Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

www.efbs.admin.ch
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Eidgenössische Fachkommission für biologische Sicherheit EFBS
Commission fédérale d'experts pour la sécurité biologique CFSB
Commissione federale per la sicurezza biologica CFSB
Cumissiun federala per la segirezza biologica CFSB
Swiss Expert Committee for Biosafety SECB

GM crops, antibiotics and pesticides: good or evil and for whom?

A case study with apple and fire blight

Michele Gusberti[1], Monika Maurhofer Bringolf[1,2], Urs Klemm[2], Matthias S. Meier[2], Isabel Hunger-Glaser[2]

[1] Institute of Integrative Biology Zurich, Plant Pathology Group, Swiss Federal Institute of Technology, CH-8092 Zürich, Switzerland;

[2]Swiss Expert Committee for Biosafety, CH-3003 Bern, Switzerland.

Fire blight (FB), caused by *Erwinia amylovora*, is probably the most destructive bacterial disease in apple and pear orchards worldwide. In Switzerland, the first observation of this pathogen dates 1989 on *Cotoneaster* sp. After this first observation, the disease spread to most of the north and central Swiss apple producing regions, reaching the peak in 2007. Due to the highly destructive nature of this pathogen, quarantine and eradication measures were promptly adopted. In 2008 the Federal Office for Agriculture permitted the use of streptomycin in pear and apple orchards to control the FB disease and in 2009 the Swiss Expert Committee for Biosafety (SECB) initiated a monitoring project for the period of 3 years to assess the evolution of antibiotic resistance upon streptomycin application. Besides streptomycin also other control measures (biocontrol agents and phytosanitary products) are used against this bacterial disease depending on the cultural praxis (Organic or IP production) adopted in the orchard. Another important control strategy would be the production of resistant cultivars (through classical breeding or genetic engineering).

Project aim: Semi-quantitative risk assessment based on expert judgments for different fire blight control strategies within the frame of most commonly used cultural practices (IP and organic) in Swiss apple orchards with respect to environment, economy and health based on defined protection goals. The outcome of the project will allow the comparison of different control strategies for advantages and disadvantages and provide the basis for an EFBS recommendation regarding biosafety of fire blight control.

Fire blight symptoms on pear tree.

FIRE BLIGHT CONTROL STRATEGIES

Chemical and biological control

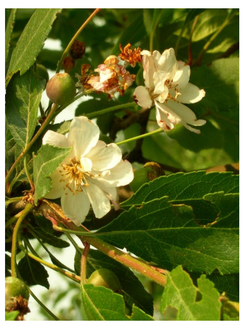
Organic production

- **Copper compounds**

Integrated production

- **AG-Streptomycin, Firewall 17** (streptomycin sulphate)
- **Blossom Protect** (*A. pullulans*)
- **Myco-sin** (aluminium sulphate)
- **LMA** (potassium aluminium sulphate; not approved in organic agriculture yet, but approval likely)

Breeding for FB-resistant cultivars



Classical breeding approach

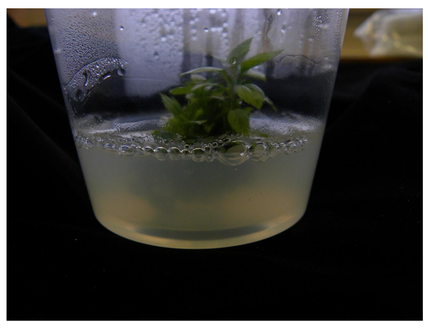
- **Conventional breeding**

1 R gene 2 R genes

Early flowering approach

- **Early flowering**

1 R gene 2 R genes



Genetic engineering approach

- **Cisgenesis**

1 R gene 2 R genes

PROTECTION GOALS

- **Durability of FB-control strategies**
  (resistant strains, virulent strains)
- **FB-free agricultural crops and environment**
  (feasibility and efficacy of the methods)
- **Preservation of cultivar diversity and diversity of cultural practices**
  (impact of the method, short and long term expectations)
- **Marketable products**
  (consumer acceptance, way of production, economic interest)
- **Protection of workers and consumers**
  (side effects: antibiotic resistance, allergy and contaminated products e.g. honey)
- **Protection of the environment**
  (terrestrial, soil, water, and biodiversity)

STUDY

For each FB-control strategy and each individual protection goal:

Data collection

- **Literature researches**
- **Interview with experts**

Data evaluation

- **Semi-quantitative risk assessment**
  (scale: 0= no risk, 1= low, 2=medium and 3=high risk)

EXPECTED OUTCOME

FB-control strategies

Protection goals	X	Y	W	Z
A	0	1	2	0
B	1	3	1	2
C	2	0	3	3
D	2	3	0	1

0 NO RISK 1 LOW RISK 2 MEDIUM RISK 3 HIGH RISK

TARGET AUDIENCE

- **Farmer and fruit associations**
- **Producers and consumers**
- **Politicians**
- **Federal offices**