

Genomic prediction of salinity stress tolerance in Maize (*Zea mays* L.)

Vishal Singh, Amita Kaundal

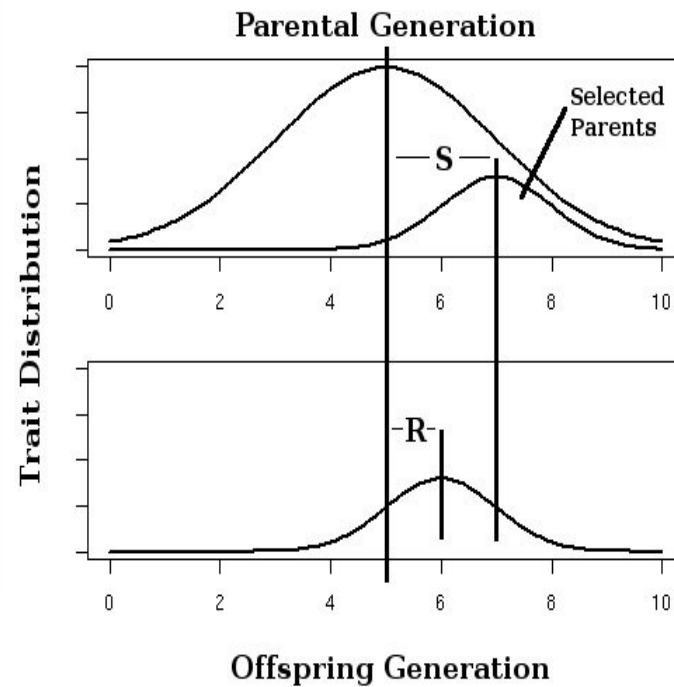
COLLEGE of
AGRICULTURE and
APPLIED SCIENCES
UtahStateUniversity



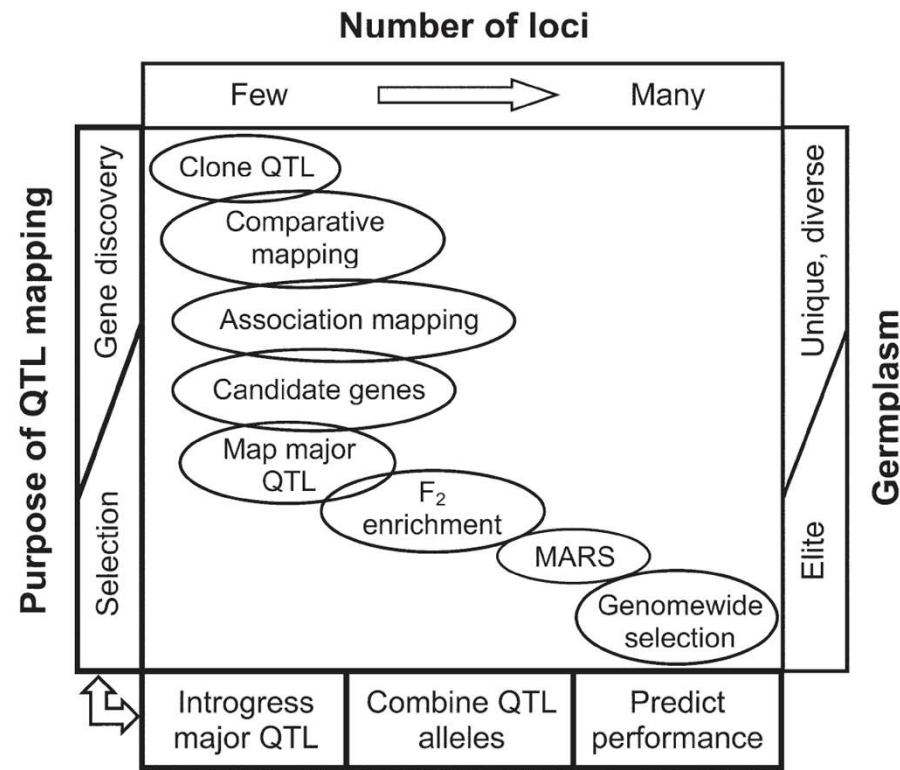
Selection in plant breeding

Selection has been a key method in plant breeding to improve plant traits

Practised for a long time



Molecular techniques in trait improvement



Bernardo, 2008

Inclusion of DNA information in selection

- ❖ Selection (traditionally): phenotypic records of individuals and its relatives.
- ❖ BLUP (Henderson, 1950): Estimation of breeding values based on phenotypic data
- ❖ Fernando and Grossman (1989): Inclusion of marker information into BLUP breeding values

Maize salinity tolerance

	MAIZE		
	1997 Demand	2020 Demand	Change (%)
Global	586	852	266 (45)
Industrial Countries	291	344	53 (18)
Developing Countries	295	508	213 (72)



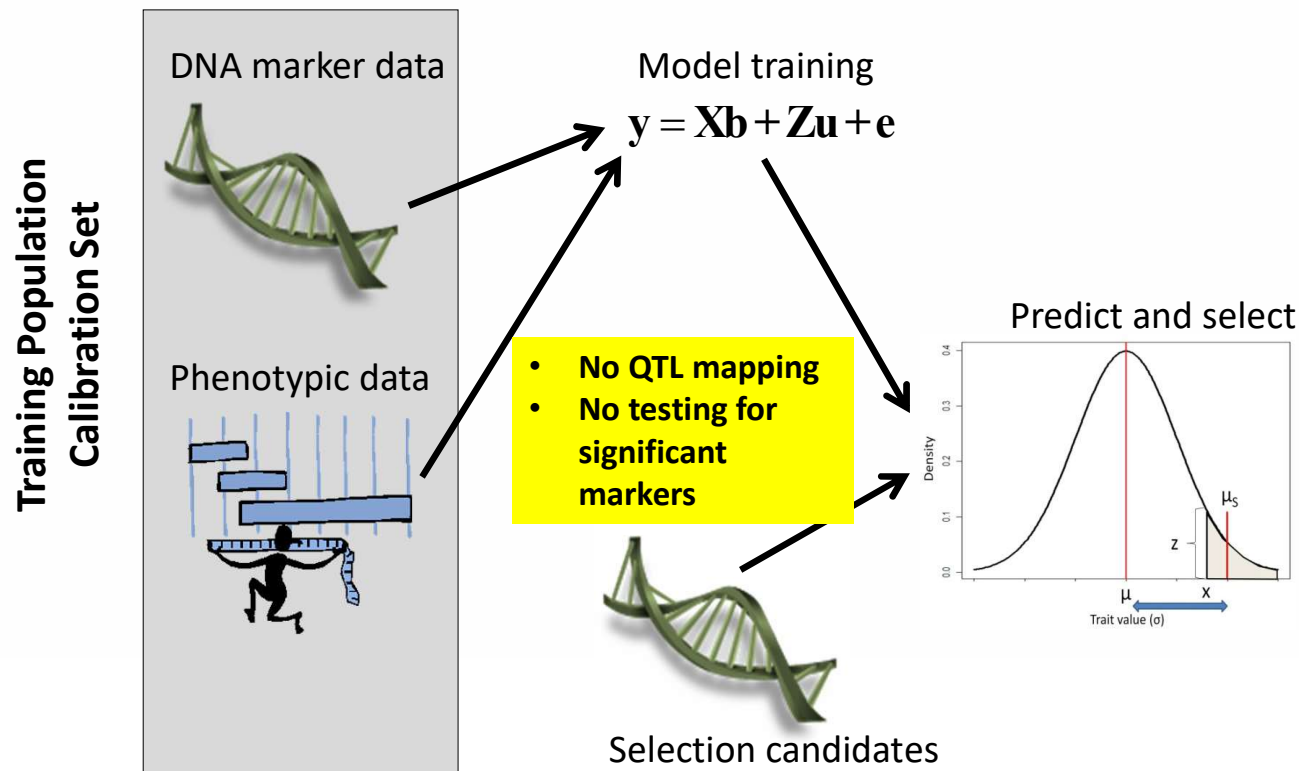
(IFPRI, 2003) (Data in million metric tonnes)

Tolerant	Barley, Sugar Beet, Wildrye, Asparagus
Moderately Tolerant	Wheat, Wheat Grass, Zucchini, Beet (red)
Moderately Sensitive	Tomato, Cucumber, Alfalfa, Clover, Corn, Muskmellon, Potato
Sensitive	Onion, Carrot, Bean, Apple, Cherry, Raspberry, Strawberry

Hill and Koenig, 1999

COLLEGE of
**AGRICULTURE and
 APPLIED SCIENCES**
UtahStateUniversity

Genomic Selection scheme



Aaron Lorenz, UNL

Material and methods

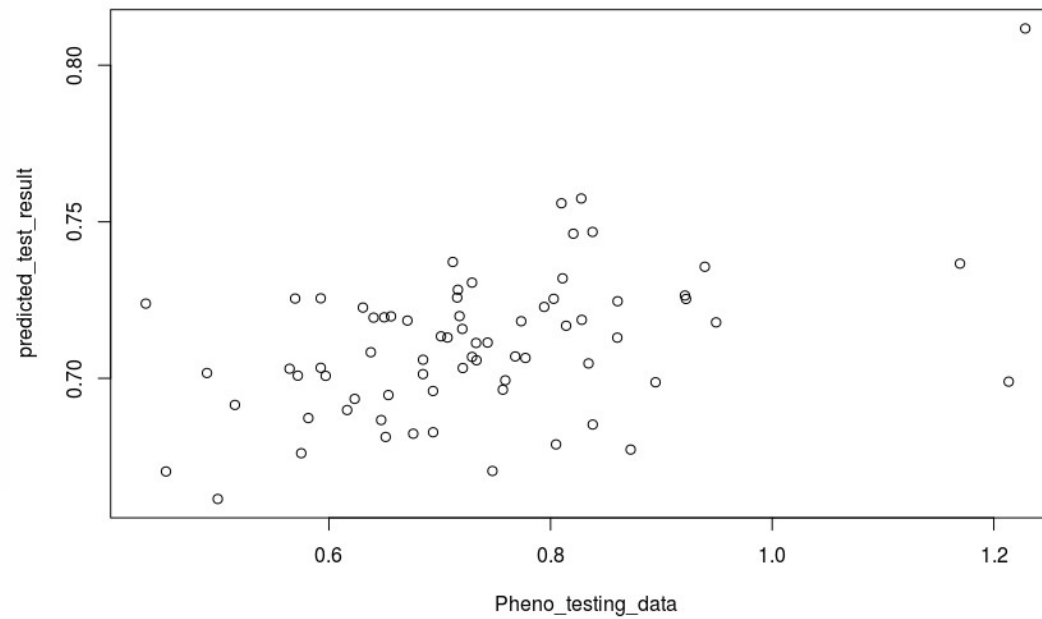
- Screening for salinity stress tolerance: Sandhu *et al.*, 2019
- Inbred lines :
 - 399, A subset of the maize diversity panel (Mazaheri et al. 2019)
- Traits measured: shoot length, shoot weight
 - BLUP estimates were used for further analysis
- Molecular data: 10,000 SNPs (random subset of a full dataset)

Modelling approach

- Ridge Regression : rrBLUP package in R (Endelman, 2011)
- Data cleaning and processing:
 - Removal of SNPs with <0.05 MAF
 - Training and Testing set (80:20)
- Model prediction accuracy

Results

- Prediction accuracy of the model: 0.47



Future direction

- Model building using full SNPs data
- Cross validation
- Additional models
- Screening of inbred lines for salt tolerance for true validation set

THANK YOU

COLLEGE of
AGRICULTURE *and*
APPLIED SCIENCES
UtahStateUniversity

