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EXCELLENCE FOR SUSTAINABILITY



CO-FREE: four crops, three years – where are we now?

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www.co-free.eu

Substitution / reduction of copper in plant protection

Results from national and international projects, e.g.







EU-funded project: Innovative strategies for copper-free low input and organic farming systems



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 289497



Aims of CO-FREE



Dissemination



Innovative Plant Protection Products

- > More than 15 candidates have been evaluated/developed
- Promising pipeline products were identified: (2 annex I listed, for 3 dossier submission planned (=investments!!!), for 4 candidates further R&D needed). Best case for fungicides/BCAs until market introduction: 2022.
- Ecotox impact was assessed: all candidates evaluated so far indicated low or no tox to most non target organisms.
- Economic assessment: Most candidates are likely to cost more than copper; unlikely that 1 candidate that can cover all uses of copper;
- Efficacy level of candidates similar to copper in best cases (but not better yet).



Alternative compounds (CTPs), e.g.

Control agents	Research aspects
Microbial origin	
Trichoderma atroviride SC1 and protein extract SCNB	Development of stable formulations for improvement of efficacy under
Yeast-based derivatives	field conditions
Cladosporium cladosporioides H39	Optimization / scale-up of production
Oligosaccharidic complex COS-OGA	 Extended elucidation of the mode(s) of action
Aneurinibacillus migulanus and Xenorhabdus	
bovienii	Characterization of chemical active
Plant origin	
Sage extract	 Identification of key components and interactions / synergies between active compounds
Liquorice extract	
PLEX	
Seaweed extract	Improvement of application timing





Field trial potato Germany 2012 (JKI)



Disease severity of *Phytophthora infestans* on potato leaves (cv. `Ditta´)



www.jki.bund.de



Field trial potato Germany 2012 (JKI)



Yield of potatoes (cv. `Ditta´)





Data statistically not significantly different



Field trial potato Poland 2014 (IPP)



Yield potatoes (cv. `Ditta´)



Decision Support Systems:

Innovative DSS were developed under COFREE and are now ready for evaluation at scale:

- Potential for copper reduction in potato based on DSS.
- Grapevine models are expected to increase yield security if copper alternatives are to be used.
- Models are available for validation and implementation.
- > (Apple DSS RIMpro is already best practice)



Potato DSS: Copper reduction strategy based on potato growth characteristics



Claudia Tebbe, Benno Kleinhenz, Paolo Racca (ZEPP), Hannes Schulz, Dagmar Werren, Maria R. Finckh, , Christian Bruns (UKA)

FiBL www.fibl.org

Model application

Developed model was implemented in the already existing DSS <u>Öko-SIMPHYT</u> and is available in the internet under <u>www.isip.de</u> (only in German)



Tebbe et al.

Zentralstelle der Länder für EDV-gestützte Entscheidungshilfen und Programme im Pflanzenschutz

Zepp

Resistant/robust varieties

- > The availability of robust varieties is constantly increasing.
- > Bottleneck include adoption by the whole value chain
- Strategies to overcome bottlenecks have been identified in CO-FREE based on pilots.
- Usefulness of variety approach differs largely depending on crop and region (potato, apple, grapevine, tomato)



How to make the markets ask for robust cultivars...



In the Netherlands the organic sector keeps growing, but organic potato production is lagging behind. This is due to the relatively high disease pressure from Phytophthora infestans, which causes foliage and tuber late blight. For organic potato growers this disease still forms a major cropping risk.

In the potato breeding programme Bioimpuls, the Louis Bolk Institute and Wageningen UR are working together with breeding companies and farmer-breeders to develop robust cultivars that are resistant to Phytophthora. Thanks to these new cultivars, organic growers now have more chance of yield security. The next step is to collaborate with organic wholesalers and retailers to make sure that the new cultivars reach the shop shelves and consumers' plates. In the Netherlands, the organic market has already accepted new cultivars such as Bionica, Sarpo Mira and Carolus, but other cultivars are still relatively unknown, and additional promising cultivars will become available for the European market in the near future. Together, these cultivars will offer a complete assortment of boiling, baking and multi-purpose potatoes in various colours and shapes. The new talents are presented in this brochure.

FARMER-BREEDER NIEK VOS ABOUT HIS CULTIVAR BIONICA (NIEK'S WITTE): "Organically produced, with disease resistance from Mexico and taste from the Dutch polder"

* http://louisbolk.org/bioimpuls/en/







MID-EARLY MATURITY, GOOD EARLY FOLIAGE DEVELOPMENT. ROUND TO OVAL TUBERS. LOW SUSCEPTIBILITY TO SCAB, RESISTANT TO PHYTOPHTHORA IN FOLIAGE AND TUBERS.



FOLINGE DEVELOPMENT. OVAL TUBERS.

TWO-COLOURED SKIN. MODERATE

SUSCEPTIBILITY TO SCAB, RESISTANT

TO PHYTOPHTHORA IN FOLIAGE

AND TUBERS.

FOLINGE DEVELOPMENT. OVAL-LONG

TUBERS, LOW SUSCEPTIBILITY TO

SCAB, RESISTANT TO PHYTOPHTHORA IN FOLINGE AND TUBERS.



MID-LATE MATURITY, RAPID EARLY FOLINGE DEVELOPMENT, ALSO WHEN FERTILISER INPUT IS LOW. ROUND TO OVAL TUBERS. LOW SUSCEPTIBILITY TO SCAB, VERY HIGH FIELD RESISTANCE TO PHYTOPHTHORA IN FOLIAGE AND TUBERS.





LATE MATURITY, RAPID EARLY FOLIAGE DEVELOPMENT, OVAL-LONG TUBERS. SUSCEPTIBLE TO SCAB, BUT RESISTANT TO PHYTOPHTHORA IN FOLIAGE AND TUBERS

EARLY MATURITY, RAPID EARLY FOLIAGE DEVELOPMENT. OVAL TUBERS. LOW SUSCEPTIBILITY TO SCAB, RESISTANT TO PHYTOPHTHORA IN FOLIAGE AND TUBERS

DEMETER GROWER ALEX VAN HOOTEGEM ABOUT VITABELLA: "Vitabella has done well and is also a



very tasty table potato"



ORGANIC GROWER CAREL BOUM ABOUT CAROLUS AND CONNECT: "If we get the chance, we'll only grow resistant cultivars



Alonette

Carolus

Vitabella

GET A TASTE OF

NEW TALENTED

ROBUST POTATO

CULTIVARS

Bionica

amert

Sapo

Nira



Cropping systems ranging from traditional high yield orchards, to VLIPS, to agroforestry, e.g. apple



High yield 'Sustainable Fruit System' (Switzerland)







The Organic Research Centre



Wakelyns Agroforestry

- ~ 2ha system
- 21 varieties of apple; 38 trees
- 7 timber species
- 12m crop alleys
- Planted 1994
- Unsprayed

Clarkes Lane Orchard

- 0.2 ha organic orchard
- Planted 2004
- 19 varieties of apples
- Mo rootstock (dwarfing)
- 3m between rows, 1.5m between trees within row
- Unsprayed





Apple: potential and recommendations

- Progressive cultivation techniques (agro-forestry, VLIPS) have been explored: interesting results but far away to be adopted in commercial apple production at scale, mostly due to lack of sufficient disease control.
- Alternative PPPs tools and strategies are available.
 COFREE products have to be further evaluated in field conditions (early season, cold, wet).
- Scab 'resistant' cultivars are available but emergence of virulent scab populations limits the use.
- Copper ban will affect yield security due to lack of control of other (emerging) diseases.

ww.fibl.ora



'There are no silver bullet solutions to replace copper, but partial solutions to reduce copper become available progressively' (www.co-free.eu)



Group photo at the start-up meeting in Darmstadt, January 2012

