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Bavarian State Research Center for Agriculture

Strategies to reduce primary *Phytophthora* infections in conventional and organic potato production

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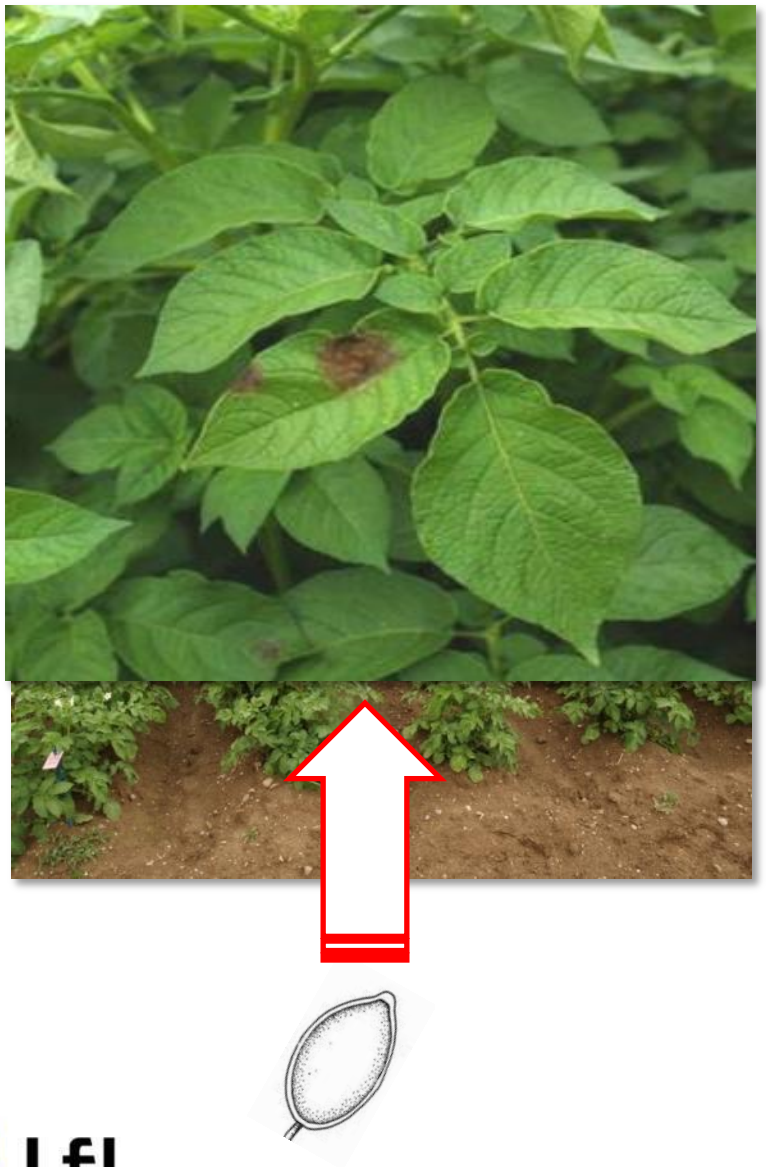
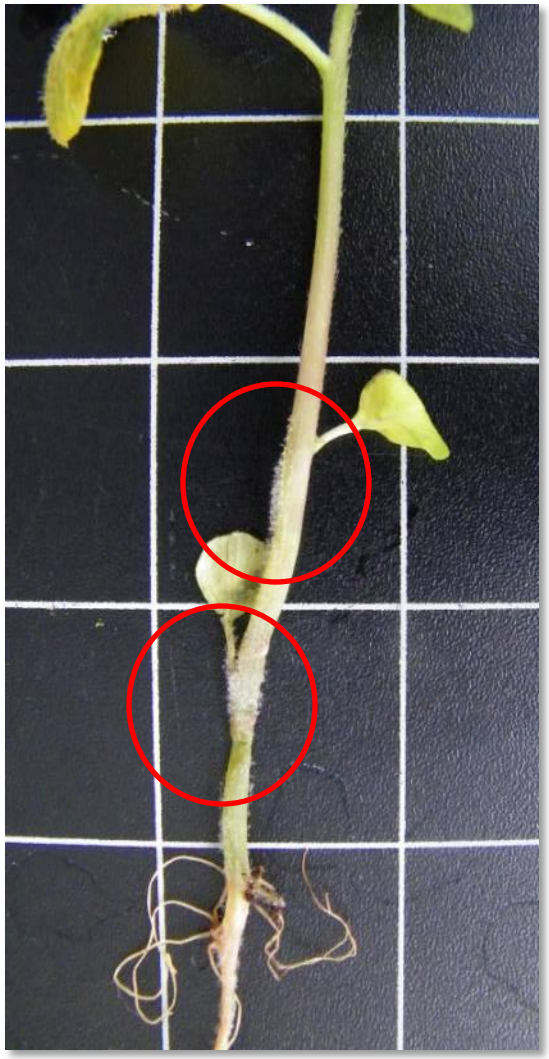
P. infestans – pathways of transmission and infection



P. infestans – pathways of transmission and infection

Potato stand heavily damaged by *P. infestans* primary infections in the first half of June

P. infestans – pathways of transmission and infection



P. infestans – pathways of transmission and infection

Analysis of certified seed tuber batches from different countries for latent infection (PCR assay), both organic and conventional seed tubers.

	2007	2008	2009	2010	2011
analysed batches	5 (n=94)	6 (n=47)	6 (n=47)	35 (n=47)	46 (n=47)
min [%]	0	2	0	0	0
max [%]	37	23	38	43	43
Mean infection rate [%]	**11**	**13**	**9**	**11**	**7**

overall mean: 10%

P. infestans – pathways of transmission and infection

Stem blight (primary infection)

Growth inside or on the stem

Infection of stem at or close to soil line

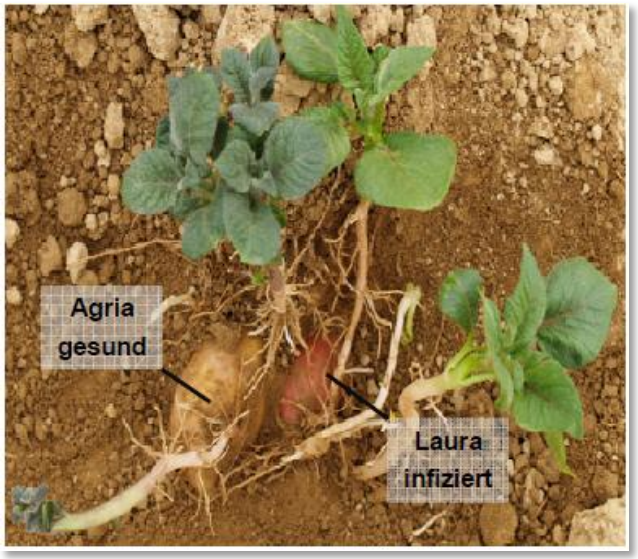
Sporulation on tubers, infection of neighbouring tubers/ plants

(Latent) infection of seed tubers
High soil moisture

Field tests

- prevention of stem infection by foliar treatment

- prevention of stem infection by seed treatment



double setting of potato seed tubers –

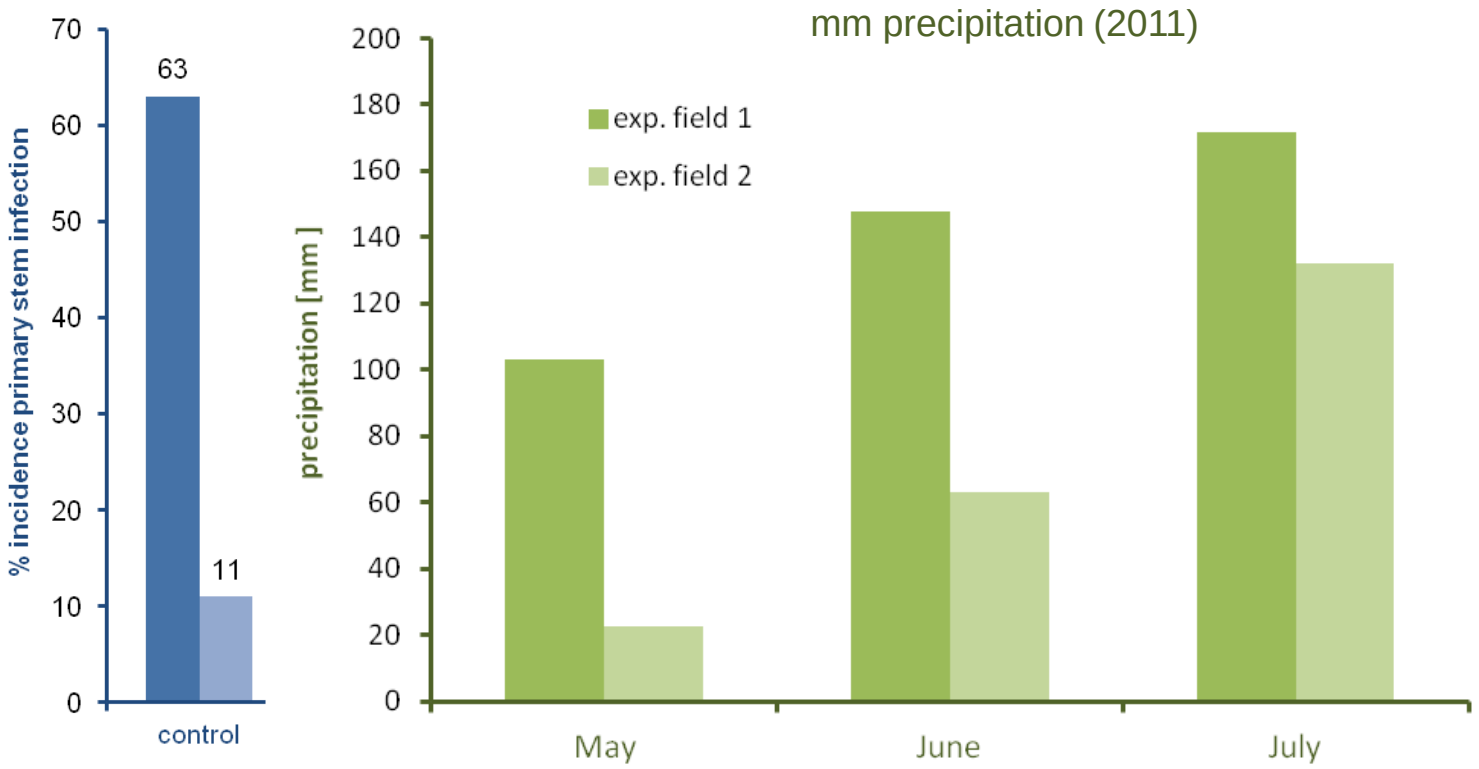
one infected, one healthy

one healthy + treated

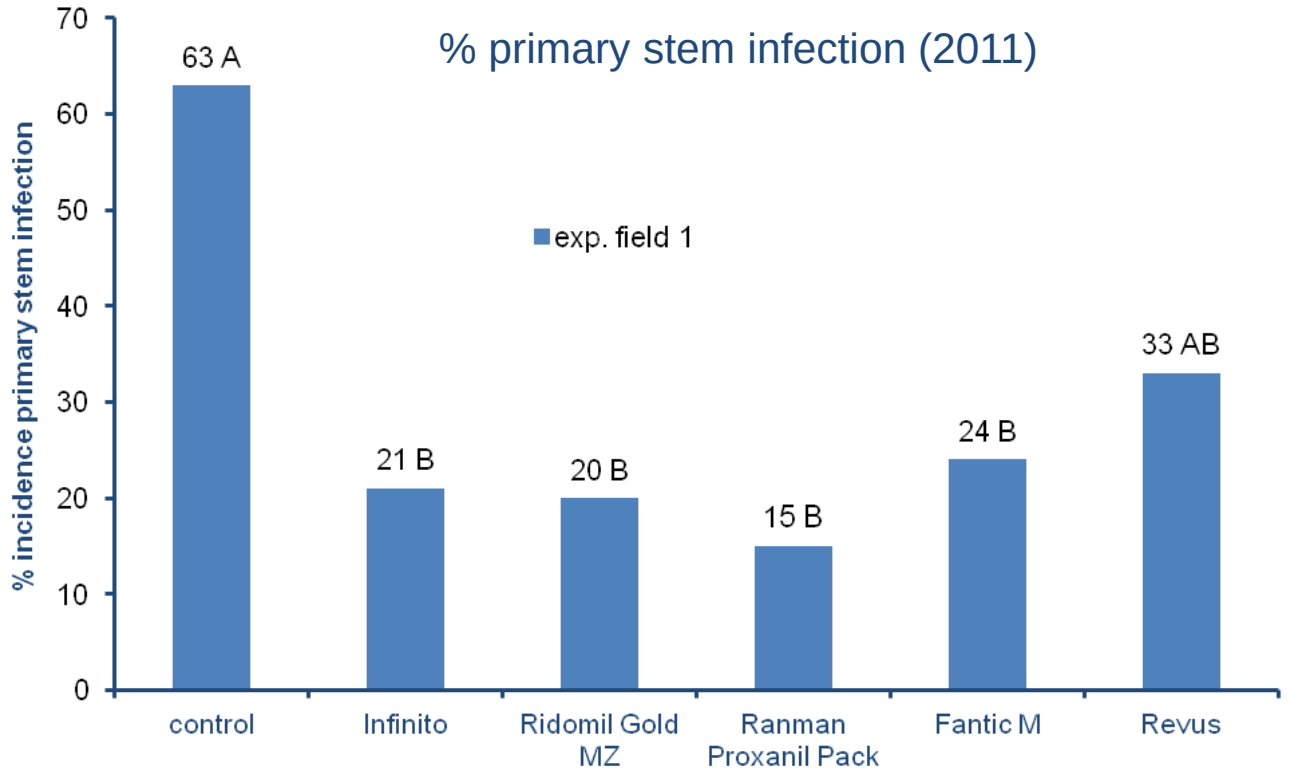
Field test: prevention of stem infection by foliar treatment

Treatment	Active ingredient	Fungicide type
untreated control	-	-
Infinito	**Propamocarb** + Fluopicolide	systemic
Ridomil Gold MZ	**Metalaxyl M** + Mancozeb	systemic
Proxanil Pack	**Propamocarb** + Cymoxanil	systemic
Fantic M	**Benalaxyl M** + Mancozeb	systemic
Revus	Mandipropamid	locally systemic/ translaminar

Field test: prevention of stem infection by foliar treatment



Field test: prevention of stem infection by foliar treatment



→ Significant effect of systemic fungicides on primary stem infection

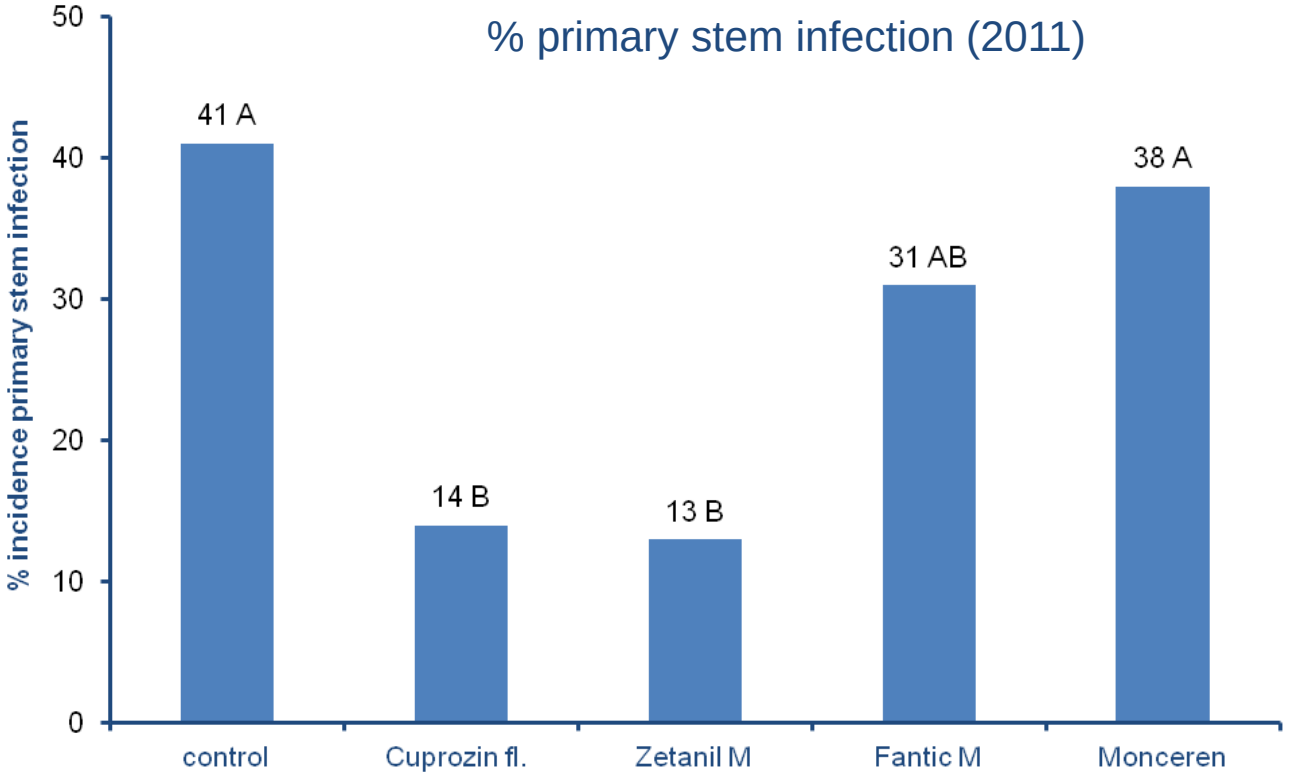
Field test: prevention of stem infection by foliar treatment

Systemic fungicides are taken up into the tissue and are distributed in the plant, thus can reduce the growth of the fungus from within the plant.

Field test: prevention of stem infection by seed treatment

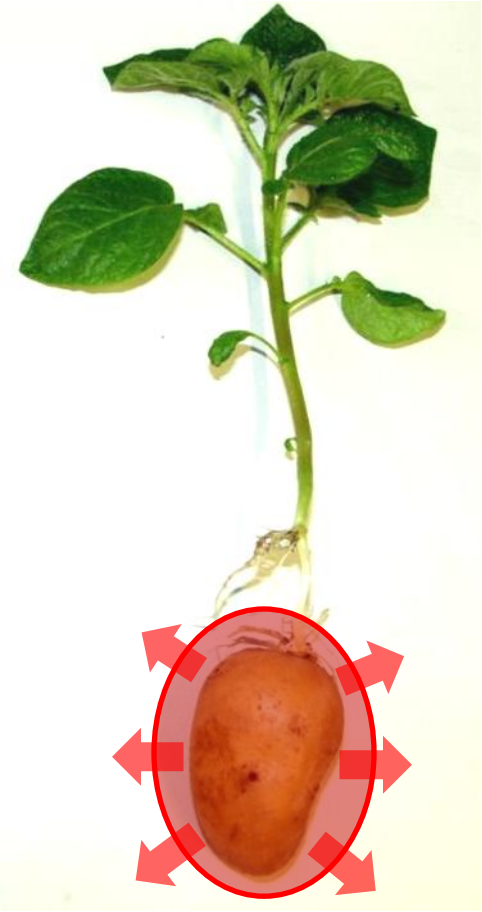
Treatment	Active ingredient	Fungicide type
control	-	-
Cuprozin fl.	Cu hydroxide	contact
Zetanil M	Mancozeb + Cymoxanil	locally systemic/ translaminar
Fantic M	Benalaxyl M + Mancozeb	systemic
Monceren	Pencycuron + Prothioconazol	[*Rhizoctonia* treatment]

Field test: prevention of stem infection by seed treatment



→ Significant effect of contact or locally systemic fungicides on (primary) stem infection

Field test: prevention of stem infection by seed treatment



Contact or locally systemic fungicides are effective against *Phytophthora* propagules located on the tuber surface, and in the surrounding soil. Protection of neighbouring tubers.

Organic potato production

Early primary stem blight is a key factor in organic potato production, as it determines the onset of an epidemic and thus, determines yield.

Systemic fungicides not available, (in Germany) copper currently is the only fungicide able to control late blight in organic farming.

Organic potato production

Project: „Strategies to reduce and avoid copper in organic potato farming“

Federal Programme for Organic and Sustainable Farming

BÖLN
Bundesprogramm Ökologischer Landbau und andere Formen nachhaltiger Landwirtschaft

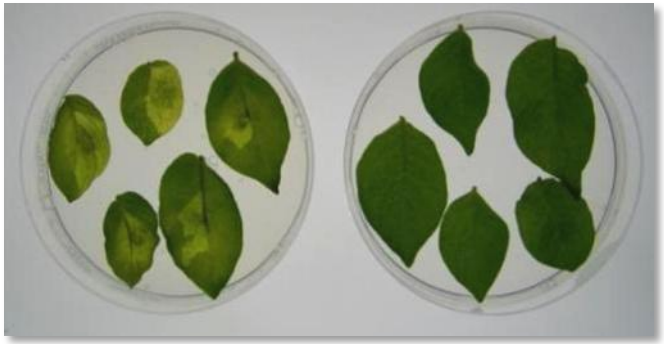
- Alternative products for **tuber treatment** to reduce primary stem infections

- Alternative products for **foliar applications** to reduce the extent of secondary leaf infections

→ reduction of latent infection rates in seed tubers

Organic potato production: leaf treatment

→ see poster



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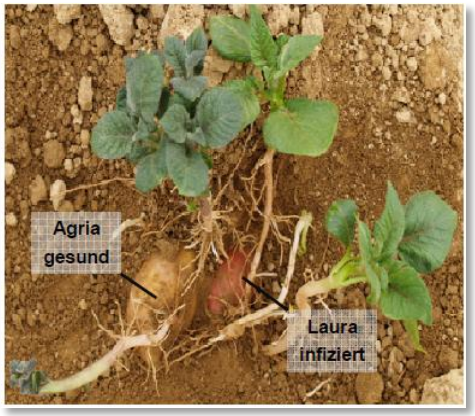
Organic potato production: tuber treatment

Active ingredient	Type of treatment
Cu hydroxide	Chemicals
Na phosphonate	
chitosan	
garlic extract	Plant extracts
knotweed extract	
mustard oil	
clover oil	
Bacillus subtilis	Antagonists
Pythium oligandrum	
Aureobasidium pullulans	
water 44 C	Heat treatment

Organic potato production: tuber treatment

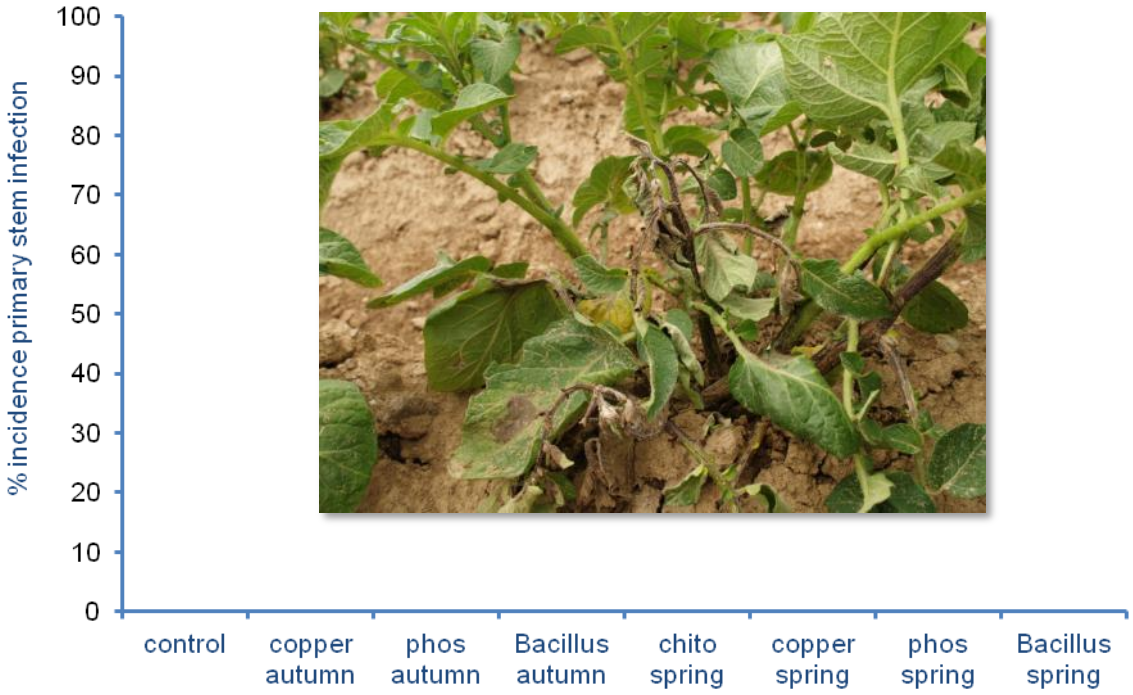
Field tests with treated seed tubers –
treatment before storage (autumn) or before seeding (spring)

Treatment	Application time
control	
Cuprozin fl. (copper)	autumn 2011
Na phosphonate	autumn 2011
Bacillus subtilis	autumn 2011
chitosan	spring 2012
Cuprozin fl. (copper)	spring 2012
Na phosphonate	spring 2012
Bacillus subtilis	spring 2012

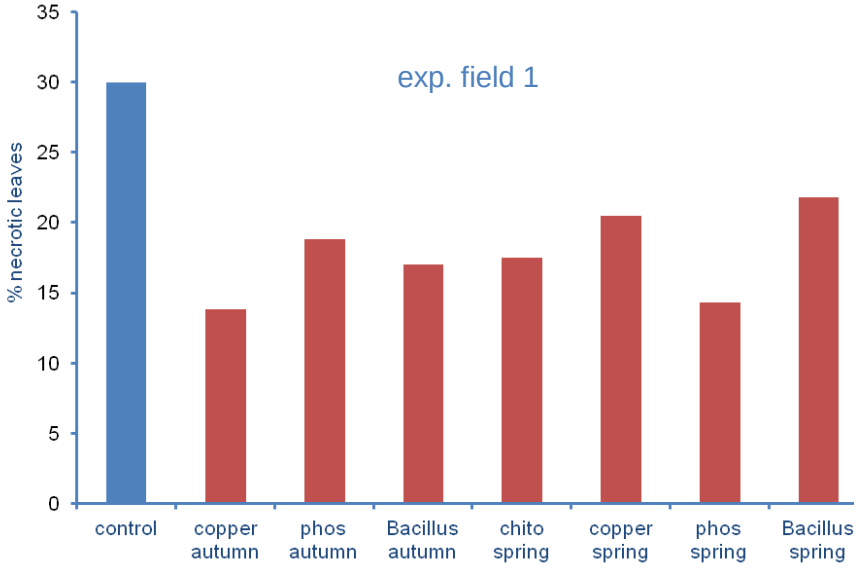


double setting of potato seed tubers –
one infected, one healthy + treated

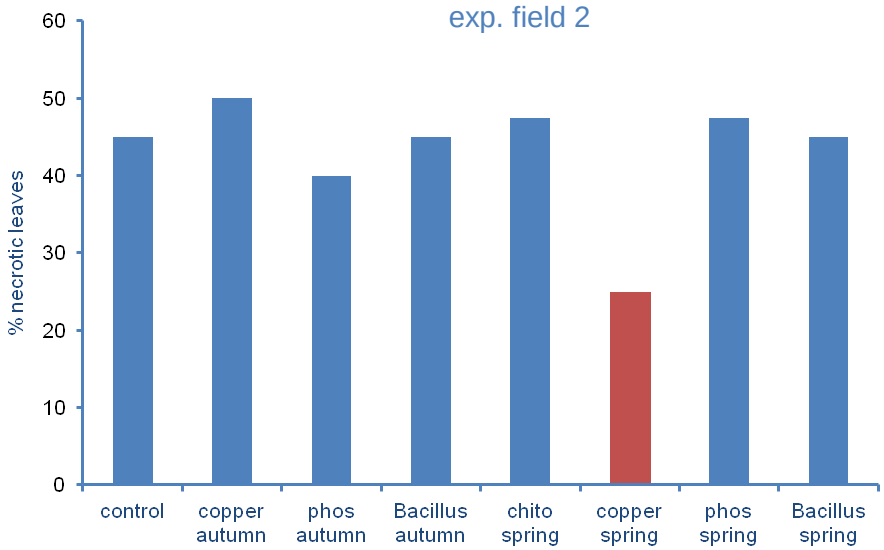
Organic potato production: tuber treatment



Organic potato production: tuber treatment

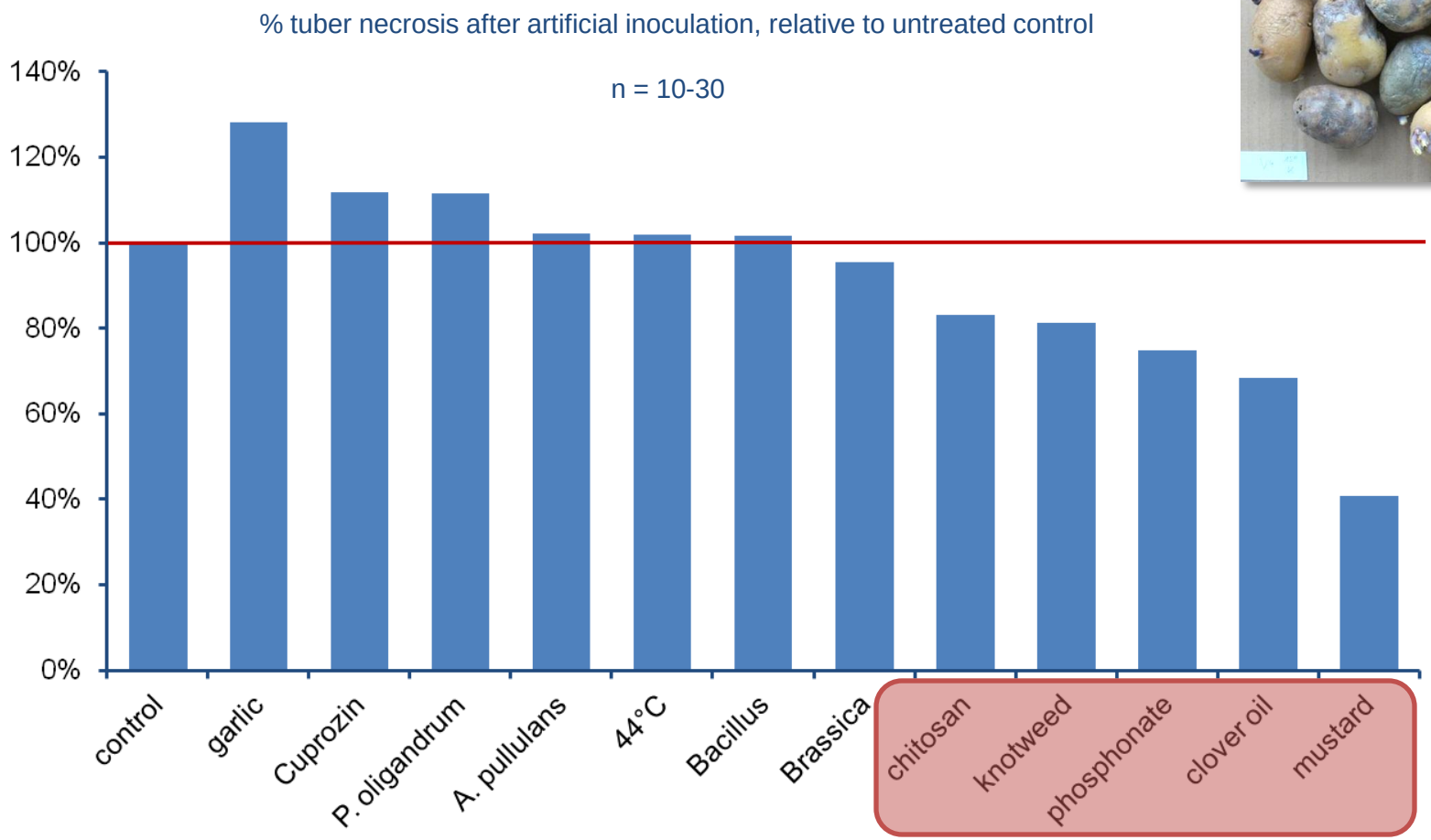


% leaf infection 2012
(end of July)



Organic potato production: tuber treatment

Laboratory tests, 15°C, with artificially infected tubers

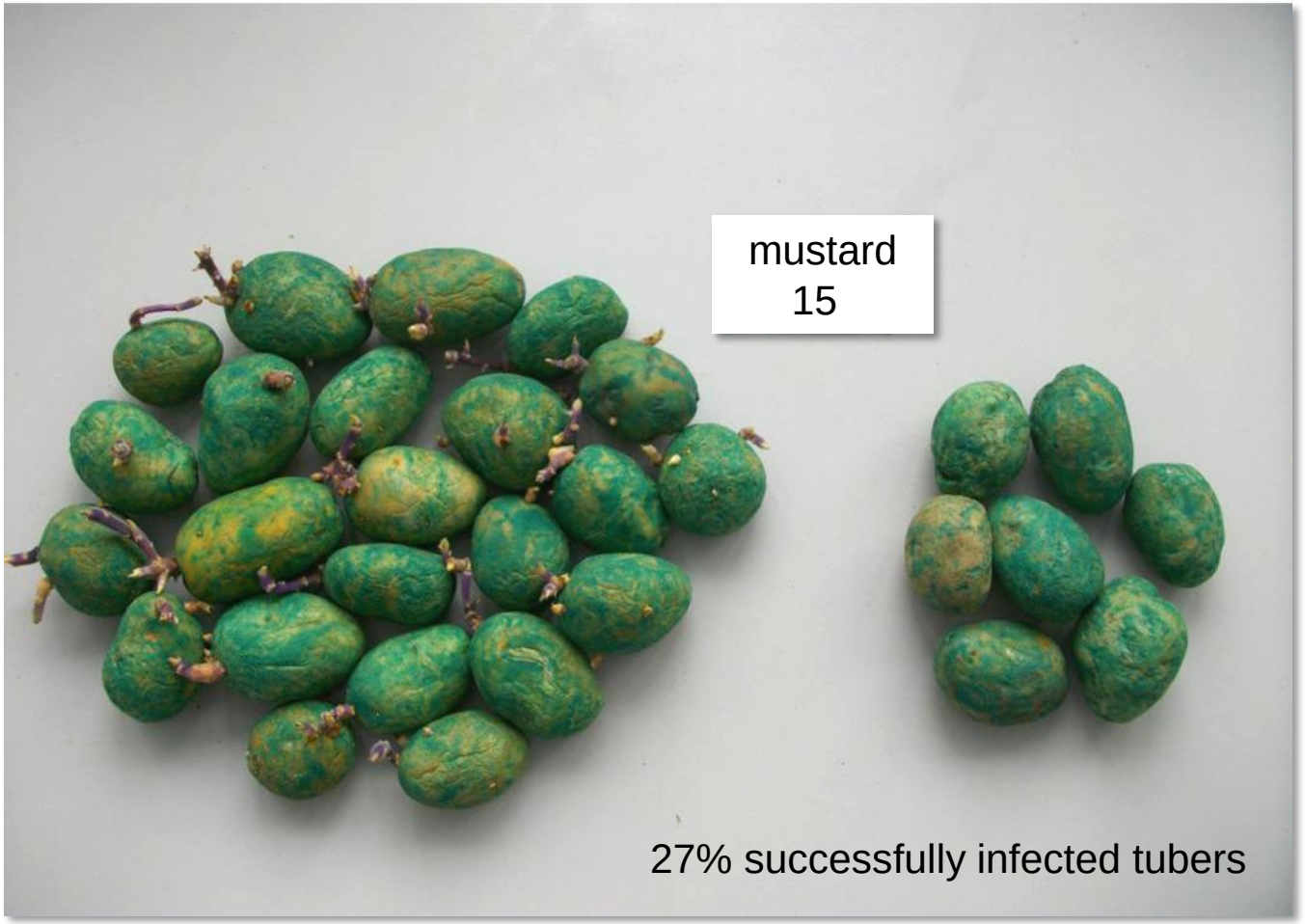


Organic potato production: tuber treatment

30 artificially infected tubers

Organic potato production: tuber treatment

30 artificially infected tubers



Summary

• early primary stem infections are the most important starting point for early and massive late blight epidemics

• can be prevented by an early foliar application of systemic fungicides (1-2 weeks ahead of the first visible symptoms)

• seed treatments might be an additional way to reduce incidence of primary infections

• in organic farming, postponing the onset of infection is even more important

• seed treatments and foliar treatments with alternative products can be part of a management strategy

• lower copper input, later disease onset, disease-free seed tubers

Thank you...

Bavarian State Research Center for Agriculture:

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Steffen Wagner
Bernhard Weber