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Coolbeans! No #FakeNews Here!

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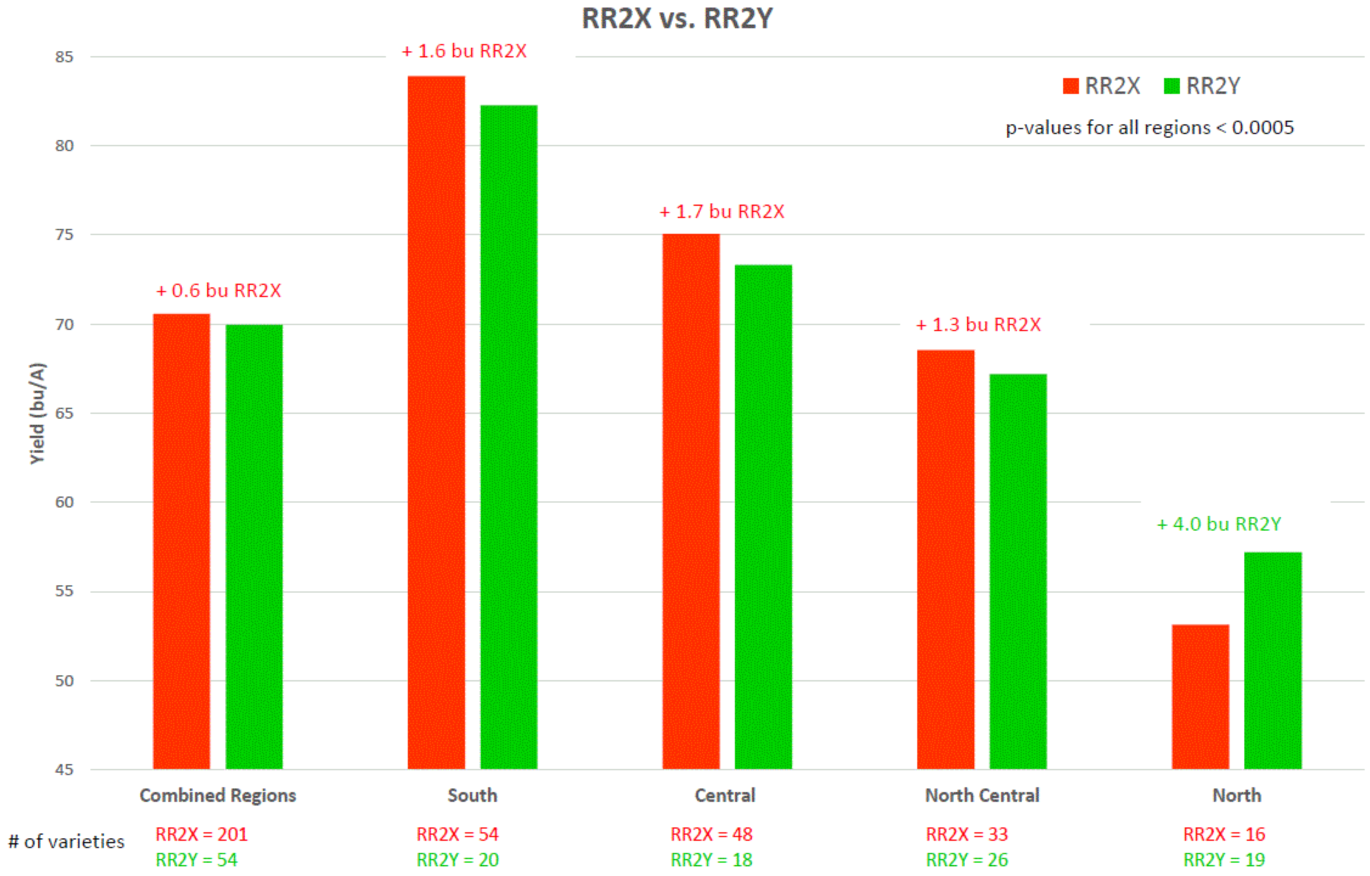
Herbicide Trait Options



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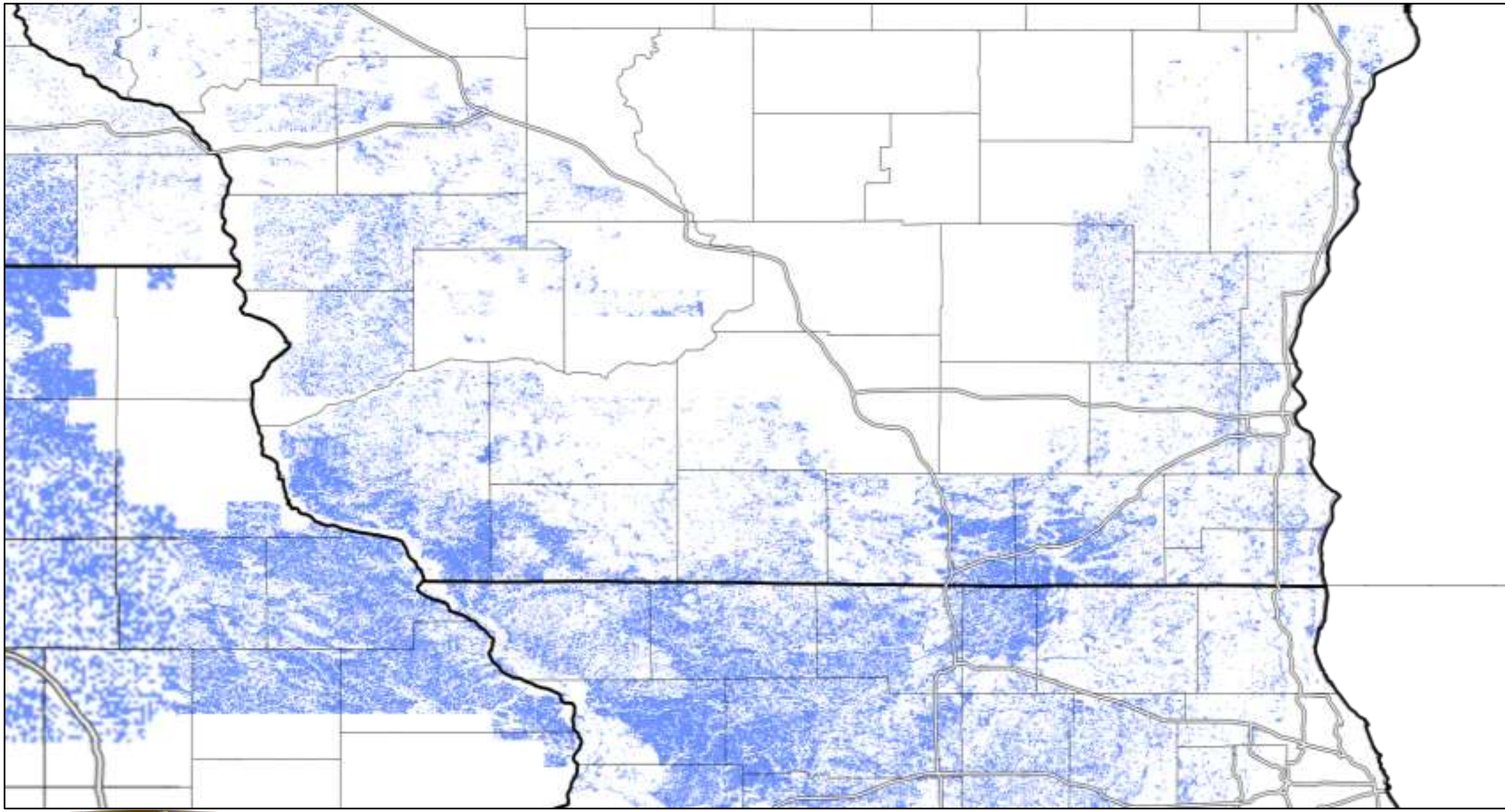
Looking for Collaborators!



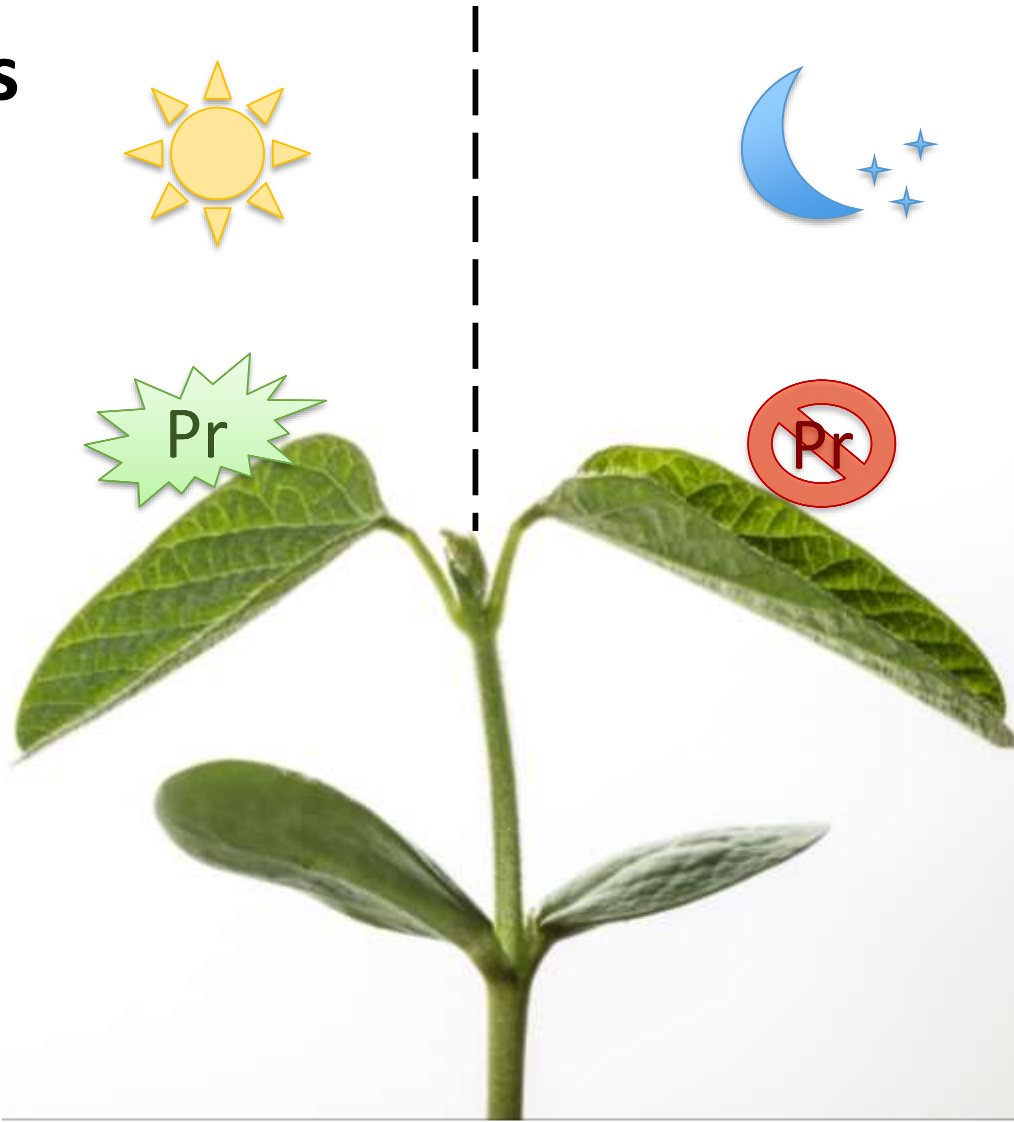

Soybeans don’t flower until after 6/21
#FakeNEWS
#ExtensionIsIrrelevant
Disclaimer: Not an actual picture of my mother-in-law.

Short-day plants

- ‘Short-day’ plants require a certain **critical period of darkness** in order to induce reproduction, or flowering.
- The duration of darkness required is variable for different species and even varieties!
- In nature, this helps many species flower at the optimal time.

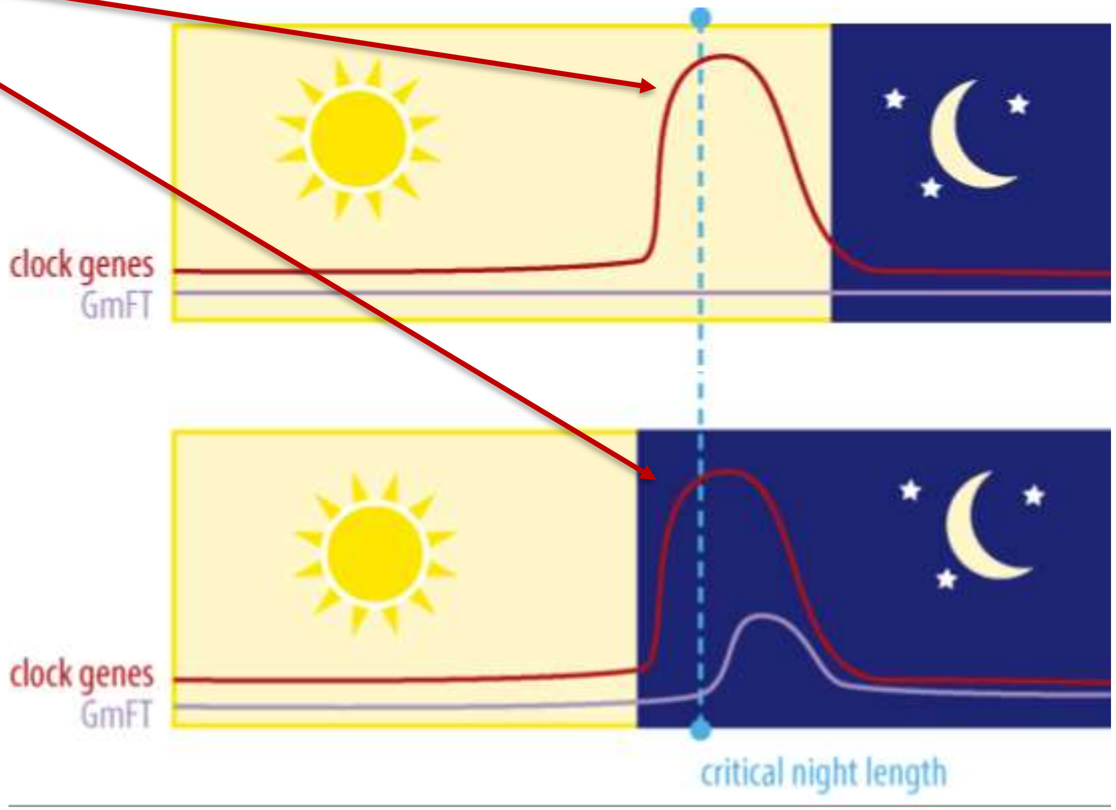
Leaves can sense light!

- A protein in the **leaves** called phytochrome senses light.
- **Sunlight** activates phytochrome, but it is inactive in the dark.
- Even the **unifoliate leaves** in soybean can perceive night length!



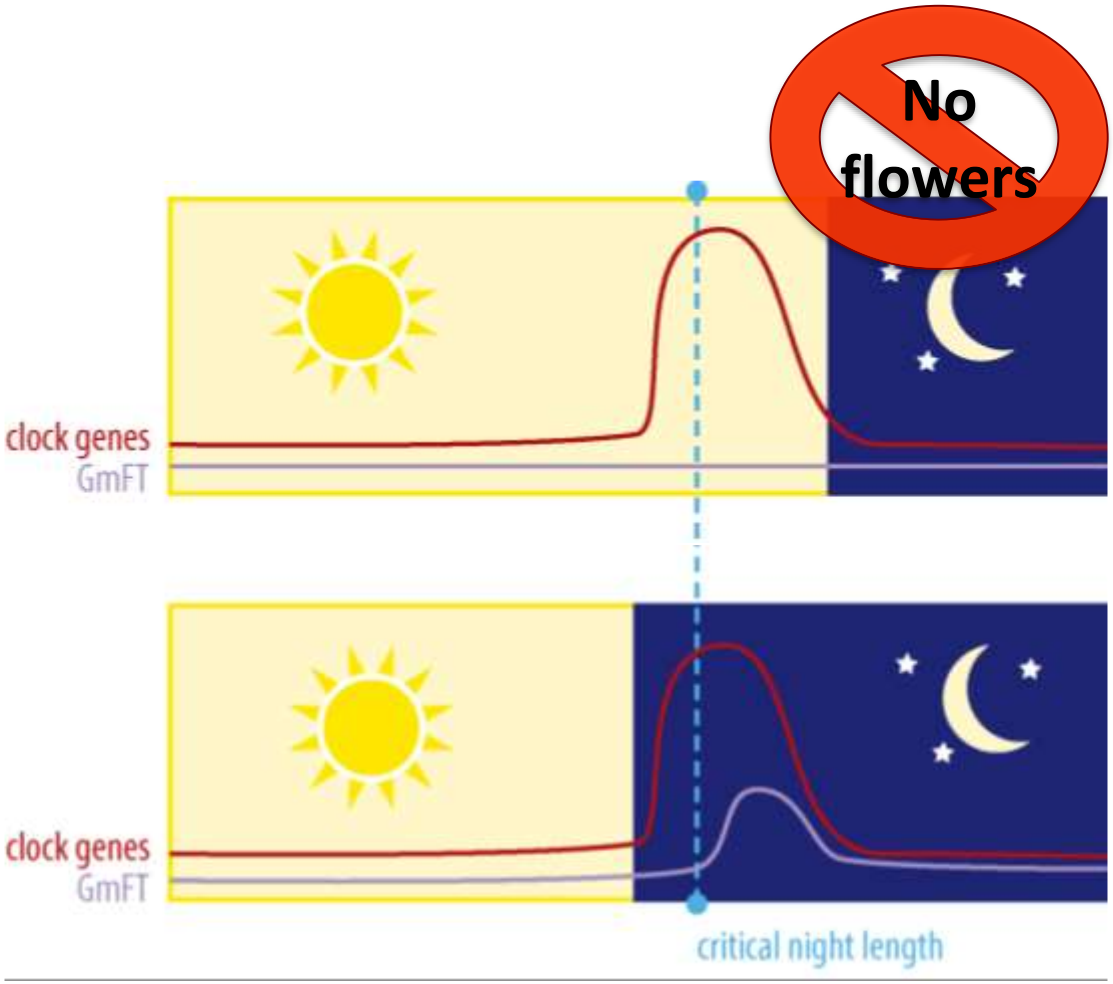
Short-day plant mechanism

- **Clock genes** are controlled by circadian rhythm, so they are expressed **at a certain time** interval.



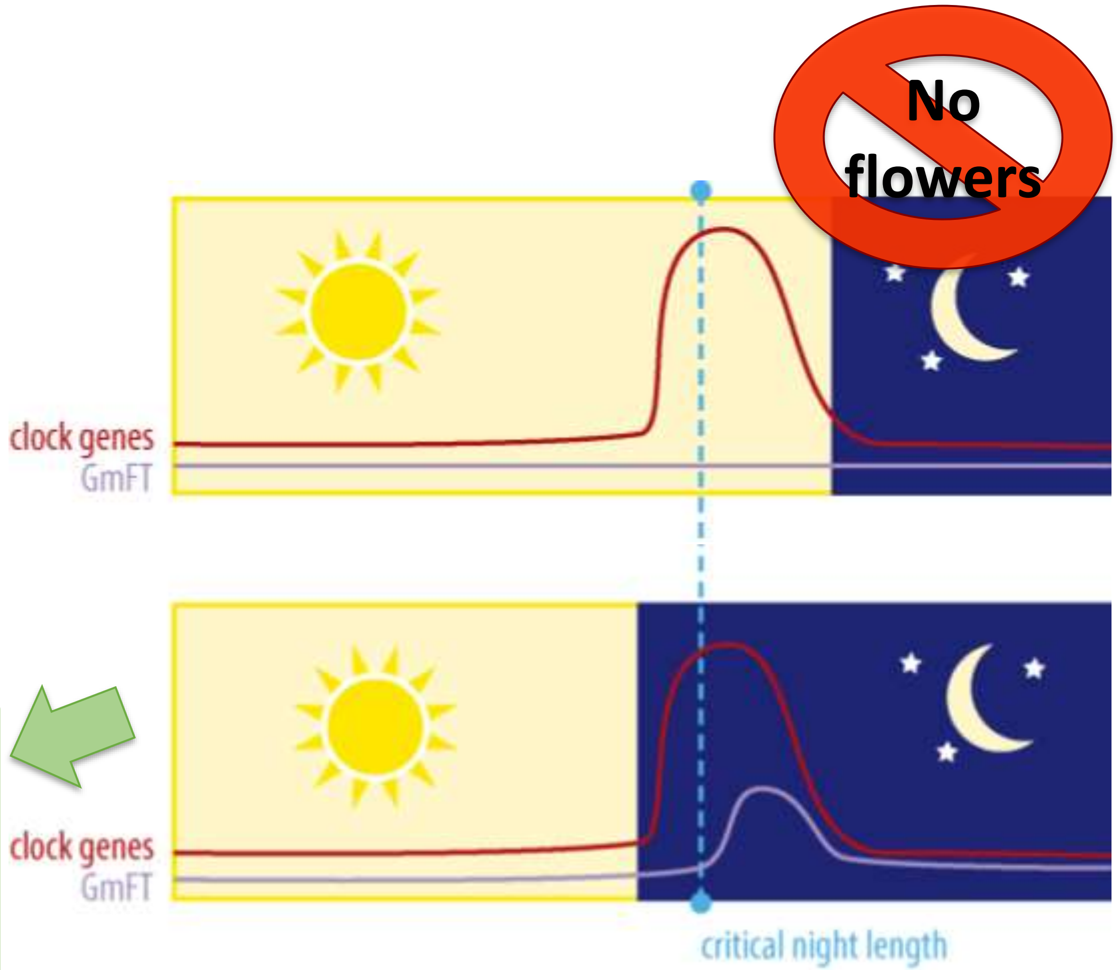
Short-day plant mechanism

- **GmFT** is a gene that induces flowering.
- If clock genes are expressed during daylight, GmFT is not expressed, and **flowering does not occur.**



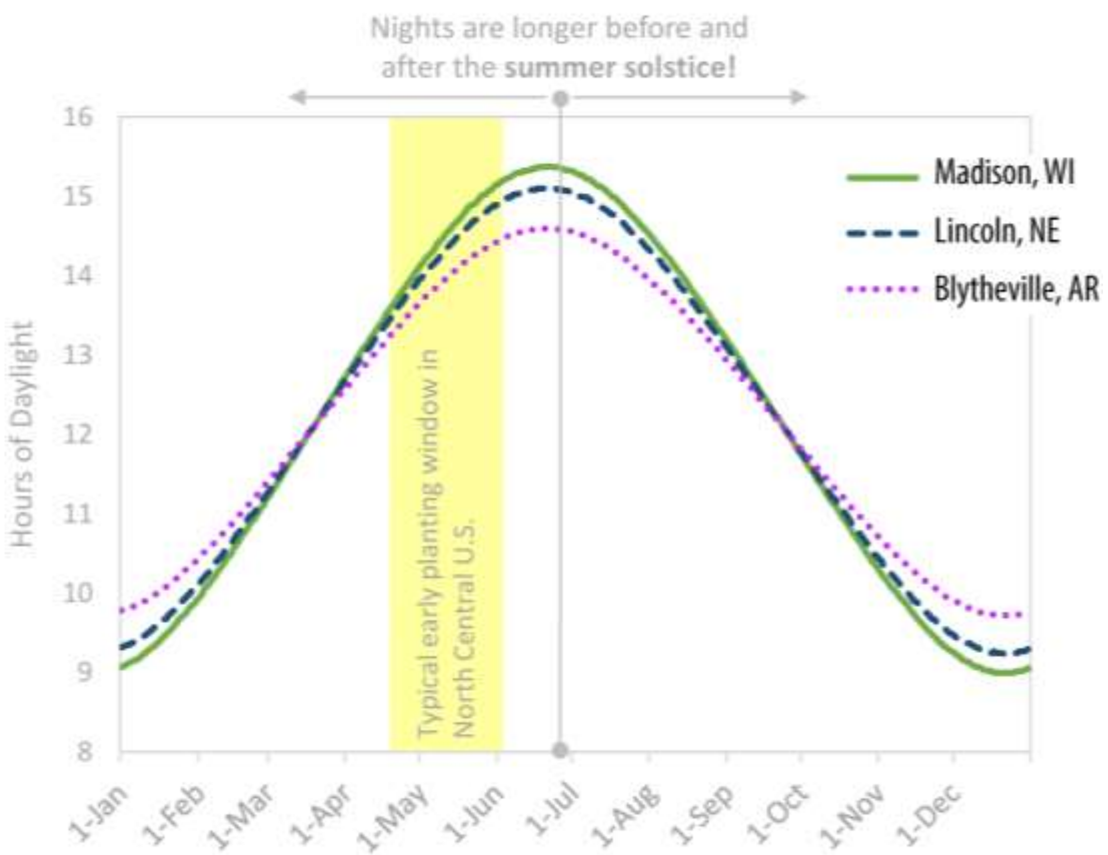
Short-day plant mechanism

- If clock genes are expressed at night, GmFT is expressed, and **flowering is induced**!



Nights are long before the solstice, too!

- Early planting windows allow soybean to perceive **shorter nights** ahead of June 21st.
- Floral induction can occur as **early as VC**!



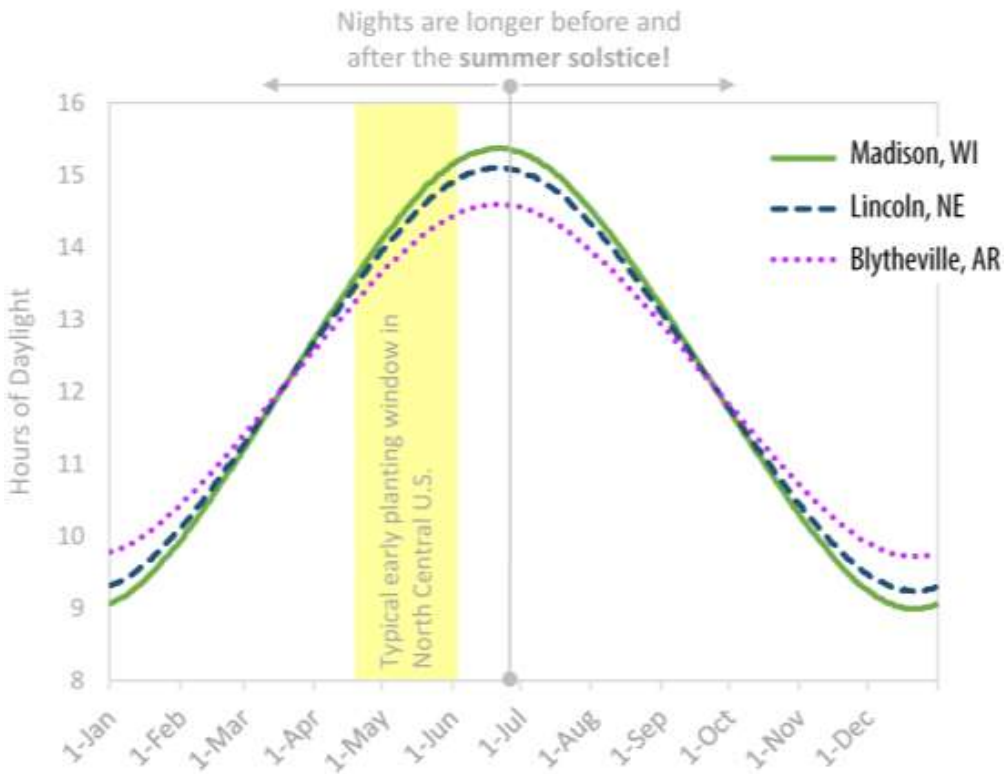
Floral induction vs R1

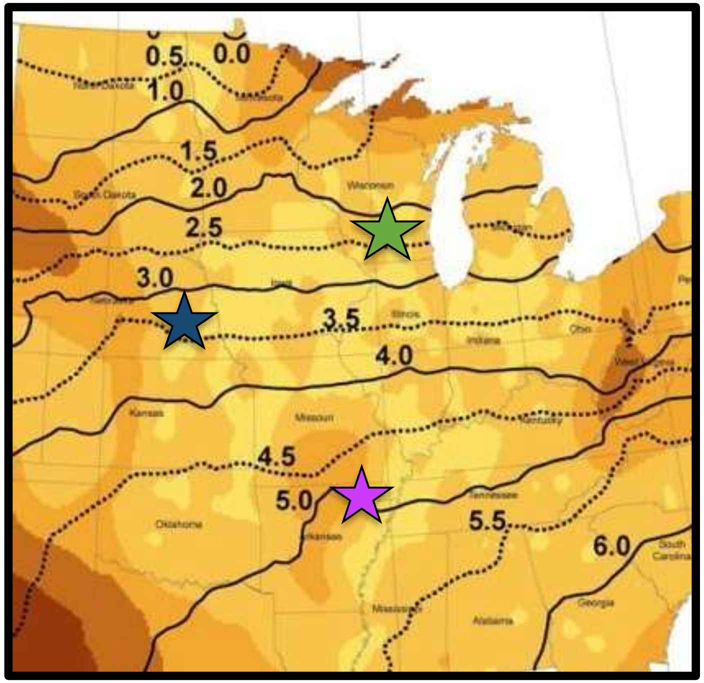
- Floral **induction** refers to the chemical signals that start the process of flower development – in soybean, this process is **photoperiod dependent**.
- Floral **evocation** is the growth of the flower that results in a visible flower. This process is faster with increased temperature.
- Both processes are needed to reach R1 – so time to R1 can be photoperiod *and* temperature dependent.

Maturity groups

- Maturity group designations for soybean are photoperiod and temperature dependent.
- Earlier maturing soybean has decreased photoperiod sensitivity compared to later maturing varieties.
- Early MG's are still short-day plants and require a critical period of darkness to flower, but the night length requirement is less severe.

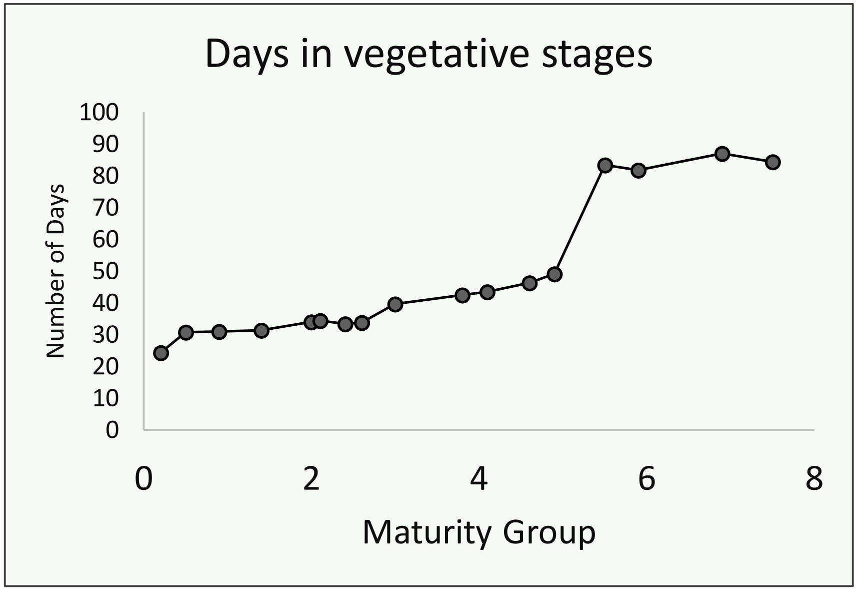
Maturity groups

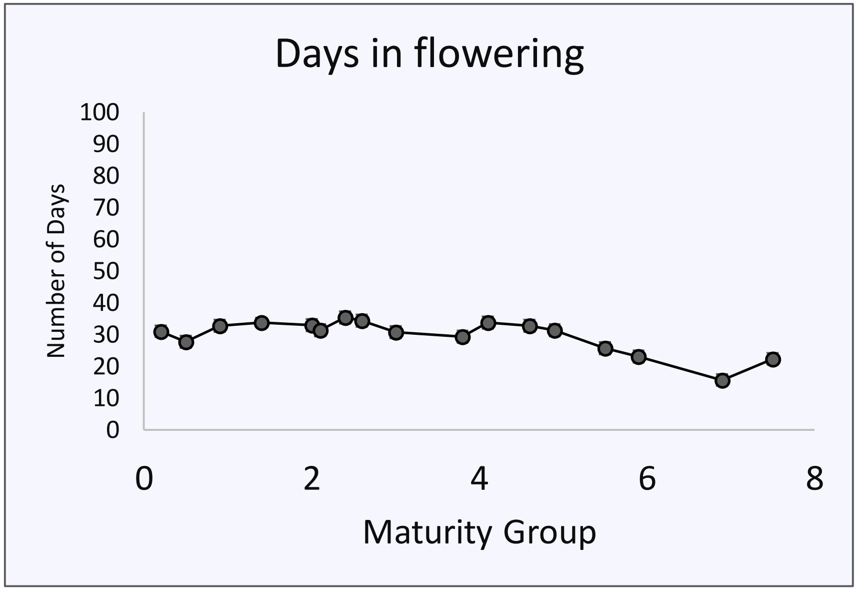


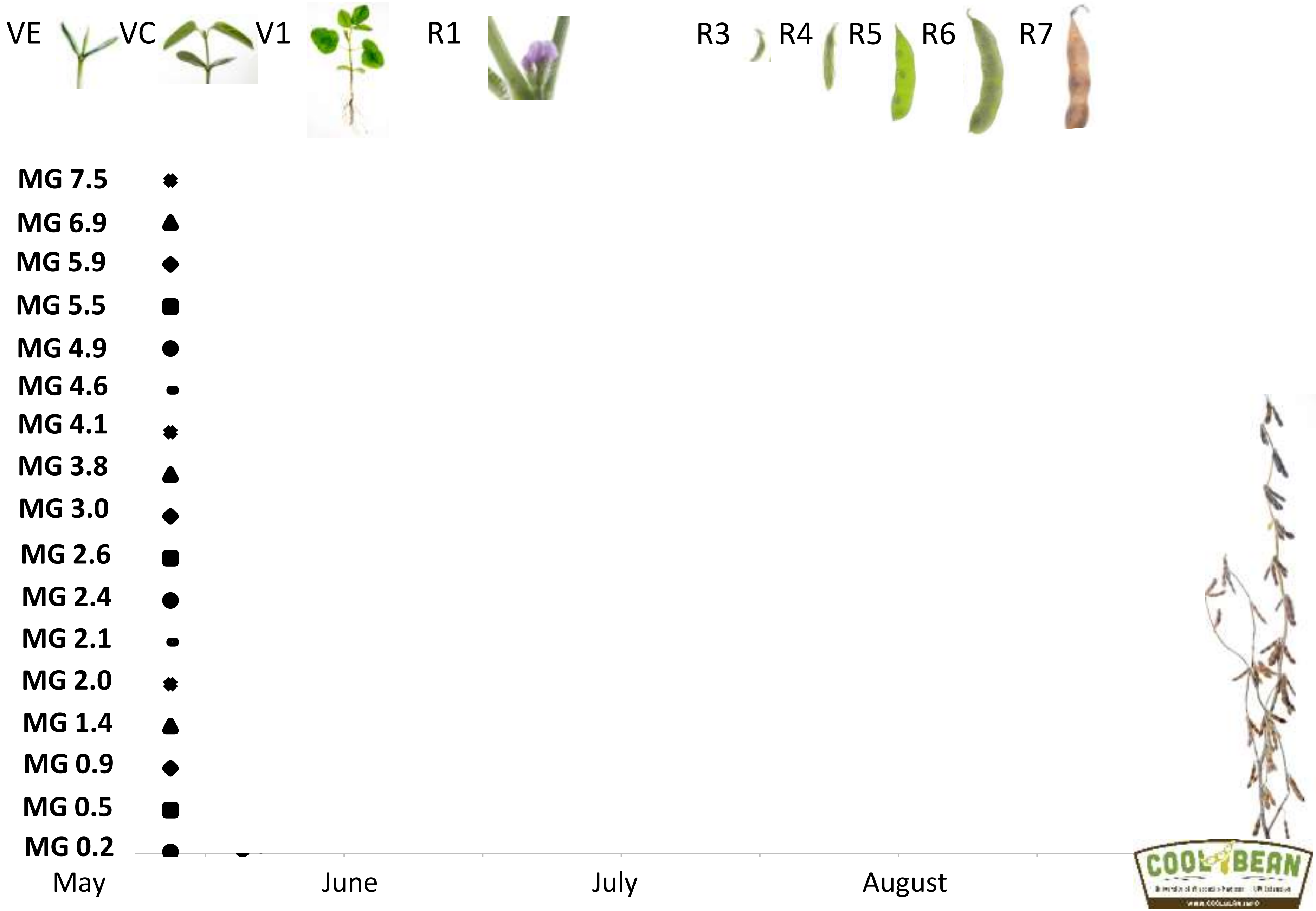


Northern regions have longer summer days, and shorter nights, meaning earlier maturities are more suited.

Wisconsin – Days Vegetative & Flowering





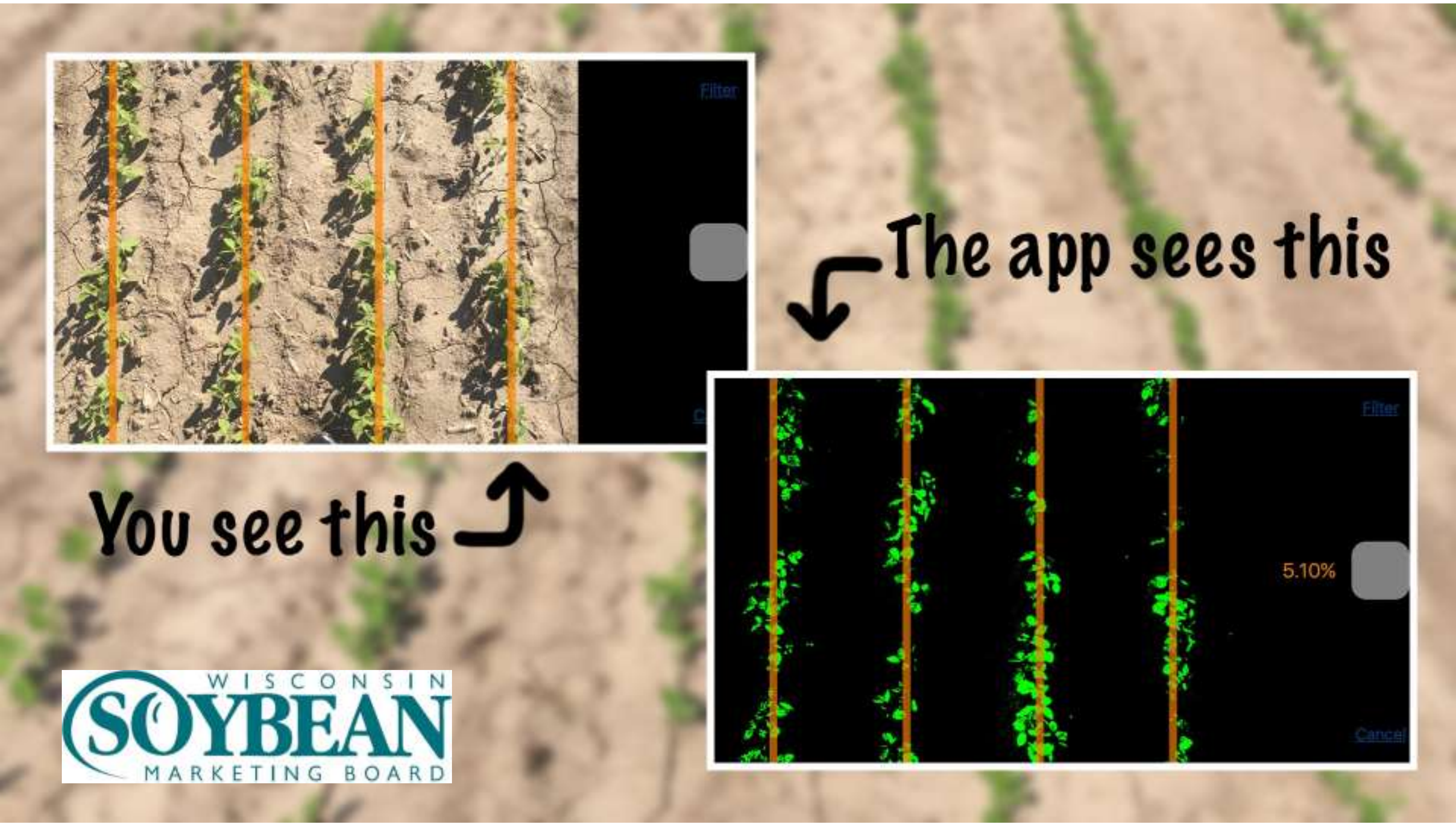


Results – Wisconsin

Why does early flowering matter?

- Proper identification of R1 is important for weed and disease management:
  - Many **herbicide labels** do not allow application after R1 or R2 growth stages.
  - Earlier risk, and need for management, of **white mold** comes with early flowering.
- Timing of flowering is not dependent on calendar date!

Just the Facts Jack…What is my AOSSR?



Introduction

- Soybean seeding rate and its relationship with seed yield has been ***densely*** studied in the major soybean producing regions across North America due to the ever-increasing importance of soybean as the primary oil seed crop grown.

- Soybean seeding rates have steadily declined over the past two decades in North America due to more accurate planting equipment, seed treatment adoption, and better seed handling and cleaning equipment.

Introduction *cont.*

- Various studies have determined that only **100,000** plants/ac at harvest are required to maximize yield (Lee et al., 2008; Epler and Staggenborg, 2008; Gaspar and Conley, 2015), others have determined that only **75,000** seeds/ac maximize profit (De Bruin and Pedersen, 2008) while other have suggested seeding rates as high as **243,000** plants/ac are needed in drought prone environments (Holshouser and Whittaker, 2002).

- However, economically optimal seeding rates can be as high as **130,000** seeds/ac (Cox et al., 2010; Gaspar et al., 2015; Gaspar et al., 2017).

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Objective

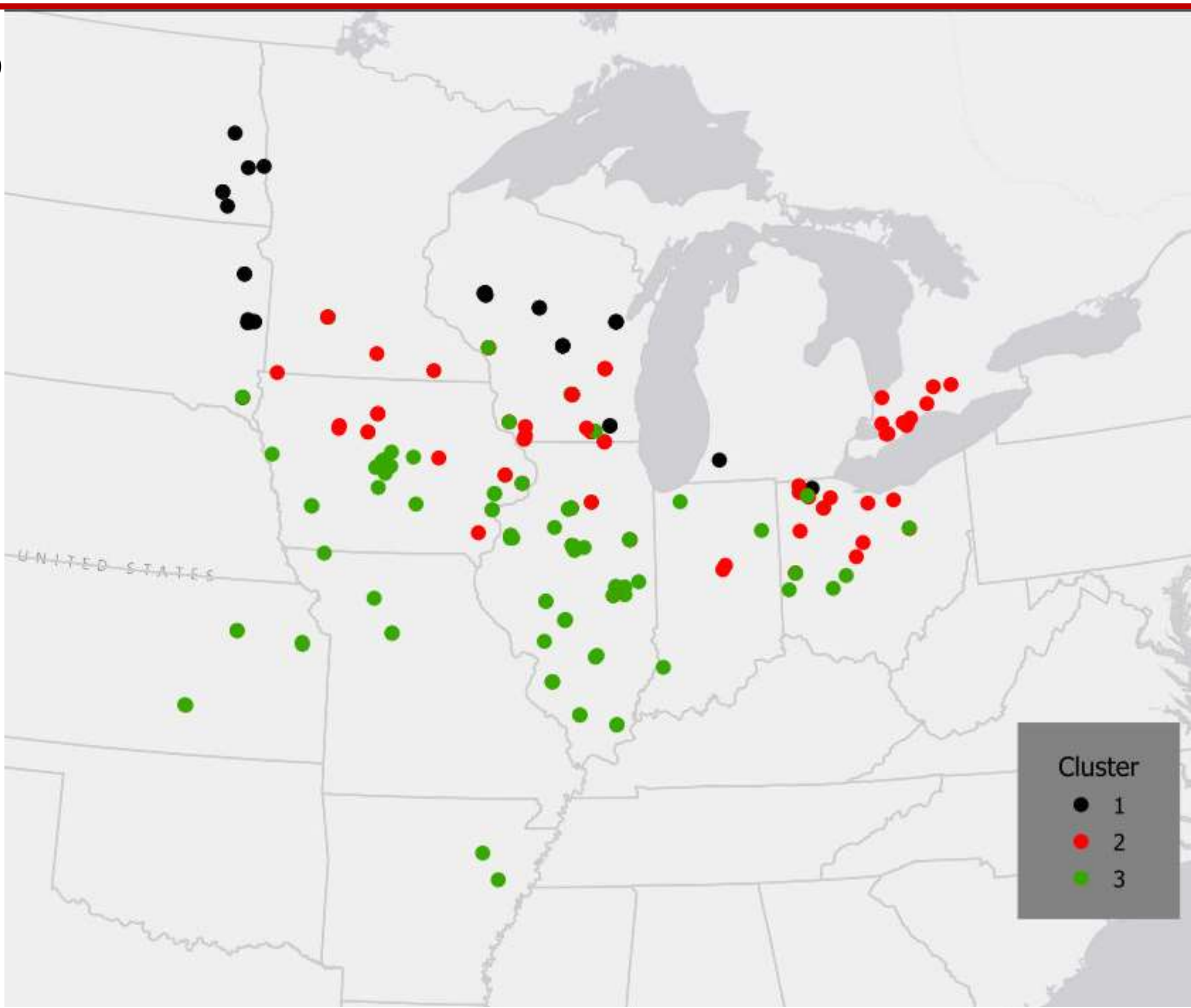
- Because a single study was not conducted at multiple USA locations for several years, we combined data from multiple soybean seeding rate studies across multiple locations and years.

- The objectives of this study were to: 1) quantify soybean seed yield response to seeding rate and plant density across different environments varying in levels of productivity, 2) identify and quantify the subsequent yield components driving these different responses, and 3) quantify natural plant attrition and the risk associated with the AOSR maximizing yield.

Materials and Methods

Soybean yield data (20,926 plots) were aggregated from 211 replicated field experiments established from 2005-2017 within 12 states and Ontario CA.

Experiments were aggregated in 3 clusters based on soil and weather.



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Materials and Methods *cont.*

- Individual trials were grouped in three yield environments based on their average yield level. The lower 30% of yield (15-58 bu/ac) were considered low, the middle 30-70% (58-71 bu/ac) were considered medium, and the upper 30% (71-111 bu/ac) were considered as high yielding environment.

- Yield was modeled separately for the three yield environments within each cluster using a negative exponential model:

$$Yield = Y_{max} \times (1 - e^{-\beta \times SR})$$

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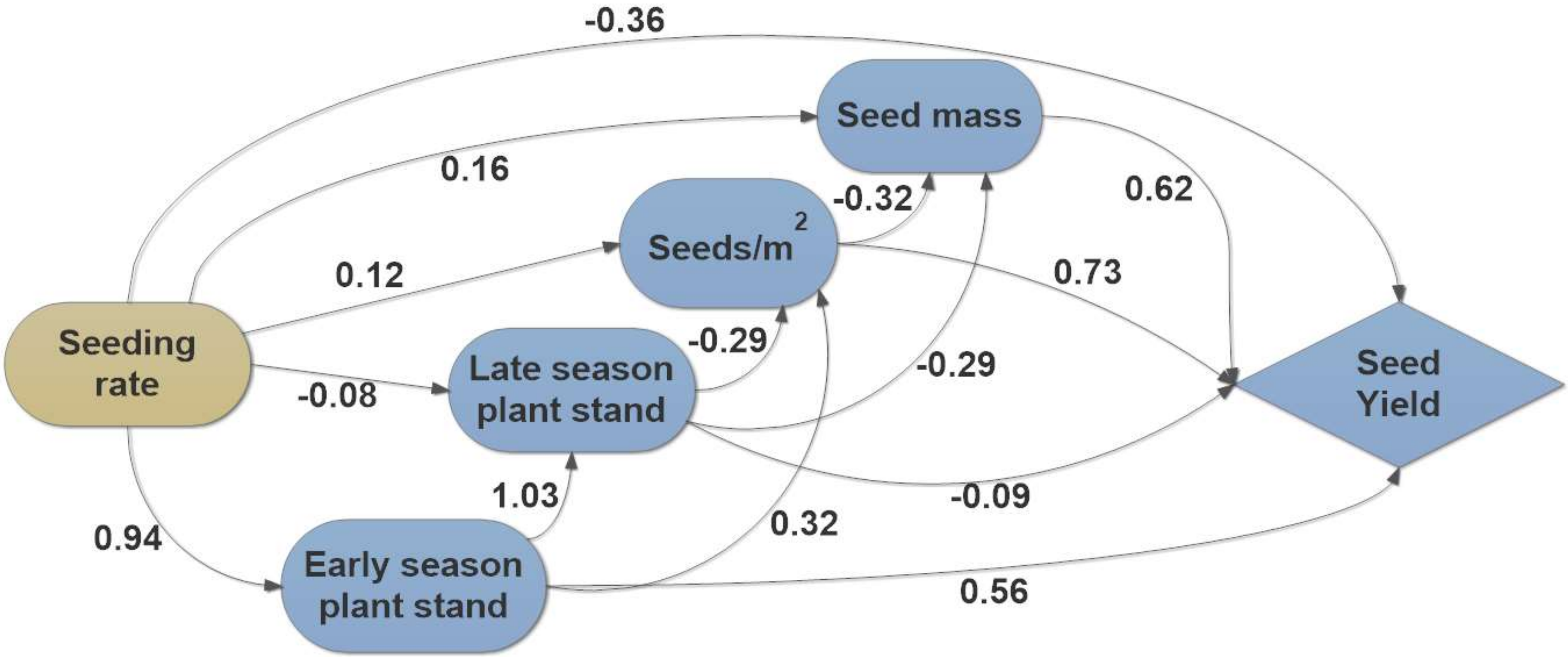
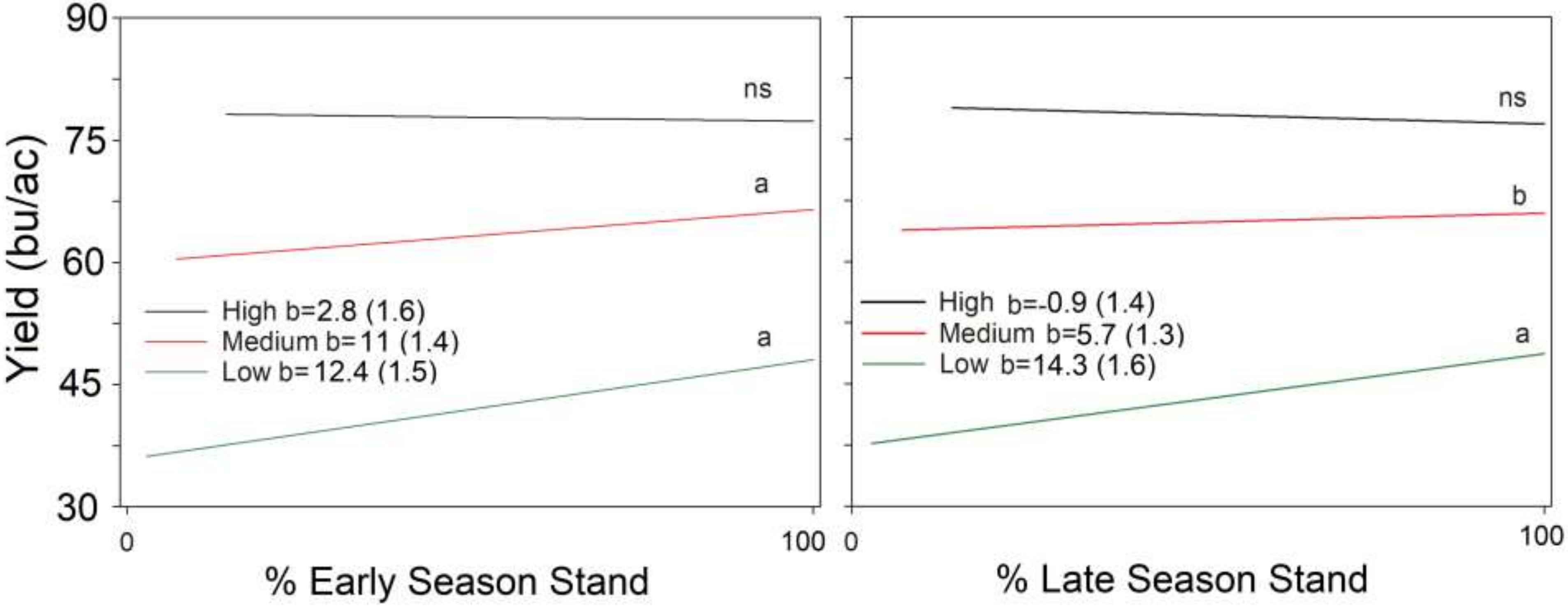
Soybean yield components-Path analysis



Soybean yield *vs.* Plant stand



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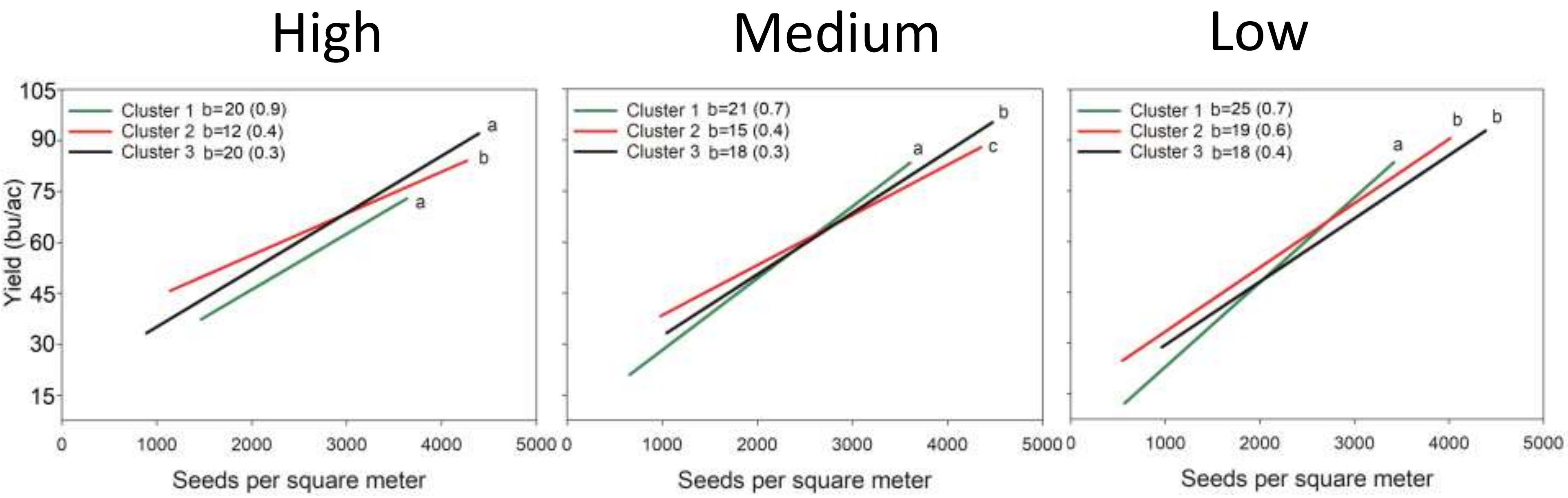
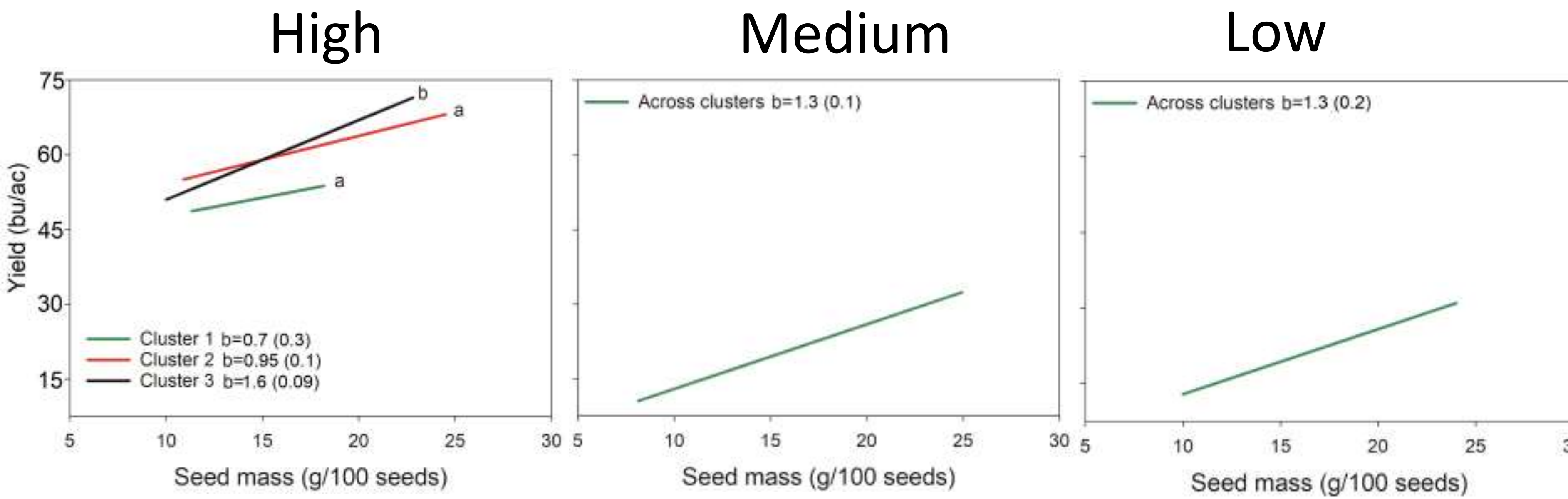
Soybean yield components-Seed number



Soybean yield components-Seed mass



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Agronomically optimal seeding rate (seeds/ac)

Yield level \ Cluster	Cluster 1	Cluster 2	Cluster 3
Low	237,000	170,000	130,000
Medium	168,000	145,000	136,000
High	154,000	128,000	142,000

Risk analysis at seeding rates surrounding each AOSR

		Cluster 1	Cluster 2	Cluster 3
Yield level	Seeding rate	Yield increase probability		
High	30%	0.58	0.64	0.59
	20%	0.57	0.62	0.58
	10%	0.54	0.58	0.55
	AOSR	**154,000**	**128,000**	**142,000**
	-10%	0.40	0.34	0.38
	-20%	0.22	0.10	0.17
	-30%	0.03	0	0.01

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Economically optimal seeding rate (seeds/ac)

Yield level \ Cluster	Cluster 1	Cluster 2	Cluster 3
Low	133,400	136,400	102,800
Medium	137,800	145,000	120,700
High	118,600	121,700	142,000

Economic analysis based on $62 per unit seed and $9 bu

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