Coping with(out) copper in organic potatoes: the CO-FREE way

D. Andrivon, S. Kühne, C. Bruns, J. Kowalska, J.E. Chauvin, R. Pellé, E. Lammerts van Bueren, L. Tamm & A. Schmidt

Euroblight Workshop, Limassol, May 2013

Blight and blight control:
a continuing challenge in organic potatoes

CropLife Foundation
Crop Protection Research Institute

Restrictions on Fungicide Use Causing Decline in Organic Potato Production in Europe

International Pesticide Benefits Case Study No. 27, September 2011

Leonard Gianessi and Ashley Williams

Late blight is an annual problem in European potato fields. Conventional growers use synthetic chemical fungicides to control the disease. Organic growers are prohibited from using synthetic chemicals, but have been allowed the use of fungicides that contain copper. Copper sprays have been shown to raise organic potato yields by 25% over untreated plots [1]. The additional yield resulting from copper-based fungicide protection is worth between 15 and 45 million EUROS per year to EU organic potato growers [1].

Copper

Because of concerns about the buildup of copper in the soil from prolonged use, the E.U. has restricted the use of copper fungicides. The use of copper is also regulated by private standards of producer's associations (the Demeter label allows no copper products). In 2001, an EU limit of 8 kg/ha was set. In January 2006 the EU imposed regulations on organic farmers to use no more than 6 kg of copper per hectare per year. In Scandinavia and The Netherlands, copper use is forbidden in organic as well as conventional farming. Under organic regulations in Germany and Switzerland copper applications are restricted to lower levels than those permitted by EU regulations (3-4 kg/ha).

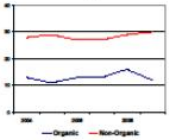


Figure 1: Swedish Potato Yields, 1000 Kg/Ha

One concern is that an early outbreak of the disease encourages the formation of a fast spreading and massive epidemic, which ultimately cannot be controlled with the allowable amount of copper. A survey of French organic potato growers revealed that in a year with low blight pressure, an average of 4.2 sprays containing 3.4 kg of copper are used per hectare [2]. In a year with high pressure, 9.9 sprays are needed with a copper content of 8 kg/ha. The total copper use per hectare in 2000 in organic potatoes in France, Germany, Switzerland and the U.K. varied between .2 and 15 kg/ha [1].

Yields of organic potatoes in Europe are typically 50% lower than from conventional fields with losses to late blight causing the most significant reduction (Figure 1). In countries where copper is prohibited, 100% losses often occur. 2004 was a catastrophe for organic potato crops in Finland; no marketable yield could be harvested except for very early fields [3]. Acreage of organic potatoes declined by 25-30% in Sweden and The Netherlands during the period 2001- 2006 while in Finland the decline has been over 50% [4] (Figure 2).

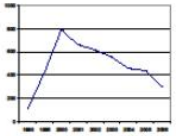


Figure 2: Organic Potato, Finland (Ha)

The ultimate aim in the E.U. was the complete prohibition of copper use in potato production. In order to overcome the expected production problems in organic potatoes without copper use, the 6 million EURO EU project "Blight-MOP" started in 2001 with a Final Report in December 2005 [1]. None of the wide range of alternatives tested gave an acceptable level of late blight control and few were any better than untreated controls.

References

1. Leifert, C. and S.J. Wilcockson. 2005. Blight-MOP: Development of a systems approach for the management of late blight (caused by *Phytophthora infestans*) in EU organic potato production. University of Newcastle, UK.
2. Bruyere, J. 2010. Fight against late blight in organic production. Euroblight Meeting in Arras, France, 5 May 2010.
3. Schepers, H.T.A.M. and H.G. Spits. 2005. The development and control of *Phytophthora infestans* in Europe in 2004-2005. Ninth Workshop of an European Network for development of an Integrated Control Strategy of potato late blight, Tallinn, Estonia. *PPO-Special Report no. 11*:11-12.
4. Hagman, J.E., A. Mårtensson and U. Grandin. 2009. Cultivation practices and potato cultivars suitable for organic potato production. *Potato Research*. 52:319-30.

CropLife Foundation
1156 15th Street, NW #400 Washington, DC 20005
Phone 202-296-1585 www.croplifefoundation.org Fax 202-463-0474

Yield concerns

** Yields of organic potatoes in Europe are typically 50% lower than from conventional fields with losses to late blight causing the most significant reduction. Where copper is prohibited, 100% losses often occur.*

Acreages down

** Acreage of organic potatoes declined by 25-30% in Sweden and The Netherlands during the period 2001- 2006 while in Finland the decline has been over 50% [4].*

Blight and blight control:
copper as one (non sustainable) solution

CropLife Foundation
Crop Protection Research Institute

Restrictions on Fungicide Use Causing Decline in Organic Potato Production in Europe

International Pesticide Benefits Case Study No. 27, September 2011

Leonard Gianessi and Ashley Williams

Late blight is an annual problem in European potato fields. Conventional growers use synthetic chemical fungicides to control the disease. Organic growers are prohibited from using synthetic chemicals, but have been allowed the use of fungicides that contain copper. Copper sprays have been shown to raise organic potato yields by 25% over untreated plots [1]. The additional yield resulting from copper-based fungicide protection is worth between 15 and 45 million EUROS per year to EU organic potato growers [1].

Copper

Because of concerns about the buildup of copper in the soil from prolonged use, the E.U. has restricted the use of copper fungicides. The use of copper is also regulated by private standards of producer's associations (the Demeter label allows no copper products). In 2001, an EU limit of 8 kg/ha was set. In January 2006 the EU imposed regulations on organic farmers to use no more than 6 kg of copper per hectare per year. In Scandinavia and The Netherlands, copper use is forbidden in organic as well as conventional farming. Under organic regulations in Germany and Switzerland copper applications are restricted to lower levels than those permitted by EU regulations (3-4 kg/ha).

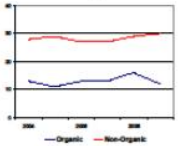


Figure 1: Swedish Potato Yields, 1000 Kg/Ha

One concern is that an early outbreak of the disease encourages the formation of a fast spreading and massive epidemic, which ultimately cannot be controlled with the allowable amount of copper. A survey of French organic potato growers revealed that in a year with low blight pressure, an average of 4.2 sprays containing 3.4 kg of copper are used per hectare [2]. In a year with high pressure, 9.9 sprays are needed with a copper content of 8 kg/ha. The total copper use per hectare in 2000 in organic potatoes in France, Germany, Switzerland and the U.K. varied between .2 and 15 kg/ha [1].

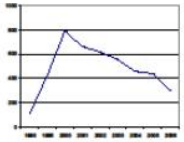


Figure 2: Organic Potato, Finland (Ha)

Yields of organic potatoes in Europe are typically 50% lower than from conventional fields with losses to late blight causing the most significant reduction (Figure 1). In countries where copper is prohibited, 100% losses often occur. 2004 was a catastrophe for organic potato crops in Finland; no marketable yield could be harvested except for very early fields [3]. Acreage of organic potatoes declined by 25-30% in Sweden and The Netherlands during the period 2001- 2006 while in Finland the decline has been over 50% [4] (Figure 2).

The ultimate aim in the E.U. was the complete prohibition of copper use in potato production. In order to overcome the expected production problems in organic potatoes without copper use, the 6 million EURO EU project "Blight-MOP" started in 2001 with a Final Report in December 2005 [1]. None of the wide range of alternatives tested gave an acceptable level of late blight control and few were any better than untreated controls.

References

1. Leifert, C. and S.J. Wilcockson. 2005. Blight-MOP: Development of a systems approach for the management of late blight (caused by *Phytophthora infestans*) in EU organic potato production. University of Newcastle, UK.
2. Bruyere, J. 2010. Fight against late blight in organic production. Euroblight Meeting in Arras, France, 5 May 2010.
3. Schepers, H.T.A.M. and H.G. Spits. 2005. The development and control of *Phytophthora infestans* in Europe in 2004-2005. Ninth Workshop of an European Network for development of an Integrated Control Strategy of potato late blight, Tallinn, Estonia. *PPO-Special Report no. 11*:11-12.
4. Hagman, J.E., A. Mårtensson and U. Grandin. 2009. Cultivation practices and potato cultivars suitable for organic potato production. *Potato Research*. 52:319-30.

CropLife Foundation
1156 15th Street, NW #400 Washington, DC 20005
Phone 202-296-1585 www.croplifefoundation.org Fax 202-463-0474

Copper works…

** Copper sprays have been shown to raise organic potato yields by 25% over untreated plots [1].*

** The additional yield resulting from copper-based protection is worth between 15 and 45 million €/ year to EU organic potato growers.*

… but at high rates …

** France: in a low blight year, an average of 4.2 sprays containing 3.4 kg/ha of copper are used [2]. In a year with high pressure, 9.9 sprays are needed with a copper content of 8 kg/ha.*

** The total copper use in 2000 in organic potatoes in F, D, CH and U.K. varied between .2 and 15 kg/ha [1].*

… and use is restricted or banned

Earlier European efforts:
improvements… but still not enough

- **High value of cultivar resistance**…
  - … but
    - > often too short-lived relative to commercial life of successful cultivars
    - > only one of the breeding goals (and usually not the main one)
- **Not much to be gained from agronomic practices besides sanitation**…
- **Some promising alternatives to copper** …
  - … but development yet to be made

CO – FREE

- **a modular, integrated project**

- **towards copper-free production systems**
  - testing
  - designing

- **Big differences with Blight MOP/ REPCO**
  - three pathosystems together
  - multicriteria assessment of socio/economic impact

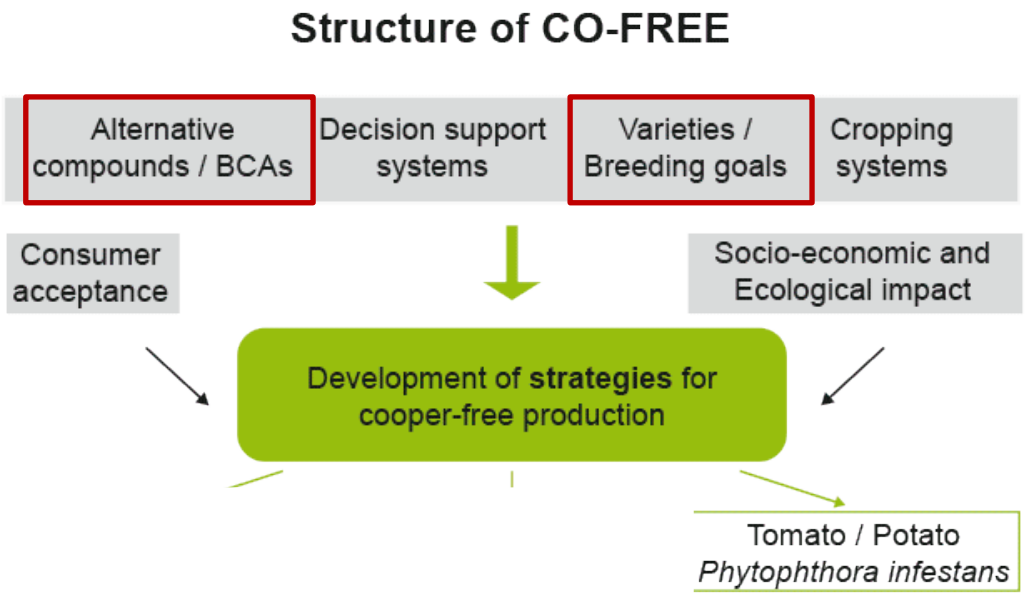
CO – FREE

- funded under

SEVENTH FRAMEWORK PROGRAMME

- started Jan.2012

- so only a first glance at early results



Testing alternative products

The French trials (Ploudaniel)

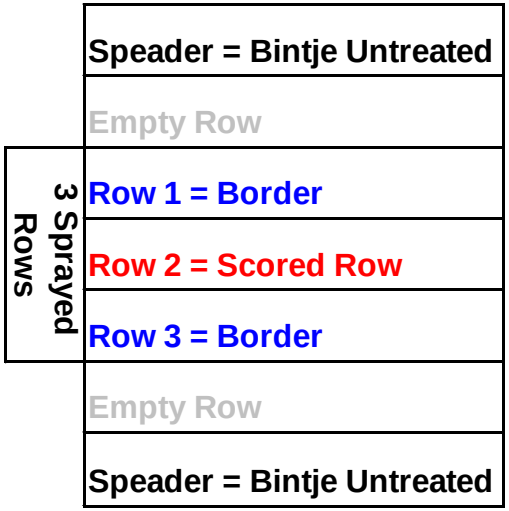
- One cultivar: Bintje (high late blight susceptibility)

- One product tested (SW); three conditions :
  -SW1 = 2%, SW2 = 5% and NT = Untreated

- Experimental design :

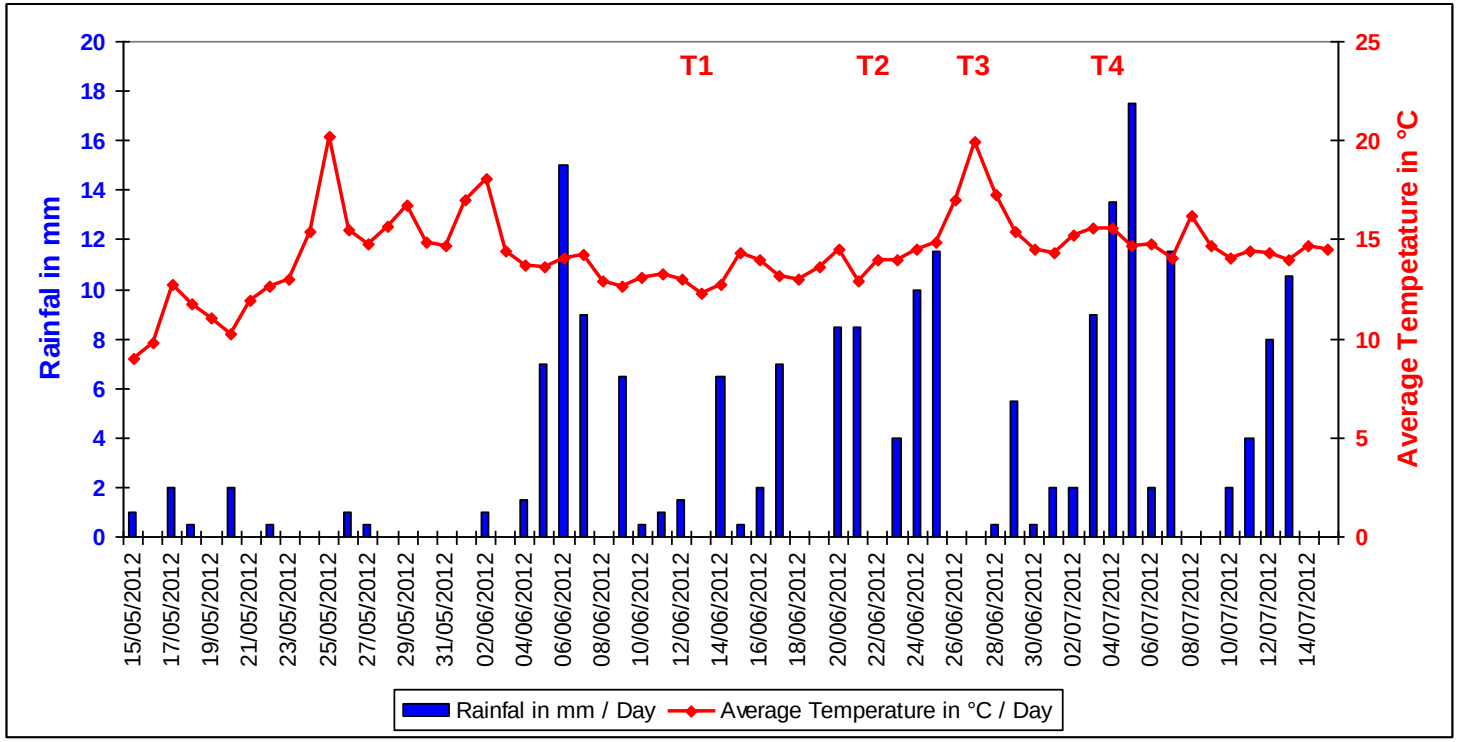
  - elementary plots : 3 rows of 15 plants
  - 0.70 m between rows
  - 0.32 m between plants

- Date of planting : 15/05/2012



The French trials (Ploudaniel):

Climatic data

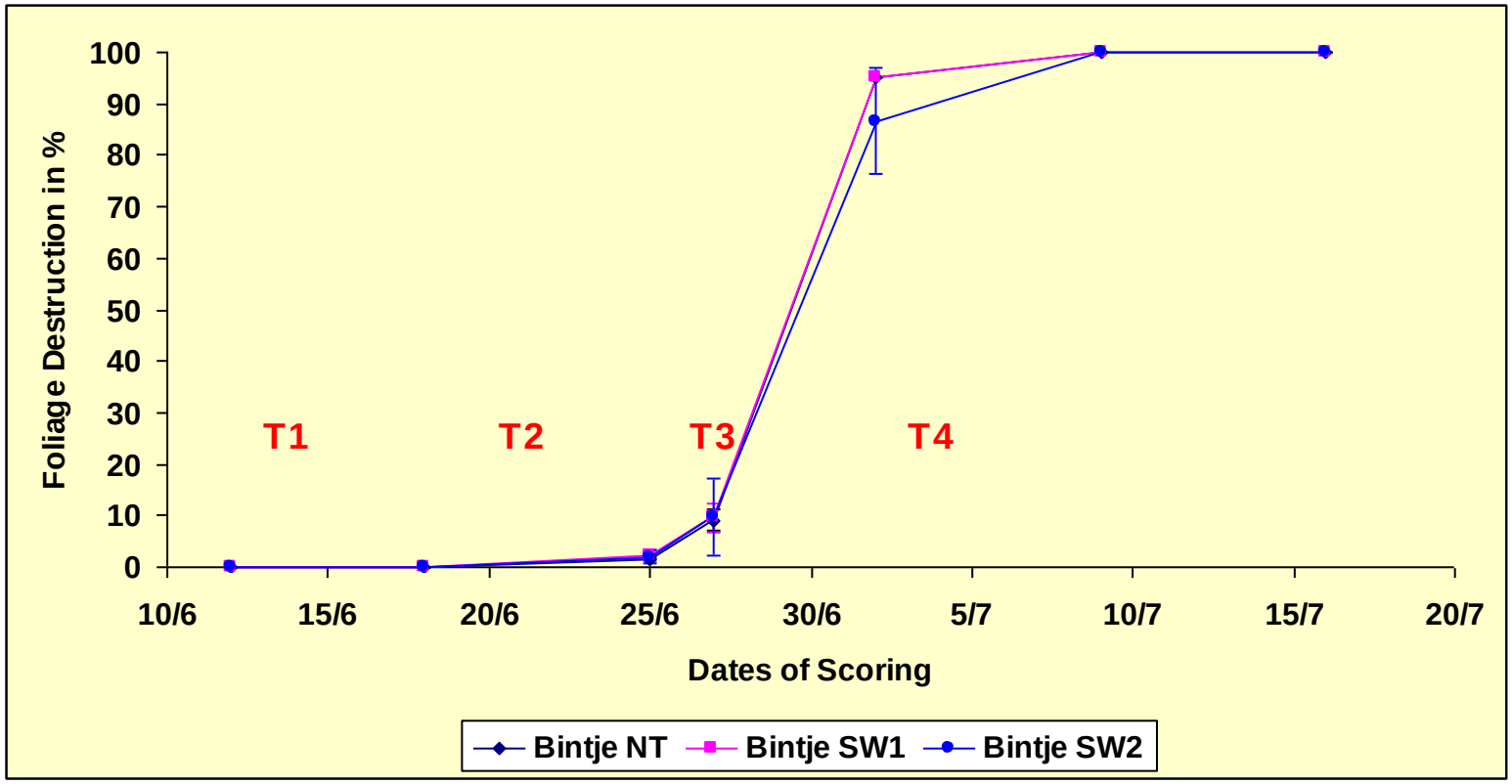


Date of emergence : from 31st of May to 4th of June

An important rainfall period in June (108 mm) and from the first to the 15th July (82 mm)

The French trials (Ploudaniel):

Disease progress



T1 to T4 : Product spraying dates

The French trials (Ploudaniel):

Disease severity

Untreated plot

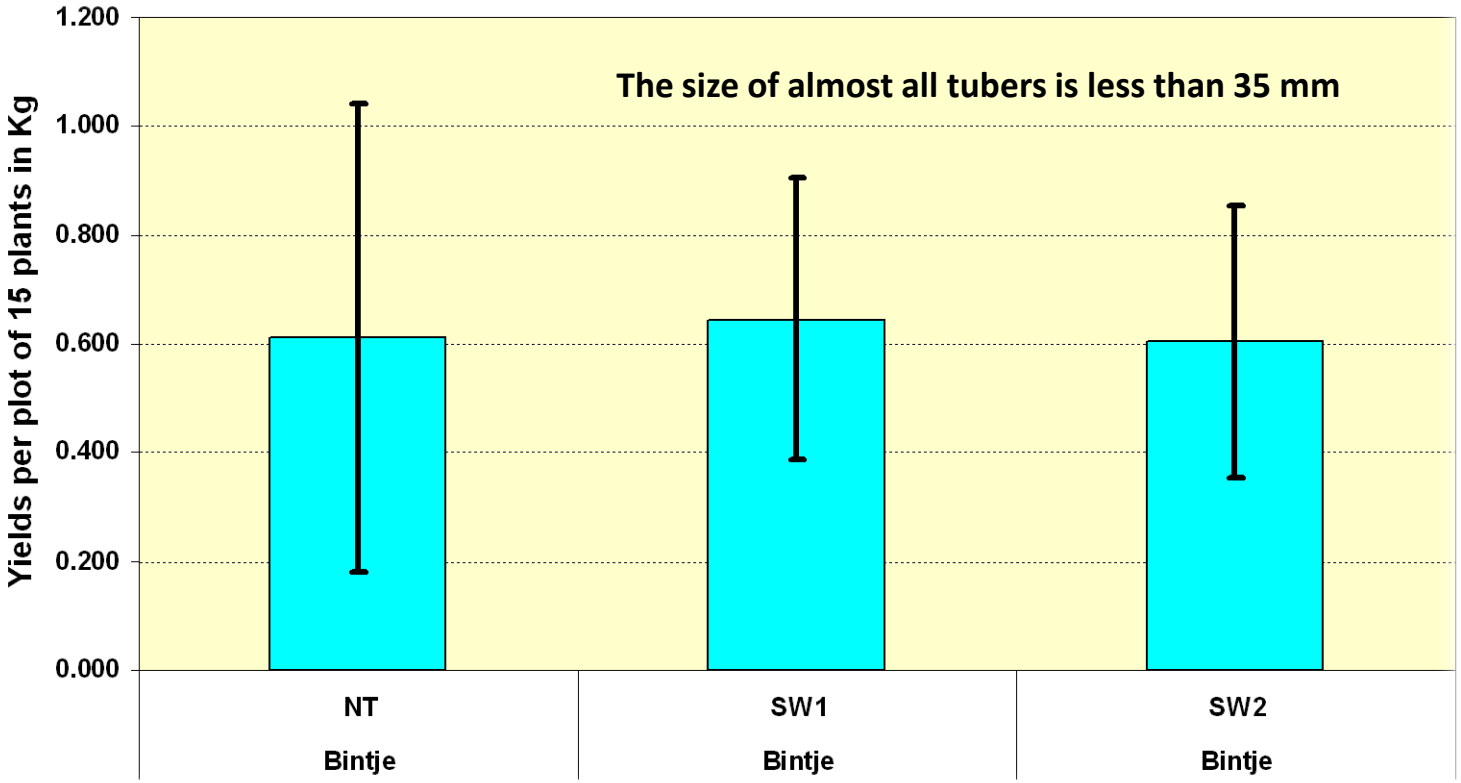
Plot treated 2%

Plot treated 5%

27 June 2012

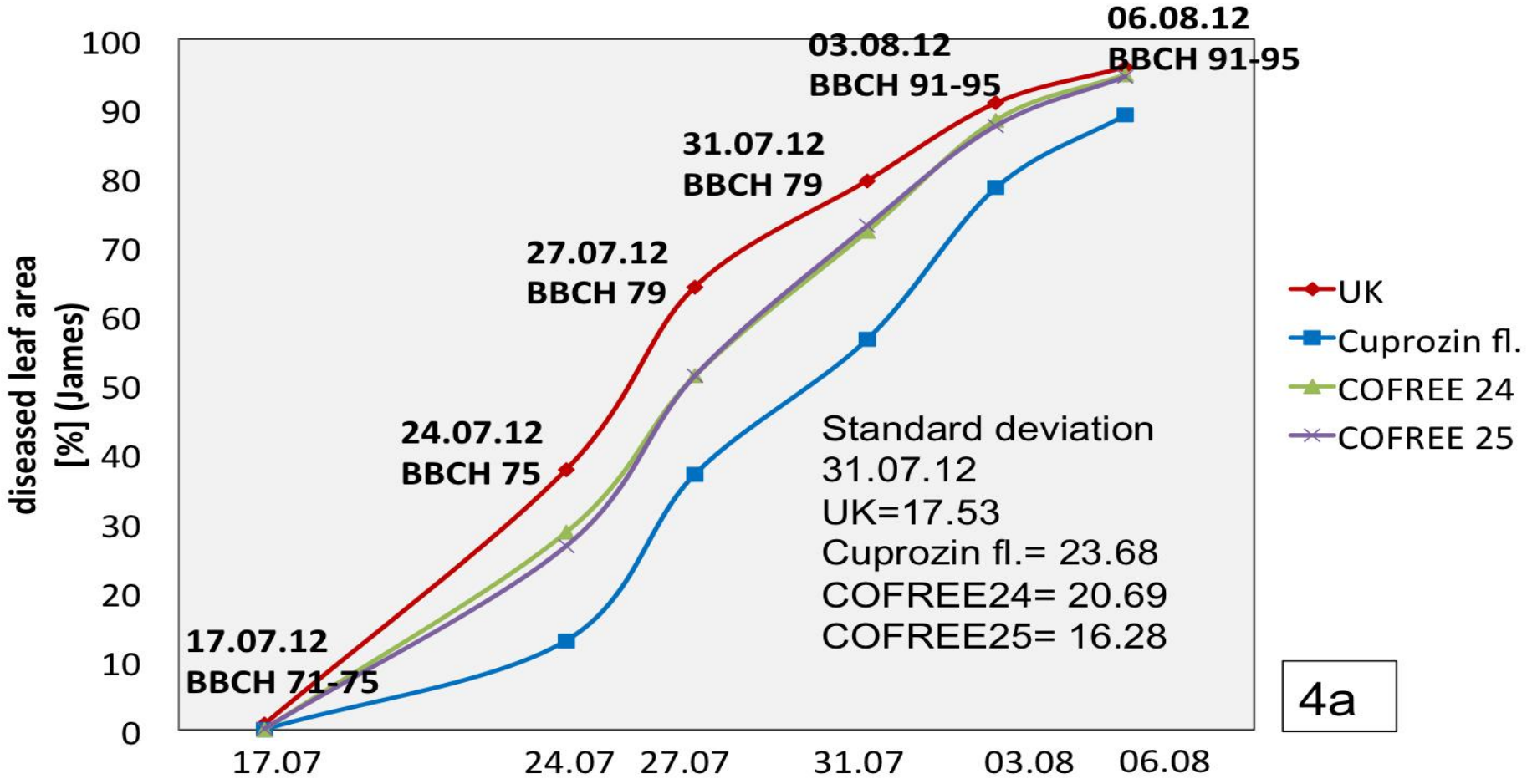
2 July 2012

The French trials (Ploudaniel):
Yield data



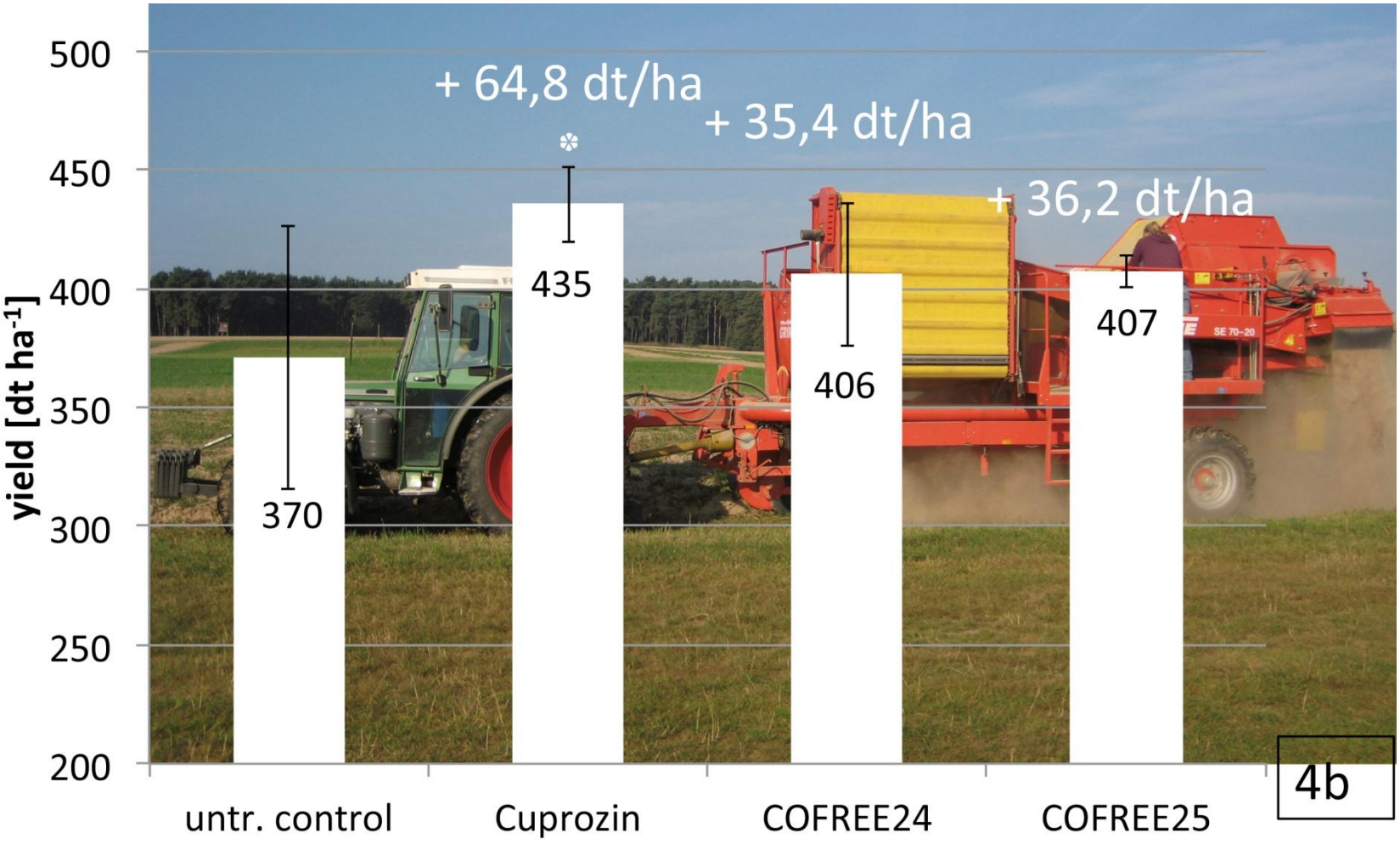
The German trials (Kleinmachnow):

Disease progress



The German trials

Yield data



Designing ideotypes

Ideotypes

- **Ideal combination of traits to associate within a cultivar**

- **Depends upon**
  - **Production objectives**
  - **Production situations**
    - Input use
    - Climatic zones
    - Pathogen complexes

Ideotypes for organic potatoes?

- **Several attempts already**
  - > Germany (K. Möller): focus on N use
  - > Netherlands (E. Lammerts et al.) : focus on taste + yield +..
  - > France (D. Ellissèche et al.): focus on LB
- **In all cases, construction method = experts' word**
- **Questions:**
  - ➢ How generic?
  - ➢ How robust?

What we'll do in Co-Free

- **Design 'copper free 'ideotypes for contrasted conditions** from
  - Earlier work
  - Own questionnaire
    - > priority ranking

- **Identify 'close matches' within current catalogues**

- **Test these comparatively in the field under optimal/non optimal conditions**

> results in 2015/2016!

Thanks for your attention!