VARIABLE-RATE LIME RESPONSE IN WISCONSIN

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CONSIDERATIONS FOR VARIABLE SOIL pH MANAGEMENT

- MANY FIELDS TEST HIGH IN P AND K: THEREFORE, LOW RESPONSE TO VRT
- SOIL TEST SUMMARIES SHOW MANY FIELDS NEED LIME
- GRID SOIL SAMPLING IDENTIFIES WITHIN FIELD pH VARIABILITY

CONSIDERATIONS FOR VARIABLE SOIL pH MANAGEMENT

- SOIL pH DISTRIBUTION VARIES BETWEEN FIELDS
- OTHER LIMING BENEFITS INCLUDE:
  - CROP QUALITY
  - PROTEIN CONTENT
  - STAND PERSISTENCE
  - IMPROVED NUTRIENT AVAILABILITY

OTHER LIMING CONSIDERATIONS

- UNIFORM APPLICATION CRITICAL
- MIXING BY TILLAGE NEEDED
- HIGH RATES REQUIRE MULTIPLE APPLICATIONS
- RENTED LAND OFTEN OVERLOOKED
- REACTION TIME UP TO THREE YEARS

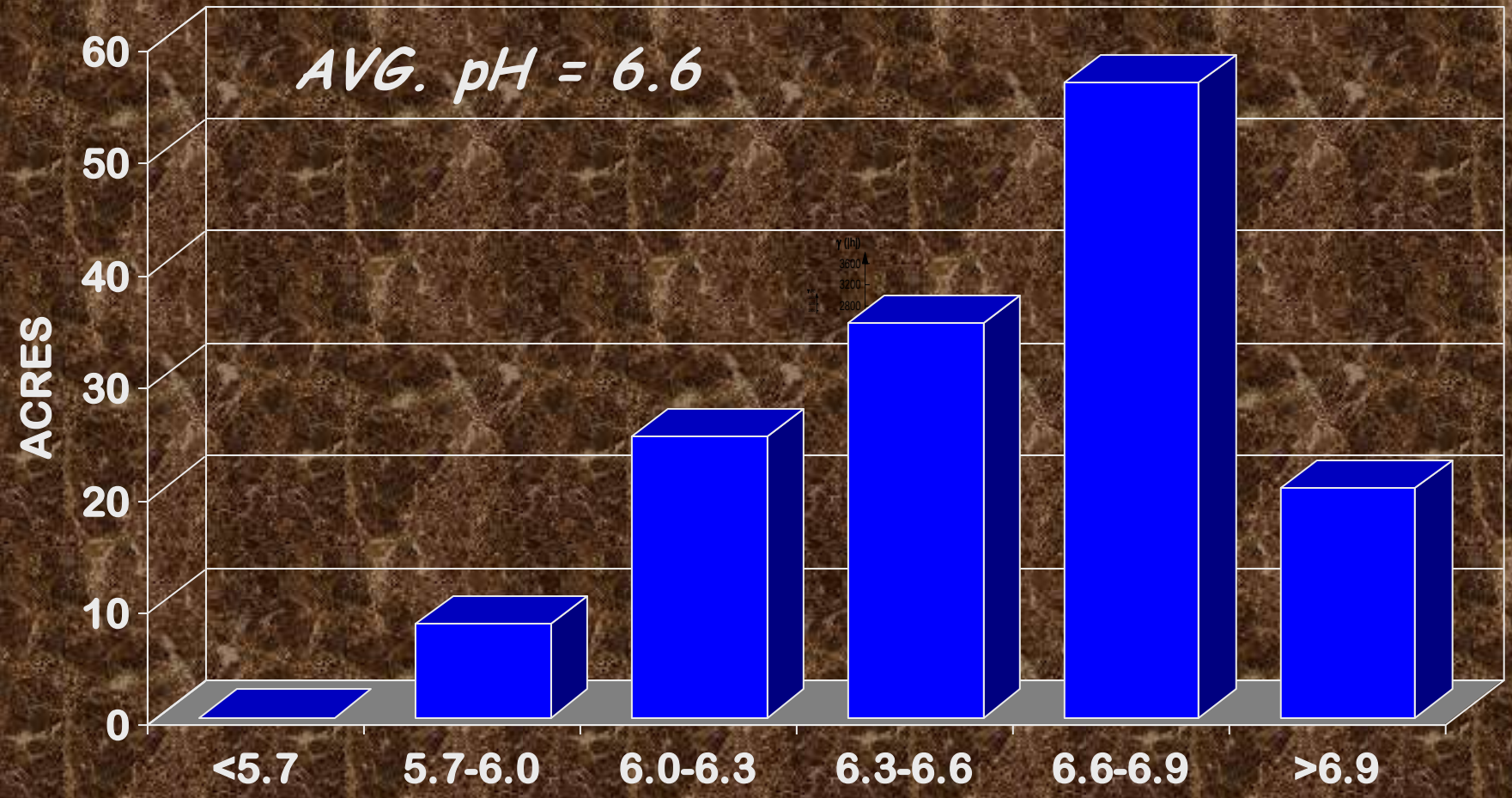
EVALUATING THE POTENTIAL FOR VARIABLE LIME MANAGEMENT

- SIX FIELDS GRID SAMPLED ON ONE ACRE
- TARGET pH 6.3 (SOYBEAN) OR 6.8 (ALFALFA)
- PARTIAL BUDGET APPROACH FOR LIMING
- ASSUMPTIONS INCLUDE:
  - MAX YIELD AT TARGET pH
  - VARIABLE APPLICATION REACHED TARGET pH
  - QUOTED COSTS AND RETURN
  - RESEARCH BASED YIELD EQUATIONS
  - COSTS SPREAD OVER FOUR YEARS

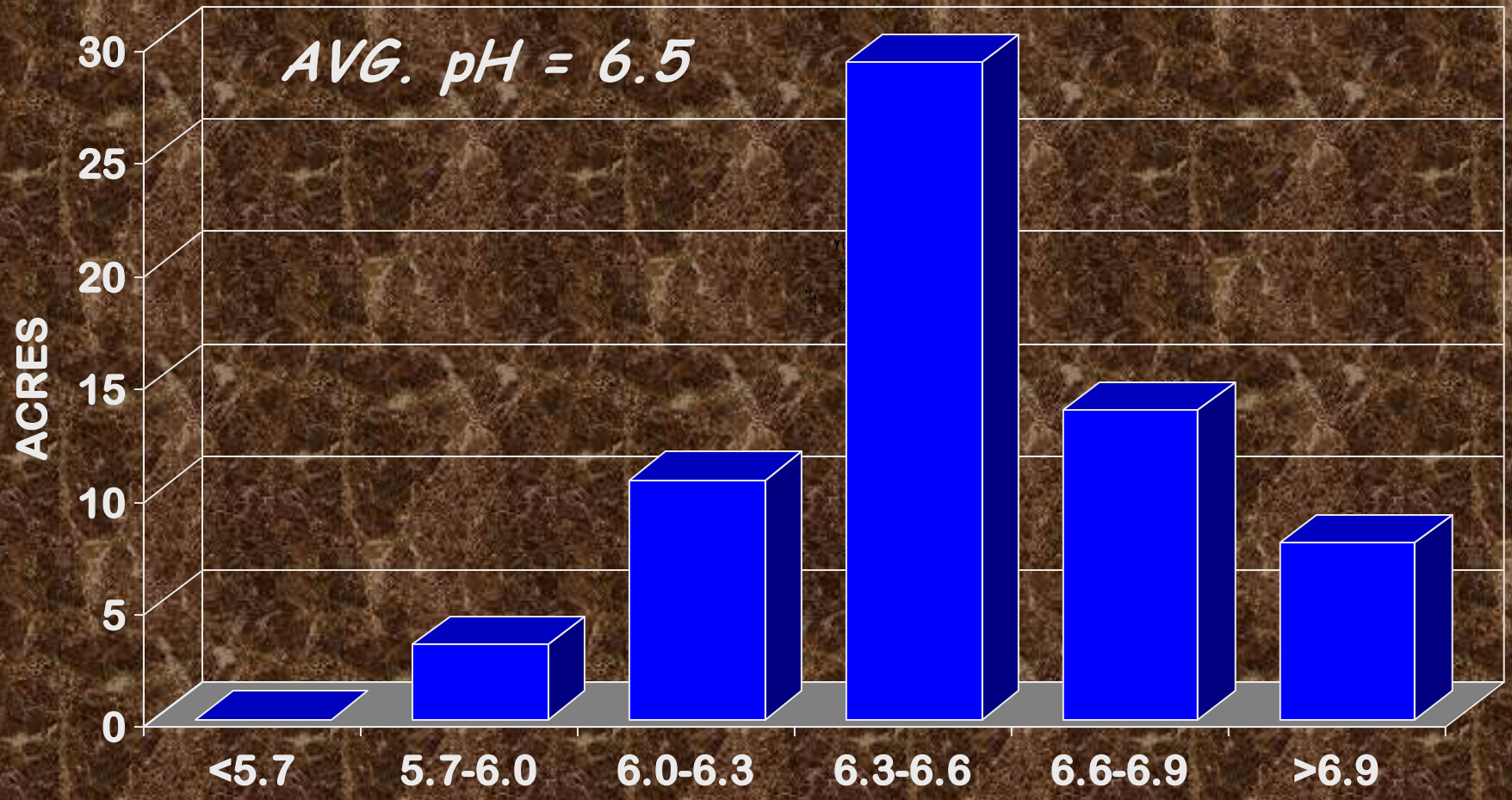
FIELD DESCRIPTIVE SOIL pH STATISTICS

SITE	MEAN pH	RANGE
FARM PROG.	6.6	5.8-7.4
CALDWELL	6.5	5.8-7.5
POST	5.8	5.0-7.2
STONE CORP.	6.5	5.9-7.0
WATZKE	6.5	5.3-7.7
FAULKNER	5.5	4.9-6.2

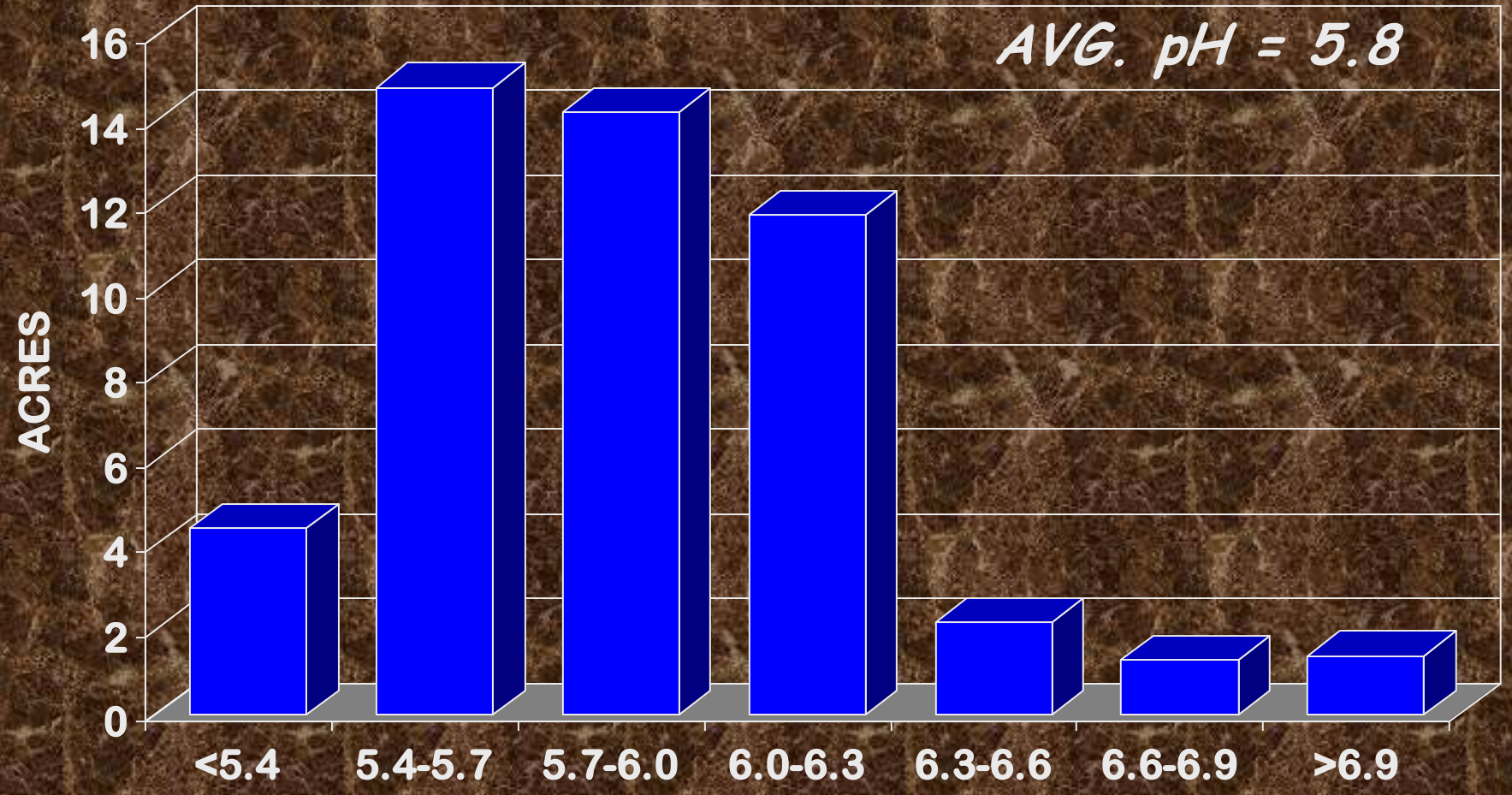
SOIL pH DISTRIBUTION FOR THE FARM PROGRESS DAYS FIELD (146 ACRES)



SOIL pH DISTRIBUTION FOR THE FARM
CALDWELL FIELD (65 ACRES)



SOIL pH DISTRIBUTION FOR THE POST FIELD (50 ACRES)



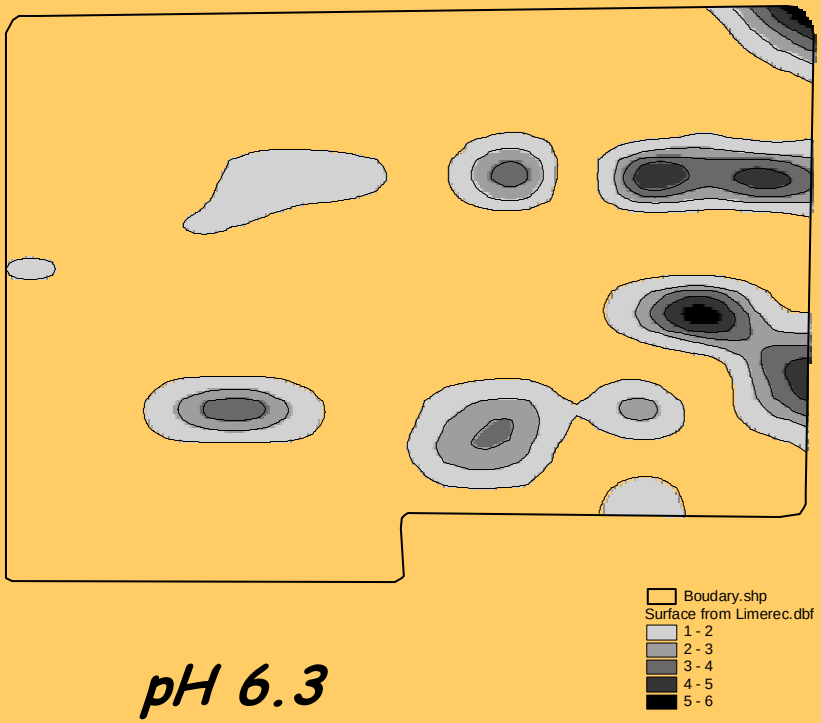
LIME REQUIREMENT FOR SOYBEAN

SITE	MEAN REC (6.3)	RANGE
FARM PROG.	1.0	0-6
CALDWELL	0.4	0-5
POST	2.9	0-6
STONE CORP.	0.3	0-4
WATZKE	1.0	0-10
FAULKNER	7.0	1-11

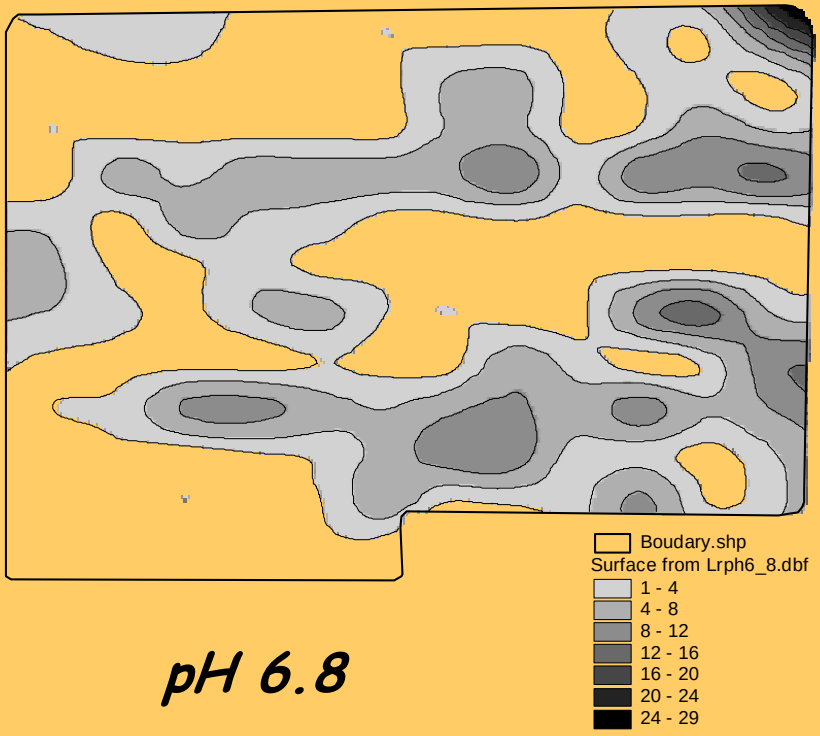
LIME REQUIREMENT FOR ALFALFA

SITE	MEAN REC (6.8)	RANGE
FARM PROG.	3.0	0-11
CALDWELL	3.1	0-13
POST	7.0	0-11
STONE CORP.	3.0	0-13
WATZKE	4.0	0-19
FAULKNER	14.0	6-21

LIME REQUIREMENT AT THE FARM PROGRESS DAYS FIELD

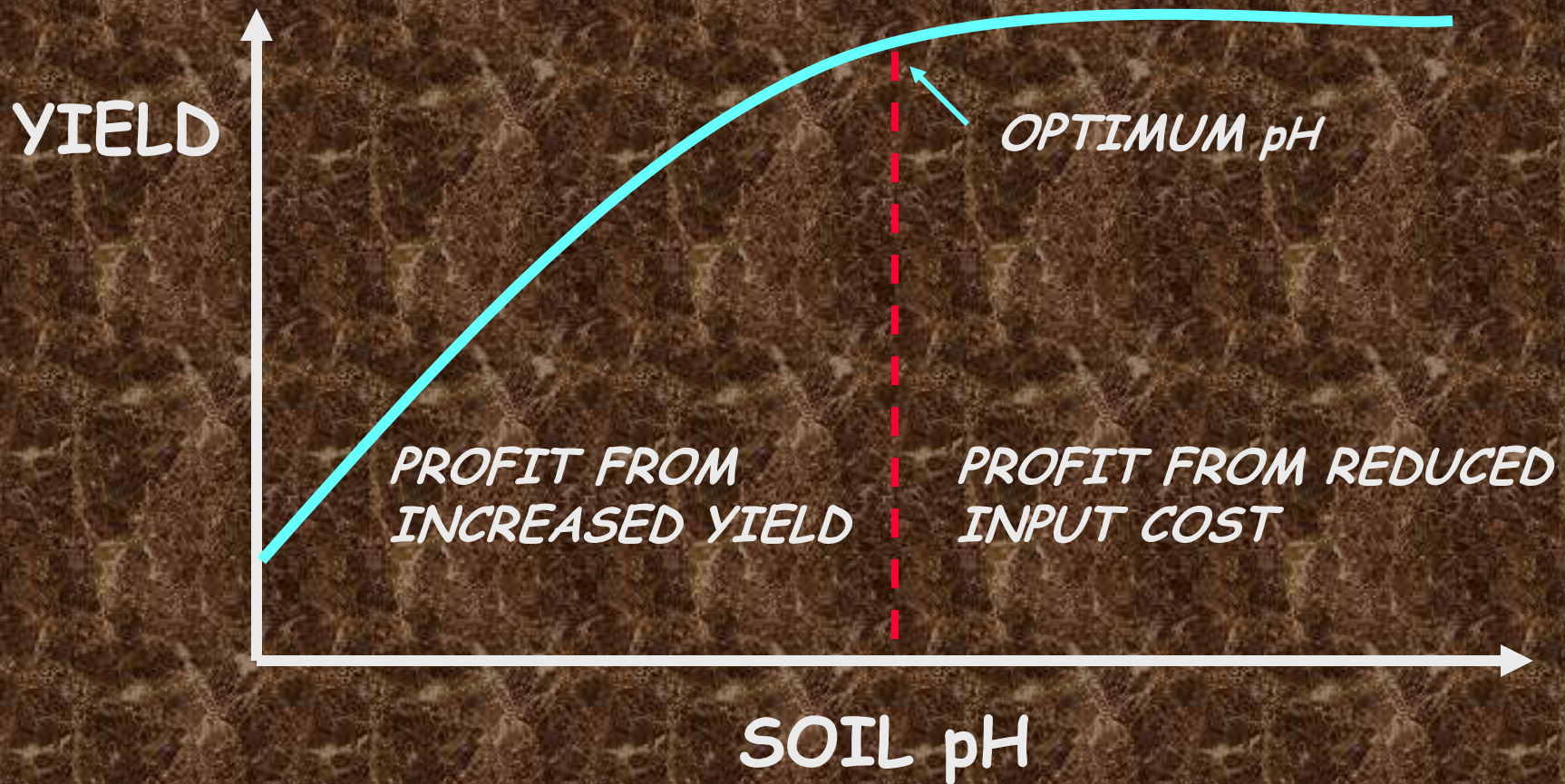


pH 6.3



pH 6.8

REALIZING A PROFIT FROM VARIABLE-RATE LIMING



PARTIAL BUDGET COMPARING VARIABLE RATE AND UNIFORM LIMING

WHAT IS A PARTIAL BUDGET

RETURN - COST FOR SPECIFIC PORTION OF THE CROP PRODUCTION SYSTEM

COSTS

1 ACRE GRID SAMPLING AND RECS.: $ 20/a

TYPICAL SOIL SAMPLING: $ 3/a

VARIABLE RATE APPLICATION: $ 6/a

LIME: $ 11.50/t, ALFALFA $ 100/t, SOYBEAN $5/bu

PARTIAL BUDGET COMPARING VARIABLE RATE AND UNIFORM LIMING

STEP 1: LIME NEEDED - VRT METHOD

ESTIMATE ACREAGE IN 0.3 pH UNIT CATEGORIES FROM MAP CREATED FROM GRID SAMPLED DATA

CALCULATE LIME REQUIREMENT FOR EACH CATEGORY WITH THE VRT PRACTICE

ASSUME ALL VRT LIMING REACHES TARGET pH

PARTIAL BUDGET COMPARING VARIABLE RATE AND UNIFORM LIMING

STEP 2: LIME NEEDED - FIELD AVERAGE METHOD

CALCULATE FIELD-AVERAGE LIME RATE FROM ALL GRID SAMPLED DATA

MULTIPLY RATE x ACRES FOR TOTAL LIME REQUIREMENT

ESTIMATE SOIL pH REACHED BY FIELD-AVERAGE LIMING FOR ACREAGE IN EACH 0.3 pH CATEGORY

ESTIMATE UN-NEEDED LIME IN HIGHER pH AREAS

PARTIAL BUDGET COMPARING VARIABLE RATE AND UNIFORM LIMING

STEP 3: ESTIMATE YIELD

ESTIMATE CROP YIELD FOR EACH LIMING PRACTICE USING RESPONSE FORMULA

e.g. ALFALFA YIELD = $-81.5 + 23.9\,(pH) - 1.67\,(pH)^2$

YIELD FOR ALL ACRES SIMILAR WITH VRT

FIELD-AVERAGE LIMING RESULTS IN LOWER YIELD IN SOME ACREAGE CATEGORIES BECAUSE OF UNDER-LIMING

PARTIAL BUDGET COMPARING VARIABLE RATE AND UNIFORM LIMING

STEP 4 - CALCULATE NET RETURN

MULTIPLY ACREAGE BY YIELD FOR EACH PRACTICE FOR TOTAL FIELD PRODUCTION

AMORTIZE COSTS OF BOTH PRACTICES OVER 4 YEARS

SUBTRACT COSTS FROM RETURNS

PARTIAL BUDGET COMPARING VARIABLE RATE AND UNIFORM LIMING (SOYBEAN, pH 6.3)

	CALDWELL		FPD		POST	
	UNI	VRT	UNI	VRT	UNI	VRT
	$/a					
RETURN						
YIELD	325	330	326	330	314	330
COST						
SAMPLING	3	20	3	20	3	20
VRT	-	6	-	6	-	6
LIME	6	5	12	5	33	35
LIME (XS)	2	-	6	-	2	-
RETURN	322	322	321	322	304	315

PARTIAL BUDGET COMPARING VARIABLE RATE AND UNIFORM LIMING (ALFALFA, pH 6.8)

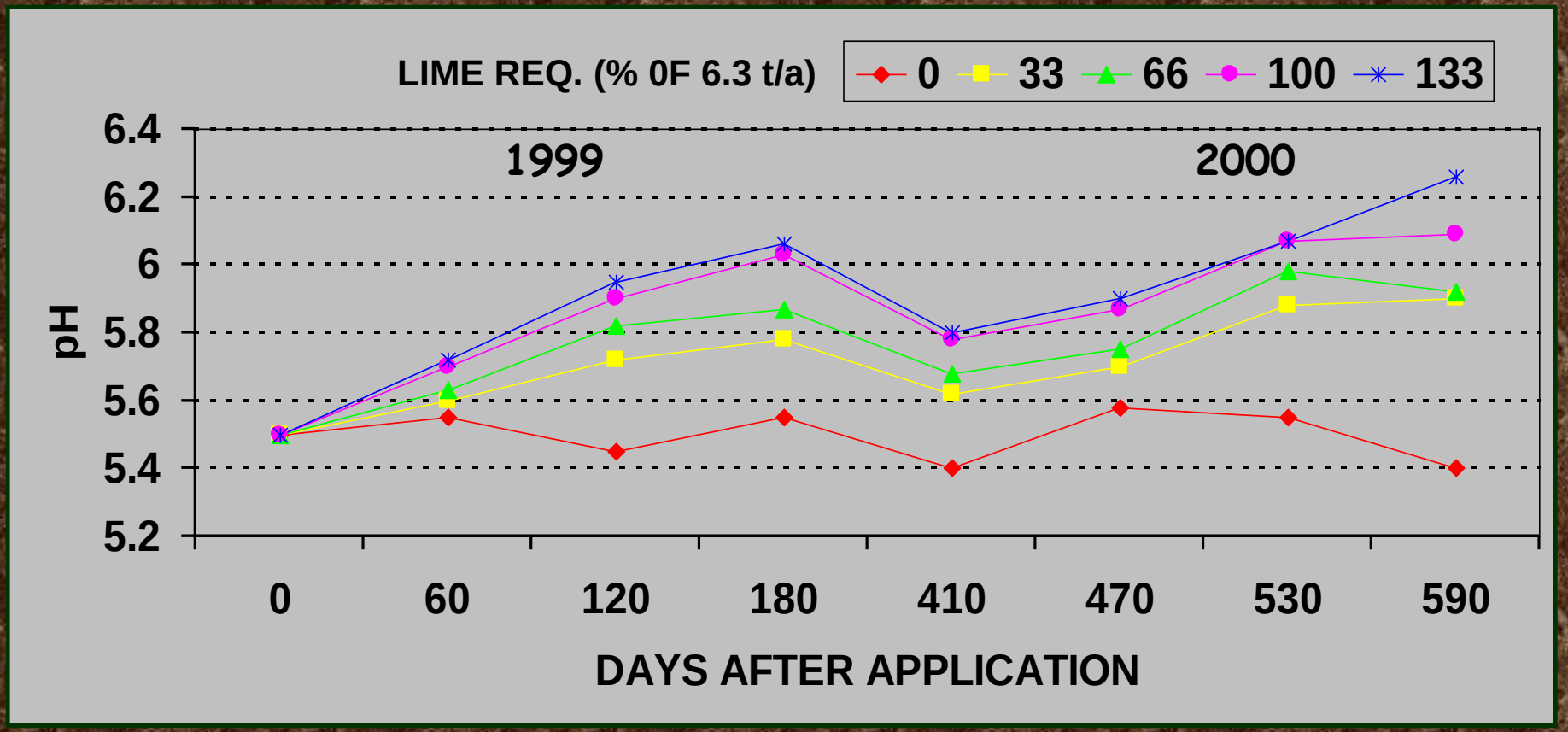
	CALDWELL		FPD		POST	
	UNI	VRT	UNI	VRT	UNI	VRT
	$/a					
RETURN						
YIELD	354	390	381	390	347	390
COST						
SAMPLING	3	20	3	20	3	20
VRT	-	6	-	6	-	6
LIME	36	35	35	30	80	75
LIME (XS)	4	-	5	-	2	-
RETURN	343	375	370	376	326	364

USB/FAR VARIABLE-RATE LIMING STUDY

- FOUR SOUTHERN WISCONSIN FIELDS
- CORN/SOYBEAN ROTATION
- 1 ACRE GRID SAMPLED
- 3 SMALL PLOT AREAS PER FIELD
  - RESPONSE TO pH
  - 0 - 133 % LIME REQ.
- FIELD LENGTH STRIPS
  - COMMERCIAL LIME APPLICATION
  - NONE, UNIFORM RATE, VARIABLE RATE STRIPS

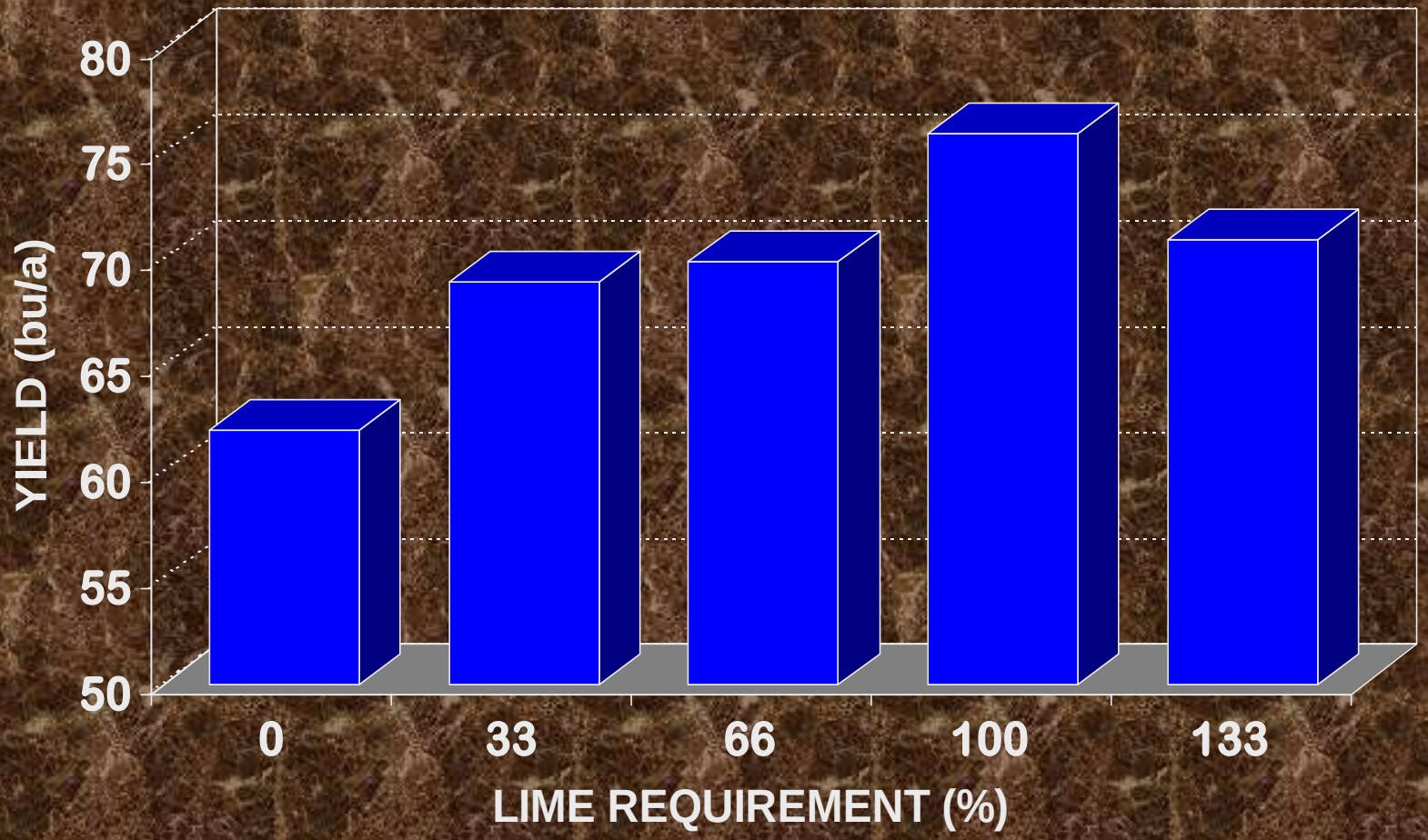
SOIL pH CHANGE FOLLOWING LIMING

(FAULKNER FIELD, ROCK CO., WIS. 1999-2000)



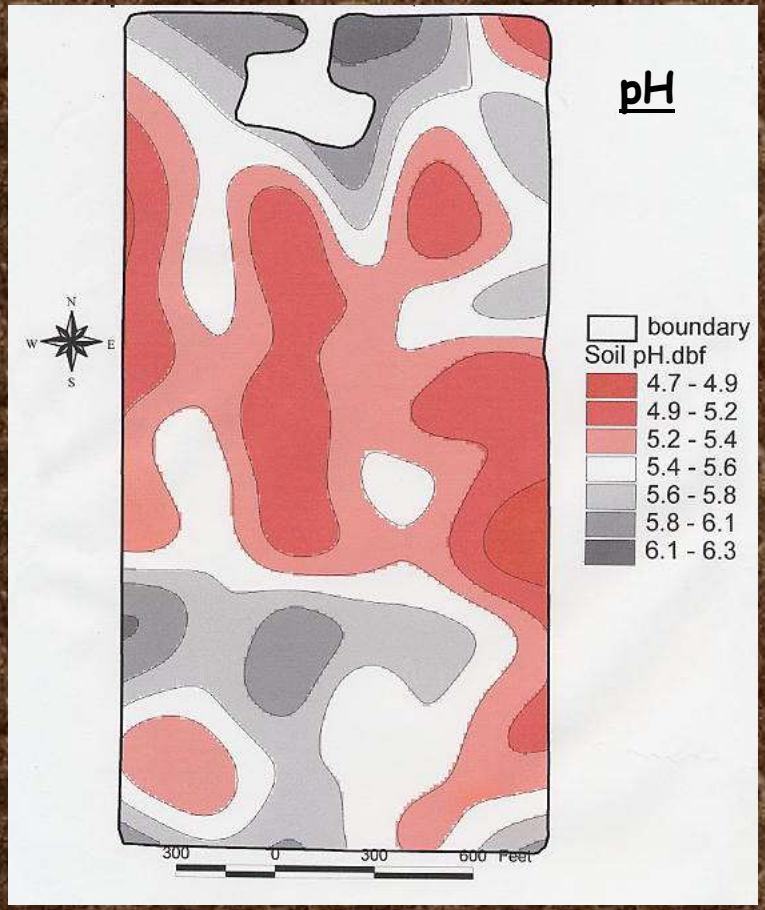
YIELD RESPONSE TO LIMING

(FAULKNER FIELD, ROCK CO., WIS., 1999)



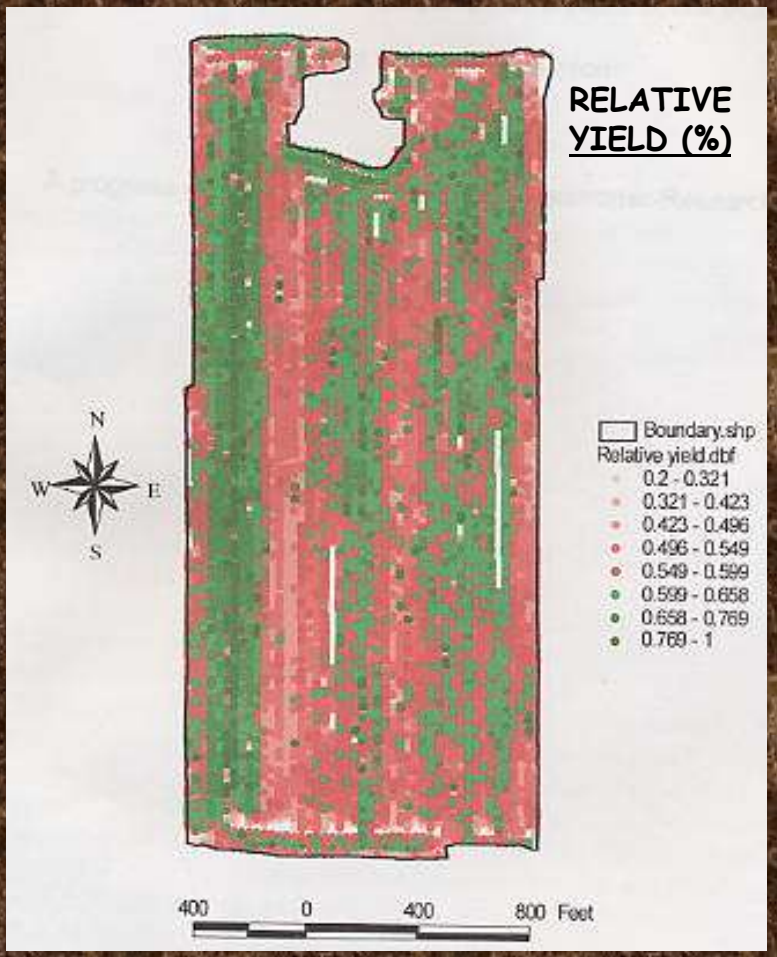
SOIL pH AND LIME REQUIREMENT

(FAULKNER FIELD, ROCK CO., WIS., 1999)



RESPONSE TO LIMING

(FAULKNER FIELD, ROCK CO., WIS., 1999)



SUMMARY

- GRID SAMPLE TO DETERMINE NEED FOR VARIABLE LIME
- SOIL pH "VARIABILITY PROFILE" DIFFERS BETWEEN FIELDS
- RETURN TO VARIABLE LIMING DEPEND ON:
  - TARGET pH
  - MANAGEMENT COSTS
  - CROP VALUE
  - YIELD RESPONSE TO LIMING
- INDIVIDUAL FIELD STUDIES VARIABLE