



Experiences from efficacy testing of microbial products and alternative chemistry

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MICROBIAL PRODUCTS AND ALTERNATIVE PRODUCT

Basic substances –

- The EU's list of basic substances, e.g. baking powder, lecithin, does not require specific GEP trials; however, documentation from peer-review papers, etc. may support an application.




Low risk substances

- An active substance can be approved as a low-risk substances if it, in addition to the regular approval criteria, meets the low-risk criteria specified in Annex II, point 5 of Regulation (EC) 1107/2009
- Low-risk products should be preferred to manage pests because the fit into IPM programmes (IPM principle # 5)
- Longer approval time, better data protection, fast track procedure

BASIC SUBSTANCES

Basisstoffer godkendt pr. 19.02.2019

HortiAdvice påtager sig intet ansvar for oversigten

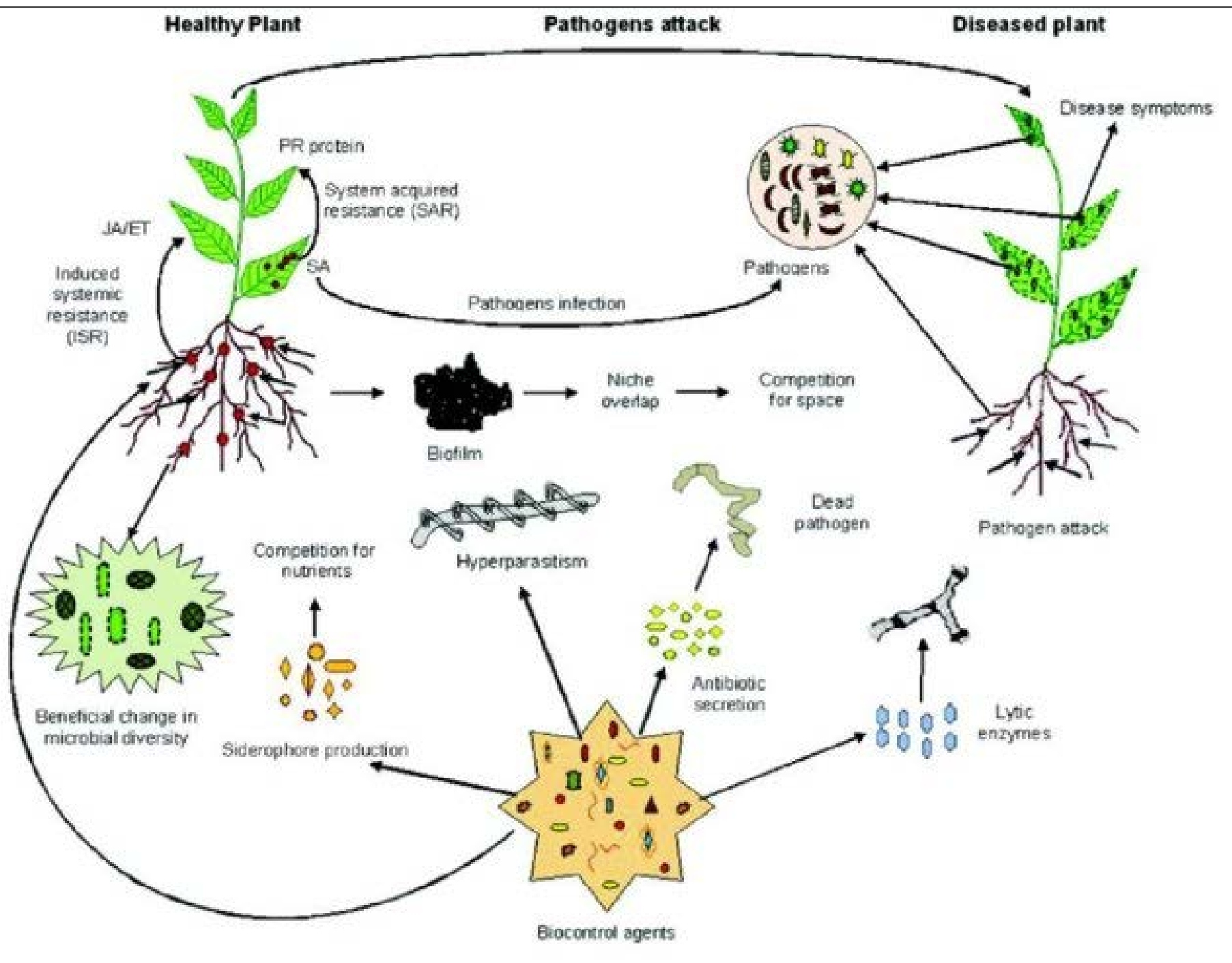
Stof	Afgrøde	Skadevolder	Dosering	Antal behandlinger og behandlingsfrist	Tidspunkt	Kommentarer
Natriumbicarbonat Natron 	Grøntsager (F og V)	Meldug	2-5 kg/ha Max 1 % opløsning	Max 8 gange med 10 dages interval. Sprøjtefrist 1 dag.	BBCH 12-89	For at undgå skader anbefales det at afprøve forskellige koncentrationer af produktet på et mindre areal første gang det anvendes.
	Bær (F og V)	Meldug	2-5 kg/ha Max 1 % opløsning		BBCH 12-89	
	Vin	Meldug	2,5-5 kg/ha Max. 2 % opløsning		BBCH 12-89	
	Æble	Skurv	2,5-5 kg/ha Max. 1 % opløsning		BBCH 10-85	
	Høstet frugt, æble, kirsebær	Penicillium lagersvampe	1-4 % opløsning	1-2 gange med 10 dages interval. Behandlingsfrist 1 dag.	Post harvest behandling ved dypning eller overfladebehandling	
	Prydplanter (F og V)	Meldug	2-5 kg/ha Max 1 % opløsning	Max 8 gange med 10 dages interval. Sprøjtefrist 1 dag.	BBCH 12-89	
	Potteplanter (V)	Lungemos (grønt løv og frugt legemer)	122 kg/ha	1 behandling	Post emergence ved direkte behandling med pulver	
Calciumhydroxid – læsket kalk 	Kernefrugt (F)	Frugttræskræft	Sprinkler: 25-50 kg/ha	Max. 7 gange med 5-14 dages interval	Fra bladfald til ultimo december	Calciumhydroxid står på økologilisten
	Kernefrugt og stenfrugt (F)	Frugttræskræft og andre sygdomme	Sprøjtning: 15-25 kg/ha Pletbehandling ved påsmøring			
Chitosan hydrochloride 	Frugt og bær (F og V)	Induceret resistens mod svampe og bakterier	0,1-0,8 kg/ha	4-8 gange med 2 ugers interval Ingen behandlingsfrist	Fra udvikling af 1. blad/udspring til afsluttet blomstring	100 % chitosan hydrochloride
	Grønsager (F og V)		0,1-0,4 kg/ha			
	Krydderurter (F og V)					
	Korn					
	Foderafgrøder					
	Korn					
Kartofler		0,5-1,0 kg/1000 L vand	1 sprøjtning/dypning af såsæd, læggekartofler eller frø	Før såning Før lægning		

HISTORICAL DEVELOPMENT OF PESTICIDES

Products	Described in
<p>Blåstensvæske (mod stinkbrand) nævnt første gang i 1893</p> <p>Bordeauxvæske (mod kartoffelskimmel), anbefalet af E. Rostrup fra 1909</p> <p>Karbolineum (frugttræs imprægnering) anbefalet af S. Rostrup fra 1909</p> <p>Kvassia (afkog til bladlus) anbefalet af S. Rostrup fra 1907</p> <p>Tobaksekstrakt (Skadedyr, sygdomme) anbefalet af S. Rostrup fra 1904</p> <p>Nikotin (Skadedyr)</p> <p>Svovl (mod bl.a. æbleskurv)</p>	<p>1910-1937</p> 
<p>Blyarsenat, Taftalin, (mod larver og andre skadedyr)</p>	<p>1913-37</p>
<p>Pyrethrum (Dufours væske) (skadedyrsmiddel)</p>	<p>1919-37</p>
<p>Uspulum (første kviksølvmiddel til afsvampning)</p> <p>Salicylsyre (fungicid til forskellige afgrøder)</p> <p>Carbokrimp (desinfektion og skadedyrsmidler) fenoler og naftalener</p>	<p>1927-37</p>

EU'S IPM CONCEPT

1. The prevention and/or suppression of harmful organisms should be supported using different options (rotations, cultivations, resistant cultivars, balanced fertilization, adjusted sowing dates etc)
2. Harmful organisms must be monitored by adequate methods and tools
3. Use thresholds before the use of PPP are considered
4. Sustainable biological, physical and other non-chemical methods must be preferred to chemical methods
5. Pesticides should be specific and least harmful
6. Pesticide use should be kept as low as possible (reduced rates, spot application etc)
7. Anti-resistant strategies should be applied
8. The results from the use of PPP should be checked following applications.

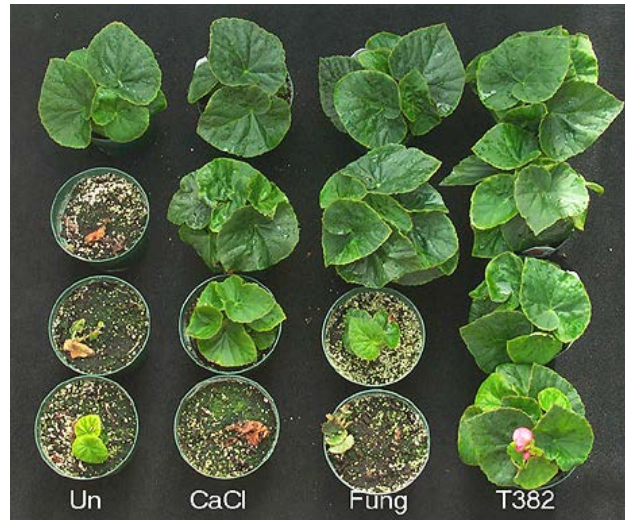
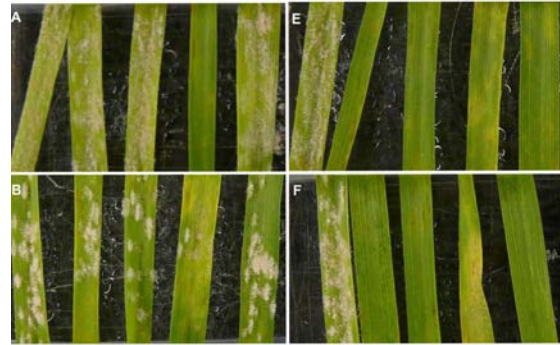


- Hyperparasitism
- Antibiotic secretion
- Lytic enzymes
- Competition – change in microbial diversity
- SAR – systemic resistance Induced by pathogens or chemicals
- ISR – Induced systemic resistance By priming

H.B Singh 2014



DIFFERENT TEST SYSTEMS FOR EFFICACY EVALUATION



Efficacy evaluation

04 Virkemåde og virkningsspektrum

Cedomon er et biologisk bejdsemiddel. Produktet forebygger svampesygdomme ved, at aktivstoffet, bakterien *Pseudomonas chlororaphis*, sandsynligvis konkurrerer med svampesygdomme om plads og næring på frøet og inducerer en resistensreaktion i planten. Bakterierne producerer også små mængder svampedræbende stof. På den behandlede såsæd ligger bakterierne i dvale. Når såsæden spirer aktiveres bakterierne og er aktive på rødder til og med 5-bladsstadiet. Behandlet såsæd kan lagres med bibeholdt effekt i op til 1 år.

05 Afgrøder og dosering

Afgrøde	Skadegørere	Anvendelsesområde	Dosering
Byg	Stribesyge (<i>Drechslera graminea</i>)	Bejdsning	7,5 mL/kg
	Bygbladplet (<i>Drechslera teres</i>)		

Cedomon har en moderat virkning over for stribesyge og en middelgod virkning over for bygbladplet.

Cedomon må kun anvendes i certificeret såsæd C2. I økologisk såsæd, dog også i C1, og kun hvis forekomst af stribesyge/bygbladplet er under 15 % i pågældende parti. Hvis der alene forekommer bygbladplet, må Cedomon kun anvendes i partier, der har under 45% angreb.



Approved 2004

CEDOMON®

Pseudomonas chlororaphis – root bacterium isolated

from Crowberries in Sweden (MA342)



	PYRNGR		PYRNTE	
	% control	no of trials	% control	no of trials
DK	84-85	4	74	3
Sweden	96-99	3	88-91	32
Sweden diverse phd	87	21	94	30
Finland	76	1		
Tyskland/UK	60-76	6		
Austria	57-100	2	77-86	3
Reference product	98-100		98-100	



PYRNGR



PYRNTE

CONTROL OF POWDERY MILDEW IN CEREALS USING SERENADE ASO

Tested in wheat, barley, triticale and oat

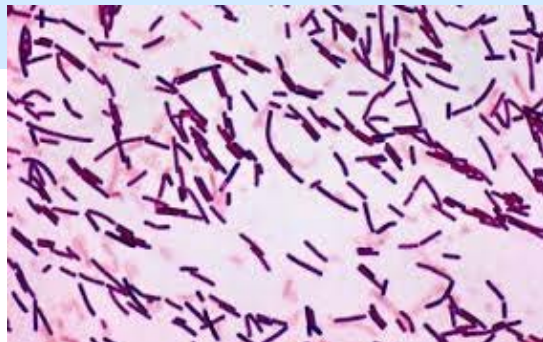
Control levels in the range of 25-65% has been achieved.

No clear dose response - testing 1-8 l/ha

The effect is not very long lasting

Control was inferior to Proline

No clear yield benefits from treatments



Control of powdery mildew (*Blumeria graminis* spp.) in cereals by Serenade®ASO (*Bacillus amyloliquefaciens* (former *subtilis*) strain QST 713)



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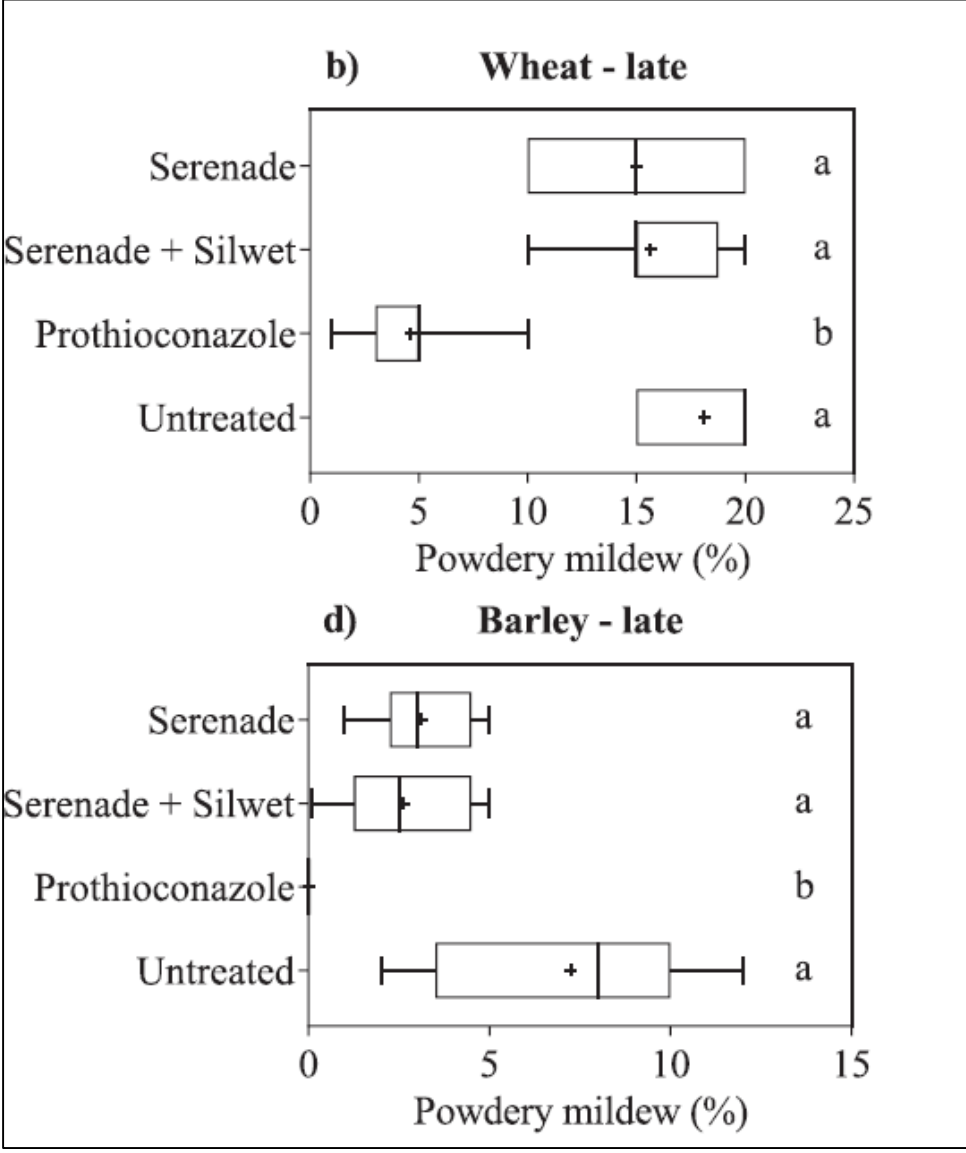
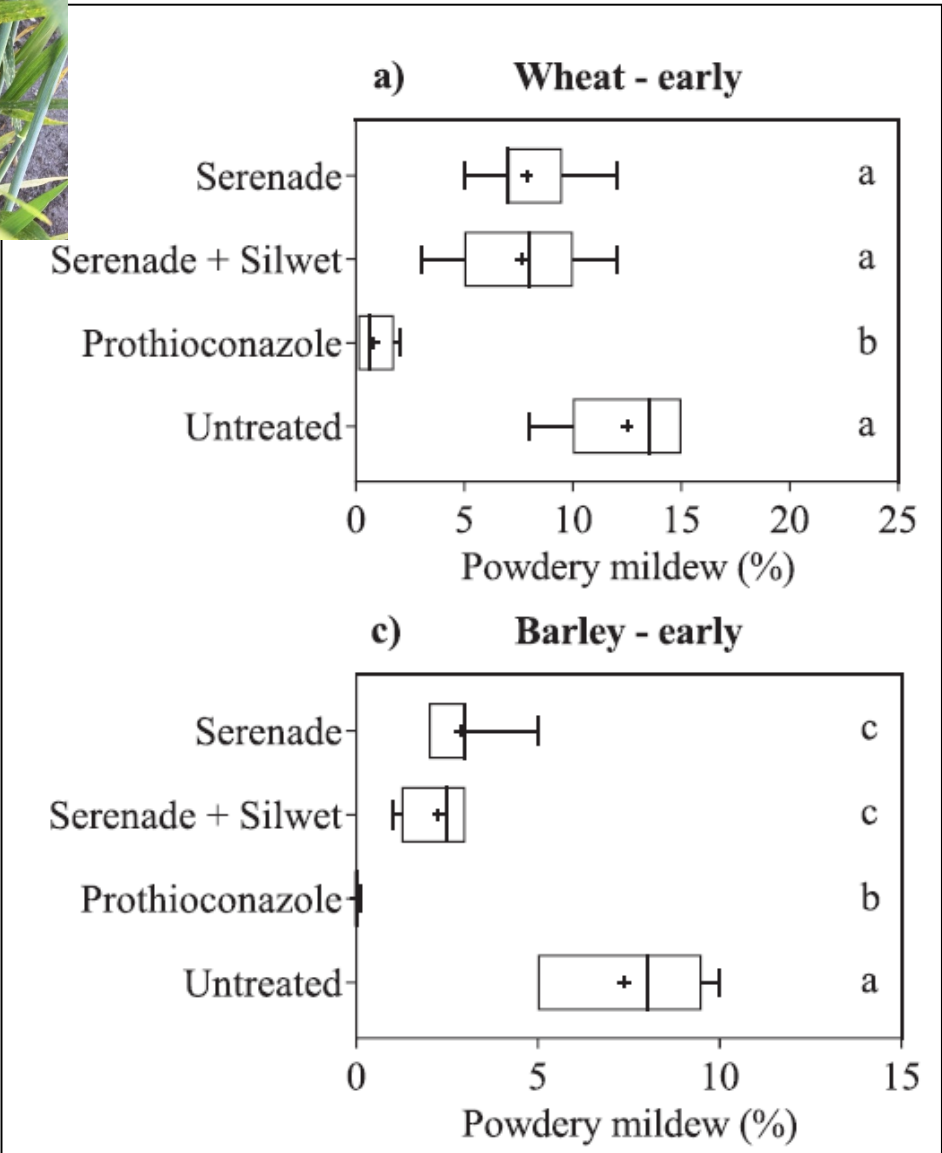
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ABSTRACT

Powdery mildew (*Blumeria graminis* f.sp. *tritici*, f.sp. *hordei*, f.sp. *avenae*) is an important disease in cereal crops causing significant yield reductions, if not effectively controlled. The biofungicide *Bacillus amyloliquefaciens* (former *subtilis*) strain QST 713 suspension concentrate (Serenade®ASO) was investigated for its potential as a control agent against powdery mildew in winter wheat, spring barley, oats and triticale. Serenade®ASO reduced the severity of powdery mildew, providing moderate control in the range of 20–65%. The efficacy was highest at the earlier assessments and less pronounced at later assessments. With a few exceptions, no clear dose-response was seen between using 1, 2, 4, 6 or 8 L/ha Serenade®ASO applied four times at 8–10-day intervals. The efficacy was more variable compared with chemical references. Yield responses were positive following treatments. However, the yield increase by Serenade®ASO was insignificant and significantly inferior to that of prothioconazole. In a few cases, the use of Serenade®ASO in combination with the adjuvant Silwet®Gold improved the efficacy, but the results were inconsistent. The preventive and curative application of Serenade®ASO was tested at three dose rates in an artificially inoculated wheat and barley greenhouse pot trial. These trials confirmed the lack of a clear dose-response but confirmed that timing has a major impact on control, with the best control obtained when application took place on the day of inoculation in wheat and 0–2 days after inoculation in barley. This study revealed that powdery mildew challenges Serenade®ASO as a stand-alone control measure. The results show that further research is needed for the promotion of biofungicides as part of an integrated disease management approach in cereal diseases.




SERENADE TESTED IN CEREALS –YELLOW RUST



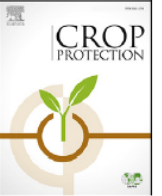
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Biological control of yellow rust of wheat (*Puccinia striiformis*) with Serenade[®] ASO (*Bacillus subtilis* strain QST713)

 CrossMark

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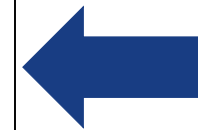
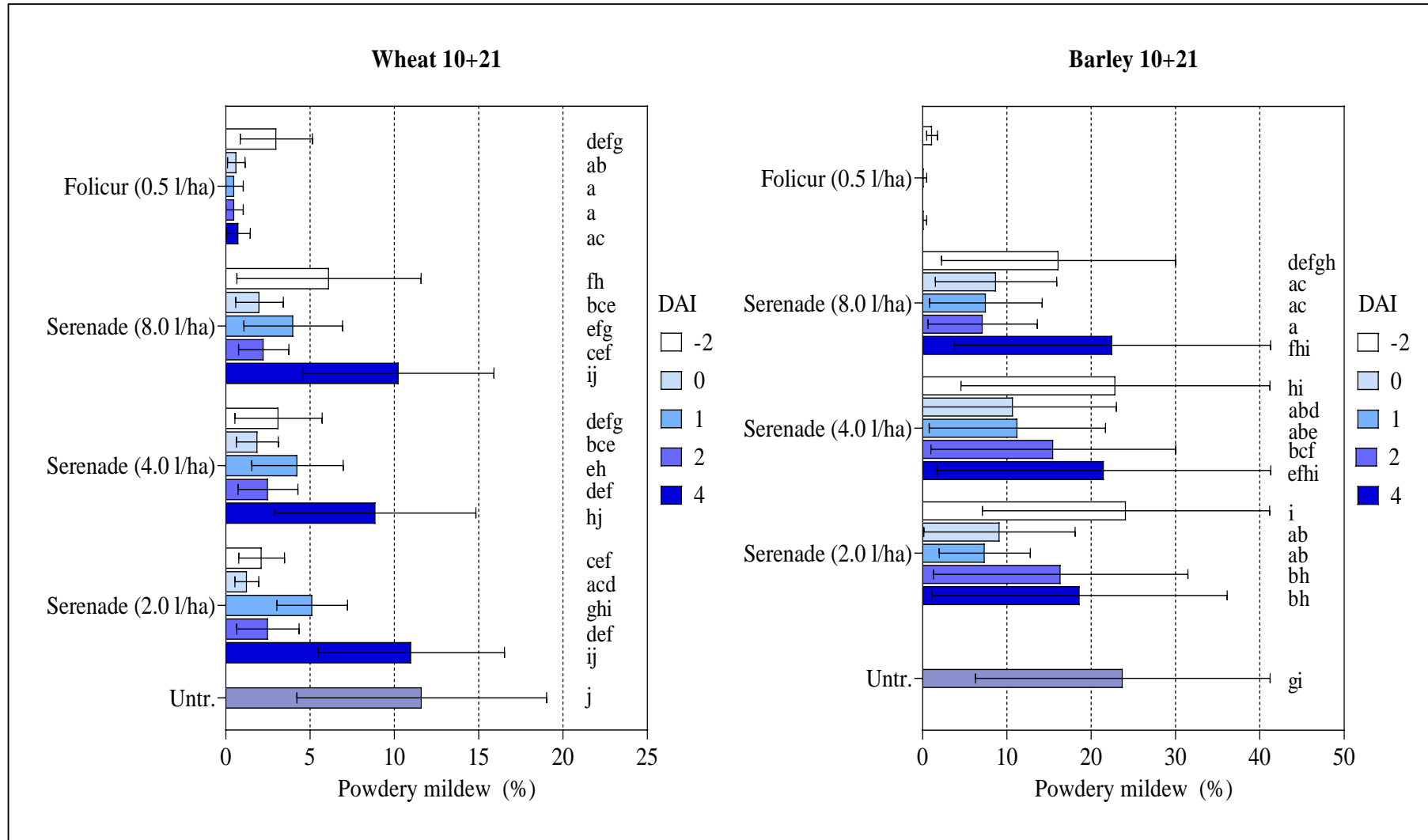
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ABSTRACT

Yellow rust (*Puccinia striiformis* f. sp. *tritici*) is an important disease in wheat causing significant yield reductions, if not effectively controlled. The biofungicide *Bacillus subtilis* strain QST 713 suspension concentrate (Serenade[®]ASO) was investigated for its potential for yellow rust control in winter wheat field trials. Serenade[®]ASO reduced severity of yellow rust significantly, providing up to 60% control at BBCH growth stage 65–69, under moderate disease pressure. Under high disease pressure reductions

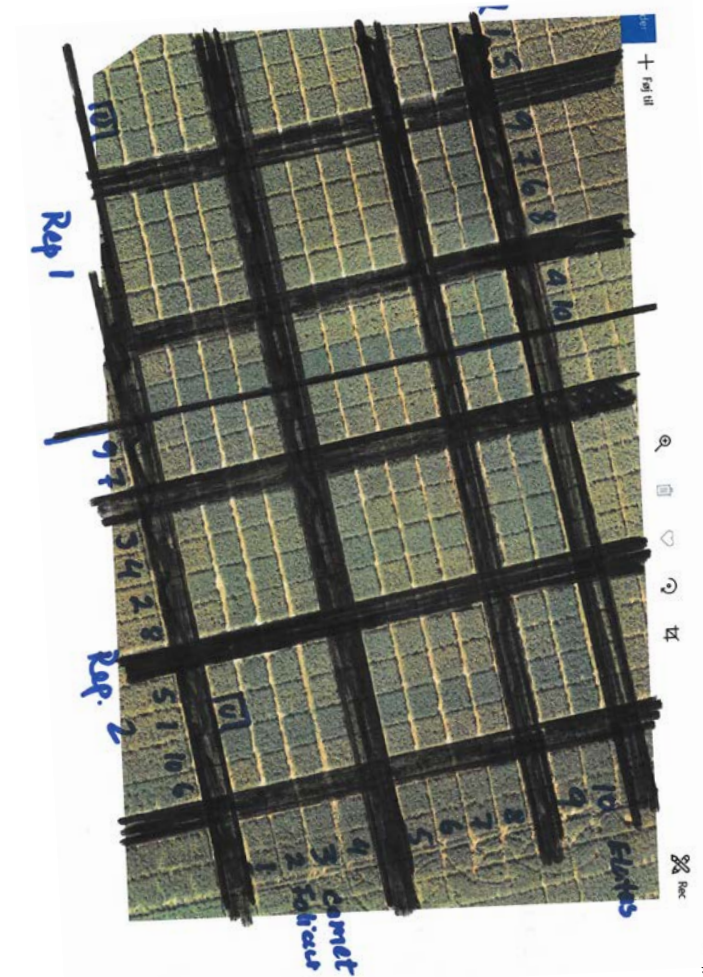
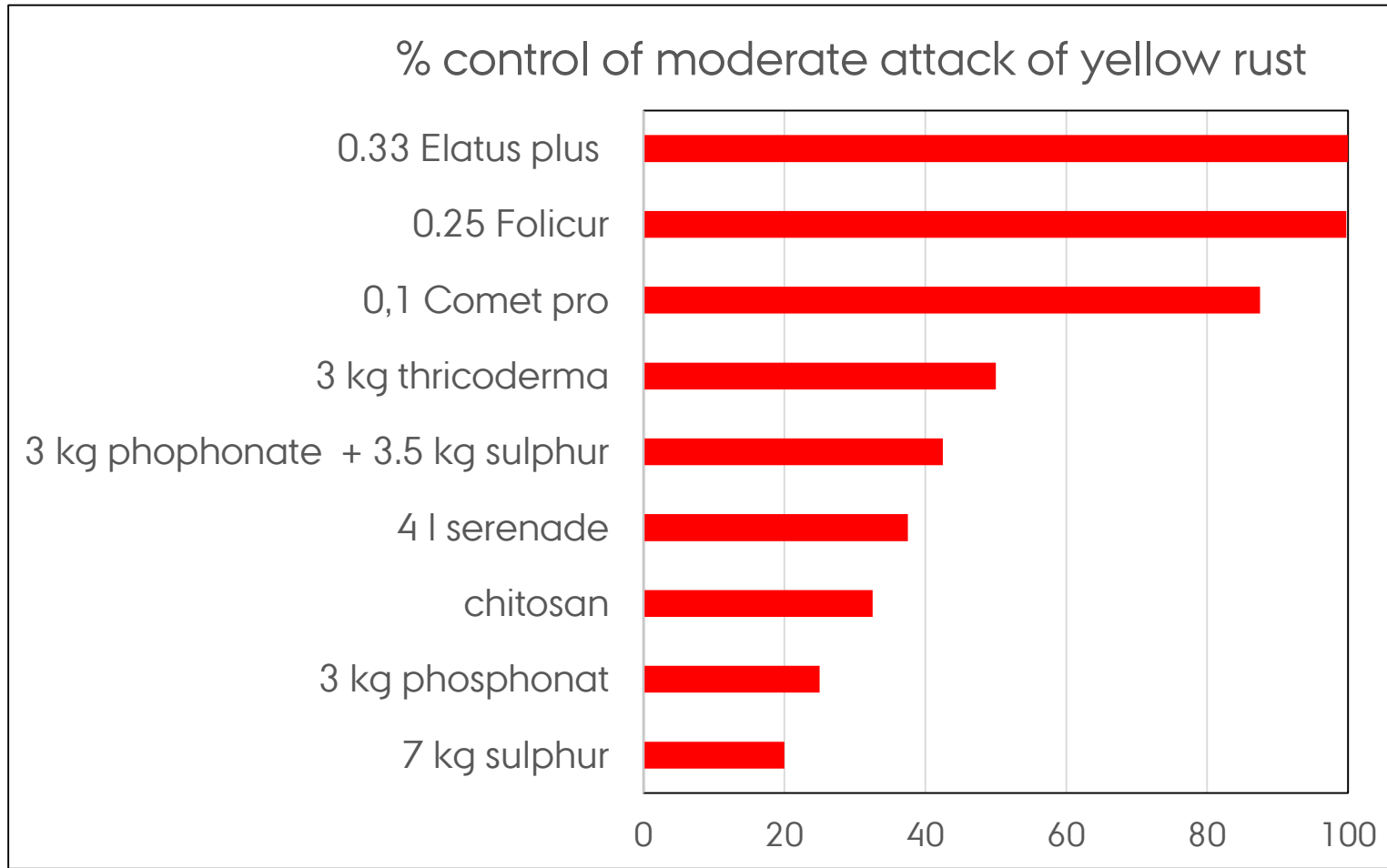
TIMING OF TREATMENTS IMPORTANT!



Timing just around Infection gives best Control

RUST WATCH - CONTROL OF YELLOW RUST 2019

COMPARING OLD AND NEW CHEMISTRY - USING 4 TREATMENTS



WHAT TO PUT ON THE LABEL!

Challenge to get the

recommendations right!

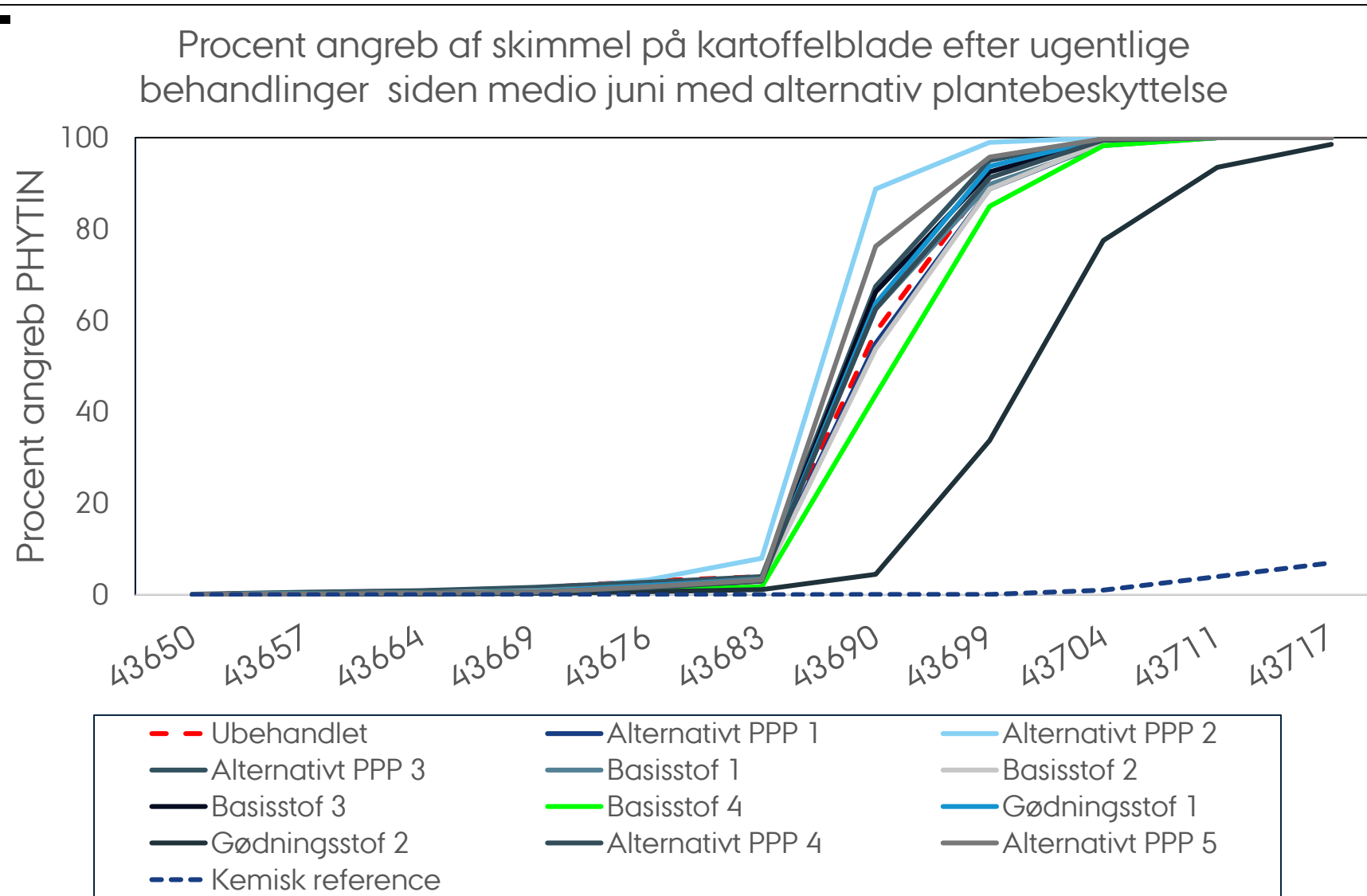
Low to moderate levels of control

Treatments have to be preventive

Treatments have to be repeated

Brugsanvisning:				
Afgrøde(r)	Skadegørere	Dosis pr. ha.	Tidspunkt	Bemærkninger
Vinterraps, Vårraps	Knoldbægersvamp, skulpesvamp	2 l	Afgrødens stadium 60-69	Lav til moderat effekt på: Knoldbægersvamp (Sclerotinia) og Skulpesvamp (Alternaria). Maks. 2 behandlinger med 5-10 dages interval. Behandlingsfrist 0 dage.
Vinterhvede, Vårhvede	Gulrust, hvedegråplet, hvedemeldug	4 l	Afgrødens stadium 20-69	Lav til moderat effekt på: Meldug. Sideeffekt på: Hvedegråplet (Septoria) og Gulrust. Maks. 4 behandlinger med 5-10 dages interval. Behandlingsfrist 0 dage.
Vinterbyg, Vårbyg	Bygbladplet, bygmeldug, bygrust, skoldplet	4 l	Afgrødens stadium 20-69	Lav til moderat effekt på: Meldug og Bygrust. Mindre sideeffekter på: Skoldplet og Bygbladplet. Maks. 4 behandlinger med 5-10 dages interval. Behandlingsfrist 0 dage.
Triticale	Gulrust, hvedegråplet, meldug, skoldplet	4 l	Afgrødens stadium 20-69	Lav til moderat effekt på: Meldug. Mindre sideeffekter på: Hvedegråplet (Septoria), Skoldplet og Gulrust. Maks. 4 behandlinger med 5-10 dages interval. Behandlingsfrist 0 dage.
Rug	Meldug, skoldplet	4 l	Afgrødens stadium 20-69	Lav til moderat effekt på: Meldug. Sideeffekt på: Skoldplet. Maks. 4 behandlinger med 5-10 dages interval. Behandlingsfrist 0 dage.
Havre	Meldug	4 l	Afgrødens stadium 20-69	Lav til moderat effekt på: Meldug. Maks. 4 behandlinger med 5-10 dages interval. Behandlingsfrist 0 dage.
Kartofler	Rodfiltsvamp	5 l	Ved lægningen	Lav til moderat beskyttelse mod udbyttetab forårsaget af knoldbåren rodfiltsvamp. Maks. 1 behandling. Behandlingsfrist 0 dage.
Jordbær i væksthuse	Gråskimmel	4-8 l	Afgrødens stadium 60-89	Serenade ASO er et kontaktmiddel som skal anvendes forebyggende mod gråskimmel. Serenade ASO skal indgå i

CONTROL OF LATE BLIGHT IN POTATOES



Peter Hartvig

INSECTICIDES BASED ON NATURAL ORIGIN

Requiem = Terpene Constituents of the Extract of *Chenopodium ambrosioides*

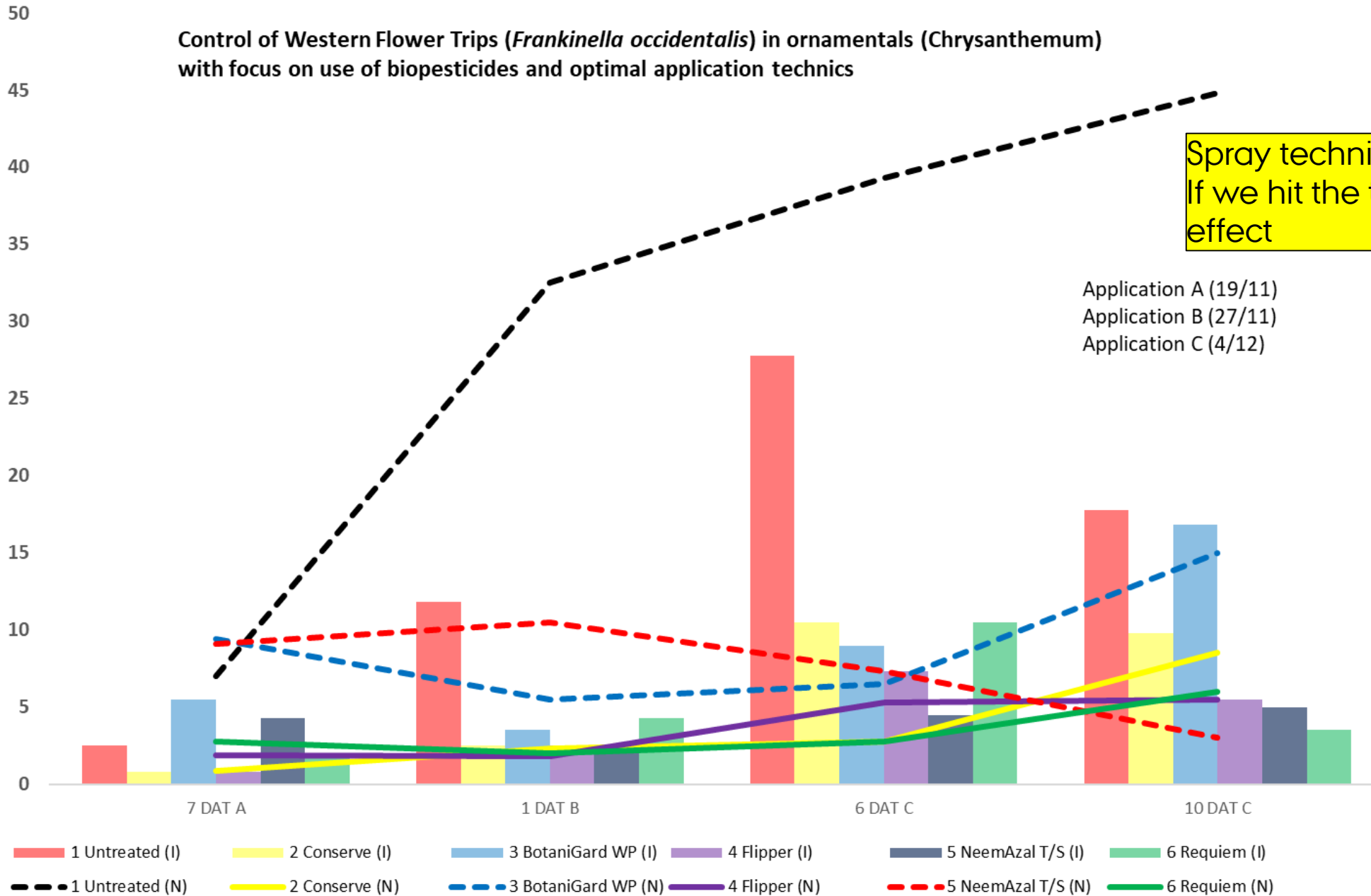
BotaniGard = *Beauveria bassiana* insect pathogen (requires high humidity)

Neemazal -Extract of seeds of Neem (*Azadirachta indica*) formulated in plant oil.

Conserve = spinosad obtained by fermentation of *Saccharopolyspora spinosa*

Control of Western Flower Trips (*Franklinella occidentalis*) in ornamentals (Chrysanthemum)
with focus on use of biopesticides and optimal application technics

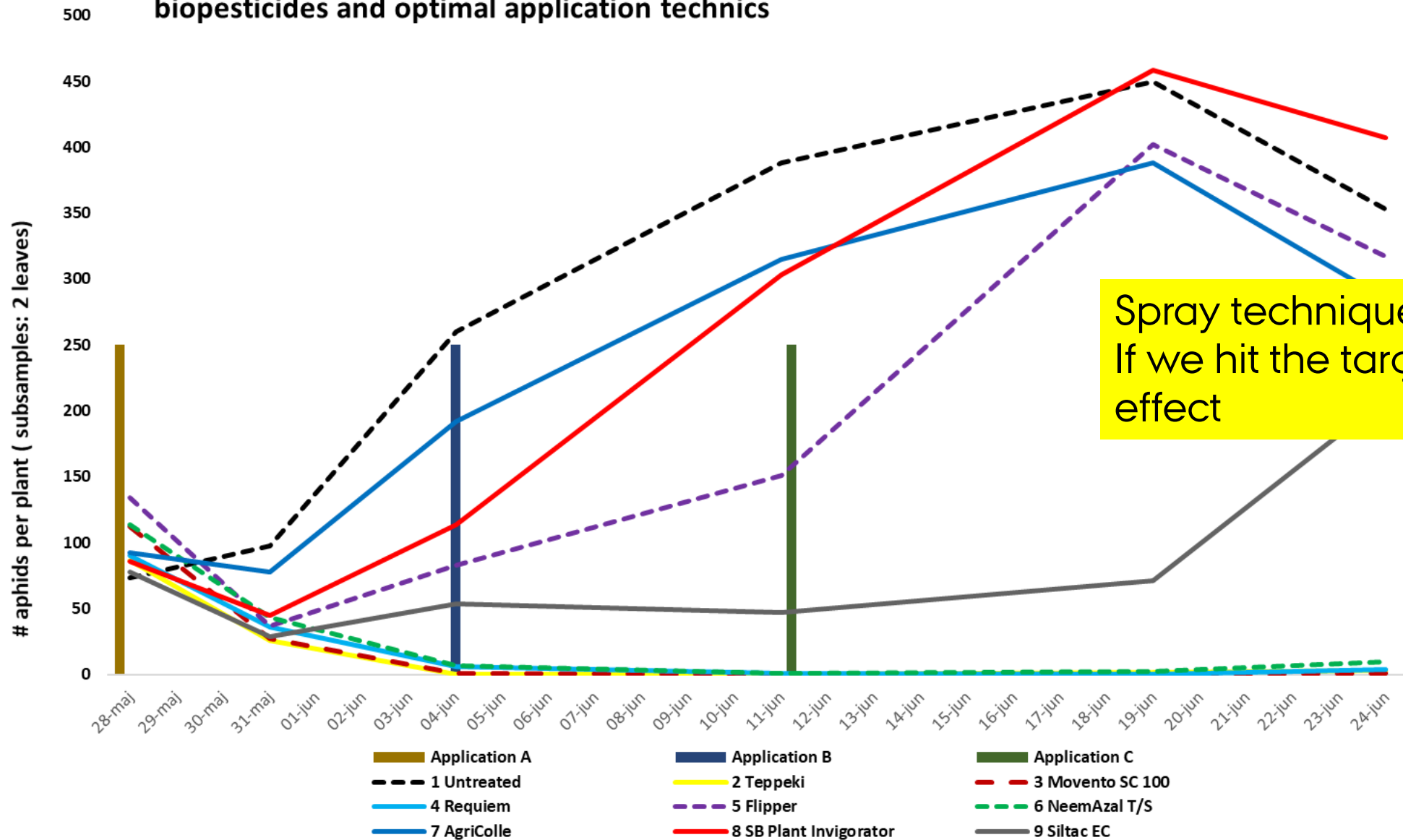
of nymphs and Imago per plot (subsamples of 20 flowers from a total of 9 plants)



Spray techniques are essential
If we hit the target you have an effect



Control of Green peach aphids (*Myzus persicae*) on pepper plants with focus on use of biopesticides and optimal application technics



Spray techniques are essential
If we hit the target you have an effect

CONTROL OF FUSARIUM IN POT PLANTS

—
Different substances tested

Triatum (*Trichoderma harzianum* T22)

Mycostop (*Streptomyces* K61)

Prestop (*Gliocladium catenulatum*)

Geoxe (fludioxonil)

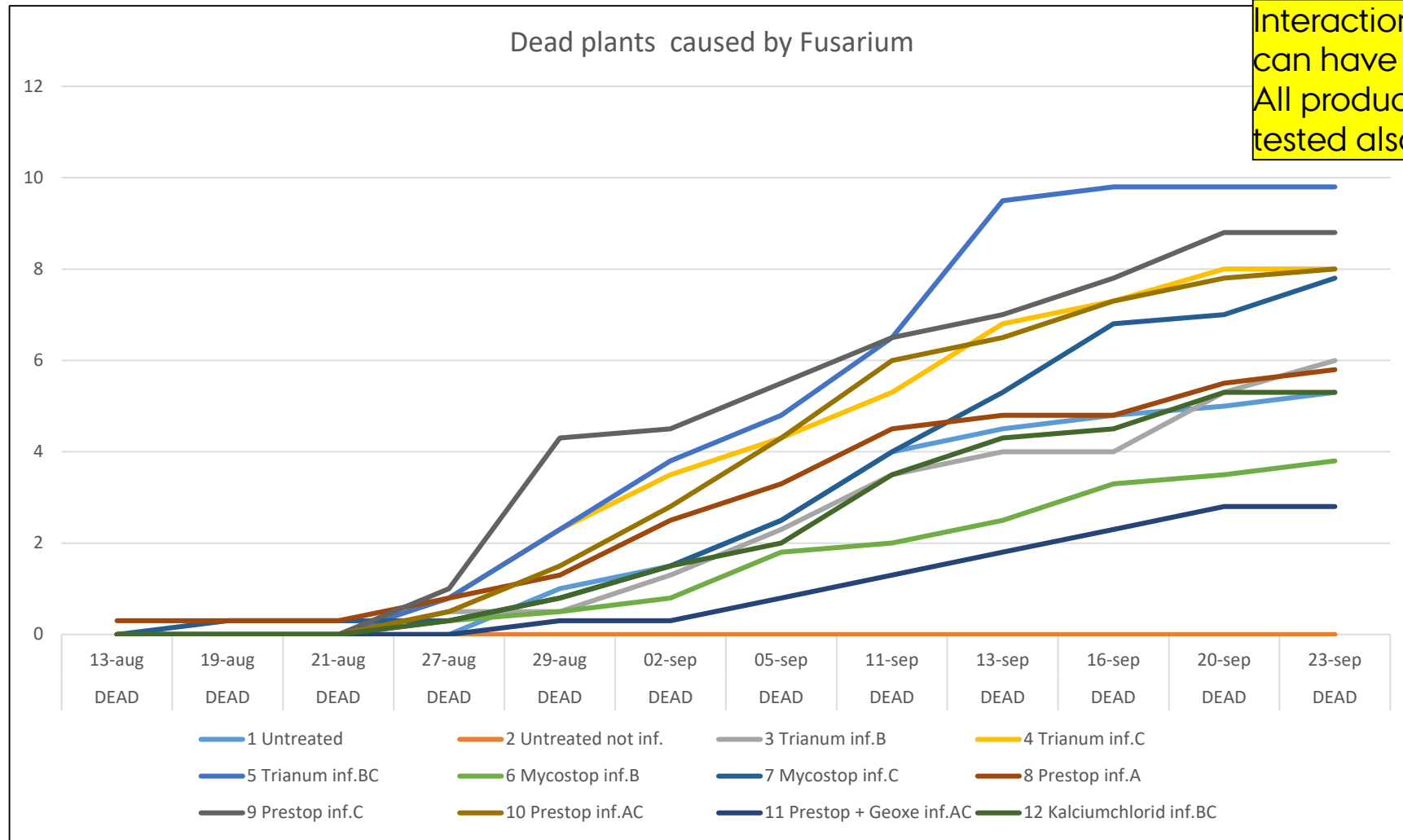
Kaliciumchlorid

Which concentration of the pathogen to use in the testing ?

Too high concentration might jeopardize the results.



CONTROL OF FUSARIUM IN POT PLANTS



Interaction between soil microbes can have major impact on the performs
All products need to be tested also without inoculations

SUMMARY

- Increasing interest in getting BCA and more green solutions on the market
- Still struggle to find methods of evaluating their full value in vivo
 - Spray technique should be good
 - Pathogen population adjusted – not too high!
- In vivo testing outdoors are often challenging!
- BCA are less persistent. Requires more treatments and typically preventive treatments
- Is it possible to reduced fungicide/insecticide resistance. Still need to show clear direct effects (indirect effects can be expected!).
- Minimize pesticide residues in crops – and option for late applications
- Need for balancing the expectations – stay positive but do not oversell the efficacy.