Evaluating a common bean/tepary interspecific population in different heat stress conditions in California

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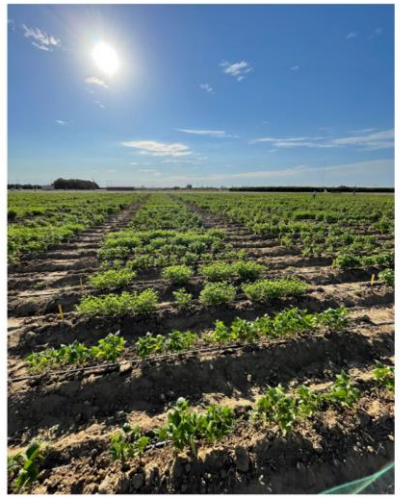
Overview

- Common bean is sensitive to heat stress especially during flowering stage
- As global climate is changing rapidly, breeding efforts must act ahead of time and efficiently select better-adapted materials
- Newly developed common/tepary bean population offers an essential source of beneficial traits (including heat-tolerance) for common bean genetic improvement
- New tools and technologies such as crop sensors and models can also be helpful in developing new common bean (and potentially also lima bean) varieties

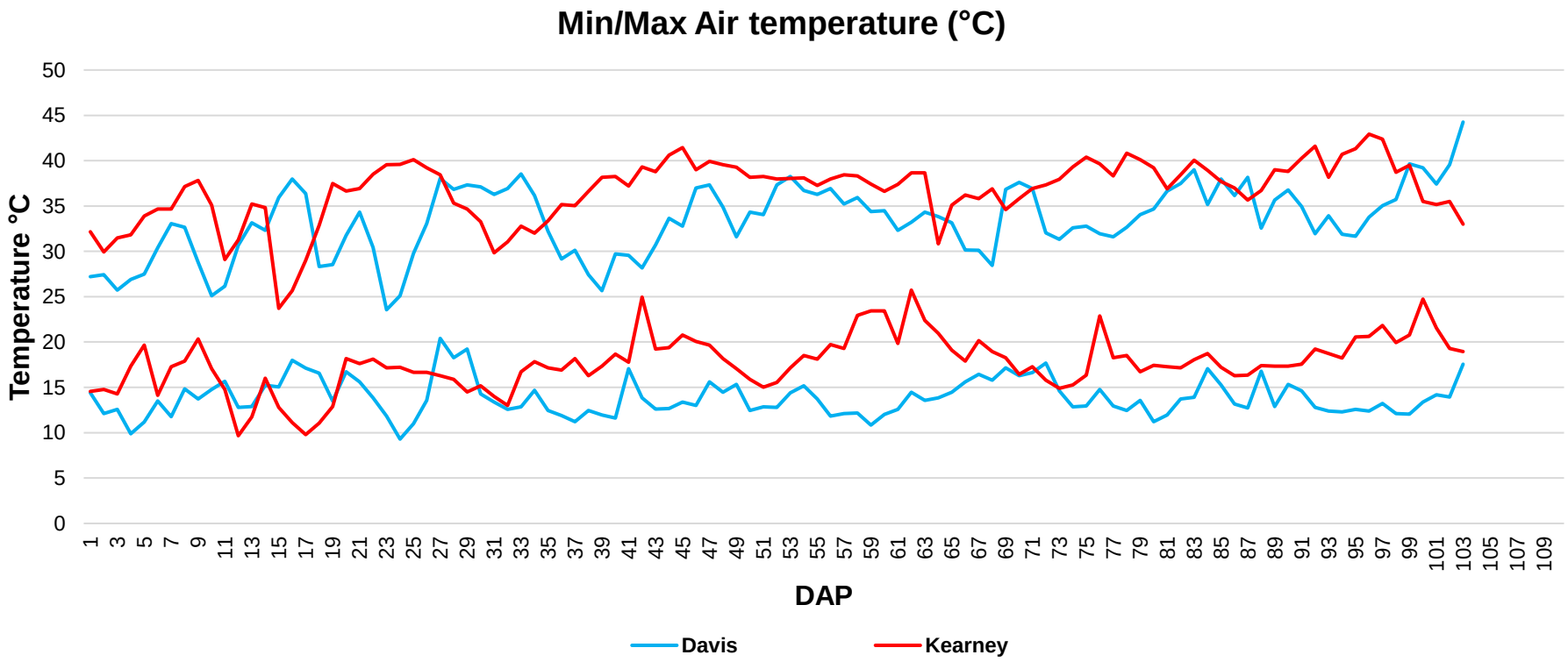
3D Crop Modeling	Pre-Breeding and Genomics	AI-Enabled Phenotyping
 HELIOS 	 	  

Field trials 2022, 2023

- Populations include:
  - 324 interspecific lines (common bean/tepary)
  - 12 tepary lines

Field trials 2022, 2023

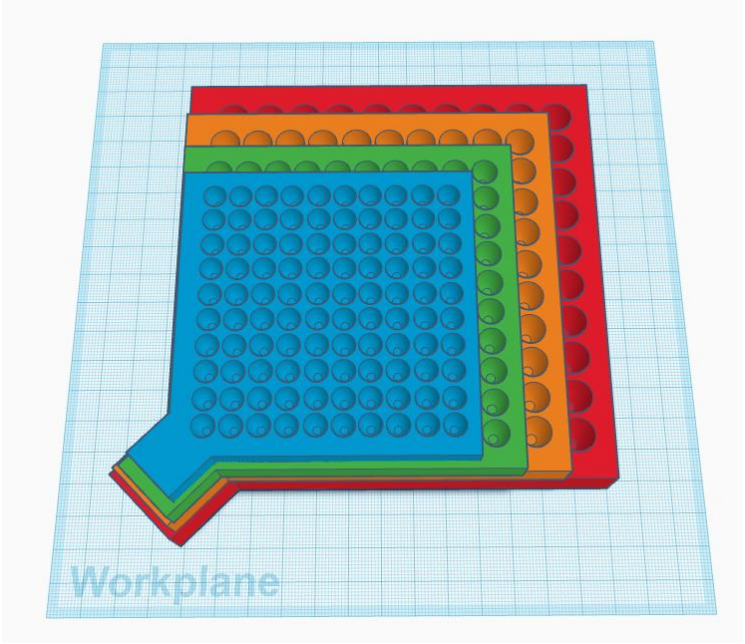
- Field environments: contrasting day and night time temperatures
  - Davis, CA ; cooler environment
  - Parlier, CA; heat stress environment (Kearney)



Traits being assayed manually

for genetic analysis and for trait predictions from sensors

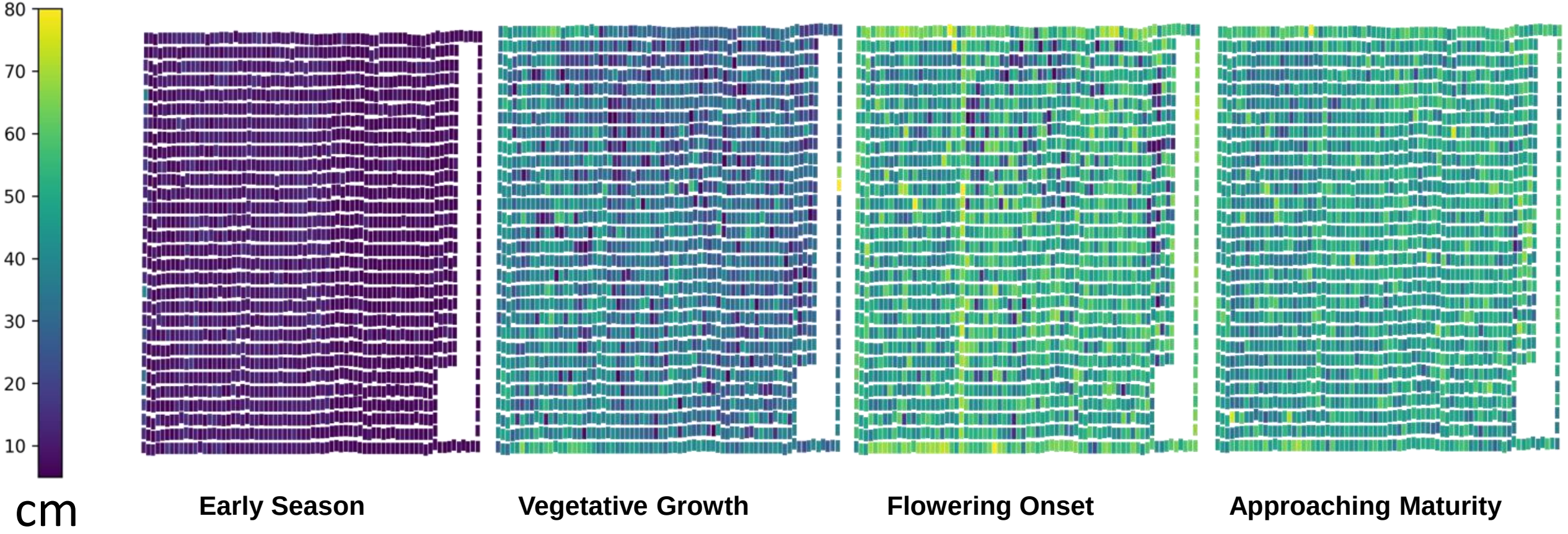
- In-field phenotypes
  - Stand count
  - Flowering time
  - Plant height
  - Yield



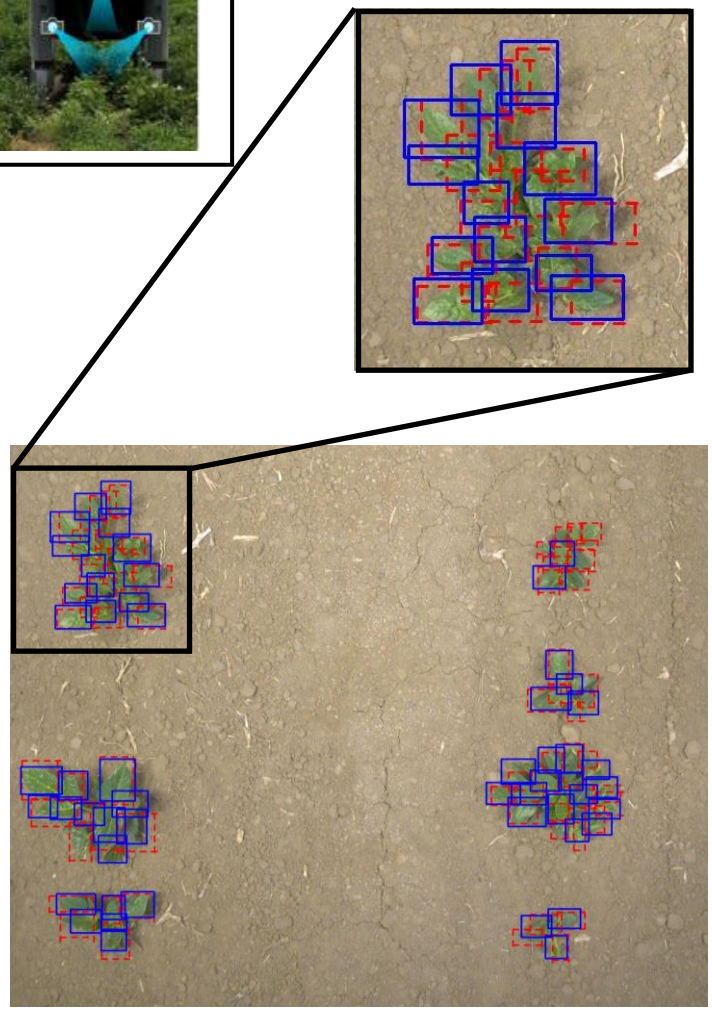
- After harvest
  - 100-seed weight
  - Seed protein, fat, starch, total phenolics, moisture
  - Seed mineral nutrients (focus on Fe, Zn, and Ca)
  - Anti-nutrients (phytic acid)
  - Seed coat color/patterning
  - Cooking time: Dr. Karen Cichy and team

Traits being assayed from drone platform

Plant height



Traits being assayed from rover platform



Leaf Detection

Observed: 66 | Predicted: 54

Pod Detection

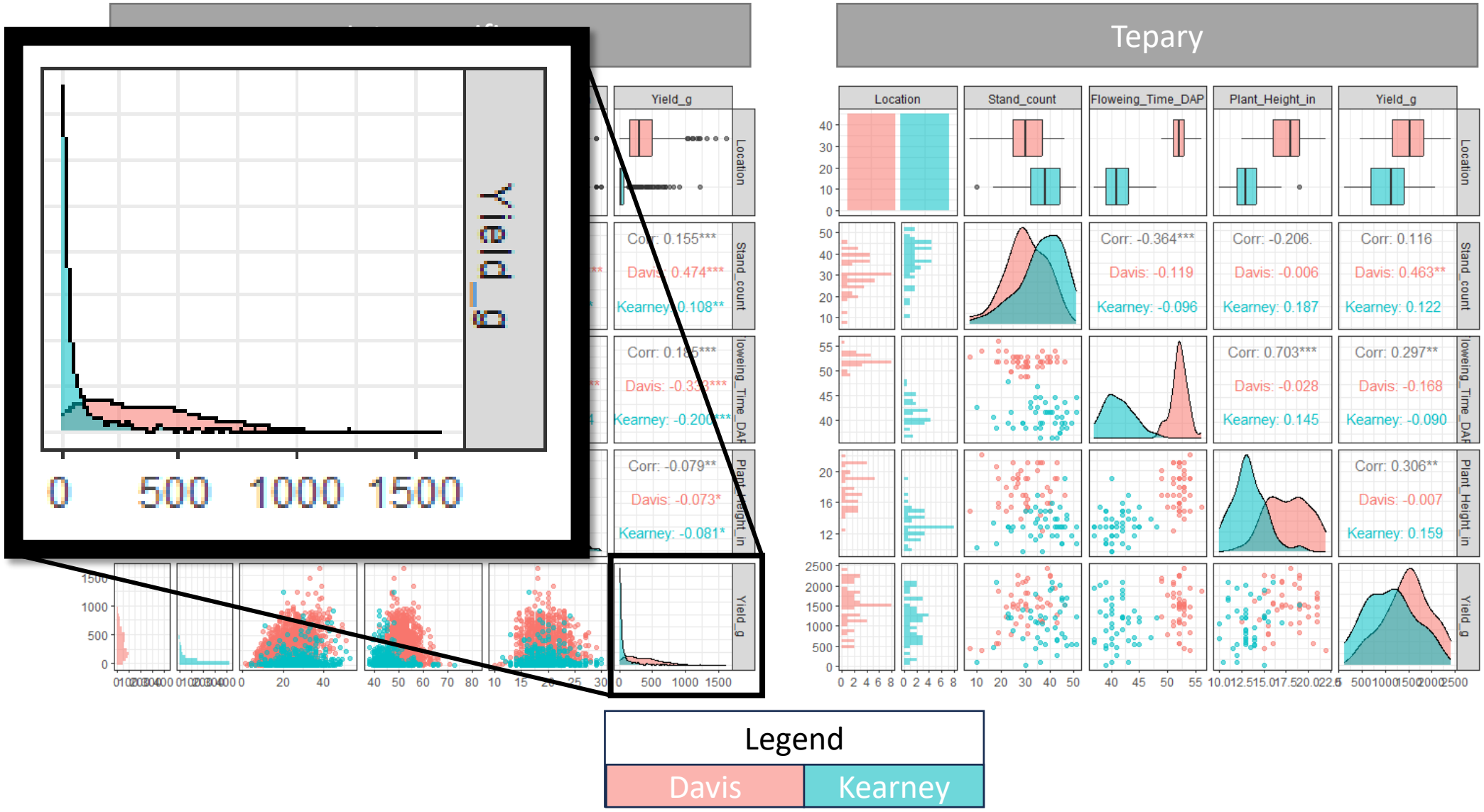
Observed: 11 | Predicted: 8

Flower Detection

Observed: 18 | Predicted: 23

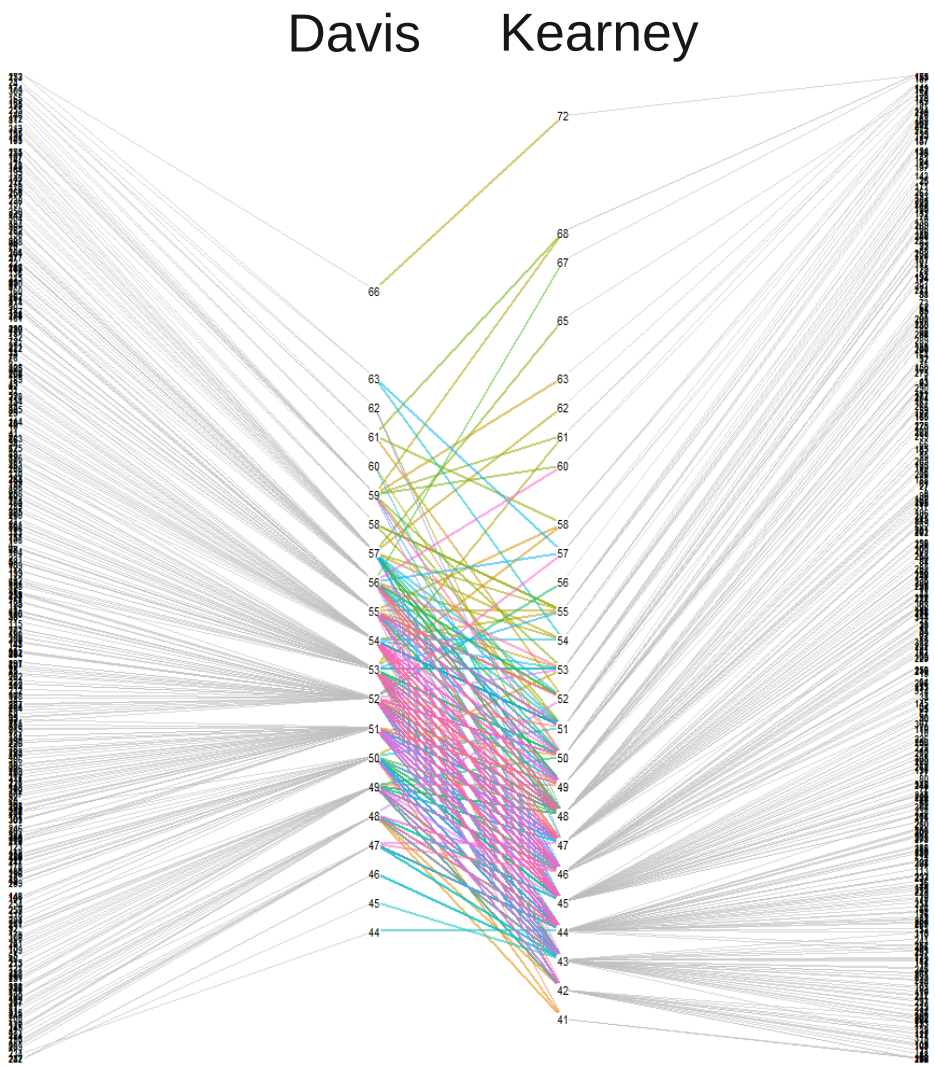
Legend: Observed | Predicted

Agronomic trait correlations (2022)

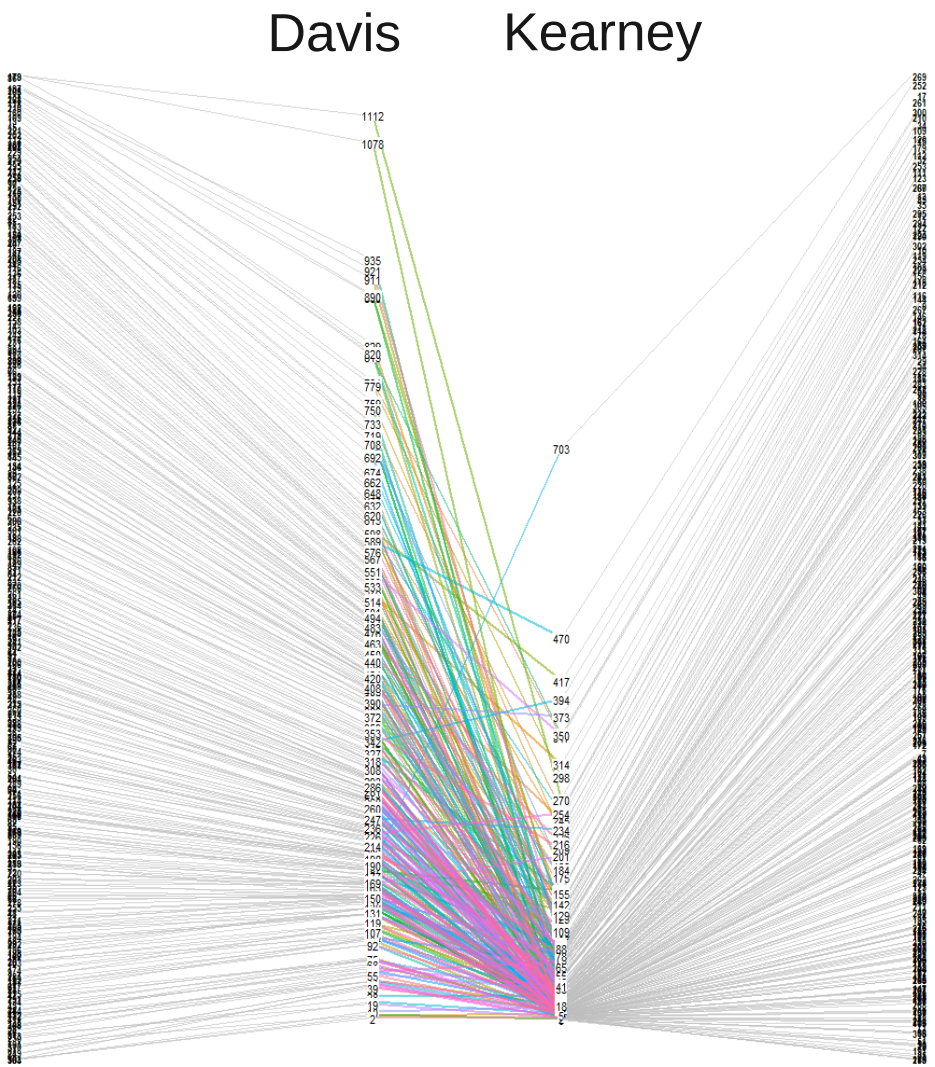


Slope graph (genotype performance across locations, 2022)

Flowering Time DAP

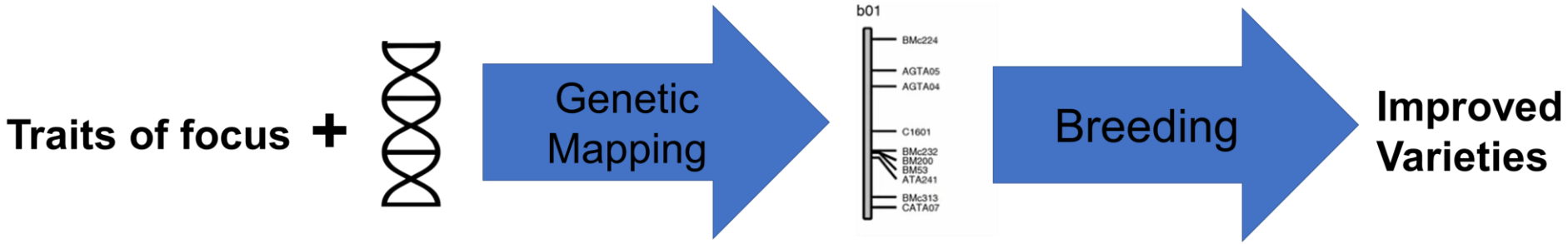


Yield



Planned analyses and outcomes

- Genetic mapping (uncover genetic regions that control priority traits)
- Genetic-by-environment interactions (how do we expect performance to vary across California environments)
- Build easier methods to predict or measure priority traits
- Accelerate breeding efforts (e.g., heat-tolerant common bean) by integrating genomics, crop modeling and sensing



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Thank you!

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