GREENHOUSE AND FIELD SCREENING FOR SALINITY TOLERANCE

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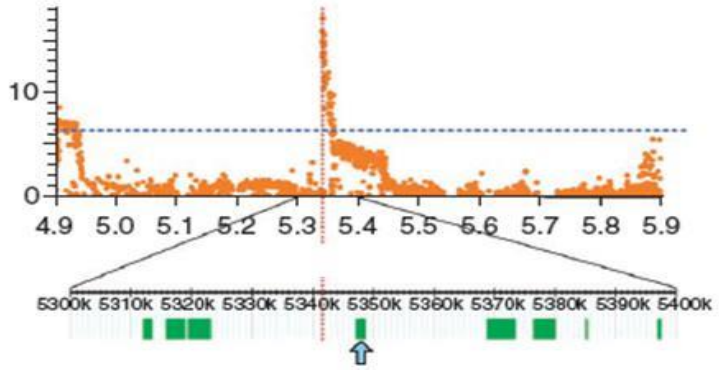
Breeding for Salt Tolerance

Greenhouse Assays

Field Testing



Marker Assisted Selection

Biotechnology Traits

Greenhouse Assays for Salt

Salt Tolerance of Germinating Alfalfa Seeds

7 day test

Forage Production Under Salt Stress

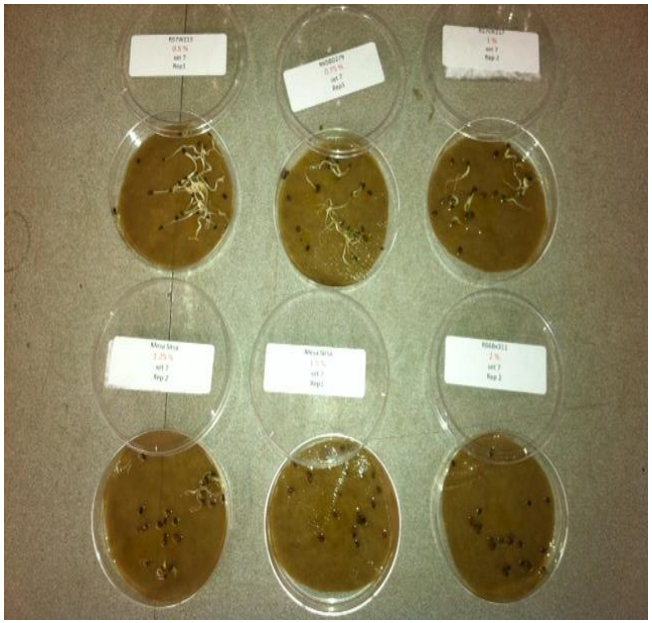
~6 month test

http://www.naaic.org/resource/stdtests.php

Greenhouse Assays for Salt

Greenhouse Assays

- Greenhouse tests/selection are useful but cannot capture all of the complexity in many saline soils.
- Field forage trials and nurseries are needed for validation of greenhouse selections for other important criteria (e.g. high pH) typical of problem soils.



Salt Evaluation Nursery
Touchet, WA

2013 Salt Forage Trial
Rocky Ford, CO

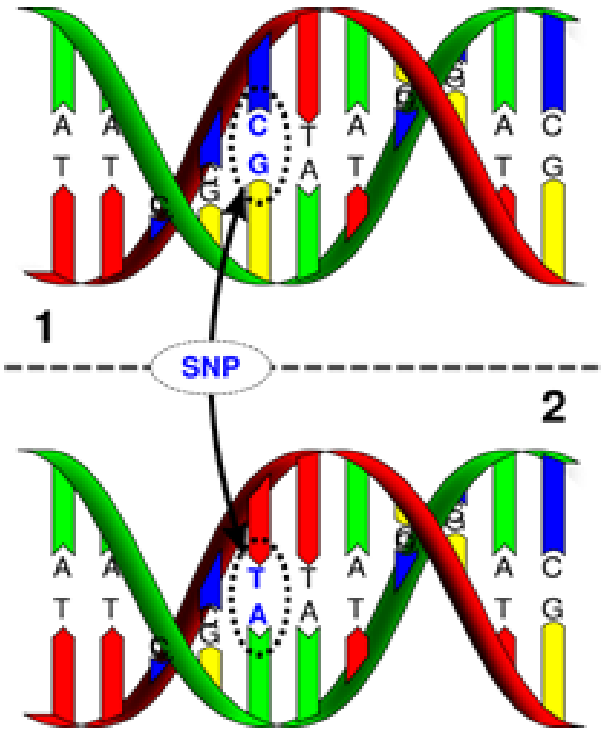
September 8, 2013

Marker Assisted Selection

- The cost of genotyping has dropped so much over the past 10 years that phenotyping, not genotyping, is now our main limitation

- FGI and Noble Foundation have developed a 10K SNP chip to map 7800 validated SNP markers
  - 20x increase in marker density in one year.

- Through selection of parents with favorable alleles at specific parts of chromosomes, we can provide growers better products faster



Biotechnology Derived Traits

Hank Aaron career home run record No. 715. (AP Photo, 1974)

- $136,000,000 is the average cost to launch a new biotech trait.
  - Regulatory science, registration and regulatory affairs 25.8% total cost
- 13.1 years from the initiation of a discovery project to commercialization.

Source: Phillips McDougall. The Cost & time from discovery to deregulation of a biotechnology derived trait Consultancy Study for Crop Life International September 2011. Phillips McDougall

– http://www.croplife.org/PhillipsMcDougallStudy

Salt Screening Conclusions

- **Greenhouse Selections:** Important components of salt tolerance but may lack the interaction with stresses typical in saline soils.
  - Most effective when used in tandem with field screening.
- **Field selections**. Best current strategy for improving salt tolerance.
  - Multiple cycles (2-3 years/cycle) of field selection for vigor and yield required.
- **Marker Assisted Selection:** Tremendous potential to speed selection cycle.
- **Biotech Genes:** Big cost in time and money.
  - Have to be major advantage to justify cost.

Moving Forward

- A combination of field nurseries and yield trials, selection for ion exclusion and QTL/molecular markers selection and greenhouse screens.

Field Testing

Marker Assisted Selection

Greenhouse Assays

Biotechnology Traits