



Gene Flow and Co-existence in Alfalfa

Allen Van Deynze
October 24, 2012



Gene Flow

- Gene flow
 - The successful transfer of genetic material.
 - A natural biological process that is not unique to biotech plants
- Gene flow is a 2- way process
- Since gene flow is a natural biological process, there is not a “risk” from gene flow per se.
- The consequences of gene flow need to be understood in context of the trait and implications of trait movement.



Potential Risks of Gene Flow

- Adventitious gene flow
 - Variety purity
 - Reduced yield
 - Product quality
- Regulatory issues
 - Transgenics
 - Organic



Pollen-mediated Gene Flow

- Often referred to as “outcrossing” or “cross-pollination”
- Pollen flow does not equal gene flow

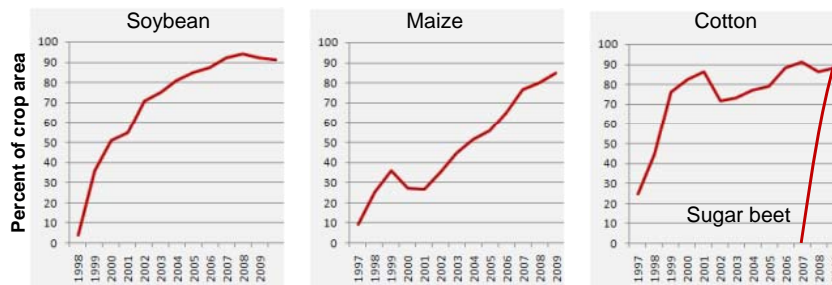


Pollen-mediated Gene Flow

- Frequency in nature depends upon:
- Sexual compatibility
 - Pollen quantity and viability
 - Proximity of recipient plants
 - Flower characteristics
 - Pollinator activity
 - Environmental conditions
 - wind
 - humidity
 - temperature



Trends in GE Crop Production

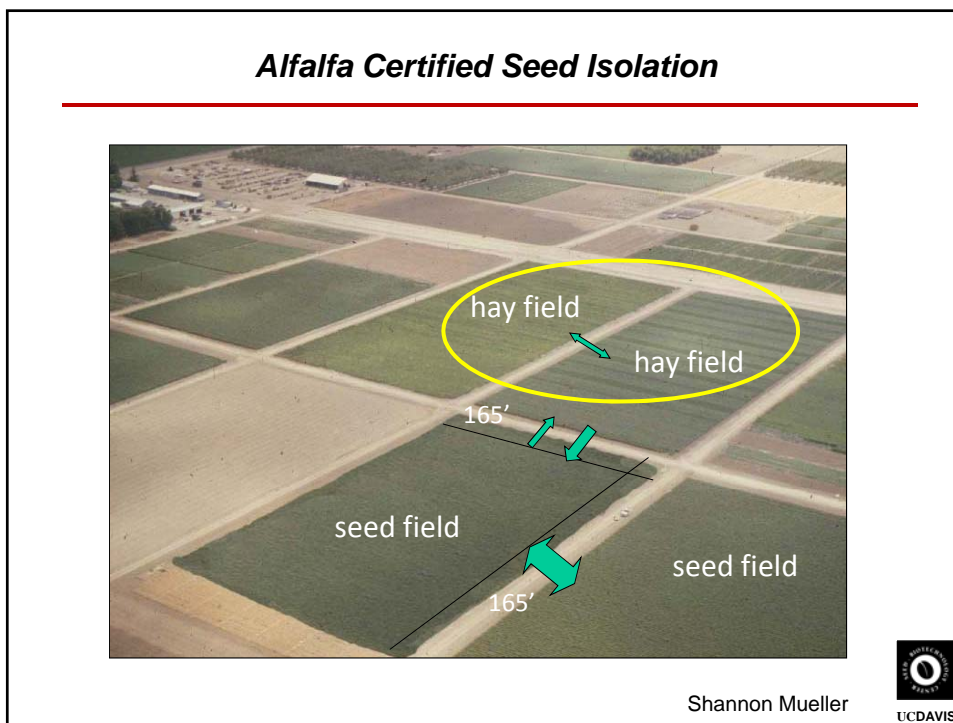
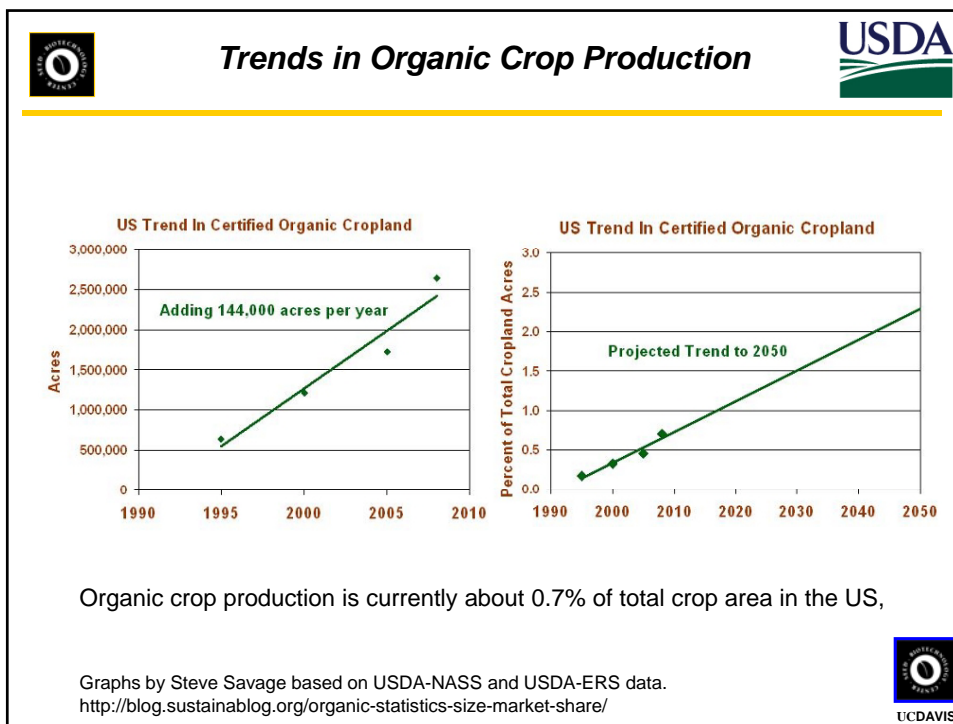


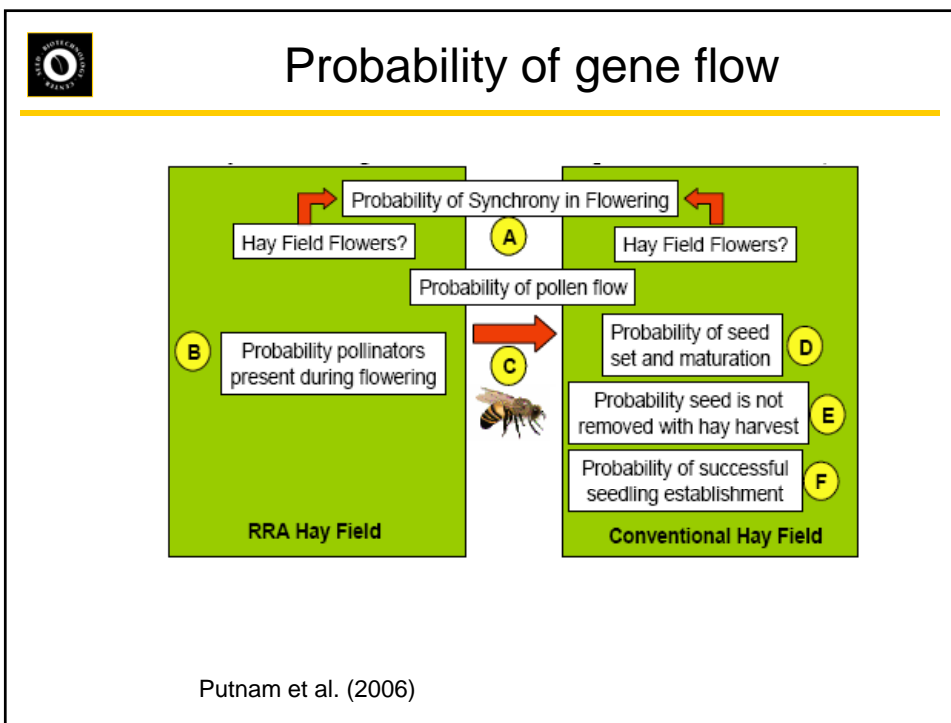
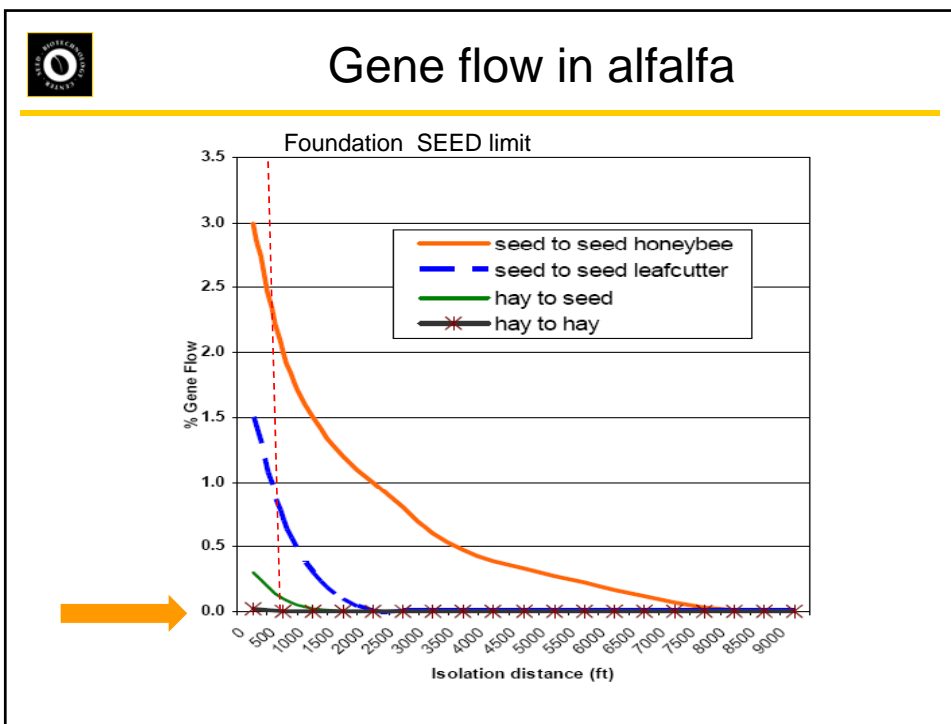
Genetically engineered (GE) varieties have been adopted by ~90% of farmers in the crops in which they are available.

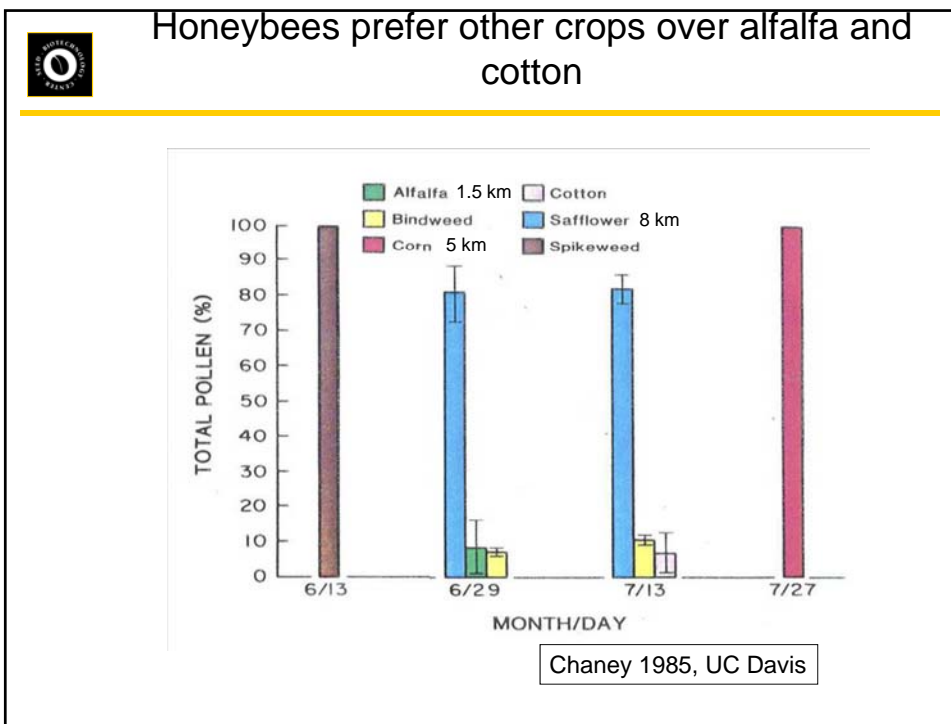
GE soybean, maize and cotton (164 million acres in 2011) equaled 51% of the total 319 million acres planted to all crops in the US in 2011.

http://www.gmo-compass.org/eng/agri_biotechnology/gmo_planting/506.usa_cultivation_gm_plants_2009.html
<http://blog.sustainablog.org/organic-statistics-size-market-share/>









Gene Flow in Alfalfa

➤ Determination and Verification of Gene Flow

© A. Van Deynze, 2004

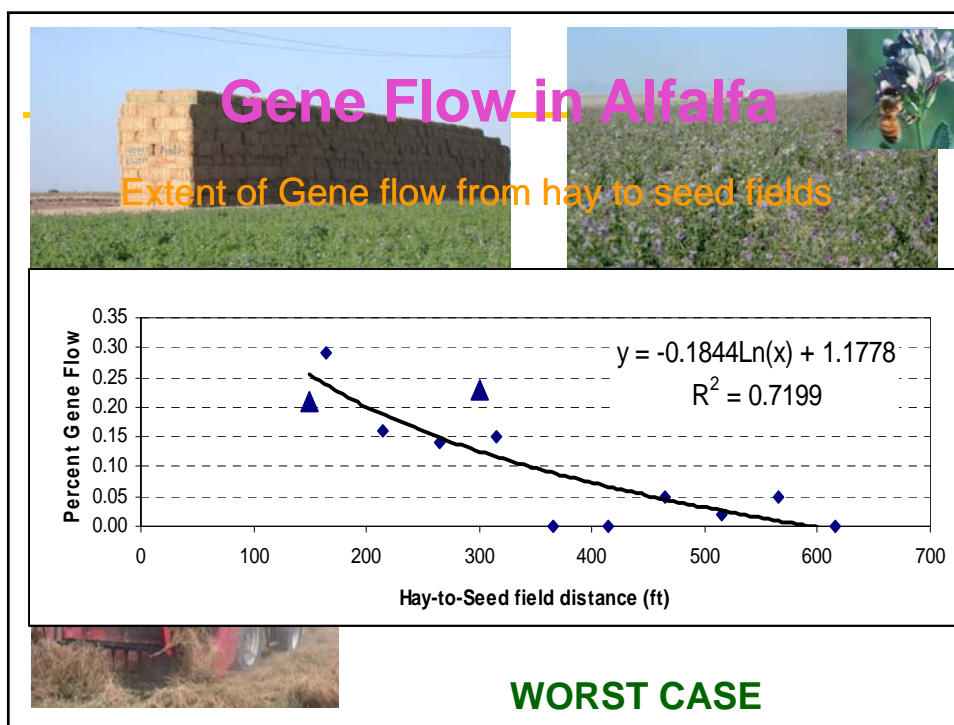
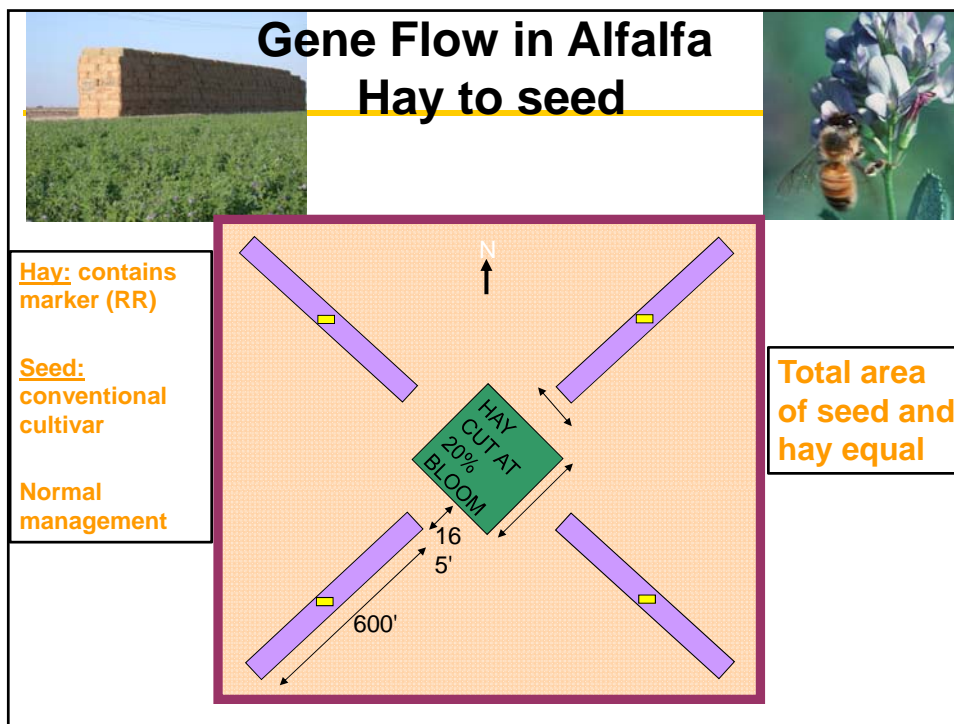
© A. Van Deynze, 2004

© A. Van Deynze, 2004

© A. Van Deynze, 2004

© A. Van Deynze, 2004

© A. Van Deynze, 2004





Seed-mediated gene flow

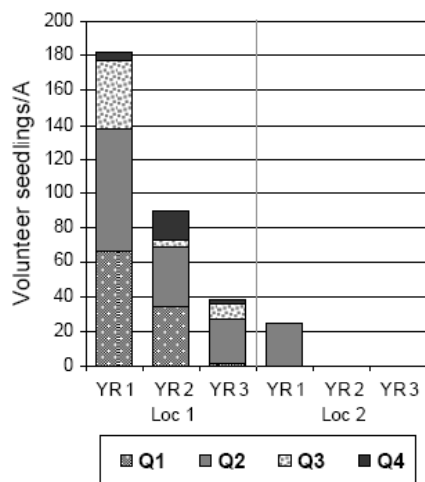


Figure 5. Volunteer emergence by quarter in Idaho (Loc 1) and Texas (Loc 2) for three years after seed field take-out (mean count/A). (P. Reisen and J. Arias unpublished)



Coexistence

- Co-existence principles rely on:
 - mutual respect among growers
 - a clear understanding of the biological restrictions of crop production systems.
- In Agriculture and biological systems, coexistence is based on **practical non-zero thresholds** that allow a diversity of markets to be addressed.



Experience in Coexistence in the Seed Industry

- CSGA- since 1909
- AOSCA-since 1919
- CSTA-1923
- It is the responsibility of the party with the higher standard to meet that standard
- Premiums in the seed industry have rewarded the extra effort needed

Nick Kalaitzandonakes



Papers

CAST Issue Paper

Number 37
December 2007

Implications of Gene Flow in the Scale-up and Commercial Use of Biotechnology-derived Crops: Economic and Policy Considerations



Gene Flow in Alfalfa:

Biology, Mitigation, and Potential Impact on Production



www.cast-science.org

