



CONTAINER

FP6 Thematic Area 5:
Food Quality and Safety

Kim Boutilier

Ruud de Maagd

Strategic Objectives

- Development of stable, environmentally safe and commercially viable biological containment strategies in crops economically relevant for Europe
- Assessing the economic, environment and consumer impact of implementing biological containment strategies in Europe
- Enhancing understanding and acceptance by stakeholders and the general public

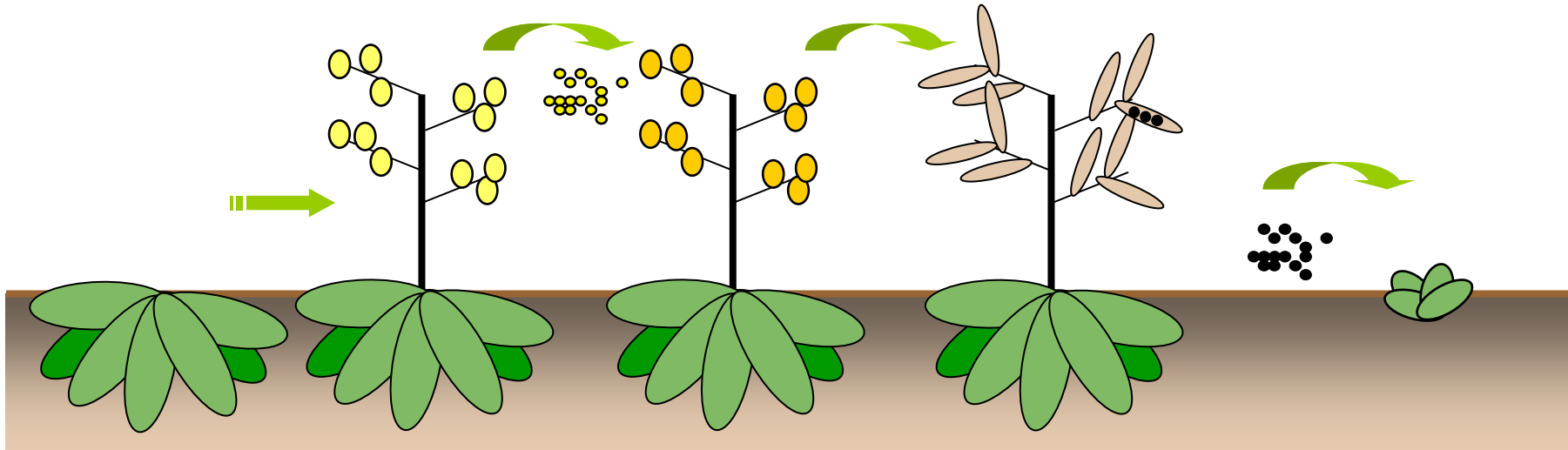
Targets for Biological Containment Systems

flowering

pollination

seed-set

germination

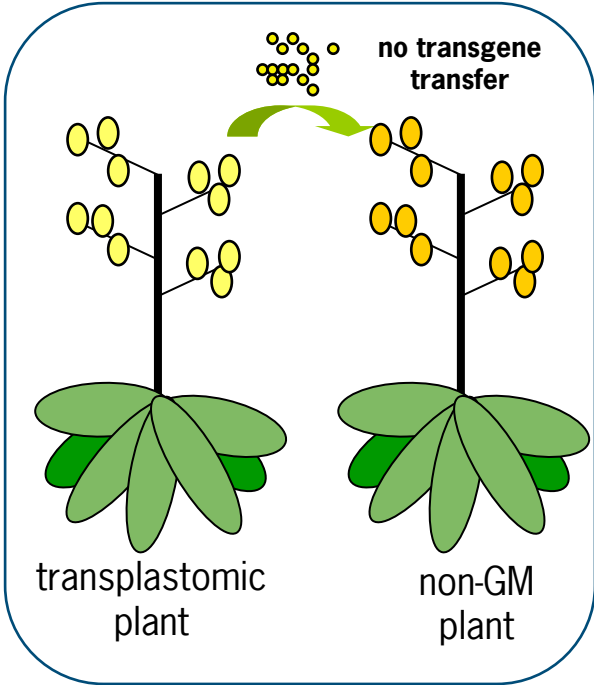
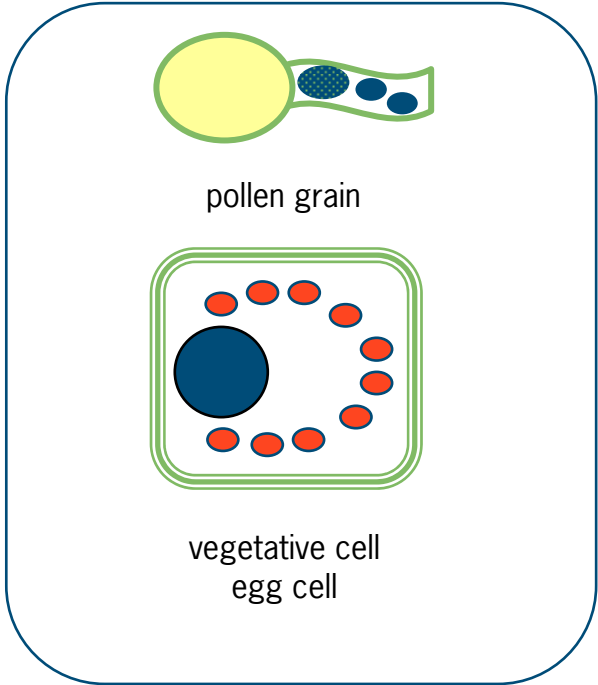


WP2: Chloroplast Transformation

Pollen of most species contain little or no plastids



Reduced transmission of plastid transgenes



WP2: Chloroplast Transformation



Sugarbeet

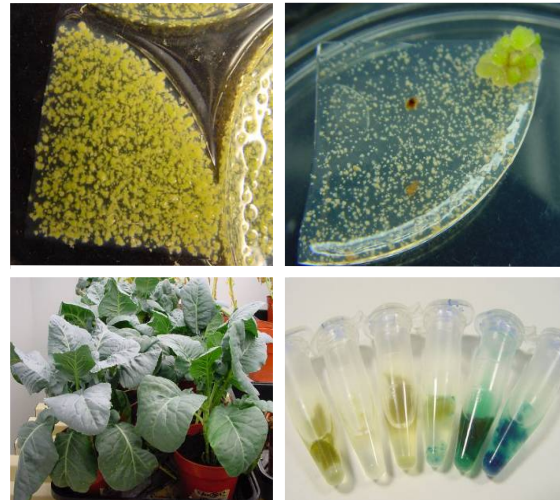
- Institute of Plant Genetics
(Sergio Arcioni)

Brassica napus

- National University of Ireland,
Maynooth
(Phil Dix)

APPROACH

- ▶ development of plastid transformation vectors
- ▶ optimize transformation and regeneration steps
- ▶ removal of selection marker



WP3: Controllable Flowering



Sugarbeet

- Plant Reserach International
(Ruud de Maagd)

TARGET CROPS

- ▶ harvested for their vegetative organs



Poplar & Birch

- SweTree Technologies
(Magnus Hertzberg)
- Swedish University of Agricultural Sciences
(Ove Nilsson)

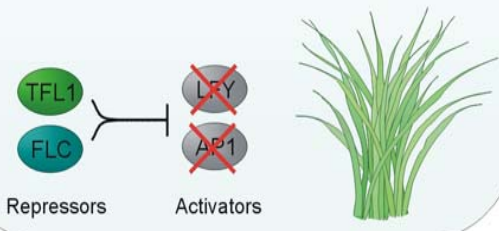


Fescue & Ryegrass

- DLF Trifolium
(Christian Sig Jensen)

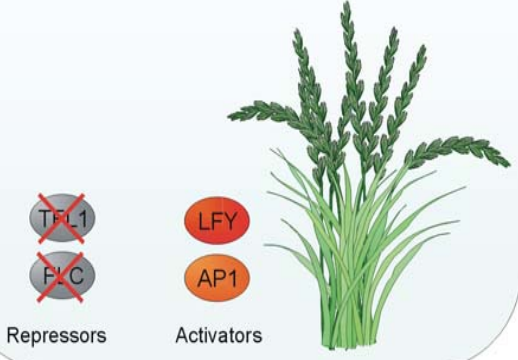
A. Vegetative growth in a wild-type plant

Floral repressors prevent precocious flowering repressing floral activators such as AP1 and LFY.



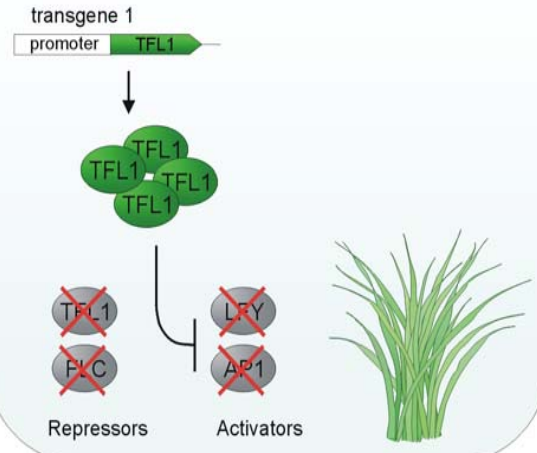
B. Flowering in a wild-type plant

Flowering starts when the floral repressors are switched off and the activators are switched on.



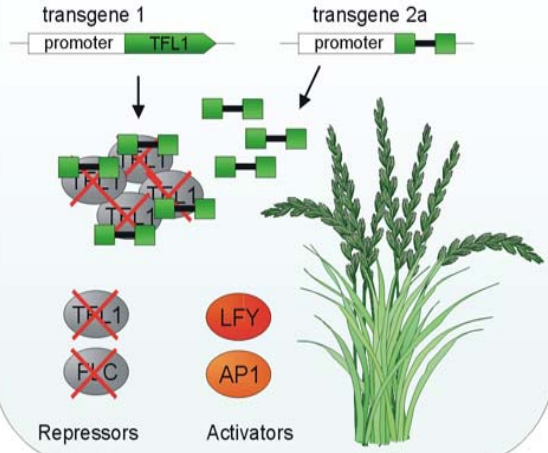
C. Floral control element 1: Repression

Overexpression of a floral repressor (TFL1) will suppress the floral activators



D. Floral control element 2: inducible TFL1-RNAi

Restoration of flowering by inducible expression a short fragment of TFL1 (RNAi/antisense) that degrades TFL1 mRNA



WP4: Controllable Fertility

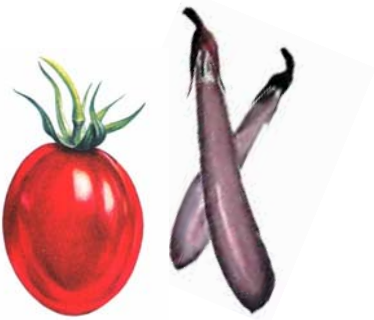


Brassica napus

- Plant Reserach International
(Kim Boutilier)
- University of Milan
(Martin Kater)

TARGET CROPS

- ▶ harvested for seed and/or fruit



Tomato & Eggplant

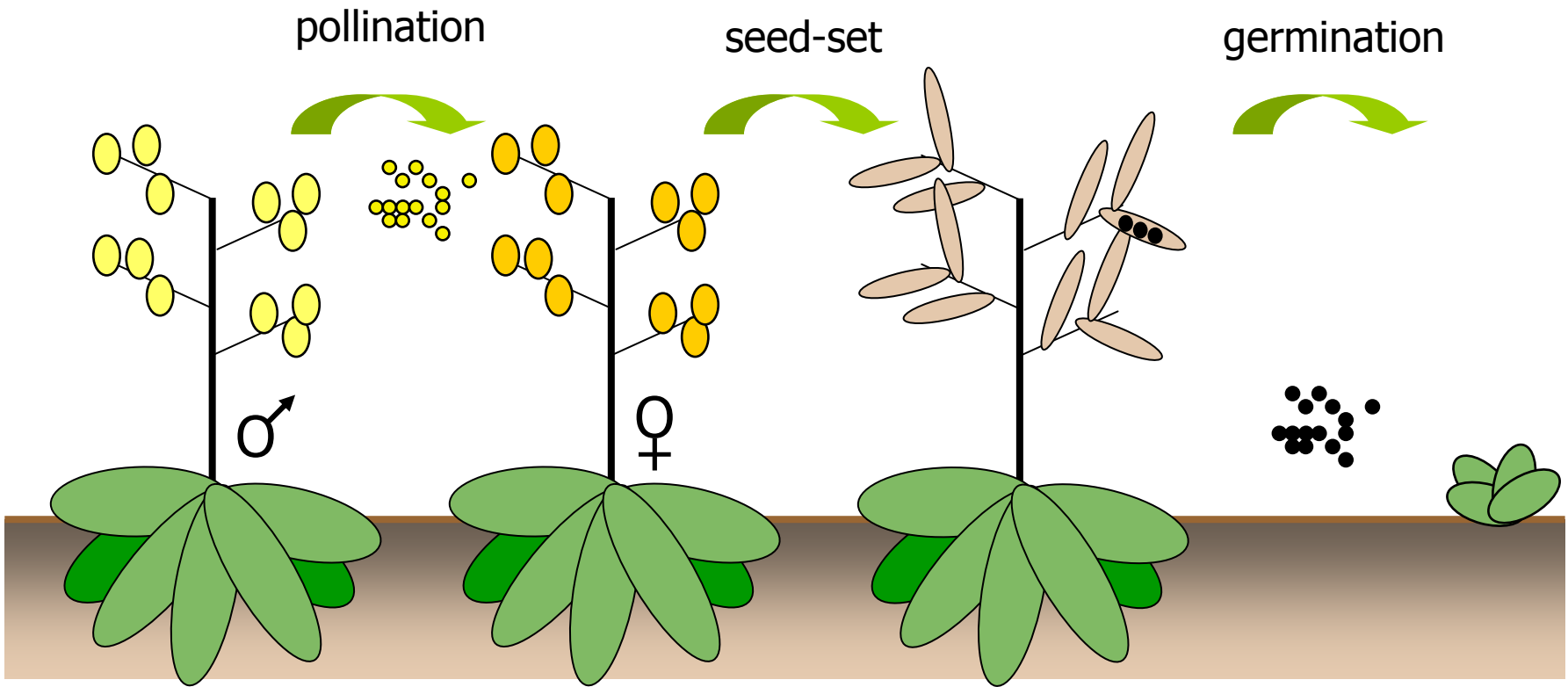
- University of Vienna
(Alisher Touraev)
- Research Institute for Vegetable Crops
(Giuseppe Rotino)



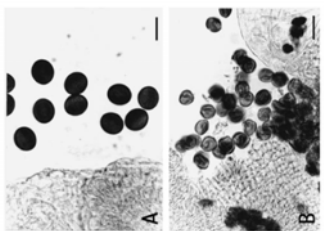
Fescue & Ryegrass

- DLF Trifolium
(Christian Jensen)

Controlling Transgene Spread through Pollen and Seed



male sterility

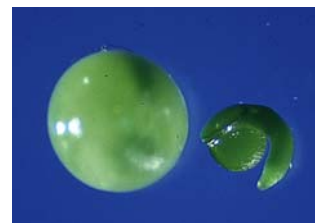


+

seed-less fruit



embryo block



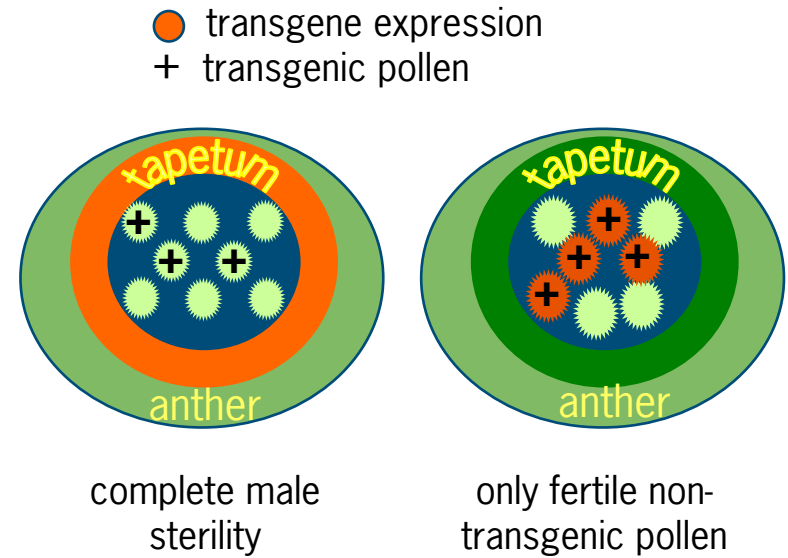
germination block



WP4: Controllable Fertility

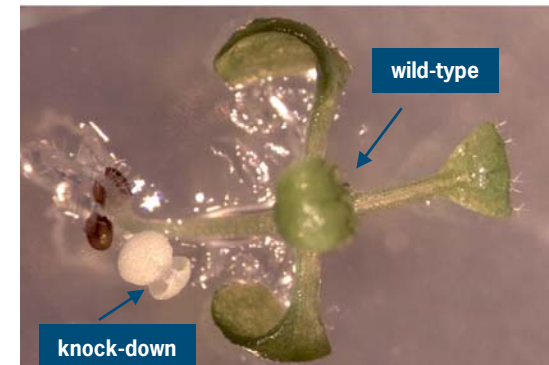
MALE STERILITY

- metabolic starvation
 - amino acid depletion (glutamine)
 - rescue in vitro/glutamine spray
- cell-lethal mutations
 - ↓ basal (TAF) transcription factors
 - rescue with inducible RNAi-insensitive gene
- pollen cell ablation
 - barnase x barstar



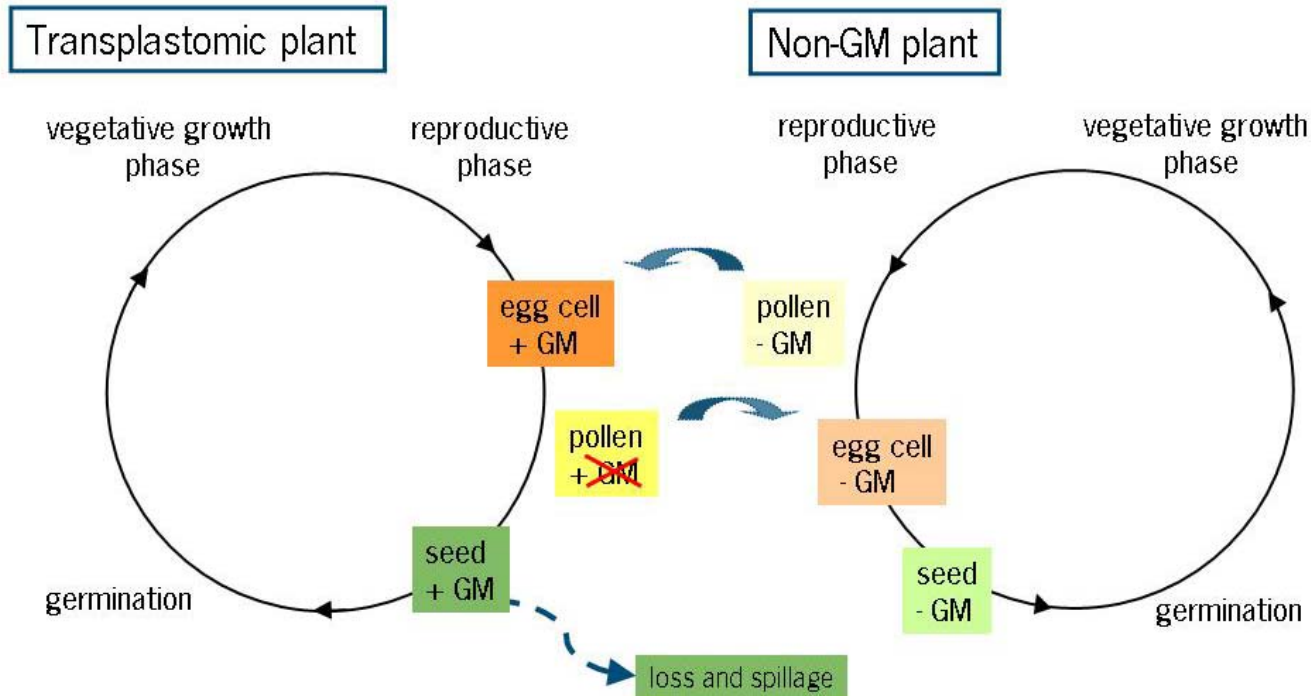
SEED LETHALITY

- seedling cell ablation
 - barnase
 - rescue with inducible barstar
- embryo development mutation
 - knock-down embryo-expressed MADS transcription factor
 - rescue with inducible RNAi-insensitive gene



WP5: Technology Assessment

- Environmental risk assessment
 - Efficiency of containment, unintended effects, sustainability
- Benefit for coexistence assessment
 - Effects of transgene containment on agricultural practices



WP5: Technology Assessment

■ Economic assessment

- Identifying potential benefits and costs of biological transgene containment implementation under different regulatory regimes and effect on GM plant adoption rates

Real Option Model

$$SIRB = \int_0^{\infty} SIRB_a(t) e^{-\mu t} dt$$

SIRB per year: partial equilibrium model for a small open economy

- Public communication
 - Website (www.transcontainer.org) and workshop reports
- Capturing the views of interested parties
 - Interviews with interested parties and production of a DVD (to be used as background material for workshops)
- Exchange of views between interested parties
 - Small workshops with legislators and industry, a larger final workshop with all stakeholders near the end of the project



website: www.transcontainer.org

contact: ruud.demaagd@wur.nl