Genomics Update

4th International Kernza Conference

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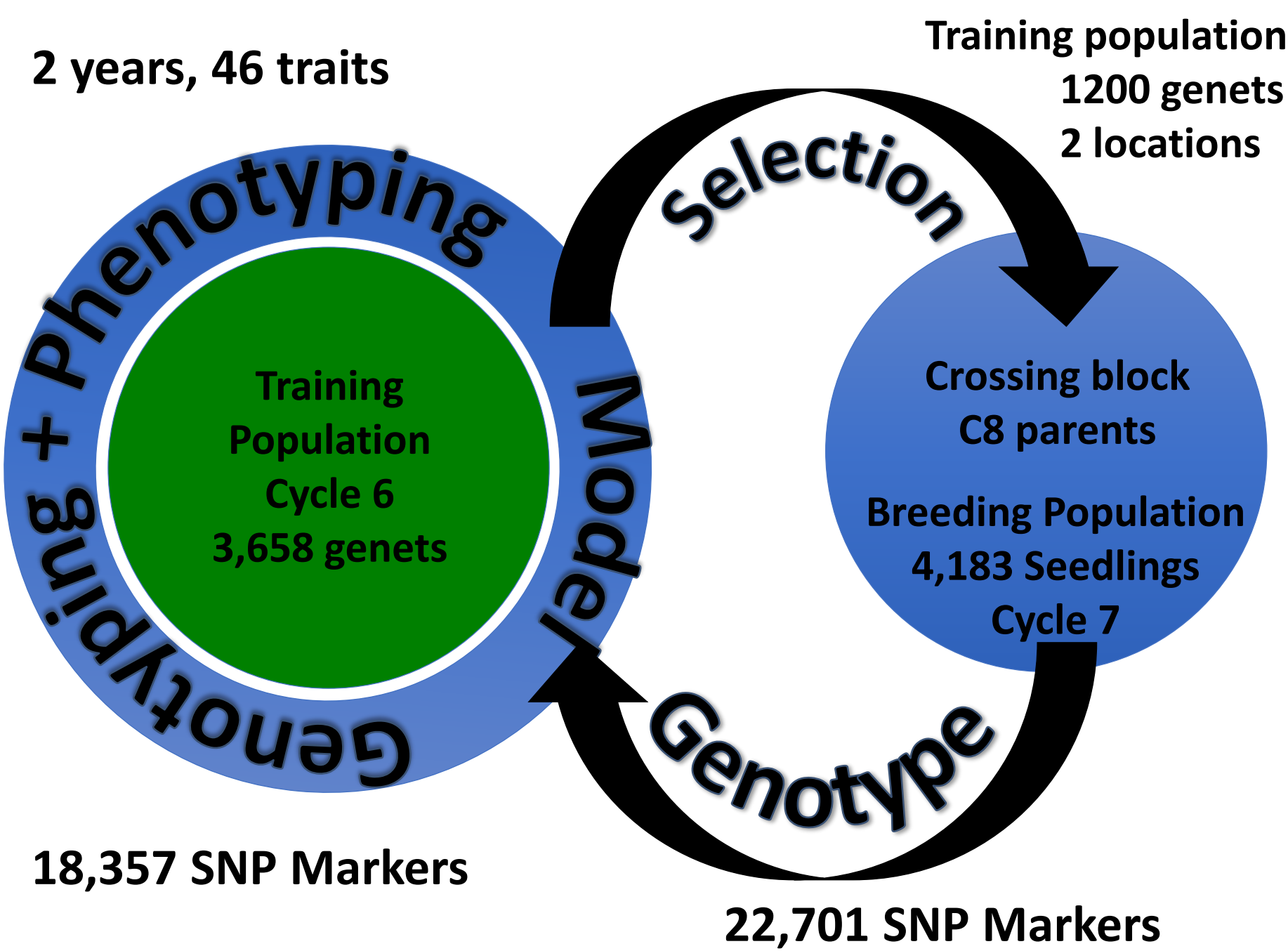
KANSAS STATE UNIVERSITY

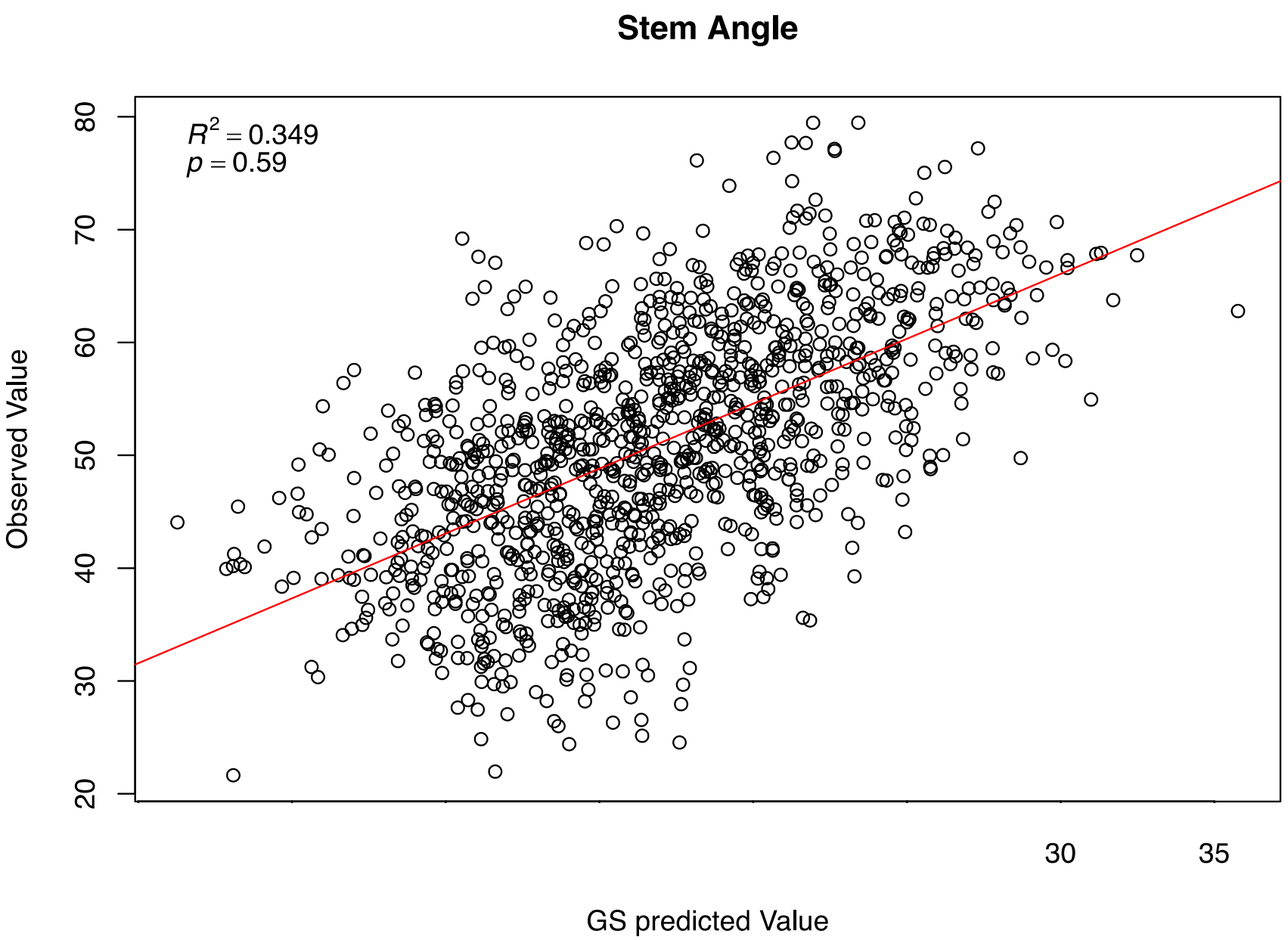
THE LAND INSTITUTE

Malone Family Land Preservation Foundation

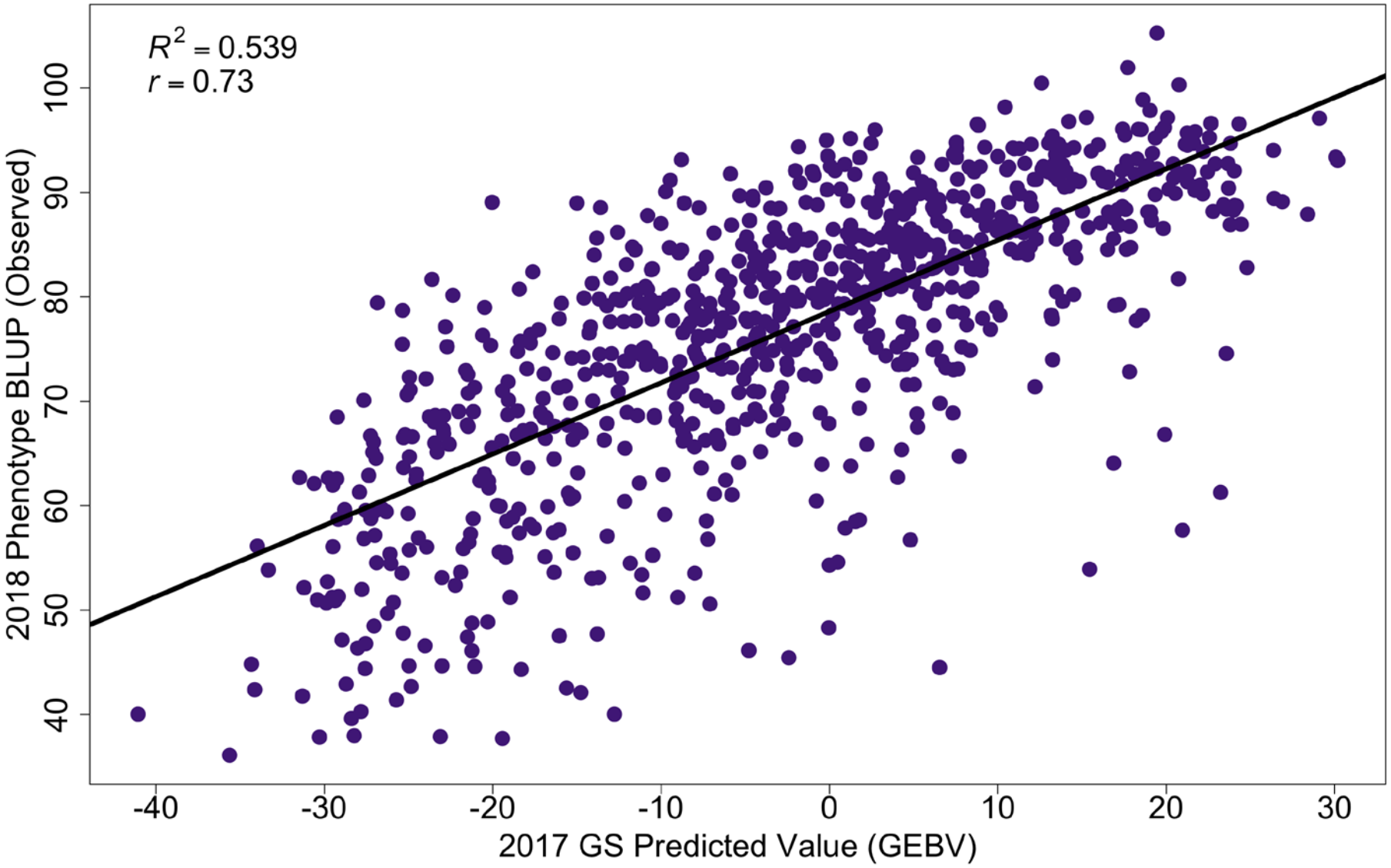
Genomics Update

- Cycle 7 GS Results and Future Direction
- Current Status of Genome Assembly
- Paternity Analysis

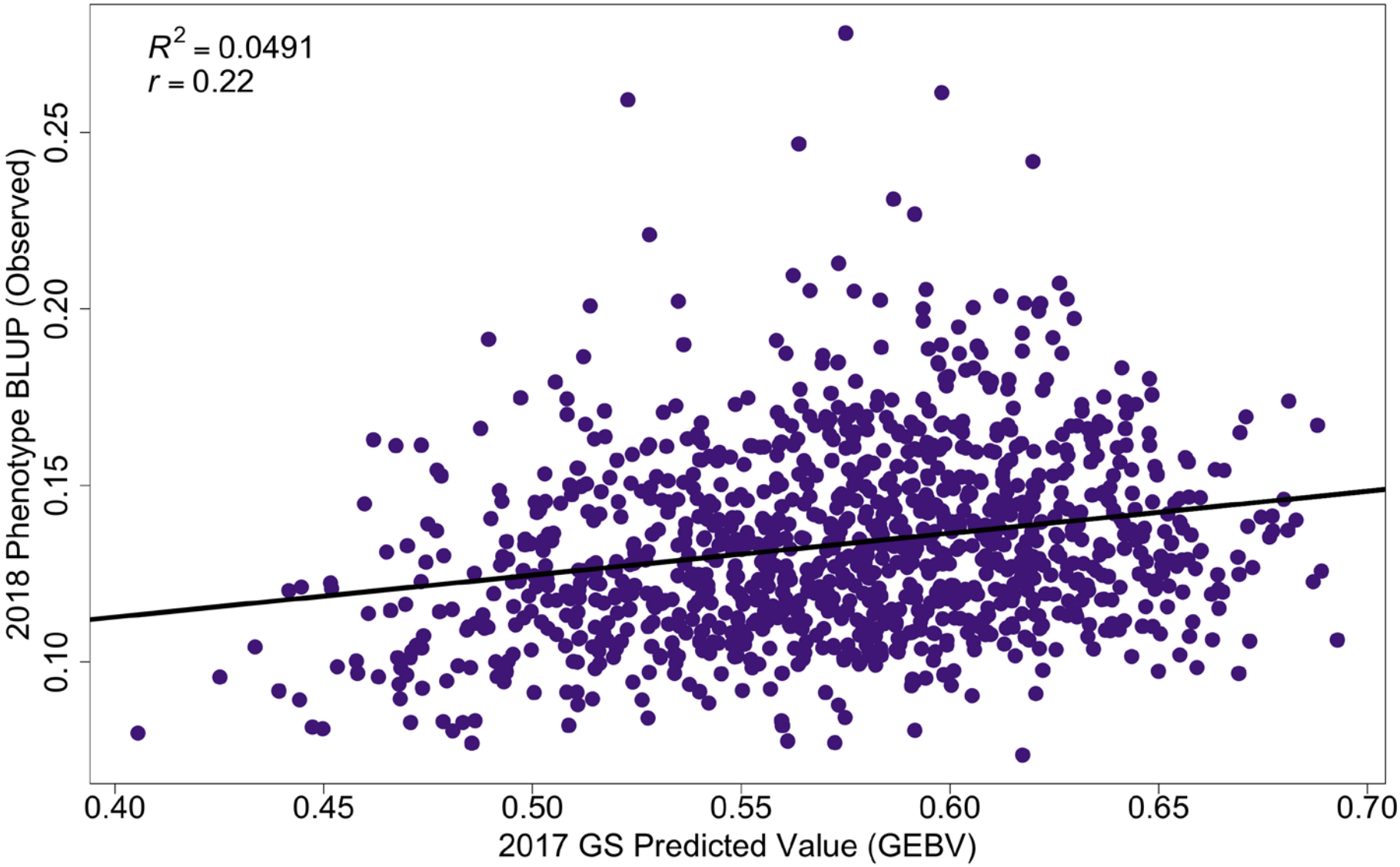

2 years, 46 traits
Training population:
1200 genets
2 locations
Genotyping + Phenotyping
Model
Selection
Training
Population
Cycle 6
3,658 genets
Crossing block
C8 parents
Breeding Population
4,183 Seedlings
Cycle 7
Genotype
18,357 SNP Markers
22,701 SNP Markers


Stem Angle
$R^2 = 0.349$
$p = 0.59$
Observed Value
GS predicted Value
20
30
40
50
60
70
80
30
35

Free Threshing 2018

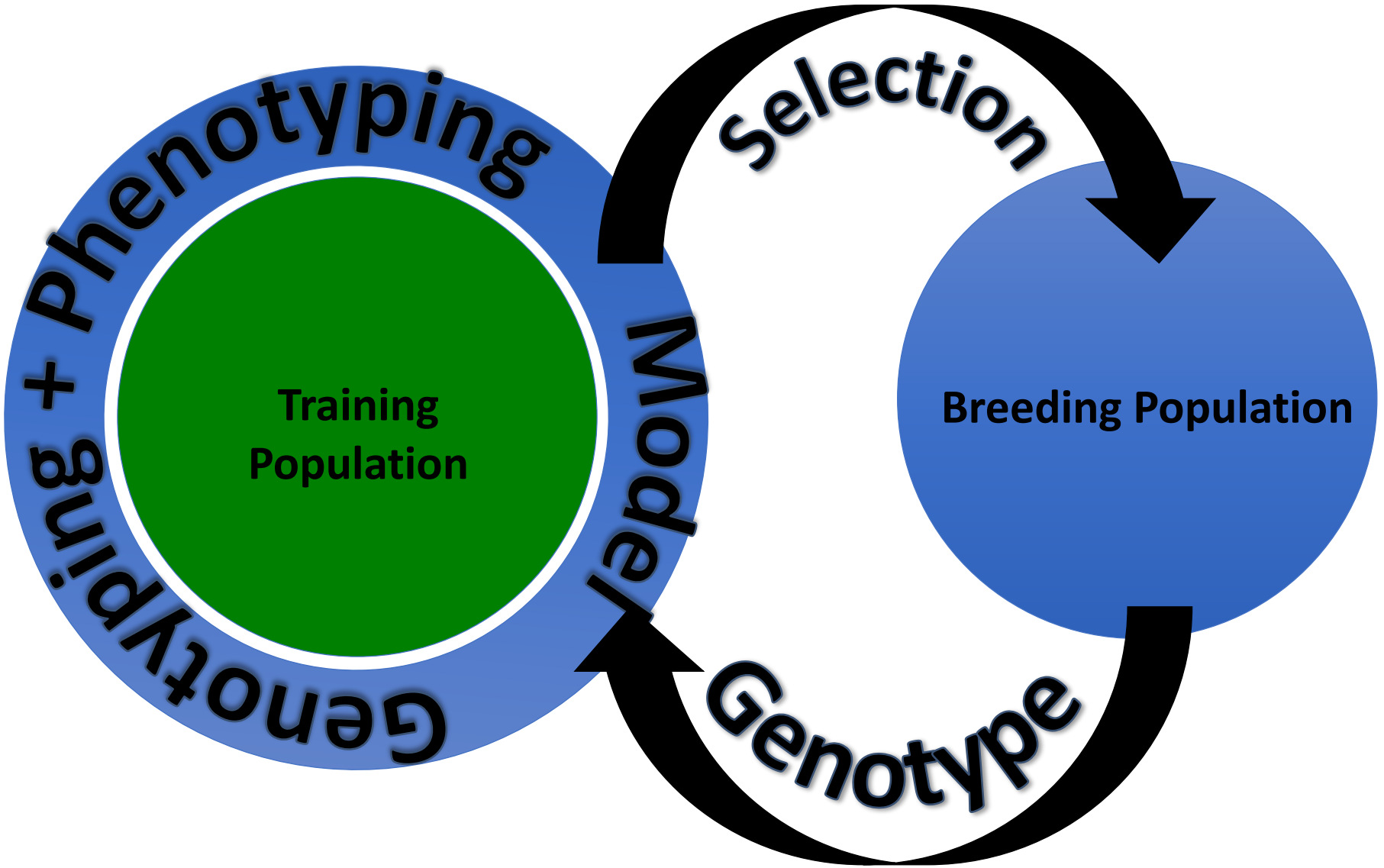


Spike Yield 2018

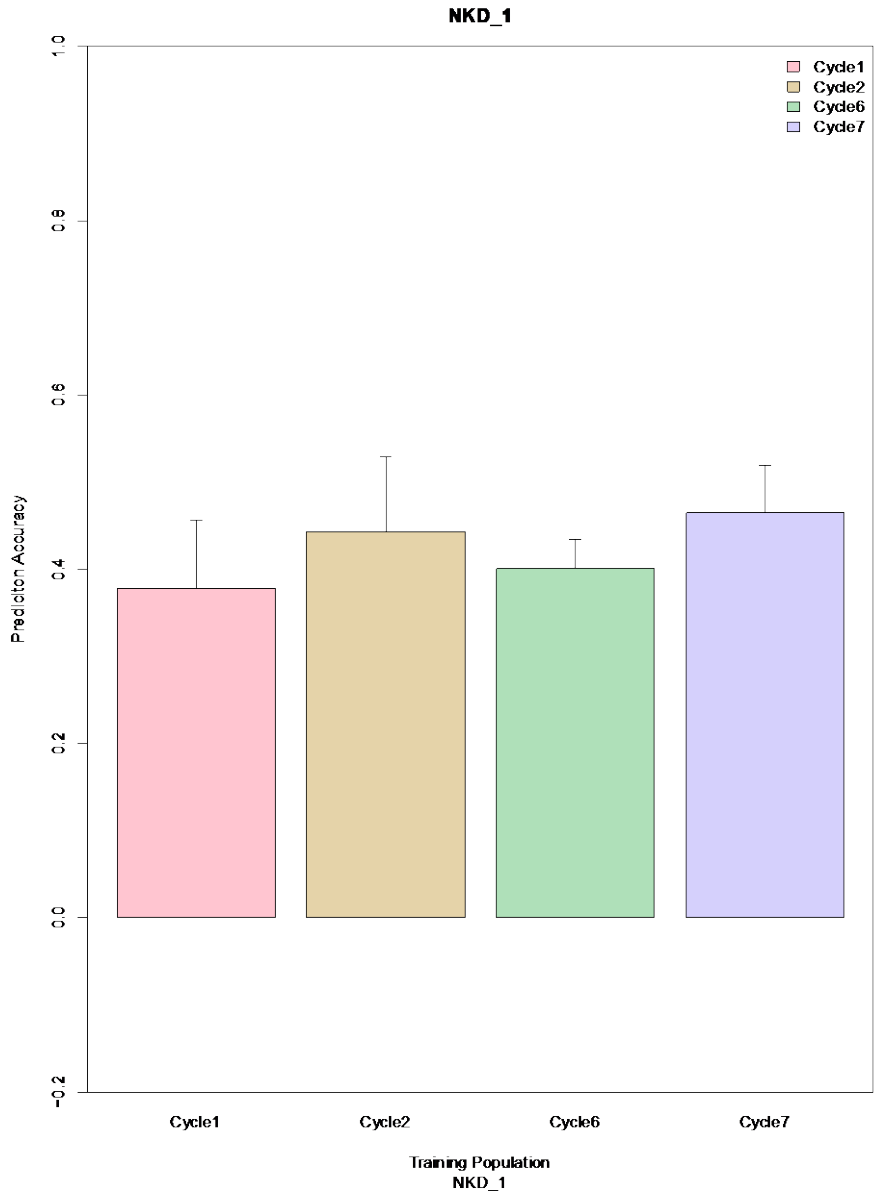


Traits 2018

Trait	h^2	r
Free Threshing	0.36	0.73
Shattering	0.65	0.71
Seed Length	0.72	0.68
Plant Height	0.48	0.59
Stem Angle	0.58	0.59
Spikelets per Head	0.21	0.57
Milligrams per Seed	0.53	0.55
Maturity	0.63	0.54
Percent Fertility	0.48	0.50
Seeds per Head	0.44	0.45
Seed Density	0.66	0.31
Spike Yield in grams	0.40	0.22
Florets per Spike	0.24	0.14

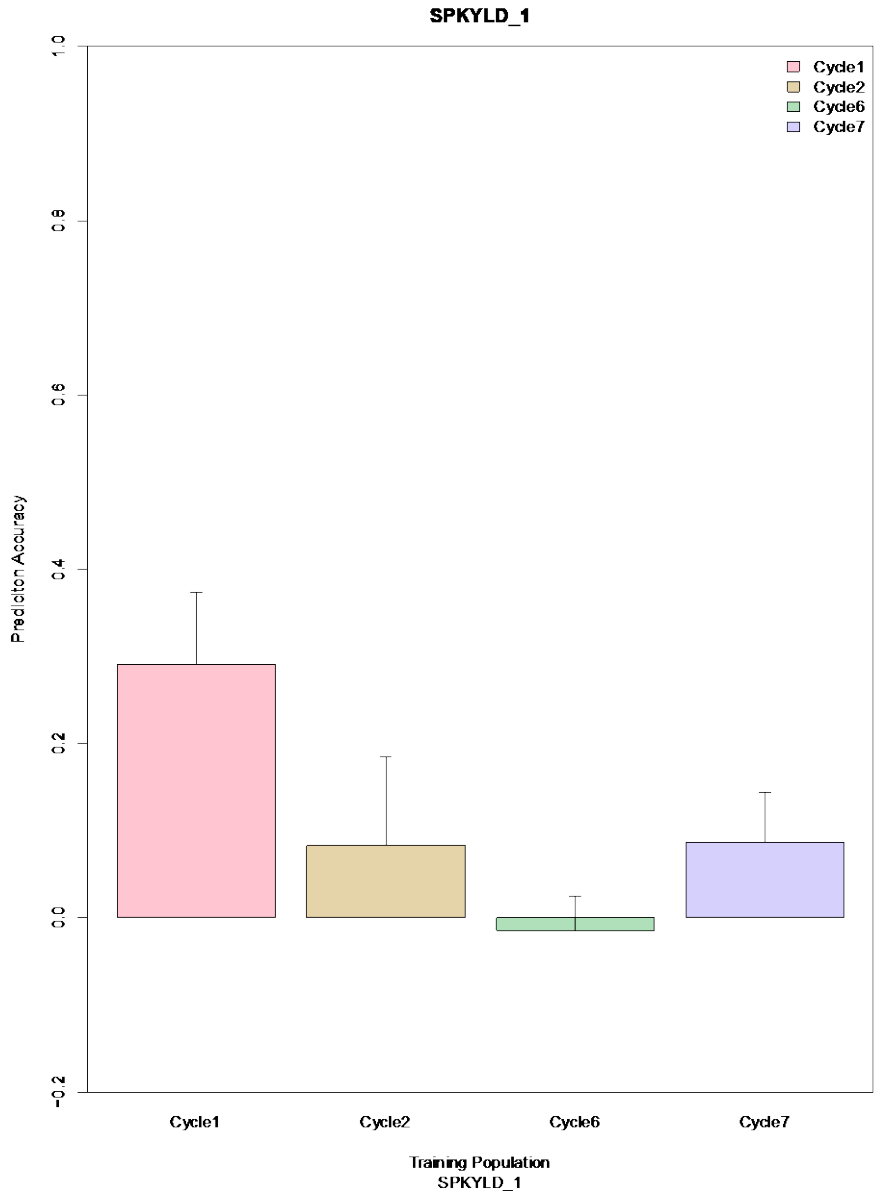

Genotyping + Phenotyping
Model
Training Population
Selection
Breeding Population
Genotype

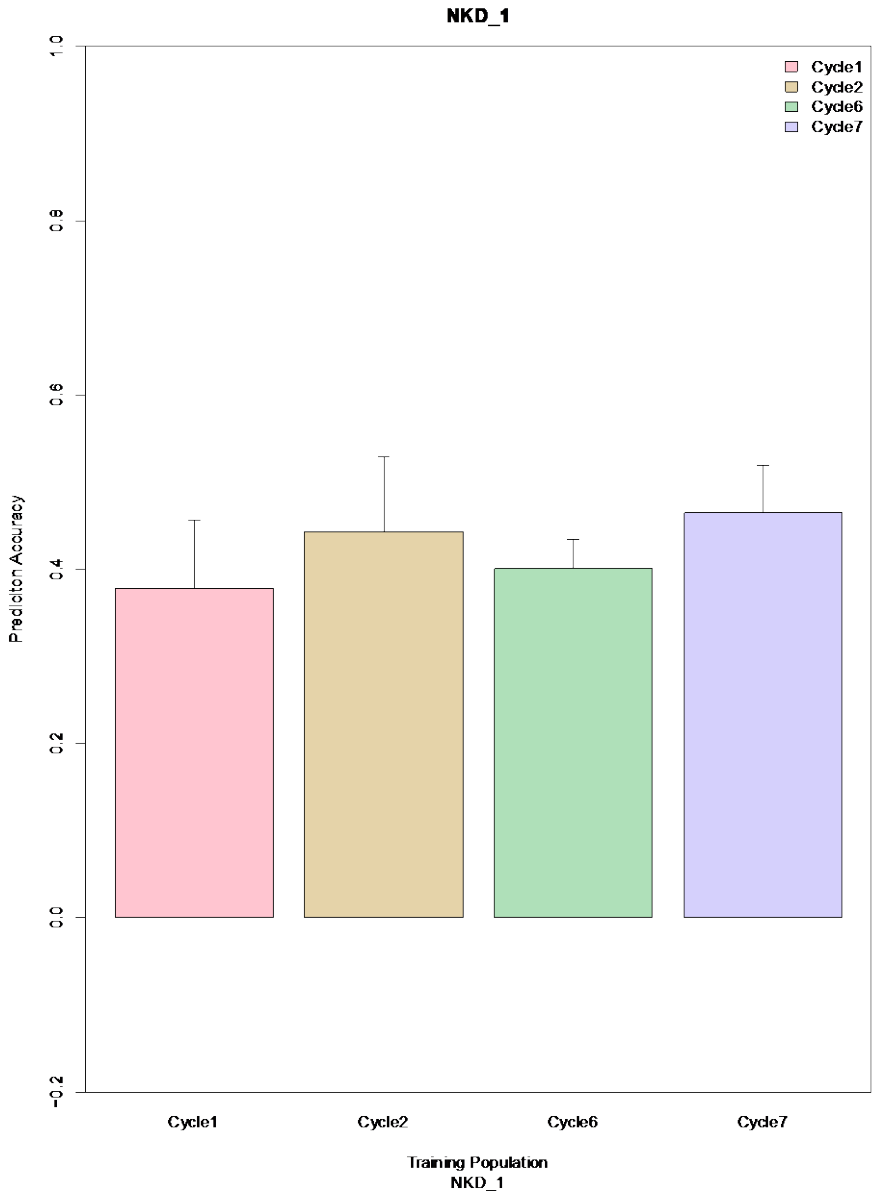
IWG Breeding Programs

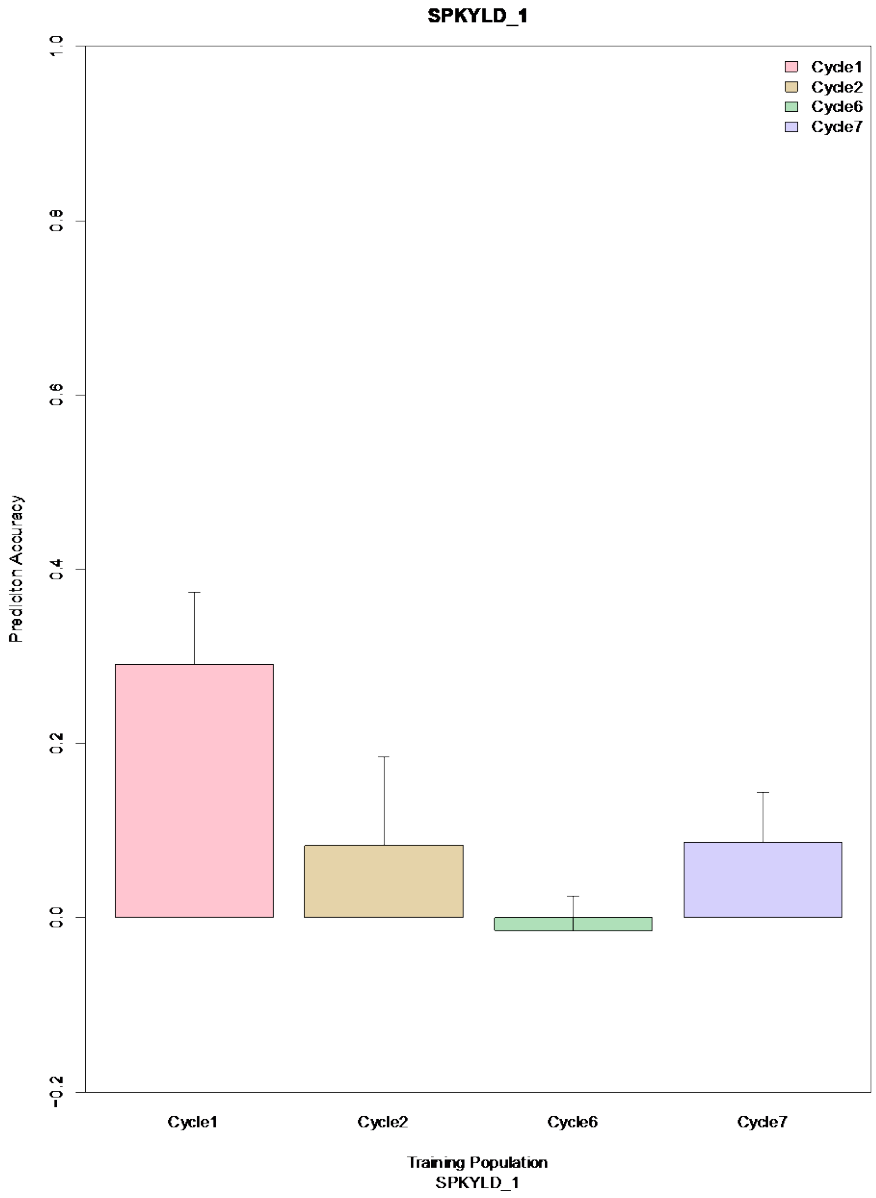


Cycle 1 & 2 UMN
Cycle 6 & 7 TLI

Using all other cycles as training population to predict each cycle—Cycle 2, 6, & 7 form the training population to predict Cycle 1.


SPKYLD_1
Cycle1
Cycle2
Cycle6
Cycle7
Prediction Accuracy
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
Cycle1
Cycle2
Cycle6
Cycle7
Training Population
SPKYLD_1


NKD_1
Cycle1
Cycle2
Cycle6
Cycle7
Prediction Accuracy
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
Cycle1
Cycle2
Cycle6
Cycle7
Training Population
NKD_1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Cycle7
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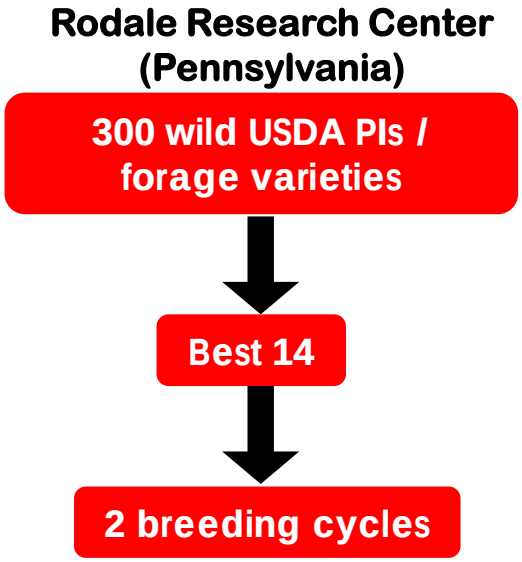
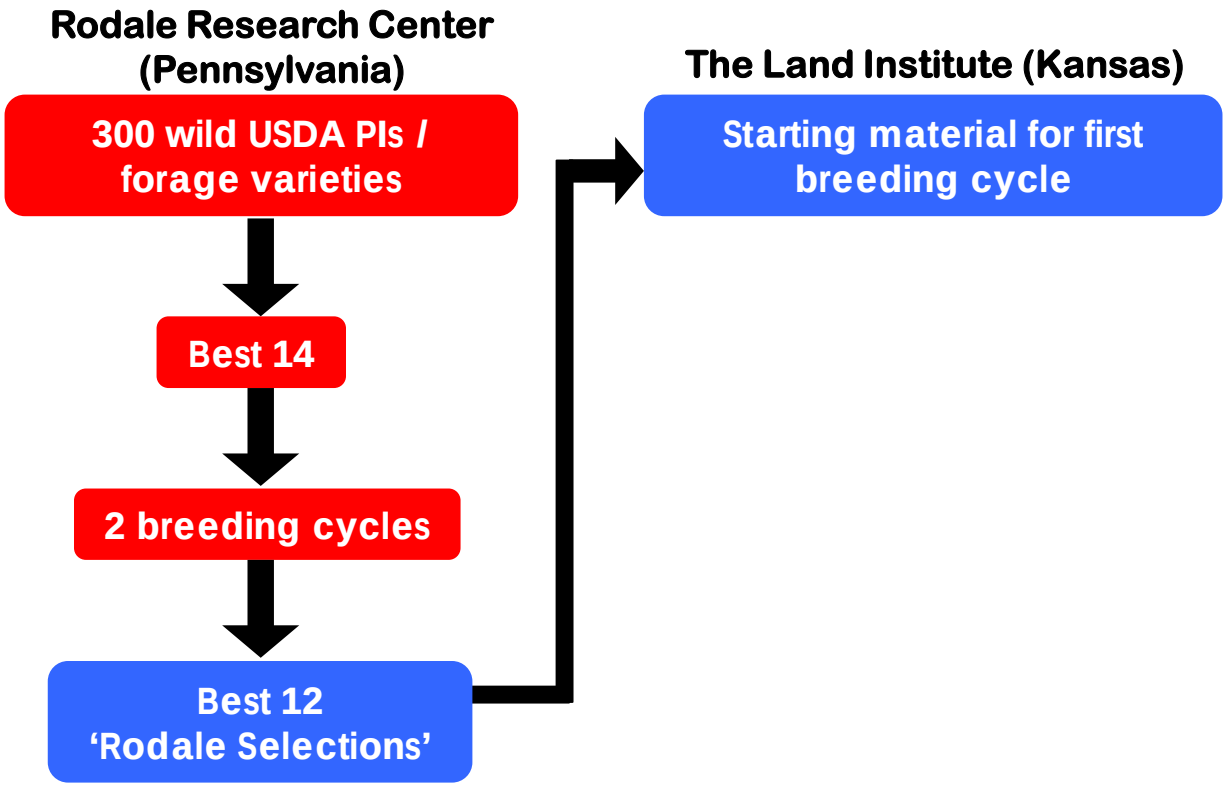
Genomic effects of neo-domestication



Slide by Kevin Dorn

Genomic effects of neo-domestication



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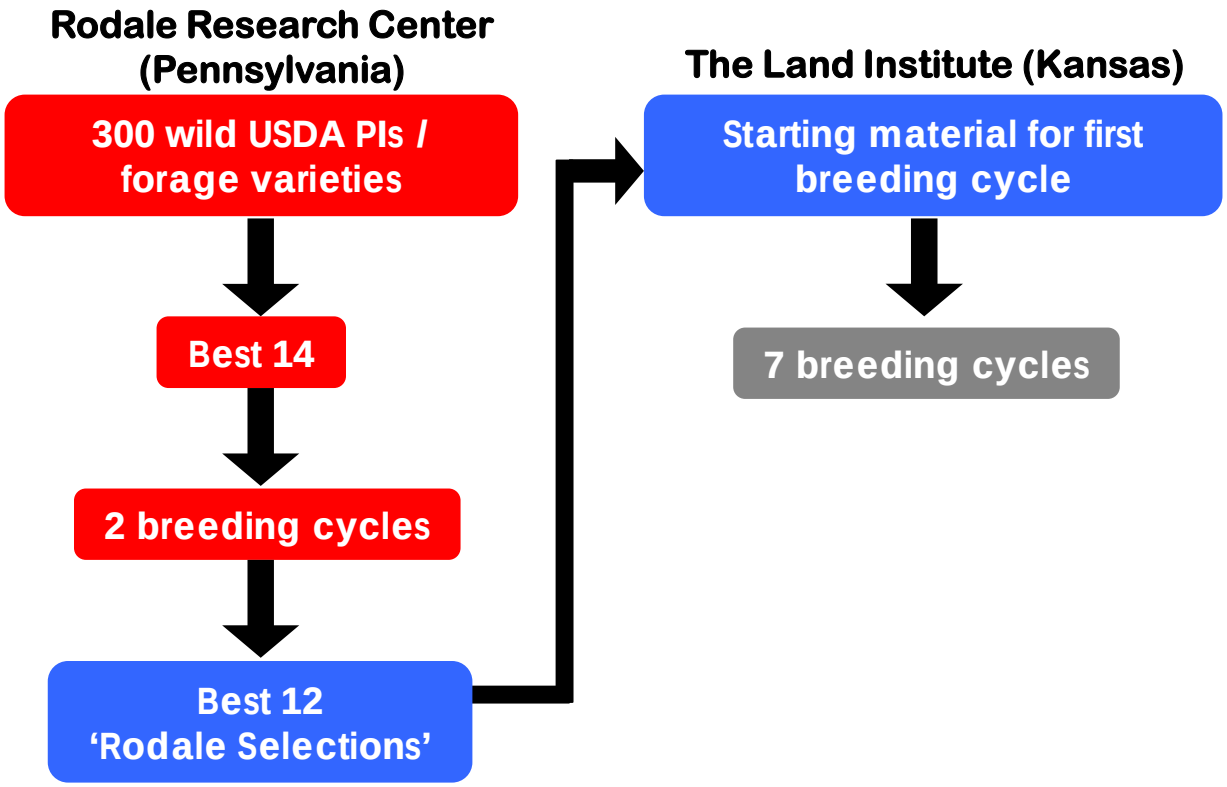


Slide by Kevin Dorn

Genomic effects of neo-domestication

Kernza domestication genomics

Rodale Research Center (Pennsylvania)

300 wild USDA PIs / forage varieties

↓

Best 14

↓

2 breeding cycles

↓

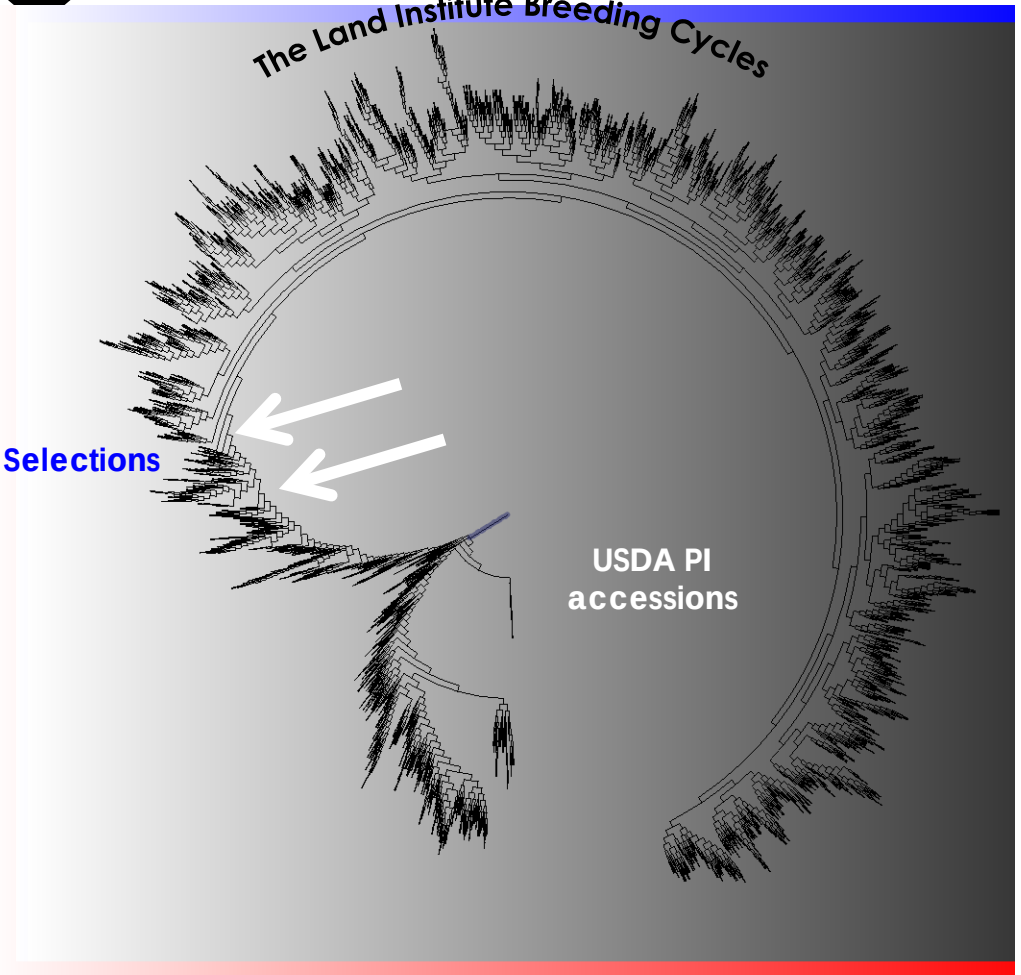
Best 12 'Rodale Selections'

The Land Institute (Kansas)

Starting material for first breeding cycle

↓

7 bree



Genotyping (via GBS) of
TLI Cycles 5-7 +
Rodale Selections +
USDA PI accessions

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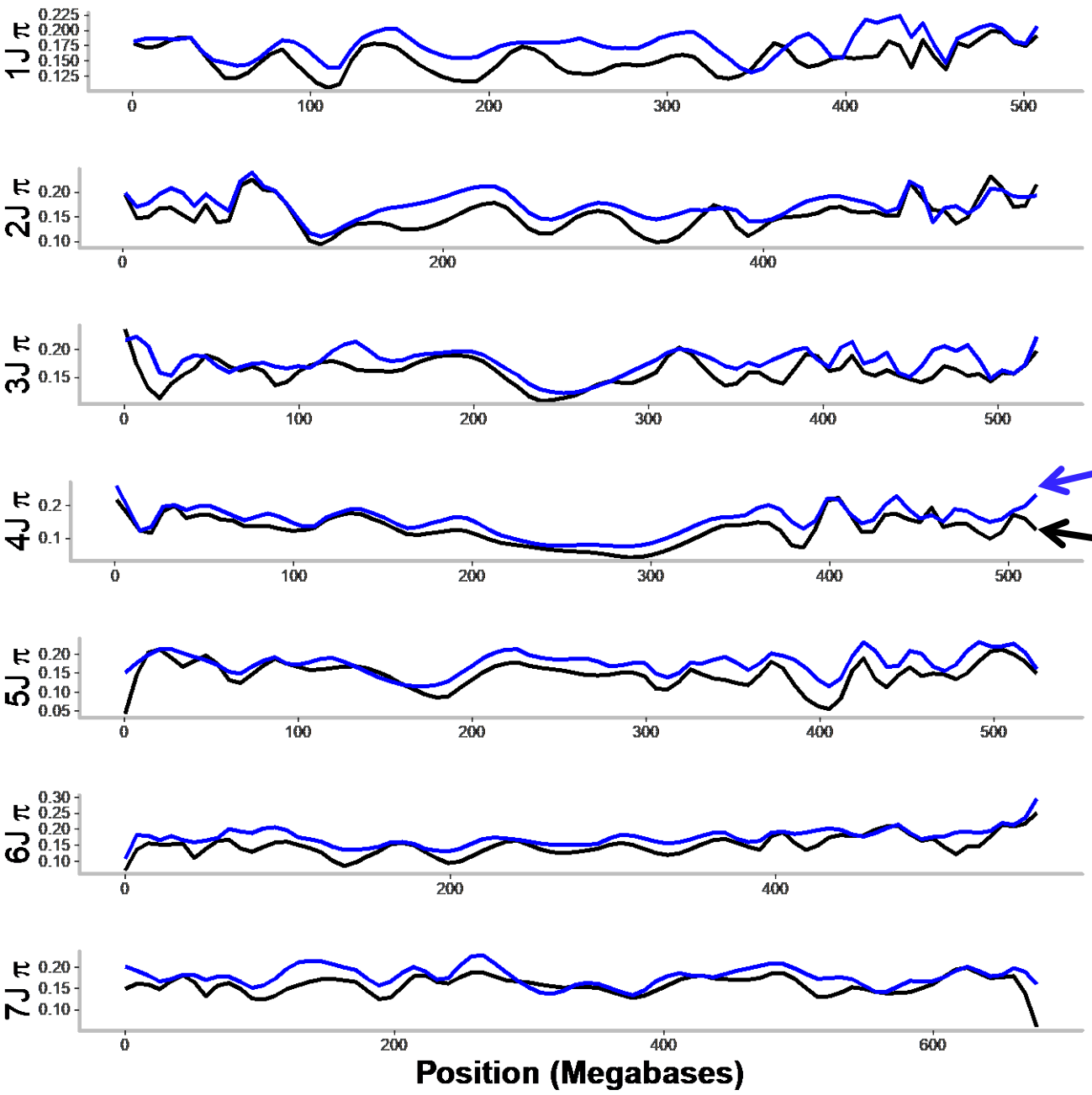
Genomic effects of neo-domestication - π



Genome-wide reductions in nucleotide diversity across the genome

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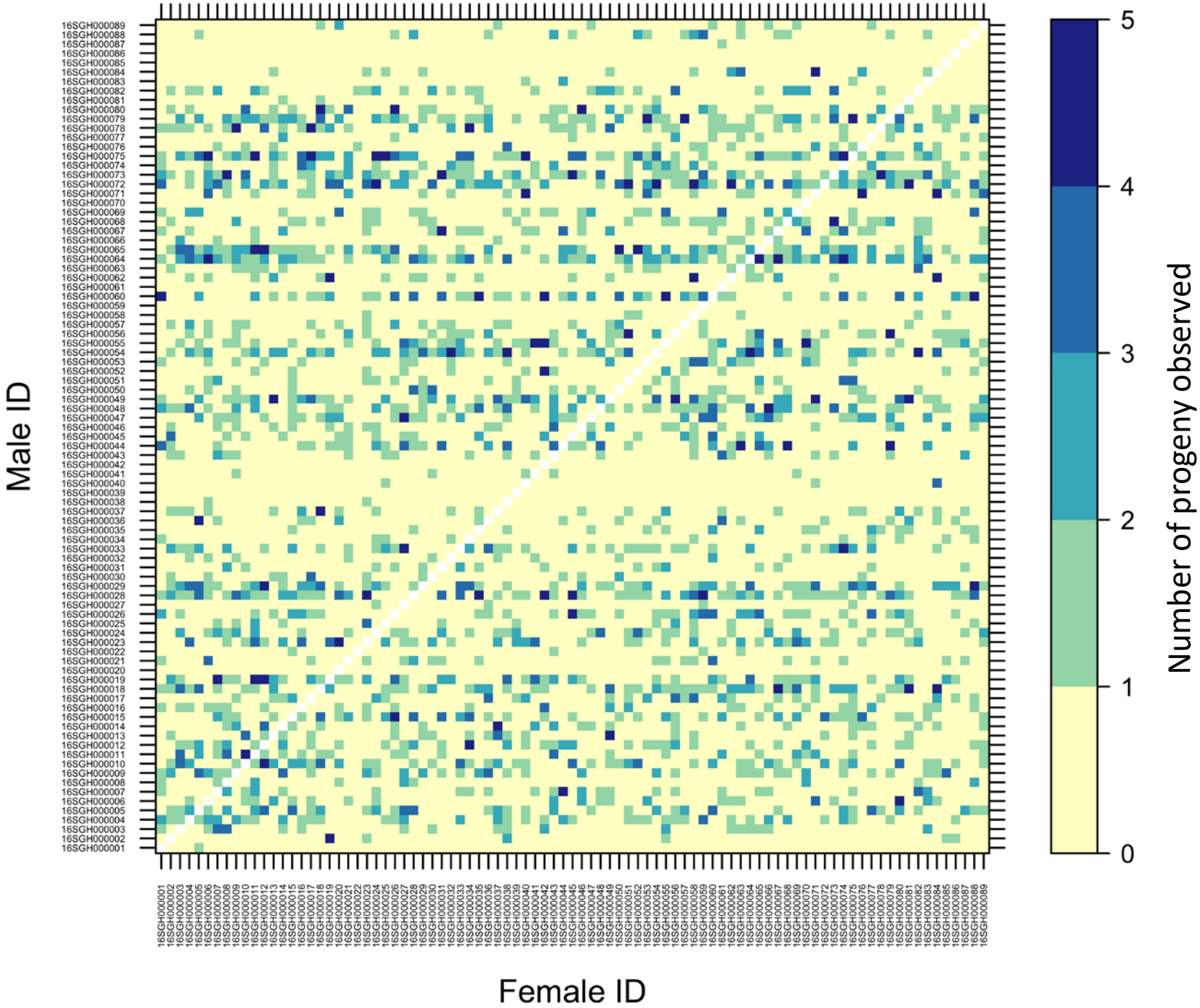
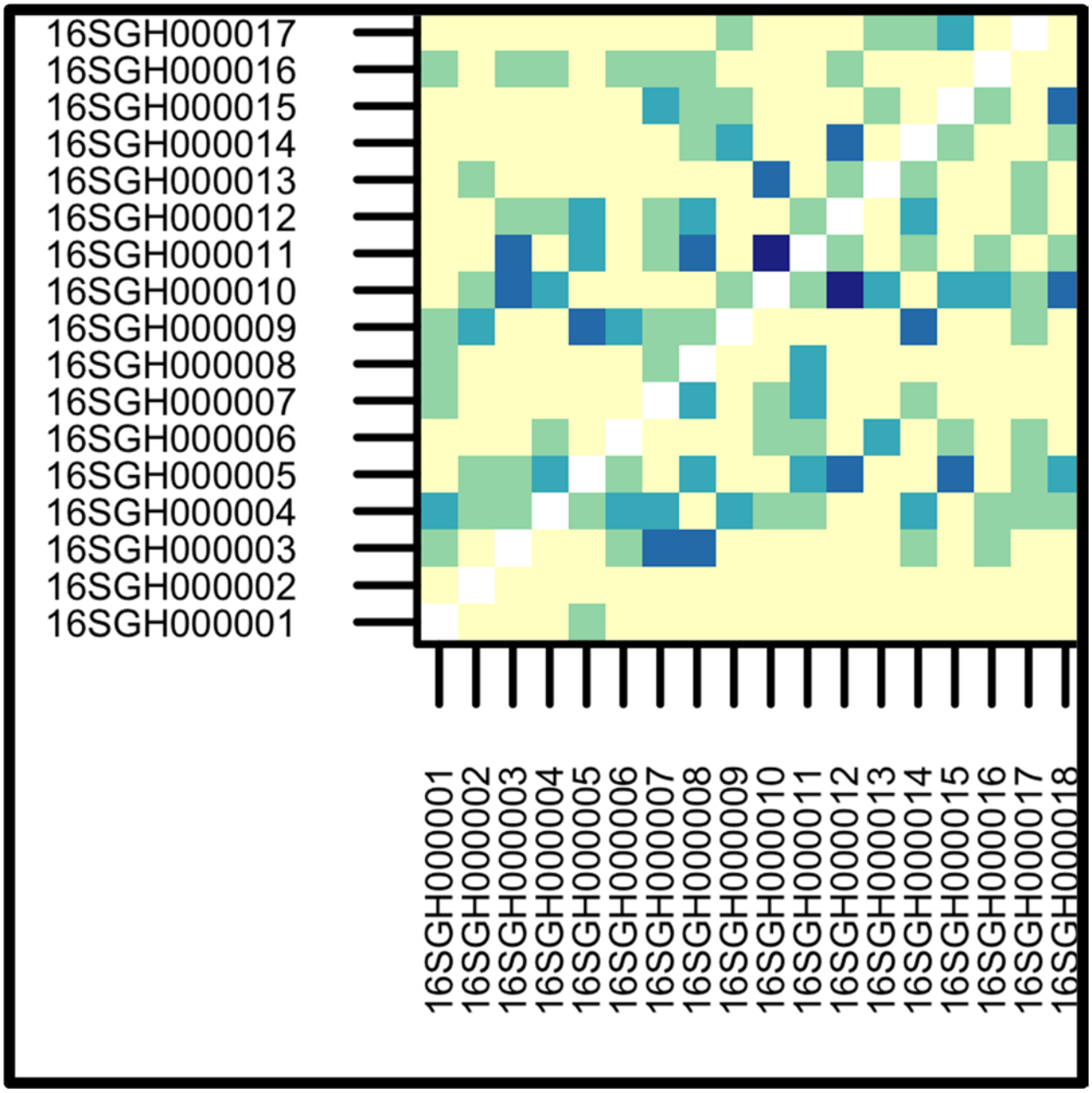

Male ID
Female ID
Number of progeny observed
0
1
2
3
4
5


16SGH000017
16SGH000016
16SGH000015
16SGH000014
16SGH000013
16SGH000012
16SGH000011
16SGH000010
16SGH000009
16SGH000008
16SGH000007
16SGH000006
16SGH000005
16SGH000004
16SGH000003
16SGH000002
16SGH000001
16SGH000001
16SGH000002
16SGH000003
16SGH000004
16SGH000005
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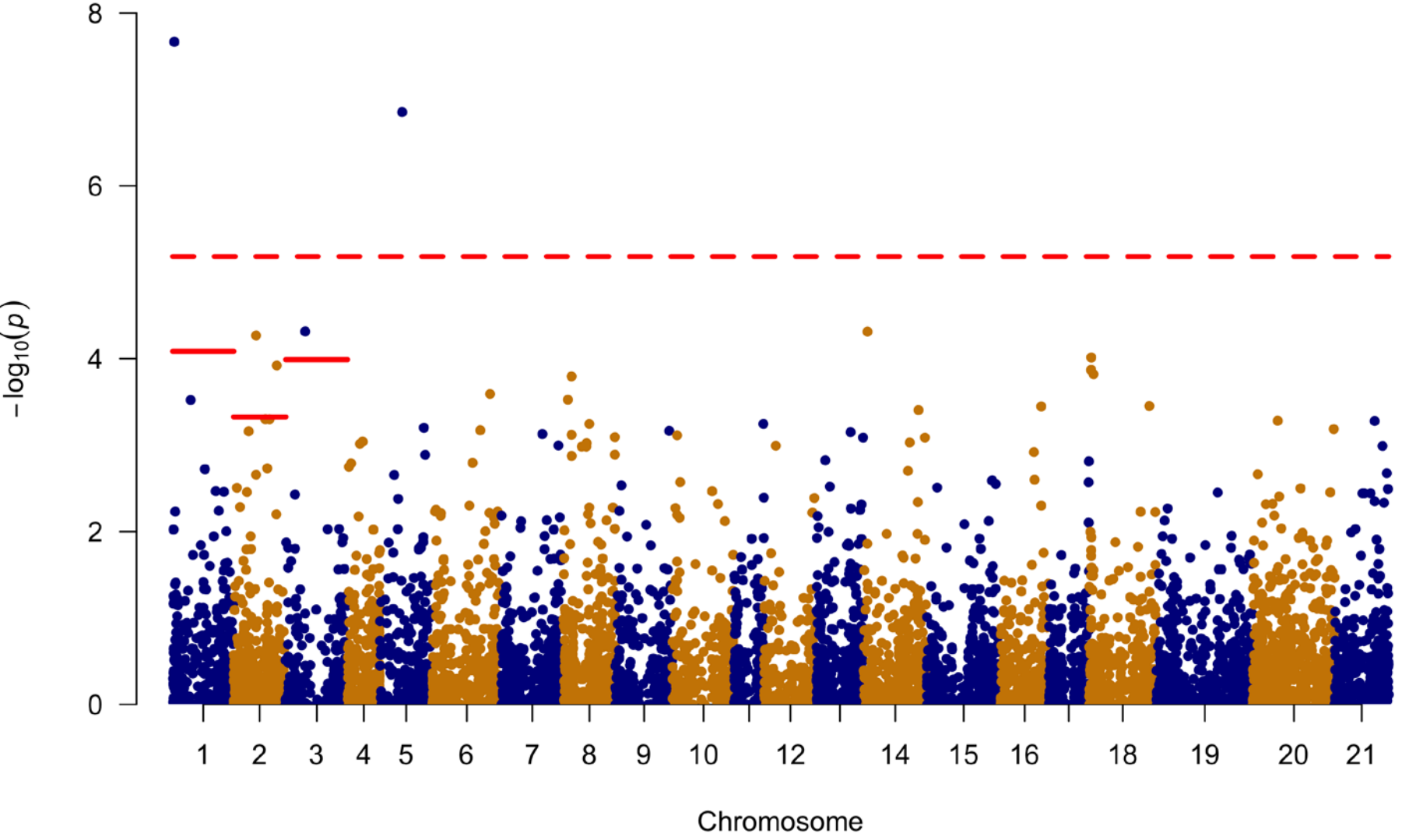
16SGH000016
16SGH000017
16SGH000018

GWAS of Progeny Combinations



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Forever Green

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