Genetic Use Restriction Technologies

GURTs

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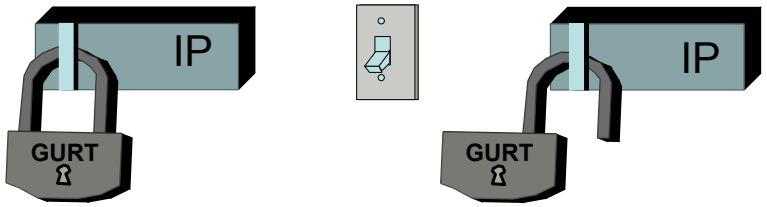
- Background
  - 1998 US patent USDA-ARS and the Delta and Pine Land Company
  - "TPS" based on induced seed sterility
  - "Terminator" by RAFI and condemned by FAO, CGIAR, Rockefeller Foundation and others
  - Patent -- gene switching control system

GURTs

- TPS – technology protection system
- Gene or multi-gene combinations created to control access to and containment of specific intellectual property (IP) genes



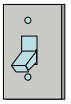
GURTs are designed to provide security for an IP gene(s)

Security

2 Types of GURTs

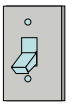
- V-GURT

  controls the ability of the plant to regenerate

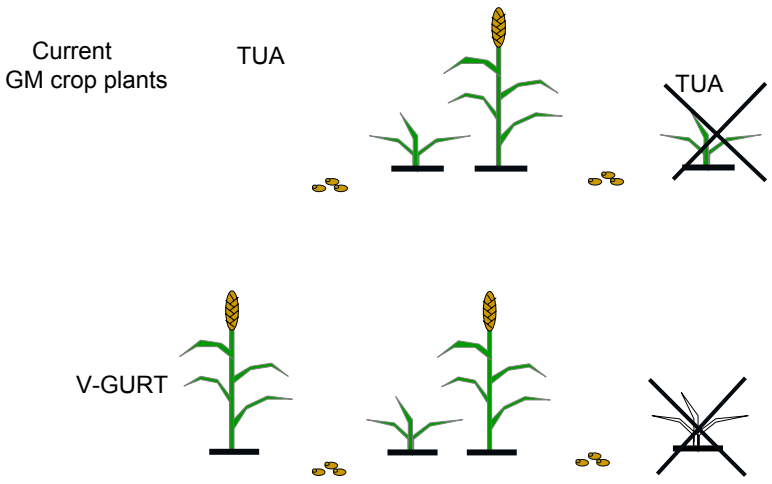
Embryo Viability 

- T-GURT

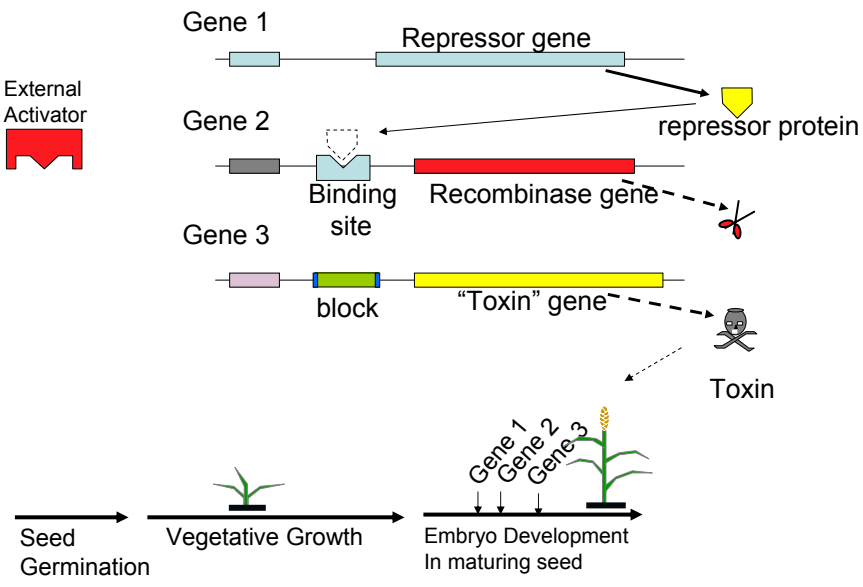
  controls trait expression

Trait Expression 

GURTs vs TUA (technology use agreement)



V-GURT - involving 3 developing embryo specific genes



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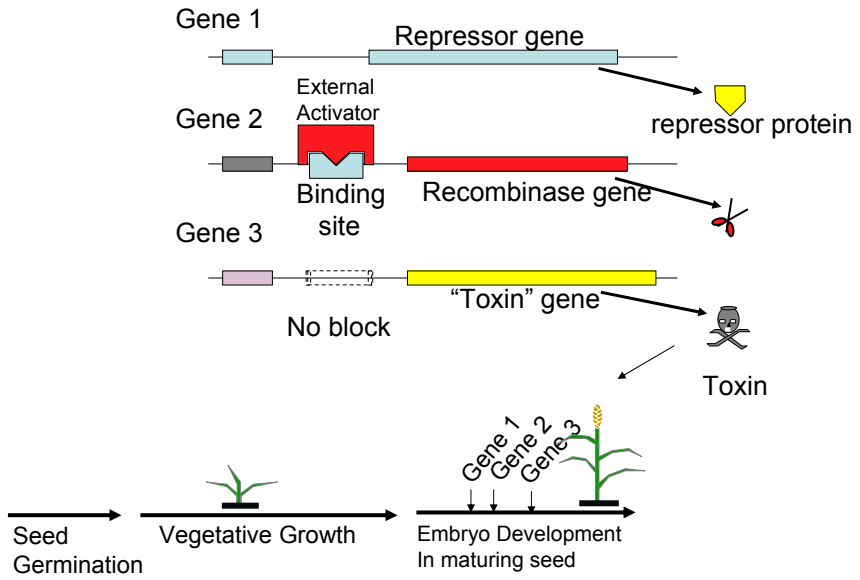
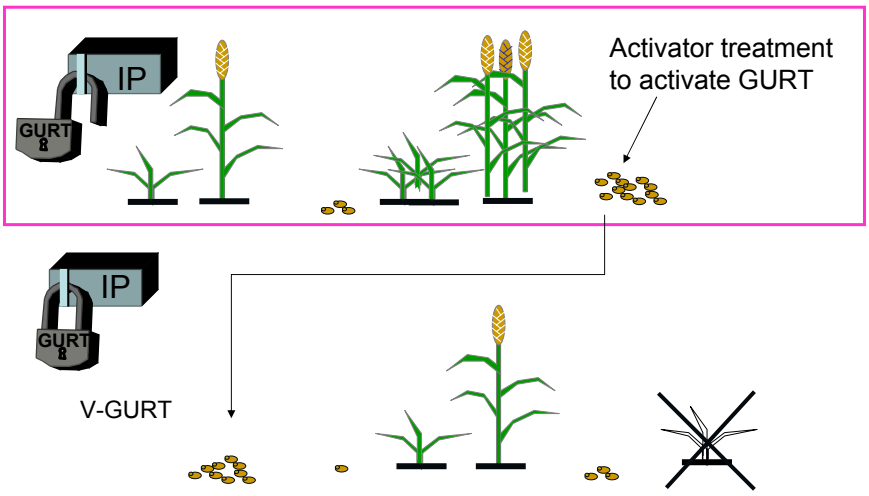
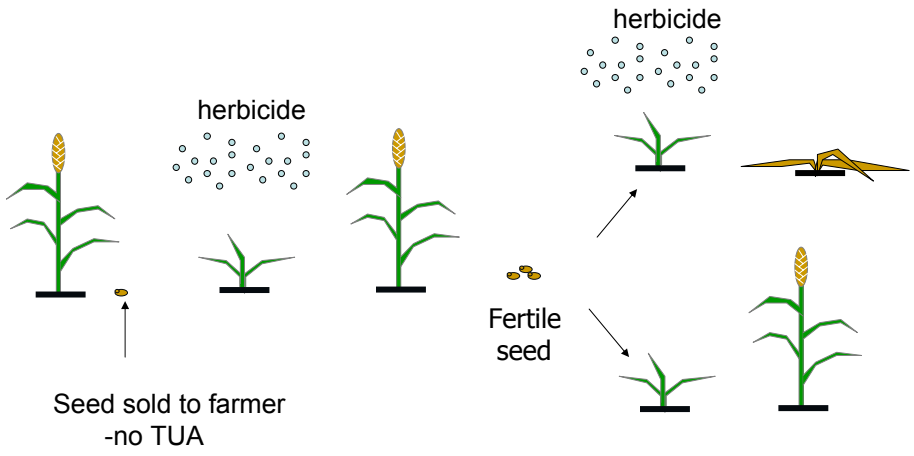


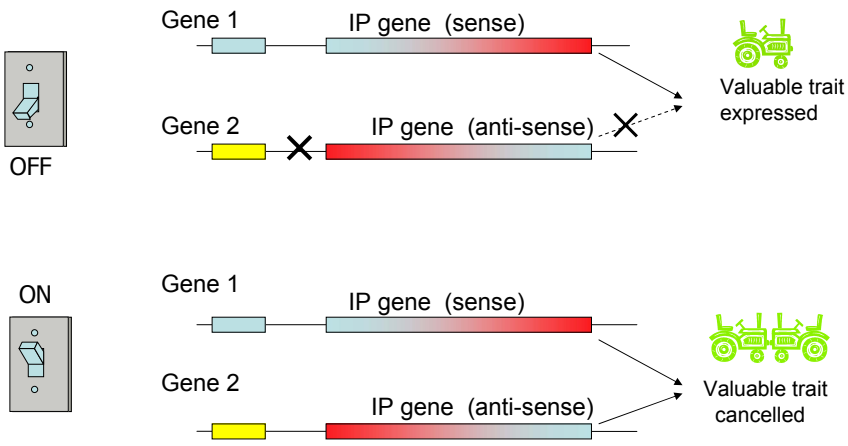
Company In-house Seed Production



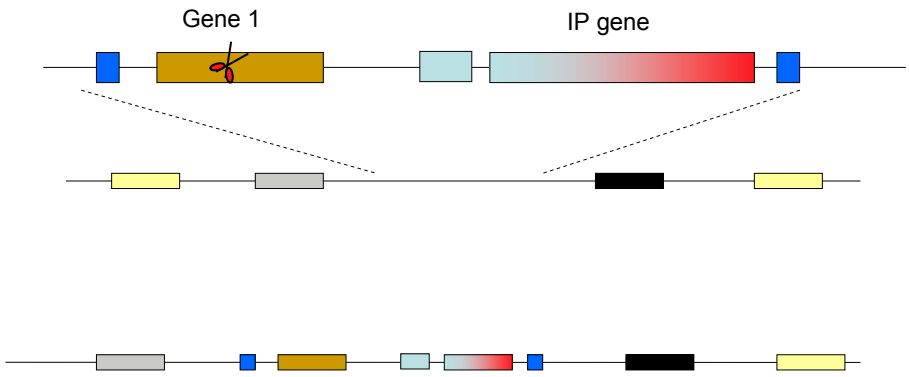
T-GURT protection eg herbicide tolerance trait

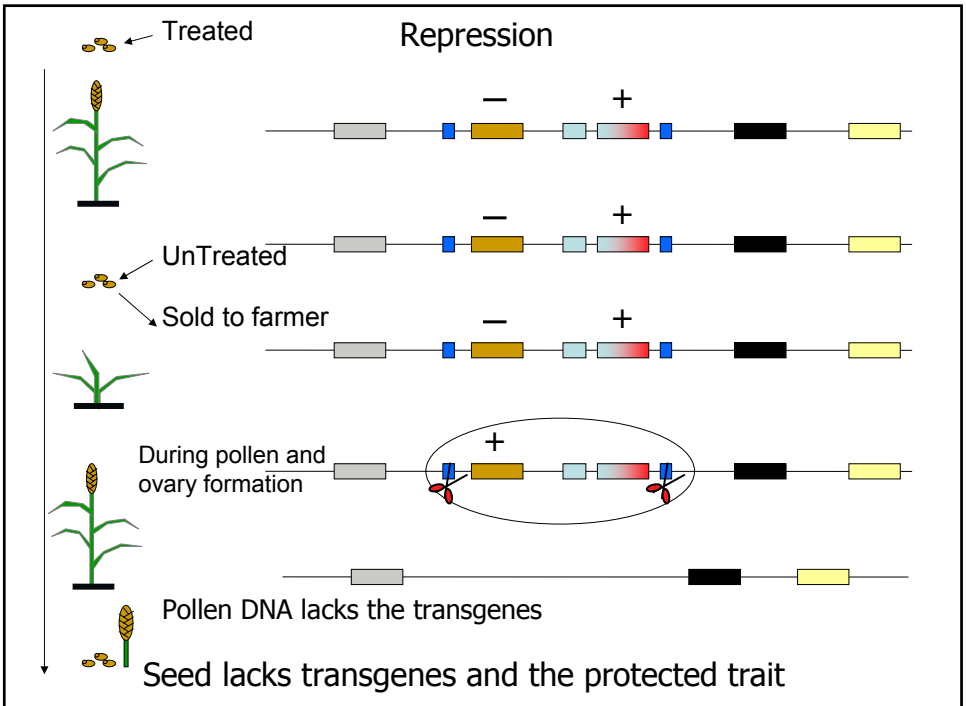


T-GURT (by cancellation of trait)



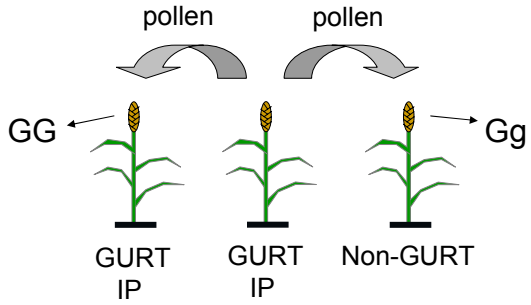
T-GURT (by gene removal)





Features of GURTs

- Activated V-GURTs and T-GURTs need to be ~100% effective
- Crosses (Gg) between a GURT and non-GURT must act like GURT selfed seed (GG)



Benefits

- To Seed Company controlling GURT and IP
  - Greater IP protection than patenting or TUAs
  - Greater return on research investment
  - Reduced environmental liability
  - More confidence in new research investments
  - More favourable press with T-GURT vs V-GURT (seed sterility issue)
- To the Environment
  - "Containment" outside of seed production facilities (V)
  - Non-containment of GM crops (silenced genes) (T)
  - Containment of novel genes in case of gene removal T-GURTs

Benefits

- To Farmers
  - More potential crops/traits
    - Conventional traits eg yield, pest tolerance
    - Biopharmaceuticals
    - Bioplastics
  - No volunteers with IP trait in following years (V-GURT only)
  - Minimal or no preharvest sprouting damage in wet year (V-GURT only)

Benefits

- To Seed Producers
  - Depends on nature of crop, GURT and IP gene

Potential Concerns

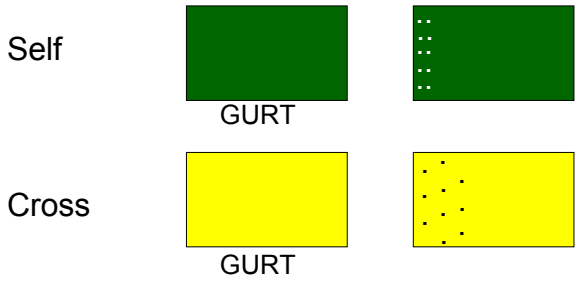
- Cost for GURT seeds relative to TUA
- Exclusivity requirement to a seed company for seed growers?

- Difficulty in developing 100% effective GURTs
- Finding an activator/repressor

- Concentration and restriction of germplasm by consolidation of seed companies

Seed producer challenges

- Seed management issues
  - Outcrossing to adjacent fields - impact?

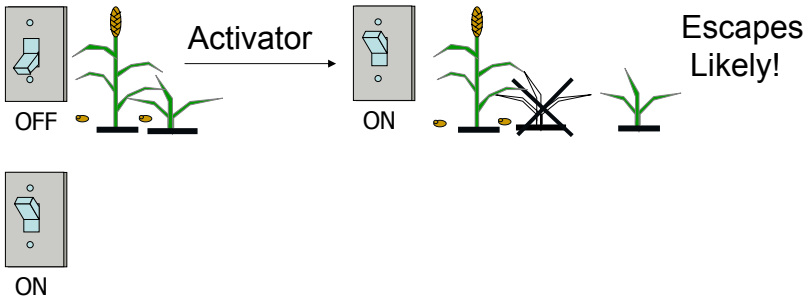


Activated GURT Seed vs non seed crop

Seed producer challenges

- Activator vs Repressor for IP protection

GURT Default



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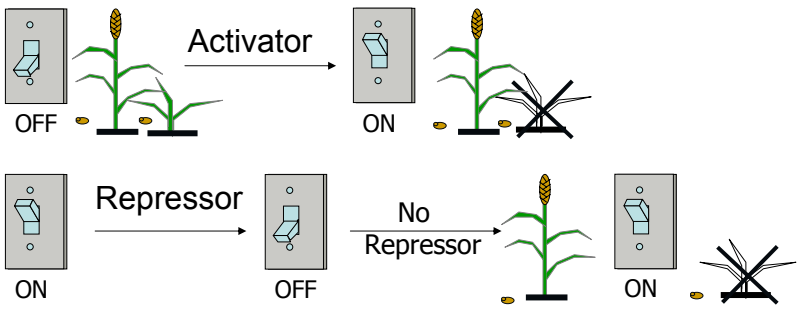

GURTs -current status

- No field testing of GURTs in Canada currently (CFIA)
- GURTs are GM and will need to go through a significant CFIA approval process before they can be approved
- Activators/repressors (if chemical in nature) will require regulatory approval

Questions?