

Multilocal field trials to evaluate alternative products to reduce or remove copper applications to control potato late blight in organic production systems

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Research objective

To test some alternatives to massive copper utilization in order to control potato late blight (*Phytophthora infestans* (Mont.) de Bary) in organic systems

We try to respond to the European regulation (regulation 2091/92) that limit the doses to 6 kg of copper metal per ha and per year from January 2006



Blight damage on field trial plot



Research methodology

- ◆ Step 1: Identification of potential alternatives
- ◆ Step 2: Screening of candidates products and additives under controlled conditions
- ◆ Step 3: Field trials



Step 1: Product tested

◆ List of products tested in the laboratory

■ Controls:

- Bordeaux mixture as reference (3kg/ha)
- Distilled water as negative control

■ Fungicides:

- Microsulfo: sulfur based product (1,5kg/ha)
- PK2: potassium phosphite (2L/ha)
- Ecoclearprox: Hydrogen peroxyde stabilised with organic molecule (3L/ha)
- Solucuvivre: copper tallate of 5% copper (2L/ha)
- Glutex CU90: 10% copper (4L/ha)
- Zonix: Rhamnolipids (0,5L/ha)
- Allicine: garlic extracts (75ml/ha)



Step 1: Product tested (2)

- ◆ List of products tested in the laboratory:
 - Helicitors of plant defense mechanism (HPDM)
 - Ilsamin: Mixture of amino-acids (4L/ha)
 - Milsana: Plant extracts (1,5L/ha)
 - Optiplant: Plant extracts and homeopathy (1,5L/ha)
 - Additives:
 - Splinter with Bordeaux mixture: short amino-acids chain aiming to have an effect on rainfastness (0,65L/ha)
 - Kendal with PK2 as HPDM: mixture of N and K₂O (3L/ha)
 - Siliforce with PK2 as HPDM: mechanic protection by silicic acid (0,3L/ha)



Step 2: Laboratory trials

◆ Methodology

- Production of healthy material (Bintje)
- Application of product with aerograph:
 - 1 time for fungicide
 - 4 times for HPDM during plant growing phase
- Rainfastness test: 2 days after fungicide application
- Inoculation of late blight on detached leaves: 4 days after last product application with a 5×10^4 spo/ml suspension
- Observation of symptoms development



Step 2: Laboratory trials (2)

- ◆ Results summary:
 - **Produits as effective as Bordeaux Mixture**
 - PK2 (even better)
 - Solucivire
 - Glutex CU90
 - **Interesting additives**
 - None
 - **Unexpected effects**
 - Zonix: better efficacy after artificial rain
 - Milsana: as effective as bordeaux mixture after rainfastness test



Step 3: Field trials

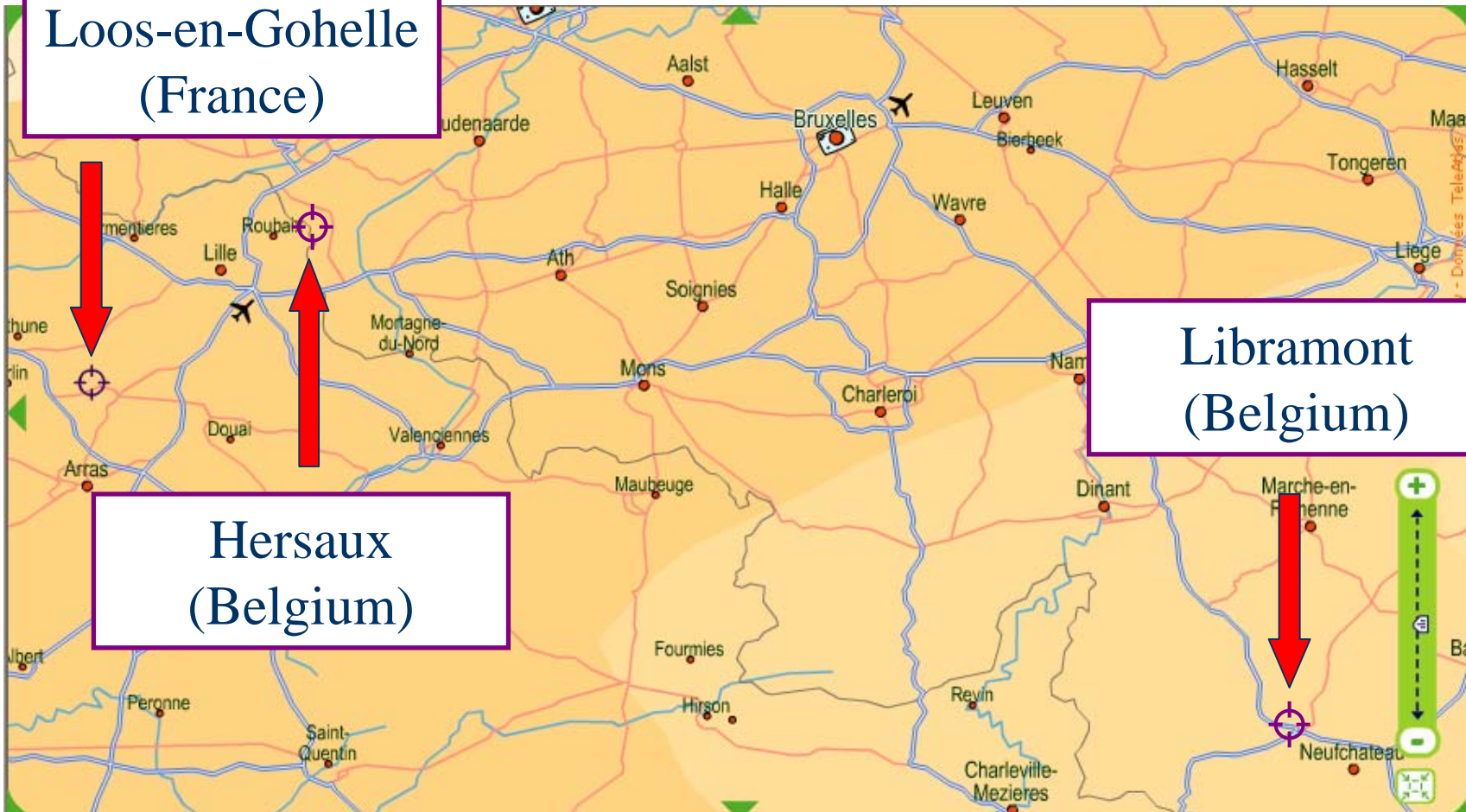
◆ Trials location

100 km

Loos-en-Gohelle
(France)

Libramont
(Belgium)

Hersaux
(Belgium)



Step 3: Field trials (2)

- ◆ Experimental schemes :
 - Four blocks - fully randomised
 - 60 plants/replication
 - Cultivar Ditta (Belgium) and Juliette (France)
 - Infecting rows planted with cultivar Bintje
 - Natural infection (excepted for Libramont)
- ◆ Crop management:
 - Crops were managed in accordance with organic farming rules



Step 3: Field trials (3)

- ◆ Products application:
 - Application in accordance to local late blight DSS
 - Total amount of metal Cu applied can't exceed 6kg/ha
- ◆ Modalities tested:
 - Untreated, in 1 site
 - Bordeaux mixture as reference (3kg/ha), in the 3 sites
 - Ecoclearprox + Bordeaux mixture, in 2 sites
 - Splinter + Bordeaux mixture, in 2 sites
 - PK2, in the 3 sites
 - Solucuvivre, in 2 sites
 - PK2+Solucuvivre, in the 3 sites
 - Glutex CU90, in the 3 sites
 - Zonix ,in 1 site

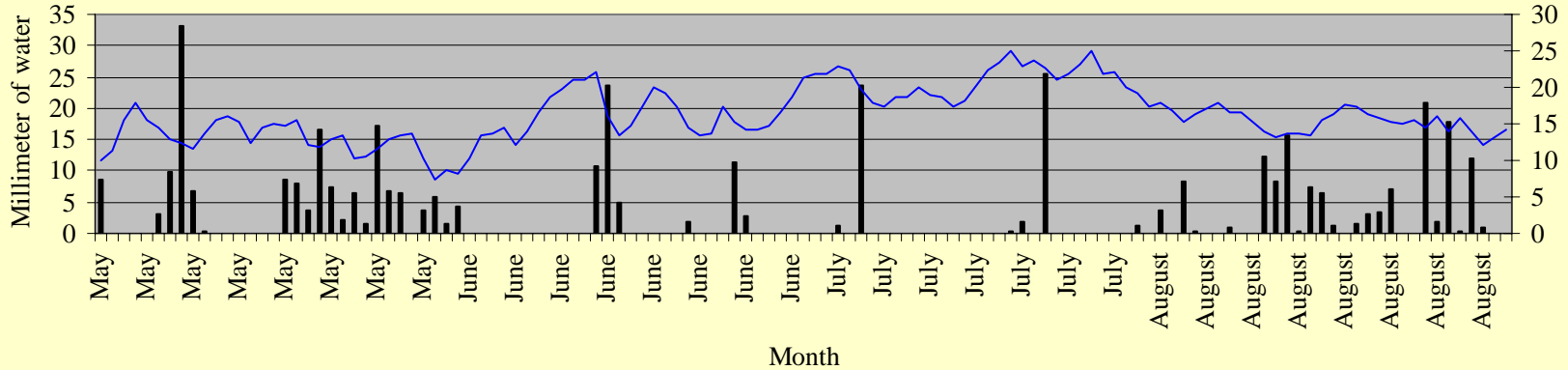


Step 3: Field trials (4)

- ◆ Field observations:
 - Evaluation of foliage destruction percentage
 - Libramont: USAID scale (from 0 to 100)
 - Herseaux: Wageningen scale (from 10 to 0)
 - Loos-en-Gohelle: French scale (from 0 to 100)
- ◆ 2006 Climatic conditions:
 - The weather led to high risk of late blight development in May and August and to low risk in June, July and September

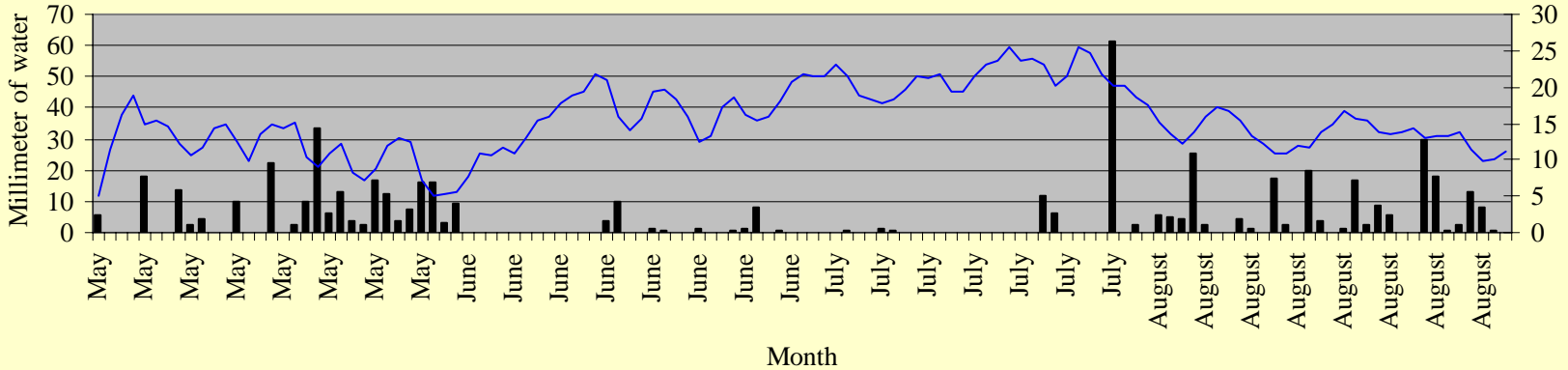


Pluviometry and mean temperature of Esplechin



Climatic conditions of Loos-en-Gohelle and Hersaux

Pluviometry and mean temperature of Libramont



Climatic conditions of Libramont

Step 3: Field trials (5)



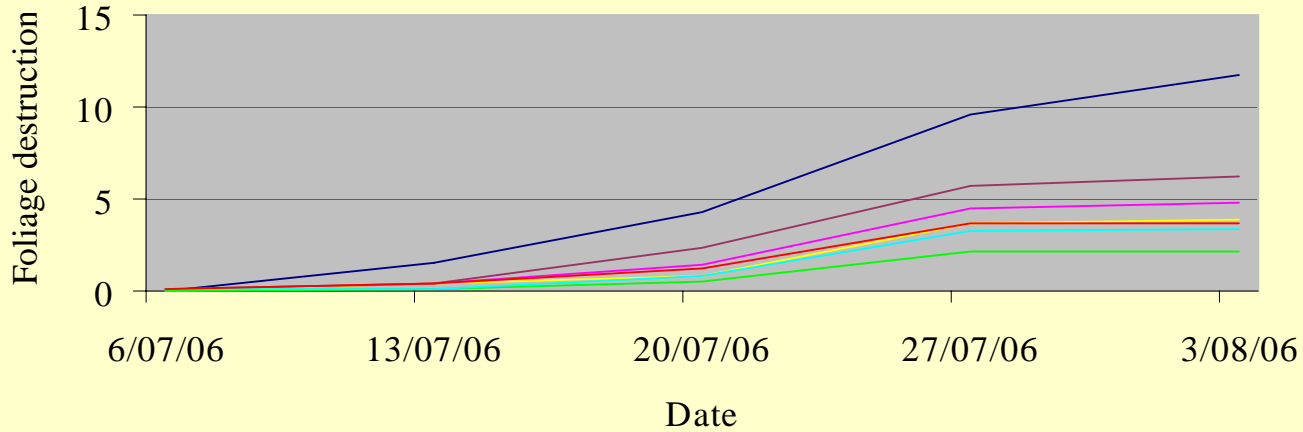
Libramont Site during inoculation



Step 3: Field trials (6)

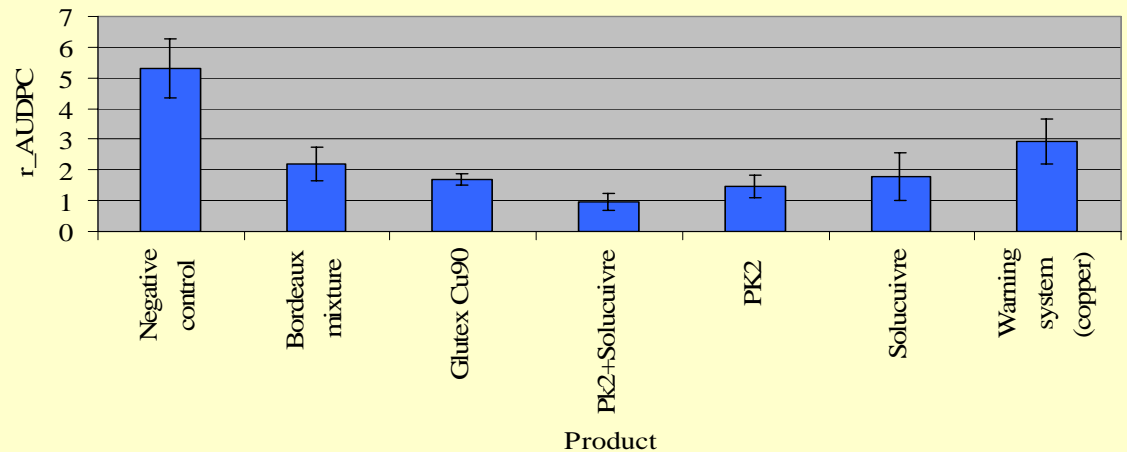
Results from Loos-en-Gohelle (Fr)

Foliage late blight evolution (Loos-en-Gohelle)



- Negative control
- Bordeaux mixture
- Glutex CU90
- PK2+Solucivire
- Warning system (copper)
- PK2
- Solucivire

All season analyse: Loos-en-Gohelle

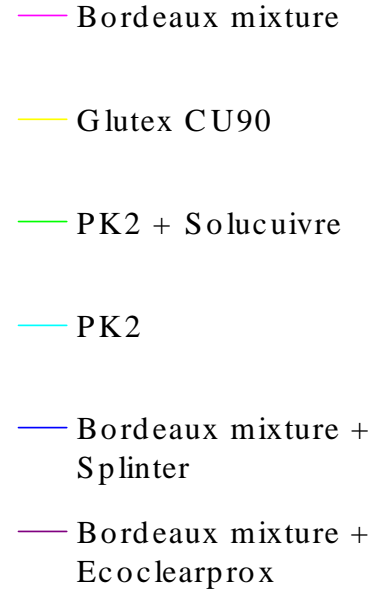
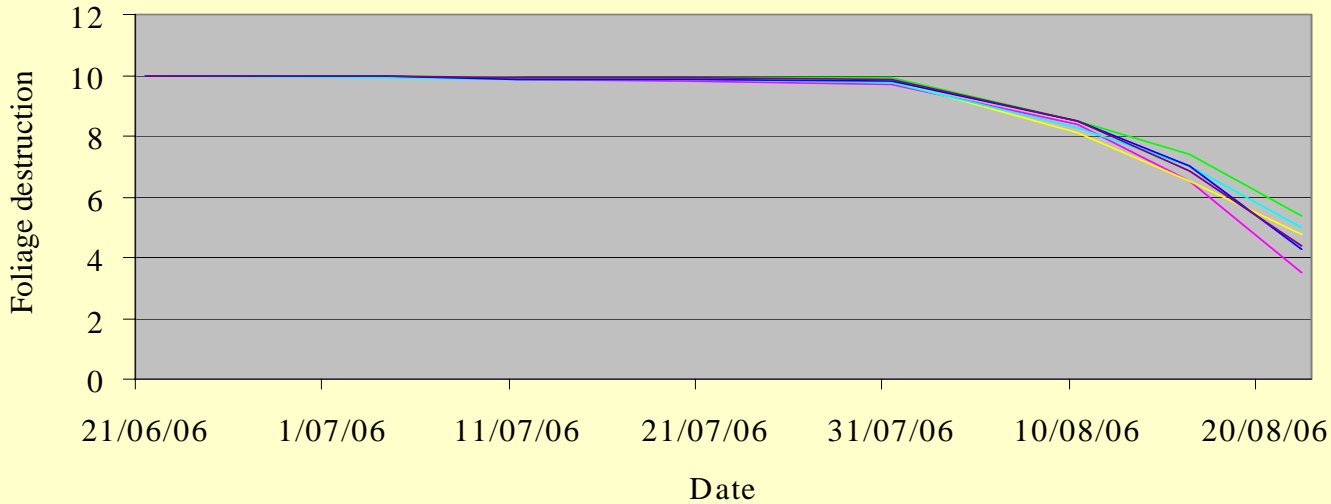


All products better than negative control

Step 3: Field trials (7)

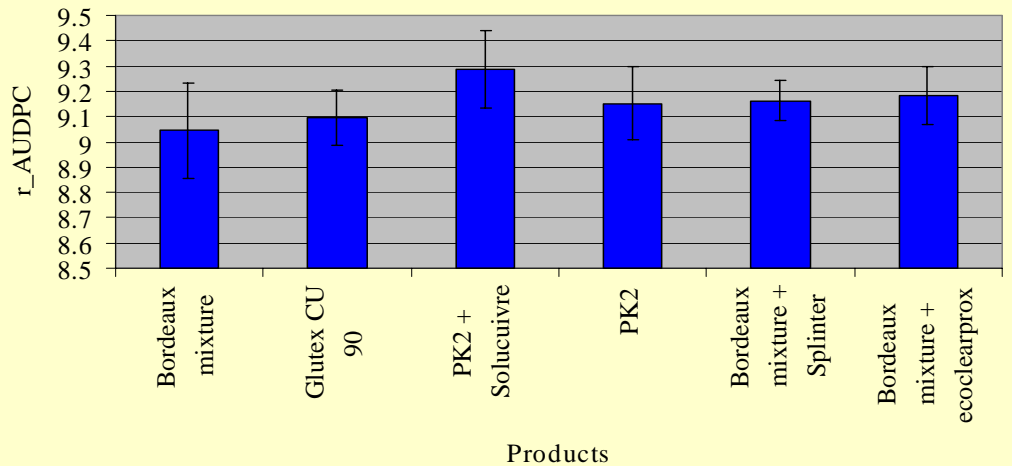
Results: Herseaux (B)

Foliage late blight evolution (Hersaux)



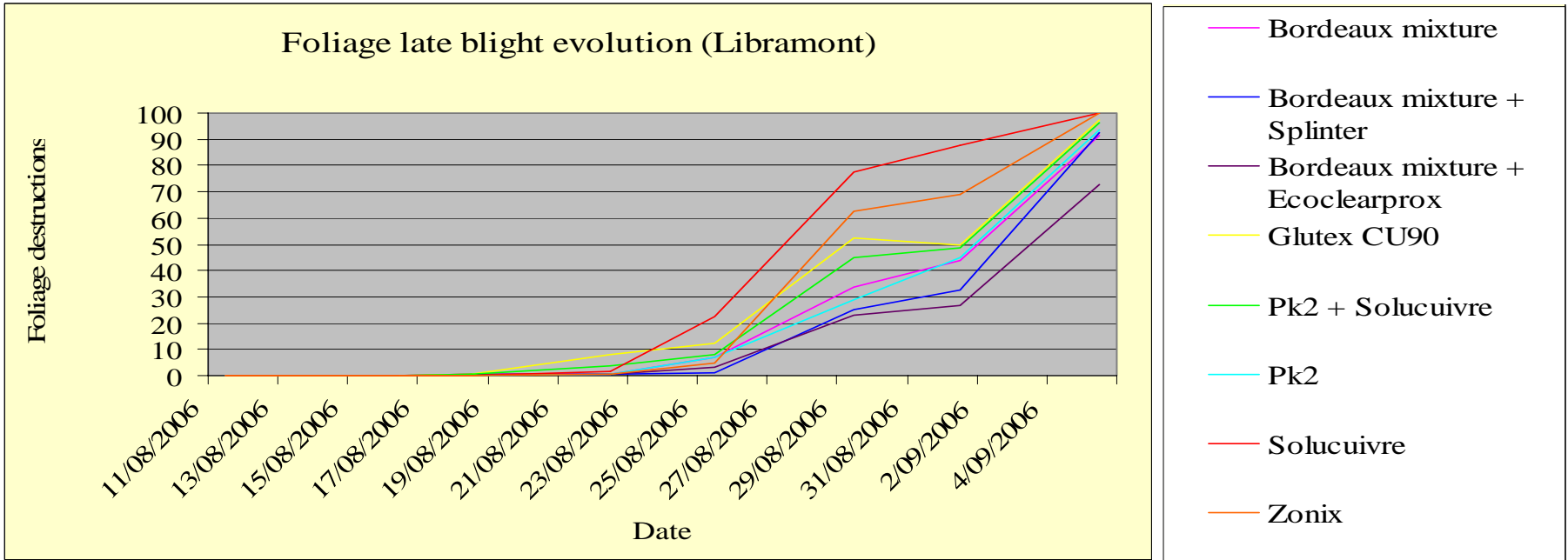
No significant difference between treatments

All season analyse (Hersaux)

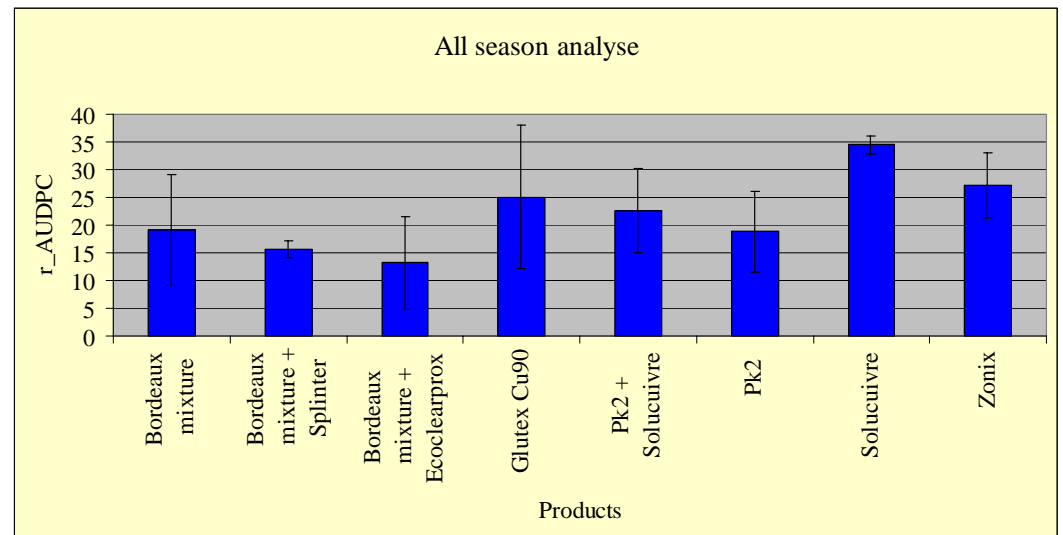


Step 3: Field trials (6)

Libramont (B)



Solucivire alone less effective than compositions with Bordeaux mixture and PK2



Conclusions

- ◆ Particular climatic conditions with very high late blight pressure on the trials.
- ◆ Low performances of the additives (Ecoclearprox and Splinter). This confirms laboratory trials.
- ◆ Solucivire was effective in Loos-en-Gohelle trials but not in Libramont.
- ◆ Good performances of PK2 even alone. Is it really « organic »?
- ◆ Interesting results of Zonix → copperless product.



Thanks for your attention !



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