Rice Breeding and Variety Stability

Louisiana
RICE RESEARCH BOARD

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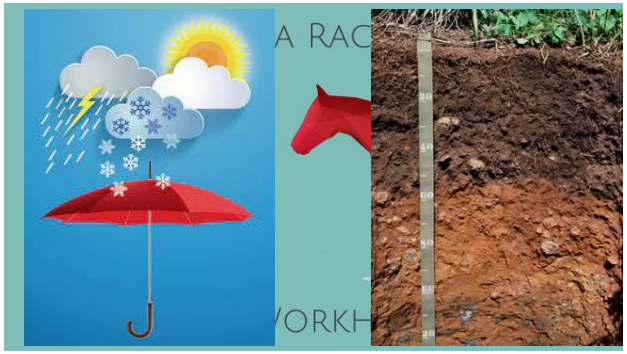
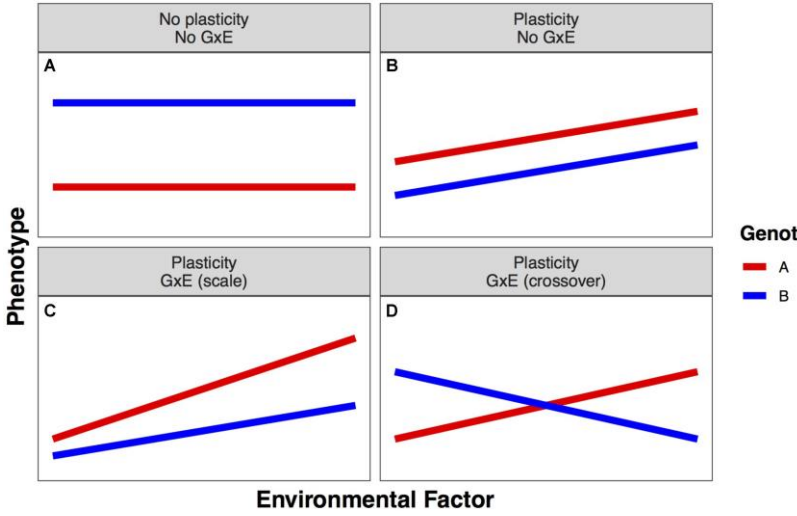
What Factors Influence Performance Stability?

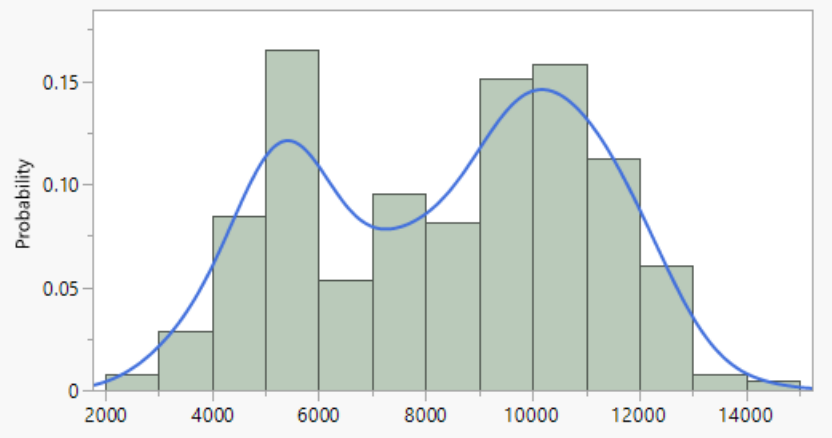
- What is variety stability?
  - It's a relative term
  - How a variety varies across environments
- What are environmental factors that impact performance?
  - Weather
  - Soil
  - Management
  - Pests (Weeds, Disease, Insects)
- Our interests in Stability is less about environment and more about Genotype x Environment interaction

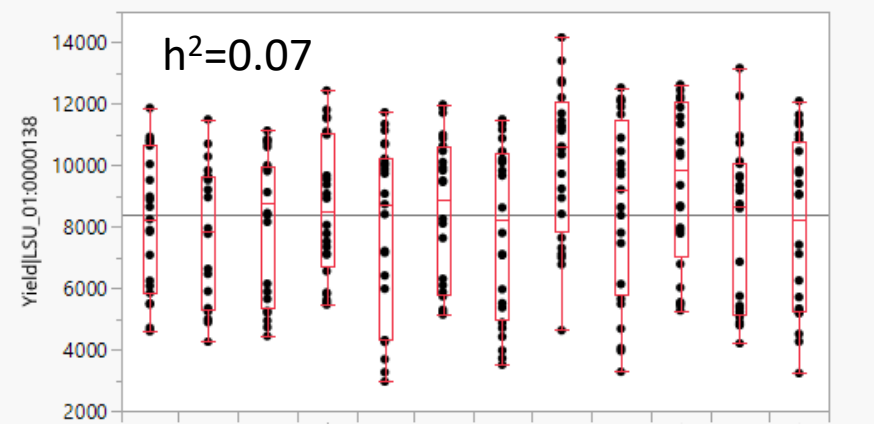




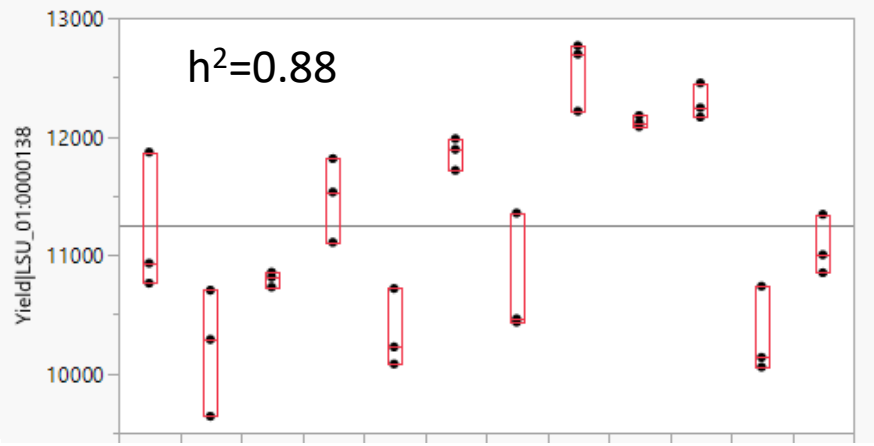
How does a Breeding Program Evaluate Stability?

- Multi-year and multi-location testing
- Experimental quality critical to decision making
  - Heritability is the measure of quality in a trial
    - Amount of the overall variation explained by genetics





Grouped by Line

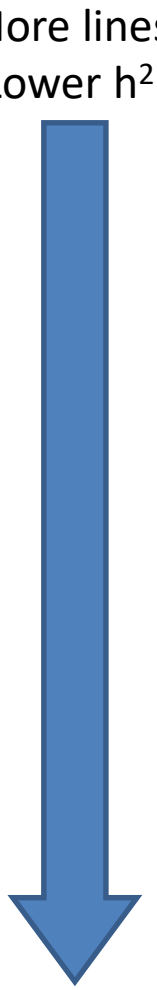


Grouped by Env. and Line

Grouped by Env.

How Can we Breed for Stability?

- Multi-year and multi-location testing
- Experimental quality critical to decision making
  - Heritability is the measure of quality in a trial
- What are the limitations?
- Opportunities at various stage
  - Increase lines evaluated at start
  - Increase/maintain h^2
  - Test advanced material is as many environments as possible
  - What about $ cost????



Breeding Crosses	Yr. 1	•300 new pops/yr. •Elite x Elite
Single Plant Selection	Yr. 1	•F2 •200 pops •PR or GH Adv.
Progeny Row Stage 1	Yr. 2	•F2:F3 •20,000 rows •Visual/Obs.
Progeny Row Stage 2	Yr. 3	• F4 and F5 • 14,000 rows • Visual Sel
Preliminary Yield Test	Yr. 4	•2000 F2:4 Entries •1 env. / 2 reps •Yield, Agro, G.Q.
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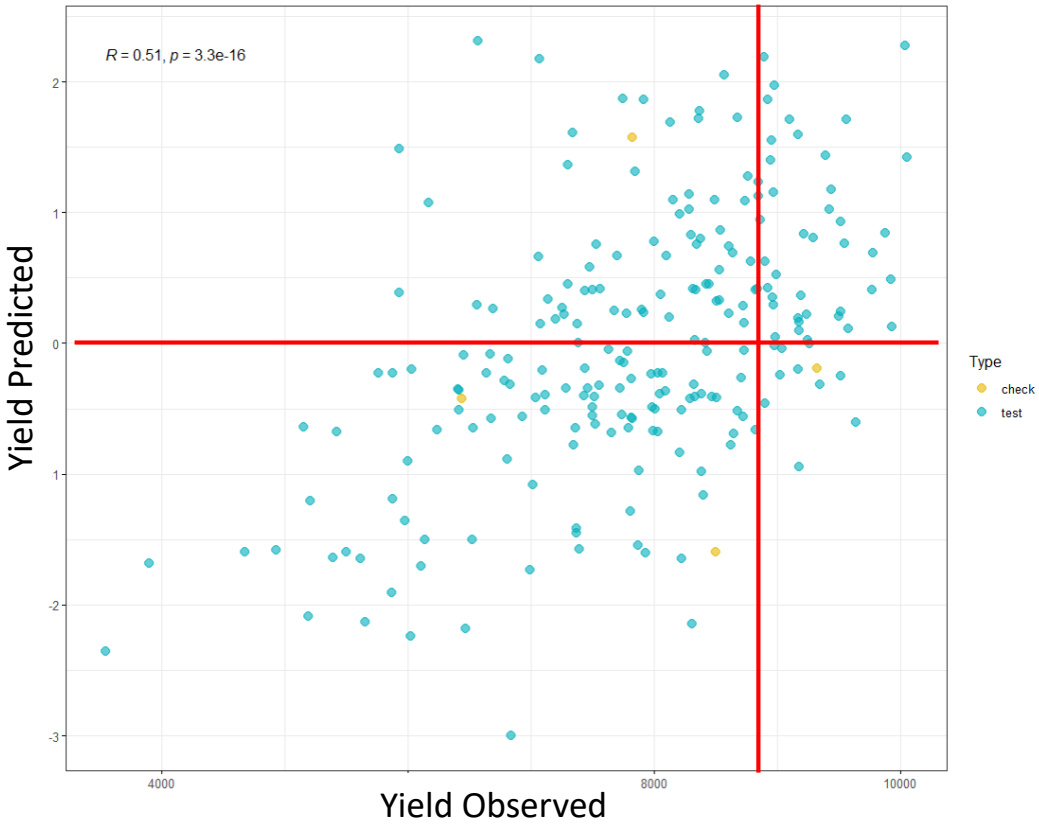
Foundation Increase	Yr. 8	•Breeder seed with last year of testing

Genomic Selection

- Opportunities at various stage
  - Increase lines evaluated at start
    - Genomic Selection (prediction)
  - Increase/maintain h^2
    - Includes multiple years/env. in prediction



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WGP
• 160 pops x 48 lines (8k lines)

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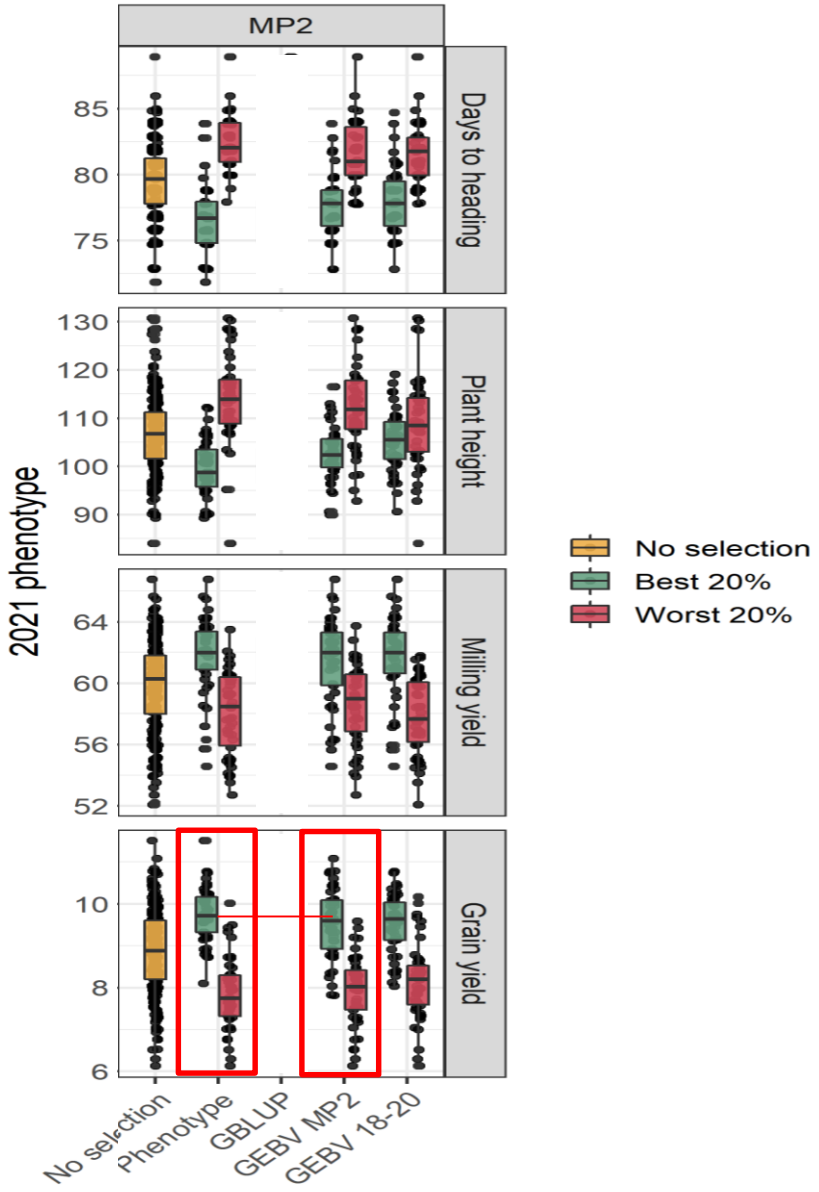
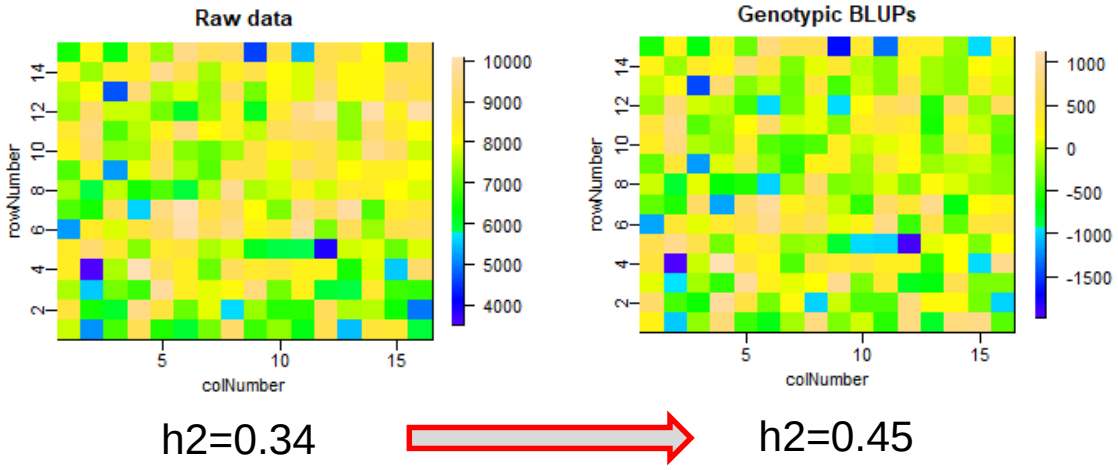


Spatial Adjustments

- Opportunities at various stage
  - Increase lines evaluated at start
    - Genomic Selection
  - Increase/maintain h^2
    - Increase environments without increasing plots
    - Move from 2 reps to 1 rep



h2=0.34 → h2=0.45

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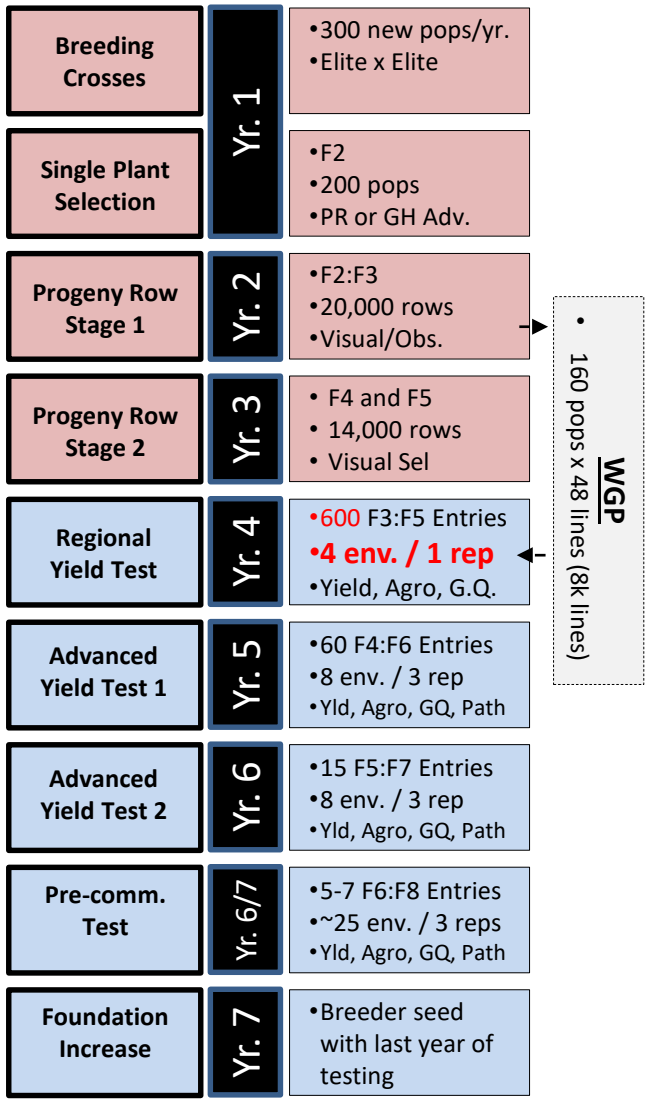
Increasing Number of Environments

- Opportunities at various stage
  - Increase lines evaluated at start
    - Genomic Selection
  - Increase/maintain h^2
    - Increase environments without increasing plots
    - Move from 2 reps to 1 rep
    - Reducing reps allows increase in environments

	1 env. with 2 reps		2 env. with 1 rep	
Test	Env1	Env2+	Env1	Env2
PYL	0.93	0.52	0.85	0.85



Increasing Number of Environments

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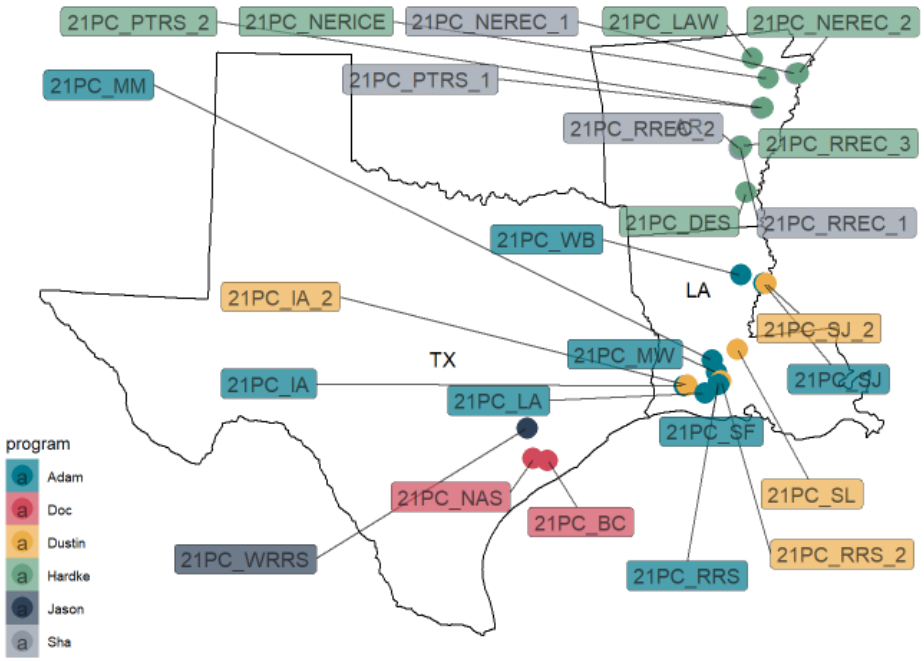
Locations



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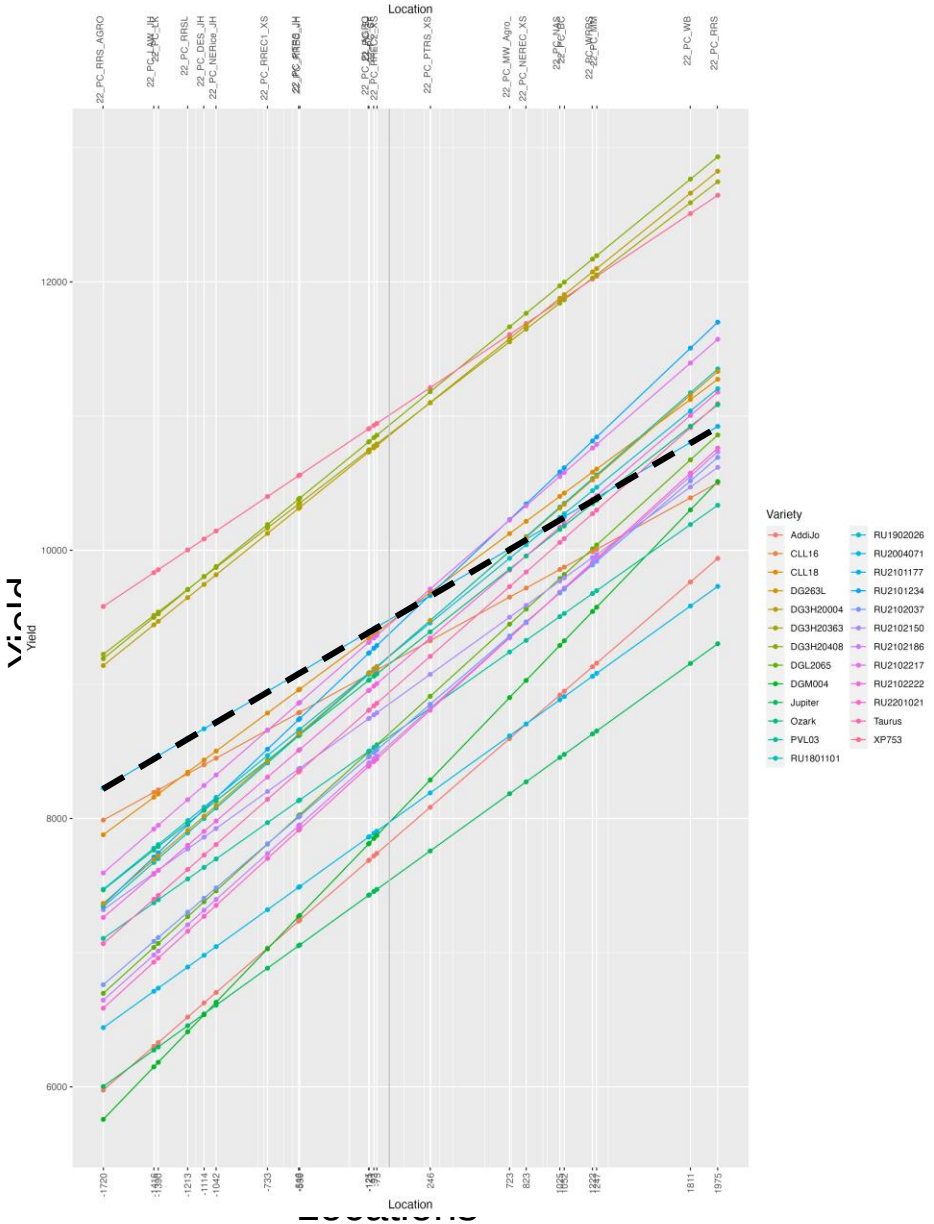
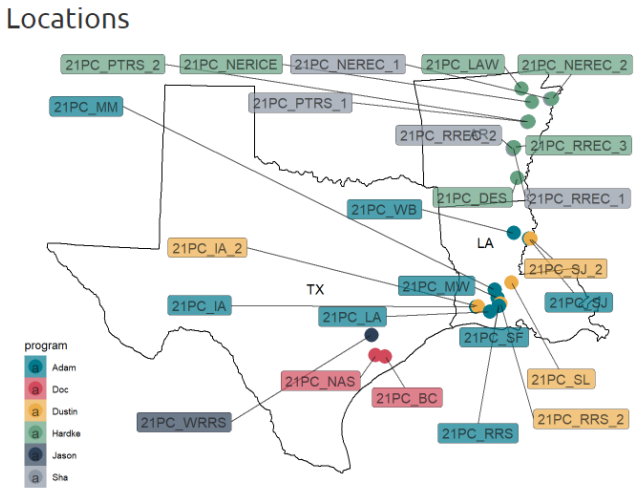
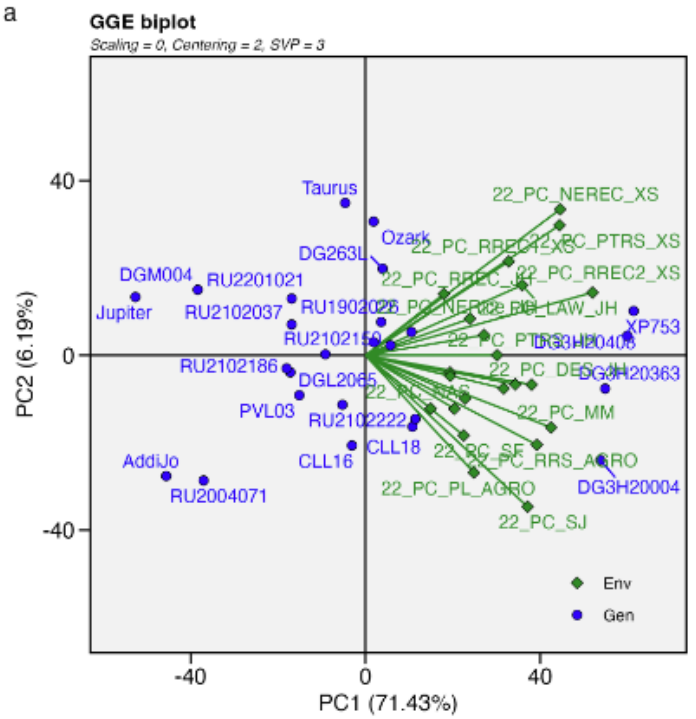
Evaluating Stability and Classifying Environments







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New Lines Evaluated
2,000 to 8,000

First Year Field Testing
1 Env. to 4

Plots for First Year Testing
4,000 to 2,400

Additional Advanced Testing
PC test: 25-30 Locs

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Thank You for your support

- Questions or Comments?
- Acknowledgements
  - RRS Faculty and Staff
    - Shop, Farm Crew, Foundation Seed
  - Breeding/Hybrid Project
    - Adam Famoso, Brijesh Angira, Roberto Fritsche-Neto
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    - Post Docs: Jose Moreno and Paola Mosquera
    - Student Workers: Andrew Thibodeaux, Tanner LaGrange, Evan Regan
  - Molecular Breeding
    - Brijesh Angira, Jennifer Dartez, Madeline LeJeune

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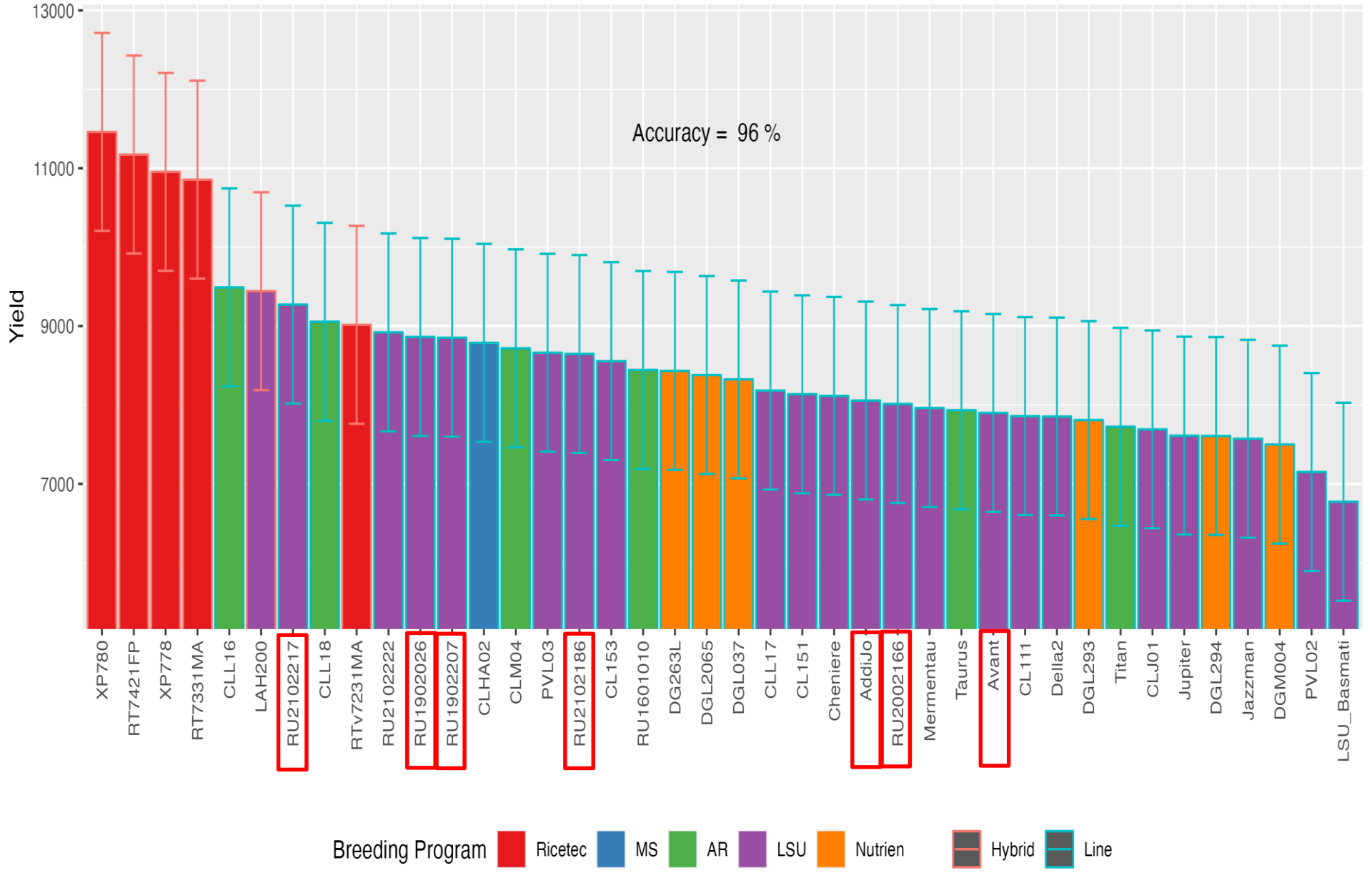
2023 Louisiana Variety Test



2023 Pre-commercial Test