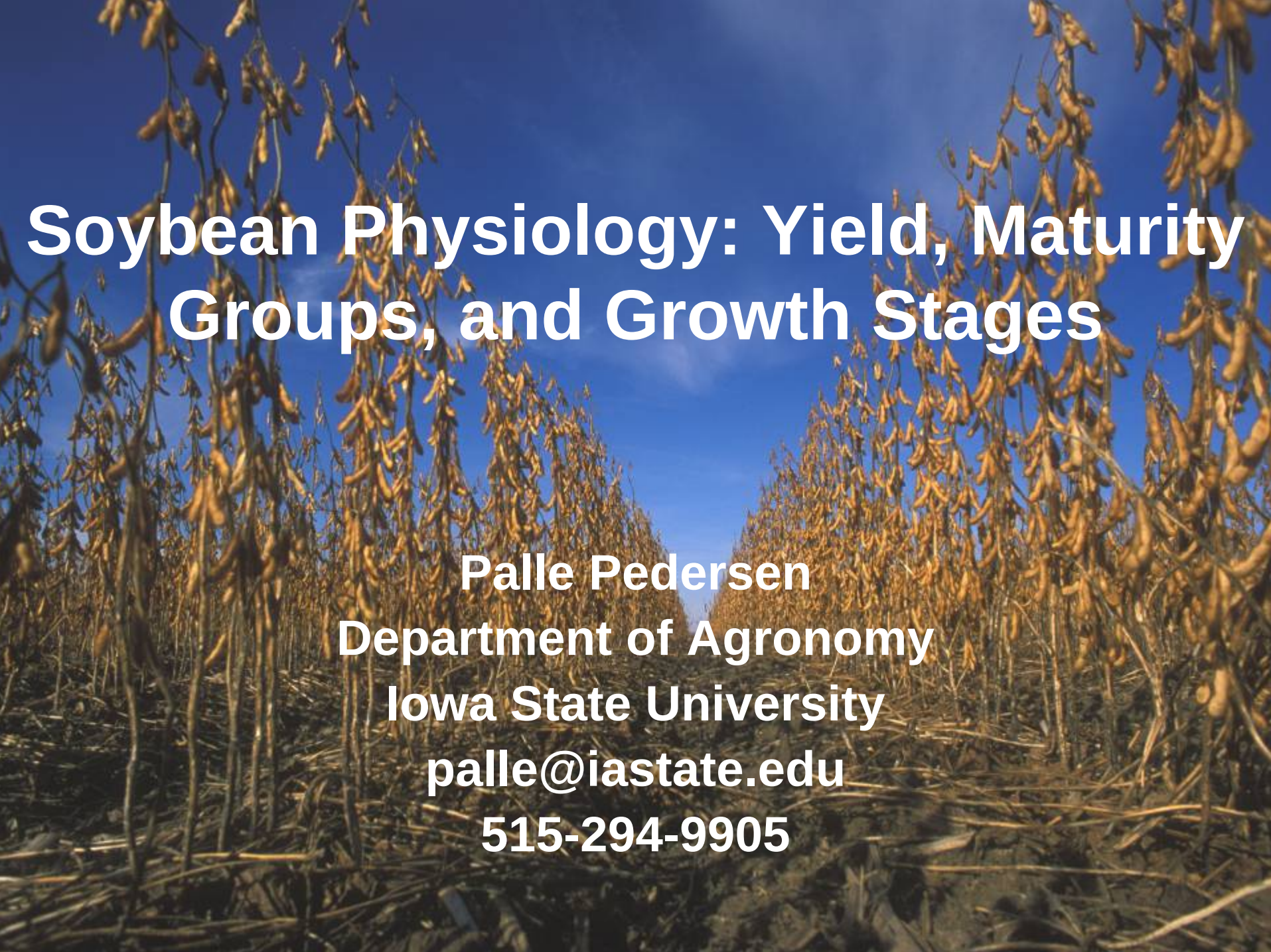
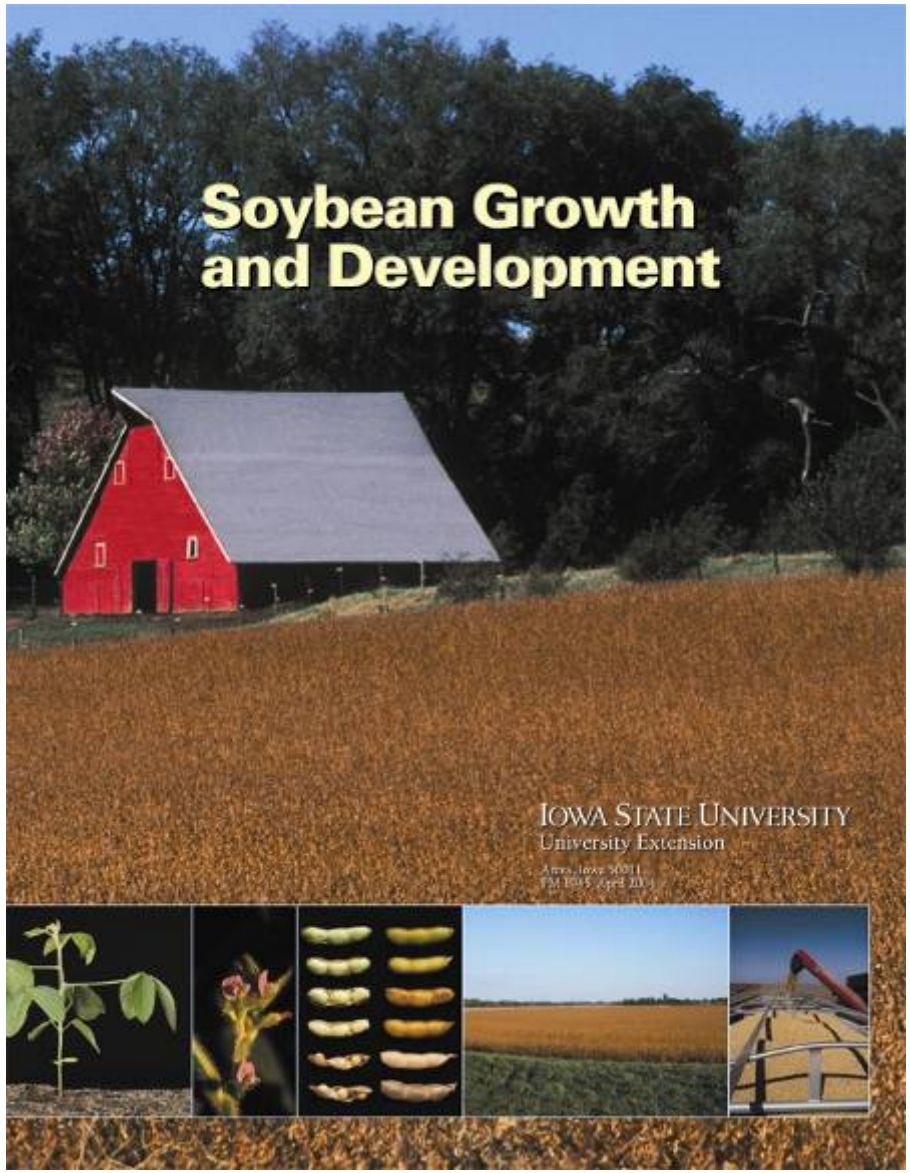


Soybean Physiology: Yield, Maturity Groups, and Growth Stages

Palle Pedersen
Department of Agronomy
Iowa State University
palle@iastate.edu
515-294-9905



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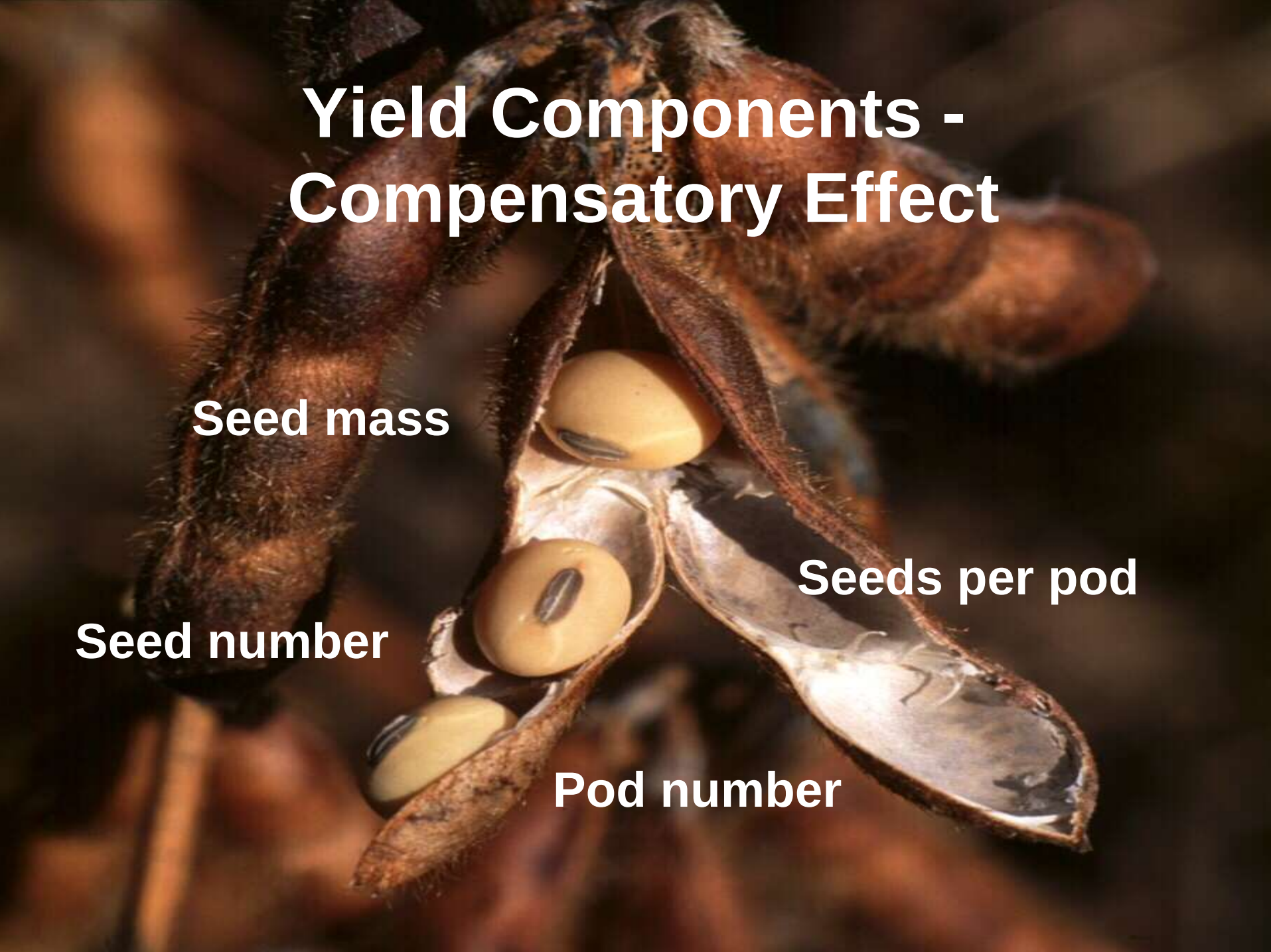
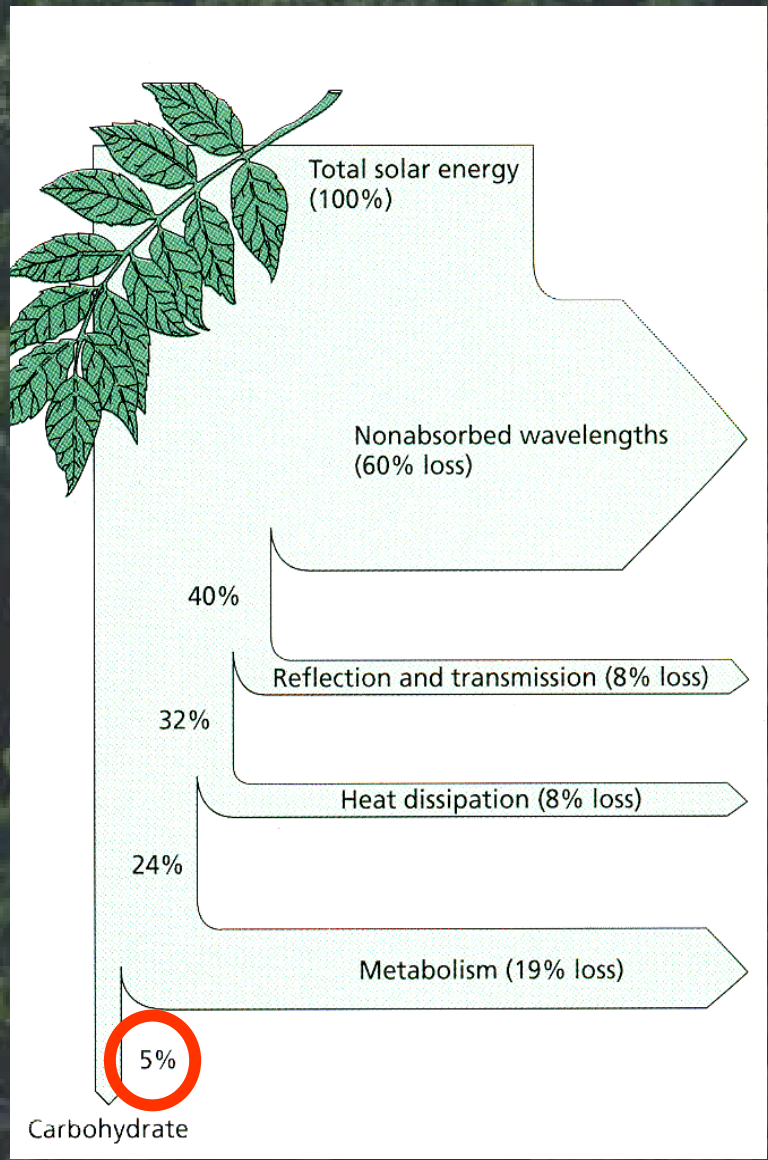

Yield Components - Compensatory Effect
Seed mass
Seeds per pod
Seed number
Pod number

Managing the soybean crop as a biomass generator

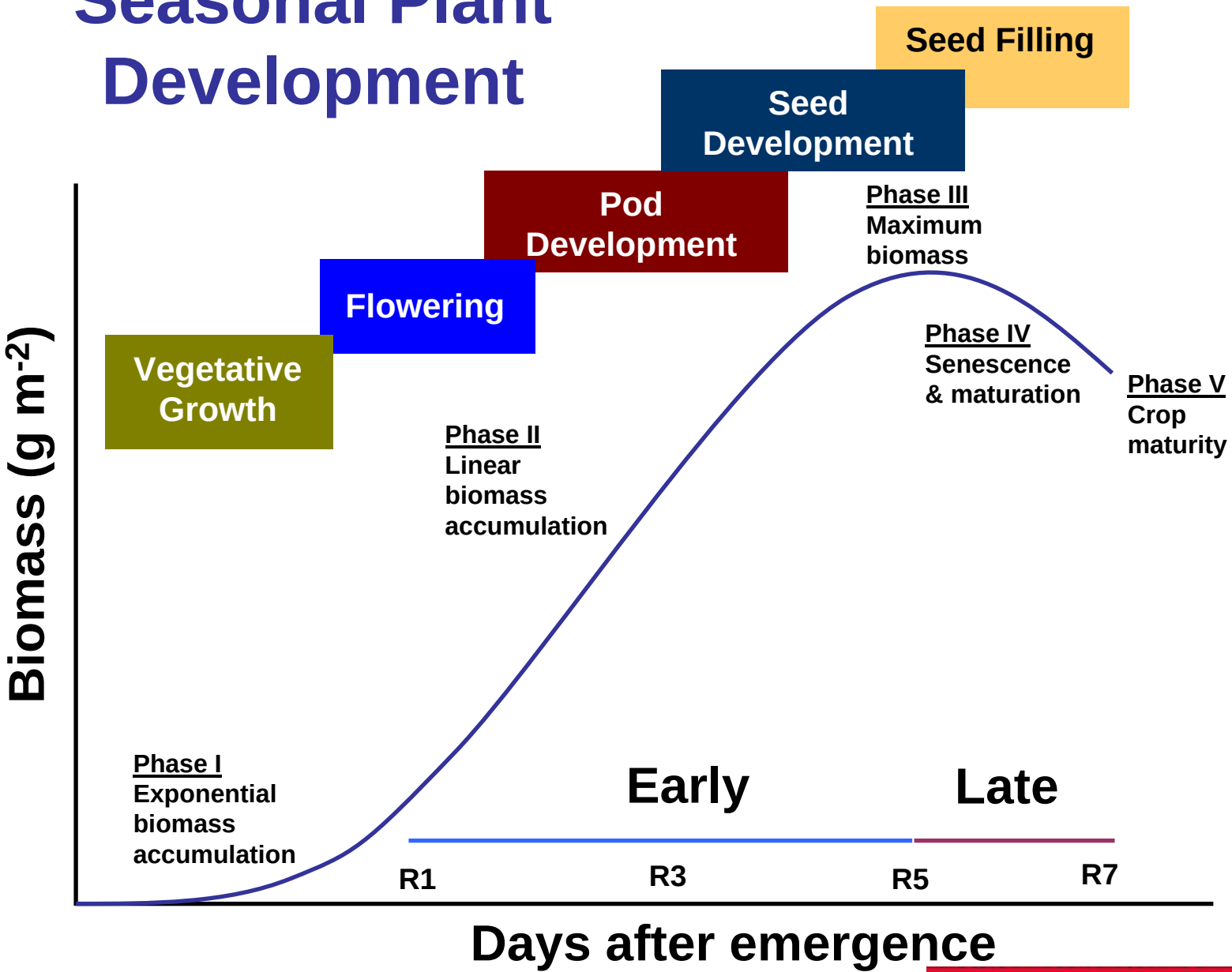
The photosynthetic process is not very efficient in the first place...

Soybean canopies convert **less than 5%** of the solar energy striking the earth's surface during the growing season into dry matter



(Taiz and Zeiger, 1998)

Seasonal Plant Development



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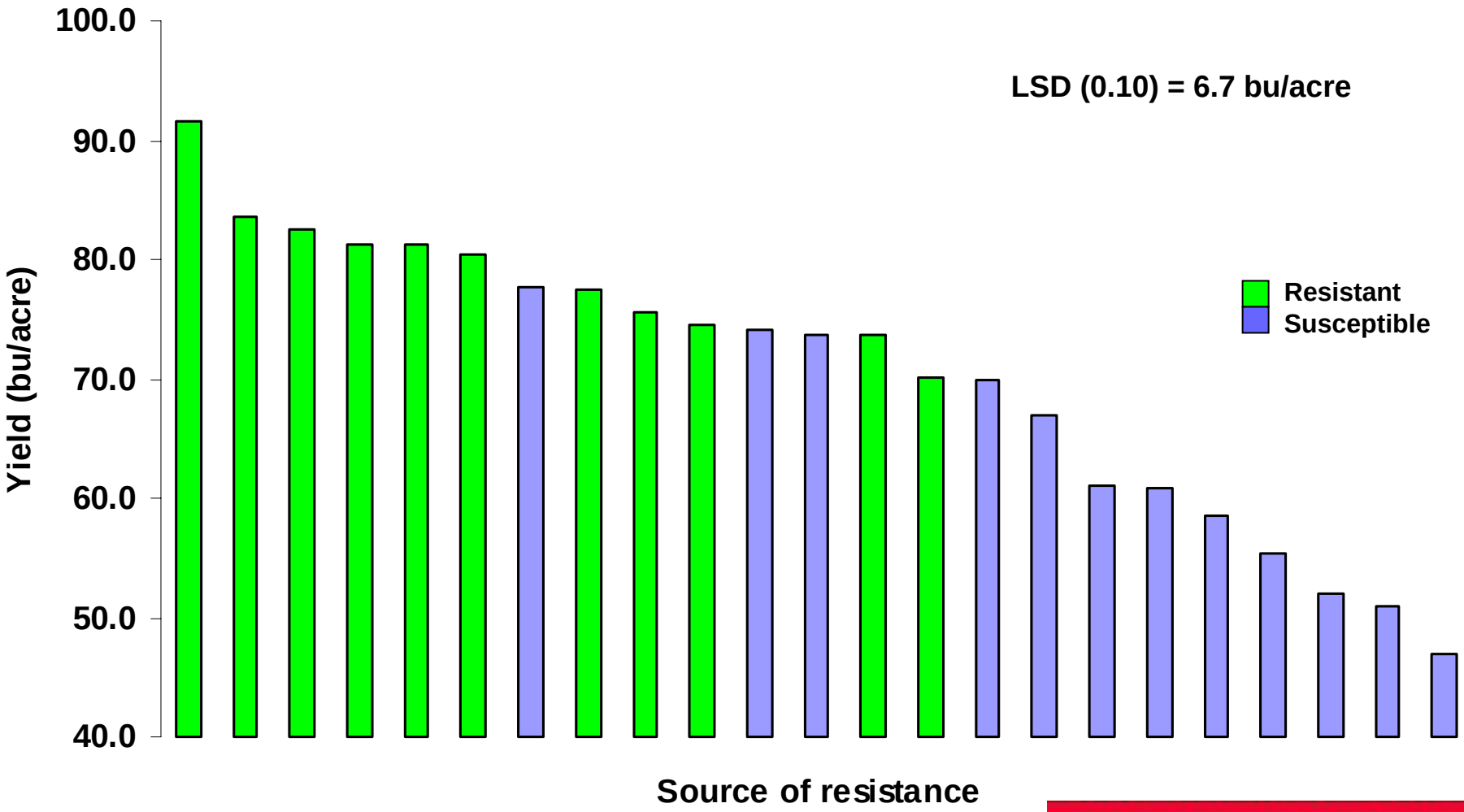
Effect of variety selection on soybean grain yield near Whiting, 2005



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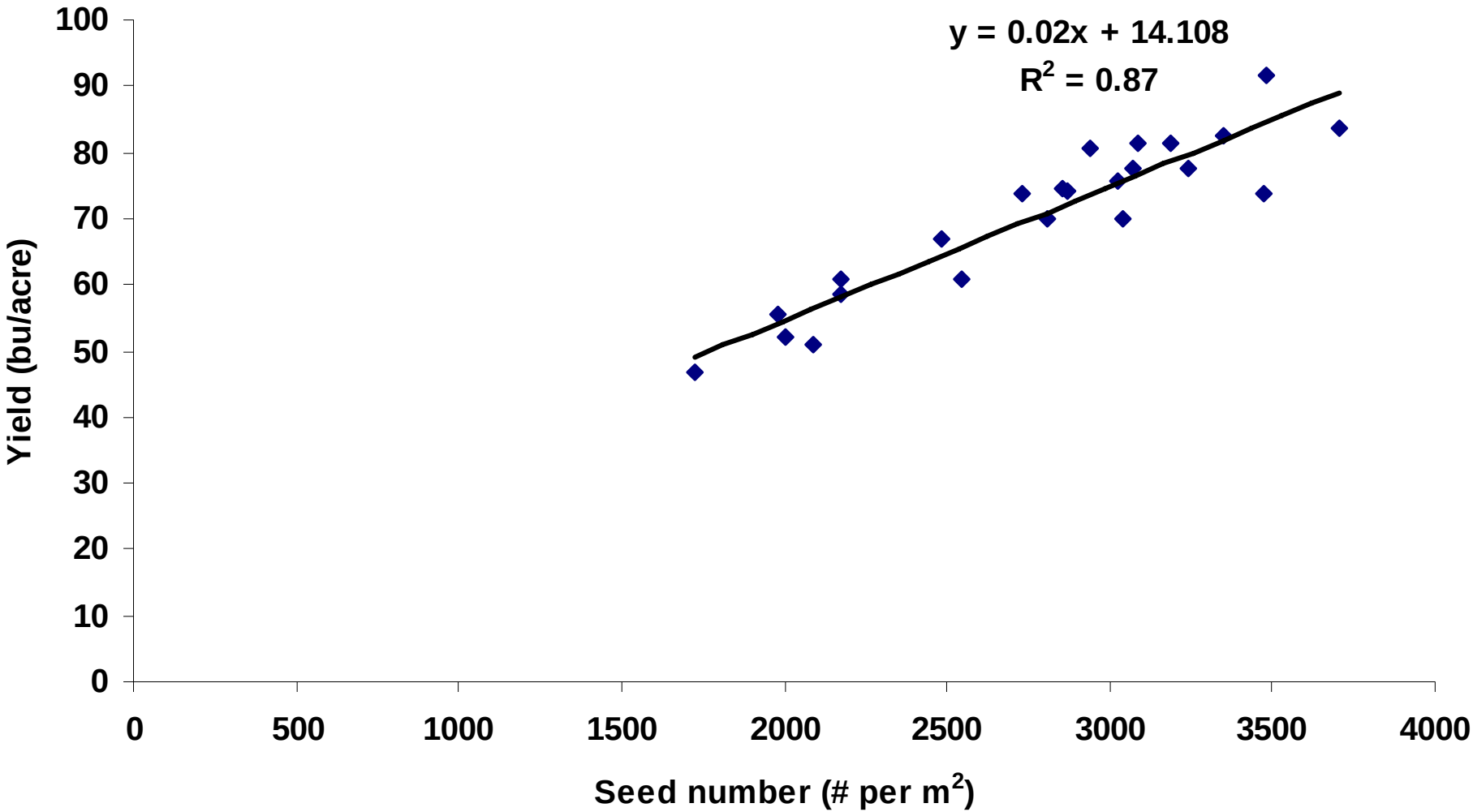
Correlation between Grain Yield and Seed Number near Whiting, 2005



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Development of the Soybean Growth Stage System

- **1949: Number system** (Kalton et al., 1949)
  - 2: Three trifoliate leaves unrolled = V3
  - 7: Small pods on top of plant with full pods at the bottom = R4 or R5

- **1977: Split development into a vegetative and reproductive stages** (Fehr and Caviness, 1977)

- **2004: Slight change in definitions from the method devised in 1977** (Pedersen, 2004)

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Soybean Growth and Development

Vegetative Stages

- V-Stages
- VE,VC,V1,V2,V3, Vn

Reproductive Stages

- R-Stages
- R1,R2,R3,…R8
- Starts at flowering

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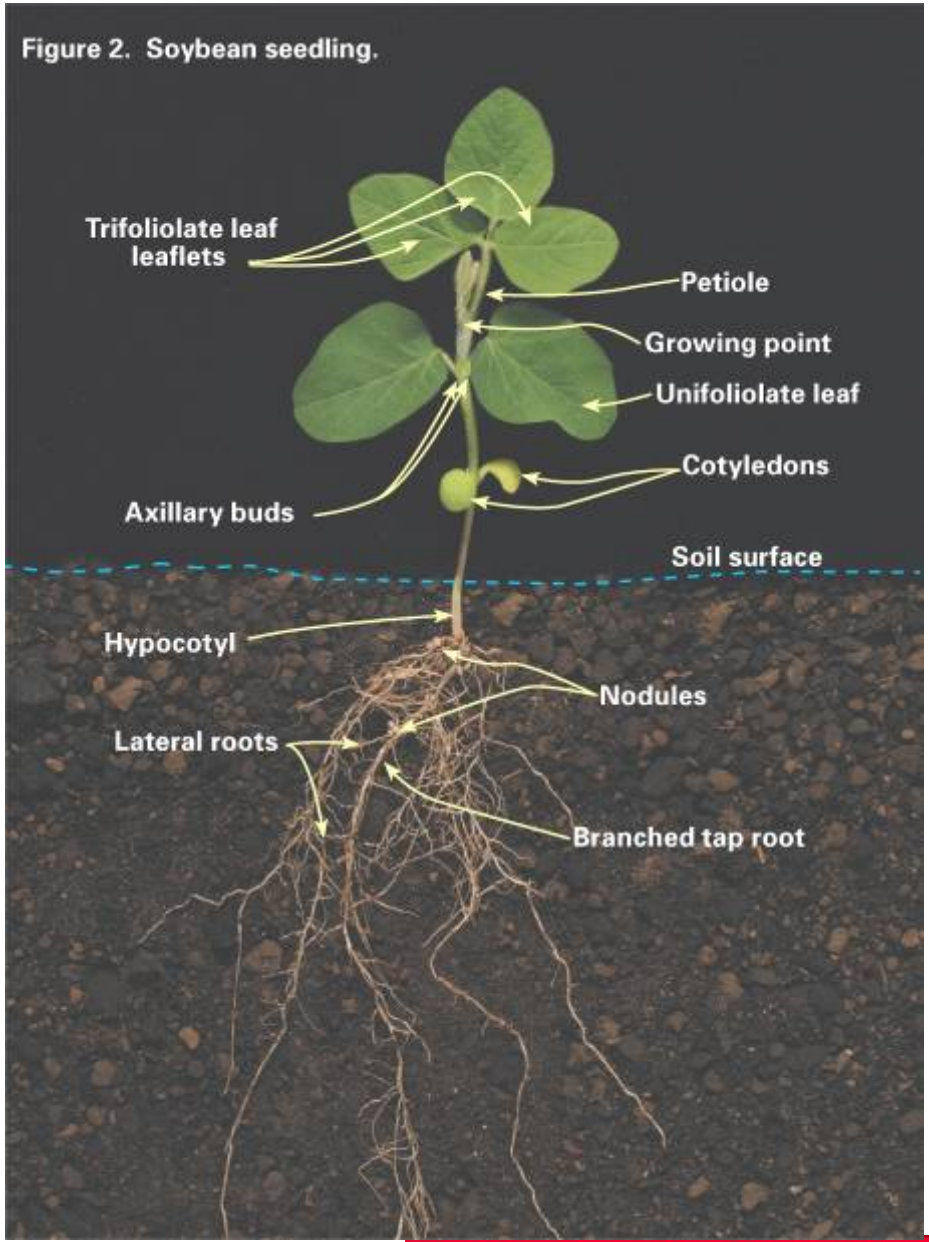
Soybean Morphology

- Note growing points
- Nodes are counted when the leaflets are fully developed



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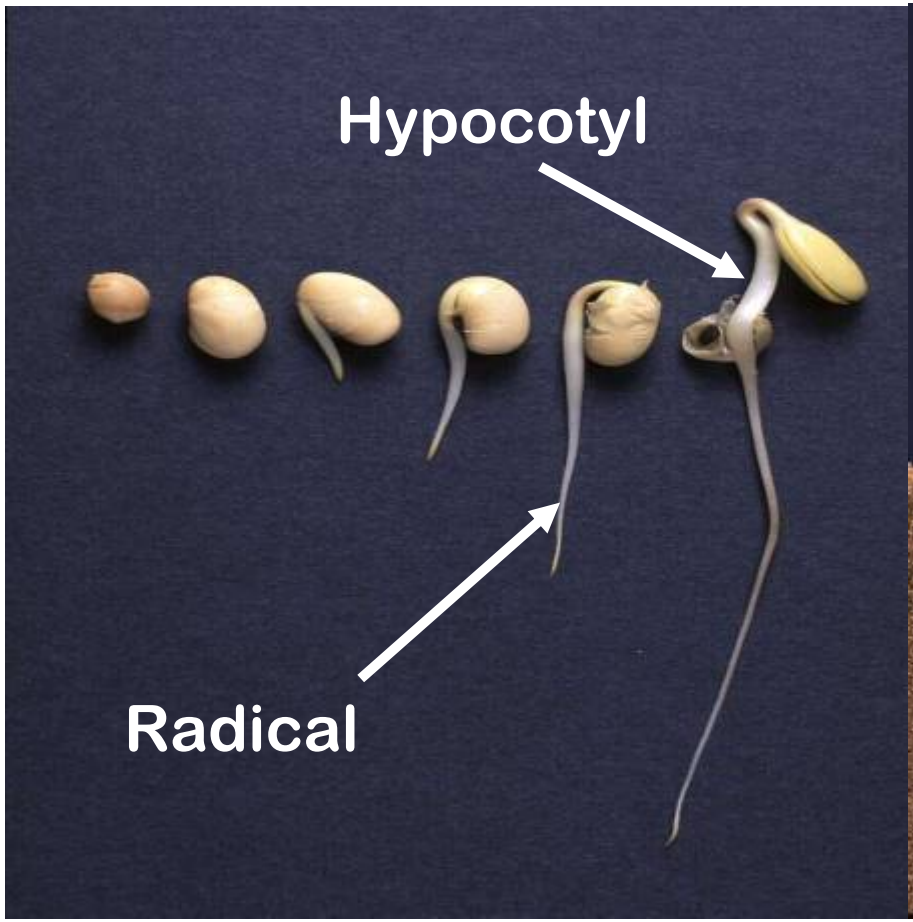
Soybean Germination



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VE - Emergence

- **5 to 14 days after planting**
- **Temperature and moisture dependent**

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VC - Stage

- **Unifoliolate leaves have unrolled**
- **Leaves are opposite**

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V1- Stage

- One trifoliolate
- Two nodes
- Trifoliolate leaf nodes are produced singularly and alternately

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“R1 - The Misconception”

- **Plants must wait to be florally induced until after the longest day of the season is over**
  - **Plants can flower soon after the development and expansion of the first true leaves**
  - **All varieties with a maturity group adaptation will be able to flower as soon as those first leaves are available, no matter when those varieties are planted**

(Yanofsky, 1995)

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Time between planting and flowering depends primarily on two things?

Temperature
Day length

What's going on?

Planting in late April to early May can, if the subsequent weather is abnormally warm

The floral induction response is stronger the shorter the photoperiod

Could then flower in early to mid-June
(13 June, 2004)
(11 June, 2005)
(11 June, 2006)
(5 June, 2007)

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Reproductive Stages and Development

R1	Beginning Bloom (flower)
R2	Full Bloom
R3	Beginning Pod
R4	Full Pod
R5	Beginning Seed
R6	Full Seed
R7	Beginning Maturity
R8	Full Maturity

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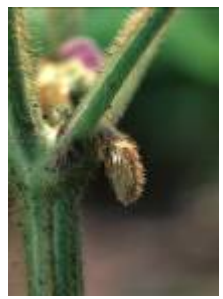
Reproductive Stages and Development


R8


R1


R2


R3


R4


R5


R6


R7

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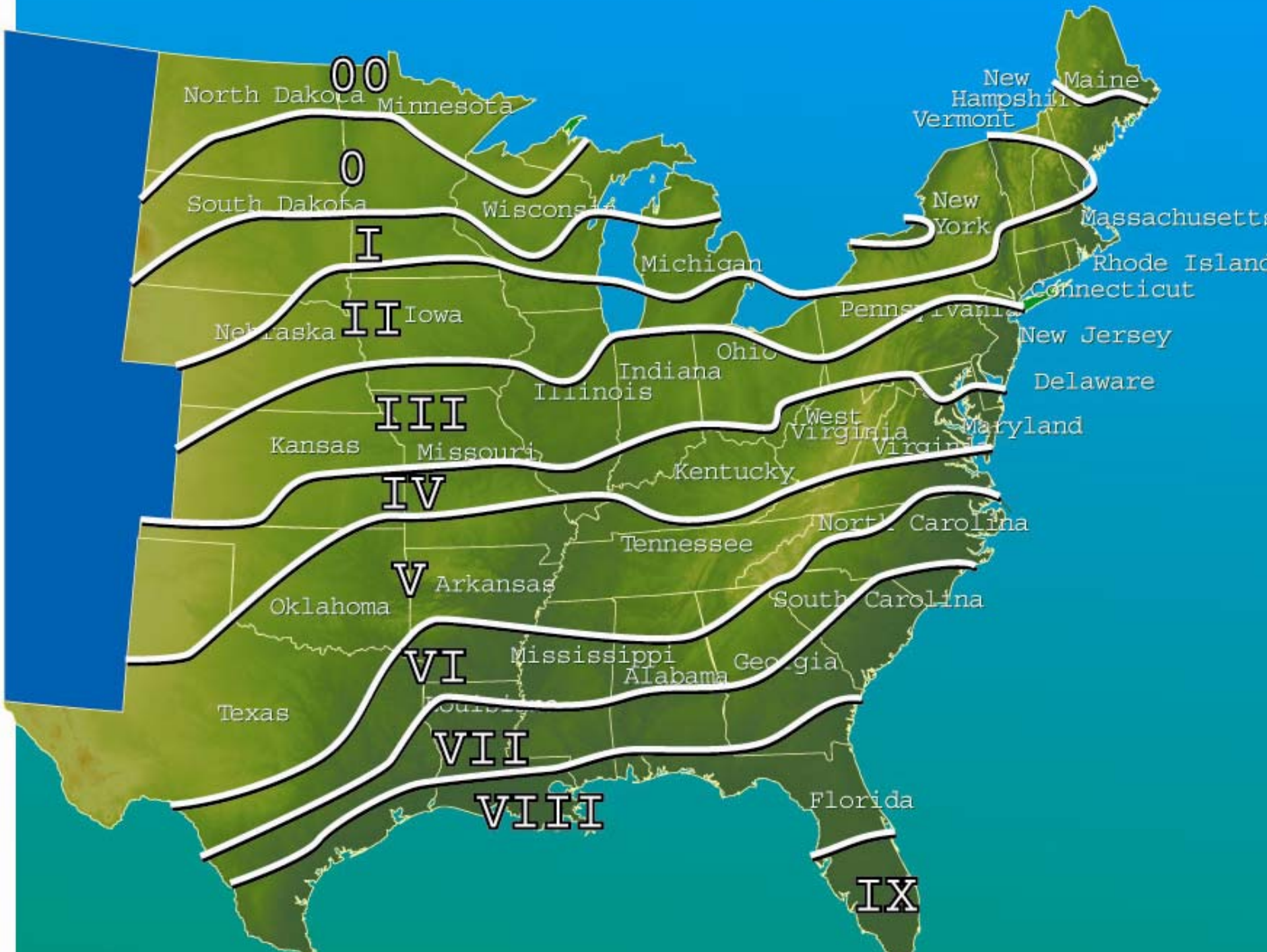
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VIII
Florida
IX
New Hampshire
Maine
Vermont
New York
Massachusetts
Rhode Island
Connecticut
New Jersey
Delaware
Maryland
West Virginia
North Carolina
South Carolina
Georgia

Main Stem Growth Habits

- **Indeterminate**
- **Semi-determinate**
- **Determinate**

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Determinate Varieties

- **MG V – IX**
- **Main stem node number accrual ceases abruptly at R1**
- **Leaves will continue to develop on branches (most yield)**

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Indeterminate Varieties

- MG 000 - 5
- Main stem node number stop at R5
- Potential number of main stem nodes produced by the plant is a function of the number of days between V1 and R5.5
  - A new node for every 3.7-5 days after V1 (linear)
- Planting date and maturity can restrict the final node number below the potential node number

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Summary

- **Reproductive growth:**
  - **R1 Flowering**
  - **R5.5 vegetative growth finished**

- **Critical period:**
  - **The early reproductive period (R1 to R5.5) is sensitive to altered source strength and crop growth rate**

- **Yield is mostly determined by seed number**

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