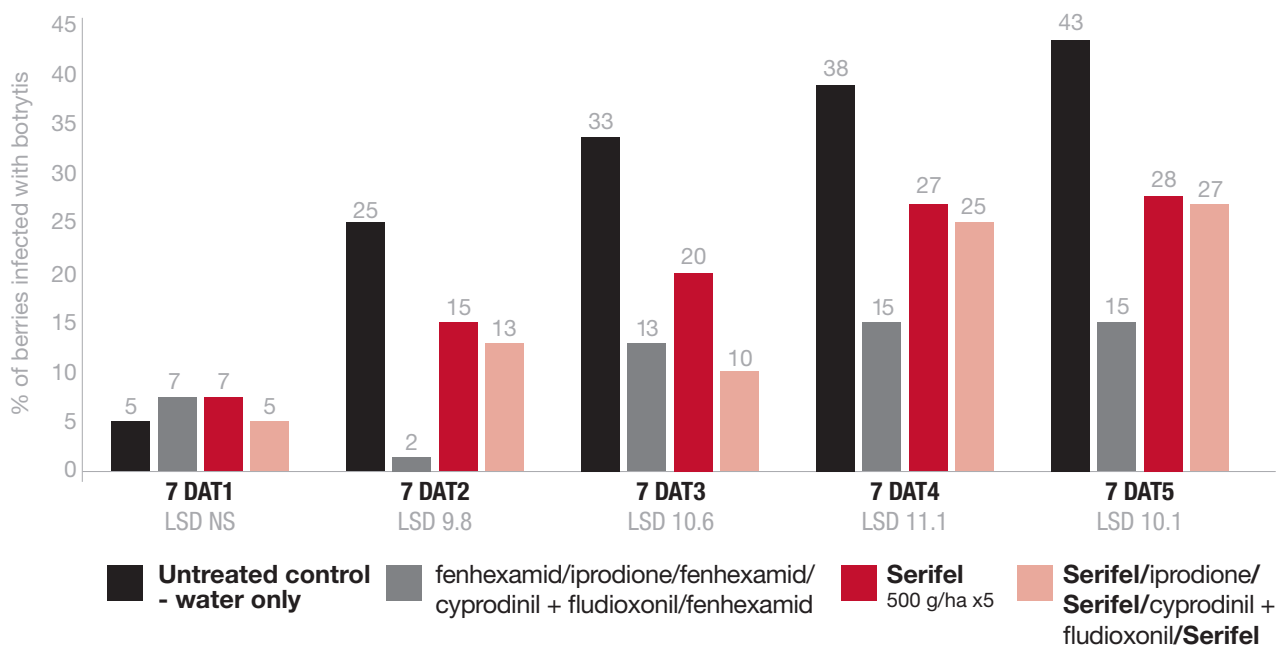
BBCH											
	00	07	11–19	51–53	57–61	68	71–73	75–77	79	81	89
	Winter bud	Bud burst	Leaf development	Flower emerges	Flowering to 10% capfall	80% capfall	Capfall	Pea-sized berries	Bunch closure	Veraison	Harvest
Table grapes					M5	Filan	Serifel	Serifel	9+12	Serifel	Serifel
Higher disease pressure with reduced sensitivity					M5	9+12		17	Serifel	Serifel	Serifel
Higher disease pressure					M5	17	9+12	Serifel	Serifel	Serifel	Serifel
Lower disease pressure					Serifel	Serifel		Serifel	Serifel	Serifel	Serifel

- Conventional chemistry (with suggested mode of action group numbers)
- Filan
- Serifel

SERIFEL IN STRAWBERRIES – TRIAL DATA

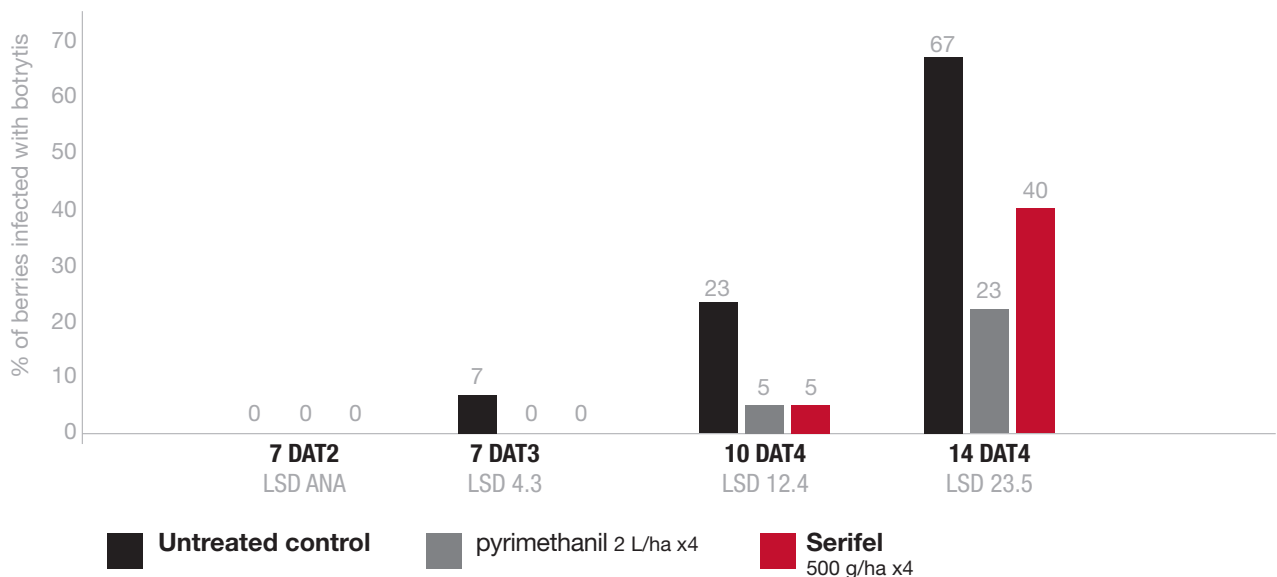
The first graph below shows how Serifel can be used to complement conventional treatments rather than replace them altogether.

Serifel as a complement to conventional treatments



DAT = days after treatment LSD = least significant difference NS = not significant
Eurofins Agrisearch Bundaberg Queensland 2013
608 L/ha water volume

Botrytis control in strawberries



DAT = days after treatment LSD = least significant difference NS = not significant
Eurofins Agrisearch Coldstream Victoria 2014
700 L/ha water volume

SERIFEL IN STRAWBERRIES – APPLICATION GUIDELINES

Serifel has no curative activity, so it must be applied preventatively. Applications should be at least 3 days and up to 14 days apart, but trial work suggests the spray interval should generally be no more than 7 days.

Serifel should only be applied when the temperature is unlikely to drop below 15°C.

Applying Serifel with spreader-type adjuvants that improve leaf and cluster coverage can stabilise Serifel's efficacy.

Using greater water volumes for optimal crop coverage will also help ensure reliable performance.

Serifel can be tank-mixed with conventional fungicides for application under low to medium disease pressure and used as a standalone spray between pickings and during the pre-harvest interval for chemical products.

Application rates: 500 g/ha

Application timing: Apply preventatively, before disease develops.

Apply again at 3–14 day intervals as required.

Suggested use patterns:



BBCH

	10–19	41	58	(62)	65	73	84	87	89	91–97
	Leaf development	Beginning of runner formation	Early balloon stage	Full flowering	Development of fruit	1 st fruit have colour	Main harvest	2 nd harvest	Post harvest	
High pressure			M4	2	9+12	17				
Low pressure					9+12	Serifel	Serifel	Serifel	Serifel	
Improving chemical performance			M4	2	9+12	17	Serifel	Serifel	Serifel	

Conventional chemistry (with suggested mode of action group numbers)

Serifel

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Biological Fungicide

For more information on Serifel, visit crop-solutions.basf.com.au
or contact your local BASF representative on **1800 558 399**


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