POTASSIUM SOIL TEST CALIBRATION WITH MAIZE IN KWAZULU-NATAL, SOUTH AFRICA: SUCCESSES AND CHALLENGES

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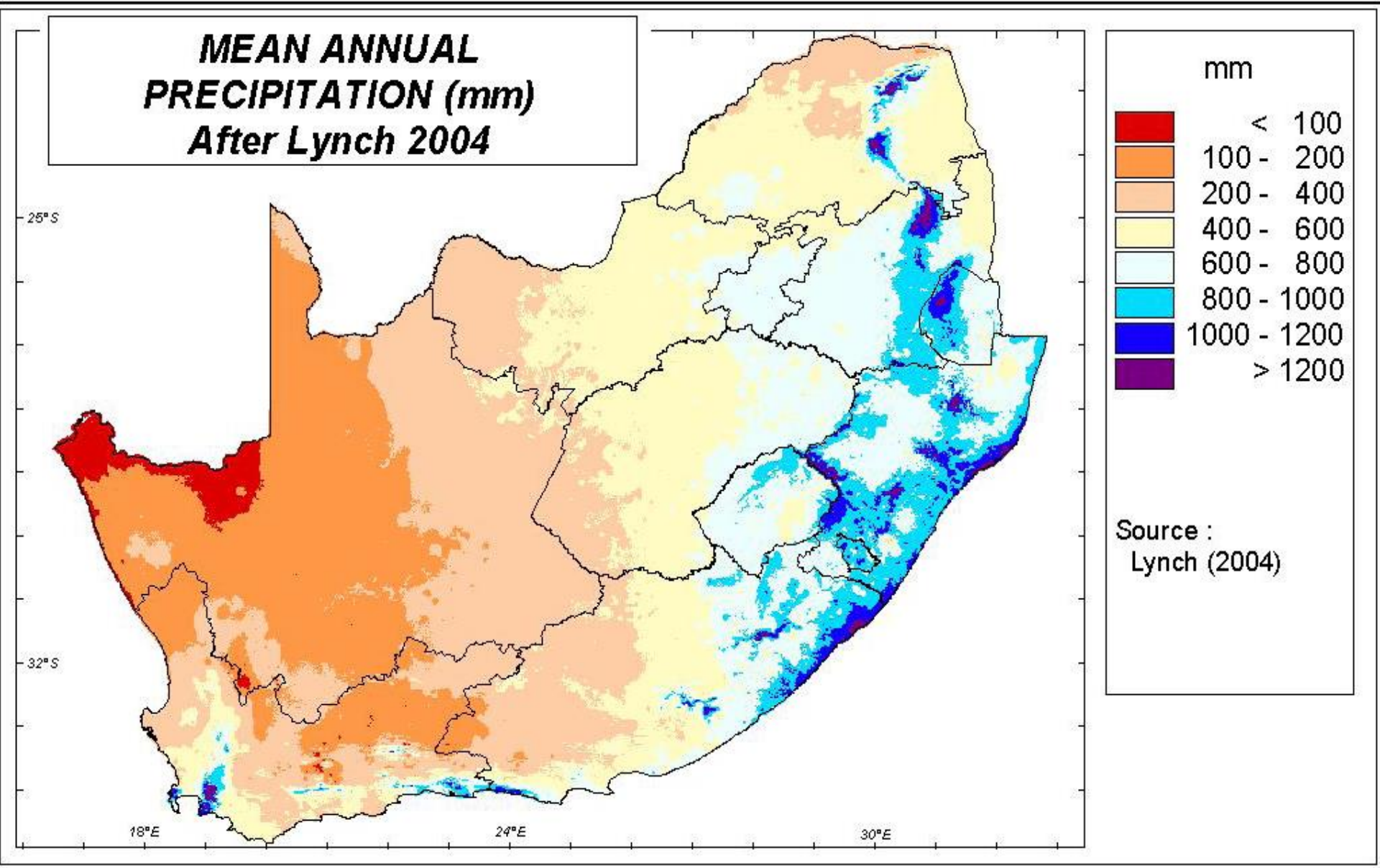
IPI – Ministry of Agriculture – Hawassa University – Ethiopian Agricultural Transformation Agency (ATA) joint symposium - The Role of Potassium in Balanced Fertilization.
24-26 November 2015 , Hawassa University, Hawassa, Ethiopia



Schulze, R.E. and Lynch, S.D. 2007. Annual Precipitation. *In:* Schulze, R.E. (Ed). 2007. **South African Atlas of Climatology and Agrohydrology**. Water Research Commission, Pretoria, RSA, WRC Report 1489/1/06, Section 6.2.

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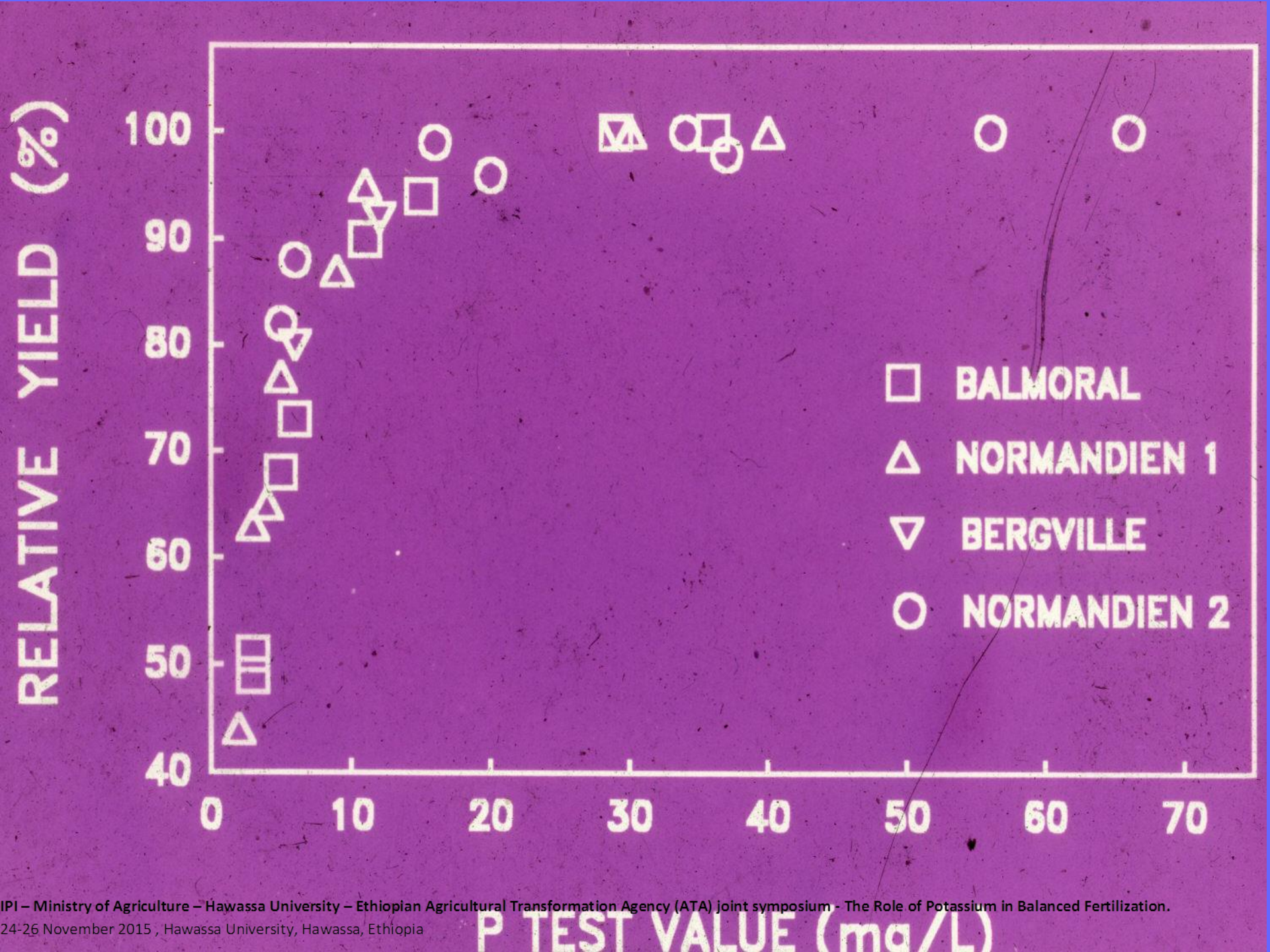

RELATIVE YIELD (%)
100
90
80
70
60
50
40
0
10
20
30
40
50
60
70
P TEST VALUE (mg/L)
BALMORAL
NORMANDIEN 1
BERGVILLE
NORMANDIEN 2

OVERALL OBJECTIVES

- to show that on sandy soils K movement may negate topsoil calibration research efforts,
- that subsoil reserves of both exchangeable and non-exchangeable K need IF POSSIBLE to be accounted for,
- that in KZN we have only been successful on highly weathered soils and,
- that genotypic differences in disease susceptibility deserve consideration

LONG-TERM RESULTS FROM THREE KEY SOILS WILL BE USED TO JUSTIFY THE OBJECTIVES:

AVALON SANDY LOAM – 32 YEARS

BERGVILLE CLAY LOAM – 25 YEARS

BAINSVLEI CLAY – 12 YEARS

Avalon sandy loam -- soft xanthic Lixisol (Plinthic)

Depth	Clay	Silt	Sand	Exchangeable cations				HNO_3	pH
				Ca	Mg	K	Al+H	Ext.K	
cm		%		$cmol_c L^{-1}$					(KCl)
0-15	14	4	82	0.56	0.22	0.16	0.20	0.20	3.9
15-30	15	4	81	0.63	0.26	0.15	0.20	0.21	3.9
30-45	24	6	70	0.69	0.81	0.14	0.30	0.28	3.9
45-60	34	6	60	0.69	1.87	0.12	0.50	0.41	4.0
60-75	42	8	50	0.94	4.19	0.36	0.10	0.60	4.5
75-90	46	8	46	1.40	4.56	0.58	-	0.74	4.9

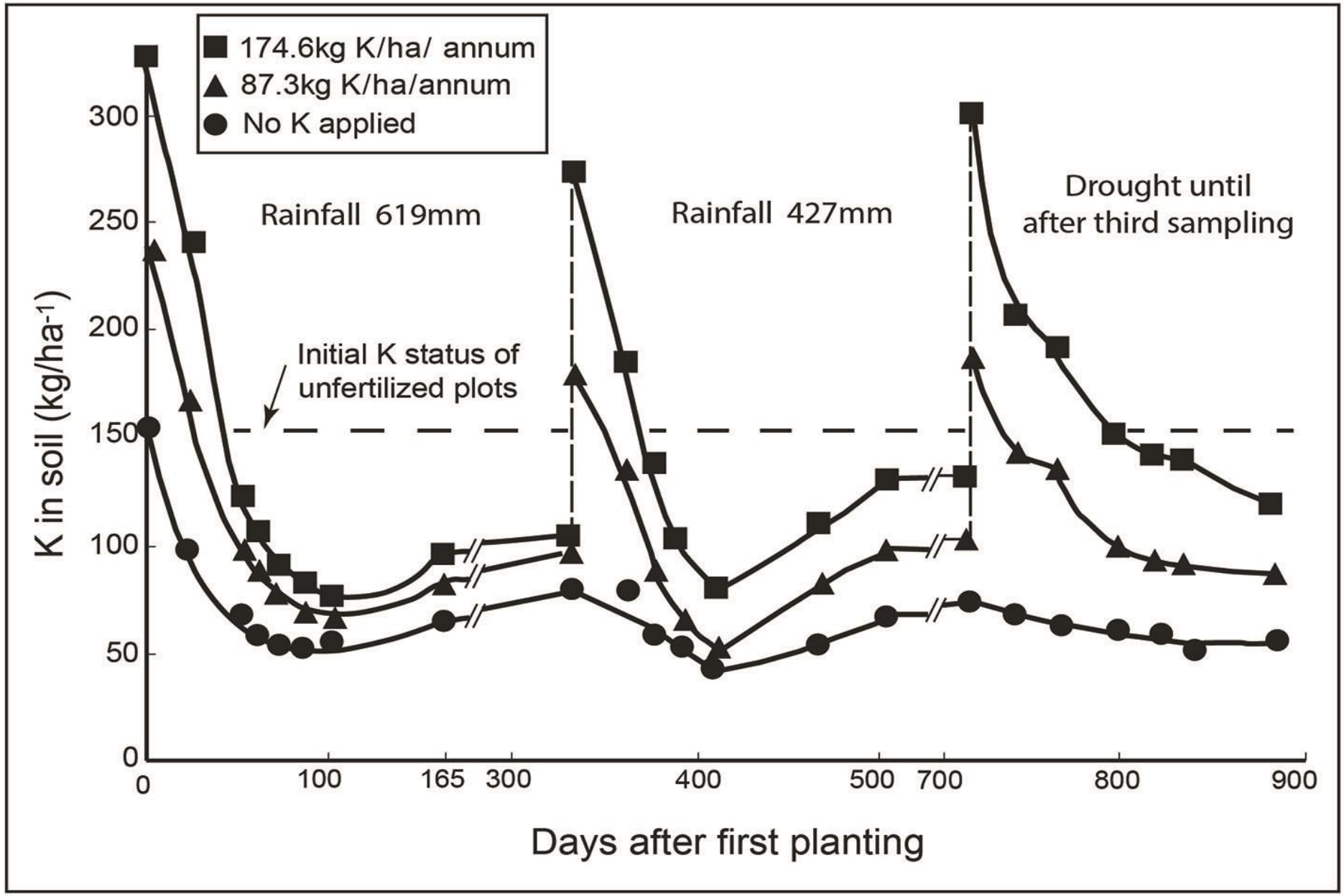


Fig. 1. Potassium status in the surface 15cm of an Avalon medium sandy loam during three seasons of cropping with maize.

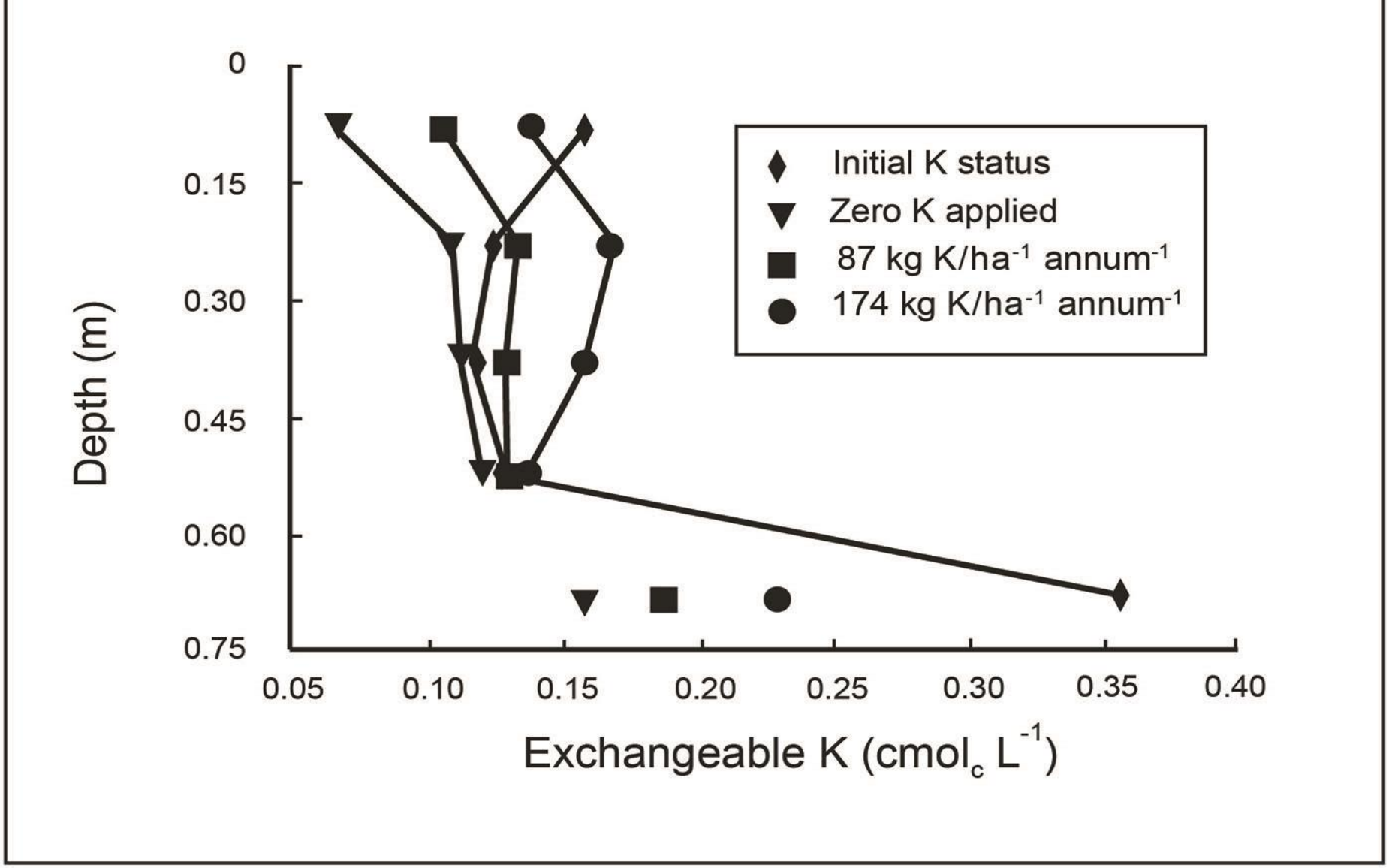


Fig. 2. Effect of differential K fertilization and two years of cropping with maize in four horizons of an Avalon medium sandy loam (values not connected indicate K levels at 60-75cm after 32 years).

Bergville clay loam -- soft xanthic Ferralsol (Plinthic)

Depth	Clay	Silt	Sand	Exchangeable cations				HNO_3	pH
				Ca	Mg	K	Al+H	Ext.K	
cm		%		$cmol_c L^{-1}$					(KCl)
0-15	32	9	59	3.37	1.84	1.30	0.10	2.97	4.4
15-30	33	9	53	2.60	1.54	1.22	0.10	2.99	4.4
30-45	35	8	57	1.56	1.13	0.97	0.30	2.70	4.2
45-60	38	8	54	1.22	1.13	0.50	0.63	2.81	4.1
60-75	41	9	50	1.41	1.75	0.55	0.52	-	4.2
75-90	42	10	48	1.39	2.03	0.32	0.35	-	4.3

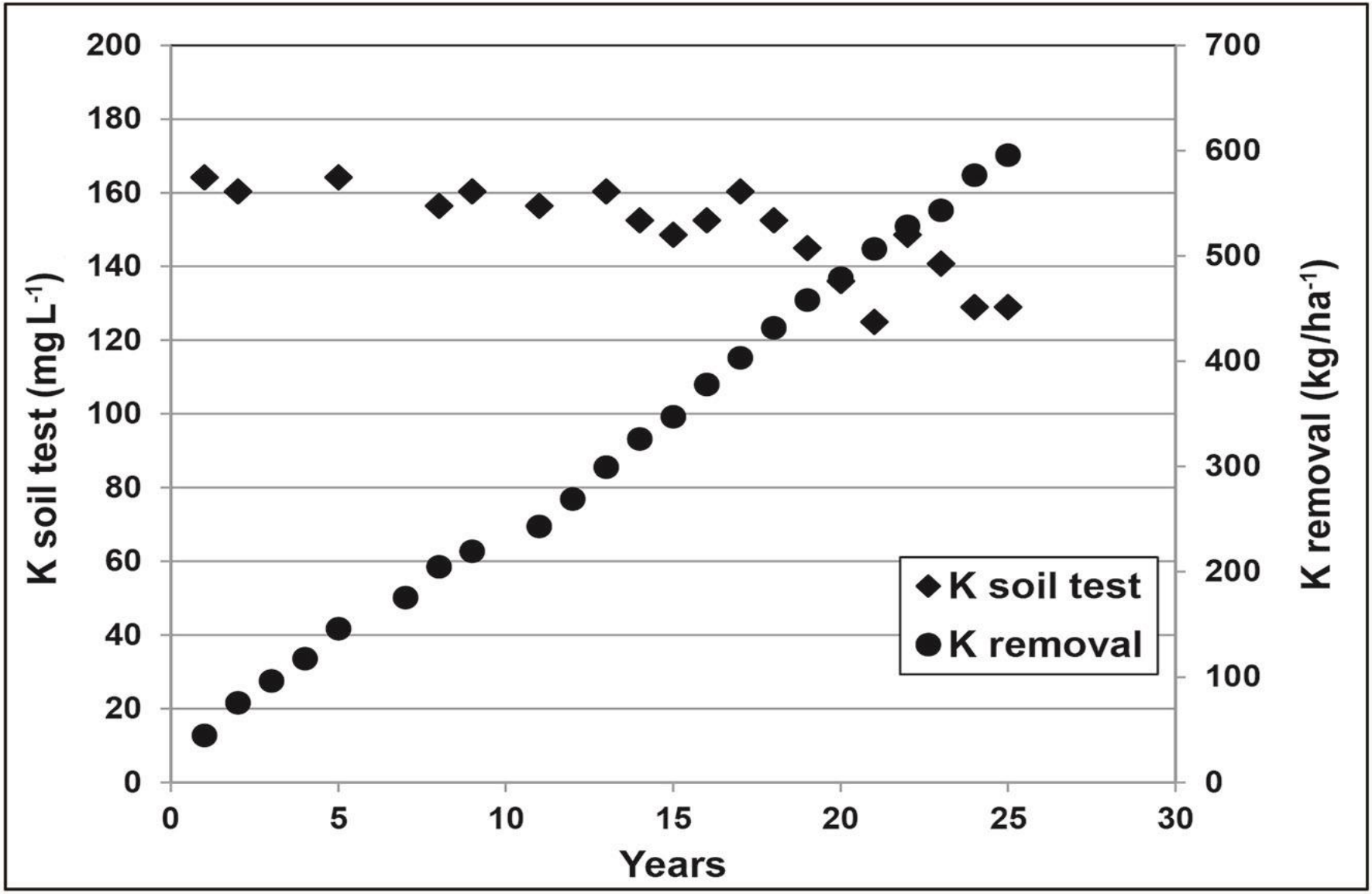


Fig. 3. Topsoil exchangeable K and K removals by maize grain; although both grain and stover were removed at each harvest, K concentrations in stover were not measured.

Bainsvlei clay -- soft rhodic Ferralsol (Plinthic)

Depth	Clay	Silt	Sand	Exchangeable cations				HNO_3	pH
				Ca	Mg	K	Al+H	Ext.K	
cm		%		$cmol_c L^{-1}$					(KCl)
0-15	53	15	32	6.31	1.23	0.11	-	0.08	4.5
15-30	53	14	33	6.60	1.11	0.06	-	0.07	4.6
30-45	53	14	33	4.56	0.73	0.05	-	0.07	4.8
45-60	49	13	38	3.54	0.48	0.04	-	0.06	4.8
60-75	51	14	35	2.01	0.62	0.04	0.13	0.06	4.5
75-90	51	17	32	0.92	0.95	0.04	1.03	0.07	4.1

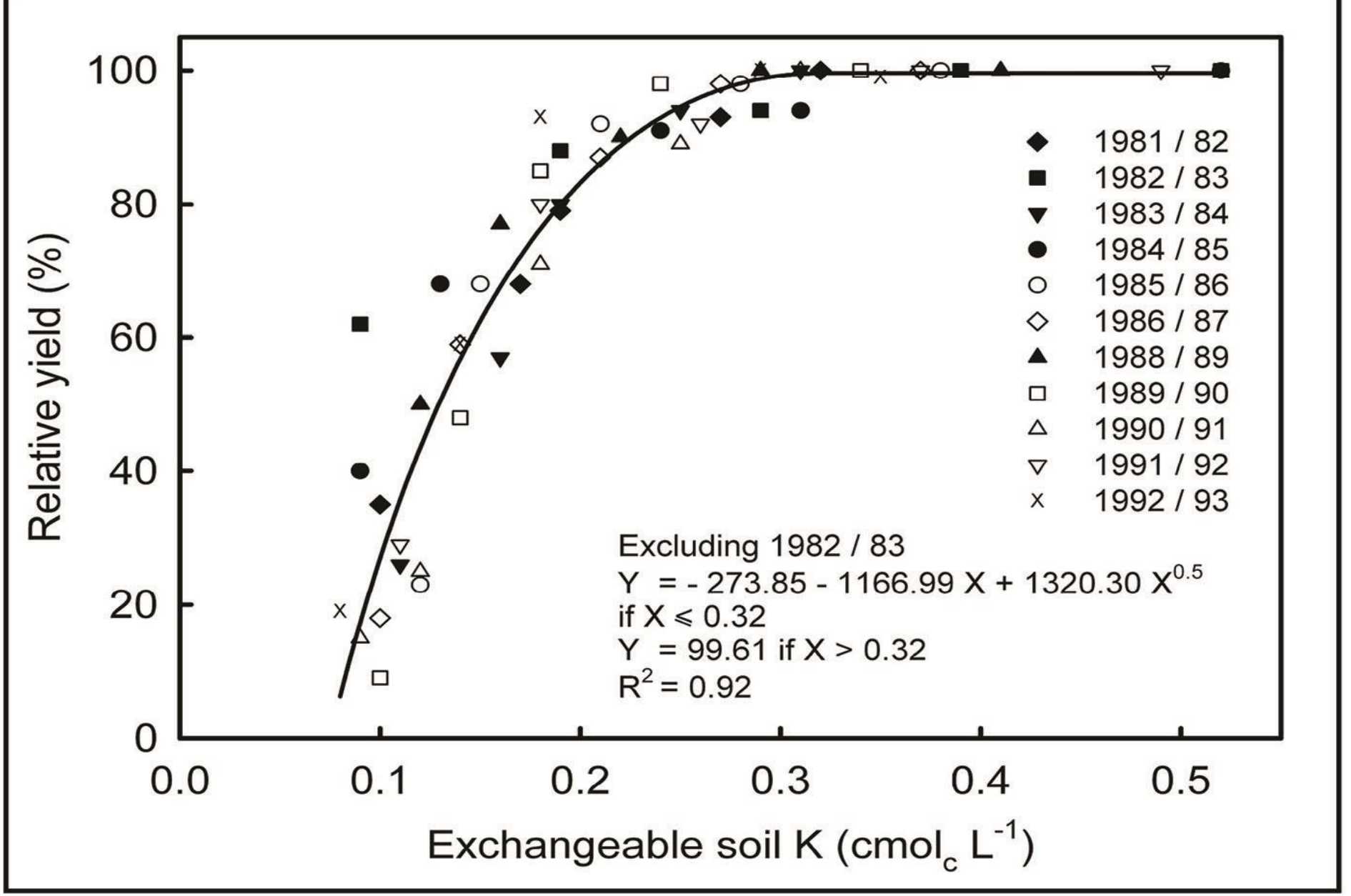


Fig. 4. Relationship between exchangeable soil K and relative maize yield on a Bainsvlei clay soil.

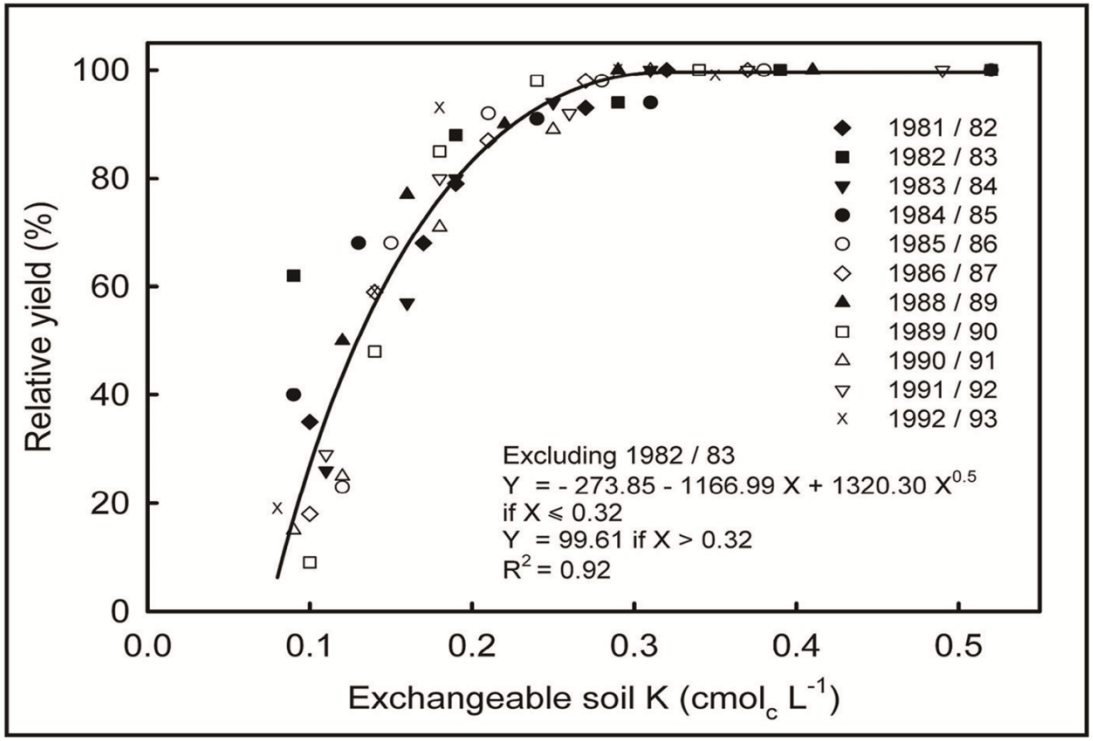


Fig. 4. Relationship between exchangeable soil K and relative maize yield on a Bainsvlei clay soil.

- K rates adjusted periodically
- In 1982/83 stover yields only
- In 1983/84 no K applied

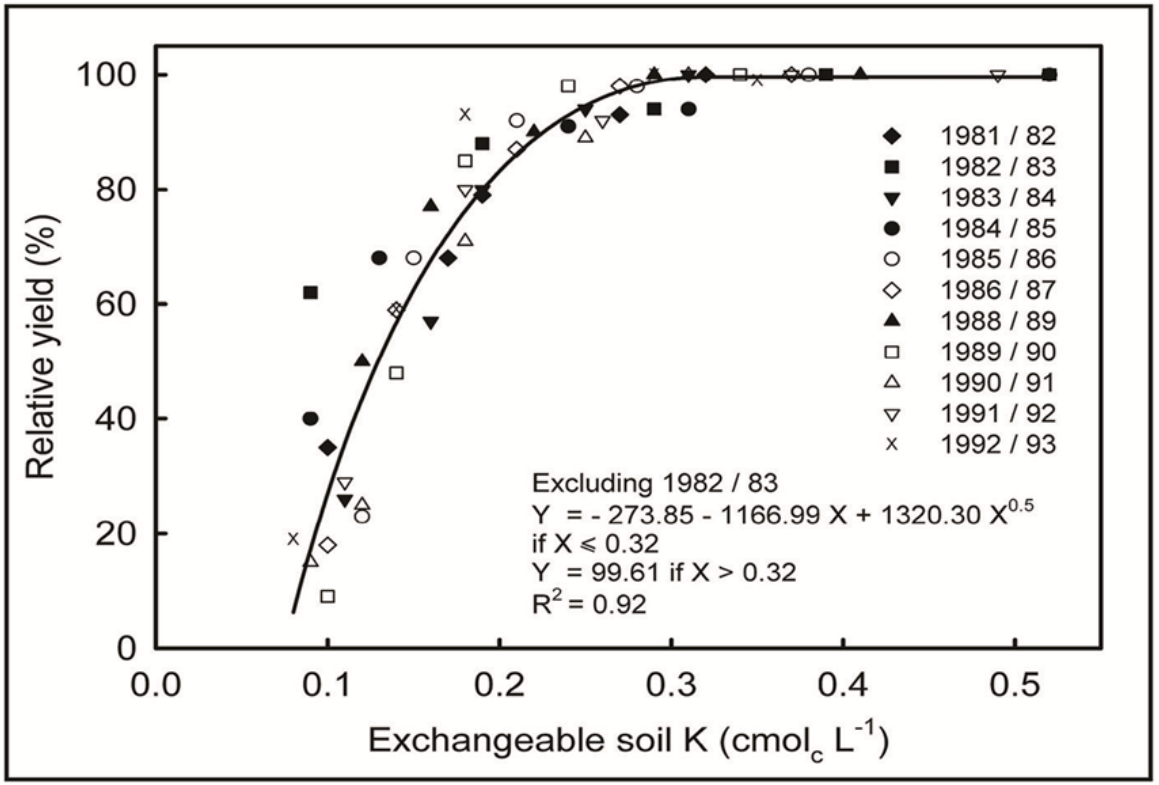
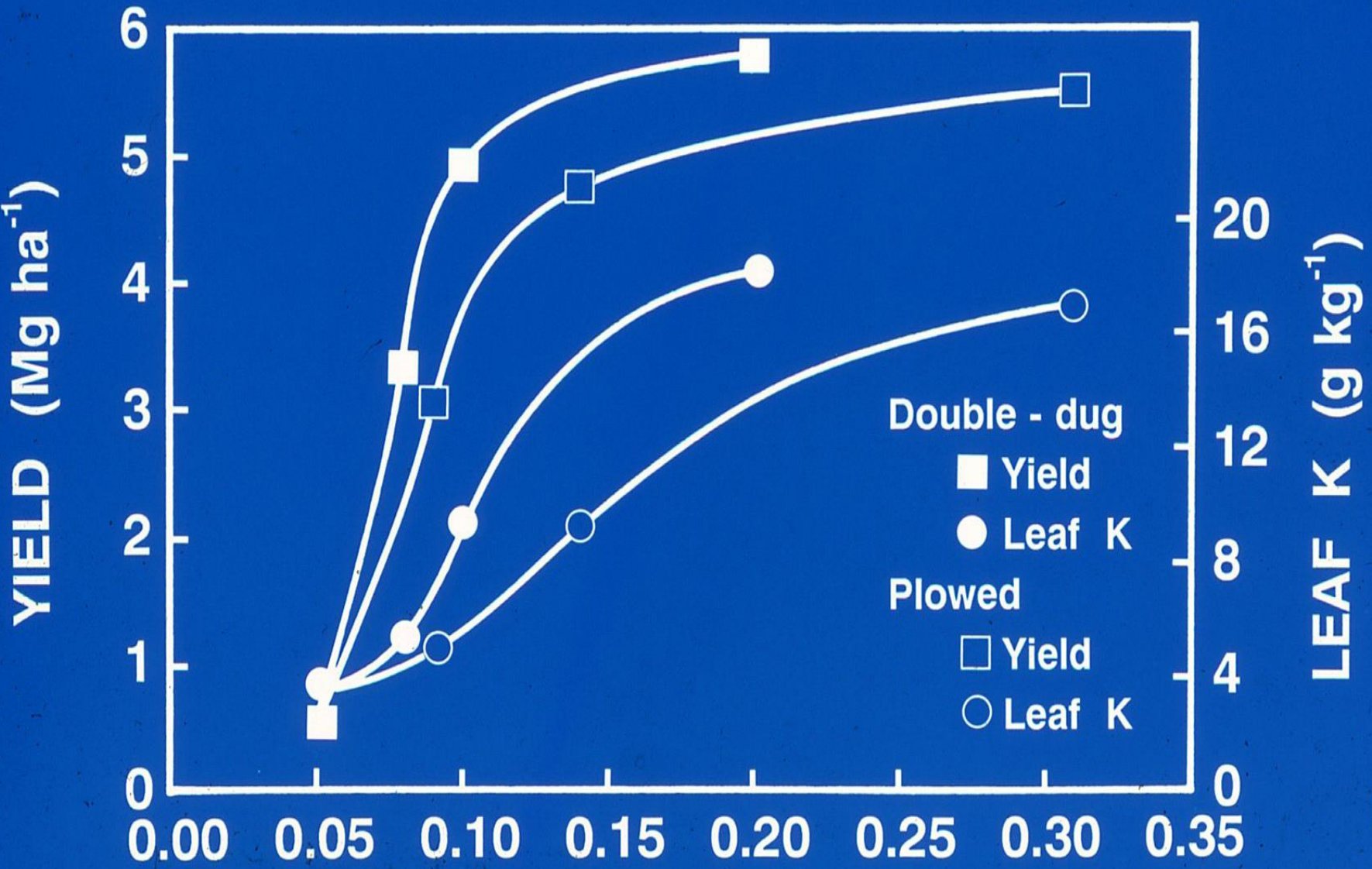


Fig. 4. Relationship between exchangeable soil K and relative maize yield on a Bainsvlei clay soil.

- Grain yield maxima from 5850 kg ha^{-1} in 1984/85 to 10 800 in 1988/89
- In 1987/88 trial neither fertilized nor planted
- In 1989 8t ha^{-1} of dolomitic lime applied to trial site. 40% decrease in ratio of K to Ca+Mg

BUT !


YIELD (Mg ha-1)
LEAF K (g kg-1)
EXCHANGEABLE K (cmol L-1)
0
1
2
3
4
5
6
0
4
8
12
16
20
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Double - dug
Yield
Leaf K
Plowed
Yield
Leaf K

WHAT OF CULTIVAR CHOICE?


PNR473
IGH K
OW K

CONCLUSIONS

- K leaching may negate value of topsoil analyses on soils with less than 14% clay,
- Where there is clay build-up with depth exchangeable K reserves play a critical role,
- In some soils non-exchangeable K may need to be considered,

- Long-term calibration trials more precise if confounding due to other nutritional inputs is reduced,

- The Mitscherlich-Bray percentage sufficiency concept deserves more credence and,

- K ameliorative effects on disease severity and grain quality cannot be ignored.

THANK YOU FOR YOUR PATIENCE