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Mikrobiologiske midler - jordbær og hindbær

Borregaard Bioplant ApS
Nina Jørgensen


Jordbærkonferencen 2022


Pejsegården Brædstrup

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Biofungicider

- Lalstop G46

  Gråskimmel & rodsygdomme

- Prestop Mix

  Gråskimmel

Biopesticider:

- Lalguard M52 GR

  Øresnudebiller og trips

- Botanigard

  Mellus

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LALSTOP G46 WG

LALGUARD M52 GR

LALGUARD M52 OD

LALSTIM OSMO

LALSTOP CONTANS WG

LALLEMAND

LALLEMAND PLANT CARE

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LALSTOP G46 WG - *Biofungicid*

- Aktiv mikroorganisme: *Clonostachys rosea* J1446 (>1x10^9 cfu/g)
  - tidligere *Gliocladium catenulatum* J1446
- Formulering: Vandopløseligt granulat (WG)
- Pakkestørrelse: 100 g og 1 kg
- Opbevaring og holdbarhed:
  - I uåbnet emballage 18 mdr under +4°C
  - I åbnet og genlukket emballage 1 mdr under +4°C

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LALSTOP G46 WG - *Biofungicid*

Nyttesvampen ***Clonostachys rosea* j446** (syn. *Gliocladium catenulatum*)
har i mere end 20 år vist dokumenteret effekt mod svampesygdomme som:

- **Gråskimmel *Botrytis***
- ***Fusarium sp.***
- ***Pythium sp.***
- ***Phytophtora sp.***
- ***Rhizoctonia***

Det er samme nyttesvamp, som findes i produkterne:
Prestop WP som har været brugt i mange år i DK i væksthuse.
Prestop Mix som er formuleret til udbringning med bier ('Flying Doctors')

Lalstop G46 :
10 x mere koncentreret end Prestop WP.
1 kg Prestop WP = 100 g LALSTOP G46 WG

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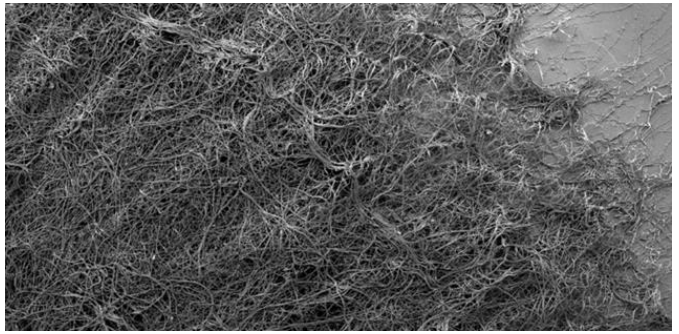
LALSTOP G46 WG

- Sådan virker det

1. Koloniserer behandlede plantedele og konkurrerer med de skadelige svampe om adgang til næring og plads.

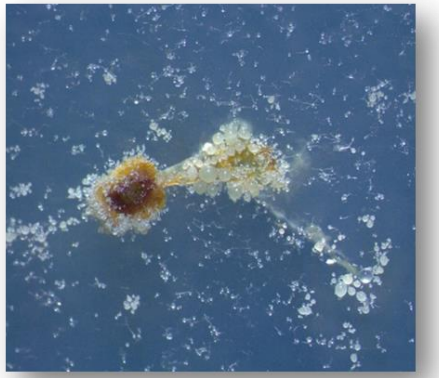
2. Fungerer som en hyperparasit, der vokser rundt om de patogene svampe.

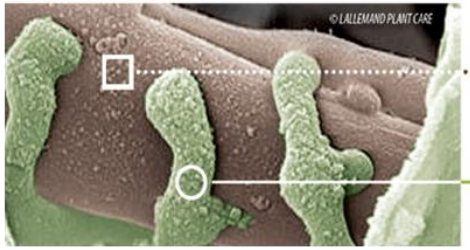
3. Producerer enzymer, der nedbryder de patogene svampes cellevægge.



Clonostachys rosea mycelium

Støvdrager fra jordbærblomst koloniseret af *Clonostachys rosea*





Mycelium of the pathogenic *Rhizoctonia* fungus

Clonostachys rosea J1446

Risikoen for udvikling af resistens er meget lille grundet produktets mange virkemåder overfor de patogene svampe.

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LALSTOP G46 WG - *Anvendelse*

1. Sprøjtes på plantens overjordiske dele
- mod gråskimmel *Botrytis*

Prestop® Mix med bier

2. Iblandes/sprøjtes på jord
- mod jordbårne sygdomme som: *Rhizoctonia, Fusarium, Pythium, Phytophthora*

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LALSTOP G46 WG

- Godkendt anvendelse

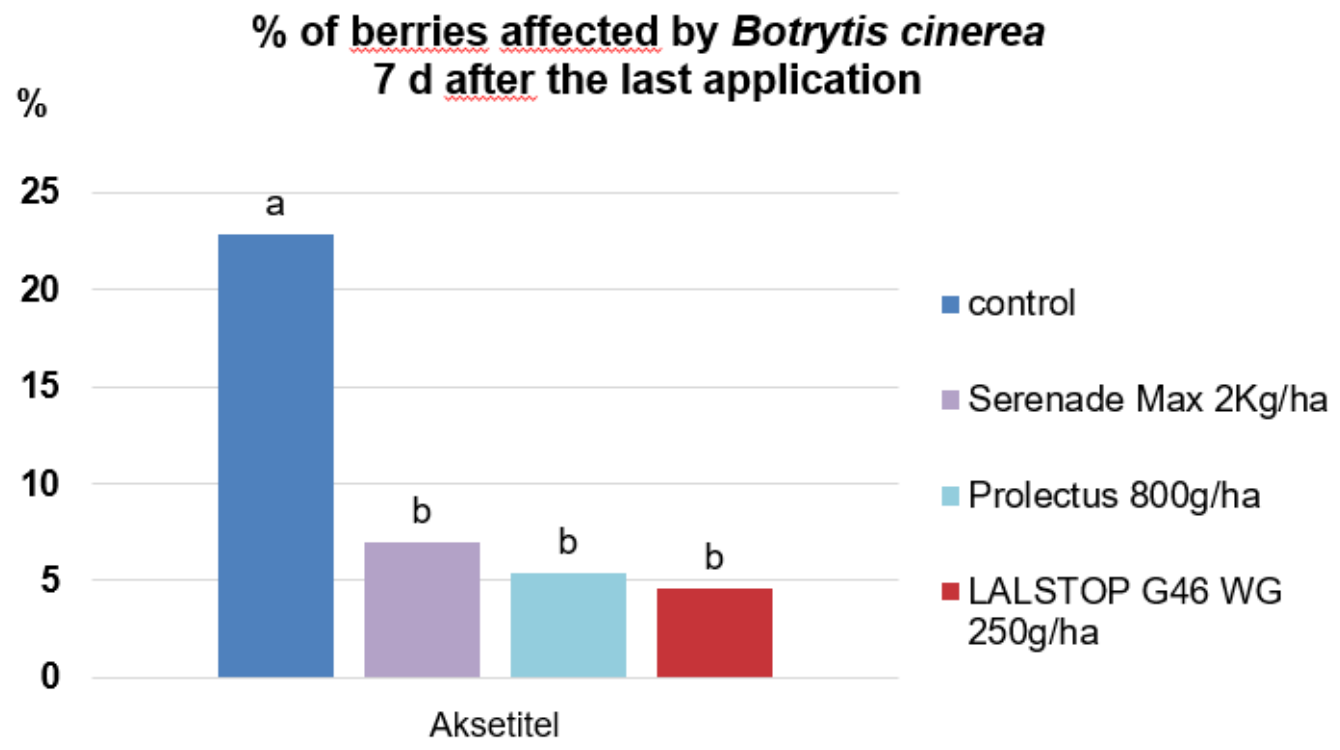
Gråskimmel - Botrytis

Metode: sprøjtning

Afgrøde	**Tidspunkt for behandling**	**Antal behandlinger per vækstsår el. sæson**
Jordbær (friland/tunnel)	ballonstadie, begyndende til slut blomstring	1-4
Jordbær (væksthus)	blomstring	1-2
Hindbær (friland/tunnel)	blomstring	1-3
Hindbær (væksthus)	Efter plantning; ved blomstring	1-4

Decrease in the share (%) of strawberries affected by grey mould (*Botrytis*)

- Promovert, Spain, 2019
- Strawberry variety: Rociera
- « Open » Tunnel
- First application at the beginning of flowering
- Weekly applications for as long as plants were flowering



Control of grey mould (*Botrytis*) on strawberry in open field

Finland, 2020
Variety: 'Polka', 2nd year of production
Open field, commercial production

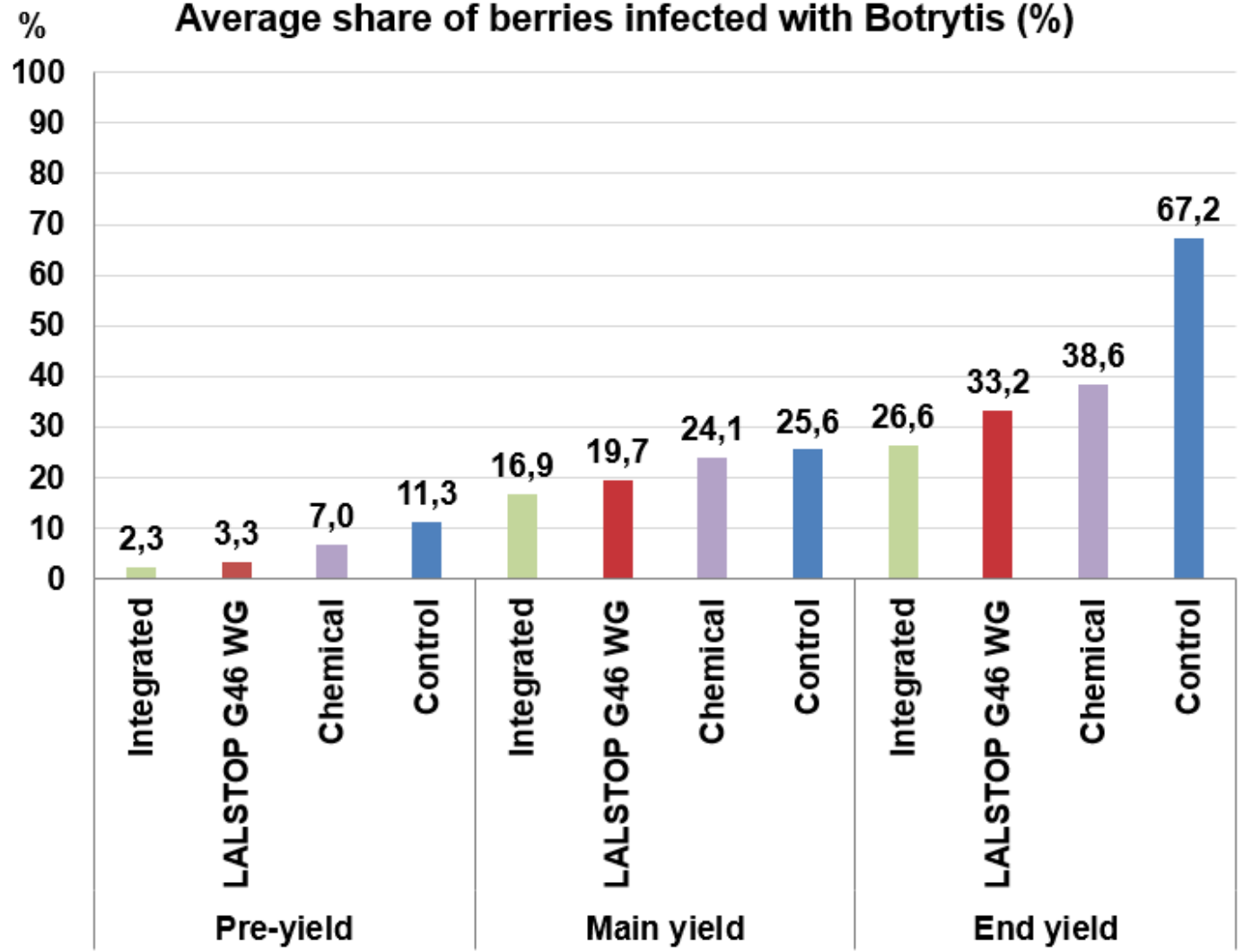
Spraying with a tractor sprayer (Rocha Mittos AC mist blower), 15 bar, spraying volume 400 l/ha

Applications in the beginning of flowering, at main flowering and in the end of flowering:

- Integrated control program: LALSTOP G46 WG 0,3 kg/ha + Frupica + LALSTOP G46 WG 0,3 Kg /ha
- 3 x LALSTOP G46 WG 0,3 kg/ha
- Standard chemical (Frupica)
- Untreated control

- Adjuvant Silwet Gold was added in all product applications

- 4 repetitions
- Observations of berry yield in 3 picking times
  - Healthy and mouldy berries



Control of grey mould (*Botrytis*) in organic strawberry production

Finland, 2020
Variety: 'Polka' 1st year of production
Open field, organic production

Spraying with a tractor sprayer (3,5 bar) in the beginning, middle and end of flowering:

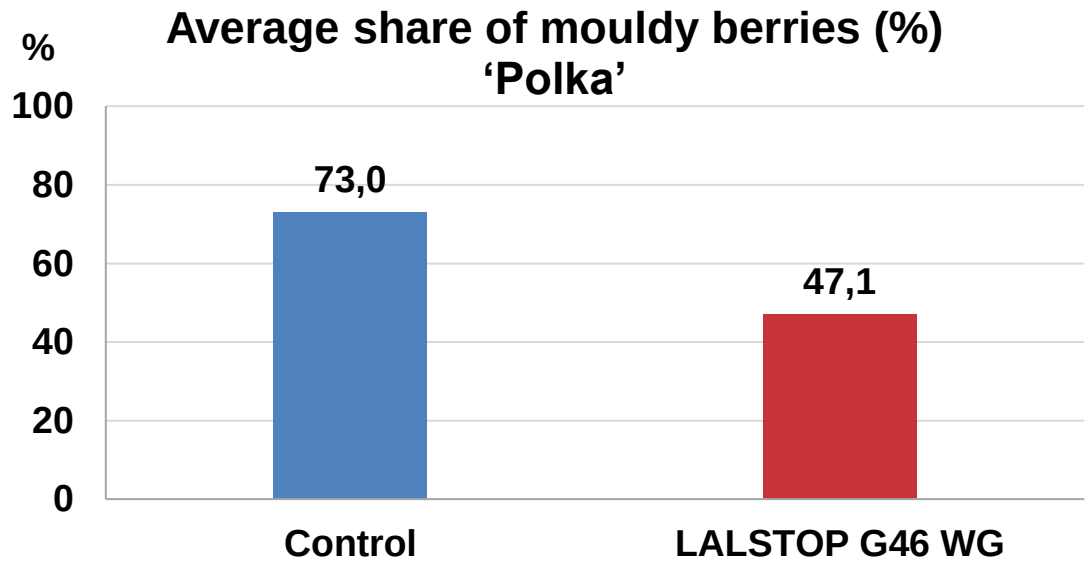
- Control
- LALSTOP G46 WG 0,3 kg/ha (0,05 %, 650 l/ha)

Observations of berries from 4 replicates in the end of picking period

- Healthy/mouldy berries

Excellent *Clonostachys* colonization in the flowers

- *13,9 % of stamens of the untreated control flowers were colonized → bees and other pollinators most probably transported *Clonostachys* from the treated area



Colonization (%) in stamens after the 2nd spray application	
Treatment	**Colonized stamens (%)**
LALSTOP G46 WG	95,0
Untreated control	13,9*

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LALSTOP G46 WG

- Praktisk anvendelse

Lalstop G46 kan anvendes alene (også til **øko**) eller som led i et **integreret plantebeskyttelsesprogram** hvor det erstatter 1-3 kemiske behandlinger.

Anvend lille dråbestørrelse (f.eks. 50-75 microns) for bedre spredning og fordeling på svært tilgængelige steder.

Anvend forebyggende ved begyndende, midt- og slut blomstring.

Behandl sen eftermiddag/aften for at minimere unødig eksponering for UV-lys.

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Flying Doctors

- Prestop mix (*Clonostachys rosea*)
- Bragt ud med humle- eller honningbier
- Jordbær og hindbær

Managing Bees for Delivering Biological Control Agents and Improved Pollination in Berry and Fruit Cultivation

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Over 20 forsøg med Prestop® Mix leveret med honningbier (primært) og humlebier i jordbær på friland i perioden 2006-2014 i Estland, Finland, Italien, Slovenien og Tyrkiet.

Country	Site	Year	Grey mold proportion[1] Untreated	Fungicide	Biocontrol	F:cide+Bio	% reduction by Biocontrol	Sign.	Citation
Light mold attack									
Turkey	1	2013	2.6		0.8		69		1
Turkey	1	2014	3.5		0.9		74		1
Estonia	BB 1	2012	3.9		0.2		95		2
Finland	3	2006	5.8		3.2		45		3
Estonia	HB 1	2011	6.0		3.0		50		2
Finland	5	2007	8.5		3.0	1.8	65		3
Finland	2	2006	9.5	2.5		0.8			3
Average			5.7	2.5	1.8	1.3	66		
Moderate mold attack									
Finland	4	2007	11.9		7.8		34		3
Finland	2	2007	12.0	4.0	7.0	4.2	42		3
Estonia	BB 1	2013	14.5		6.5		55		2
Finland	3	2007	17.0		9.1		46		3
Estonia	BB 2	2012	17.5		5.5		69		2
Slovenia	1	2014	19.0		17.0		11	ns	4
Finland	1	2009	22.1	2.6	9.6	3.3	57		3
Estonia	HB 1	2012	23.0		15.0		35		2
Finland	3	2008	24.0	9.0	8.0	3.0	67		3
Finland	3	2009	24.2		14.9		38		3
Average			18.5	5.2	10.0	3.5	45		
Heavy mold attack									
Finland	1	2007	26.3	6.0	7.8	1.0	70		3
Finland	2	2009	38.5		19.6		49		3
Italy	1	2012	39.4	25.8	13.3	10.5	66		5
Finland	2	2008	40.0		20.0		50		3
Finland	1	2008	45.0	10.0	35.0	1.0	22	ns	3
Estonia	HB 1	2010	48.0		38.0		21	ns	2
Finland	4	2009	50.3	46.0					3
Slovenia	1	2013	55.0		27.0		51		4
Finland	1	2006			10.5	9.0			3
Average			42.8	22.0	21.4	5.4	47		

Citation: 1 = Eken, 2014; 2 = Mänd et al., 2014; 3 = Hokkanen et al., 2014; 4 = Bevk, 2014; 5 = Maccagnani,

- Stort smittetryk (>25% angrebne bær i ubehandlet kontrol), gav Prestop Mix bragt ud med bier i gns. 47% reduktion i forekomsten af gråskimmel (= program med kemi).
- Ved lavt smittetryk: i gns. 66% reduktion sammenlignet med ubehandlet.
- Prestop mix med bier gav en signifikant reduceret forekomst af gråskimmel i 20 ud af 23 markforsøg

Hokkanen *et al.* 2015

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LALSTOP G46 WG - *Anvendelse*

1. Sprøjtes på plantens overjordiske dele
- mod gråskimmel *Botrytis*

2. Iblandes/sprøjtes på jord
- mod jordbårne sygdomme som: *Rhizoctonia, Fusarium, Pythium, Phytophthora*

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LALSTOP G46 WG - *Godkendt anvendelse*

Mod rodsygdomme: *Phytophthora, Pythium, Fusarium, Rhizoctonia*

Jordbær og hindbær på friland/tunnel og væksthus

Behandlingsmetoder:

- Dypning ved plantning og udplantning (f.eks. frigo planter)
- Udvanding eller sprøjtning før plantning (småplanter)
- Udvanding, drypvanding eller sprøjtning efter plantning (gentag efter 4 uger)

Dyp-behandling af jordbærplanter inden plantning

- Hele frigo planten, inkl. rødder og krone, dyppes i en 0,05 % LALSTOP G46 WG opløsning.
- Alternativt: dyp hele bakken i en 0,05 % LALSTOP G46 WG opløsning.
- En hurtig behandling på ca. 1-minuts tid er tilstrækkelig.
- Det har ingen betydning for effekten at opløsningen bliver beskidt.

Clonostachys kolonisering af rødder på en jordbær plante efter en hurtig dyp-behandling.

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LALSTOP G46 WG

Effektiv kolonisering af rødder i forskellige jord og substrat typer:

- Jord på friland, spaghnum, rockwool, perlite mfl.
- Clonostachys rosea er aktiv i min. 4-6 uger efter behandling

Kolonisering af rødder

LALSTOP G46 WG Control of root diseases on strawberry

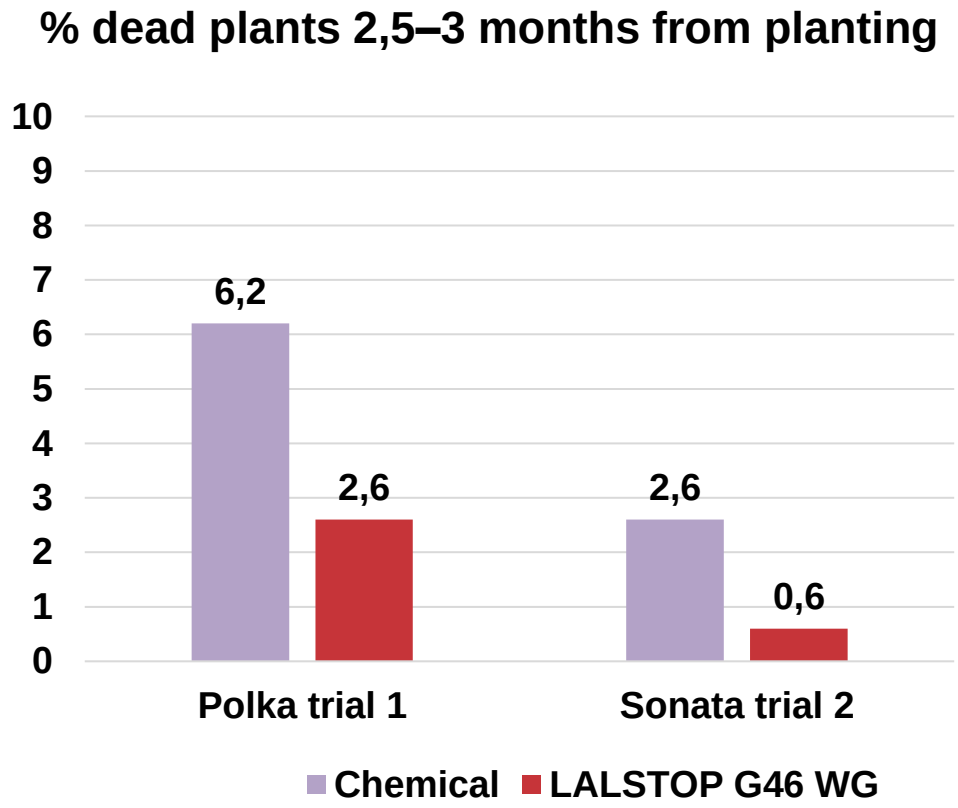
- Commercial farms, Finland 2020
- Open field

- The trials were conducted in cooperation with the Finnish Natural Resources Institute and ProAgria Advisory Services

- Varieties:
  - ‘Polka’ A+ frigo plants
  - ‘Sonata’ A++ frigo plants

- Treatments:
  - LALSTOP G46 WG dipping (0,05 %)
  - Soaking in chemical product (Aliette)

- Pathogen isolations (Eurofins DNA multiscan):
  - ‘Polka’: *Pythium, Pestalotia*
  - ‘Sonata’: *Fusarium, Pythium*, *Rhizoctonia, Verticillium*



Control of root diseases on strawberry, mortality of plants during winter period

- Commercial farm, Finland 2020-2021
- Open field

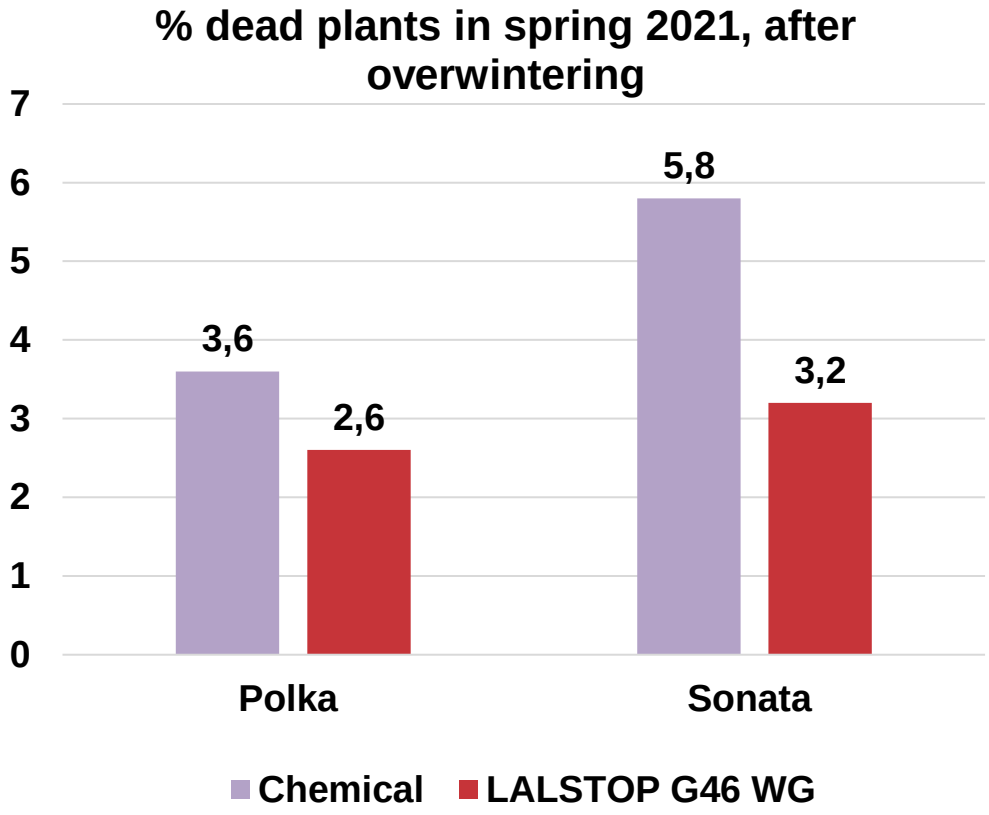
- The trials were conducted in cooperation with the Finnish Natural Resources Institute and ProAgria advisory services

- Varieties:
  - ‘Polka’ A frigo plants
  - ‘Sonata’ A++ frigo plants

- Treatments at planting in spring 2020
  - LALSTOP G46 WG dipping (0,05 %)
  - Soaking in chemical product (Aliette)

- Mortality of the plants was observed in spring 2021

- Pathogen isolations (Eurofins DNA multiscan):
  - ‘Polka’: *Pestalotia, Verticillium, Fusarium*
  - ‘Sonata’: *Fusarium, Pythium*, *Rhizoctonia*



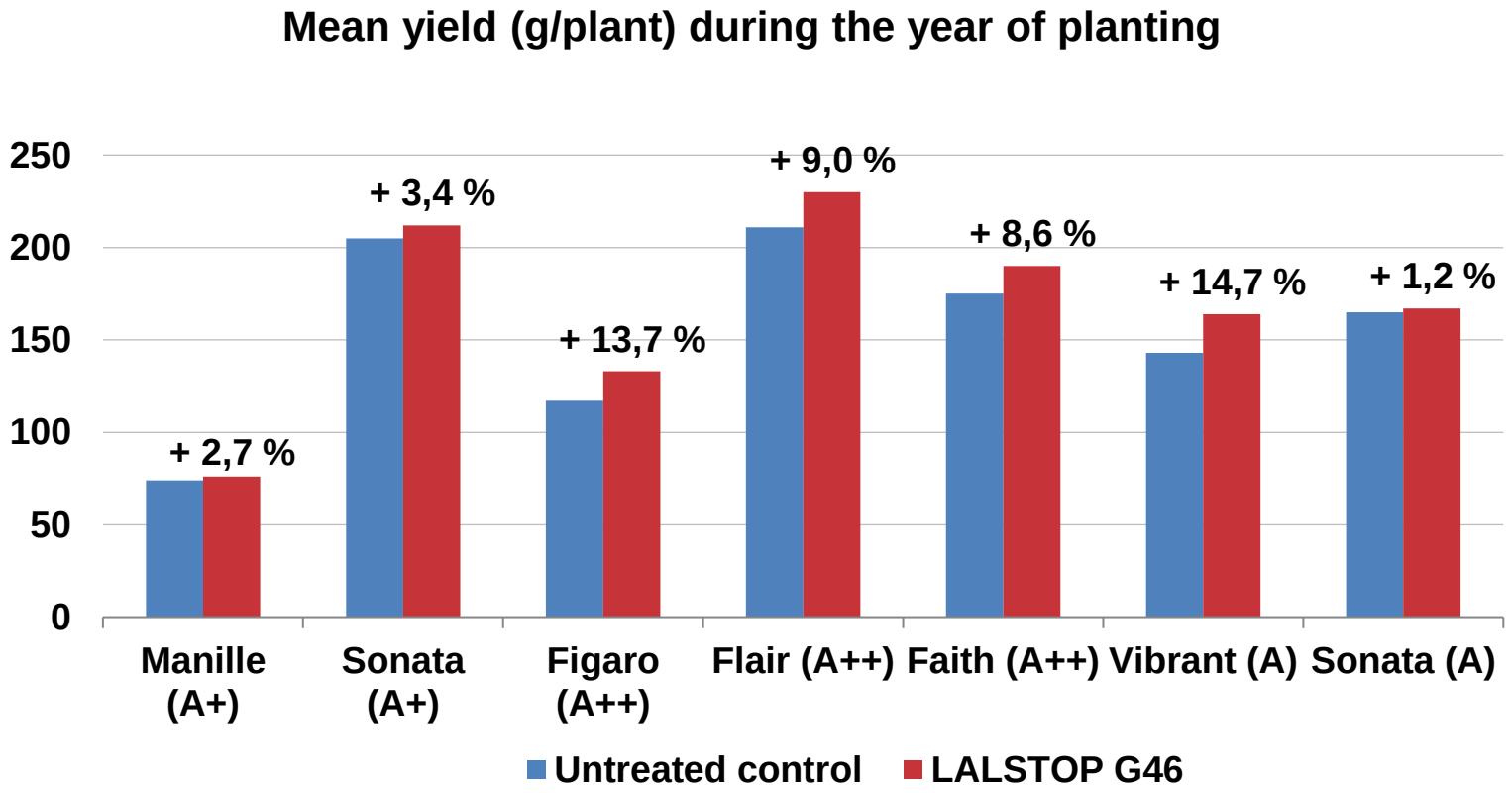
Control of root diseases on strawberry, effect in yield

- Commercial farm, Estonia 2017
- Open field

- The trials were conducted in cooperation with the Estonian University of Life Sciences

- 6 different varieties in the trial

- Treatments:
  - LALSTOP G46 dipping
  - Untreated control



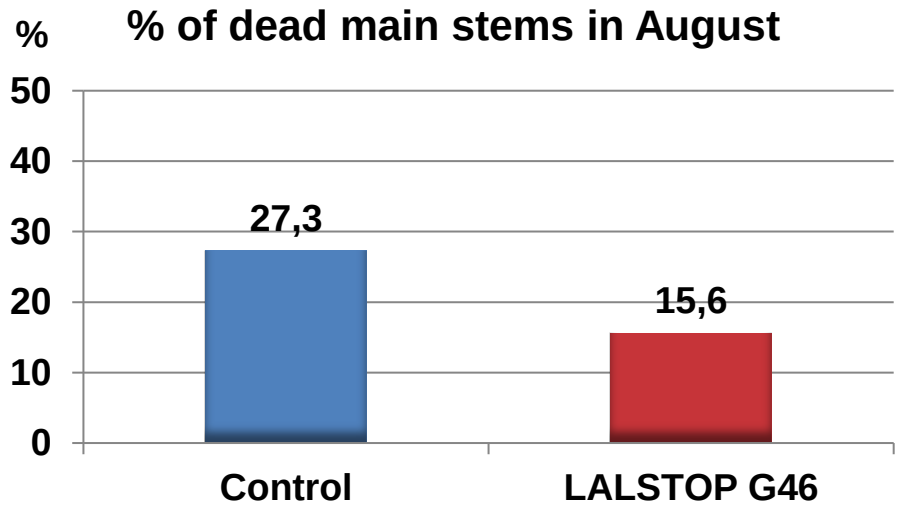
Control of root diseases on raspberry

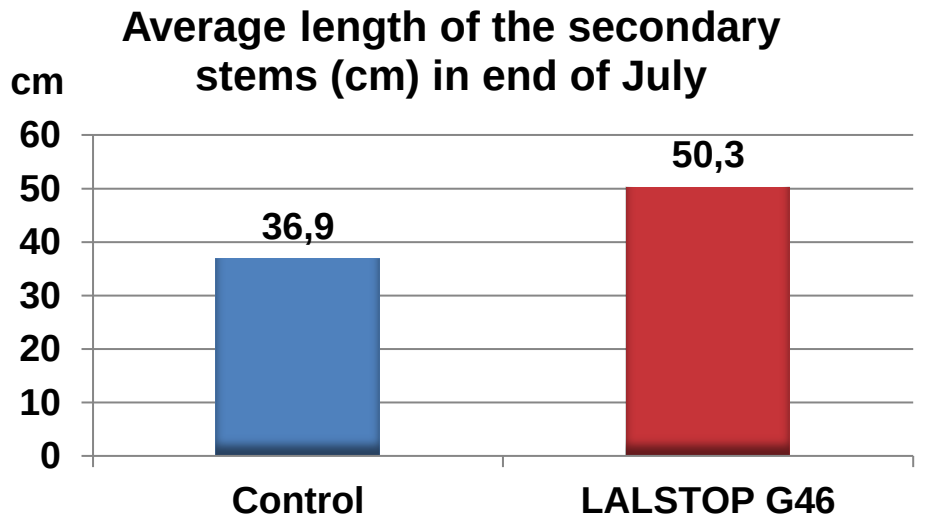
- Finland, 2014
- Commercial production
- Tunnel production

- Variety ‘Glen Ample’

- Treatments:
  - Untreated control
  - LALSTOP G46
    - At planting by drenching
    - 1 month after planting through drip irrigation

- *Phytophthora rubi* and *Fusarium* were isolated from diseased plants





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LALSTOP G46 WG - i en IPM strategi

FUNGICIDES			
ACTIVE INGREDIENT	RECOMM. INTERVAL (DAYS)	ACTIVE INGREDIENT	RECOMM. INTERVAL (DAYS)
Ametoctradin + Dimethomorph	0	Mancozeb	4
Azoxystrobin	2	Mepanipyrim	0
Azoxystrobin + Difenoconazole	7	Metalaxyl-M	2
Benomyl	4	Monopotassium phosphonate + Dipotassium phosphonate	2
Bitertanol	2	Myclobutanil	0
Boscalid + Kresoxim-methyl	0	Myclobutanil + Cyclohexanone	0
Bupirimate	0	Myclobutanil + Quinoxyfen	1
Carboxin	4	Penconazole	1
Cold pressed orange oil + Aromatic Hydrocarbons + Alcohol Ethoxylate	2	Potassium bicarbonate	0
Copper oxychloride	0	Potassium iodide + Potassium thiocyanate + Addit (Adjuvant)	2**
Cyazofamid	1	Prochloraz	7
Cyflufenamid	0	Procymidone	0
Cymoxanil	0	Propamocarb-HCl	0
Cymoxanil + Zoxamide	1	Propiconazole + Prochloraz	7
Difenoconazole	7	Proquinazid + Tetraconazol	0
Dithianon	1	Pyraclostrobin + Boscalid	2
Dodemorph-acetate	0	Pyrimethanil	1
Fenhexamid	0	Pyriofenone	3
Fludioxonil	4	Quinoxyfen	0
Fludioxonil + Cyprodinil	4	Spiroxamine + Difenoconazole	7
Fluopicolide + Propamocarb HCl	1	Sulphur	1
Fluopyram	0 (1)*	Sulphur + Sodium hydroxide	4
Fluxapyroxad	0	Tetraconazole	3
Folpet + Dimethomorph	7	Thiabendazole	4
Fosetyl + Propamocarb	0	Tiophanate-methyl	2

Husk: det er en levende mikroorgansime!

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LALGUARD M52 GR - *Biopesticid*

- Aktiv mikroorganisme: *Metarhizium brunneum* stamme F52.
- Koncentration: 9 x 10^8 CFU/g.
- Pakkestørrelse: 1kg og 10kg (i en vakuumpakket pose for længere holdbarhed).
- Formulering: Granulat, sporer på riskorn.
- Opbevaring og holdbarhed: 12 mdr ved ≤20°C, 18 mdr ved 4°C.

Tidligere Met52 fra Novozymes

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LALGUARD M52 GR - Godkendelse

BRUGSANVISNING

Afgrøde	Skadegører	Dosering
Jordbær, på friland og i væksthus Solbær, ribs, blåbær og stikkelsbær Hindbær, brombær	Larver af væksthussnudebiller *(Otiorhynchus sulcatus)*	0,5 kg pr m^3 vækstmedie, iblandet før potning/plantning
Prydplanter, i væksthus og på friland Planteskolekulturer		100 kg pr ha Indarbejdes i rækker/bede før såning/plantning

Samt godkendelse til **mindre anvendelse mod trip** i jordbær, bær etc på friland og i væksthuse. (mod jordboende puppestadier af trips)

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LALGUARD M52 GR

- Hvordan virker det

Når et insekt får sporer på sig, vil svampen begynde at spire ind gennem dets hud. Gradvist nedbrydes de indre organerne og larven dør efter 5-7 dage ved 20º C. Efterfølgende udvikles der ofte hvide og olivengrønne sporebelægninger udenpå insektet. Det er Metarhizium-svampens sporer der opformeres og medvirker til en fornyet smitte-effekt i jorden.

Foto: Swansea university

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LALGUARD M52 GR

- Anvendelse

Væksthuse/tunnel:

- Lalguard M52 GR skal indarbejdes i dyrkningsmediet før potning eller udplantning.
- Bland grundigt. Anvend inden for 30 dage.
- Når planterne ompottes til større potter, bør det nye vækstmedie, som de plantes i, også behandles for at sikre god kontrol.

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LALGUARD M52 GR

- Anvendelse

Friland:

- Indarbejdes i rækker/bede før såning/plantning.
- LALGUARD M52 GR blandes med jord/substrat og herefter inkorporeres denne jord/substrat lidt i muldjorden eller lægges som topping på jorden i marken.
- Dette kan gøres enten manuelt eller med forskelligt mekanisk udstyr f.eks. såmaskiner eller såmaskiner med monterede skiver til at inkorporere den behandlede jord/substrat i jorden.

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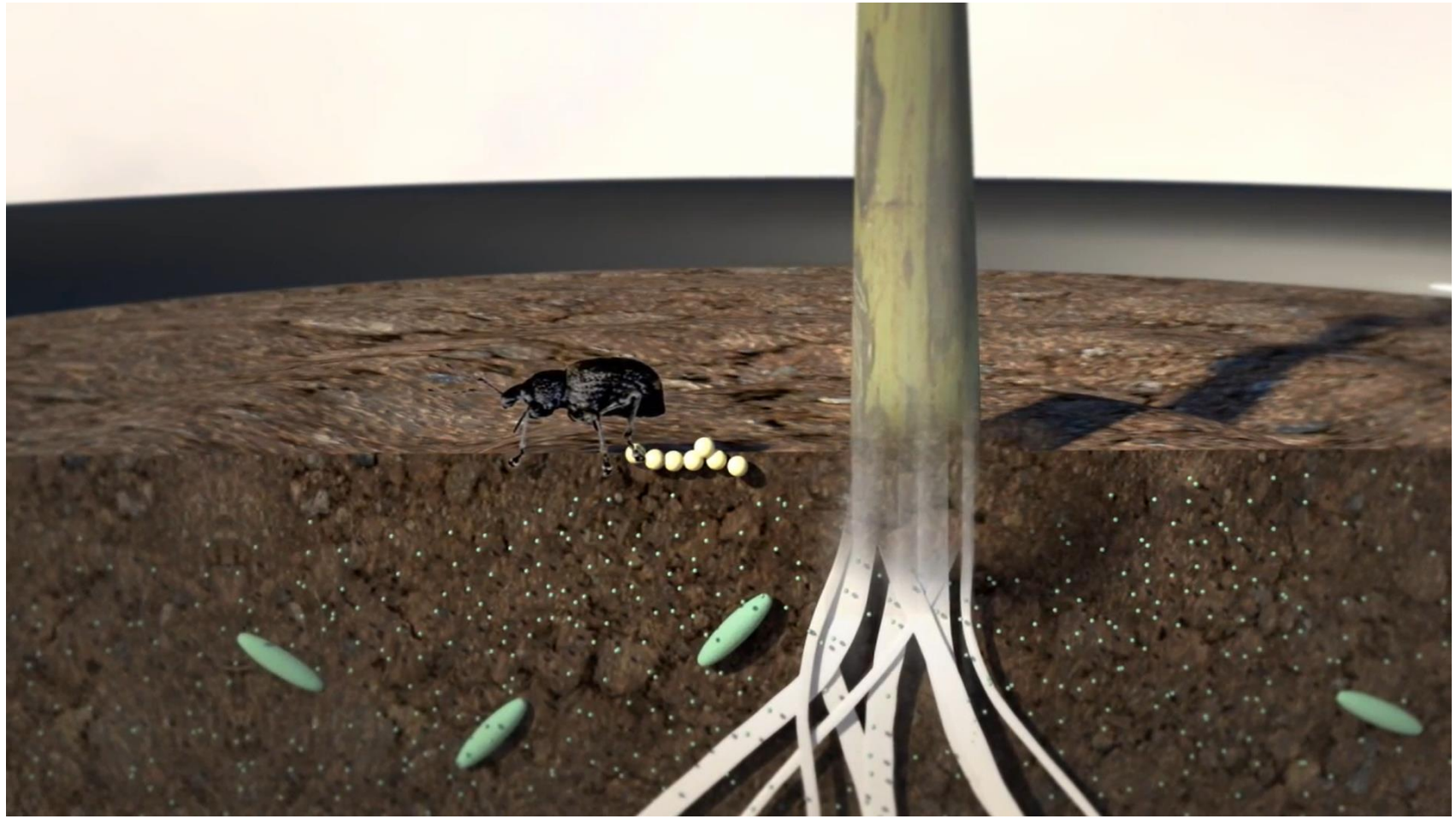
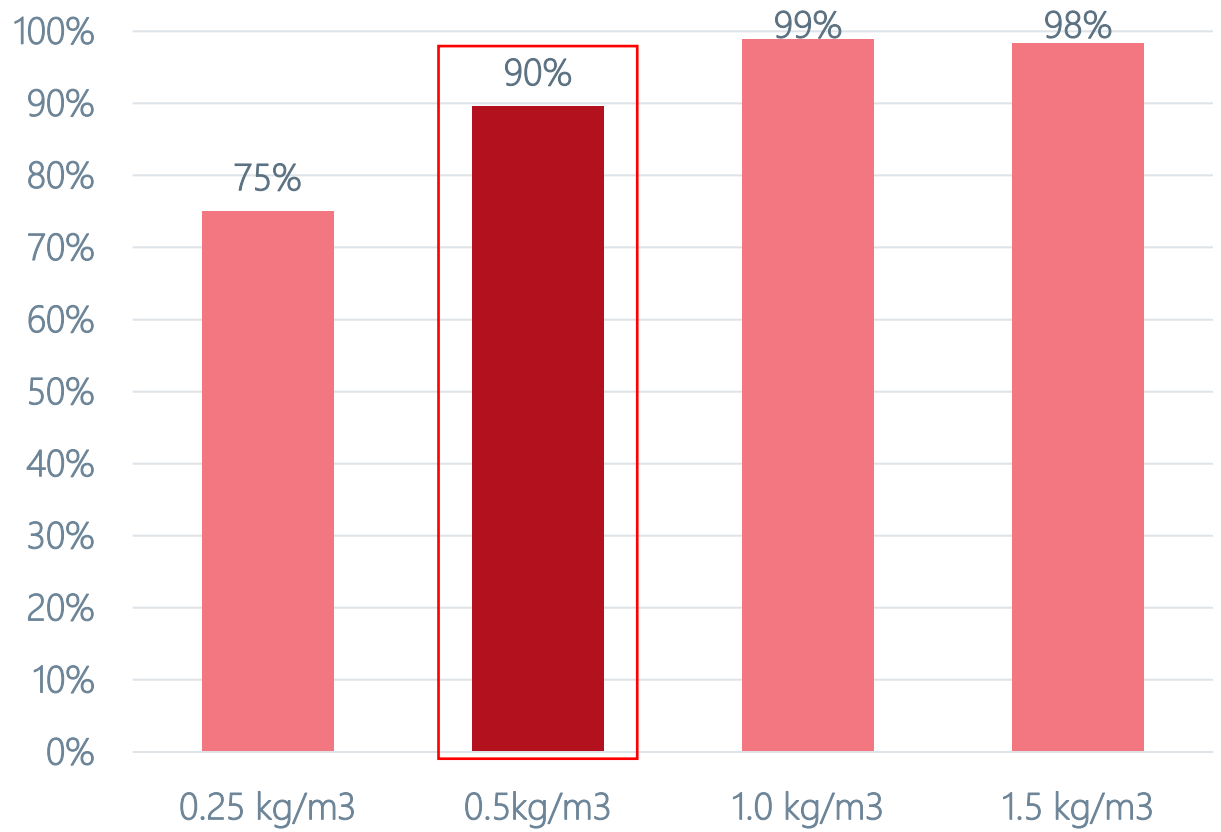


LALGUARD M52 GR RATE RESPONSE ON BVW

BVW = Black Vine Weevil
= Øresnudebille

Microbial by nature

0.5 kg m^3 showed to be efficient enough rate to control BVW



18 Trials run from 2005 -2009

Netherlands	5
Italy	4
France	4
UK	4
Germany	1

Ornamentals	13
Soft fruits (Berries	4
Grapes	1

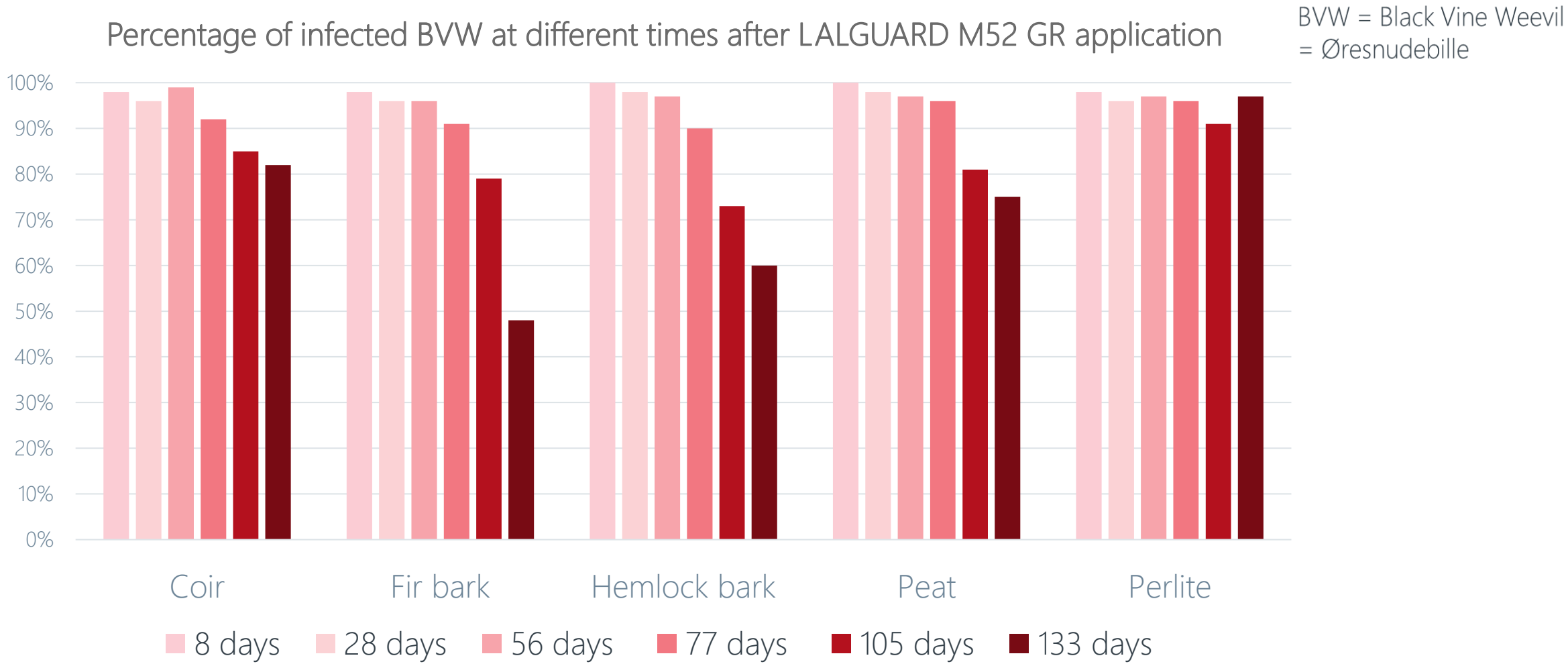
Source: BAD Met52 Gran 2021-09-14. Table IIIM 6.1.3-5 Summary of effectiveness field trials

LALLEMAND

LALGUARD M52 GR PRODUCT DESCRIPTION

Microbial by nature

LALGUARD M52 GR effectiveness can last up to 130 days after substrate treatment



(Bruck (2006). J. Environ. Hort. 24(2):91–94)

HAS COMPARABLE EFFICACY WITH CHEMICALS

Microbial by nature

8 Efficacy trials: LALGUARD M52^{GR} 58% to 100% vs Chemicals 43% to 100%

Crop	Situation	Region	Application	Product	Rate	Efficacy
Strawberry	Unprotected pots	UK (July-Nov)	Soil incorporation at plant Drench	M52 GR	0.5 kg/m^3	83%
				Cyren*	2L/ha (1000L)	100%
Strawberry Trial 1: Sandy loam soil* Trial 2: Clay loam soil**	Field-grown	UK (June-Oct)	Soil incorporation at plant Drench	M52 GR	110 kg/ha	89%*, 72%**
				Cyren *	2 L/ha (1000L)	94%
Grape	Unprotected pots	France (March-July)	Soil incorporation at plant Drench	M52 GR	0.5 kg/m^3	100%
				Suxon Vert MG*	1 kg/m^3	100%
Ornamental Trial 1: Lawsons Cypress Trial 2: Sweet bay* Trial 3: Rhododendrons** Trial 4: Oregon Cypress♣	Unprotected pots	Italy (March-July) Italy (March-July) France (Aug-Oct) Germany (Sept-Oct)	Soil incorporation at plant Spray growing media	M52 GR	0.5 kg/m^3	100%; 100%*, 100%**, 90%♣
				Suxon Vert MG*	1 kg/m^3	100%; 100%*, 100%** 43%♣
				Reldan 22*	0.2L/hL	75%; *100%
				Thiacloprid	5L/hL	87%♣

* chlorpyriphos-ethyl no longer authorize in EU and NA

PRODUCT USE RECOMMENDATIONS

Microbial by nature

LALGUARD M52^{GR} is compatible with most beneficial insects in the soil

Species	Exposure of F52	Mortality vs non treated
Entonem nematode (Steinernema feltiae)	2 x 10^9 CFU/g. 14 days of exposure	0%
Rove beetle (*Dalotia coriaria*)[4]	5x10^6 conidia /g of soil. 12 days of exposure	5%
Hypoaspis mites (*Stratiolaelaps scimitus*)[2]	1x10^5 conidia /g of soil. 12 days of exposure	18%
Gaeolaelaps Mite (*Gaeolaelaps gillespie*)[2]	1x10^5 conidia /g. 12 days of exposure	28%
Gaeolaelaps Mite (*Gaeolaelaps aculeifer)*[4][6]	5 × 10^6 conidia/g of soil(4), 2.2×10^6 12 days exposure	<5%[4], and 0%[5]
Earthworm *(Lumbricus terrestris*)[1]	(>1000 mg kg-1 dry soil). 14 days of exposure	No mortality observed

[1]US Environmental Protection Agency . Office of Pesticide Programs BIOPESTICIDES REGISTRATION ACTION DOCUMENT Metarhizium anisopliae strain F52 (PC Code 029056)

[2]Taro Saito. Biological Control Volume 92, January 2016, Pages 92-100

[5]Met52 EC Application guide. 2017.

[5] L. Reinbacher, 2020. Standard non-target tests for risk assessment of plant protection products are unsuitable for entomopathogenic fungi—aproposal for a new protocol. Journal of Soils and Sediments (2021) 21:2357–2368

(4)A.G.C.de AzevedoJ. 2019. Non-target effects of Metarhizium brunneum (BIPESCO 5/F 52) in soil show that this fungus varies between being compatible with, or moderately harmful to, four predatory arthropods. Department of Plant and Environmental Science, University of Copenhagen, 1871 Frederiksberg C, Denmark
https://www.sciencedirect.com/science/article/abs/pii/S1049964419300192

Microbial by nature

LALGUARD M52^{GR} is compatible with most fungicides

Application guidance / fungicide compatibility

- Do not apply LALGUARD M52^{GR} mixed with fungicides
- Compatible fungicides. Apply after planting.
- Non-compatible fungicides. Apply in a minimum of 7-day rotational program
- Microbial fungicides need mores testing

Fungicide	Compatibility
Azoxystrobin	Compatible
Dimethomorph	Compatible
Etridiazole	Compatible
Fludioxinil + mefanox.	Compatible
Fludioxanil	Compatible
Fosetyl-Al	Compatible
Iprodione	Compatible
Mefanoxam	Compatible
Phosphorus acids / K-salts	Compatible
Propamocarb	Compatible
Pyraclostraobin	Compatible
Quintozene	Compatible
Thiophanate-methyl	Compatible
Triflozystrobin	Compatible
Triflumizole	Not compatible
Captan	Not compatible

** Bruck DJ (2009) Impact of fungicides onMetarhizium anisopliaein the rhizosphere, bulk soil and in vitro. BioControl (2009) 54:597–606*

LALLEMAND

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Biologisk Plantebeskyttelse

Biologisk Plantebeskyttelse

Botanigard 22WP *- biopesticid*

Aktiv mikroorganisme: *Beauveria bassiana – insektpatogen svamp.*

Godkendt til mindre anvendelse mod mellus på jordbær på friland

Afgrøde, skadevolder, dosering, antal behandlinger, interval, behandlingspunkt og sprøjtefrist

Afgrøde	Skadevolder	Dosering pr. behandling	Antal behandlinger (interval)	Behandlings-tidspunkt /vækststadier	PHI
Jordbær	Mellus	0,0625 % (62,5 g middel pr. 100 liter vand)	3-12 (5-7)	BBCH 10-59 og BBCH 70-97	1 dag

Må ikke anvendes i blomstrende afgrøder

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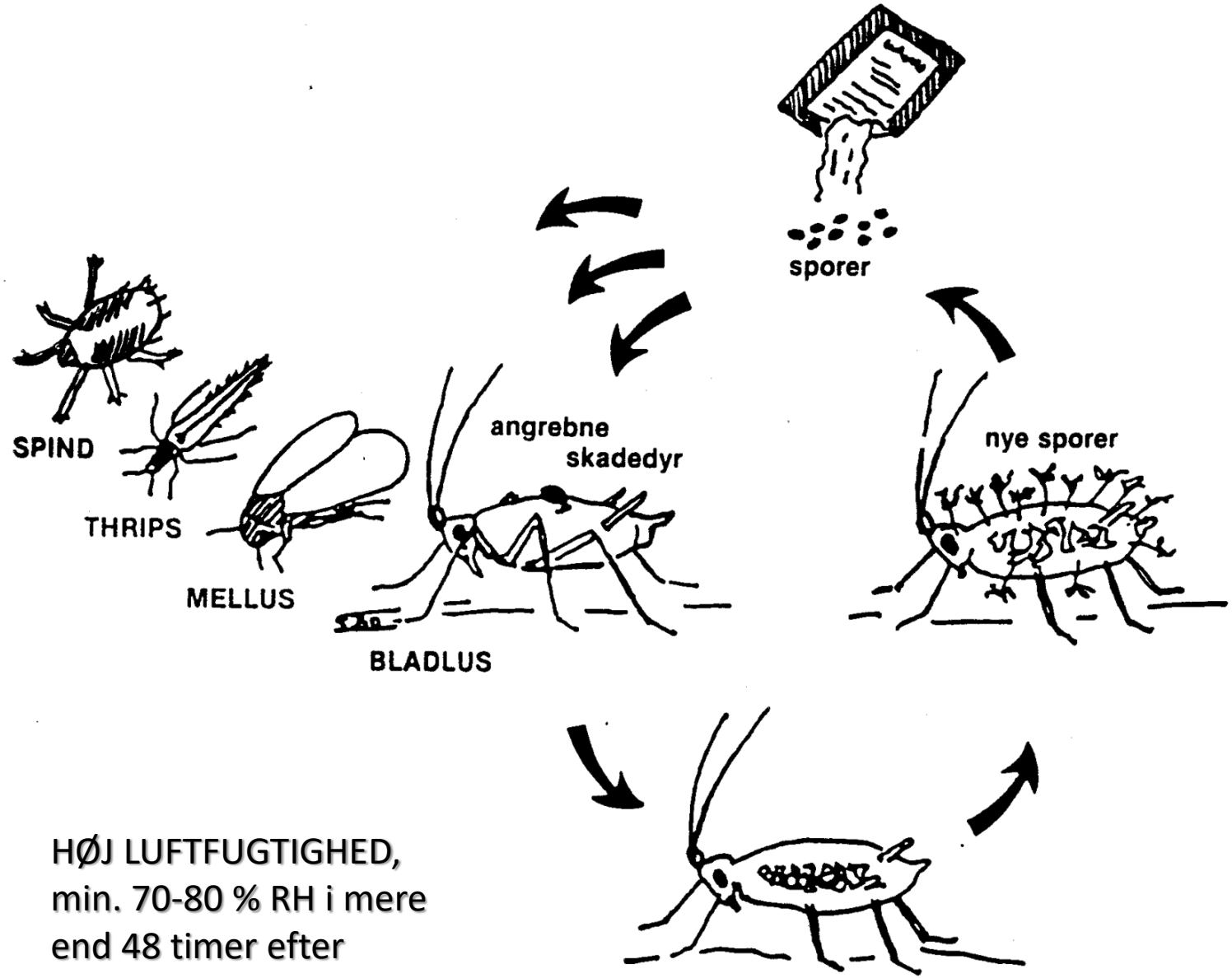

HØJ LUFTFUGTIGHED,
min. 70-80 % RH i mere end 48 timer efter behandling

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Botanigard *- anvendelse*

- Effektivt overfor mellus (larvestadier).
- Kræver høj luftfugtighed for at virke.
- Behandl om aftenen – højere luftfugtighed og ikke skadeligt UV-lys.
- Start behandlinger ved begyndende angreb. Når temperaturen tillader det >18 ºC.
- Foretag hyppige behandlinger for at sikre nok sporer på de behandlede plantedele, samt ramme nye mellus. Min 2-3 behandlinger med 5 dages mellemrum.

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Tak for opmærksomheden

Borregaard Bioplant ApS

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