

14th Euroblight Workshop in Limassol, Cyprus 12- 15 May, 2013

An integrated concept for fighting early blight in potatoes

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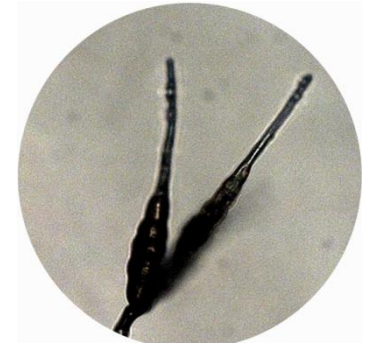


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Early blight in potatoes

- In the field: pathogen complex (*Alternaria solani* and *Alternaria alternata*)
- yield loss of up to 25%
- pathogen control by fungicides, e.g. strobilurines
- problem: in the USA a loss of sensitivity of *A. solani* isolates to azoxystrobin has been reported (Pasche et al. 2004)
- first mutations of isolates in Europe (Adolf, unpublished)



A. solani



A. alternata

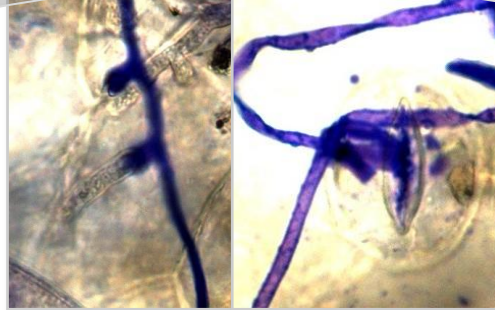
Are there any alternatives or additions to current early blight control?

Life cycle of *Alternaria solani*

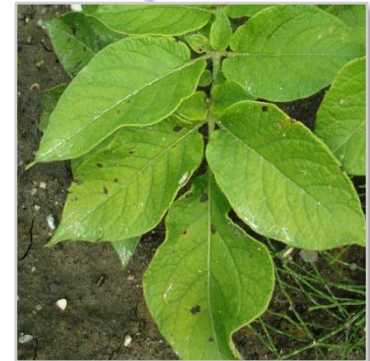
Dispersal of conidia by wind and rain splash



Overseasoning of the pathogen in soil and on plant debris or on infested tubers



Hyphal penetration via stomata and wounds or directly into epidermal cells



First symptoms on leaves near soil surface, sporulation on necrotic tissue



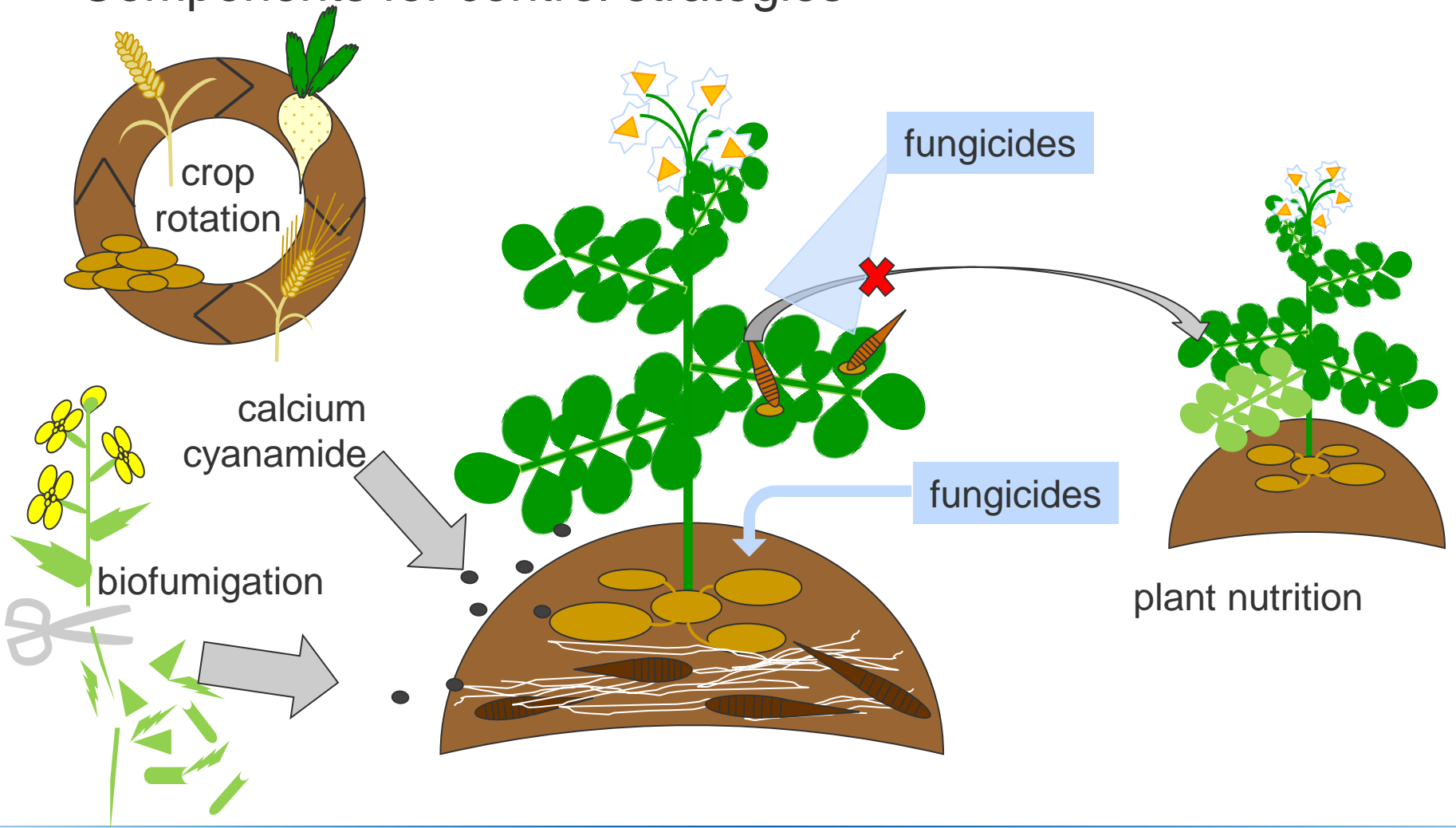
Necrotic lesions either as fine spots or as typical concentric rings, stronger symptoms on senescing leaves



Secondary spread of conidia between plants is crucial for epidemic development.

Death of plant

Components for control strategies



Calcium cyanamide (CaCN_2)

- Calcium cyanamide and its degradation products have fungistatic or fungicidal properties
- alternative to methyl bromide (soil disinfestans)
- application in agriculture and greenhouse vegetable production
- effective against soil pathogens like *Fusarium oxysporum*, *Plasmodiophora brassicae*, *Verticillium dahliae*, *Sclerotinia sclerotiorum*, *Rhizoctonia solani*,...

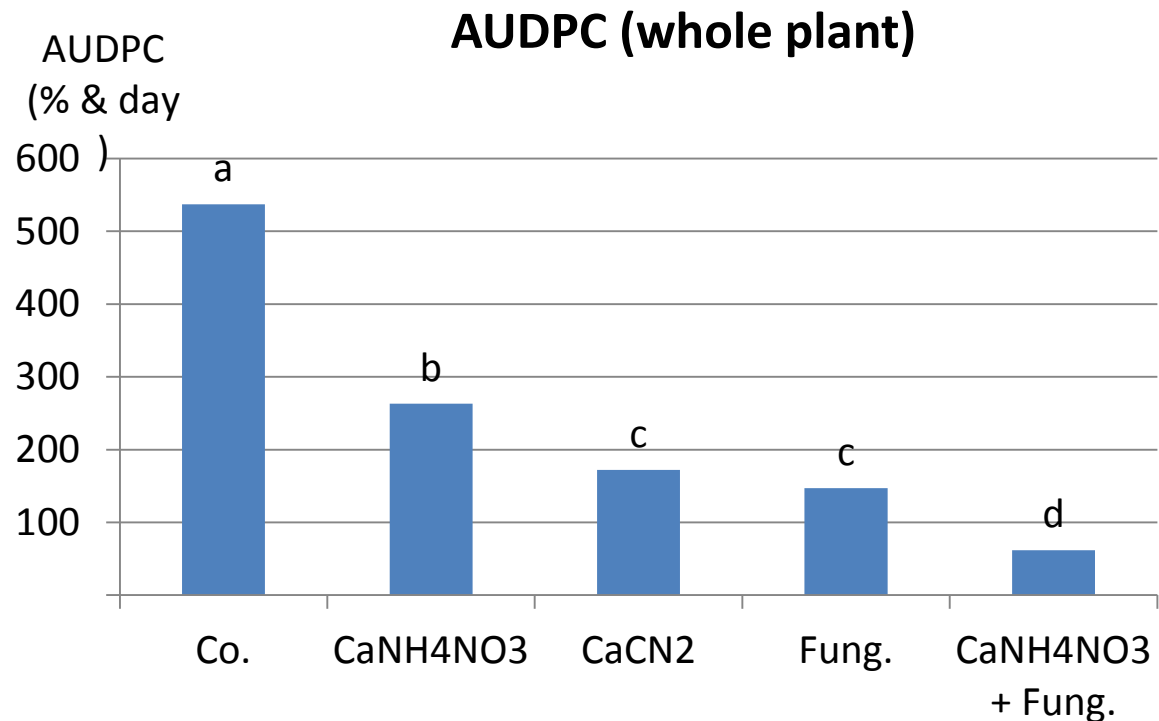
Effect of calcium cyanamide in field trials 2010

Co. = 0N control

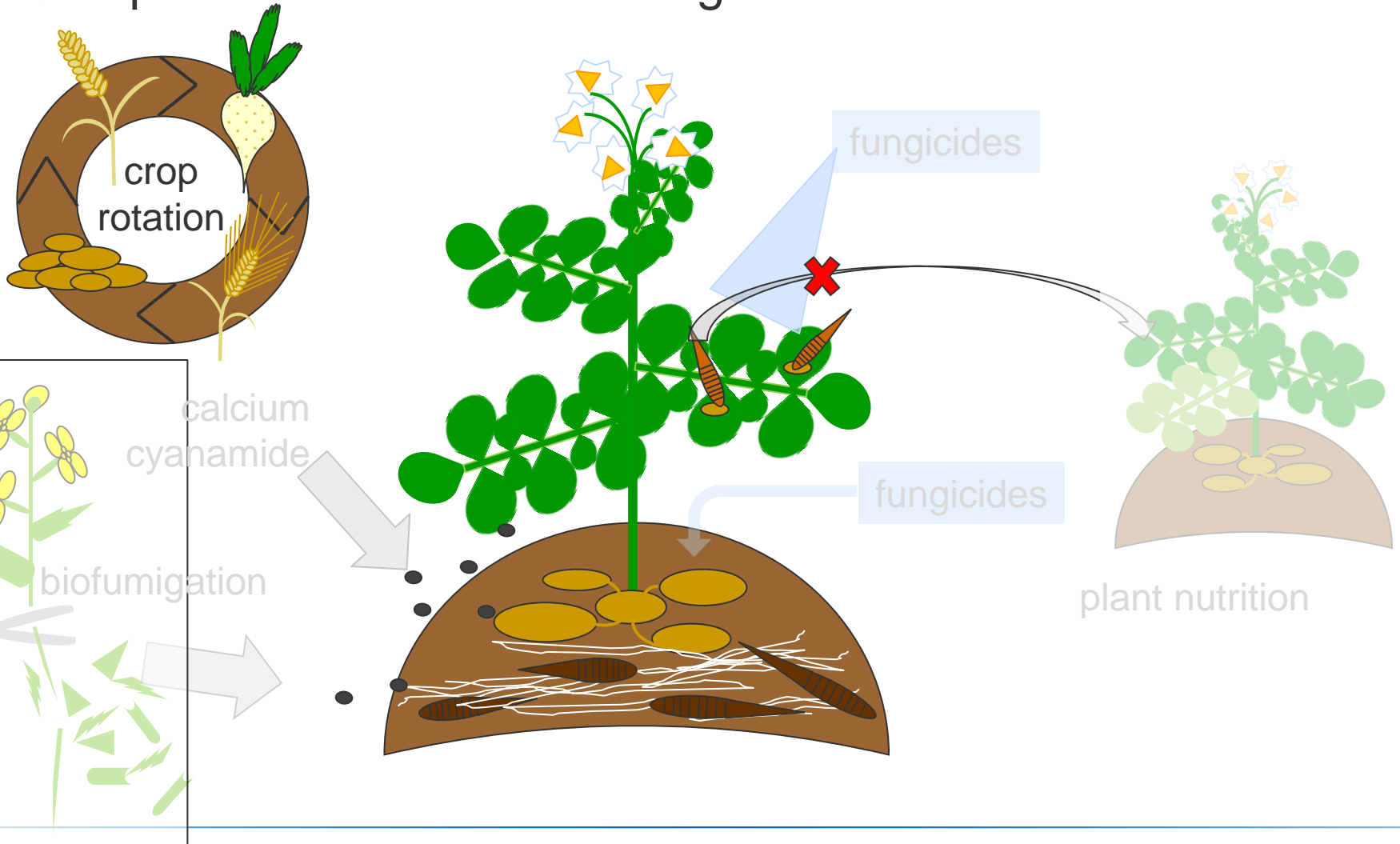
CaNH₄NO₃ = calcium ammonium nitrate

CaCN₂ = calcium cyanamide

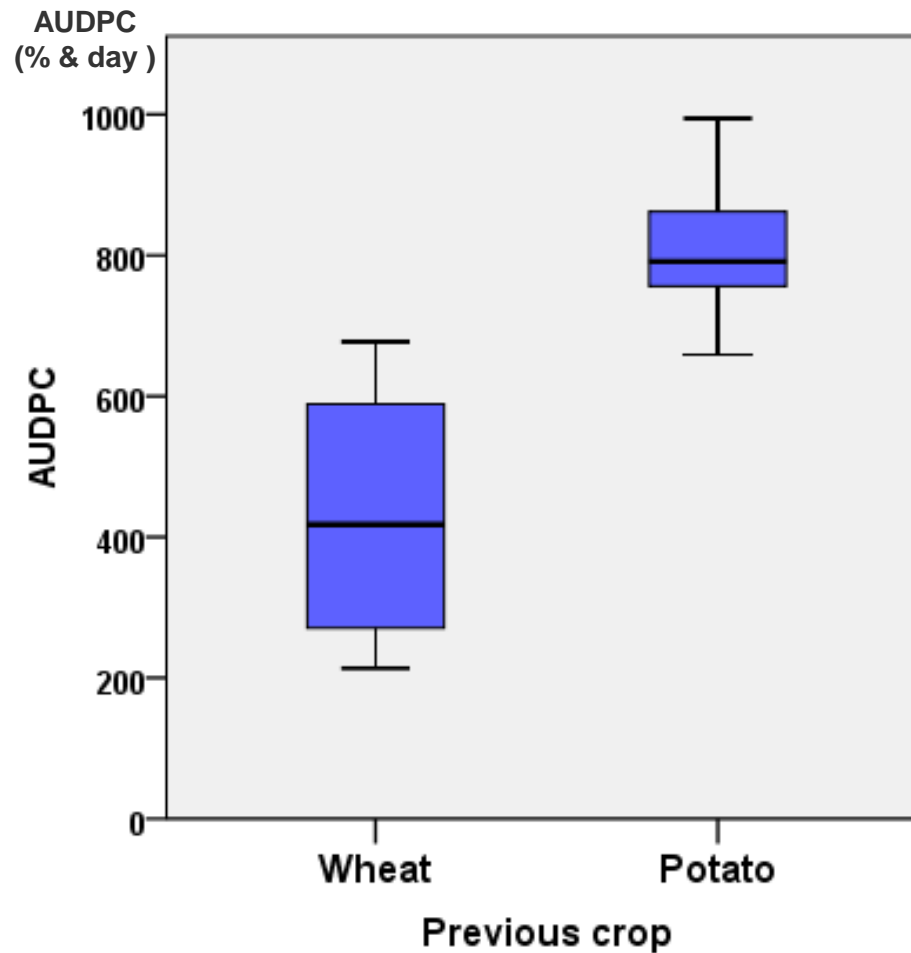
Fung. = Ortiva as soil application



Components for control strategies

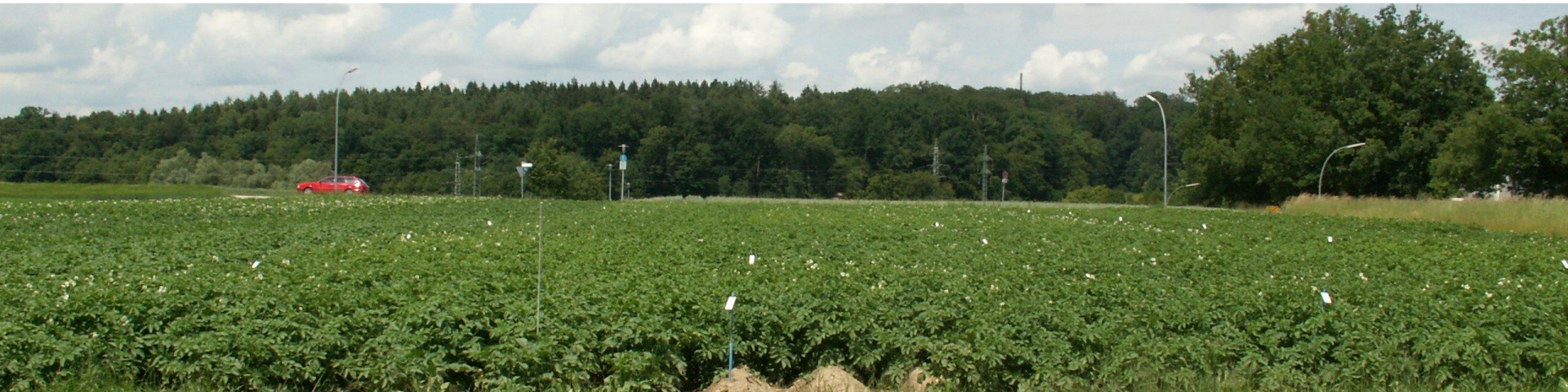


Effect of crop rotation in field trials 2011

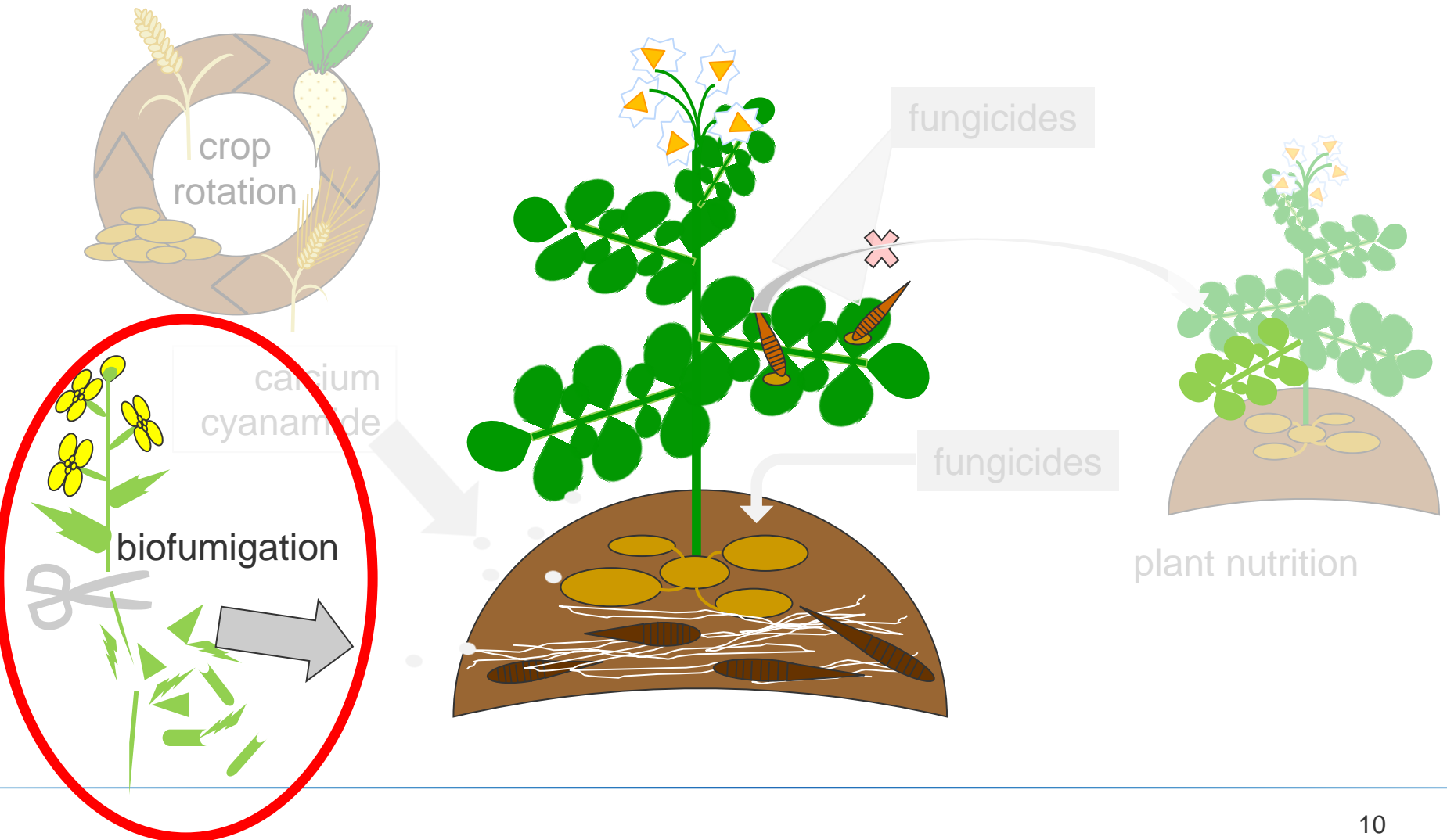


Next steps

- effective dose tests for calcium cyanamide and its degradation products versus *A. solani* & *A. alternata*
- comparison of soil DNA content of both pathogens and disease severity for assessing the impact of soil inoculum
- one more season of field trials for further tests



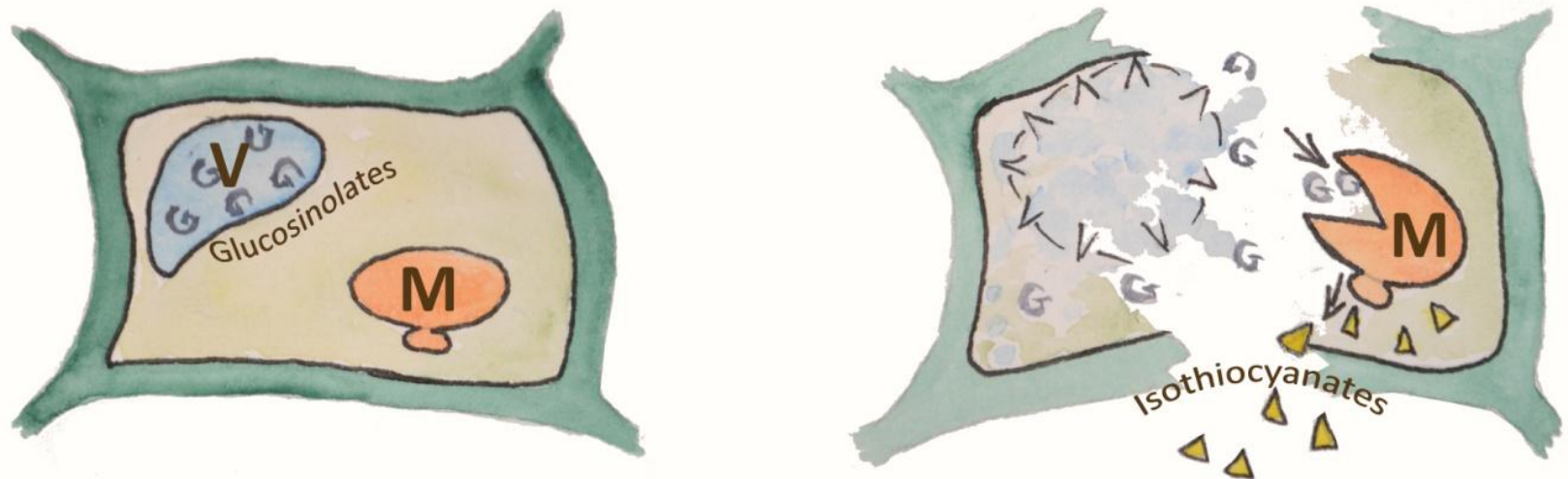
Components for control strategies



Biofumigation

Definition I

suppression of soil-borne pathogens, pests and weeds by isothiocyanates (ITCs), which derive from hydrolisation of glucosinolates by myrosinase (Kirkegaard et al. 1993)

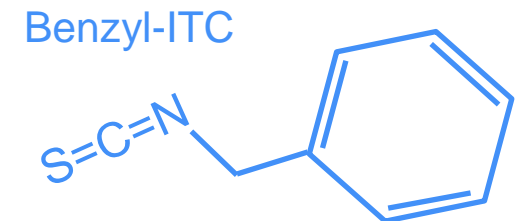


V = Vacuole M = Myrosinase

Isothiocyanates of interest

- aliphatic ITCs
 - allyl-ITC (*Brassica juncea*, *Armoracia rusticana*)
 - ethyl-ITC (*Lepidium menziesi*)
 - methyl-ITC (*Brassica napus*)

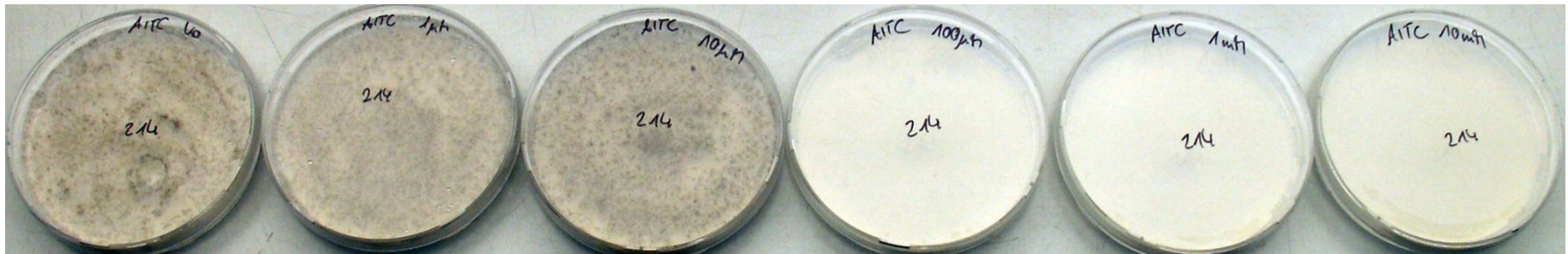
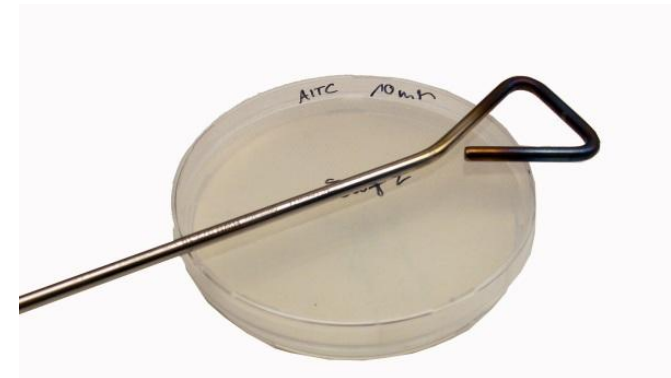
- aromatic ITCs
 - benzyl-ITC (*Tropaeolum majus*)
 - phenylethyl-ITC (*Armoracia rusticana*)



Lab assay with biofumigant agents

Effect of direct contact between spores and ITCs in the medium

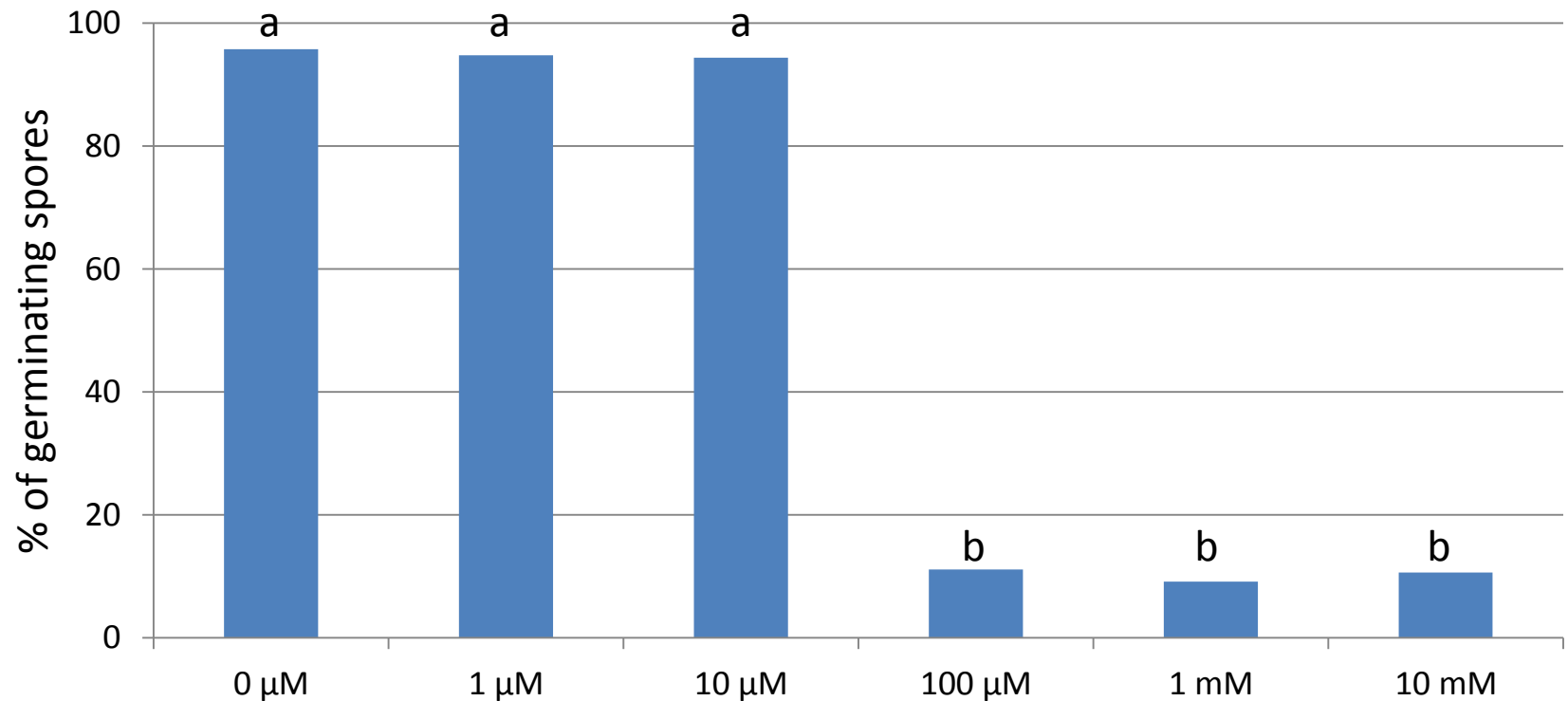
- petri dishes with SNA medium of different ITC concentrations are prepared
- spore solution (400 μ l à 2,000 spores/ml) is spread in every dish



dilution series of allyl-ITC (4 days after inoculation)

Effect of allyl-ITC

Spore germination of *A. solani* on media with increasing allyl isothiocyanate concentrations



different letters mean significant differences of treatments (Tukey-Test, $\alpha=0,05$)

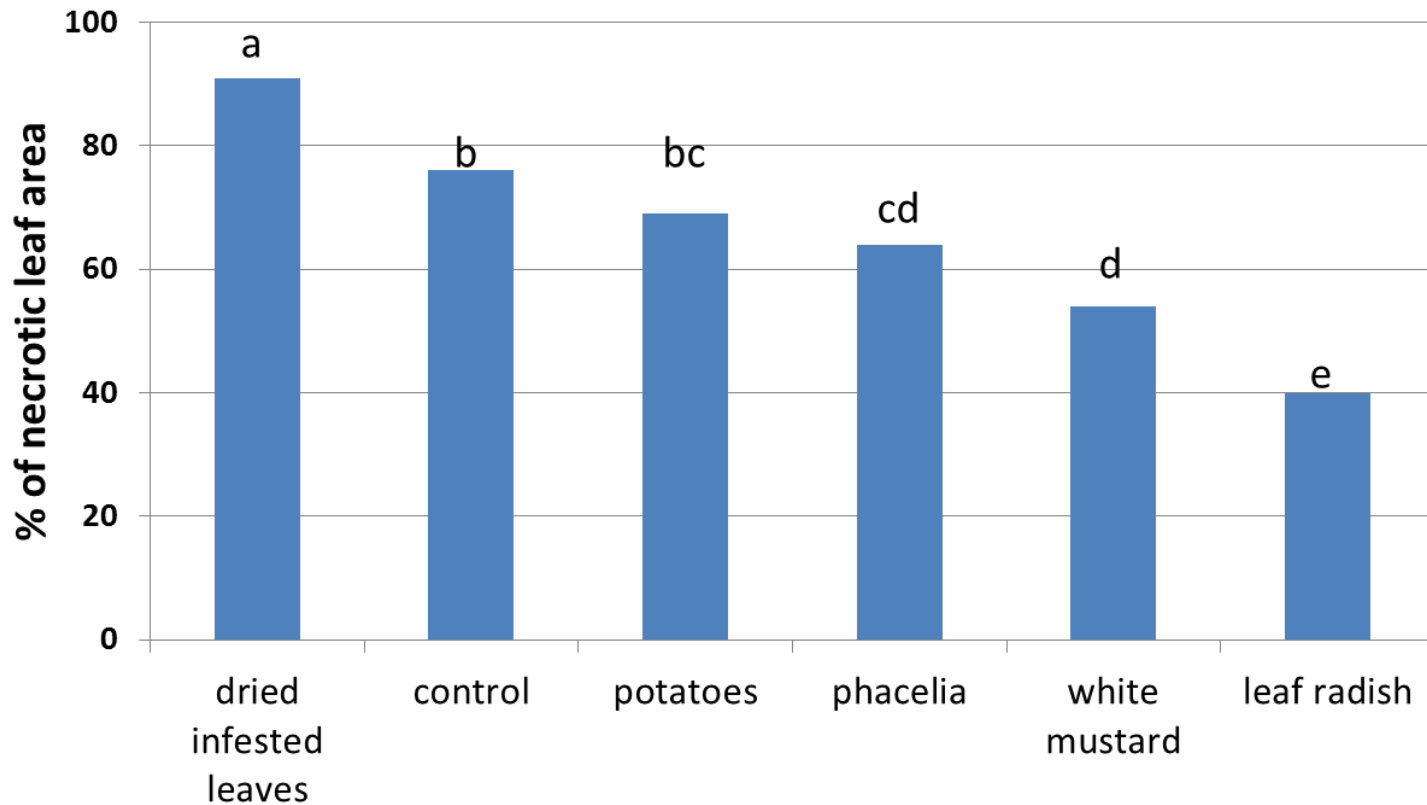
Field trial 2012 in Kirchheim

Effect of biofumigant crops (leaf radish, white mustard) compared to other previous crops/organic amendments (4 repetitions)

Treat-ment	Previous crop / green manure amendment	Amount/plot (kg fresh weight)
1	leaf radish	7.5
2	white mustard	7.5
3	phacelia	7.5
4	potatoes	7.5
5	control	
6	dried infested potato leaves	0.5

Biofumigation field trial results 2012

Effect of previous crops on early blight symptoms of upper leaves in the late season

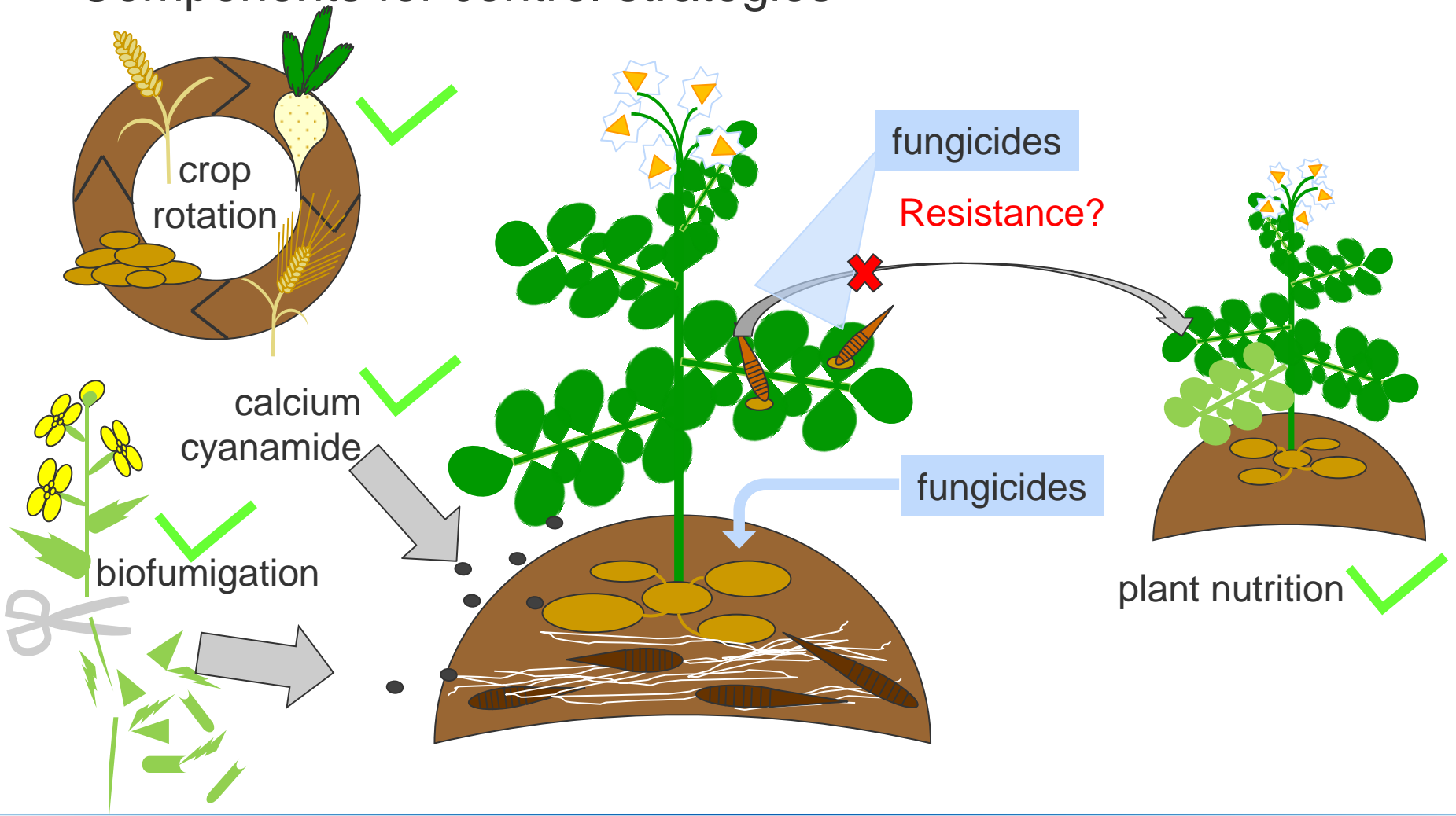


different letters mean significant differences of treatments (Tukey-Test, $\alpha = 0,05$)

Outlook field and lab trials

- Leaf radish promising for further field trials
 - Possible alternative: Indian mustard (allyl-ITC)
 - Main isothiocyanates of leaf radish (4-(methylthio) butyl-ITC) and white mustard (p-hydroxybenzyl-ITC) are not commercially available
- ⇒ next step: extraction of ITCs in cooperation with scientists of the TUM
Chair of Genetics
- Further lab trials on other biofumigant agents

Components for control strategies





Thank you for your attention!