WISCONSIN CORN AND SOYBEAN RESPONSES TO FERTILIZER PLACEMENT IN CONSERVATION TILLAGE SYSTEMS

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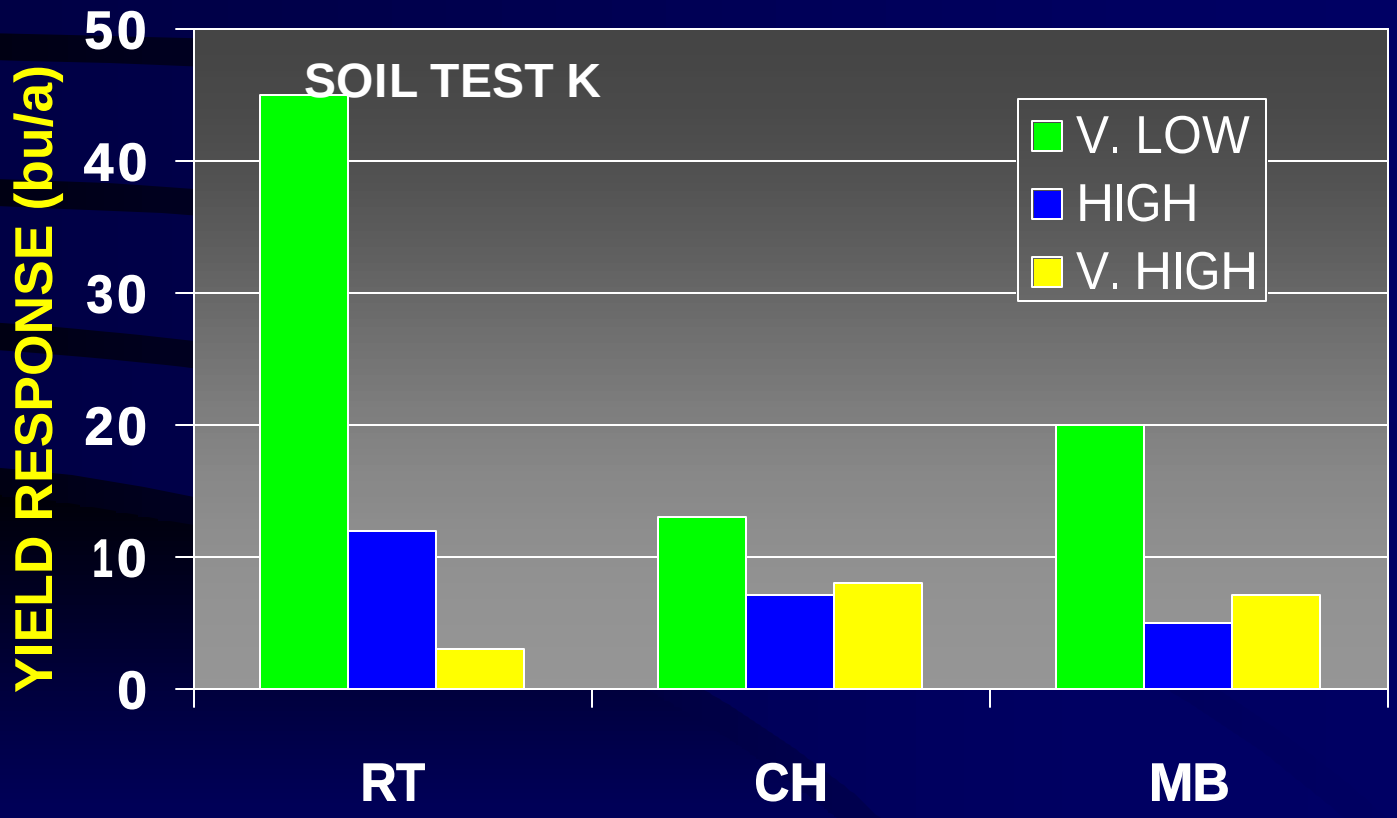
THOUGHTS ON FERTILIZER PLACEMENT FOR CONSERVATION TILLAGE

- BROADCAST SHOULD BE INCORPORATED
  - Positional availability
  - Environmental concerns
- POSITIVES FOR BANDING
  - Greater nutrient use efficiency
  - Supply other nutrients
  - Overcome incorporation concerns
- NEGATIVES FOR BANDING
  - Slows planting operation
  - Cost of planter attachments
  - Existing high soil tests

WISCONSIN RESEARCH SHOWS RESPONSE TO ROW-PLACED FERTILIZER

- MONCRIEF, 1981
  - Response in ridge-till greater than moldboard and chisel at low soil test K
- WOLKOWSKI, 1989
  - Greater response to K on compacted soil
- Bundy and Widen, 1992
  - Demonstrated importance of complete fertilizer
- Bundy and Andraski, 1999
  - Response likely if soil test K < 140 ppm
- WOLKOWSKI, 2000
  - Response in no-till and strip-till, not chisel

RESPONSE OF CORN TO ROW-APPLIED FERTILIZER AT ARLINGTON, WIS.



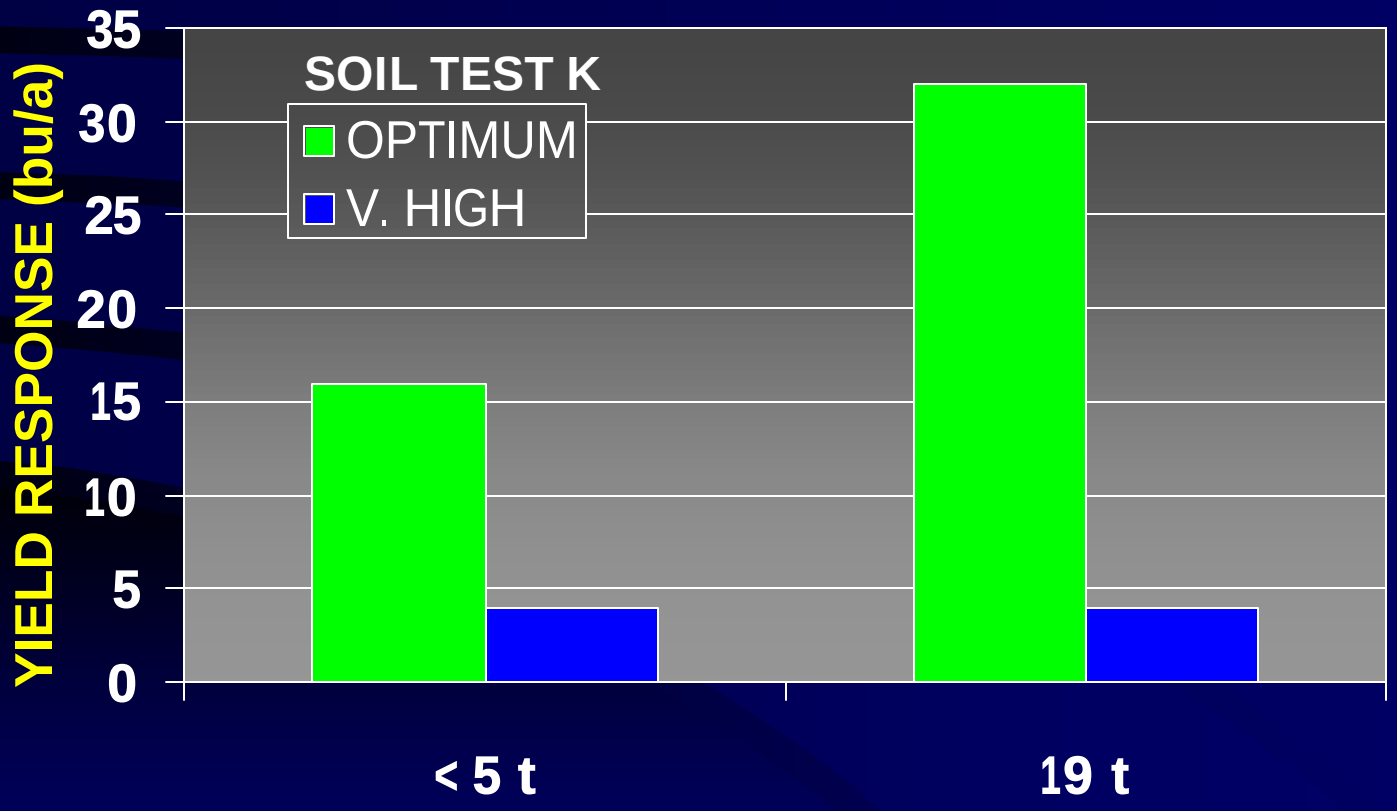
MONCRIEF, 1981 (8+21+10 /a)

ROW FERTILIZER RESPONSE ON COMPACTED SOILS

Potassium Affected Most

- Compaction reduces porosity
- Lowers soil oxygen
- O_2 needed for root respiration and active uptake

RESPONSE OF CORN TO ROW-APPLIED K ON A SILTY CLAY LOAM SOIL (3 yr. avg.)



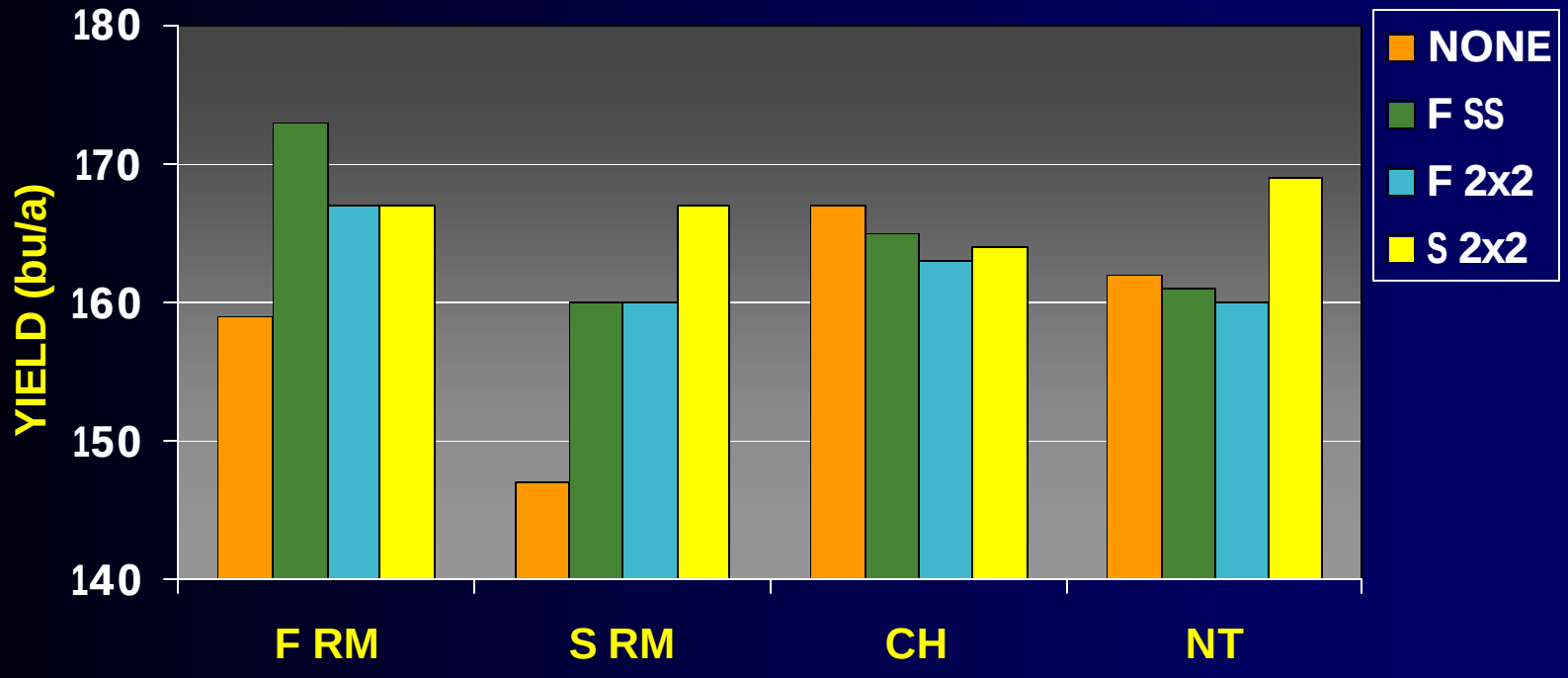
Oshkosh, Wis. (45 lb $K_2$0/a)

SELECTED FACTORS AFFECTING STARTER RESPONSE FROM 100 ON-FARM TRIALS

FACTOR	Pr>F
Phosphate rate	0.91
Surface residue	0.87
Soil texture	0.77
Soil test P	0.63
Potash rate	0.36
Soil test K	0.05
Corn RM	0.05

Bundy and Andraski, (1999)

INTERACTIVE EFFECT OF TILLAGE AND ROW FERTILIZER, ARLINGTON, 1994-1996



WOLKOWSKI, 2000 (7+22+8/a)

ROW FERTILIZER PLACEMENT CONSIDERATIONS FOR CONSERVATION TILLAGE - SUMMARY

- USE A COMPLETE MATERIAL
  - Relatively small rates are effective
- RESPONSE INCREASES WITH COMPACTION
  - Avoid compaction as overall yield is lower
- RELATED TO SOIL TEST K, RM, PLANTING DATE
  - Recipe for failure: Full season hybrid, planted late, on low K testing soils
- TILLAGE INTERACTION
  - Response more likely in high residue, undisturbed systems

SOME UNANSWERED QUESTIONS

ROTATIONS

First-year corn after alfalfa or soybean

STRIP-TILL

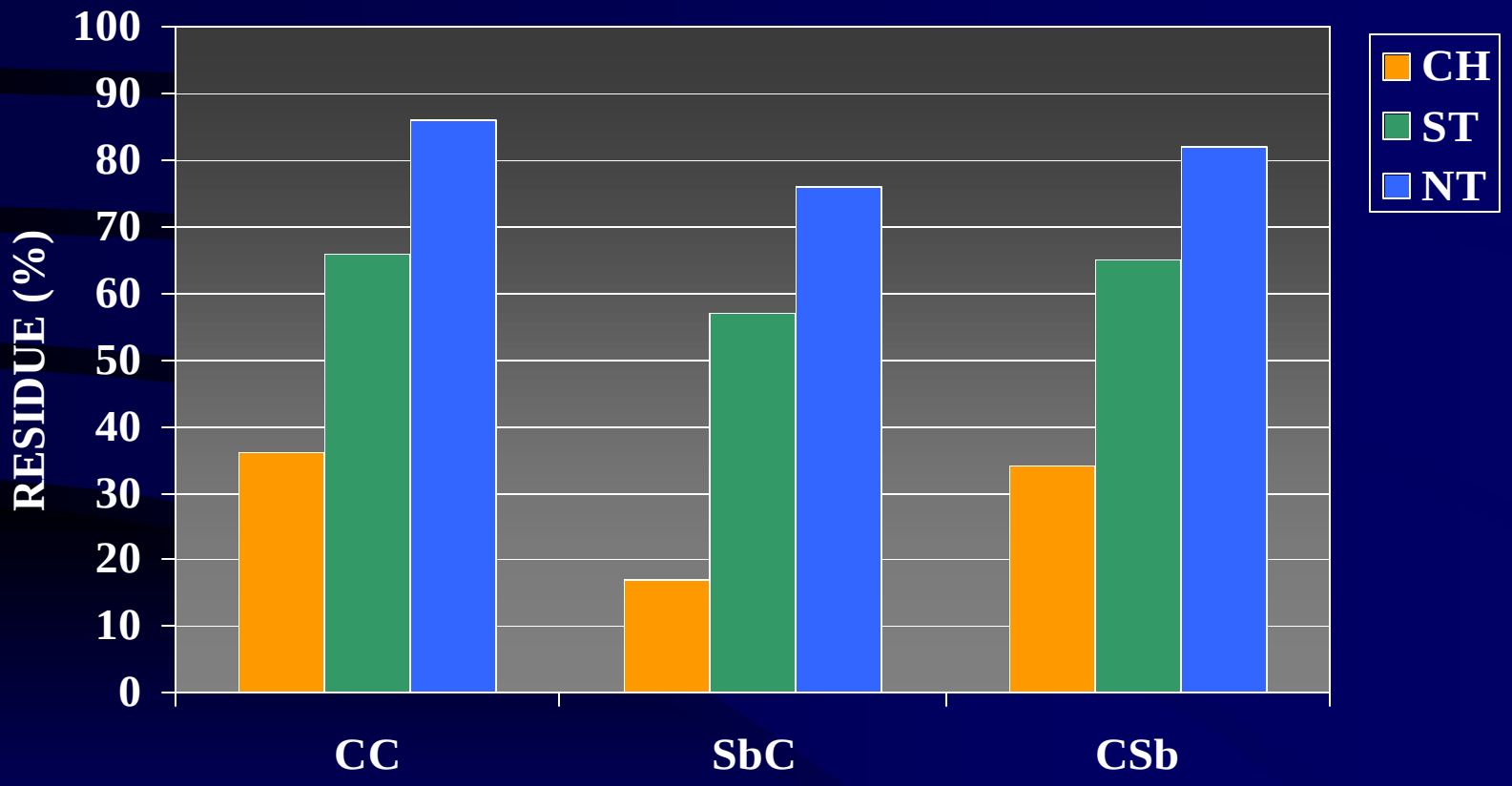
Designed for fall operation in fragile residue crops

Easily add dry or liquid fertilizer attachments

ARLINGTON LONG-TERM ROTATION-TILLAGE-FERTILIZATION STUDY

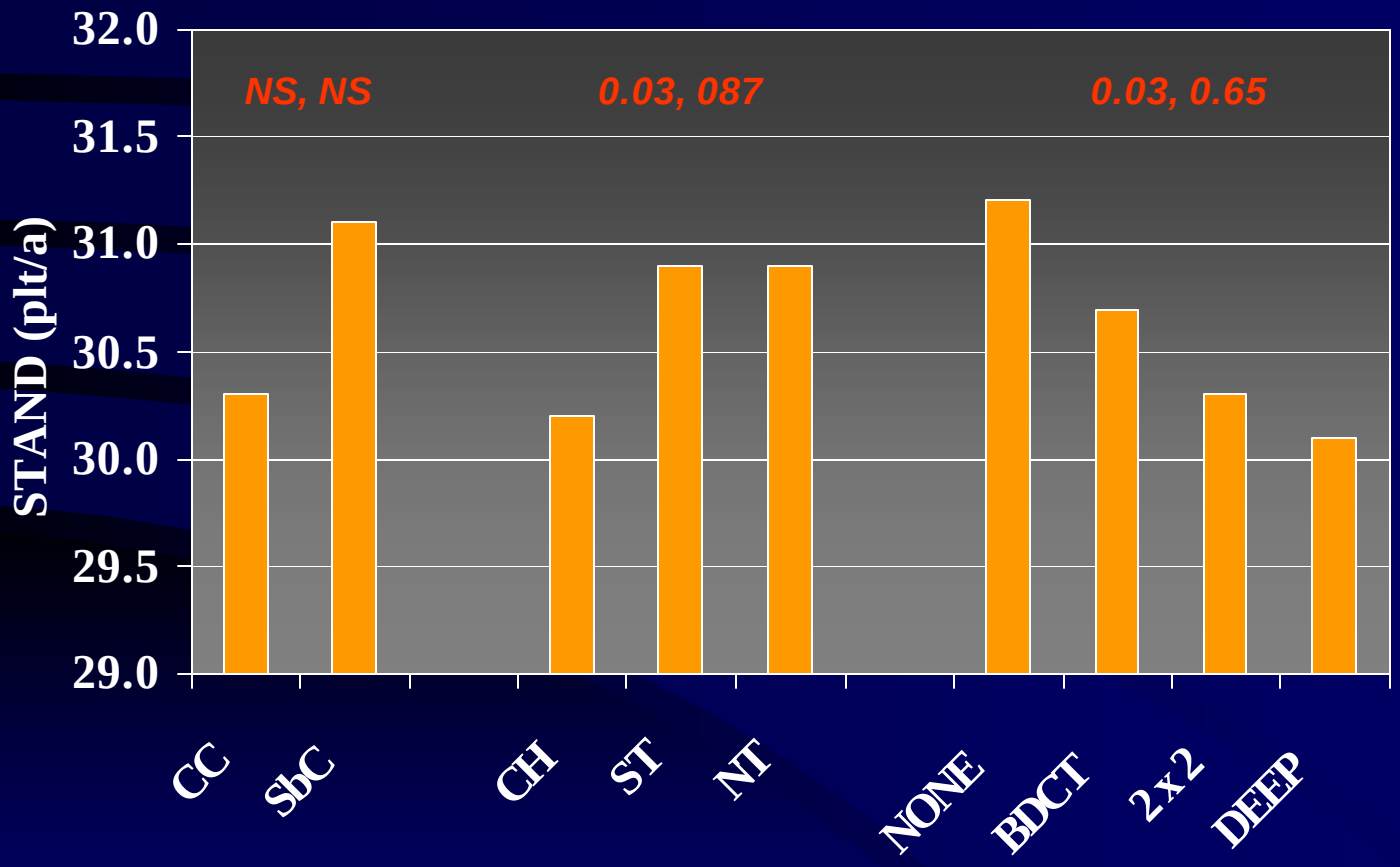
- ROTATION AND TILLAGE TREATMENT SINCE 1997
  - Fertilizer treatments installed 2001
- ROTATION
  - Cont. corn, soybean/corn, corn/soybean
- TILLAGE
  - Chisel/field cultivator, strip-till, no-till
- FERTILIZER PLACEMENT
  - None, fall broadcast, 2 x 2, deep (strip-till only)
  - 18+46+60
- MEASURE EMERGENCE, EARLY GROWTH, YIELD

SURFACE RESIDUE AS AFFECTED BY ROTATION AND TILLAGE, ARLINGTON, WIS., 2001

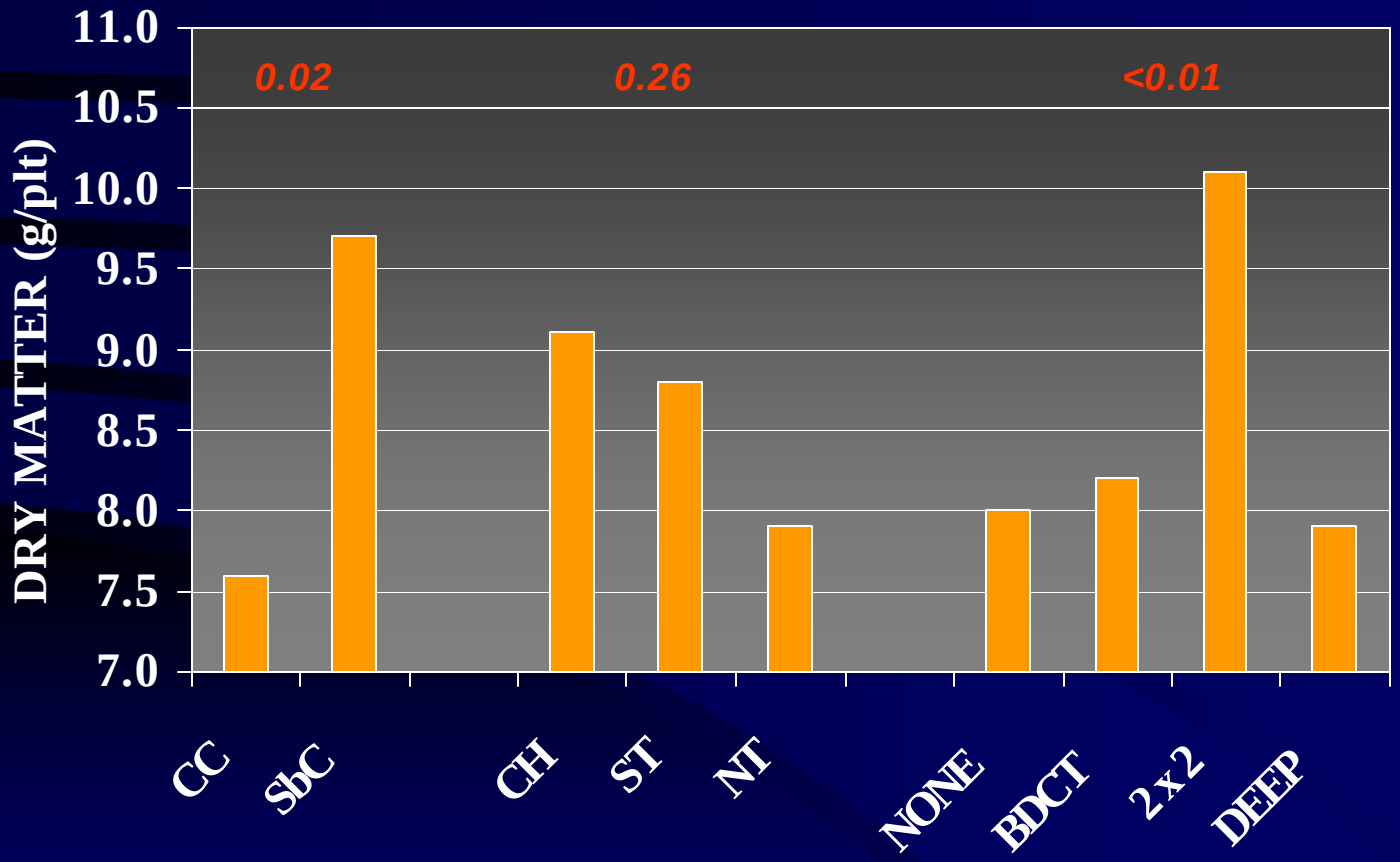


*Pr>F: R =<0.01; T=<0.01; R*T =0.08*

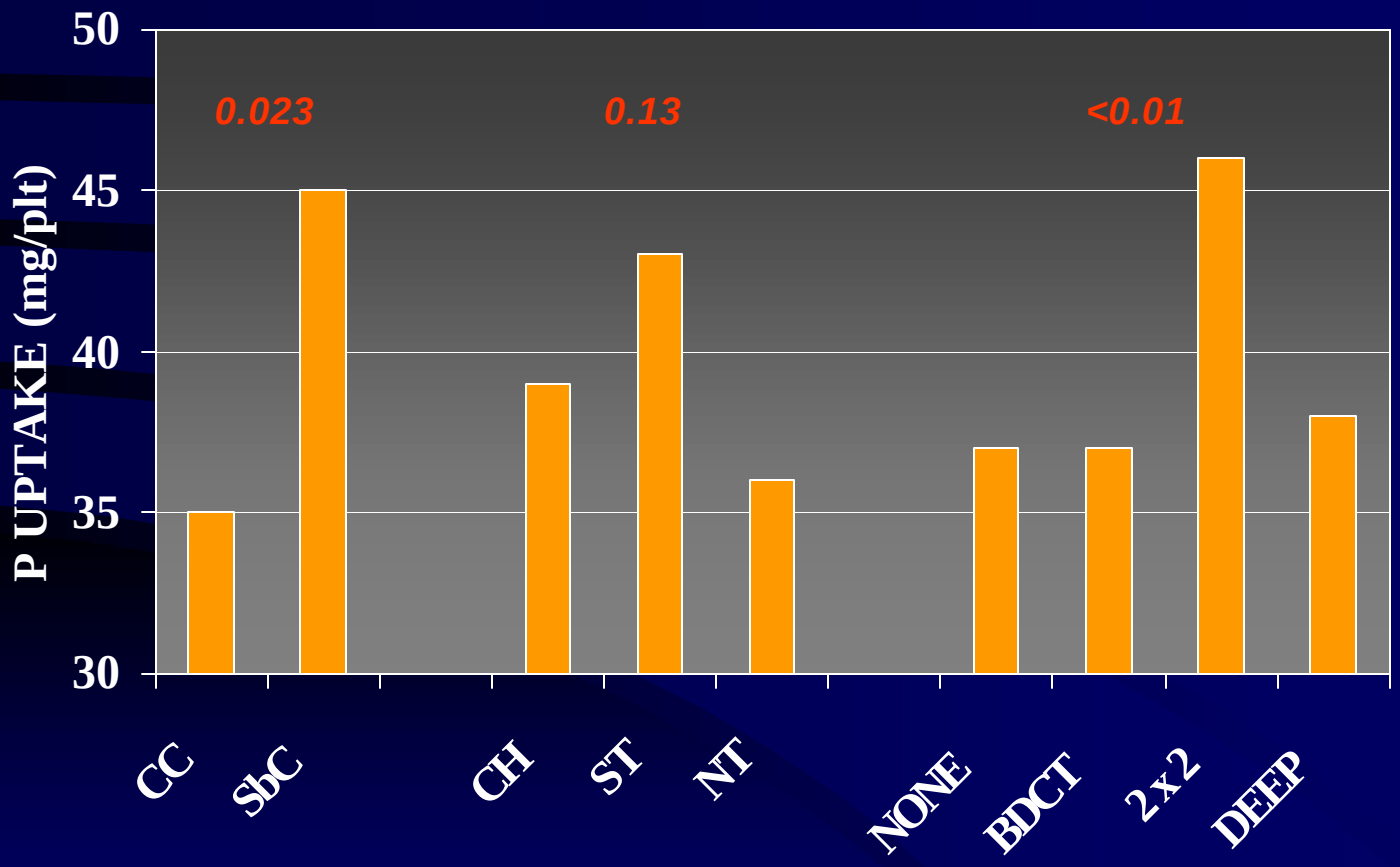
MAIN EFFECTS OF ROTATION, TILLAGE, AND FERTILIZER ON CORN STAND, ARLINGTON, WIS., (2 YEAR AVG.)



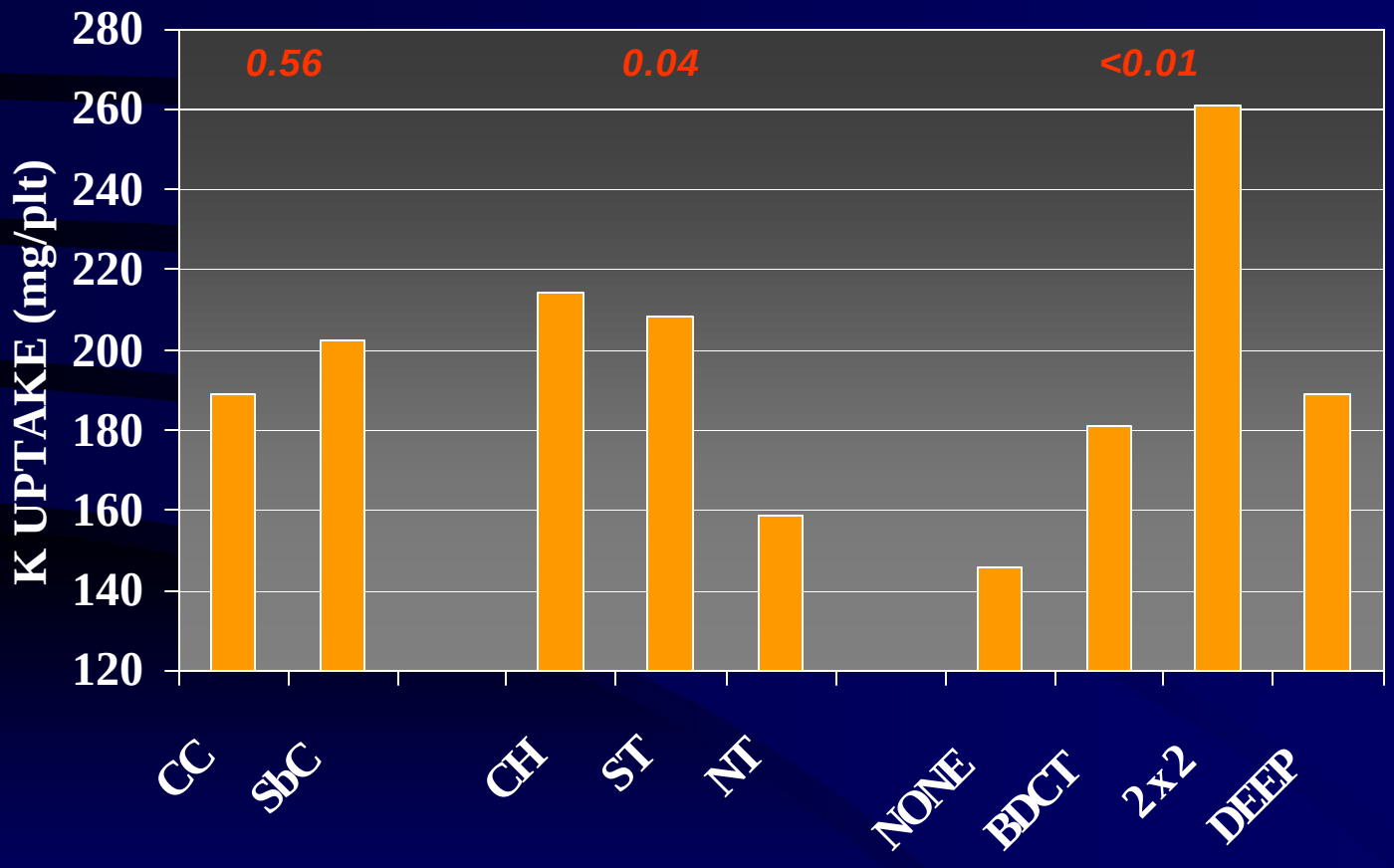
MAIN EFFECTS OF ROTATION, TILLAGE, AND FERTILIZER ON DRY MATTER 45 DAP, ARLINGTON, WIS., 2001



MAIN EFFECTS OF ROTATION, TILLAGE, AND FERTILIZER ON P UPTAKE 45 DAP, ARLINGTON, WIS., 2001



MAIN EFFECTS OF ROTATION, TILLAGE, AND FERTILIZER ON K UPTAKE 45 DAP, ARLINGTON, WIS., 2001



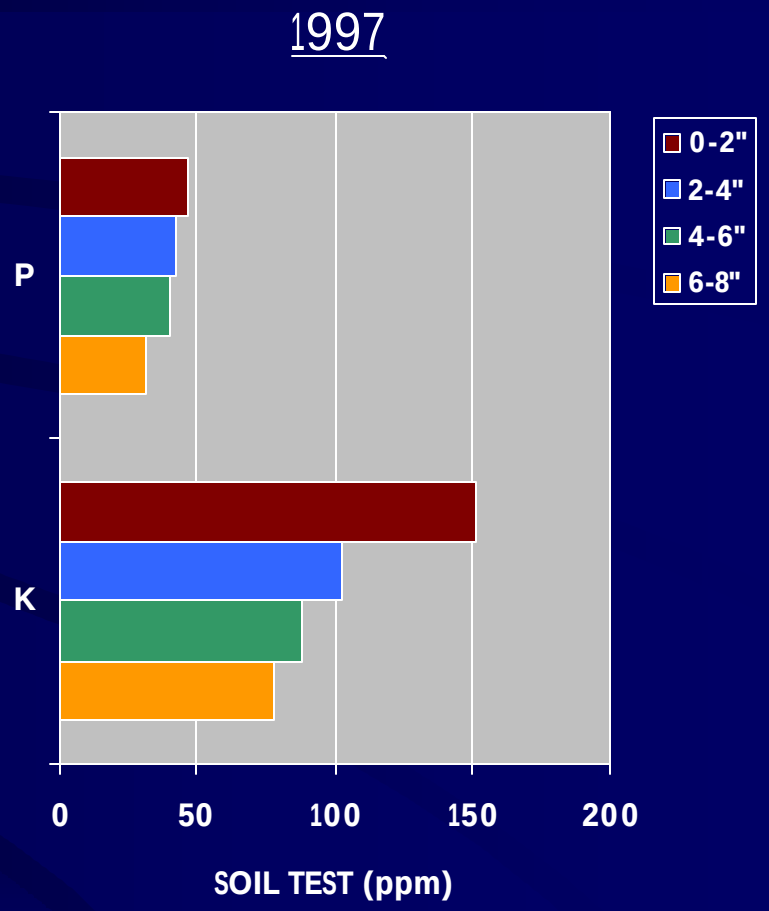
EFFECT OF ROTATION, TILLAGE, AND FERTILIZER ON TISSUE K CONCENTRATION 45 DAP, ARLINGTON, WIS., 2001

	CC			SbC		
	CH	ST	NT	CH	ST	NT
	--------- % --------			--------- % --------		
NONE	2.23	2.37	2.35	1.65	1.34	1.40
BDCT	2.35	2.19	2.51	2.51	2.18	1.40
2 x 2	2.85	3.26	2.31	2.46	2.58	2.16

*Pr>F: R =0.03; T=0.11; F= <0.01; R*T*F =0.10*

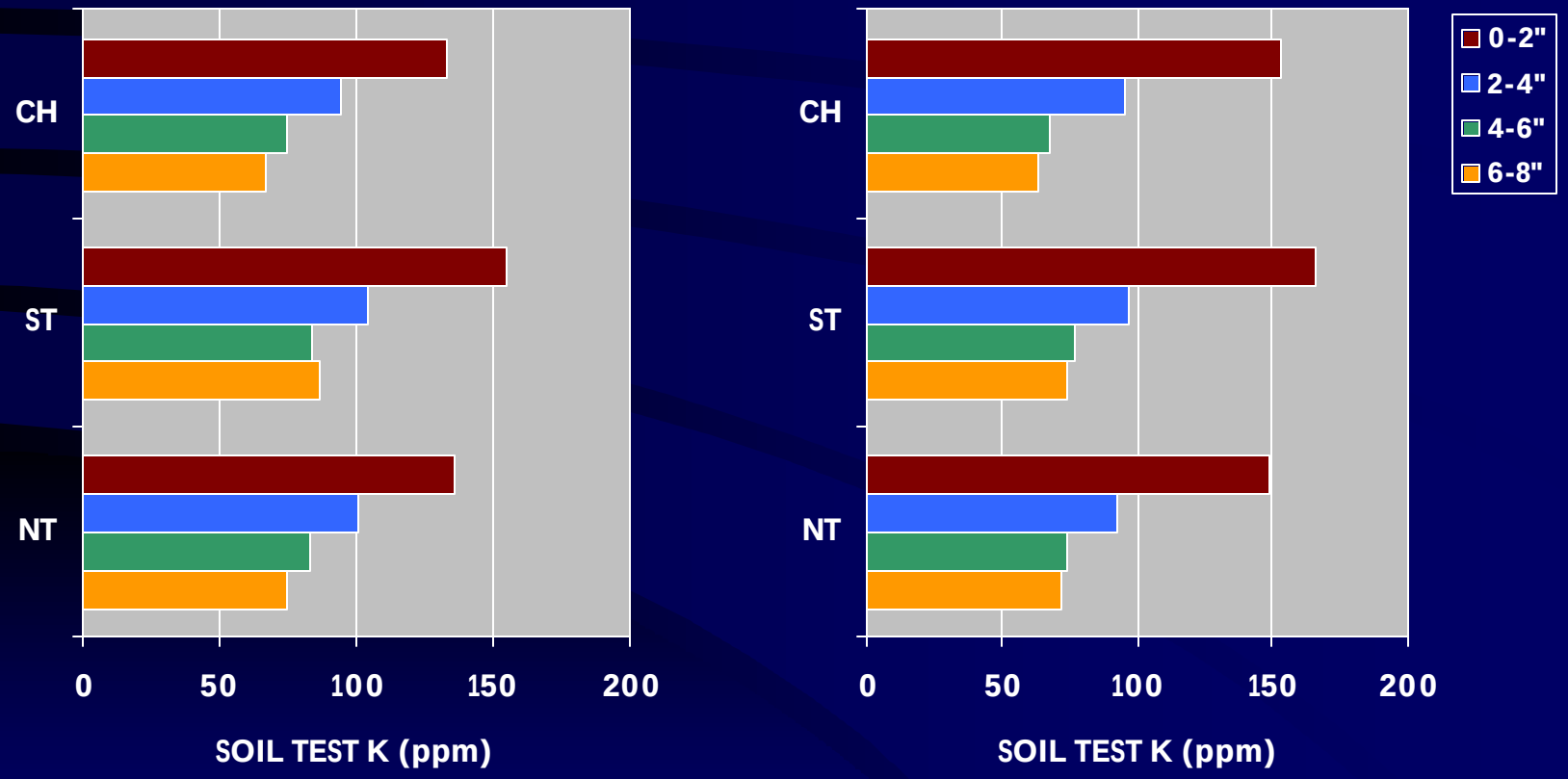
INITIAL INCREMENTAL SOIL TEST P AND K

- FIELD HISTORICALLY CHISEL PLOWED
- UNIFORM FERTILITY MANAGEMENT IN CC AND SbC
- WHY IS THERE A DIFFERENCE IN EARLY K IN SbC



SOIL TEST K AS AFFECTED BY ROTATION, TILLAGE, AND FERTILIZATION, 2002

CONTINUOUS CORN

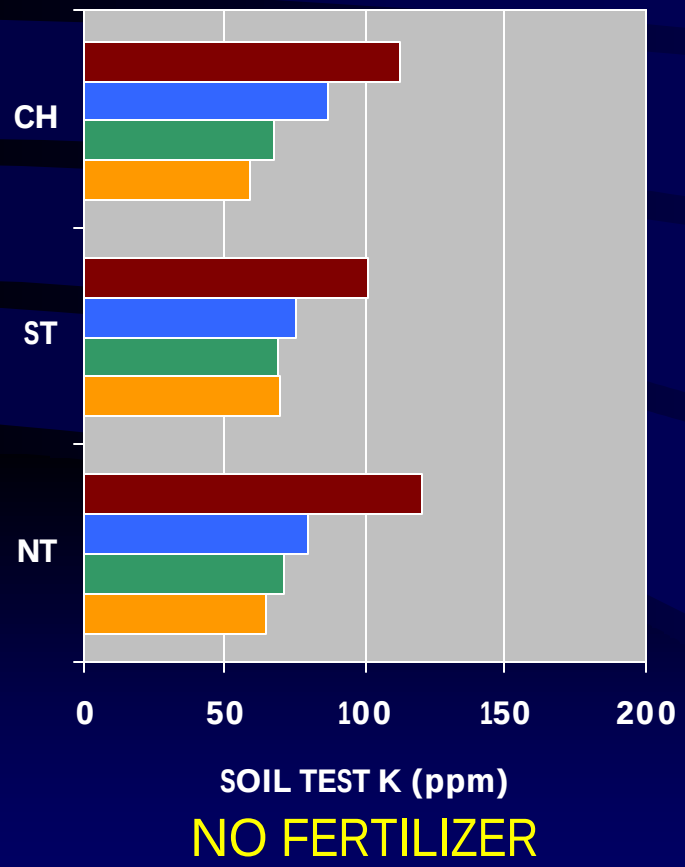


NO FERTILIZER

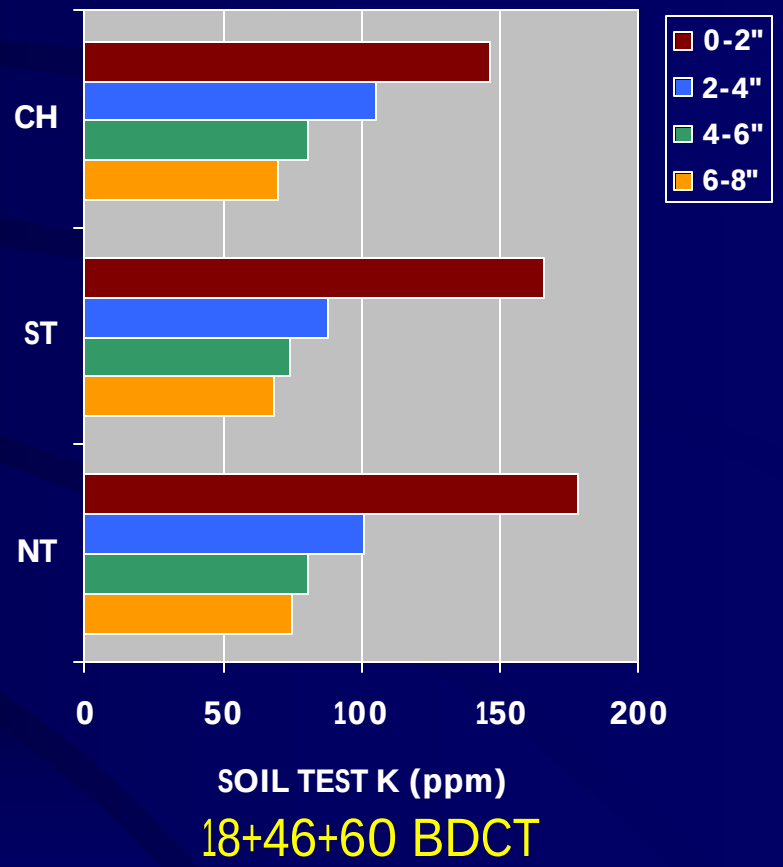
18+46+60 BDCT

SOIL TEST K AS AFFECTED BY ROTATION, TILLAGE, AND FERTILIZATION, 2002

SOYBEAN/CORN



NO FERTILIZER

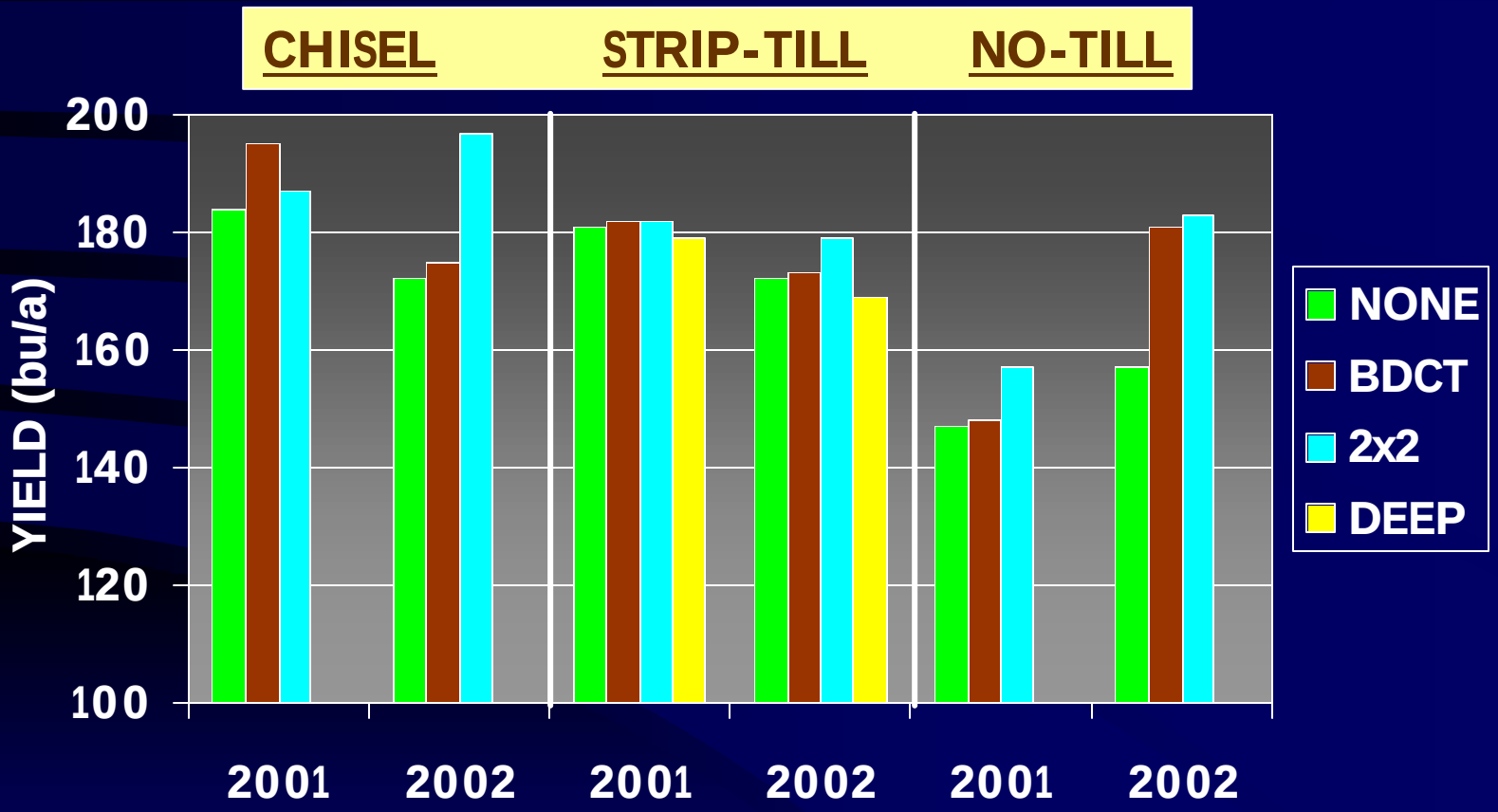


18+46+60 BDCT

POSSIBLE EXPLANATION FOR ROTATIONAL SOIL TEST K DIFFERENCE (1997-2001)

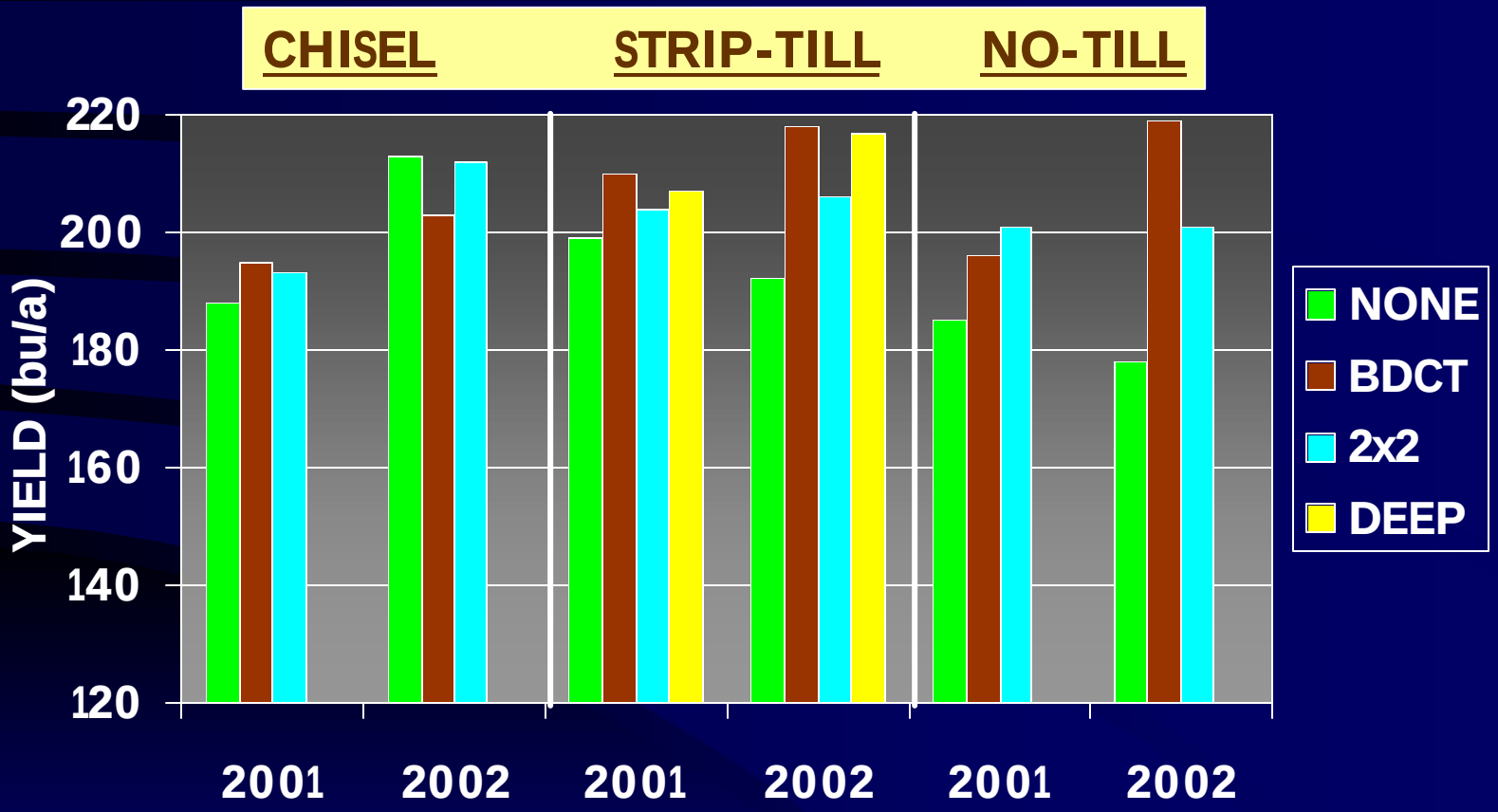
- DIFFERENTIAL REMOVAL IN GRAIN
  - Assume corn grain 0.3% K; soybean grain 1.7 % K
  - 180 and 50 bu/a yield levels for past five years
  - 5 yr corn = 155 lb K_2O/a removed
  - 3 yr corn/2 year soybean = 200 lb K_2O/a removed
- STOVER CONTRIBUTION
  - Assume corn stover contains 150 lb K_2O/a; soybean stover 50 lb K_2O/a
  - 5 yr corn = 750 lb K_2O/a deposited
  - 3 yr corn/2 year soybean = 550 lb K_2O/a deposited
- LIKELY A COMBINATION OF EACH
  - Does this make first-year corn more responsive than continuous corn?

RESPONSE OF CORN TO TILLAGE AND FERTILIZER PLACEMENT, ARLINGTON, WIS. 2001-2002



CONTINUOUS CORN

RESPONSE OF CORN TO TILLAGE AND FERTILIZER PLACEMENT, ARLINGTON, WIS. 2001-2002



SOYBEAN/CORN

SUMMARY

- STARTER FERTILIZER STILL A RECOMMENDED PRACTICE
  - Pay attention to soil test, maturity, planting date, tillage, etc.
  - Use complete materials
- ROW PLACED FERTILIZER PROVIDES EARLY RESPONSE
  - Broadcast and deep not utilized in early season
- UNFERTILIZED SbC ROTATION HAS LOWER SURFACE K
  - Combination of increased K removal and stover K addition
- FIRST-YEAR CORN APPEARS MORE RESPONSIVE TO ROW FERTILIZER THAN CONTINUOUS CORN