SOIL MANAGEMENT AND POTASSIUM AVAILABILITY

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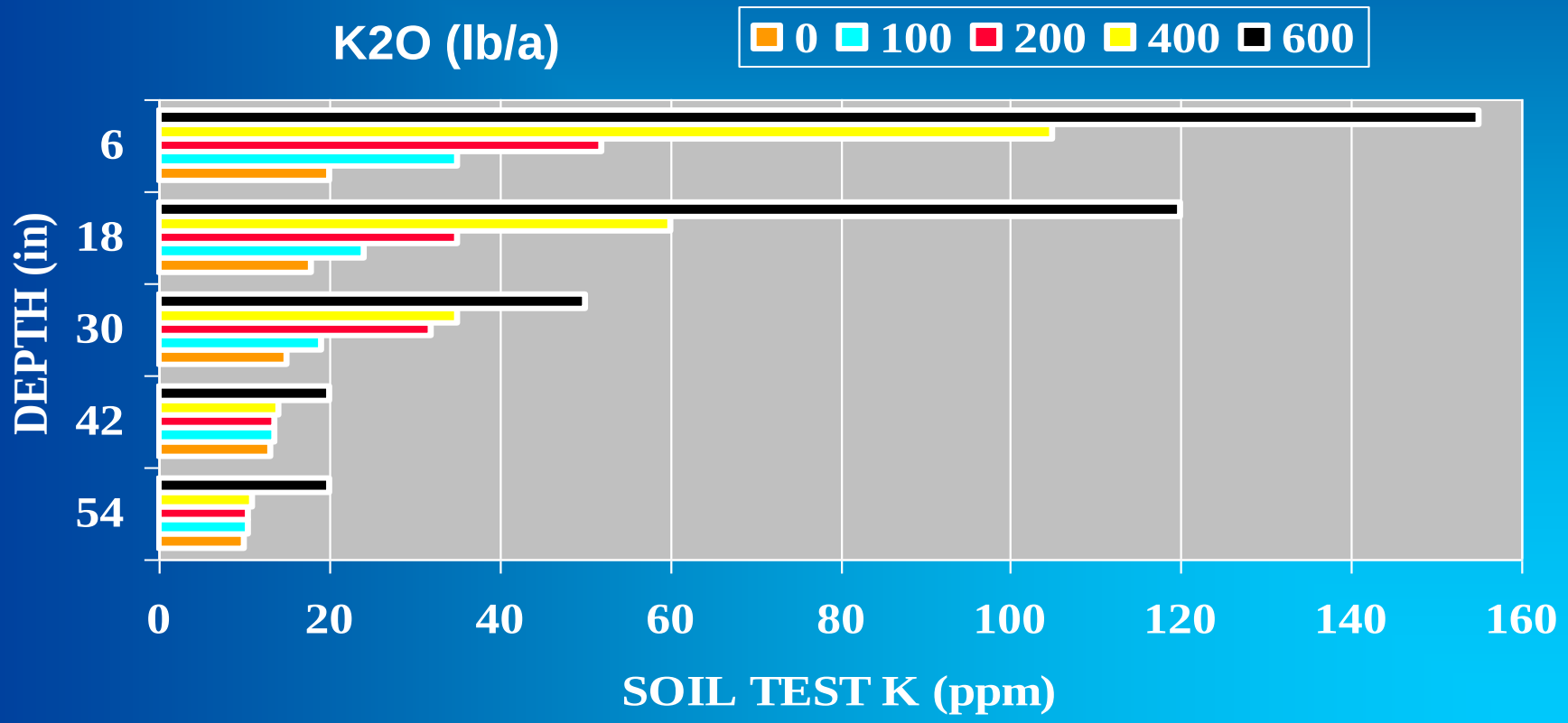
THERE WERE NUMEROUS QUESTIONS IN 2000

- RELATED TO WEATHER ?
  - DRY EARLY
  - HEAVY RAINS IN MAY AND JUNE
  - RELATIVELY COOLER SUMMER
- RELATED TO MANAGEMENT
  - NO-TILL AND HIGH RESIDUE FIELDS
  - MODERATE SOIL TEST K FIELDS
  - SOME FOLLOWING ALFALFA

REFRESHER – K IN SOILS AND PLANTS

- K (KALIUM) IS A CATION
  - >90% OF TOTAL K IS UNAVAILABLE
  - <2% IS READILY AVAILABLE
- MOST AVAILABLE K ON CEC
  - LEACHING AN ISSUE ON SANDS AND ORGANIC SOILS
  - MOVEMENT ON MTS & FTS SMALL
- PLANT USE AFFECTED BY
  - MOVEMENT TO ROOT SURFACE
  - ACROSS ROOT MEMBRANE

K FERTILIZATION AND LEACHING IN ANNUALLY TOPDRESSED ALFALFA



HANCOCK, WIS., 1979-1983
WOLKOWSKI AND KELLING

NUTRIENT MOVE TO ROOT SURFACE BY THREE MECHANISMS

- DIFFUSION
  - MOVEMENT FROM HIGHER TO LOWER CONCENTRATION
  - RANDOM MOVEMENT OF ATOMS
- MASS FLOW
  - MOVEMENT IN WATER BEING ABSORBED BY PLANTS
- ROOT INTERCEPTION
  - ROOT GROWS TO EXISTING ION

RELATIVE IMPORTANCE OF OF NUTRIENT MOVEMENT MECHANISMS FOR A 150 bu/a CORN CROP

NUT.	AMT. (lb/a)	ROOT INTERC.	MASS FLOW	DIFFUSION
N	190	2	150	38
P	40	1	2	37
K	195	4	35	156

AFTER BARBER, 1884

MOVEMENT ACROSS ROOT MEMBRANE

- PASSIVE vs. ACTIVE TRANSPORT
  - PASSIVE IS MOVEMENT DOWN AN ELECTROCHEMICAL GRADIENT
  - ACTIVE REQUIRES ENERGY BECAUSE TRANSPORT IS AGAINST EC GRADIENT
- K IS ABSORBED BY AN ACTIVE PROCESS
  - THE ONLY CATION ACTIVELY ABSORBED
  - ROOT RESPIRES
  - UTILIZES PHOTO-SYNTHATE AND NEEDS O_2
  - <10 % O_2 REDUCES GROWTH
  - REDUCTIONS IN AIR-FILLED POROSITY WOULD REDUCE K UPTAKE

BULK DENSITY AND POROSITY

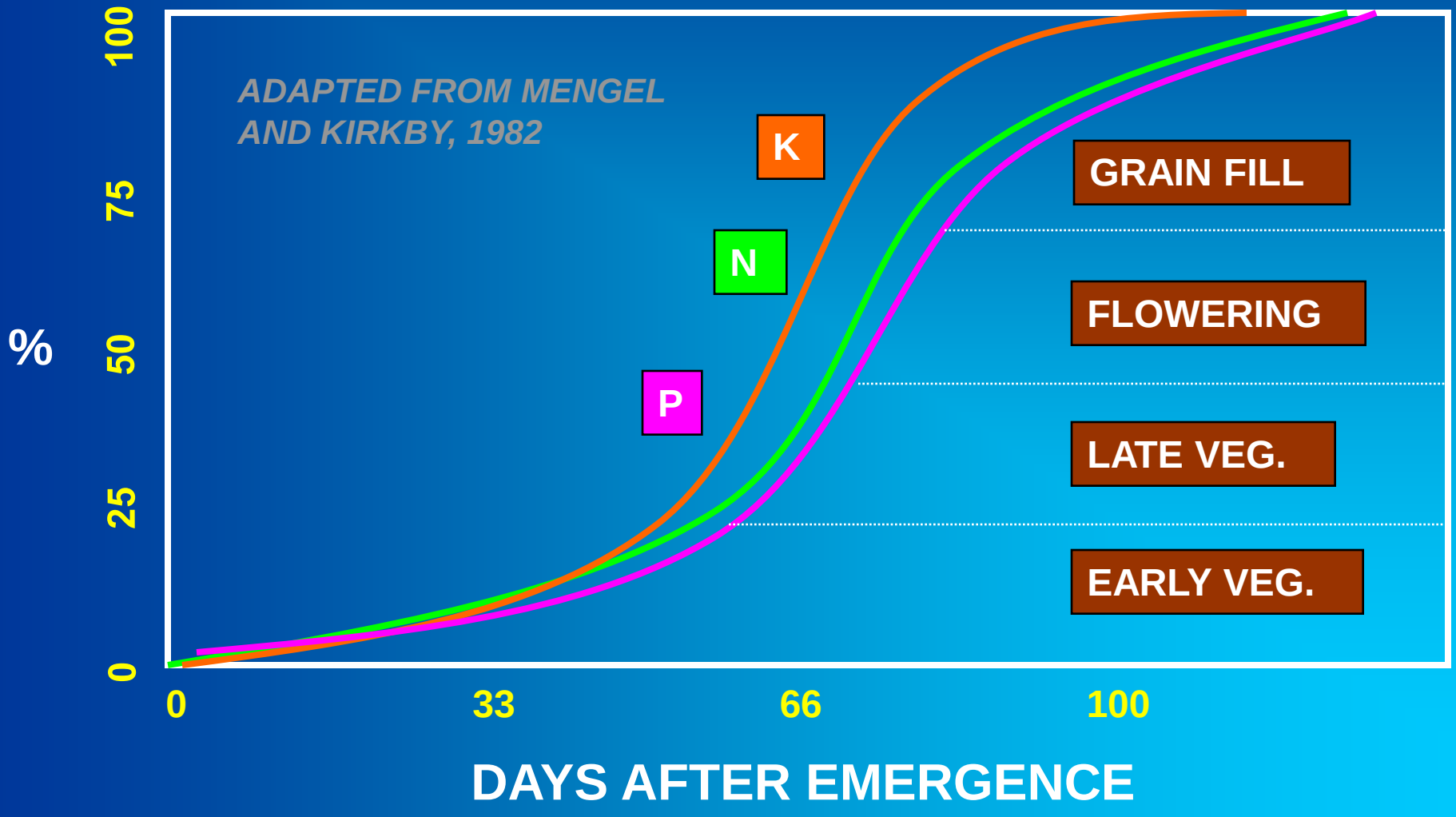
- BULK DENSITY = MASS/VOLUME
  - PARTICLE DENSITY: 2.65 g/cc
  - SAND: 1.5-1.6 g/cc
  - SILT LOAM: 1.2-1.3 g/cc
- POROSITY: $1 - D_b / D_p$
  - SAND: 1 - 1.6/2.65 = 0.40
  - SILT LOAM: 1 – 1.2/2.65 = 0.55
- INCREASING BULK DENSITY REDUCES POROSITY

COMPACTION EFFECT ON POROSITY AND PORE SIZE DISTRIBUTION

COMP.	DEPTH (in)	POROSITY (%)	PERCENT SIZE			
			L	M	S	VS
NO	1-4	53.4	27	7	36	30
	6-9	52.5	24	5	39	32
YES	1-4	47.9	5	13	43	39
	6-9	47.9	5	9	48	38

COMPACTION WITH 5 T TRACTOR, TAHLA ET AL., 1979

POTASSIUM ACCUMULATES EARLY



BULK DENSITY EFFECT ON SOYBEAN

BULK DENSITY	K ADDED	SHOOT WEIGHT	ROOT AREA	SHOOT K
	ppm	oz/pot	sq in/pot	%
1.25	0	0.086	85	1.68
	100	0.092	84	1.91
1.45	0	0.081	57	1.48
	100	0.087	67	1.79

HALLMARK AND BARBER, 1981

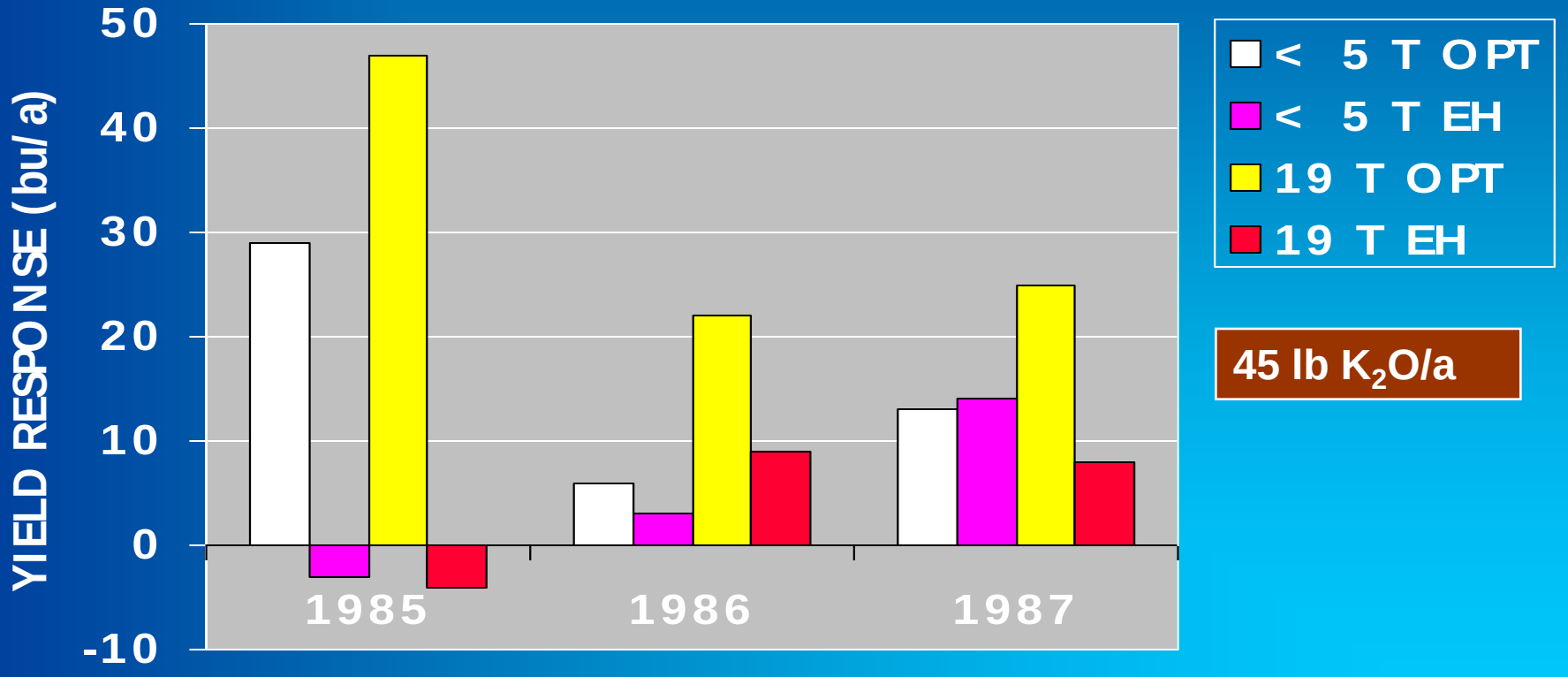
BULK DENSITY EFFECT ON CORN

BULK DENSITY	KEWAUNEE		PLAINFIELD		PLANO	
	LEAF K	ROOT	LEAF K	ROOT	LEAF K	ROOT
	g/plt	mg/plt	g/plt	mg/plt	g/plt	mg/plt
INITIAL	1.12	39.6	0.72	32.0	1.00	42.3
X 1.25	0.98	35.7	0.60	30.8	0.92	39.2

WOLKOWSKI, 1990

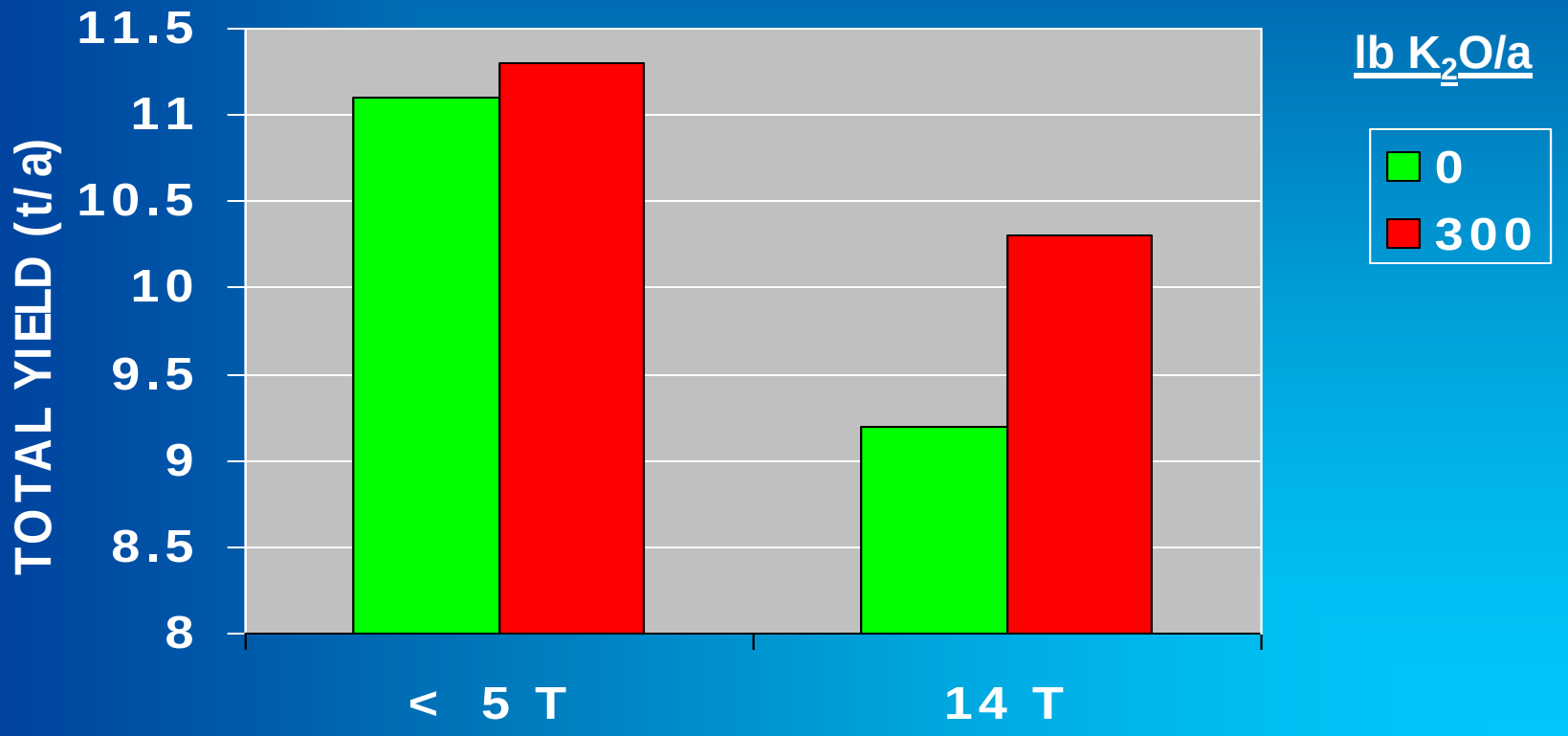
INITIAL D_b: KEWAUNEE=1.17, PLAINFIELD=1.36, PLANO=0.88

RESPONSE OF CORN TO ROW K FERTILIZATION ON A COMPACTED SOIL



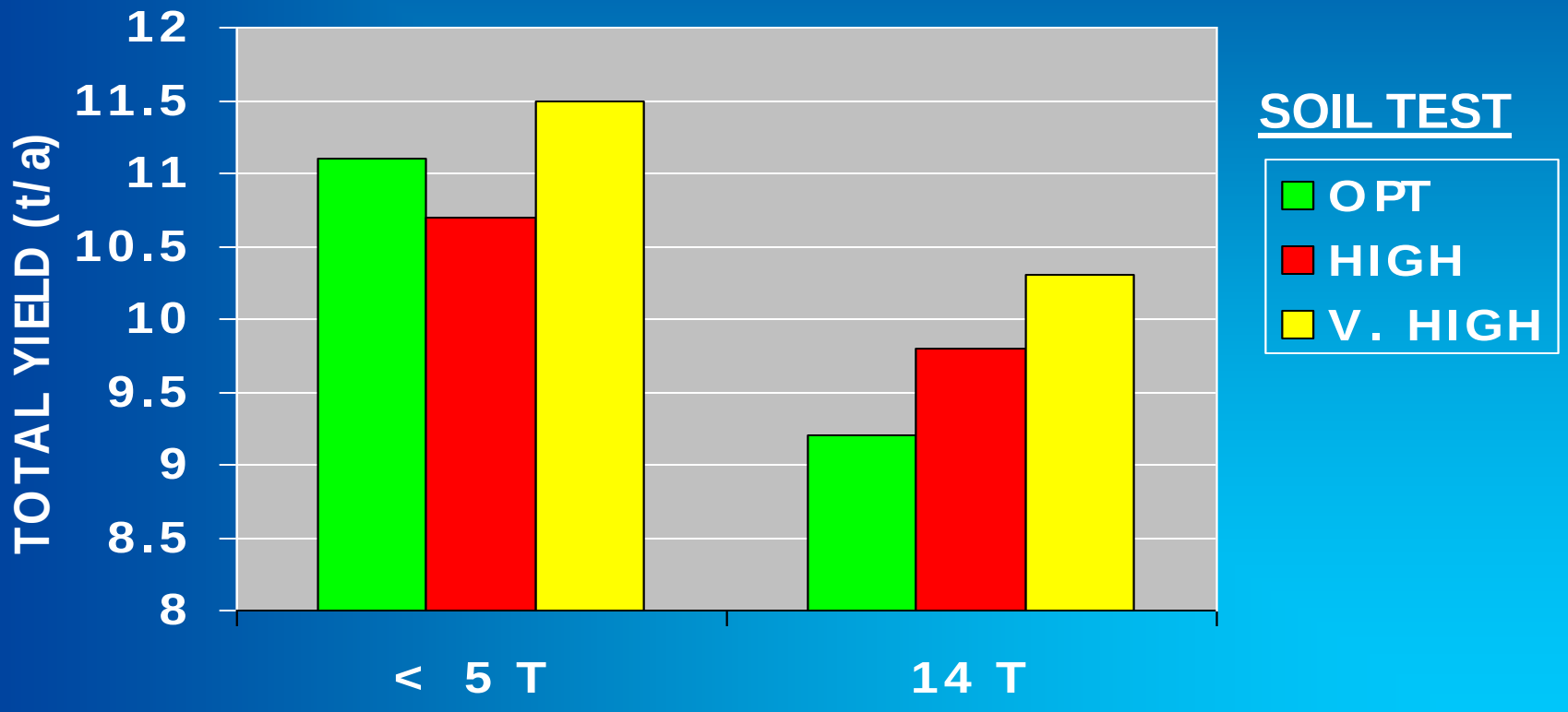
OSHKOSH, WIS. (WOLKOWSKI, 1989)

RESPONSE OF ALFALFA TO TOPDRESSED K FERTILIZER ON A COMPACTED SOIL



ARLINGTON, WIS. (WOLKOWSKI, 1992-1994)

RESPONSE OF ALFALFA TO SOIL TEST K ON A COMPACTED SOIL



ARLINGTON, WIS. (WOLKOWSKI, 1992-1994)

SUMMARY

- WEATHER LIKELY AFFECTED K UPTAKE
- WET MAY AND JUNE LIMITED ROOT DEVELOPMENT AND EARLY UPTAKE
- FACTORS THAT REDUCE AIR-FILLED POROSITY COULD CONTRIBUTE
- REDUCE COMPACTION AND PAY ATTENTION TO K FERTILITY