Effect of planting date, latitude and environmental factors on the choice of maturity group in mid-south soybean production

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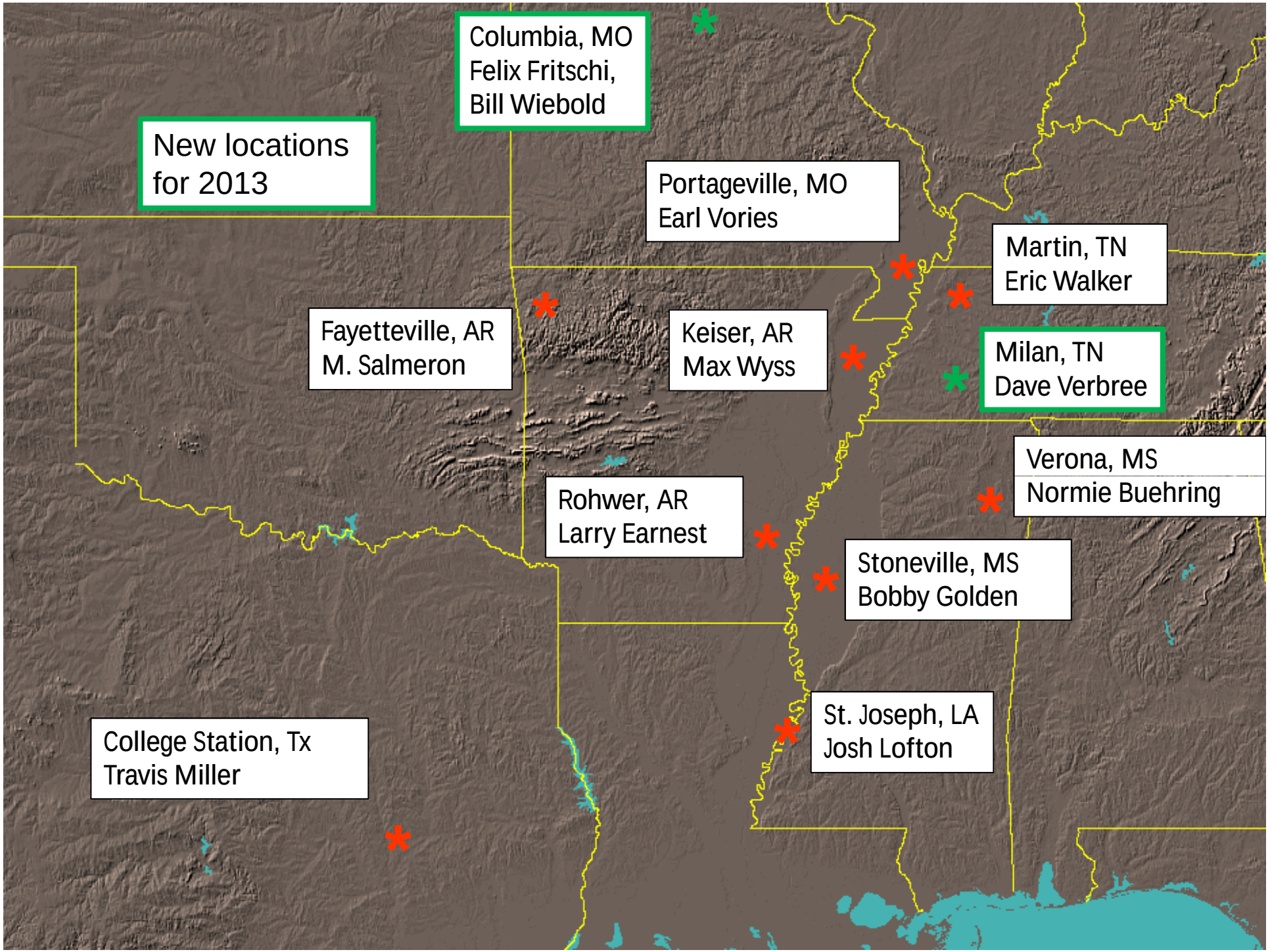
DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

- Brief description of research
- Preliminary results
  - Yield
  - Phenology
  - Seed quality
- Next steps and conclusions

Goals of this research:

- Determine best MG for any date at any latitude
- Predict development stages for MGs when planted at different dates
- Characterize production concerns and seed quality over the range of MGs and planting dates


Columbia, MO
Felix Fritschi,
Bill Wiebold
New locations
for 2013
Portageville, MO
Earl Vories
Martin, TN
Eric Walker
Fayetteville, AR
M. Salmeron
Keiser, AR
Max Wyss
Milan, TN
Dave Verbree
Verona, MS
Normie Buehring
Rohwer, AR
Larry Earnest
Stoneville, MS
Bobby Golden
St. Joseph, LA
Josh Lofton
College Station, Tx
Travis Miller

At each location:

Four planting dates.

Four maturity groups (3, 4, 5, & 6).

Four varieties within a MG.

Four replications.

All locations irrigated

At all locations, we are measuring:

- Yield
- Seed quality (AA, germ, grade, oil/protein)
- Dates of key developmental stages
- Stand counts, plant height, node number
- Lodging, shattering, green stem

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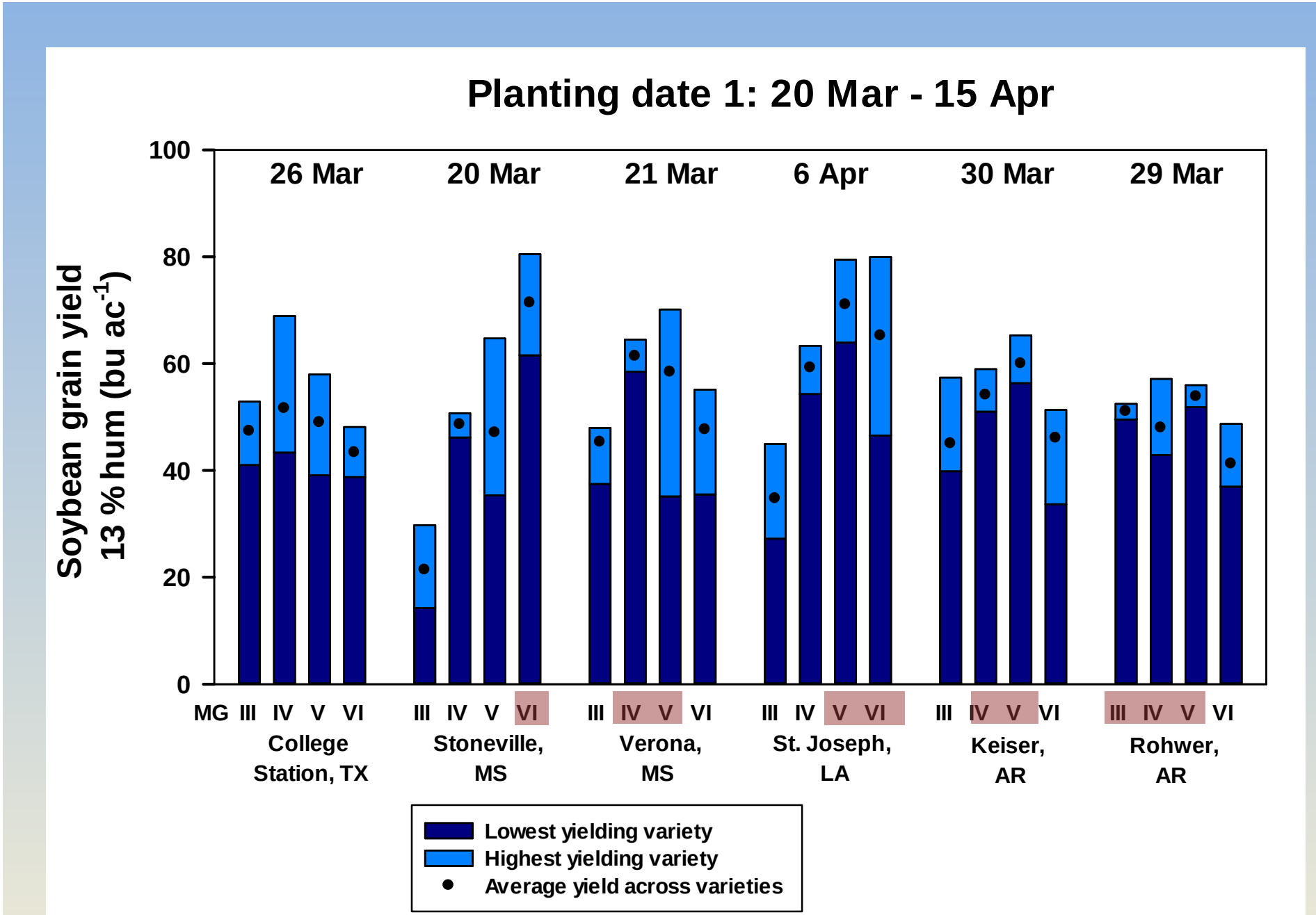
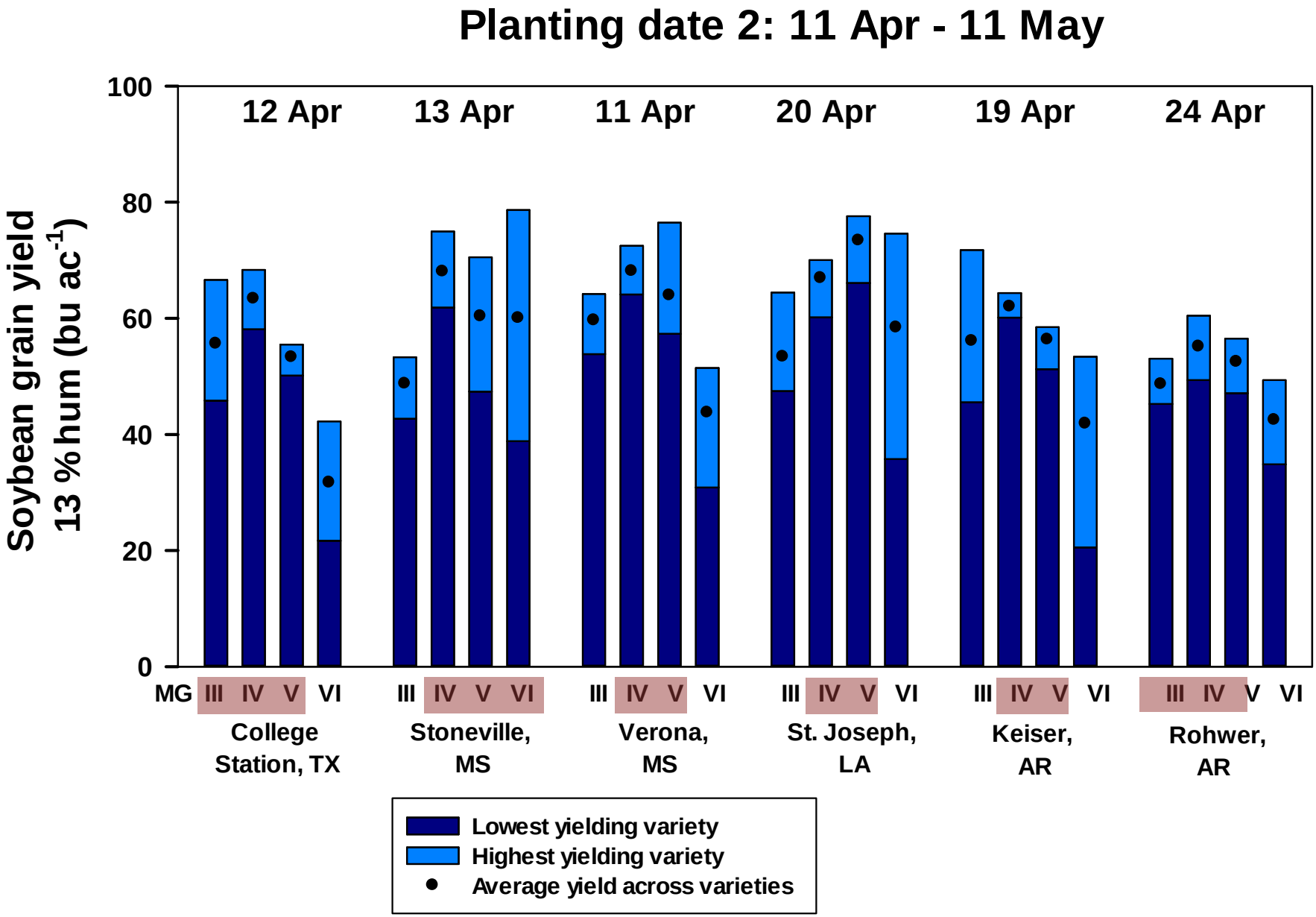
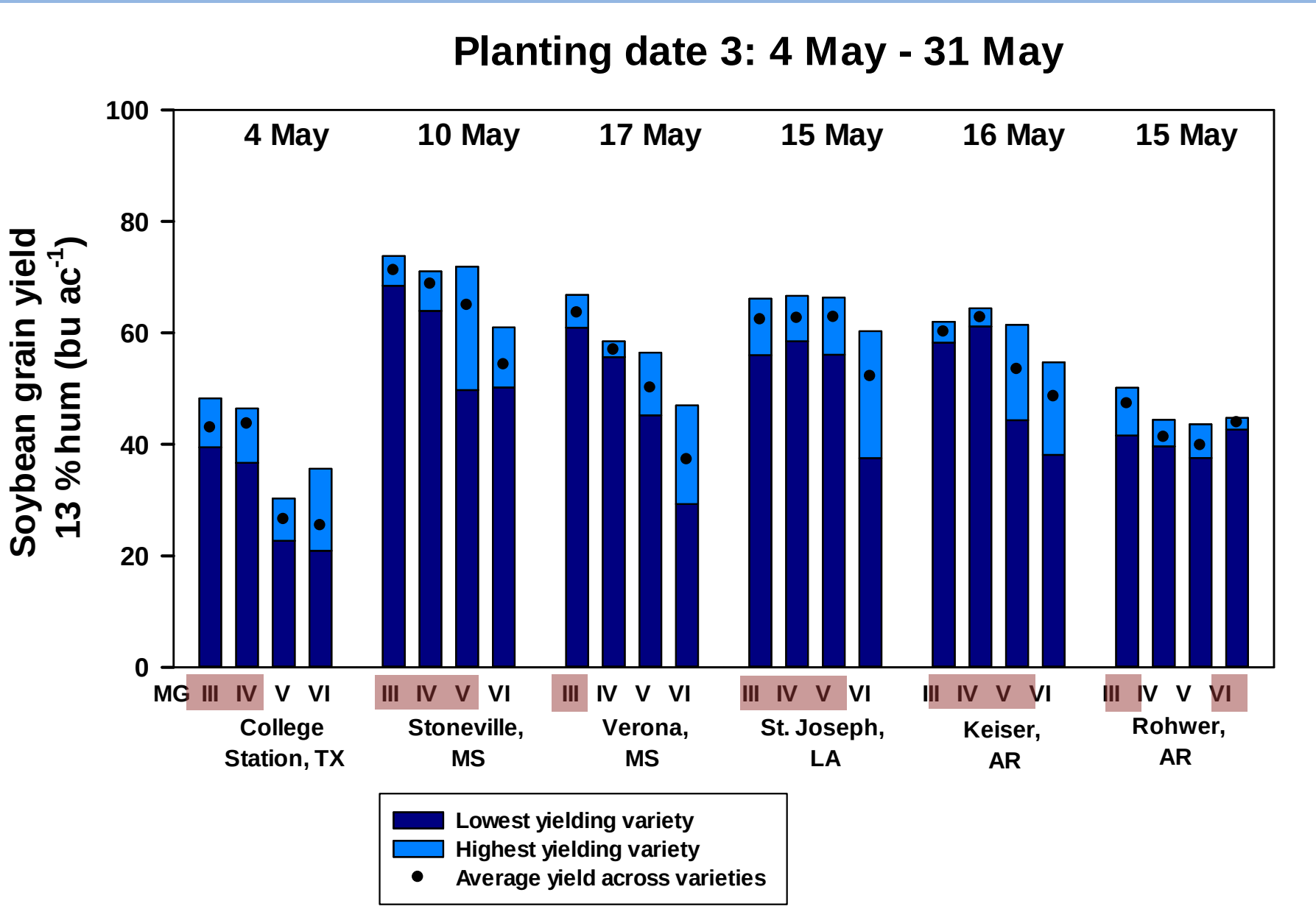
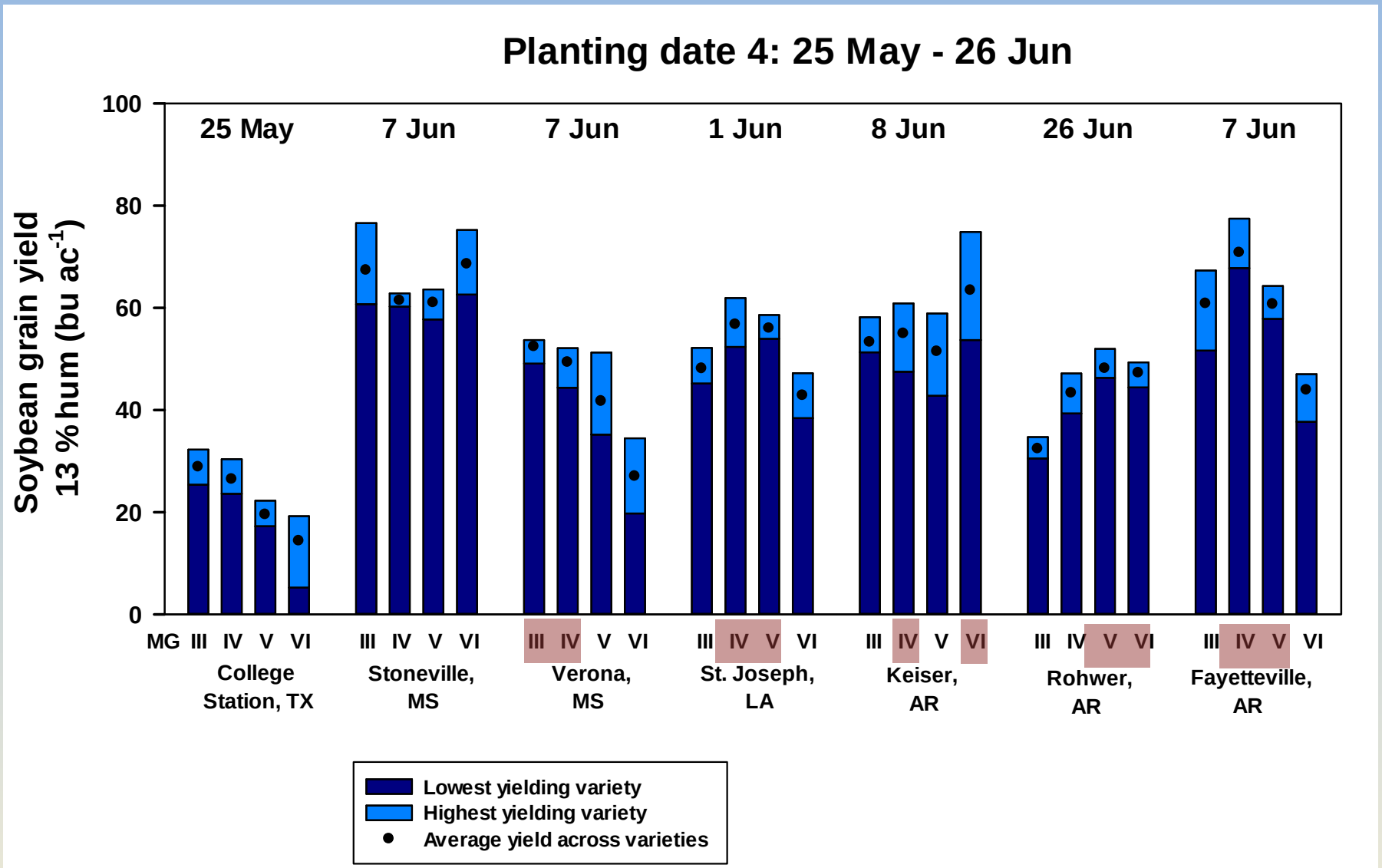

Planting date 1: 20 Mar - 15 Apr
Soybean grain yield
13 % hum (bu ac-1)
100
80
60
40
20
0
26 Mar
20 Mar
21 Mar
6 Apr
30 Mar
29 Mar
MG III IV V VI
III IV V VI
III IV V VI
III IV V VI
III IV V VI
III IV V VI
College Station, TX
Stoneville, MS
Verona, MS
St. Joseph, LA
Keiser, AR
Rohwer, AR
Lowest yielding variety
Highest yielding variety
Average yield across varieties


Planting date 2: 11 Apr - 11 May
Soybean grain yield
13 %hum (bu ac-1)
100
80
60
40
20
0
12 Apr
13 Apr
11 Apr
20 Apr
19 Apr
24 Apr
MG III IV V VI
III IV V VI
III IV V VI
III IV V VI
III IV V VI
III IV V VI
College Station, TX
Stoneville, MS
Verona, MS
St. Joseph, LA
Keiser, AR
Rohwer, AR
Lowest yielding variety
Highest yielding variety
Average yield across varieties


Planting date 3: 4 May - 31 May
Soybean grain yield
13 % hum (bu ac-1)
100
80
60
40
20
0
4 May
10 May
17 May
15 May
16 May
15 May
MG III IV V VI
College Station, TX
Stoneville, MS
Verona, MS
St. Joseph, LA
Keiser, AR
Rohwer, AR
Lowest yielding variety
Highest yielding variety
Average yield across varieties


Planting date 4: 25 May - 26 Jun
Soybean grain yield
13 % hum (bu ac-1)
100
80
60
40
20
0
25 May
7 Jun
7 Jun
1 Jun
8 Jun
26 Jun
7 Jun
MG III IV V VI
III IV V VI
III IV V VI
III IV V VI
III IV V VI
III IV V VI
III IV V VI
College Station, TX
Stoneville, MS
Verona, MS
St. Joseph, LA
Keiser, AR
Rohwer, AR
Fayetteville, AR
Lowest yielding variety
Highest yielding variety
Average yield across varieties

Stability analysis

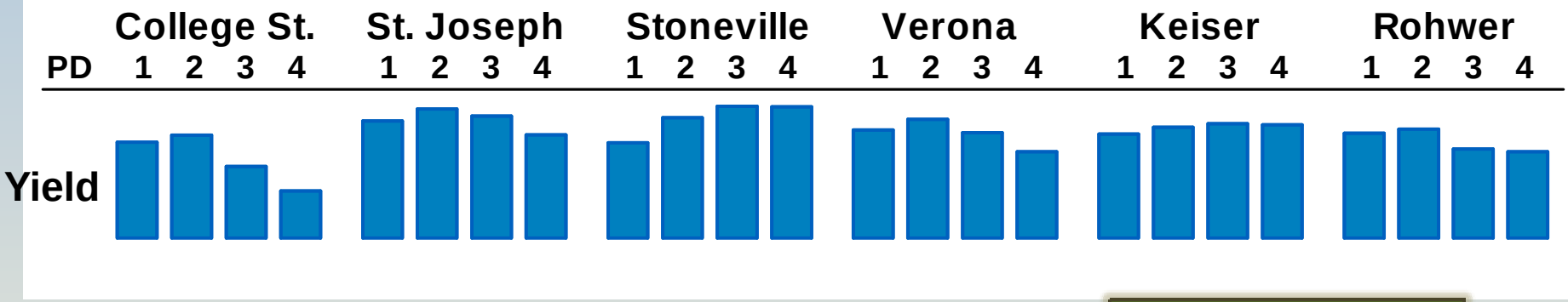
- Indicates how stable a trait is across a range of environments.
- Can we find soybean varieties with a more stable yield across the environments studied (location x PD)?

Average yield for 2012 across all:

- Varieties
- Locations
- planting dates

Grand mean 45.2 bu ac^{-1}

Environments = Locations x Planting dates combinations



Environmental Index (bu ac^{-1}) = Average yield at each environment bu ac^{-1} - **Grand mean 45.2 bu ac^{-1}**

Regression

Location	Planting date	PD x Location Mean bu ac^{-1}	Environmental Index Mean – Grand mean	Yield Varieity 1 bu ac^{-1}	Yield Varieity 2 bu ac^{-1}
College St.	1	41.1	-4.1	38.1	37.4
	2	44.2	-1.1	29.6	59.8
	3	30.9	-14.3	20.0	39.5
	4	20.5	-24.8	8.1	23.1
St. Joseph	1	41.0	-4.2	53.5	44.1
	2	51.6	6.4	55.7	53.7
	3	56.4	11.2	45.4	61.7
	4	56.2	11.0	65.4	54.6
Stoneville, MS	1	46.3	1.1	47.9	53.9
	2	50.8	5.6	44.7	59.4
	3	45.2	0.0	33.3	48.4
	4	37.1	-8.1	24.4	43.0
Verona, MS	1	50.1	4.8	60.6	50.2
	2	55.2	10.0	59.6	58.9
	3	52.2	7.0	49.7	50.8
	4	44.3	-0.9	41.0	45.5
Keiser, AR	1	44.6	-0.6	44.6	51.2
	2	47.4	2.2	43.8	53.4

			Regression		
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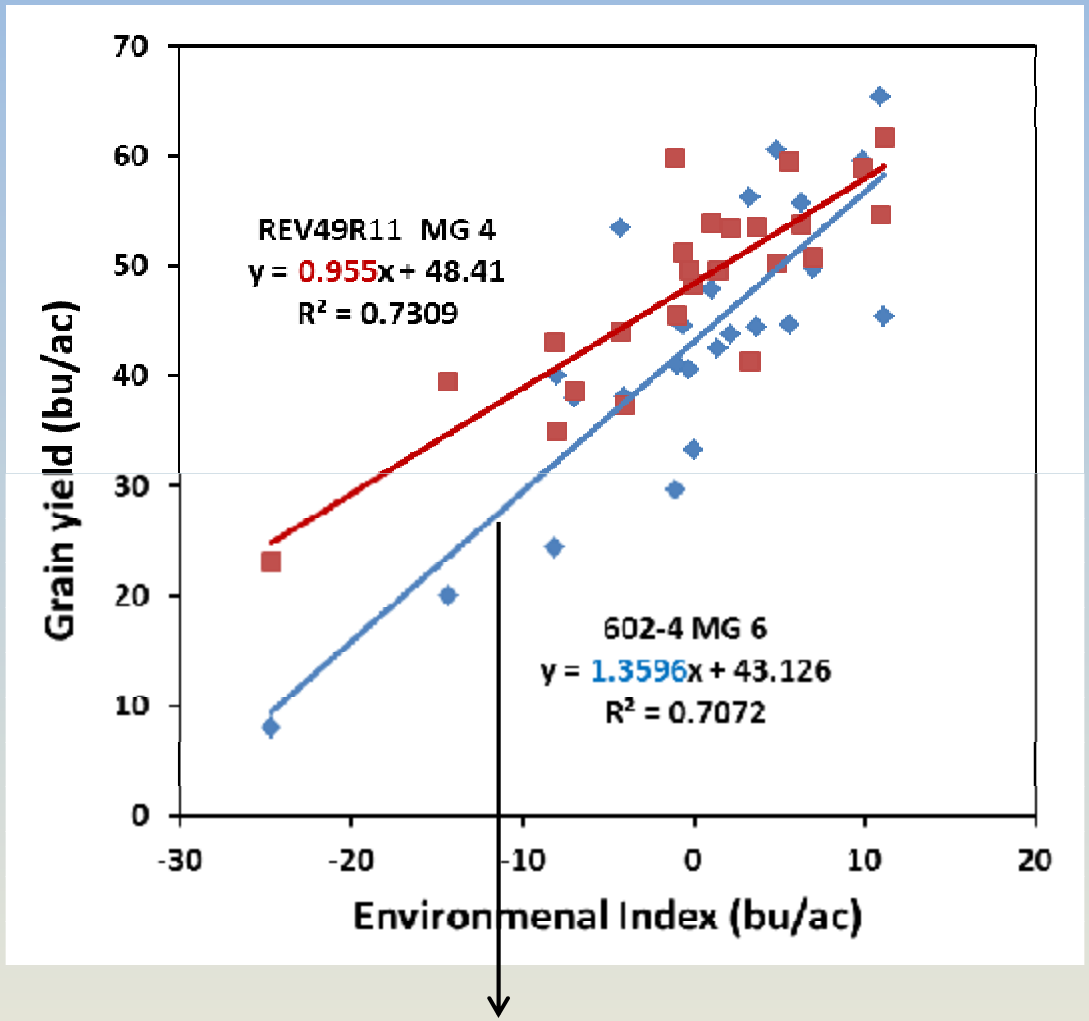
	3	45.2	0.0	33.3	48.4
	4	37.1	-8.1	24.4	43.0
Verona, MS	1	50.1	4.8	60.6	50.2
	2	55.2	10.0	59.6	58.9
	3	52.2	7.0	49.7	50.8
	4	44.3	-0.9	41.0	45.5
Keiser, AR	1	44.6	-0.6	44.6	51.2
	2	47.4	2.2	43.8	53.4

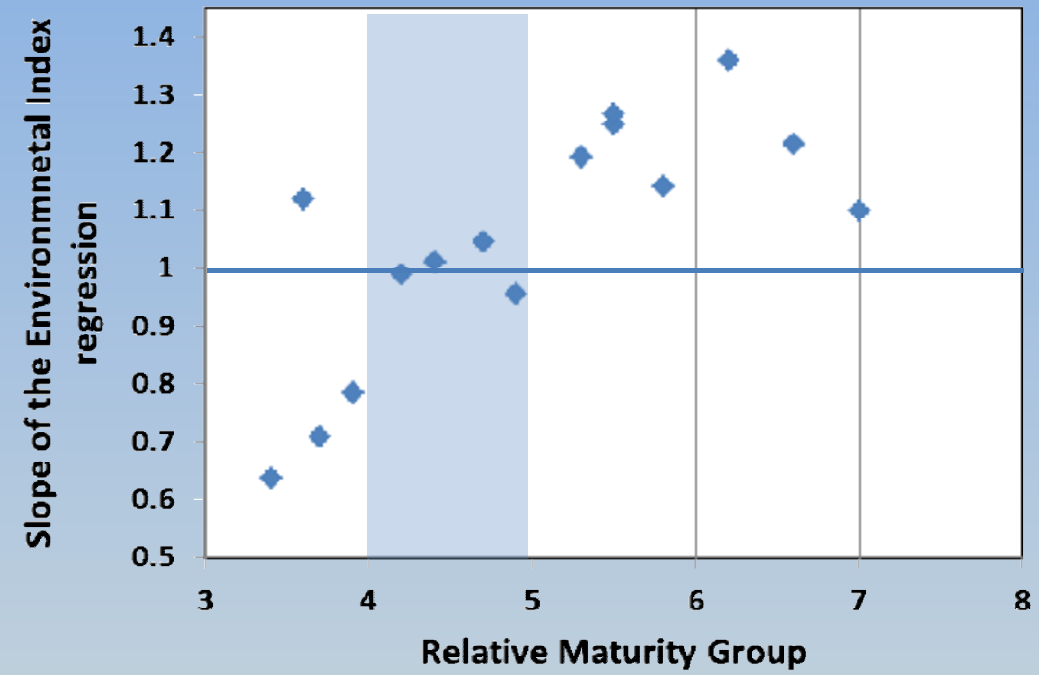


Slopes closer to 1:

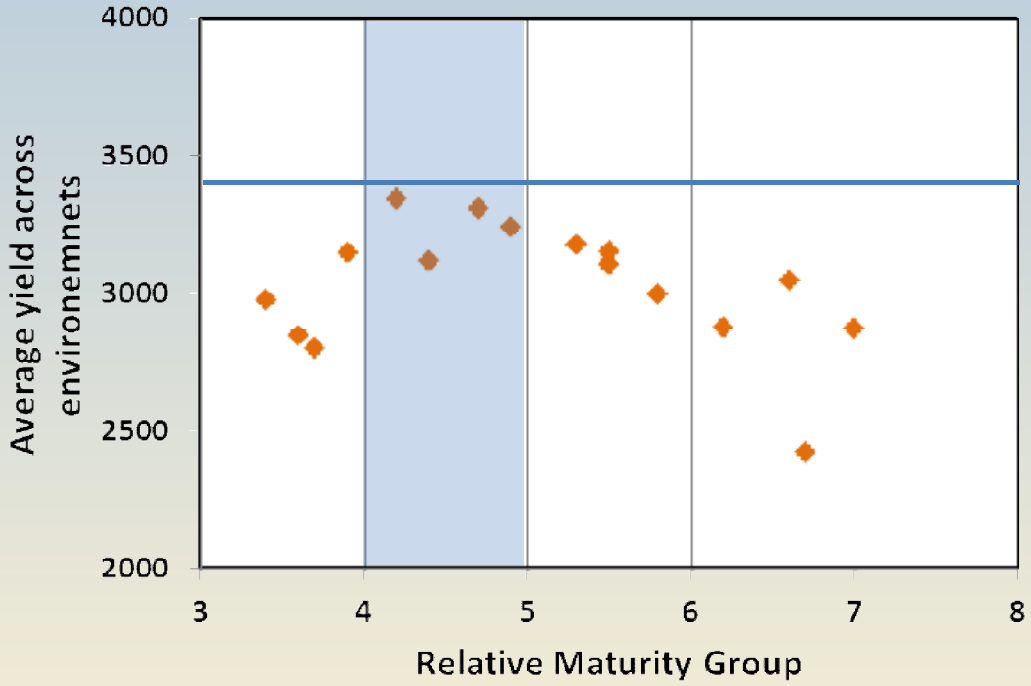
MORE STABLE VARIETIES

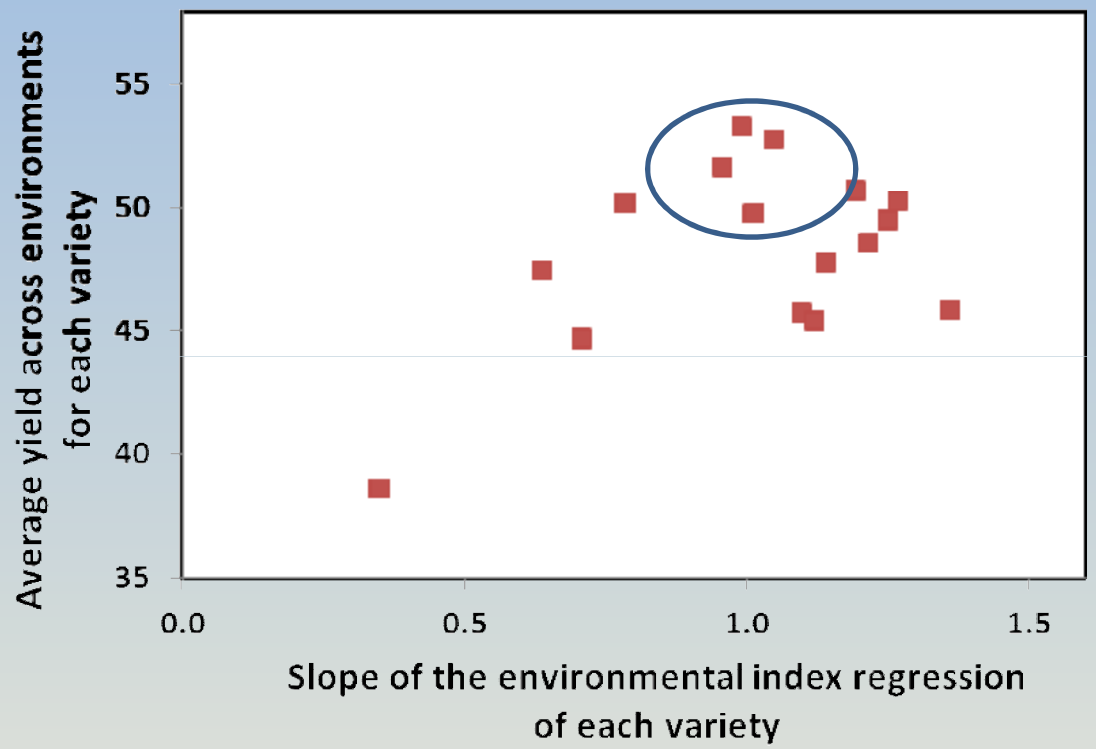
Yields lower under less favorable environments with this variety

Slopes of the environmental index regression closer to 1 in MGs 4



Higher yields averaged across environments for MGs 4





The more stable varieties also higher yielding

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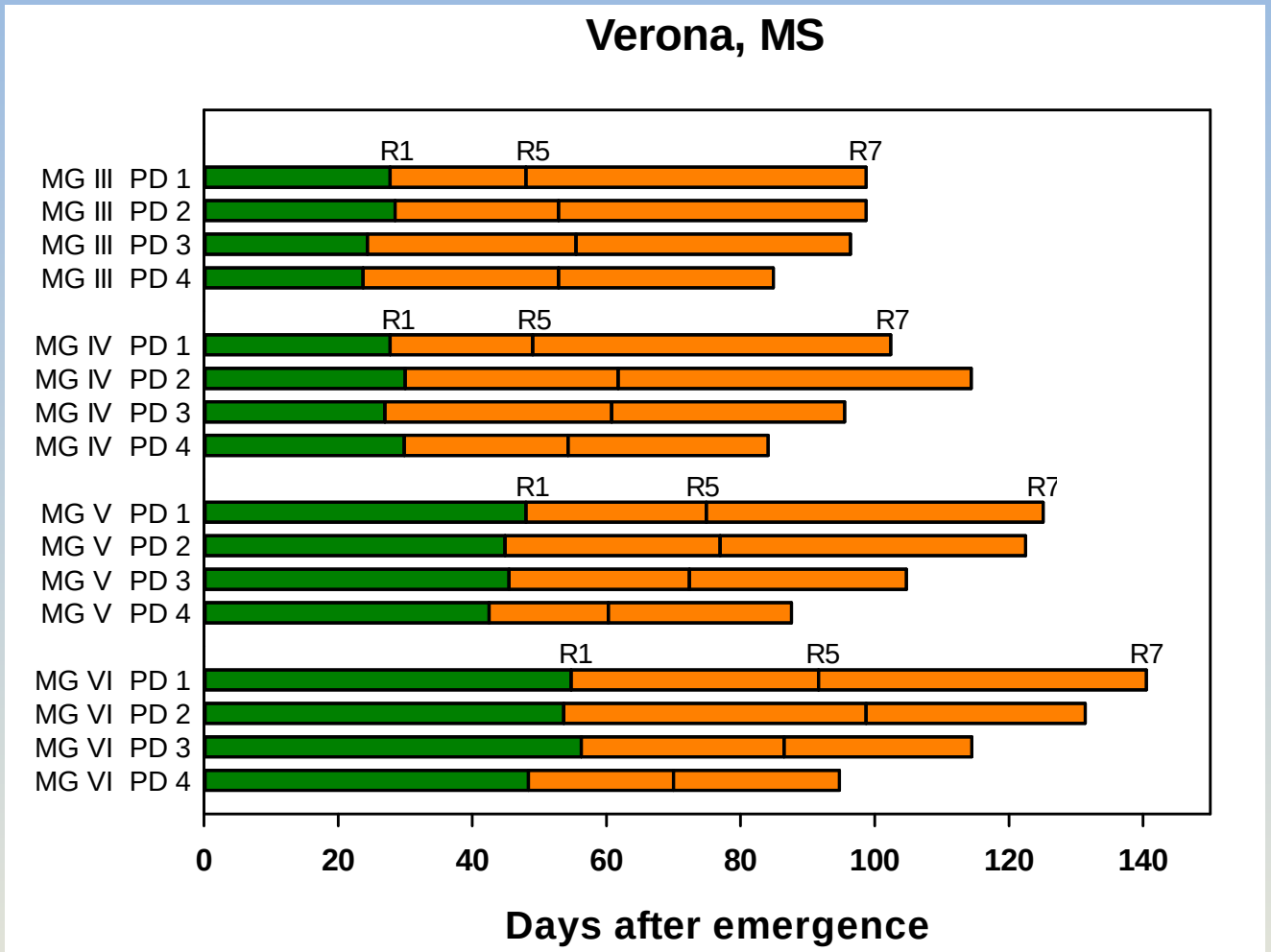
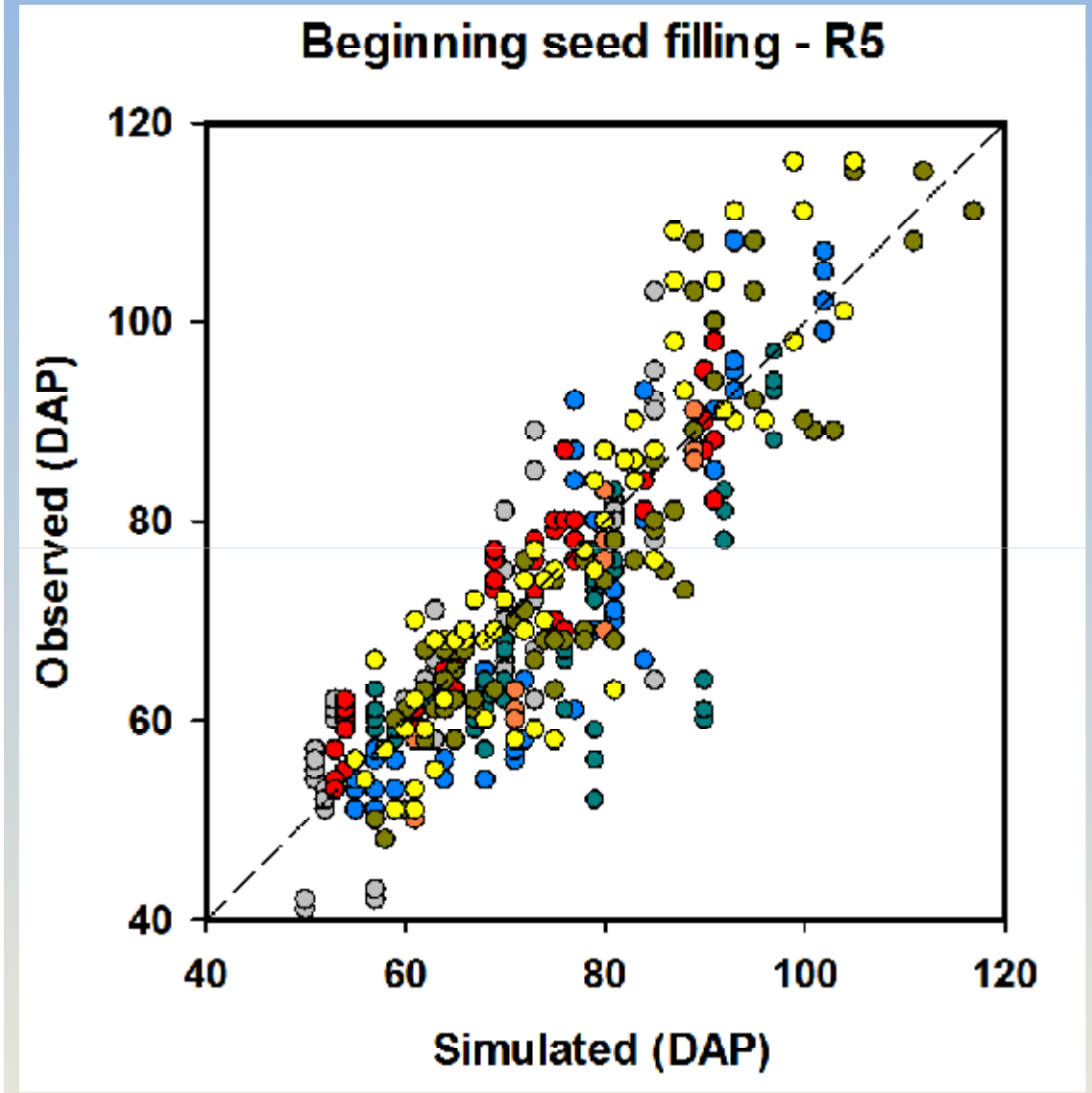
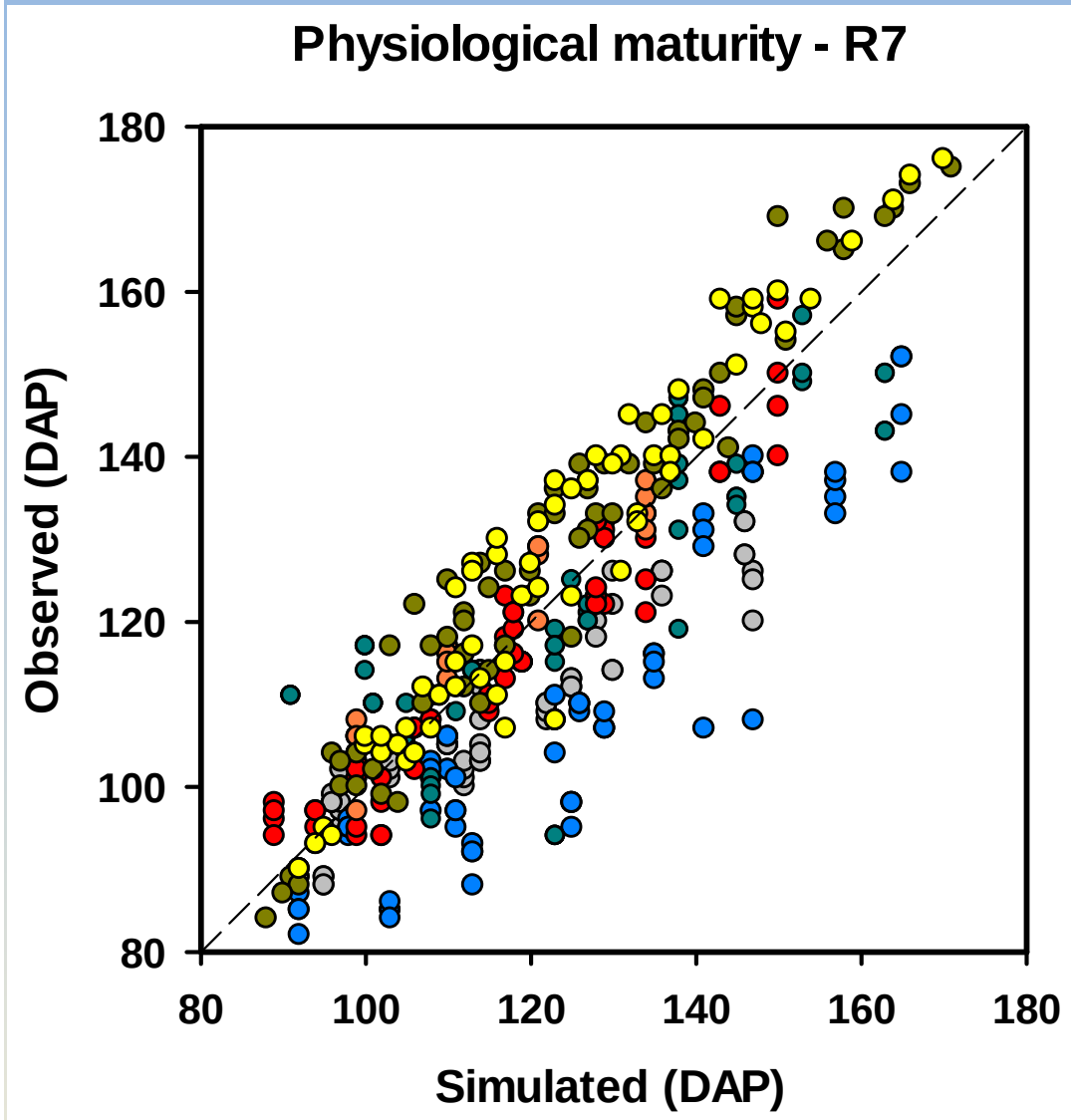

Verona, MS
R1
R5
R7
MG III PD 1
MG III PD 2
MG III PD 3
MG III PD 4
MG IV PD 1
MG IV PD 2
MG IV PD 3
MG IV PD 4
MG V PD 1
MG V PD 2
MG V PD 3
MG V PD 4
MG VI PD 1
MG VI PD 2
MG VI PD 3
MG VI PD 4
0
20
40
60
80
100
120
140
Days after emergence



Location	Days after planting	
	Obs - Sim	RMSE
Fayetteville	-4	6.6
Keiser	-2	7.7
Verona	-5	8.4
Rohwer	5	7.8
Stoneville	-11	11.3
St. Joseph	1	4.3
College St.	-1	7.8



Location	Days after planting	
	Obs - Sim	RMSE
Fayetteville	4	5.6
Keiser	5	7.9
Verona	-16	17.5
Rohwer	1	8.3
Stoneville	-2	12.1
St. Joseph	-1	4.9
College St.	-18	10.2

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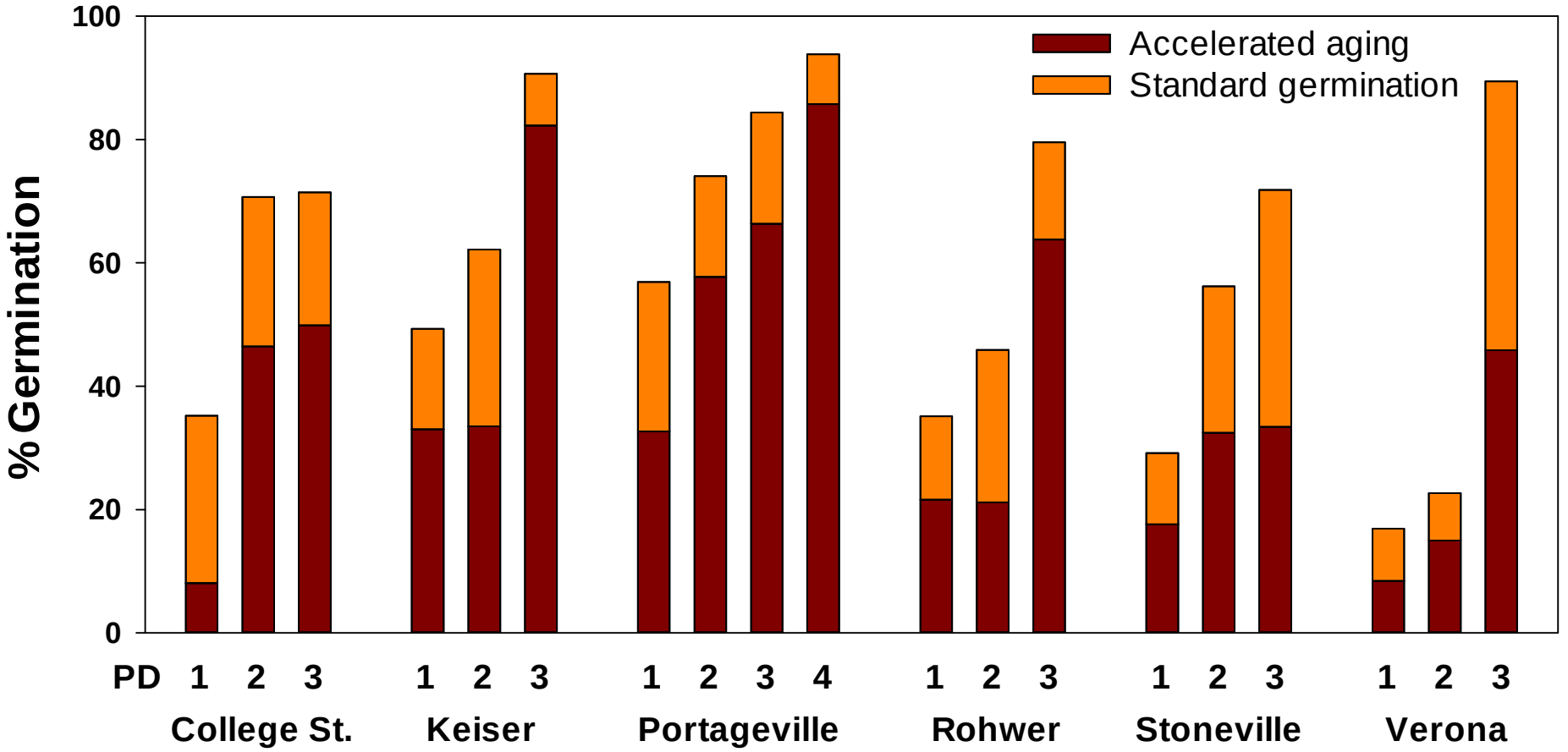
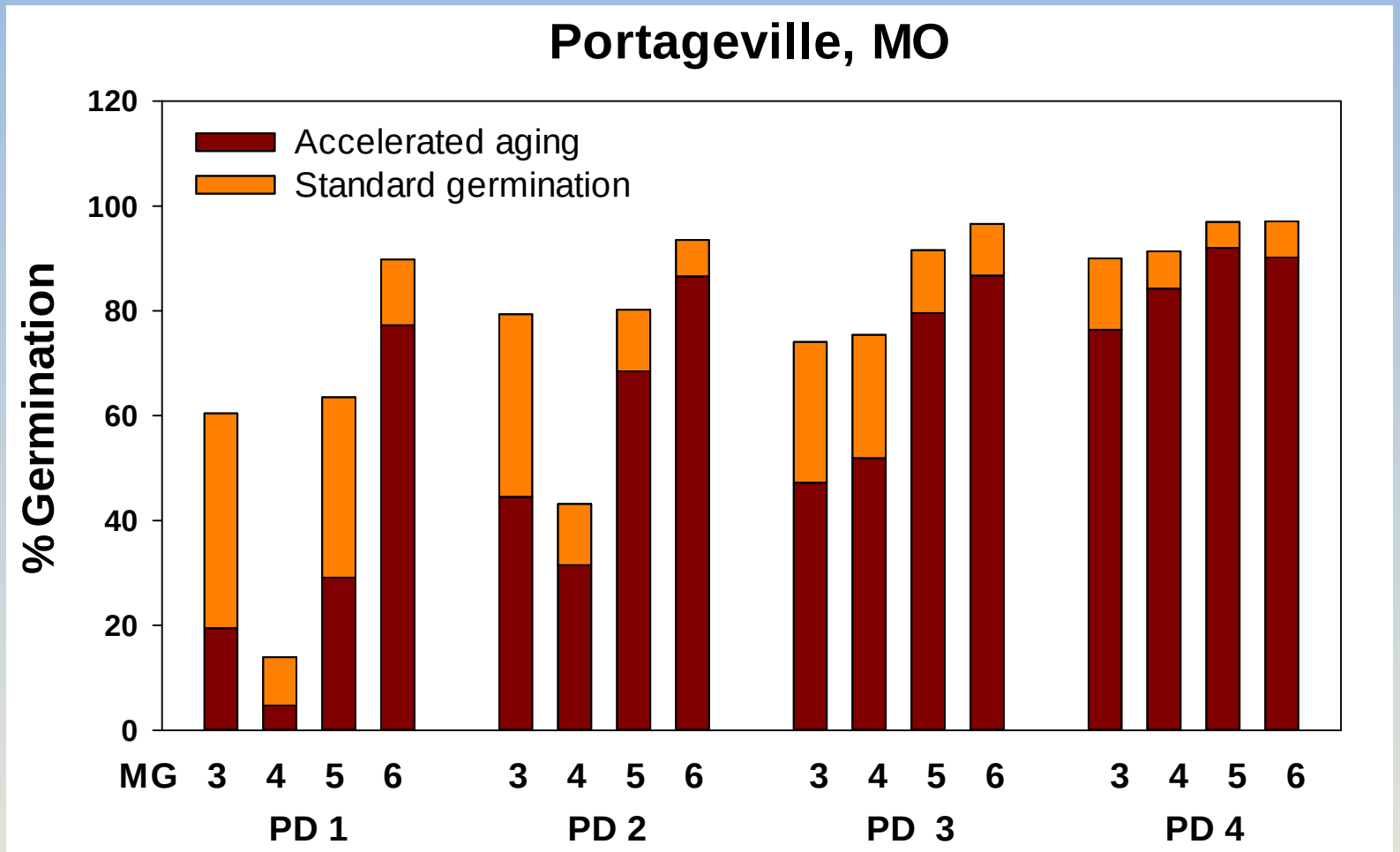
Seed quality: % Germination



% germination in standard conditions and after accelerated aging increases as planting date is delayed


Portageville, MO
% Germination
120
100
80
60
40
20
0
Accelerated aging
Standard germination
MG 3 4 5 6 3 4 5 6 3 4 5 6 3 4 5 6
PD 1
PD 2
PD 3
PD 4

Seed grading

- Rohwer
- 2112 samples in total

For each sample

- Weigh 125 g
- Course foreign matter
- Fine foreign matter
- Splits
- Small seeds
- Weather damaged
- Green beans
- Stink bugs

Next steps:

- Repeat experiment at all locations in 2013 and 2014
- ‘Calibrate’ and ‘validate’ the model
- Prepare production guides summarizing results

Preliminary conclusions:

- **High grain yields** (50-70 bu/ac) were possible at planting dates with proper selection of maturity group.
- **Exceptions**:
  - St. Joseph: Lower yields in PD 4 than in earlier PDs.
  - College St: PD 1 has the highest yields, followed by PD2.
- **Overall greatest stability and yield** – MG IV
- **Seed quality -** standard germination and AA germination increases when delaying planting date from PD 1 to 3. Poorest quality for MG 3&4.
- **Modeling of phenology**: The model is efficient in estimating the plant development across planting dates and MGs.