Factors Affecting Soybean Grain Composition

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WHICH FIELD CONDITIONS?

- UW Agronomy and Volunteer Growers
  - ✓ 11 fields
  - ✓ 289 samples
  - ✓ Geo referenced maps of yield and grain composition variables across the landscape
  - ✓ Multi-correlation analysis among field and crop variables

- UW Agronomy and DeLong Company
  - ✓ 1 variety
  - ✓ 200+ Fields
  - ✓ 7 Wisconsin counties
  - ✓ 1 Soybean grain sample per field
  - ✓ Correlation analysis between field conditions and grain composition

Correlation coefficients for UW Agronomy – Delong Project

	pH	OM	P	K	Till	SD	RW	Seed TRT	Spray	
Yield		+++		++		---	++		+++	Yield
Moist	-	+		-				-	-	Moist
Prot		--			++			+	-	Prot
Oil	+	++			--					Oil
Fiber									+++	Fiber
PPO	+							++		PPO
PPA	+	+++		+++		---	++		++	PPA
OPA		+++		++		---	+		++	OPA
PPOA		+++		++		---	++		++	PPOA
	pH	OM	P	K	Till	SD	RW	Seed TRT	Spray	

Correlation coefficients for UW Agronomy – Delong Project

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Yield		+++		++		---	++		+++	Yield
Moist	-	+		-				-	-	Moist
Prot		--			++			+	-	Prot
Oil	+	++			--					Oil
Fiber									+++	Fiber
PPO	+							++		PPO
PPA	+	+++		+++		---	++		++	PPA
OPA		+++		++		---	+		++	OPA
PPOA		+++		++		---	++		++	PPOA
	pH	OM	P	K	Till	SD	RW	Seed TRT	Spray	

Correlation coefficients for UW Agronomy – Delong Project

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Moist	-	+		-				-	-	Moist
Prot		--			++			+	-	Prot
Oil	+	++			--					Oil
Fiber									+++	Fiber
PPO	+							++		PPO
PPA	+	+++		+++		---	++		++	PPA
OPA		+++		++		---	+		++	OPA
PPOA		+++		++		---	++		++	PPOA
	pH	OM	P	K	Till	SD	RW	Seed TRT	Spray	

pH 89% 6.1 to 7.2
OM 1.4 to 6.0

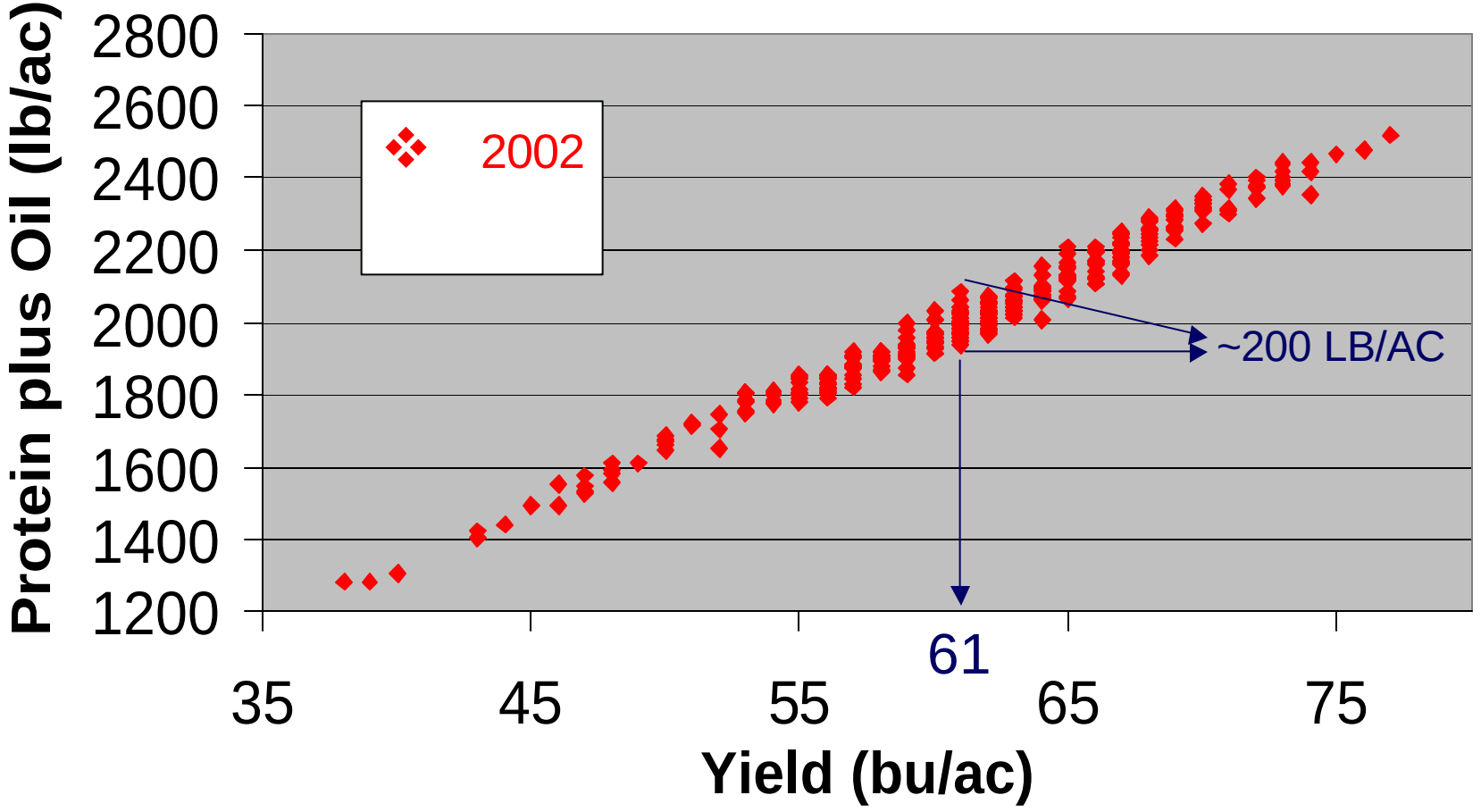
P 90% above sufficiency
K 25% below sufficiency

WORK IN PROGRESS

- Protein, oil, and fiber determinations by 12/22/03
  - ✓8,754 soybean samples
  - ✓71 experiments

- Wisconsin Soybean Variety Trials 2003
  - ✓Average Protein 37.37% (35.6% in 2002)
  - ✓Average Oil 18.97% (19.2 in 2002)

RELATIONSHIP BETWEEN SOYBEAN WHOLE GRAIN YIELDS AND PROTEIN AND OIL YIELD/ACRE OBSERVED IN 2002



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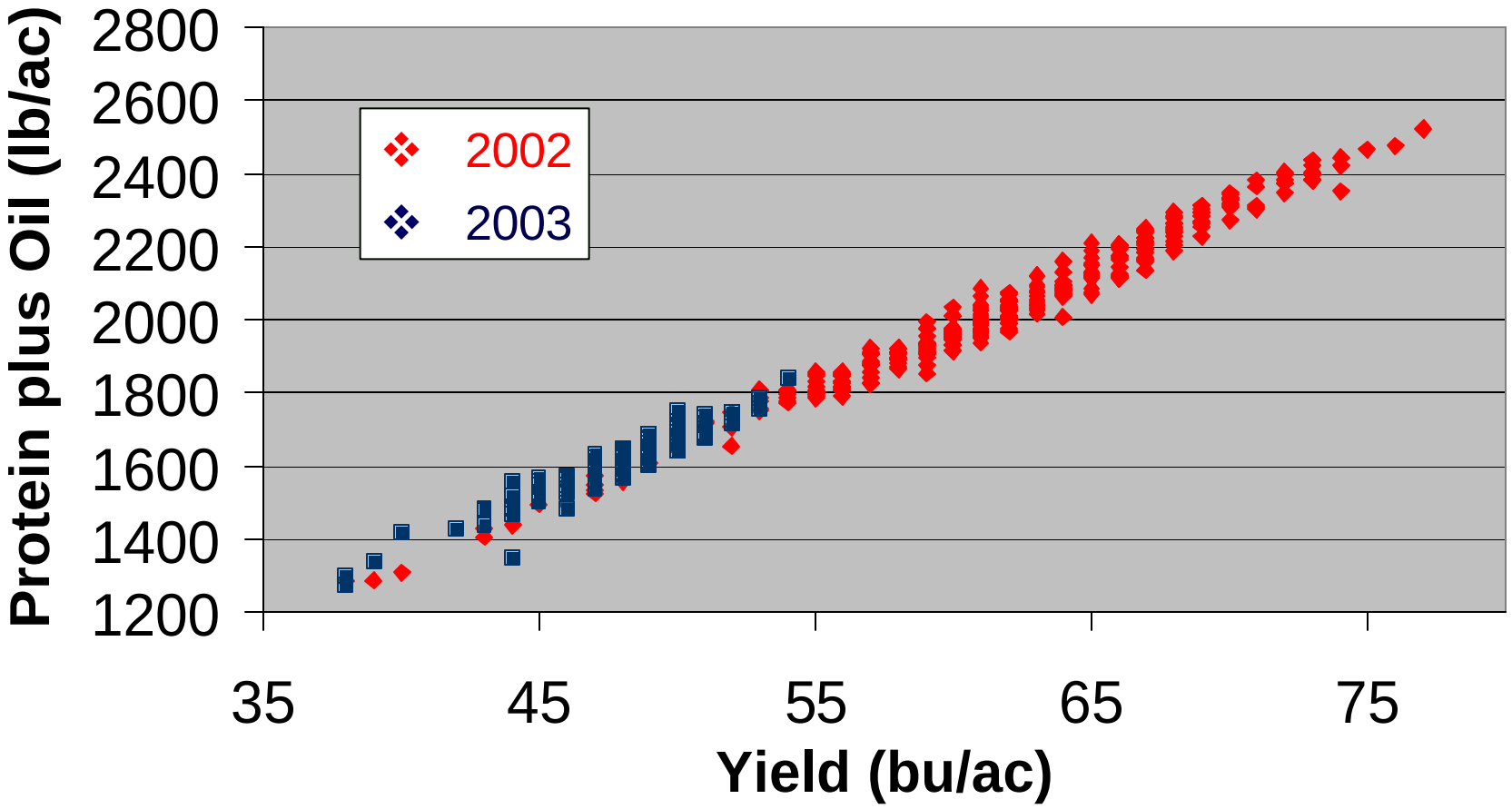


GENERAL TRENDS OBSERVED IN 2003

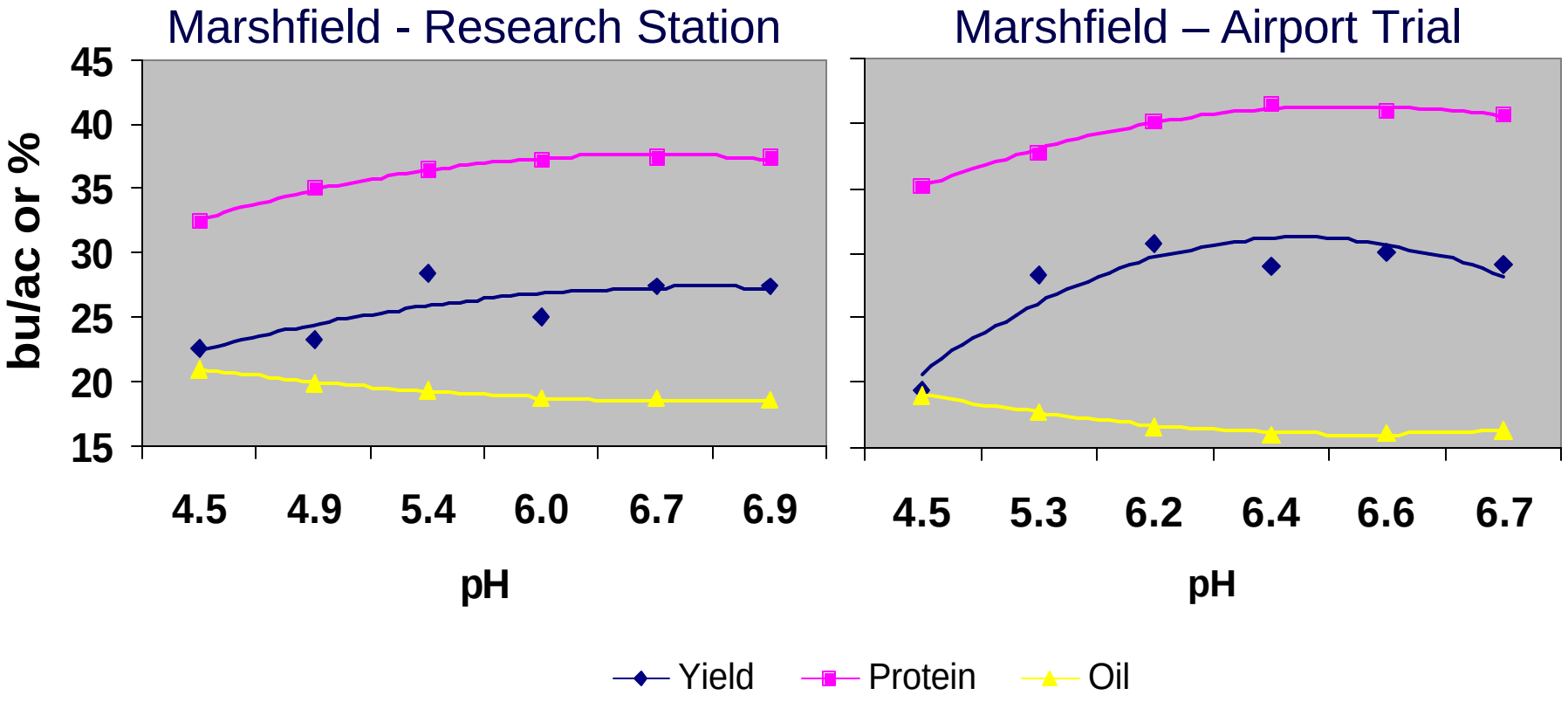
Yield ↓	Protein % ↑	Oil % ↓	Fiber % ↓
Yield ↓	Protein lb/ac ↓	Oil lb/ac ↓	Fiber lb/ac ↓

HYPOTHETICAL EXAMPLE

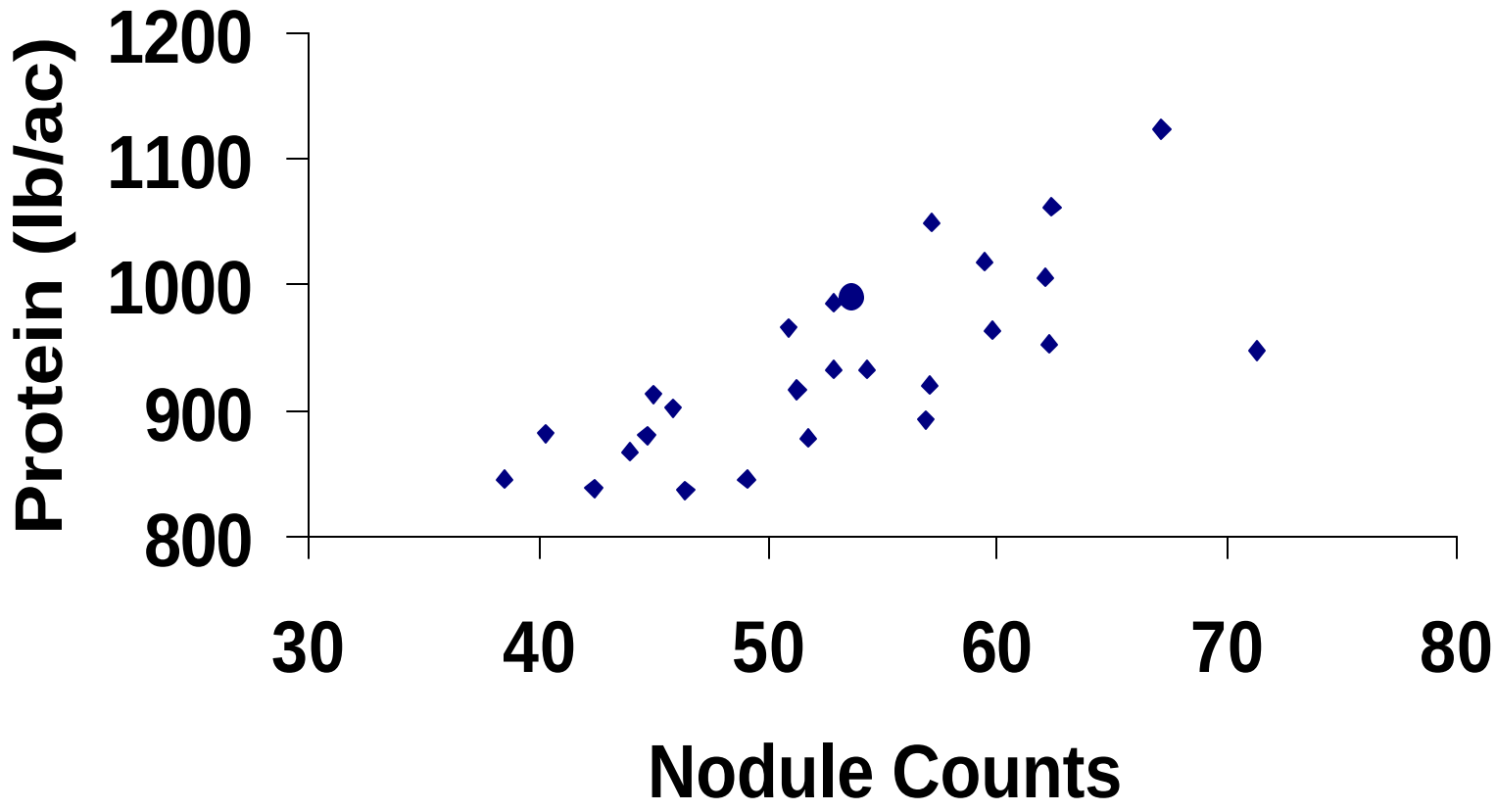
Yield	Protein	
bu/ac	%	lb/acre
60 ↓ 30	35 % ↑ 37 %	1260 ↓ 660

Production Variables	Yield	Protein	Protein	Oil
	bu/ac	%	lb/ac	%
Variety	x			
Maturity Group	x			
Herbicide Tolerance	x			
Pest Tolerance	x			
Specialty Traits	x			
Seed Inoculants	x			
Row Space				
Planting Date				
Fungicide Seed Treat.	x			
Insecticide Seed Treat.	x			
Crop Rotation	x			
Irrigation	x			
Tillage	x			
Soil pH	x	x		x
Soil Organic Matter	x			
Nutrient Availability	x			
NPK Availability	x			
Micronutrient				
Foliar Fertilization				
Soil Compaction				
Manure Application	x			
Aphid Population	x			
Bean Leaf Bettle Pop	x			
SCN Population	x			
Desiase Pressure	x			
White Mold	x			
Root Rots				
Viruses	x			

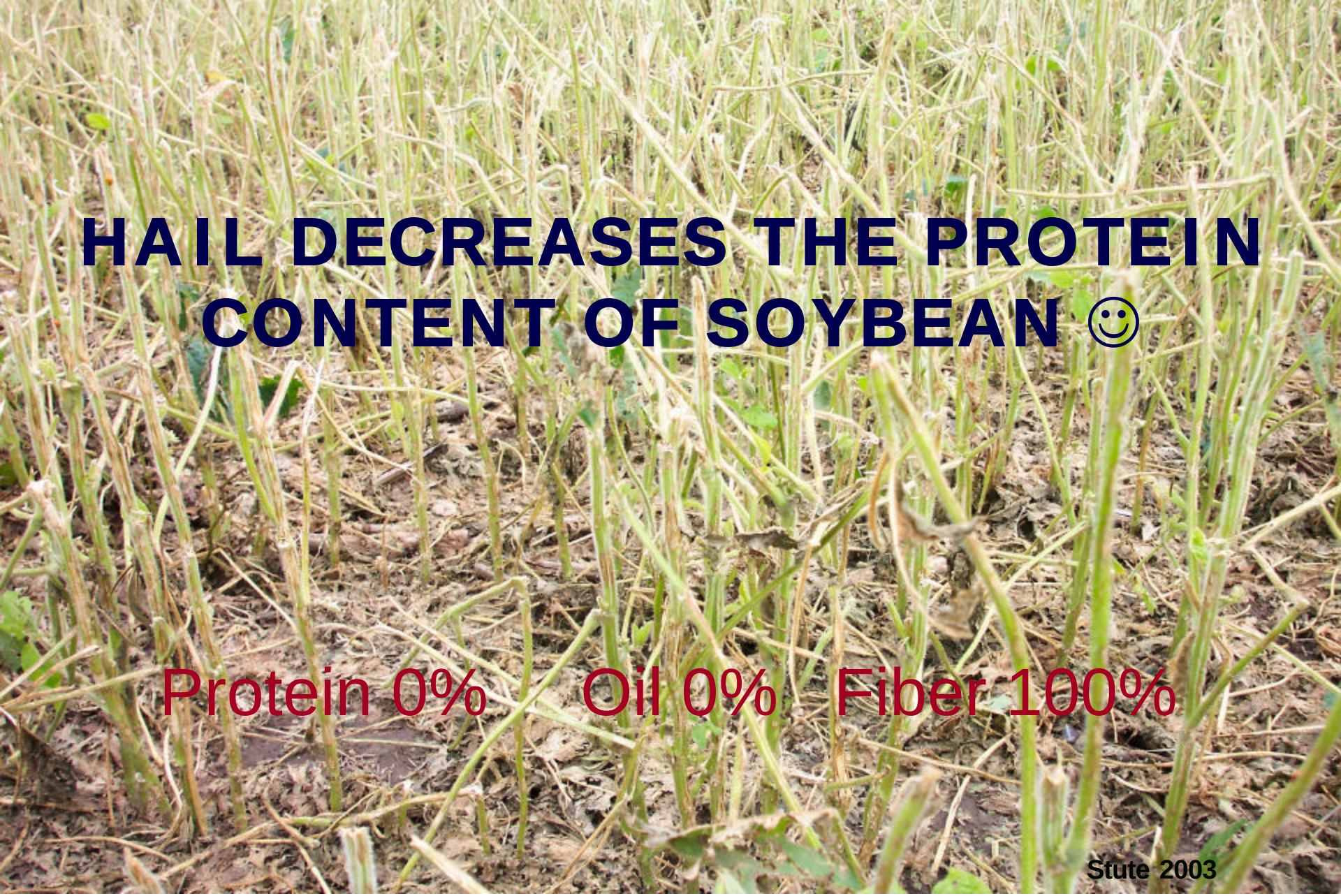
Yield, protein, and oil by soil pH



Soybean Protein Output as Impacted by Rhizobium Nodule Counts in Mid July



Production Variables	Yield	Protein	Protein	Oil	Oil	Protein + Oil	
	bu/ac	%	lb/ac	%	lb/ac	%	lb/ac
Variety	x	x	x	x	x	x	x
Maturity Group	x	x	x	x	x	x	x
Herbicide Tolerance	x	x	x	x	x	x	x
Pest Tolerance	x	x	x	x	x	x	x
Specialty Traits	x	x	x	x	x	x	x
Seed Inoculants	x	x	x	x	x	x	x
Row Space							
Planting Date							
Fungicide Seed Treat.	x	x	x	x	x	x	x
Insecticide Seed Treat.	x	x	x	x	x	x	x
Crop Rotation	x	x	x	x	x	x	x
Irrigation	x	x	x	x	x	x	x
Tillage	x	x	x	x	x	x	x
Soil pH	x	x	x	x	x	x	x
Soil Organic Matter	x	x	x	x	x	x	x
Nutrient Availability	x	x	x	x	x	x	x
NPK Availability	x	x	x	x	x	x	x
Micronutrient							
Foliar Fertilization							
Soil Compaction							
Manure Application	x	x	x	x	x	x	x
Aphid Population	x	x	x	x	x	x	x
Bean Leaf Bettle Pop	x	x	x	x	x	x	x
SCN Population	x	x	x	x	x	x	x
Desiase Pressure	x	x	x	x	x	x	x
White Mold	x	x	x	x	x	x	x
Root Rots							
Viruses	x	x	x	x	x	x	x

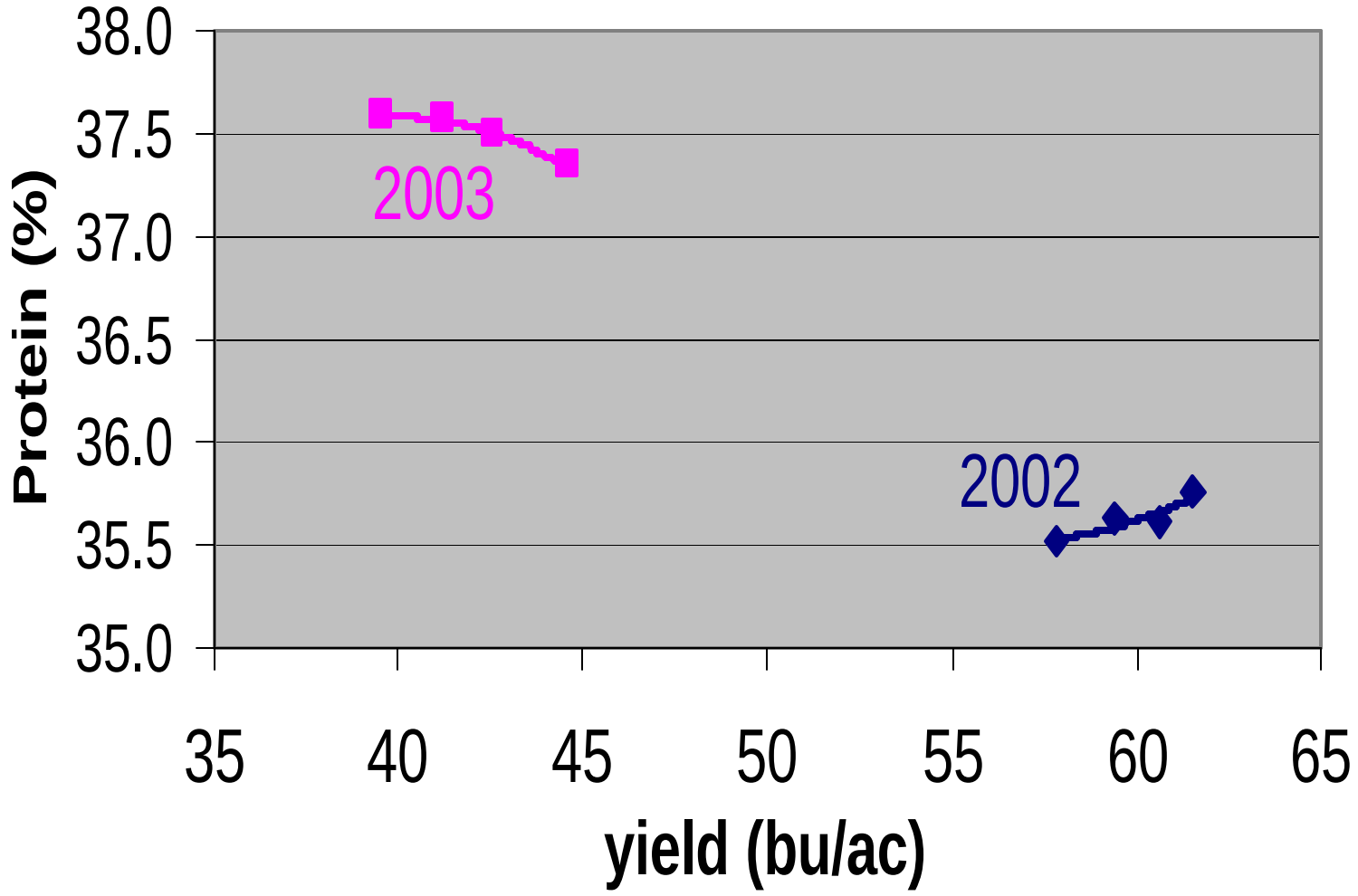


HAIL DECREASES THE PROTEIN CONTENT OF SOYBEAN ☺

Protein 0% Oil 0% Fiber 100%

Stute 2003

AVERAGE YIELD AND PROTEIN CONTENT BY BLOCK OVER ALL VARIETY TRIAL LOCATIONS



STATE OF KNOWLEDGE ON JANUARY 2004

- Variety selection is currently the most effective known way to increase the protein and/or oil content of Wisconsin grown soybeans.
- The relationship between yield and protein content vary from year to year.
- Protein and oil tend to be negatively correlated.
- Management practices can have a significant impact on soybean grain composition
- Sound conclusions on grain composition studies will typically require multiyear data.