

Sugar beet breeding

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Head of breeding DLF beet seed

Breeding – a joint venture

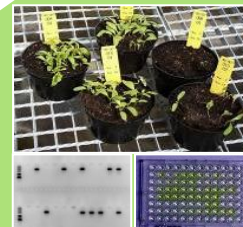
Grower



Needs ?
Problems?



Soil sample
Results



Analys of Rhizomania
and Aphanomyces

Sugar industri



Needs ?
Problems?

Problem in breeding ?
Visions ?



1975



1982



1997



Breeder

Breeding targets increase over time

- Agronomical traits
- Disease traits
- Agronomical traits
- Breeding traits

Sugar yield

- Virus yellows
- Aphanomyces
- Herbicide resistance
- Rhizoctonia
- Seed quality
- Nematode
- Cercospora
- Rhizomania
- Bolting resistance
- Monogermity
- Sterility system (CMS)
- Root yield
- Sugar content

1940s

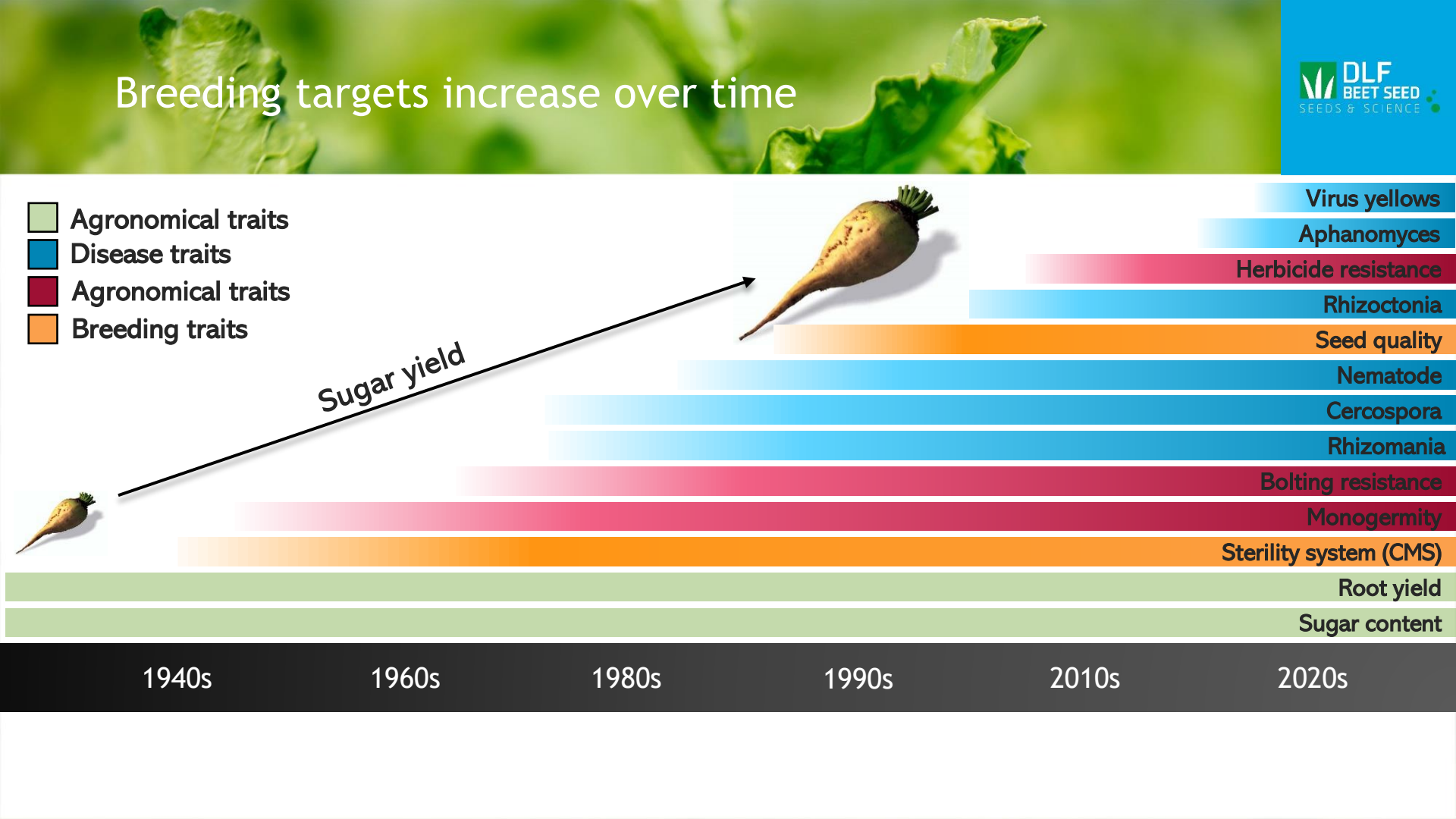
1960s

1980s

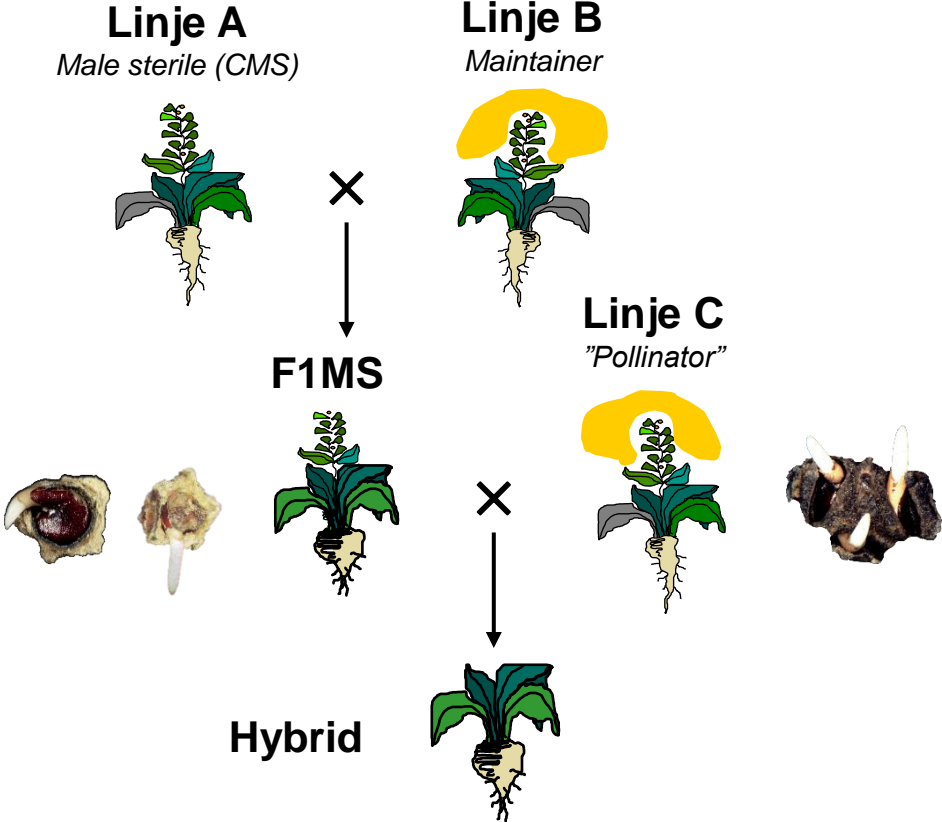
1990s

2010s

2020s



Sugar beet a hybrid crop



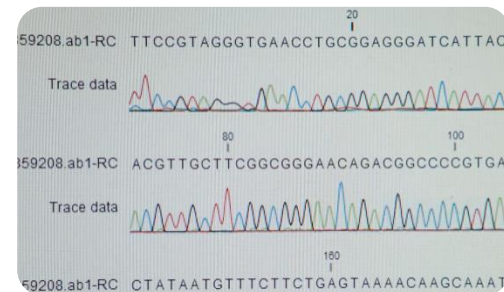
Biotech key pillow in sugar beet breeding



Marker assisted selection



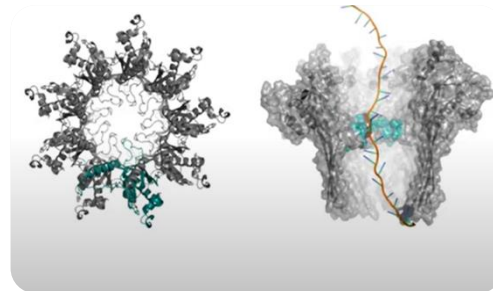
Genomic selection



Marker development

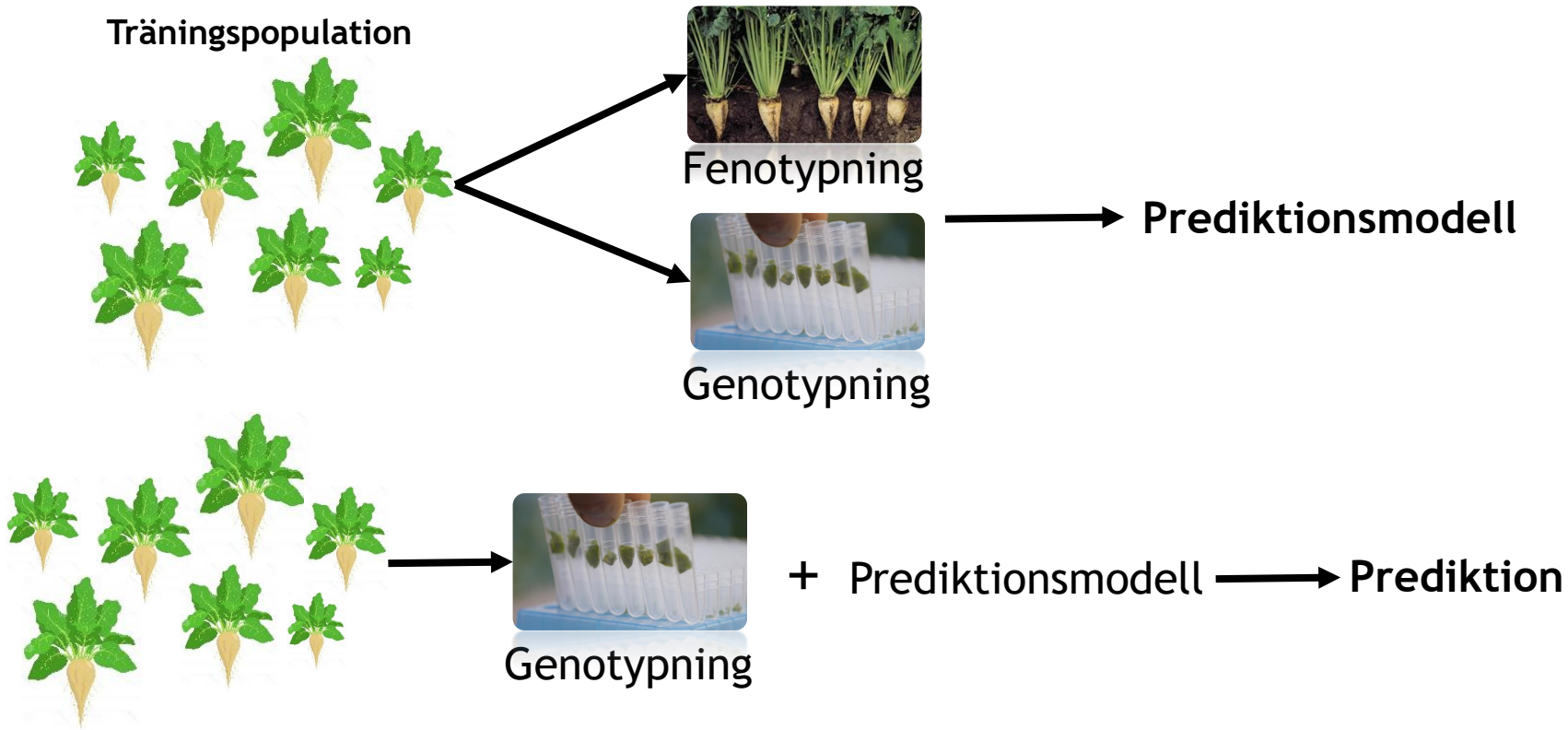


Genome editing

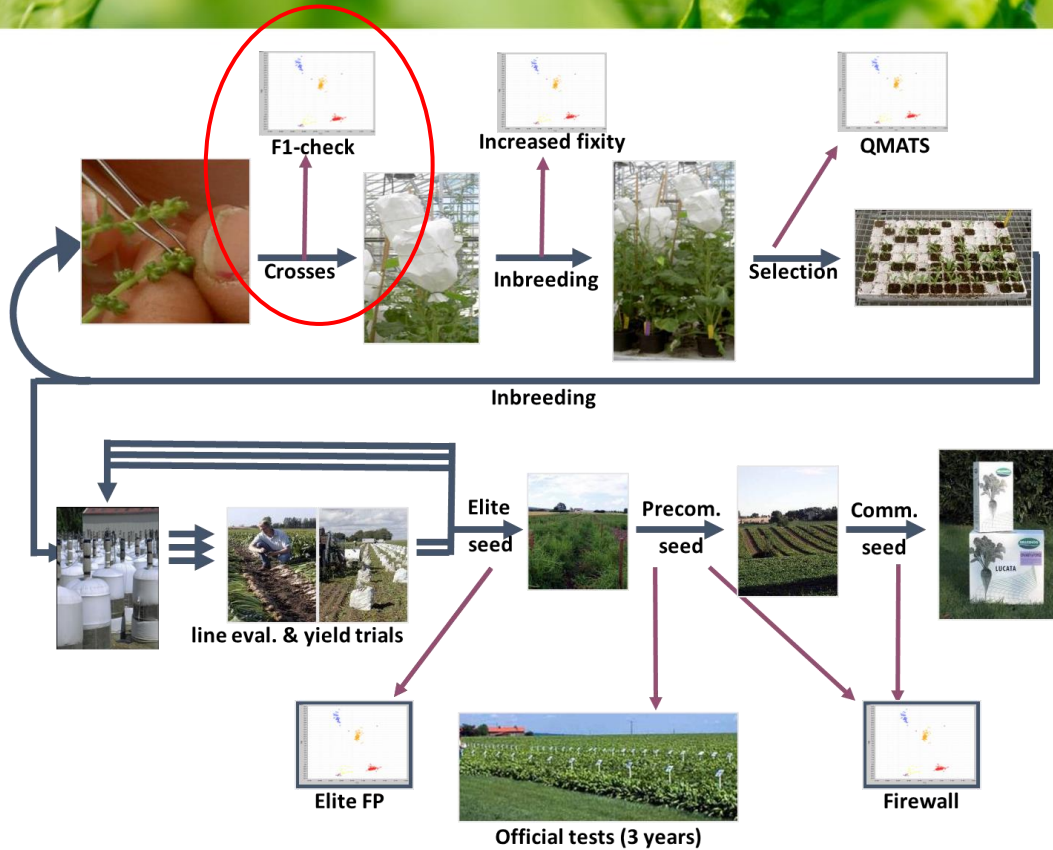


New technologies

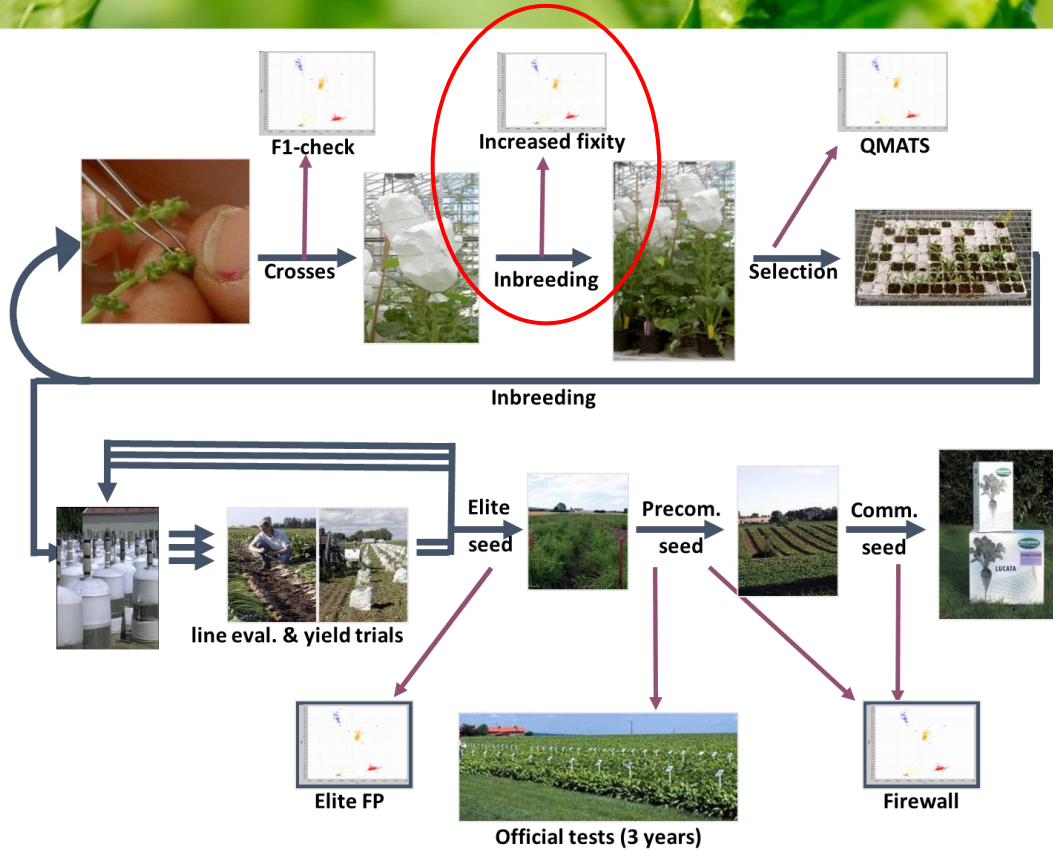
Genomic selection



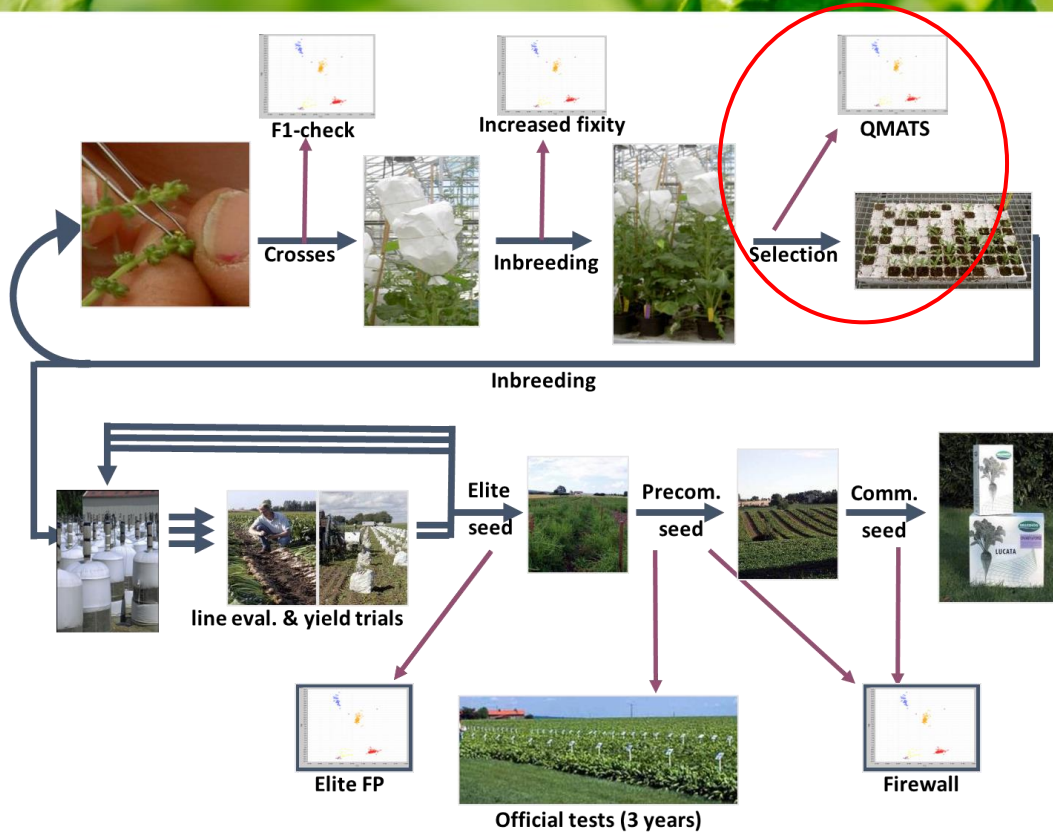
Molecular markers in breeding



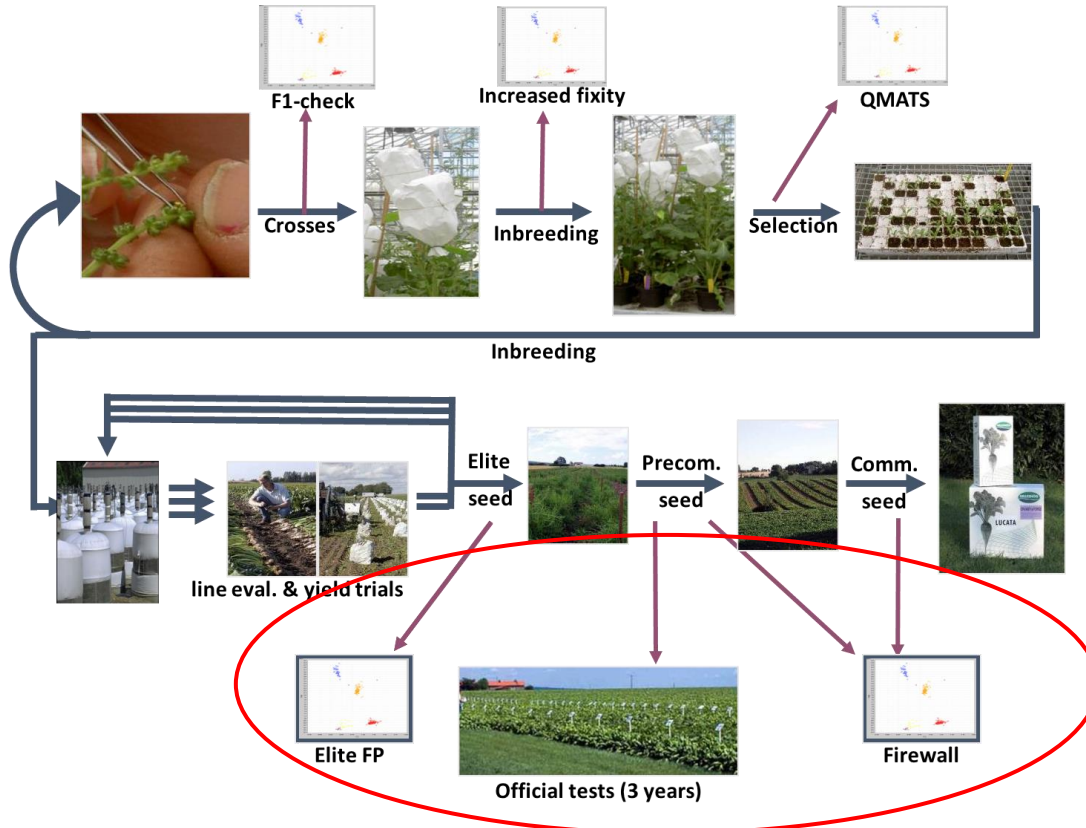
Molecular markers in breeding



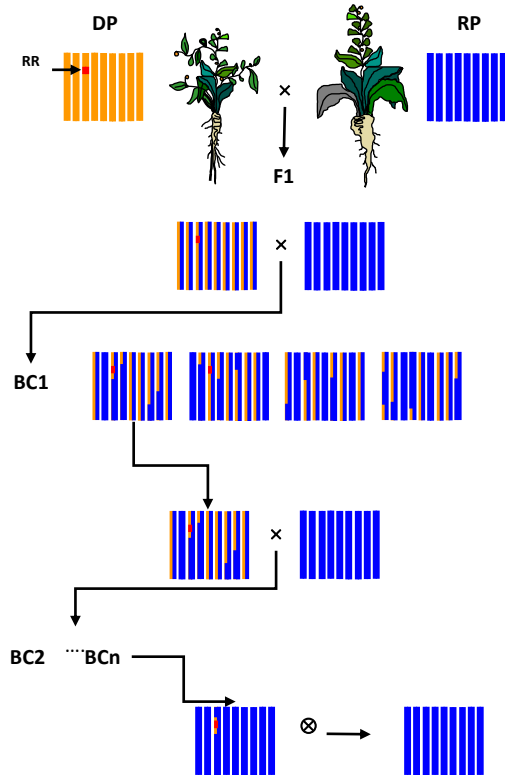
Molecular markers in breeding



Molecular markers in breeding



Marker assisted backcrossing



RP with RR



Virus yellows in Europe

In Europe Virus Yellows is mainly caused by:



BYV
Beet yellows virus



BMV
Beet mild yellowing
virus



BChV
Beet chlorosis virus

Virus vectors



Myzus persicae

Transmit: BYV, BMYV, BChV, BtMV, TuYV

Photo: Tobias Ekblad



Aphis fabae

Transmit: BYV, BtMV

Photo: bugguide.net

One of MH sources is resistant / tolerant to all
three viruses:
BYV + BMYV + BChV



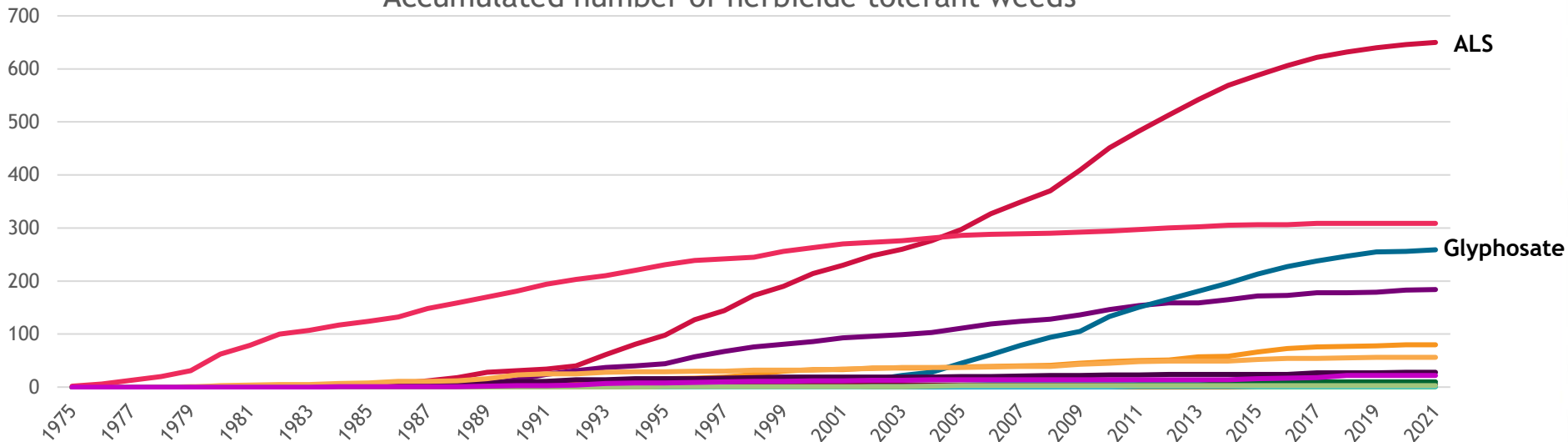
Resistant/tolerant gene source



Susceptible line

Raise of resistant weeds need for new herbicide solution.

Accumulated number of herbicide tolerant weeds



- Antimicrotubule mitotic disruptors
- Cell elongation inhibitors
- Inhibition of Acetyl CoA Carboxylase
- Inhibition of Enolpyruvyl Shikimate Phosphate Synthase
- Inhibition of Hydroxyphenyl Pyruvate Dioxygenase
- Inhibition of Microtubule Assembly
- Phytoene Desaturase inhibitors

- Auxin Mimics
- Inhibition of Acetolactate Synthase
- Inhibition of Cellulose Synthesis
- Inhibition of Glutamine Synthetase
- Inhibition of Lycopene Cyclase
- Inhibition of Protoporphyrinogen Oxidase
- PS I Electron Diversion

Achieving herbicide resistance

Genetic modification

Resistance is achieved by the addition of genetic material, e.g. a gene conferring resistance.

Generally a very successful method with high predictability and low cost for R&D.

Limited target markets and high regulatory costs.

Genomic editing

Resistance is achieved by targeted mutations of native genes.

Higher market acceptance compared to GM resulting in lower regulatory costs.

Difficult to predict success early in project.

Requires a priori knowledge of resistance mechanisms.

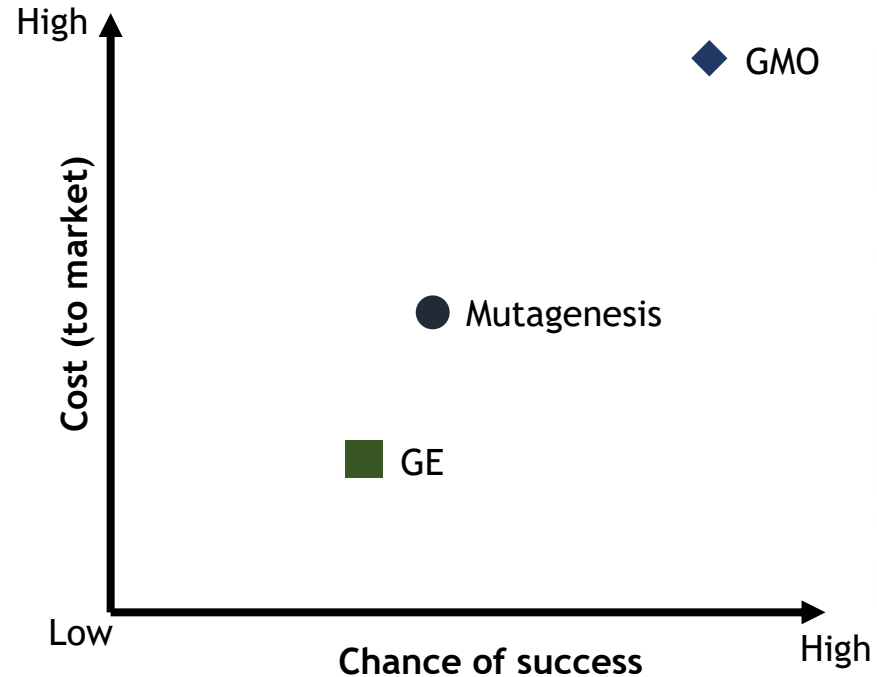
Mutagenesis

Resistance is achieved by non-targeted mutations of native genes.

High market acceptance.

Difficult to predict success early in project.

Requires a priori knowledge of resistance mechanisms.



External collaborators

We collaborate extensively with several universities in our area such as SLU, LU, CU and AU.

Examples of current projects include:

- Endophytes as growth stimulants
- Reduced herbicide usage through breeding
- Drone technology development
- Cercospora resistance and molecular pathology
- Aphanomyces resistance
- VY resistance
- Genome editing for disease traits
- Genomic prediction

Questions ?

