Managing for High Yield in Soybean

Louisiana Agricultural Technology & Management Conference

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Louisiana Historical Yield

Year	Yield (bu A^{-1})	Year	Yield (bu A^{-1})
2017	54	2007	43
2016	48.5	2006	36
2015	41	2005	34
2014	56.5	2004	33
2013	48.5	2003	34
2012	46.5	2002	32
2011	36	2001	33
2010	41	2000	24
2009	39	1999	27
2008	33	1998	21

quickstats.nass.usda.gov

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High Yielding Soybean

- Steps to High Yield
  1. Soil Management: pH
  2. Fertility
  3. Genetics/Variety Selection
  4. Light Interception
  5. Protection

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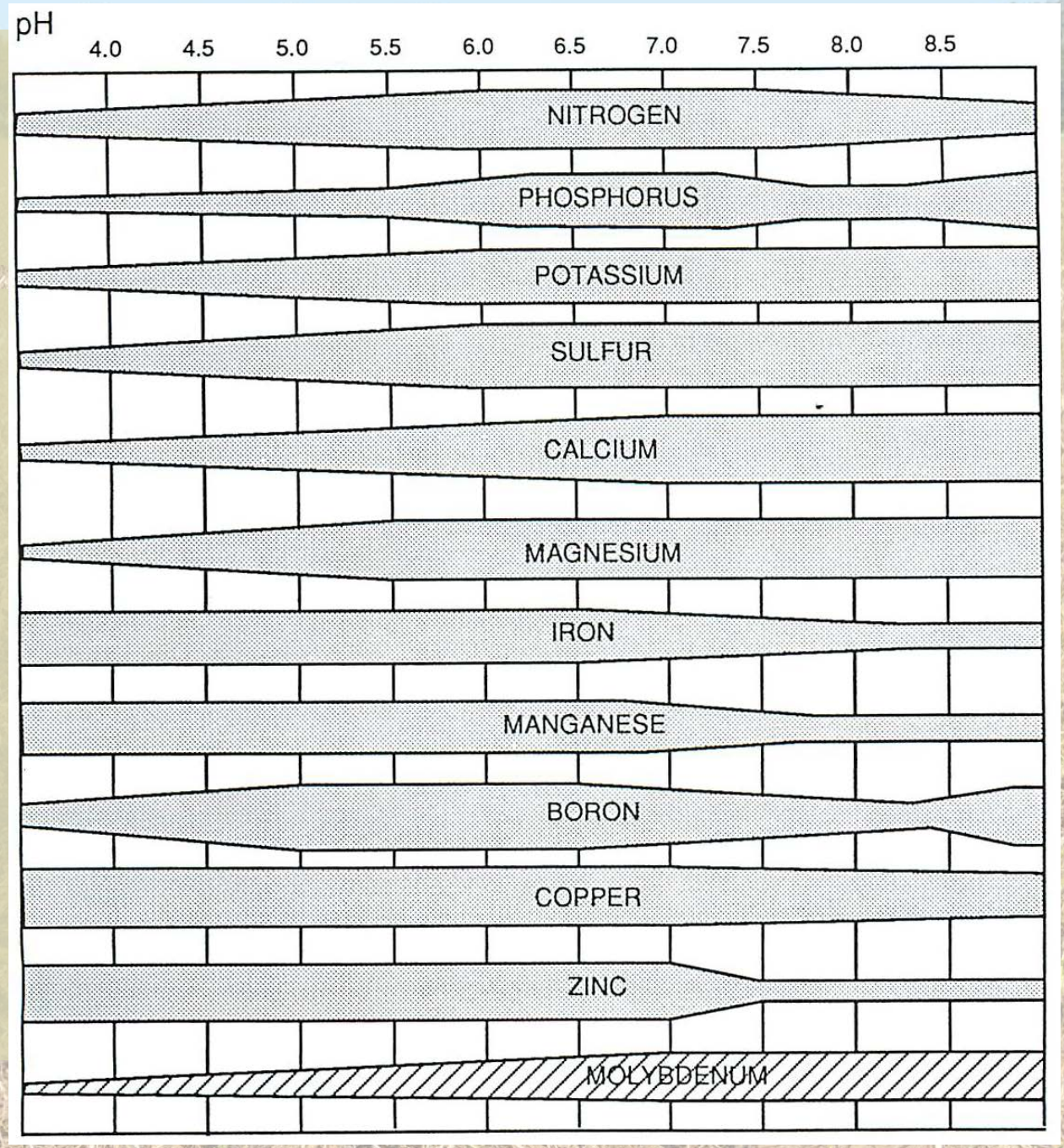
Soil Management: pH

Soil Test pH – **6.5-7.2**

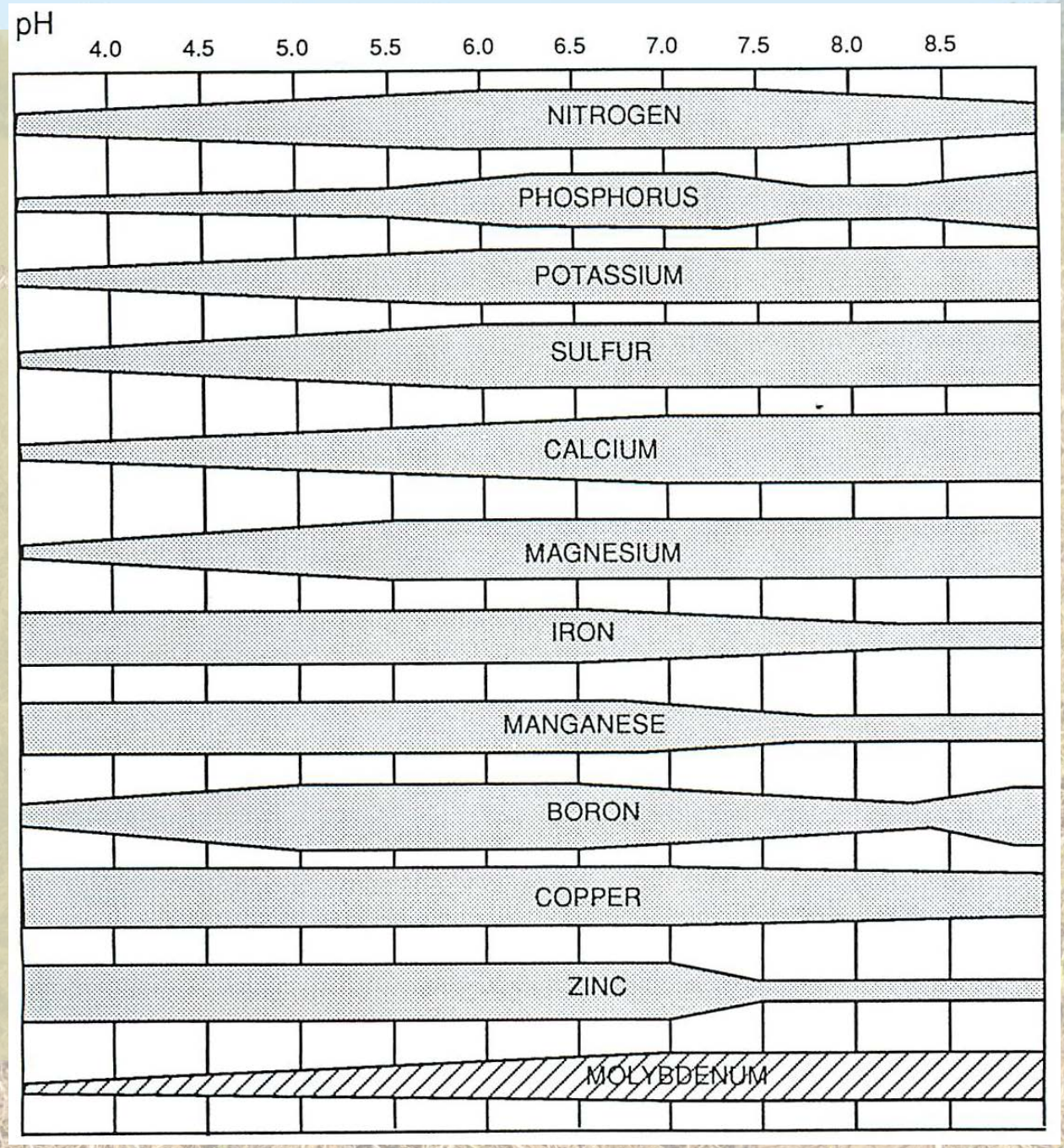
- Phosphorus
  - **pH < 5.5 –** $H_2PO_4^-$ forms less soluble compounds with iron (Fe) and aluminum (Al)
  - **pH >7.5 –** HPO_4^{2-} forms less soluble compounds with calcium (Ca) and magnesium (Mg)

- Toxicity
  - **pH<5.2 –** Manganese
  - **pH<5.0 –** Aluminum



Soil Test pH – **6.5-7.2**

- **pH<6.2** – Molybdenum
  - Required for nitrogen fixation and becomes increasingly unavailable
- **pH<6.0** – Root hair deformation is inhibited
  - Root hair deformation is the initial plant response to *Bradyrhizobium* initiation



Fertility: P & K

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Fertility: P & K

- Phosphorus
  - Removal – 0.8 lb P_2O_5 bu^{-1} A^{-1}
  - Total Uptake – 1.2 lb P_2O_5 bu^{-1} A^{-1}
- Potassium
  - Removal – 1.4 lb K_2O bu^{-1} A^{-1}
  - Total Uptake – 4 lb K_2O bu^{-1} A^{-1}

Photo Credit: University of Missouri Extension

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Soybean Uptake and Removal

Yield Level	Phosphorus (P)		Potassium (K)	
	Uptake	Removal	Uptake	Removal
40	48	32	160	56
60	72	48	240	84
80	96	64	320	112

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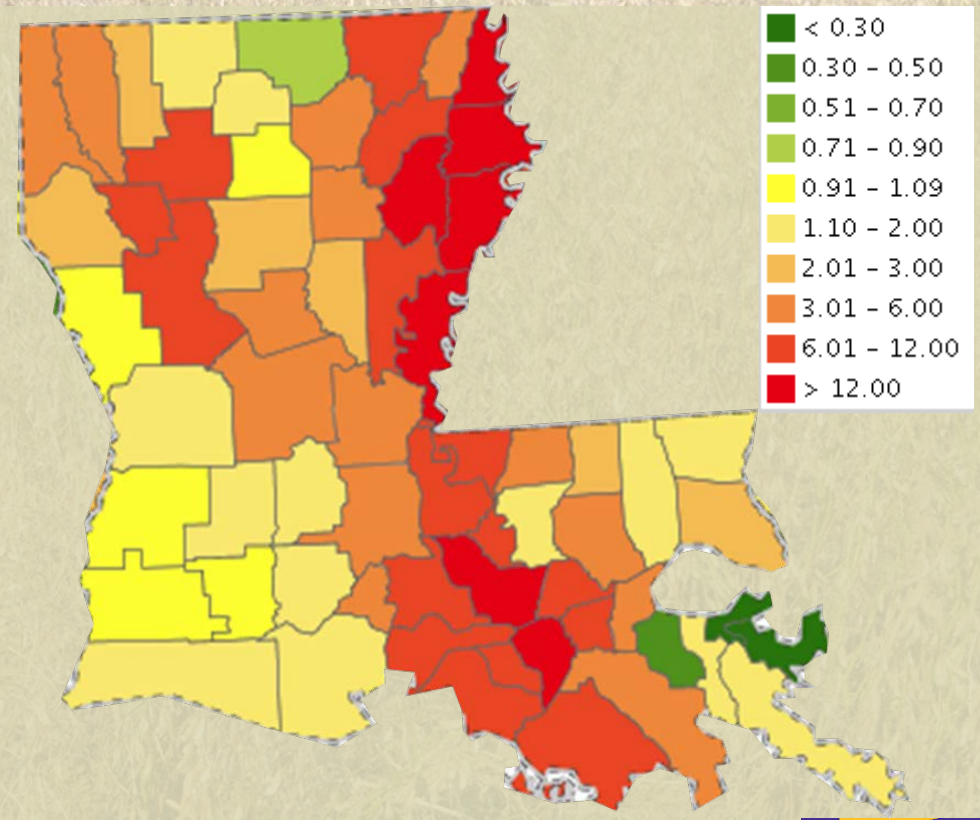
Nutrient Removal

- Less than 30% of LA soybean acres received K or P in 2015.

- Top 15 soybean parishes (2012)
  - Removal:Replacement
    - **K = 6:1**
    - **P = 3.25:1**
  - Net Balance
    - **K_2O = -54 lb A^{-1}**
    - **P_2O_5 = -27 lb A^{-1}**



Adapted from: *nugis.ipni.net*

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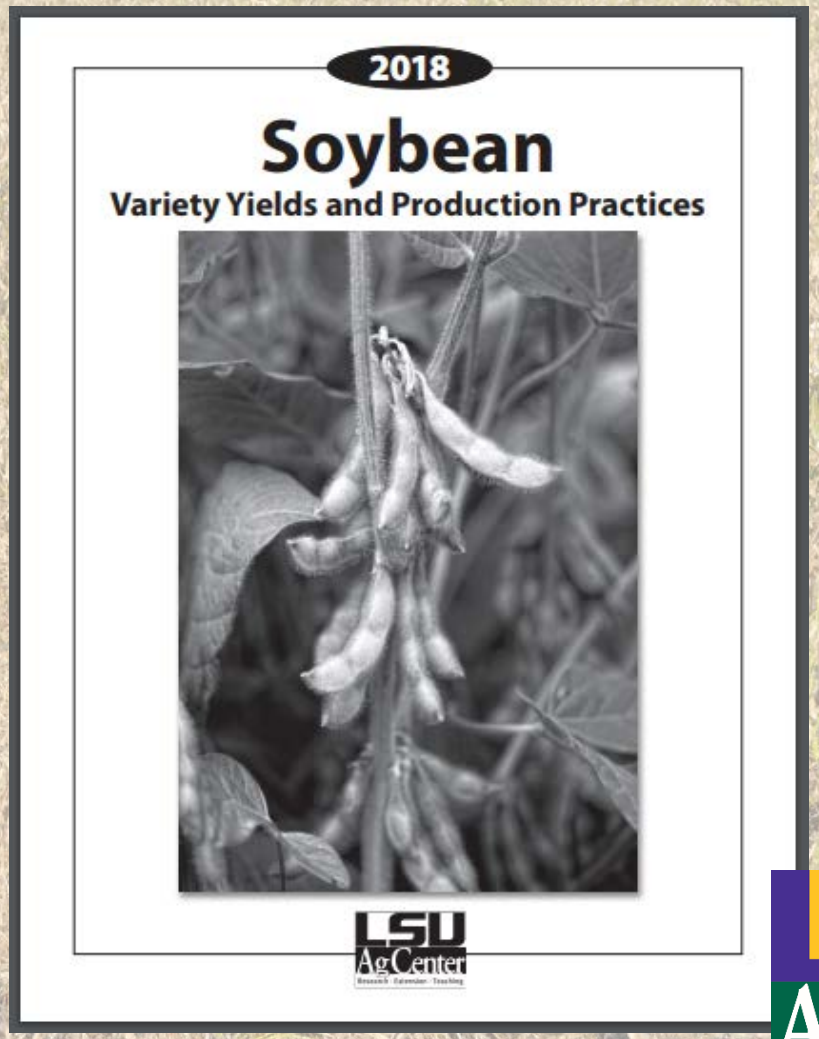
Variety Selection

Variety Selection

- A decision that costs.
- 2017 Core-Block ($8.50 bu^{-1})
  - Small error (above average)
    - $55
  - Large error (below average)
    - $155



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Variety Selection

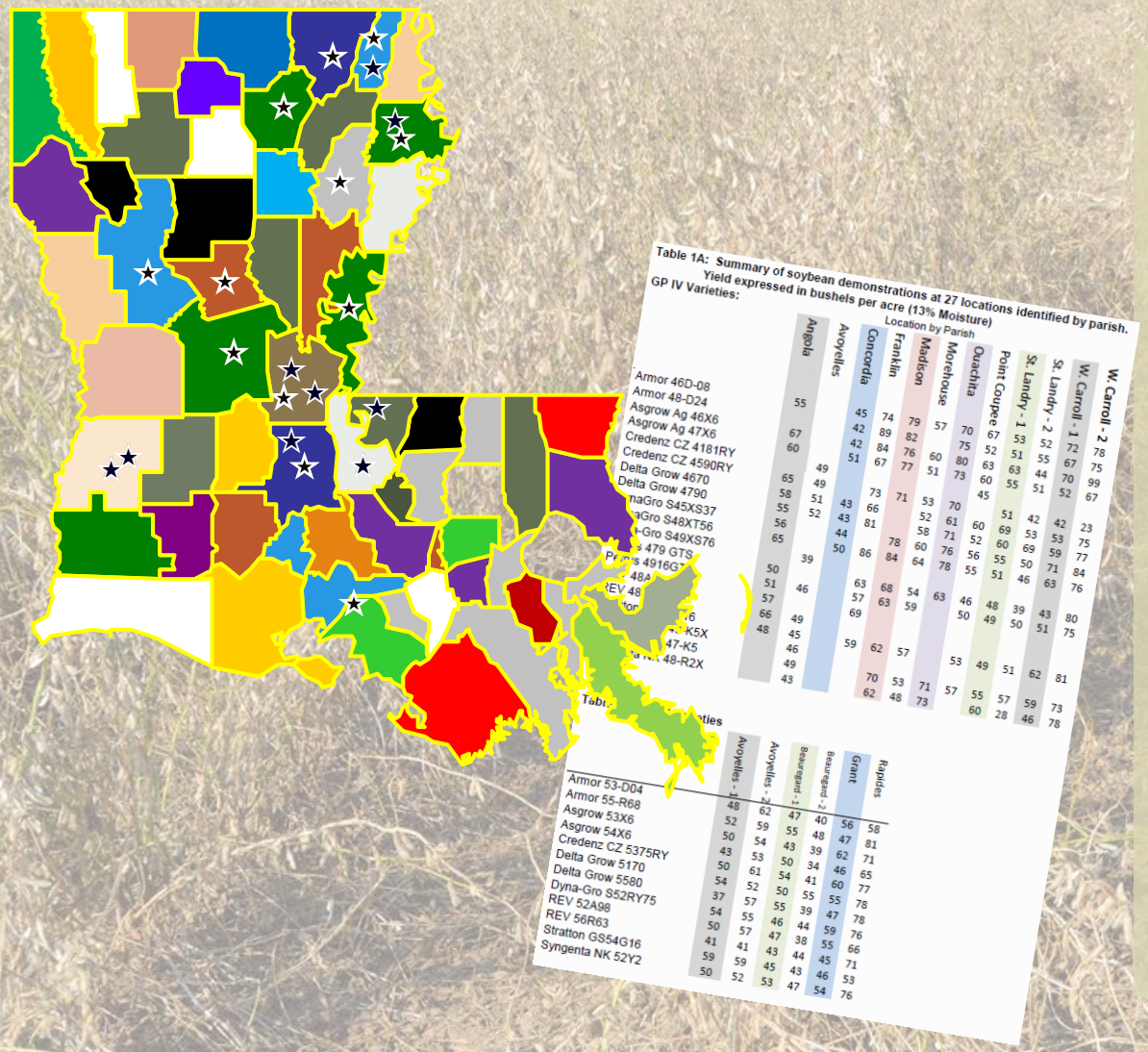

Table 1A: Summary of soybean demonstrations at 27 locations identified by parish. Yield expressed in bushels per acre (13% Moisture)
GP IV Varieties:

Location by Parish

	Angola	Avoyelles	Concordia	Franklin	Madison	Morehouse	Ouachita	Point Coupee	St. Landry - 1	St. Landry - 2	W. Carroll - 1	W. Carroll - 2
Armor 46D-08	55		45	74	79	57	70	67	53	52	72	78
Armor 48-D24			42	89	82		75	52	51	55	67	75
Asgrow Ag 46X6	67		42	84	76	60	80	63	63	44	70	99
Asgrow Ag 47X6	60		51	67	77	51	73	60	55	51	52	67
Credenz CZ 4181RY		49						45				
Credenz CZ 4590RY	65	49		73	71	53	70		51	42	23	
Delta Grow 4670	58	51	43	66		52	61	60	69	53	75	
Delta Grow 4790	55	52	43			58	71	52	60	59	77	
naGro S45XS37	56		44	81	78	60	76	56	55	71	84	
Gro S48XT56	65		50		84	64	78	55	51	63	76	
-Gro S49XS76		39		86					46			
479 GTS	50				68	54	63	48	39	43	80	
s 4916G7	51	46	63	68	63	59	46	49	50	51	75	
48A	57		57									
REV 48	66	49	69		54	63	46	48	39	43	80	
	48	45		62	59		50	49	50	51	75	
6		46	59		57							
K5X		49		70		53	53	49	51	62	81	
47-K5		45		62	53	71	57	55	57	59	73	
48-R2X		46		53	48	73	57	60	28	46	78	
		49		71								
		43		48								

Table 1B: Summary of soybean demonstrations at 27 locations identified by parish. Yield expressed in bushels per acre (13% Moisture)
GP IV Varieties:

Location by Parish

	Avoyelles - 1	Avoyelles - 2	Beauregard - 1	Beauregard - 2	Grant	Rapides
Armor 53-D04	48	62	47	40	56	58
Armor 55-R68	52	59	55	48	47	81
Asgrow 53X6	50	54	43	39	62	71
Asgrow 54X6	43	53	50	34	46	65
Credenz CZ 5375RY	50	61	54	41	60	77
Delta Grow 5170	54	52	50	55	55	78
Delta Grow 5580	37	57	55	39	47	78
Dyna-Gro S52RY75	54	55	46	44	59	76
REV 52A98	50	57	47	38	55	66
REV 56R63	41	41	43	44	45	71
Stratton GS54G16	59	59	45	43	46	53
Syngenta NK 52Y2	50	52	53	47	54	76

- Performance – high yielding in environment
  - Near your farm
- Stability – high yielding in all environments
  - Across all locations

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Light Interception

Light Interception

- To maximize photosynthesis we must maximize light interception

- Canopy closure
  - “3 feet tall and lapping the middles”
  - Leaf Area Index (LAI) – **3.5-4** m^2 leaf area m^{-2} ground area

Light Interception

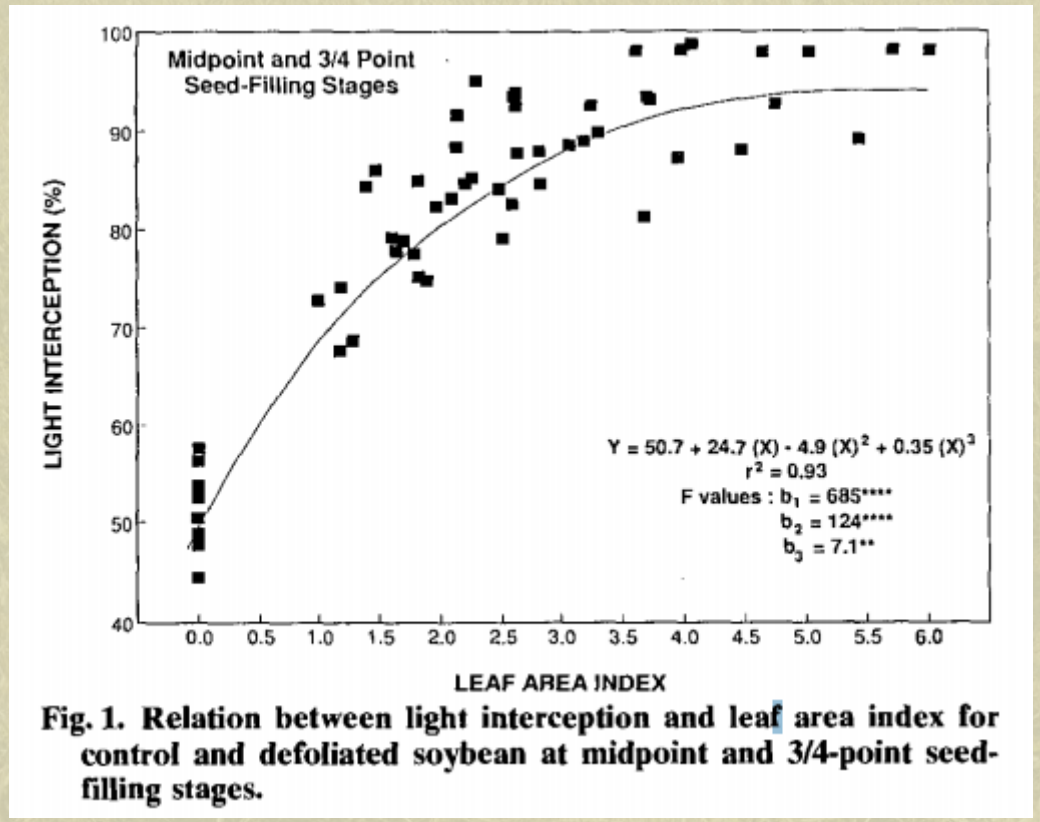

Fig. 1. Relation between light interception and leaf area index for control and defoliated soybean at midpoint and 3/4-point seed-filling stages.

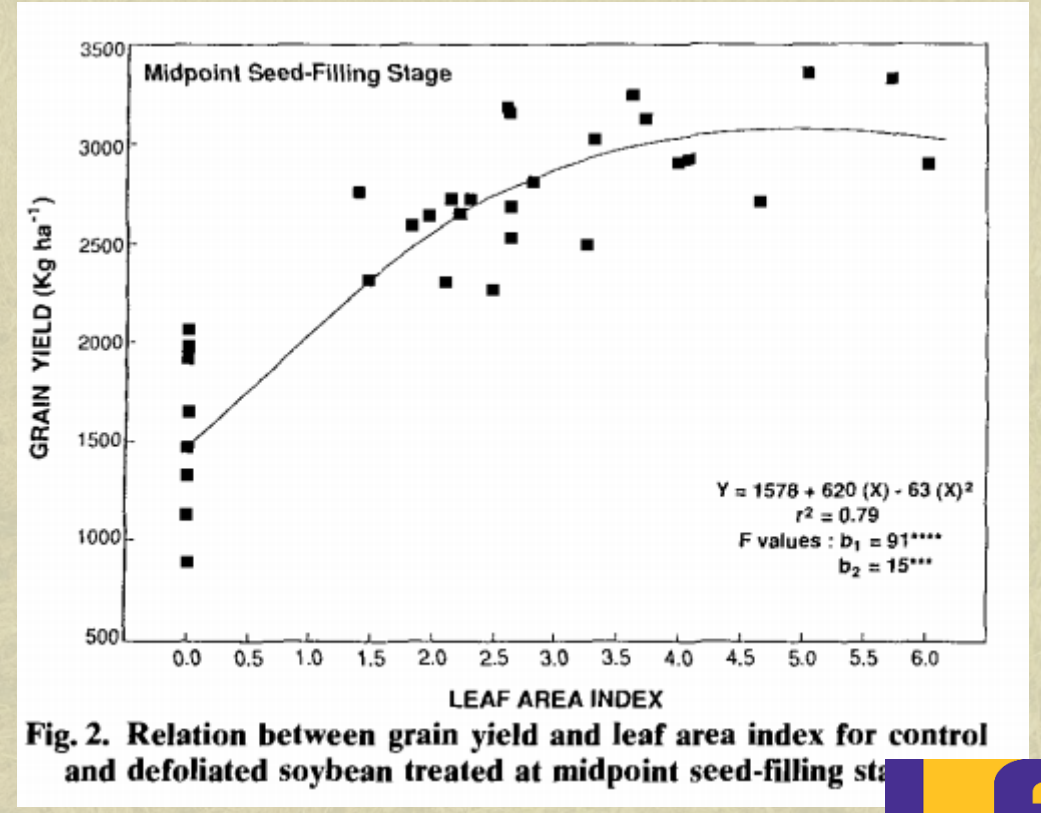

Fig. 2. Relation between grain yield and leaf area index for control and defoliated soybean treated at midpoint seed-filling sta

James Board, Ph.D., St. Gabriel, LA

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Light Interception

- Early Planting
- Uniform Plant Spacing
- Proper fertility and soil management

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Maximizing Crop Yield

- Steps to High Yield
  1. Soil Management: pH
  2. Fertility
  3. Genetics/Variety Selection
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Our goal is to ensure that the most limiting factor is one out of our control.

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