POTASSIUM MANAGEMENT ACROSS THE COTTON BELT

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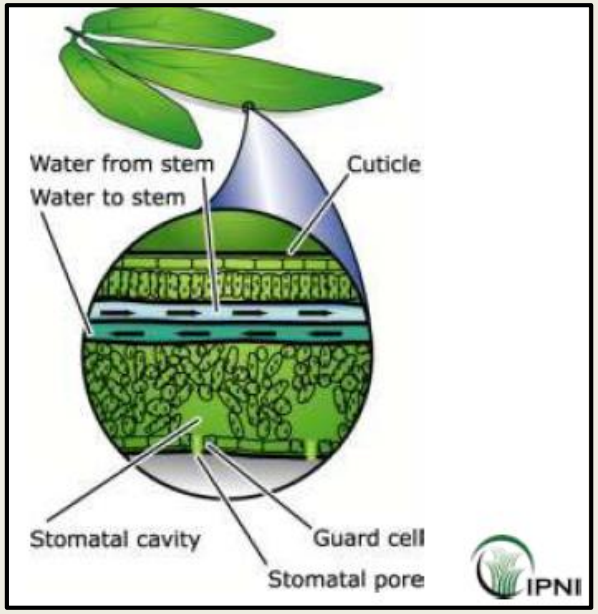
INTRODUCTION

- **Required by plants in amounts *second* only to N**
  - *Cotton can require greater K than N*

- **Quality Nutrient**
  - Fiber maturity

- **Mitigates drought stress**
  - Regulates leaf stomata and controls water use
    - During drought and in areas dependent on irrigation (dwindling supply), K could be key



INTRODUCTION

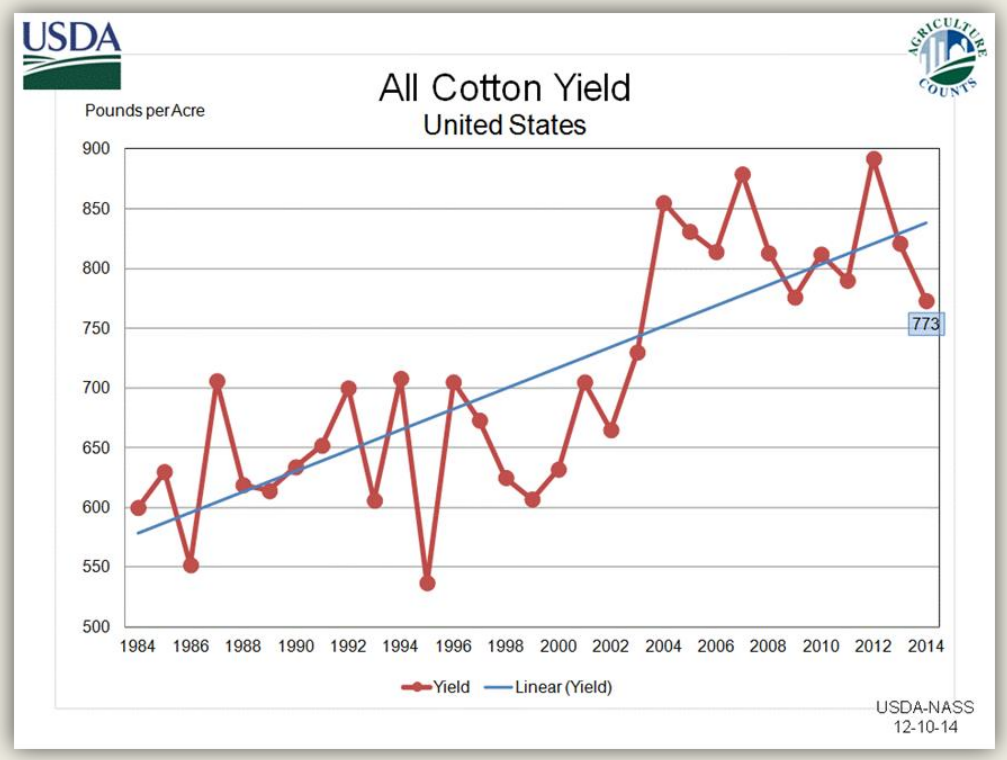
- K deficient plants more prone to foliar/root diseases

Lubbock, 2017
Mid-season K def.
and Verticillium wilt

Gaylon Morgan

INTRODUCTION

- **Increased reports of K deficiency symptoms across the Cotton Belt**
- **Modern varieties – increased yields and in many cases faster fruiting – increased K demand in a shorter amount of time**



INTRODUCTION

Wellington, TX

Source: Kenny Patterson

Lab No.: 8414

PLANT ANALYSIS REPORT

Date Reported: 08/22/2018

Send To:
36469
1974

PERRYTON EQUITY EXCHANGE
309 S 2ND
MEMPHIS, TX 79245

Kelly Brauer
Data Review Coordinator

Results For:
Plant Type: COTTON
Field ID: COTTON
Sample ID:

Date Received: 08/21/2018
Date Sampled:
Invoice No.: 215558

Plant Part: YOUNGEST MATURE LEAVES Stage: FIRST-BLOOM to FULL-BLOOM

Plant Sufficiency

		DEFICIENT	MARGINAL	SUFFICENT	HIGH
Total Nitrogen, % N	3.62	4.05	4.35	5.25	5.60
Phosphorus, % P	0.21	0.24	0.28	0.44	0.54
Potassium, % K	0.214	1.35	1.50	2.15	2.60
Calcium, % Ca	4.24	2.35	2.60	3.90	4.60
Magnesium, % Mg	1.24	0.50	0.60	0.90	1.05
Sulfur, % S	0.36	0.70	0.80	1.50	1.85
Zinc, mg/kg Zn	19	20	25	35	50
Iron, mg/kg Fe	145	75	85	180	275
Manganese, mg/kg Mn	54	40	50	90	140
Copper, mg/kg Cu	3	5	6	9	10
Boron, mg/kg B	80	40	50	85	105
Sodium, % Na	0.032	0.025	0.035	0.120	0.220
Nitrogen:Sulfur Ratio N:S	10.0	7.5	5.5	3.5	3.0

DATA INTERPRETATION: Note that results from a single plant sample may be affected by time of day, climatic conditions, plant stress, age, or disease -- factors that are not directly related to fertility status. Nutrient concentrations are not uniform throughout the plant tissues and may change as the tissue matures. The interpretation ranges apply to the plant parts or growth stages listed above, so should not considered valid with other plant parts or growth stages.

SURVEY RANGES: The interpretation ranges were developed from survey data that was collected across a wide range of crop, soil, and climate conditions. The data ranges for the "Marginal" categories correspond to the low range of samples in the survey. The "Sufficient" categories correspond to the medium or"normal" ranges of plant tissue data found in the survey. The "High" category corresponds to the upper range of survey sample data. These ranges apply to the plant parts or growth stages listed above, so should not considered valid with other plant parts or growth stages.

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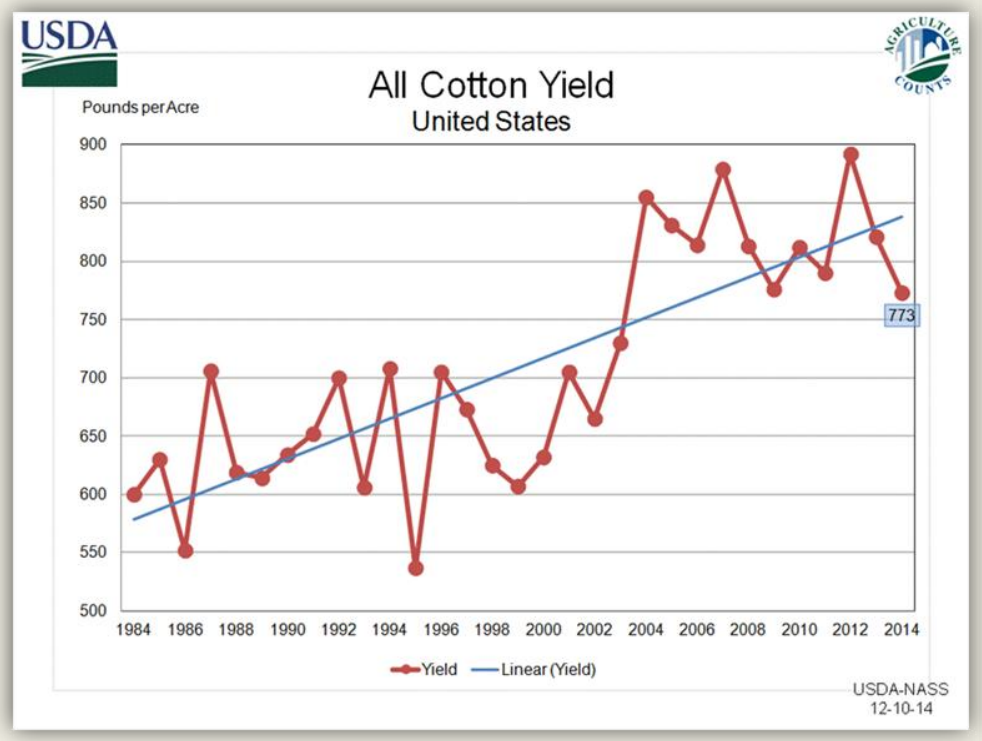
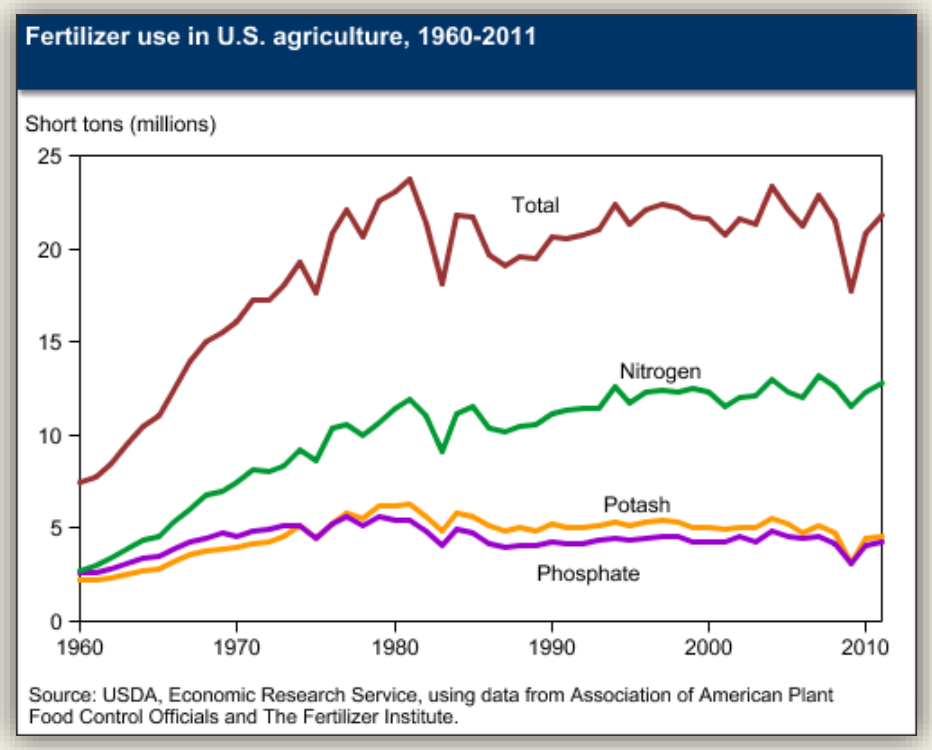
INTRODUCTION

- **Potassium is often overlooked as a key component in successful farming operations**
- **If K removed by plant is greater that what is being applied, soil fertility declines**





BELTWIDE K OBJECTIVES

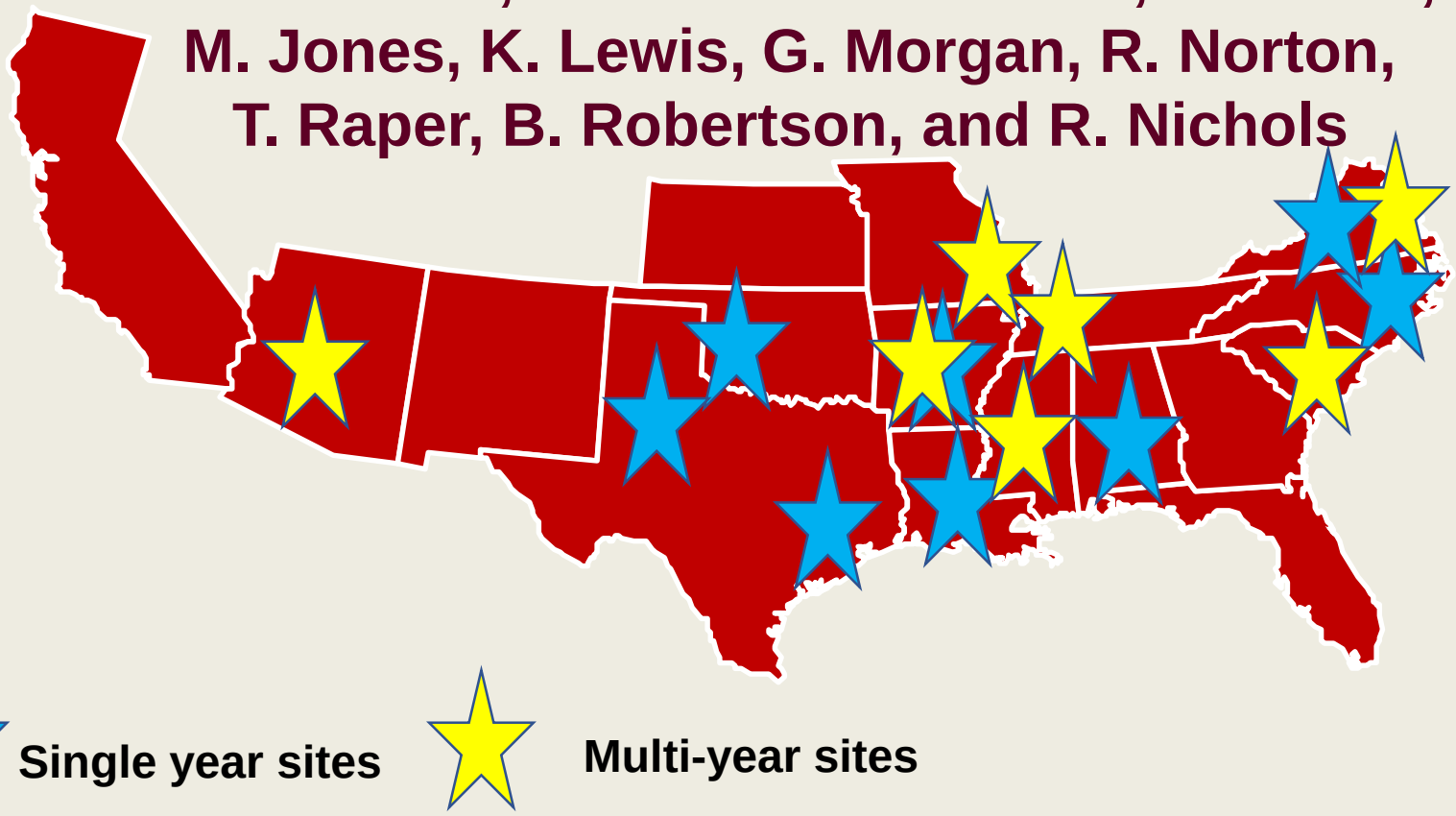
- **Evaluate the impact of K application methods and rates on cotton yield and fiber quality**

- **Based on these findings, Mehlich III K critical levels and recommendations will be reevaluated and modified as appropriate to optimize yields**

MATERIALS AND METHODS

- **2015-2017 Locations**

R. Boman, T. Cutts, D. Delaney, D. Dodds, K. Edmisten, H. Frame D. Fromme, A. Jones, M. Jones, K. Lewis, G. Morgan, R. Norton, T. Raper, B. Robertson, and R. Nichols



Experimental Site				Soil Classification		
Site	Year	County/State	Irrigation	Series	Texture	Group
1	2015	AL				
2	2015	AR	Furrow	Herbert	silt loam	
3	2015	Rapides Parish/LA	Rainfed	Coushatta	silt loam	FE
4	2015	Dawson/TX	SDI	Amarillo	fine sandy loam	AP
5	2015	Williamson/TX	Rainfed	Burleson	clay	UH
6	2015	VA		Suffolk		
7	2016	AL				
8	2016	AR	Furrow	Herbert	silt loam	
9	2016	Rapides Parish/LA	Rainfed	Coushatta	silt loam	FE
10	2016	Jackson/OK	Furrow	Hollister	silty clay loam	TH
11	2016	Edgecombe/NC	Rainfed	Norfolk	loamy sand	TK
12	2016	Dawson/TX	SDI	Amarillo	fine sandy loam	AP
13	2016	Williamson/TX	Rainfed	Burleson	clay	UH
14	2016	VA		Southampton		
15	2017	Macon/AL	Rainfed	Marvyn	sandy loam	TKH
16	2017	AR	Furrow	Herbert	silt loam	
17	2017	Rapides Parish/LA	Rainfed	Coushatta	silt loam	FE
18	2017	Edgecombe/NC	Rainfed	Norfolk	loamy sand	TK
19	2017	Jackson/OK	Furrow	Hollister	silty clay loam	TH
20	2017	Leflore/MS	Furrow	Dubbs	loam	THA
21	2017	Dawson/TX	SDI	Amarillo	fine sandy loam	AP
22	2017	Williamson/TX	Rainfed	Branyon	clay	UH
23	2017	VA		Sussex		

METHODS

Treatment Factors:

- **Application Method**
  - Broadcast incorporated, > 3”
    - Granular KCl (0-0-60)
  - Knife injected, 4”x 6” from seed furrow
    - Liquid KCl (0-0-15)

- **Application Rate**
  - 0, 40, 80, 120, and 160 lb K_2O/A
  - All plots received equivalent amounts of N and P fertilizer
  - Fertilizer was applied 2 to 4 weeks before planting

Year	Location	Mehlich-3 K concentrations at different soil depths								
		0-6"		6-12"		12-24"		*P > F*	0-12"	0-24"
		mg K kg^{-1} soil							mg K kg^{-1} soil	
2016	VA	30	a	40	a	37	a	0.748	35	36
2016	**★AL**	**39**	**b**	**56**	**a**	**44**	**b**	**0.002**	**48**	**46**
2017	AL	56	a	54	a	67	a	0.153	55	59
2015	AL	61		64		82			63	69
2017	VA	61	a	47	a	61	a	0.184	54	56
2017	NC	73	a	69	a	63	a	0.344	71	68
2016	WM	83	a	77	a	86	a	0.133	80	82
2016	**NC**	**86**	**a**	**66**	**b**	**57**	**b**	**0.007**	**76**	**70**
2015	VA	92	a	99	a	93	a	0.393	95	94
2015	WM	96	a	96	a	98	a	0.694	96	97
2017	**MS**	**100**	**a**	**90**	**b**	**89**	**b**	**0.071**	**95**	**93**
2017	**LA**	**152**	**a**	**129**	**b**	**92**	**c**	**0.003**	**140**	**124**
2017	**★AR**	**158**	**b**	**167**	**b**	**212**	**a**	**0.005**	**163**	**179**
2015	**LA**	**159**	**a**	**144**	**b**	**129**	**c**	**0.0004**	**151**	**144**
2016	**★AR**	**168**	**ab**	**153**	**b**	**174**	**a**	**0.099**	**160**	**165**
2015	**AR**	**174**	**a**	**112**	**b**	**99**	**c**	**<.0001**	**143**	**128**
2016	**LA**	**177**	**a**	**139**	**b**	**92**	**c**	**0.0004**	**158**	**136**
2016	**OK**	**204**	**a**	**178**	**b**	**171**	**c**	**0.0002**	**191**	**185**
2017	**WM**	**207**	**a**	**216**	**a**	**180**	**b**	**0.001**	**211**	**201**
2017	**LU**	**261**	**a**	**236**	**b**	**246**	**b**	**0.019**	**249**	**248**
2017	OK	267	a	267	a	259	a	0.366	267	264
2016	**LU**	**277**	**a**	**265**	**a**	**244**	**b**	**0.015**	**271**	**262**
2015	**LU**	**391**	**a**	**281**	**b**	**253**	**c**	**<.0001**	**336**	**309**

LINT YIELD (sites with < 125 mg K/kg)

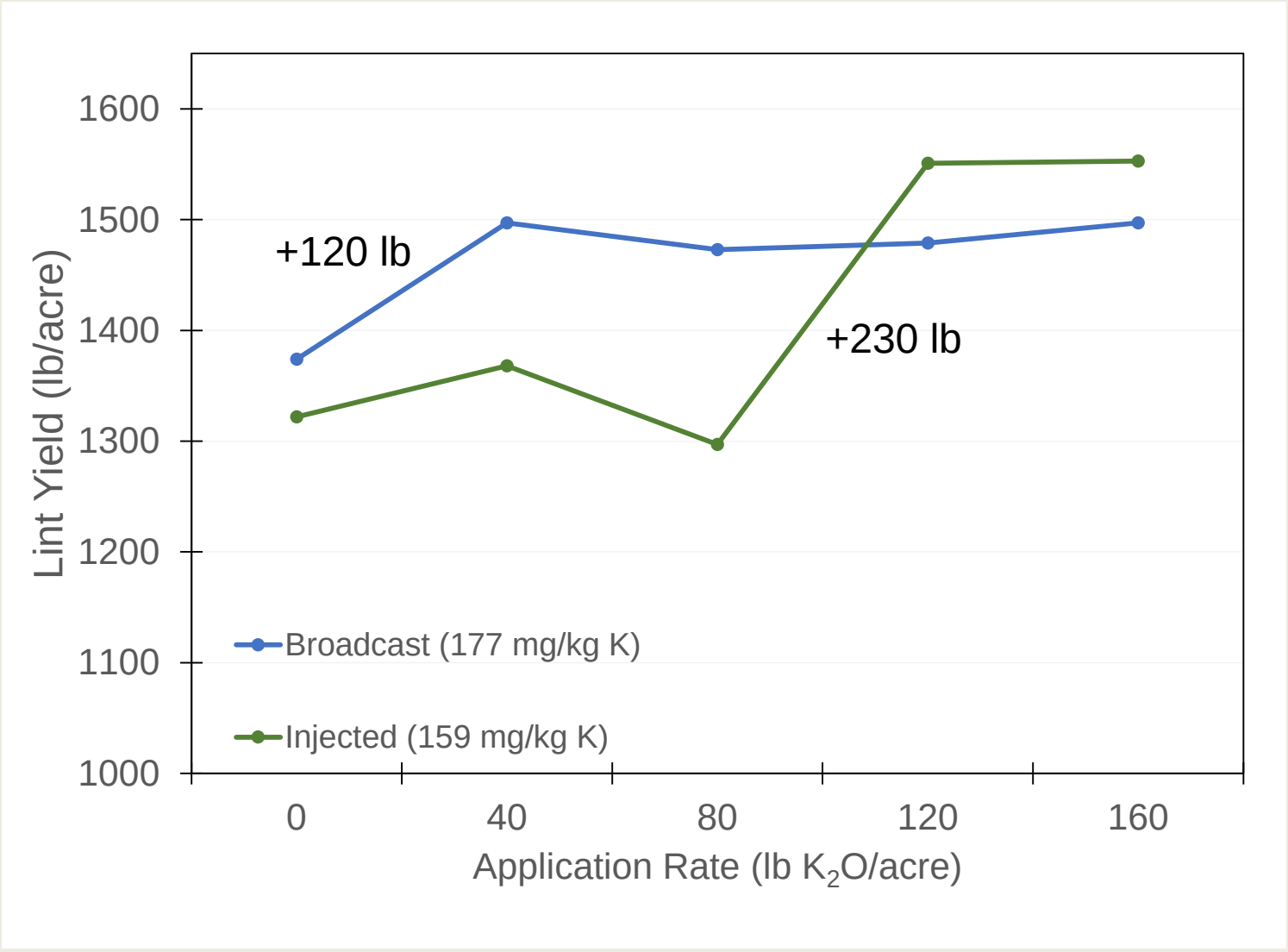
Loc.	Soil	Broadcast K, lb K_2O $acre^{-1}$					*P > F*	Injected K, lb K_2O $acre^{-1}$					*P > F*
	K	0	40	80	120	160		0	40	80	120	160	
	mg kg^{-1}	lb $acre^{-1}$						lb $acre^{-1}$					
VA	30	78	236	427	406	321	**0.002**	114	319	456	296	469	**0.004**
AL	39	1123	1120	1093	1166	1147	0.888	1130	1176	1129	1159	1112	0.652
AL	56	1777	1569	1609	1526	1552	**0.034**	1657	1386	1489	1583	1499	0.428
AL	61	1382	1500	1407	1530	1334	0.630	1393	1429	1453	1536	1619	0.174
VA	61	1342	1633	1970	1868	1597	**0.005**	1806	1932	1588	1638	1691	0.541
NC	73	1411	1497	1426	1475	1478	0.515	1344	1425	1518	1430	1533	**0.067**
WM	83	219	246	218	306	317	**0.094**	185	209	257	244	309	**0.031**
NC	86	661	590	648	743	636	0.924	627	654	655	609	625	0.956
VA	92	1237	1216	1228	1220	1235	0.850	1260	1210	1173	1224	1283	0.599
WM	96	318	343	416	385	392	**0.032**	298	377	434	363	421	**0.001**
MS	100	600	506	507	528	537	0.228	543	545	530	561	512	0.926

Approximately 40% of sites with K < 125 mg/kg responded to K fertilizer

LINT YIELD (sites with >125 mg K/kg)

Loc.	Soil	Broadcast K, lb K_2O acre^{-1}					*P* > *F*	Injected K, lb K_2O acre^{-1}					*P* > *F*
	K	0	40	80	120	160		0	40	80	120	160	
	mg kg^{-1}	lb acre^{-1}						lb acre^{-1}					
LA ★	152	904	902	842	944	891	0.899	953	886	951	871	820	0.357
AR	158	1177	1099	1231	1103	1072	0.691	1204	1303	1226	1257	1131	0.838
LA ★	159	1549	1454	1464	1309	1355	0.281	1322	1368	1297	1551	1553	0.374
AR	168	1132	1105	1088	1116	1163	0.909	1096	1140	1145	1295	1267	0.375
AR	174	1382	1401	1343	1343	1312	0.772	1342	1362	1272	1336	1433	0.928
LA ★	177	1374	1497	1473	1479	1497	0.152	1522	1508	1487	1466	1525	0.752
OK	204	1629	1788	1779	1788	1893	**0.002**	1767	1851	1857	1768	1862	0.279
WM	207	800	875	734	754	788	0.881	811	771	701	790	814	0.500
LU	261	1695	1602	1600	1847	1773	0.922	1758	1871	1868	1539	1865	0.856
OK	267	1652	1678	1607	1685	1630	0.975	1713	1723	1733	1701	1573	0.516
LU	277	1724	1753	1902	1649	1629	0.945	1474	1695	1813	1778	1788	**0.032**
LU	391	1790	1640	1739	1687	1660	0.119	1670	1743	1767	1770	1868	**0.033**

LINT YIELD (Louisiana 152-177 mg/kg K)

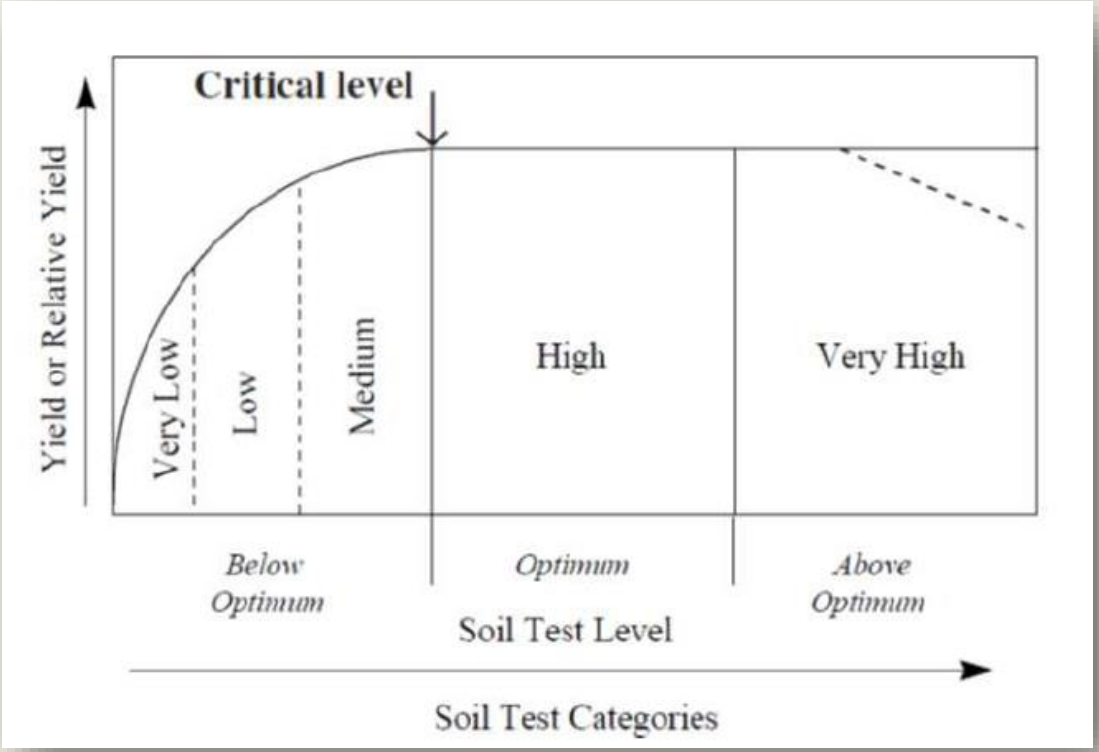


SUMMARY

- **Low yielding sites tend to be more responsive**
  - TX-Williamson and VA in 2016 but not 2017
  - Yield response was not consistently observed at locations with low soil K – poor soil test correlation
- **General yield increase with added K at locations with soil test levels > 125 mg/kg (LA, AR, OK and TX), but not consistent**
- **Application rate and method comparison**
  - Greater yield increase with 40 and 80 lb K_2O/A
  - TX and NC more responsive to injected K compared to broadcast K
  - VA (2017) responded to broadcast but not injected

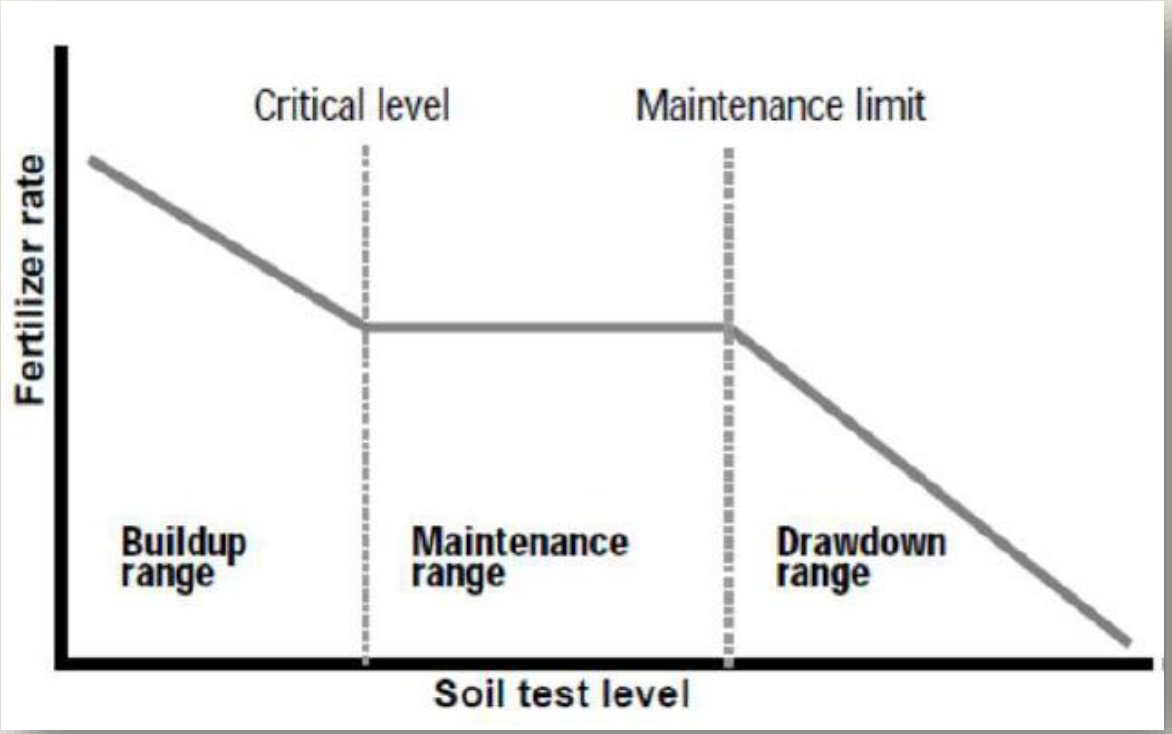
SOIL TEST DEVELOPMENT

- **Two parts – correlation and calibration**
- **Correlation – process of determining the relationship between plant nutrient uptake or yield and the amount of nutrient extracted by a particular soil test method (e.g. Mehlich III K)**



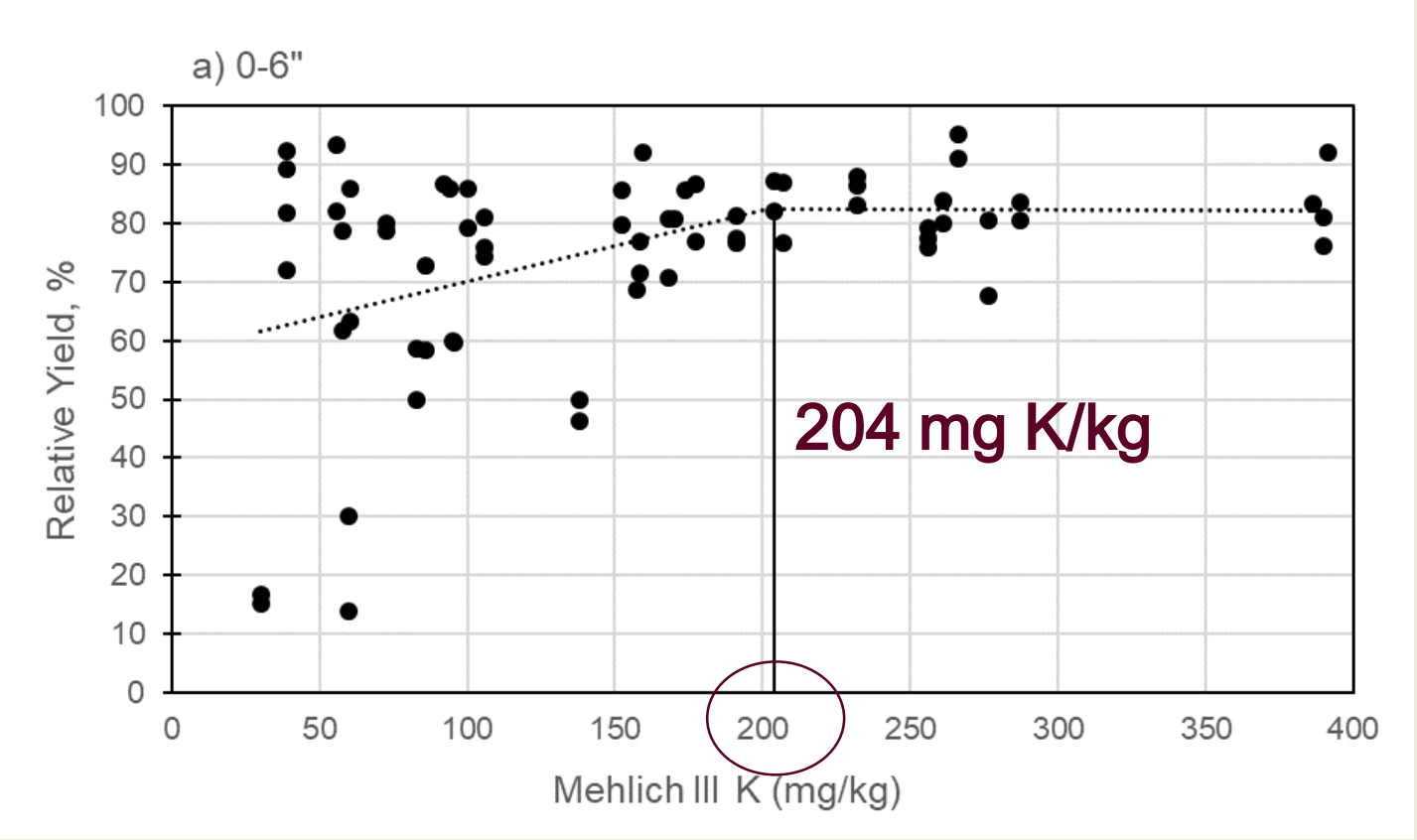
SOIL TEST DEVELOPMENT

- **Calibration – process of determining the crop nutrient requirement at different soil test levels**
  - Soil test fertilizer recommendations
  - How much fertilizer is needed for a specific soil test?



POTASSIUM SOIL TEST CORRELATION

Mehlich III K critical level is currently 125 mg/kg in TX



Observations	Plateau	Joint	*P*-value
68	83%	204 mg/kg	0.001

Relative Yield = mean of check lint yield divided by highest numerical treatment lint yield; multiplied by 100.

SUMMARY

- Mehlich III critical level of K in TX may need to be increased (125 mg/kg to 200 mg/kg)
- Large data set represented with wide array of environments, irrigation methods and soil characteristics
- Next step will be to work with soil the testing laboratory on soil test calibration – fertilizer recommendations

ACKNOWLEDGMENTS

- **Funding Sources**

- **Cooperators**

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