

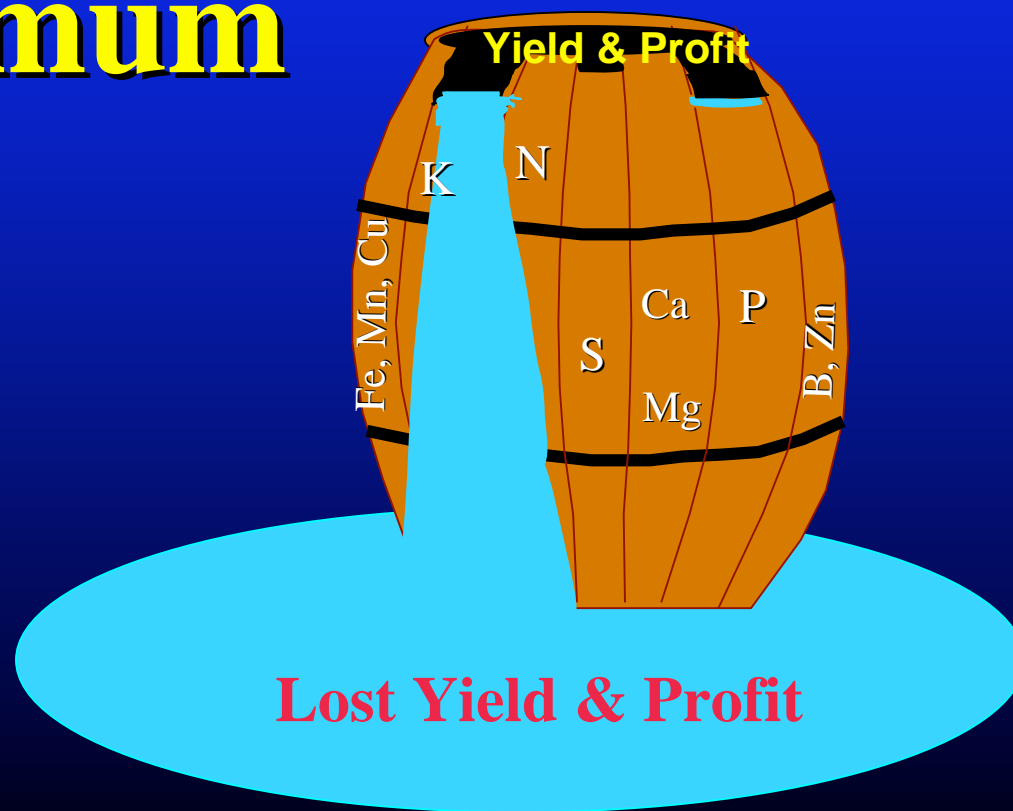
Nutrient Management of 2008 Soybeans

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The Law of the Minimum





Nutrient Uptake for Selected Crops

Crop	Yield	N	P₂O₅	K₂O	S	Mg
	bu or lb/A	-----		lb/A	-----	
Corn	180	240	102	240	30	58
Soybean	55	288	54	188	18	22
Wheat	70	130	48	142	18	22
Cotton	1000	160	48	140	24	22
Rice	7000	112	60	168	12	14



Plant Food Removed in Harvest

Crop	lb/bu		
	N	P ₂ O ₅	K ₂ O
Corn	0.75	.44	.29
Soybeans	4.00	.80	1.40
Wheat	1.15	.55	.34
Rice	0.55	.29	.18
	-----	lb/bale	-----
Cotton	32.00	14.00	20.00



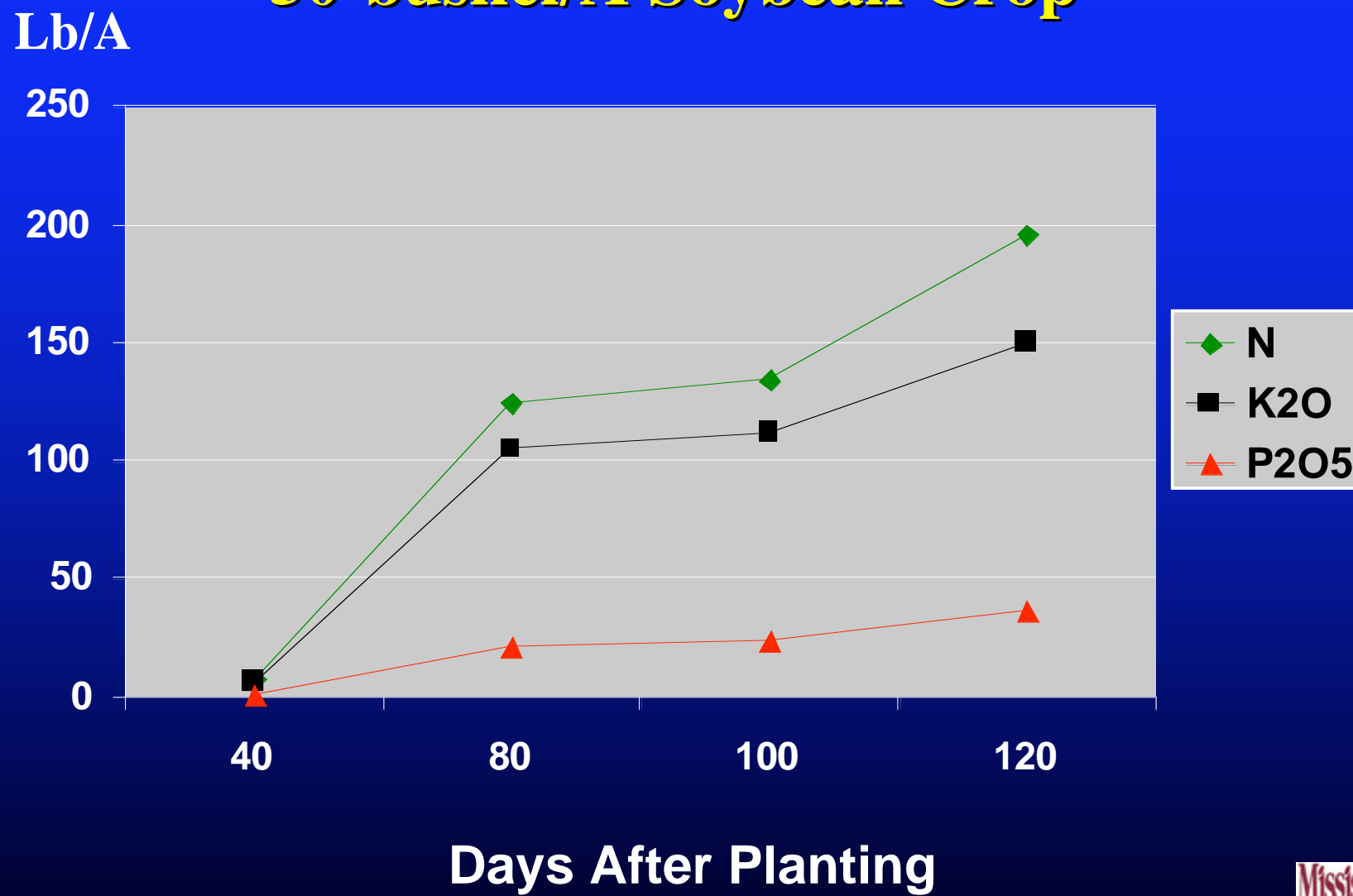
Harvested Nutrients

Crop	Yield	N	P₂O₅	K₂O
	bu or lb/A	-----	lb/A	-----
Corn	180	136	80	52
Soybean	55	220	44	78
Wheat	70	80	38	24
Cotton	1000	64	28	40
Rice	7000	70	44	28

Plant Food Uptake

Nutrient	Soybeans, bu/A		
	40	55	70
	----- lb/A -----		
N	224	388	364
P ₂ O ₅	38	53	67
K ₂ O	144	188	220
Mg	16	22	28
S	14	18	22

N, P₂O₅, and K₂O Uptake by a 50-bushel/A Soybean Crop



Soybean Nutrition Facts

- ⌞ Soybeans can use lower soil solution P conc. than corn early in season
(they scavenge for early season needs)
- ⌞ Soybeans can not effectively use high conc. of P, as in band application, because of slow root uptake rate early
- ⌞ **Nearly 80 % of P & K uptake by soybeans is after first 60 days**

Maximum Daily Uptake Rates

N 6.9 lb/A/day

P 0.4 lb/A/day (0.9 lb P₂O₅/A/day)

K 4.1 lb/A/day (4.9 lb K₂O/A/day)

Ca 2.8 lb/A/day

Mg 1.5 lb/A/day

MSU Soil Test Summary - Soybeans

Upper Coastal Plain and the Delta, FY 1996-97 & 2004-05

<u>% of Samples</u>	<u>Upper CP</u>		<u>Delta</u>	
	<u>FY 96-97</u>	<u>04-05</u>	<u>96-97</u>	<u>04-05</u>
pH 5.4 or lower	22	21	18	21
Medium or lower in P	54	49	31	29
Medium or lower in K	46	40	14	15

Soil Acidity



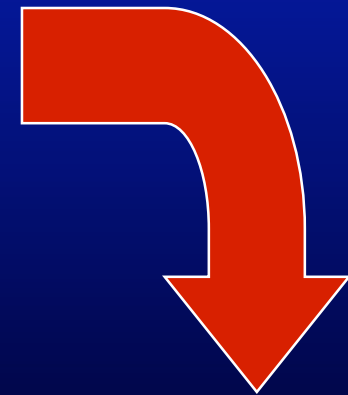
Lime Increases
Profit Potential



**Crop failures seldom occur
until pH drops to 5.0 or lower
but**



**Significant yield loss may occur
between pH 5.2 and 5.8**



Manganese Toxicity (Crinkle Leaf) at Soil pH Below 5.2



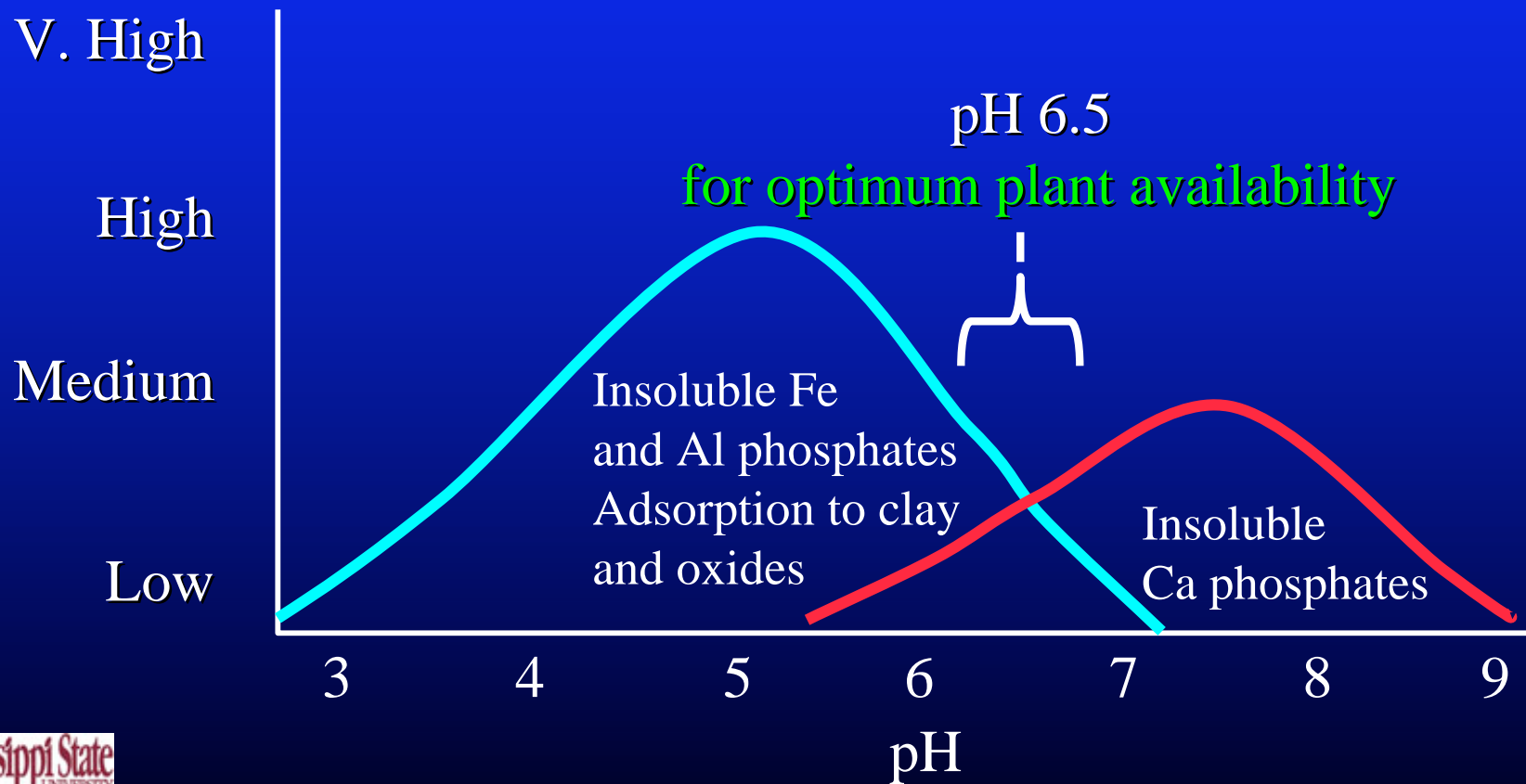
Crinkle-leaf in soybean looks just like these symptoms in cotton

Lime Needs

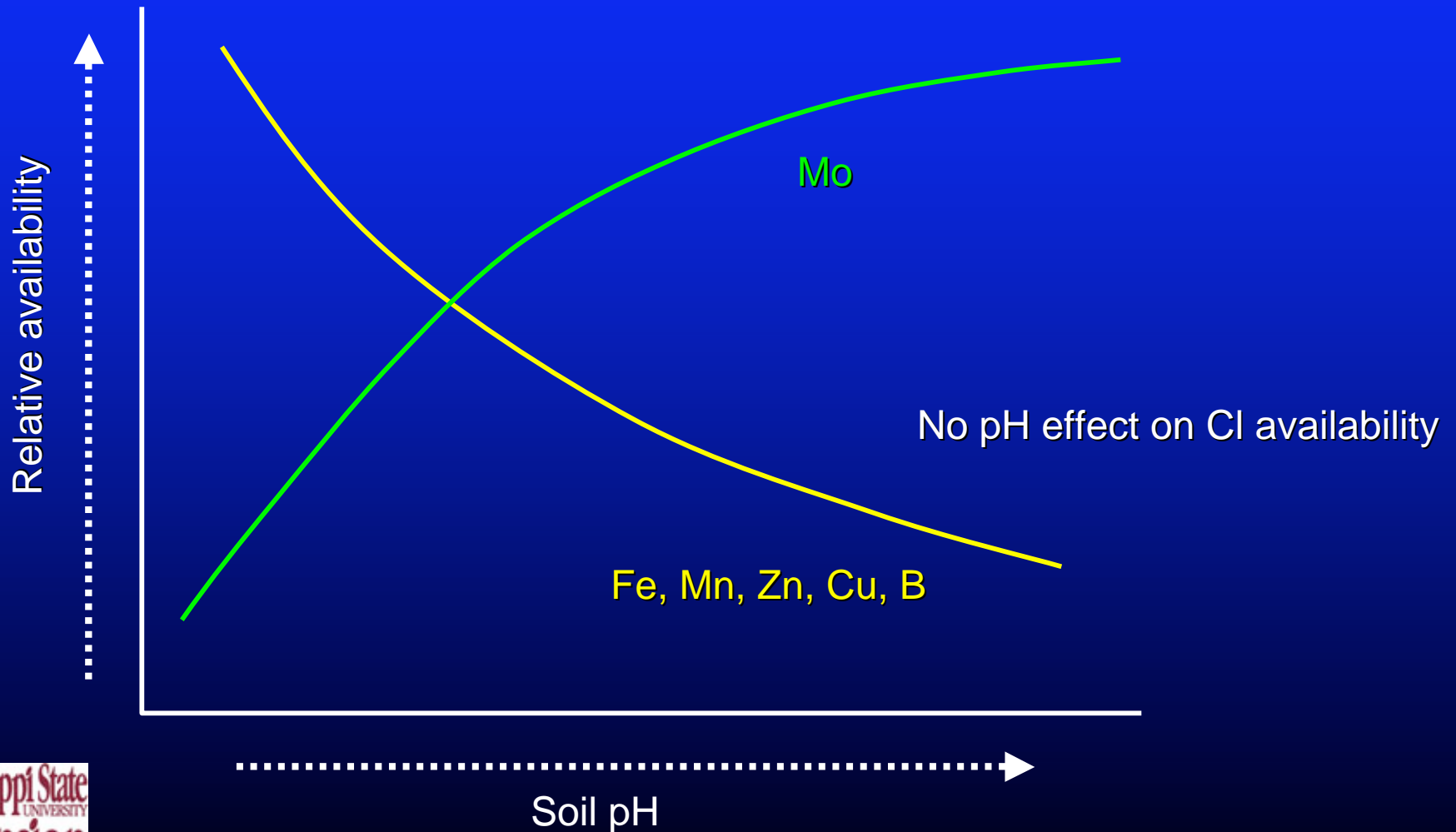
- √ **pH 5.2 & below** - Lime to prevent manganese and aluminum toxicity
- √ **pH 5.3 to 5.5** - Lime to improve P availability, and N and S conversions from O.M.
- √ **pH 5.6 to 5.7** - Lime not urgently needed. Application prevents future problems

Soil pH Effects on P Adsorption and Precipitation

Relative "Tie-Up"



Micronutrient Availability



Soybean Yield Loss from Soil Acidity

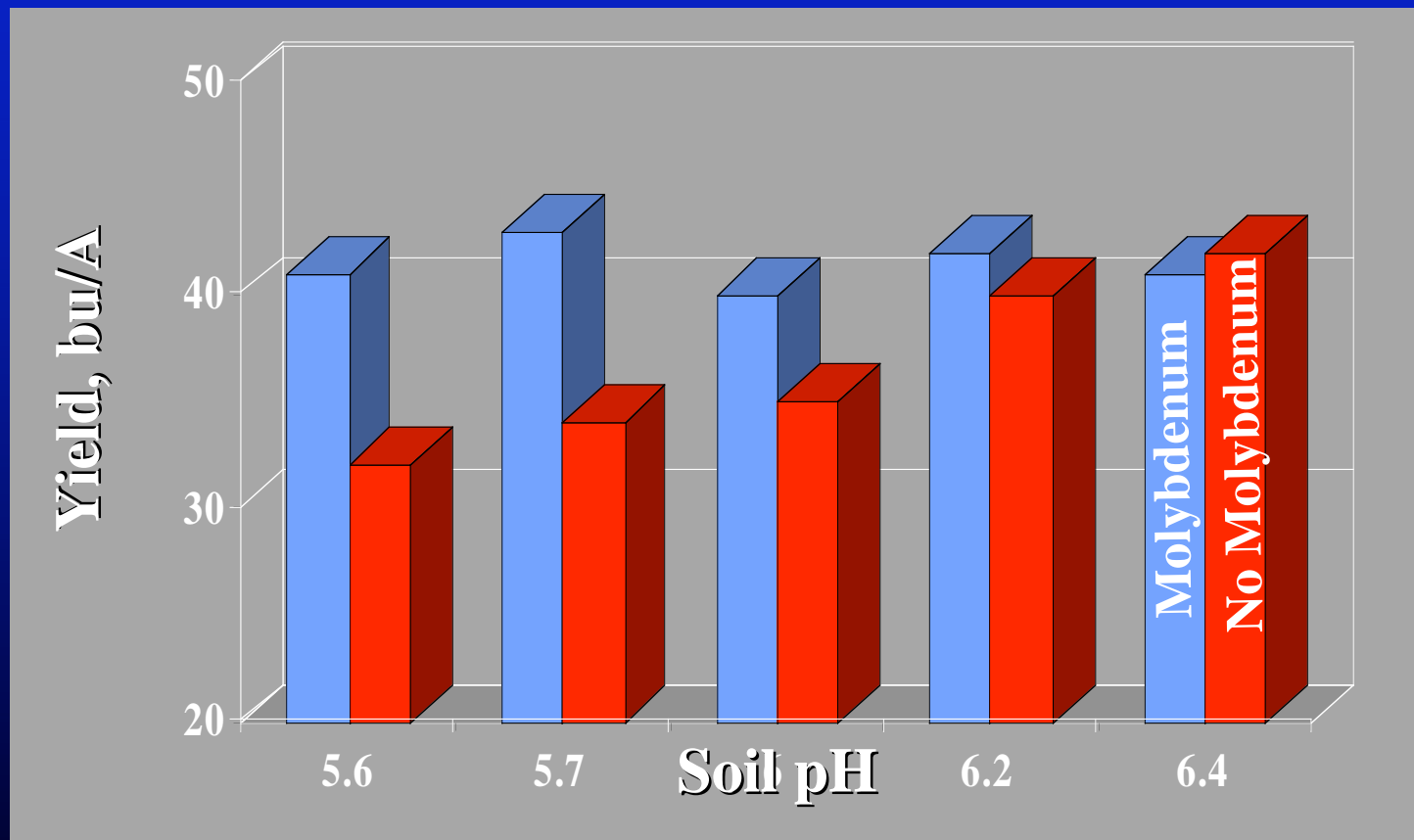
Yield Loss Expected¹

<u>Soil pH</u>	<u>Upland Soils</u>		<u>Bottomland Soils</u>	
	%	bu/A ²	%	bu/A
4.6 - 5.0	30 - 50	15 - 25	15 - 20	8 - 10
5.1 - 5.4	20 - 30	10 - 15	10 - 15	5 - 8
5.5 - 5.7	10 - 20	5 - 10	5 - 10	3 - 5
5.8 - 6.0	5 - 10	3 - 5	0 - 5	0 - 3

¹ Loss at indicated pH compared to optimum pH of 6.0 to 6.5

² Bu/A assuming a **50 bu/A yield potential**

Soybean Response to Molybdenum at Varying Soil pH Levels



Soil Test Interpretation Categories

P and K?

Soil Test Level	Relative Supply of Nutrients From Soil and Fertilizer	Probability of Yield Increase	MSU P_2O_5
Very High	Soil	<5%	> 144
High	Soil Fert.*	5-30%	73 - 144
Medium	Soil Fertilizer	30-60%	37-72
Low	Soil Fertilizer	60-90%	19 - 36
Very Low	Soil Fertilizer	>90%	< 18

Nutrients available from soil
Nutrients required

* Fertilizers used at high soil test levels are for starter or maintenance purposes

Soybean Response to P and K Nutrition

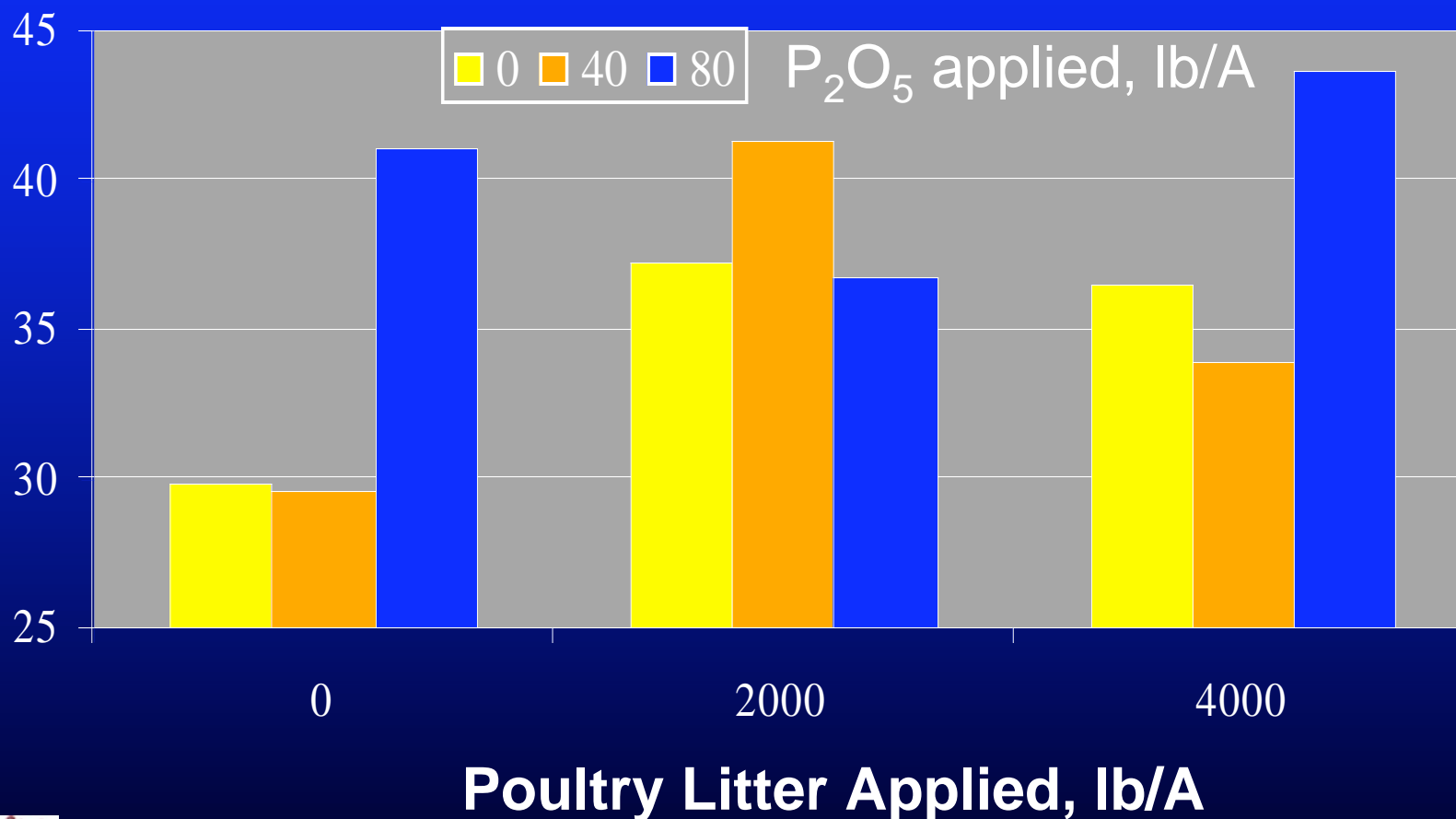
Miss. State Univ. Information Sheet 873. (Revised 2008)

Soil Test	Expected Yield without Fertilizer		Recommended Fertilizer	
	P ₂ O ₅	K ₂ O	P ₂ O ₅	K ₂ O
	-----	% -----	-----	lb/A -----
V. Low	35-80	50-80	120	120
Low	75-96	75-96	60	60
Medium	92-100	92-100	30	60
High	100	100	0	0
V. High	100	100	0	0

Soybean Response to Poultry Litter and Phosphorus

(4 yr. ave.) Muir and Hedge. 1999. AR Soil Fert. Studies 1998.

Bu/A



Soil Fertility/Nutrient Management

- **Evaluate soil test levels**
- **Document yield levels, crop rotations, and nutrient removal in harvests**
- **Compare with nutrient inputs: fertilizer, manures, other sources**
- **Develop action plan**
- **Implement and document**

Other Nutritional Pointers

- ✓ Inoculate seed with live Bradyrhizobium if field not in soybeans in last 3 to 5 years, or if land recently leveled
- ✓ Sulfur issues: low CEC, low OM soils
- ✓ Beware of “snake oils”

There is no substitute for research- proven practices

Thank You!

