

# SUBSOIL ACIDITY AND ITS MANAGEMENT

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# INTRODUCTION

- Discussion is limited to subsoil acidity, but the dominant cause of acidity damage is the same for both surface and subsoil acidity.
- Stunted root development and poor water use efficiency.
- Differences that exist are in their amelioration.







# Geluksburg soil acidity study area

Depth (cm)	Clay (%)	Org C (%)	Acid (%)
0 – 15	41.2	1.5	59
15 – 30	41.2	1.2	65
30 – 45	46.1	0.8	77
45 – 60	48.7	0.5	77
60 – 75	46.8	0.4	79
75 – 90	46.4	0.3	75

1979 - 1998

An aerial photograph of a farm with a grid of fields and a road. The fields are arranged in a regular pattern, with a road running horizontally across the middle. The fields are mostly brown and tan, suggesting they are fallow or have been recently plowed. There are some green areas, possibly grass or crops. The overall scene is a typical agricultural landscape.



# MEAN ANNUAL PRECIPITATION (mm) After Lynch 2004

25°S

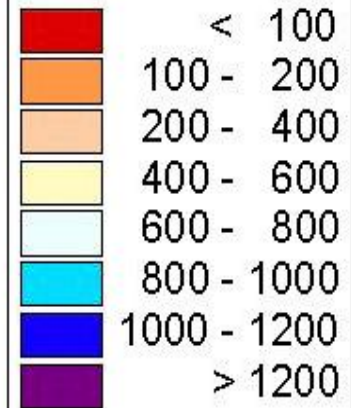
32°S

18°E

24°E

30°E

mm

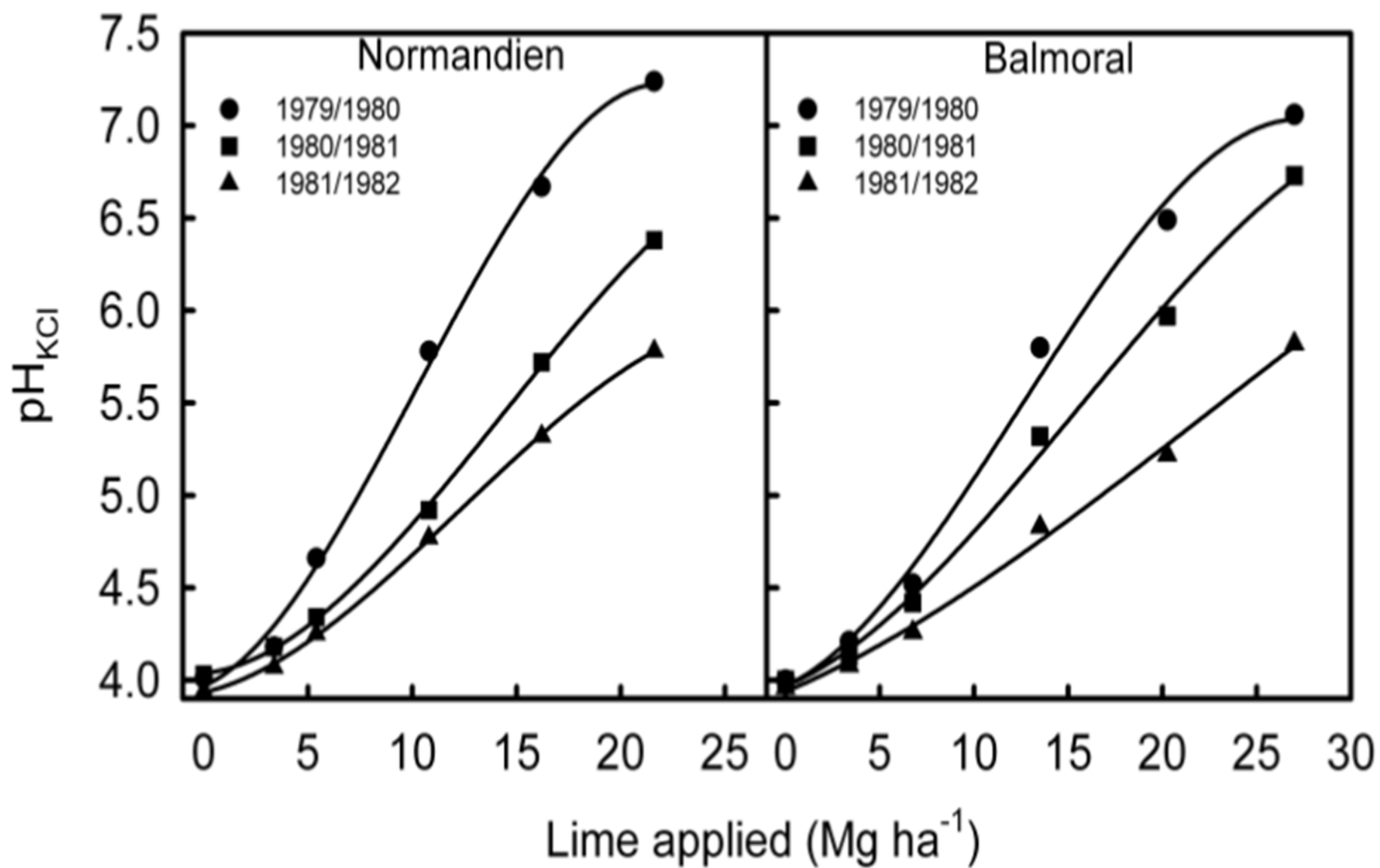


Source :  
Lynch (2004)

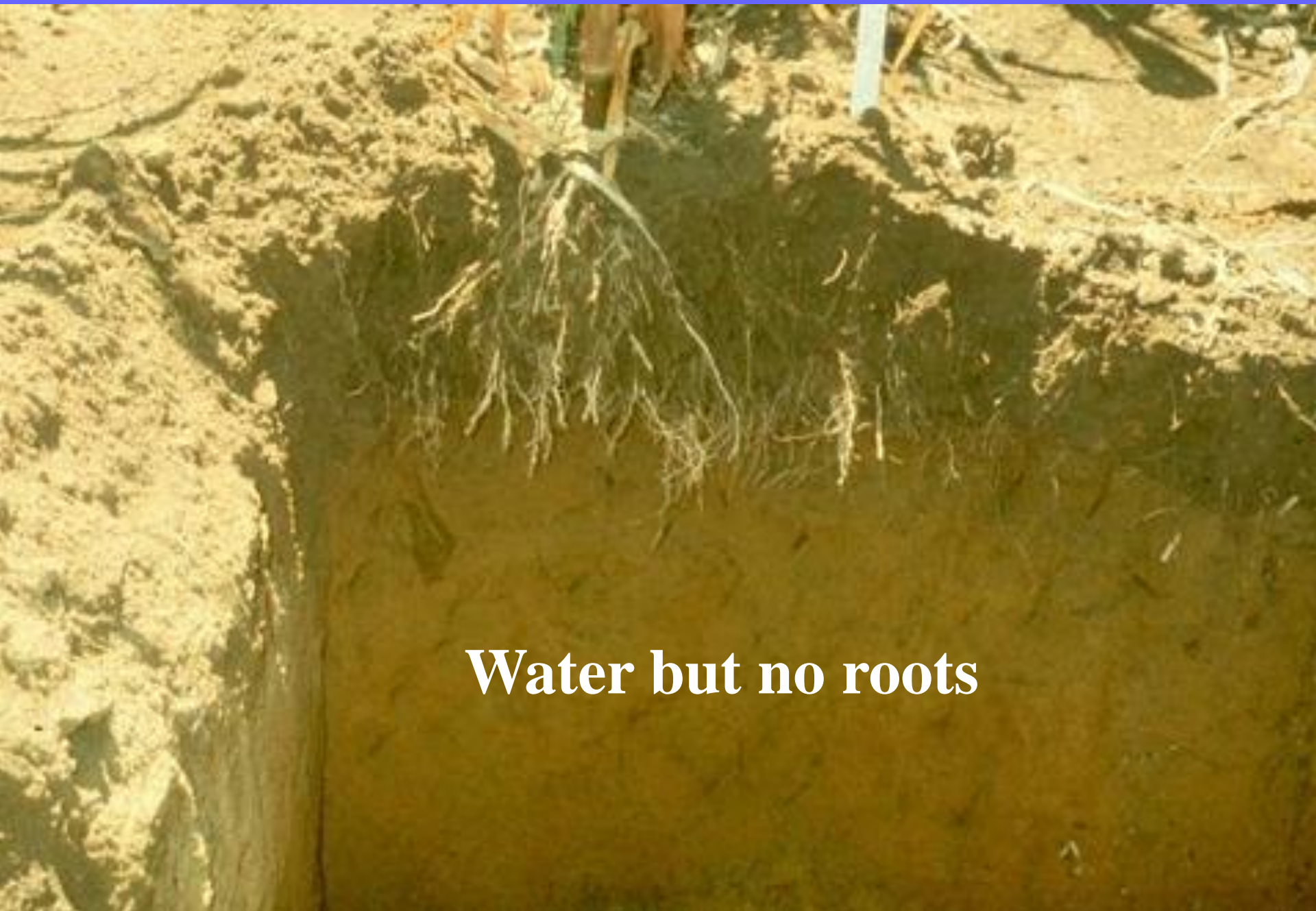
# OPTIONS EXAMINED

- Heavy topsoil liming in order to facilitate downward movement of alkalinity.
- Deep placement of lime.
- Use of gypsum and lime.
- Avoidance.

**LIMING TO pH LEVELS > 6**

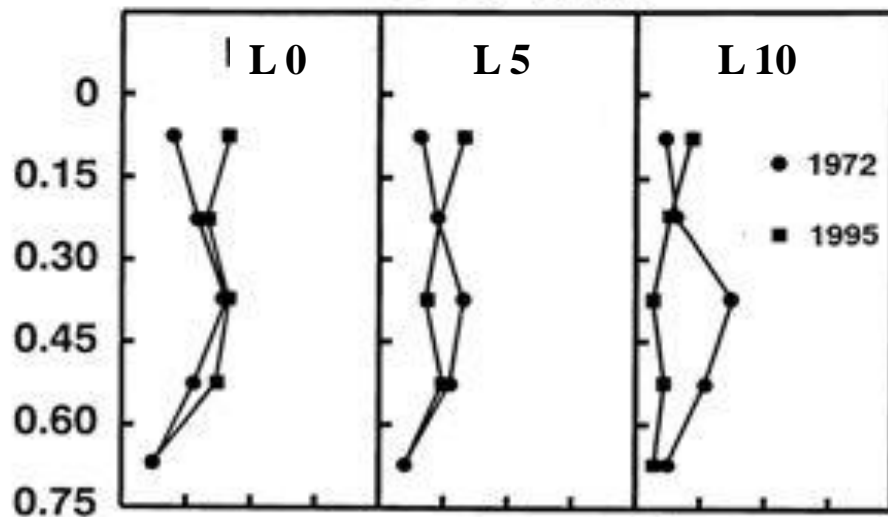


**16t/ha calcium hydroxide four years previously**

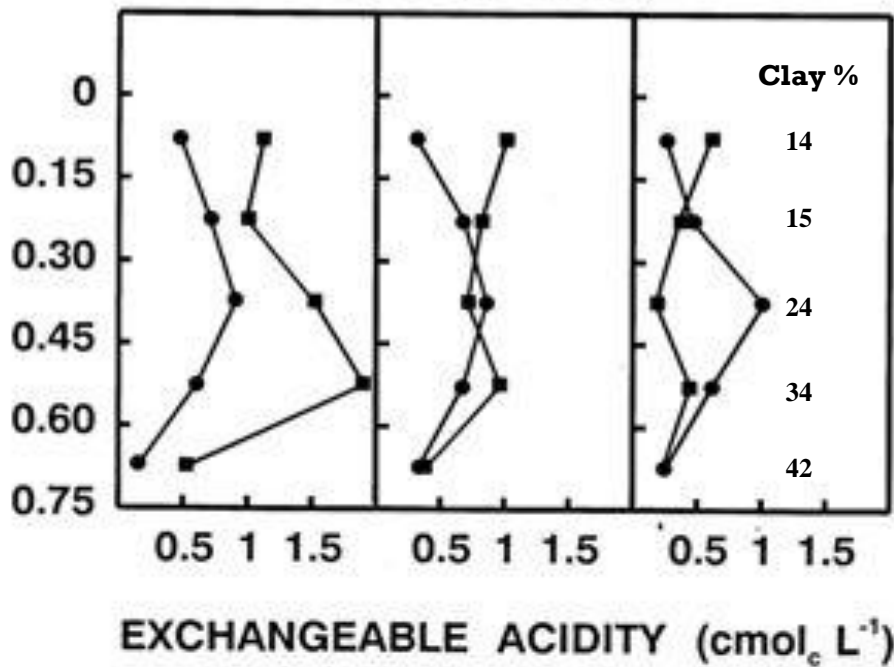


**Water but no roots**

100 kg N ha<sup>-1</sup>



200 kg N ha<sup>-1</sup>



Cost effective  
to pH over 6

# DEEP PLACEMENT OF LIME



## Deep limer

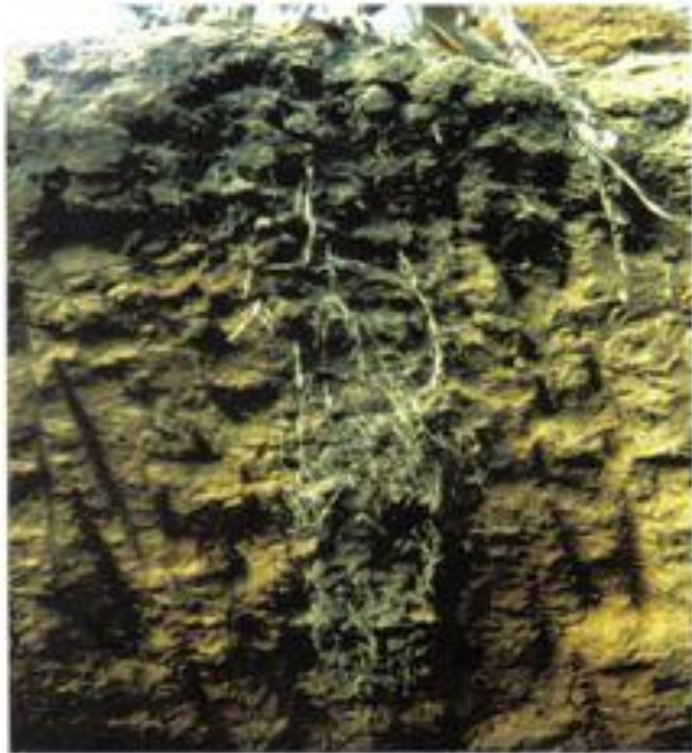
28 t/ha lime below  
plough depth

15 t/ha lime ploughed in

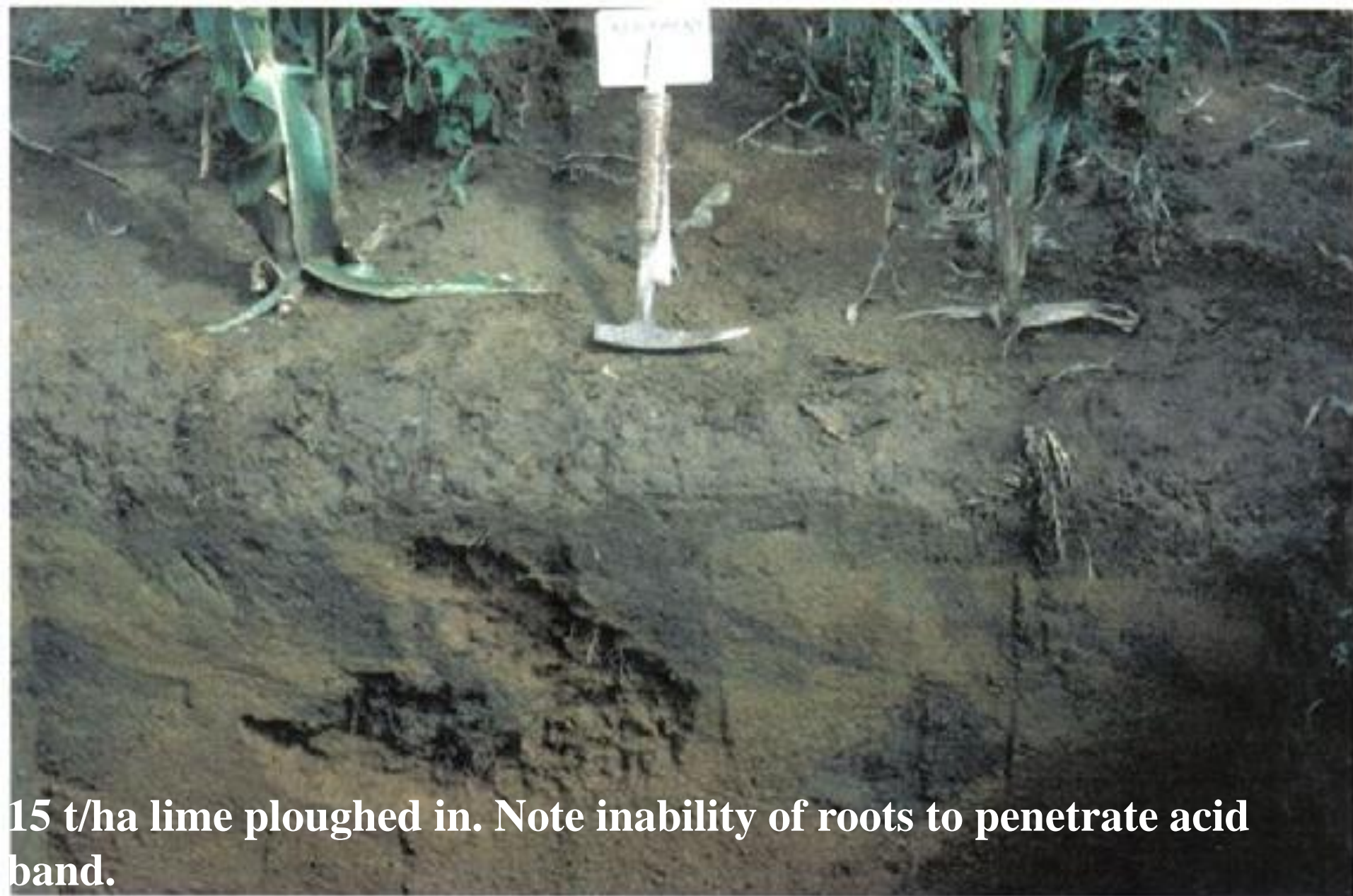




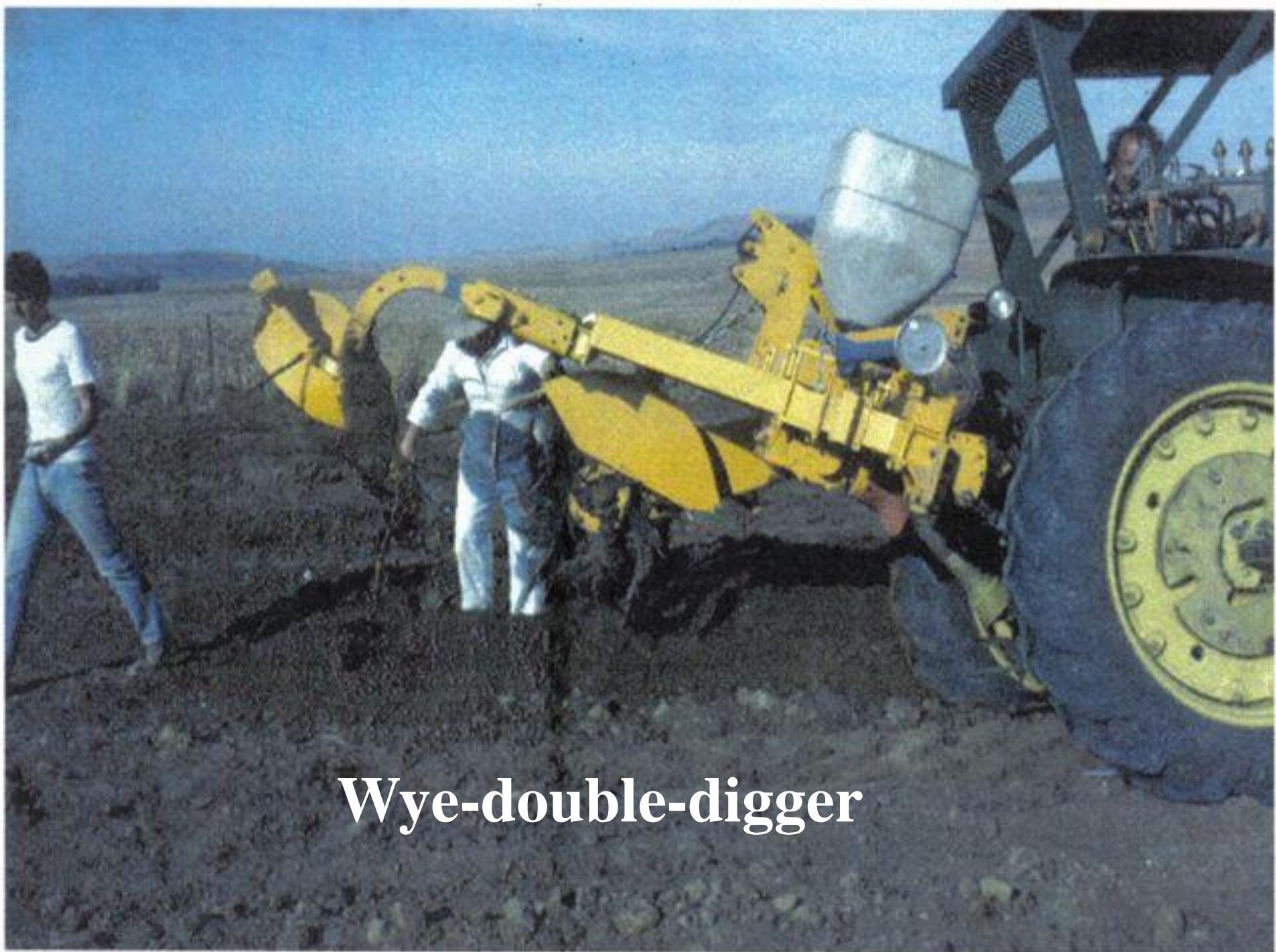
**Alubuster**



**Better access to  
subsoil moisture**



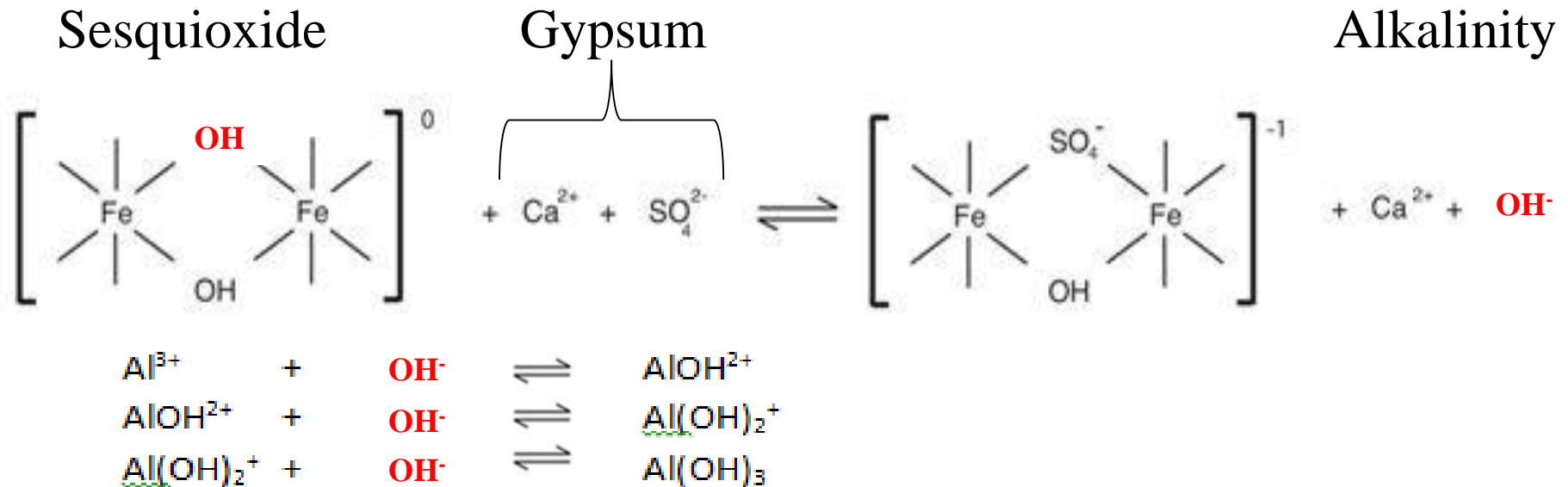
**15 t/ha lime ploughed in. Note inability of roots to penetrate acid band.**



**Wye-double-digger**

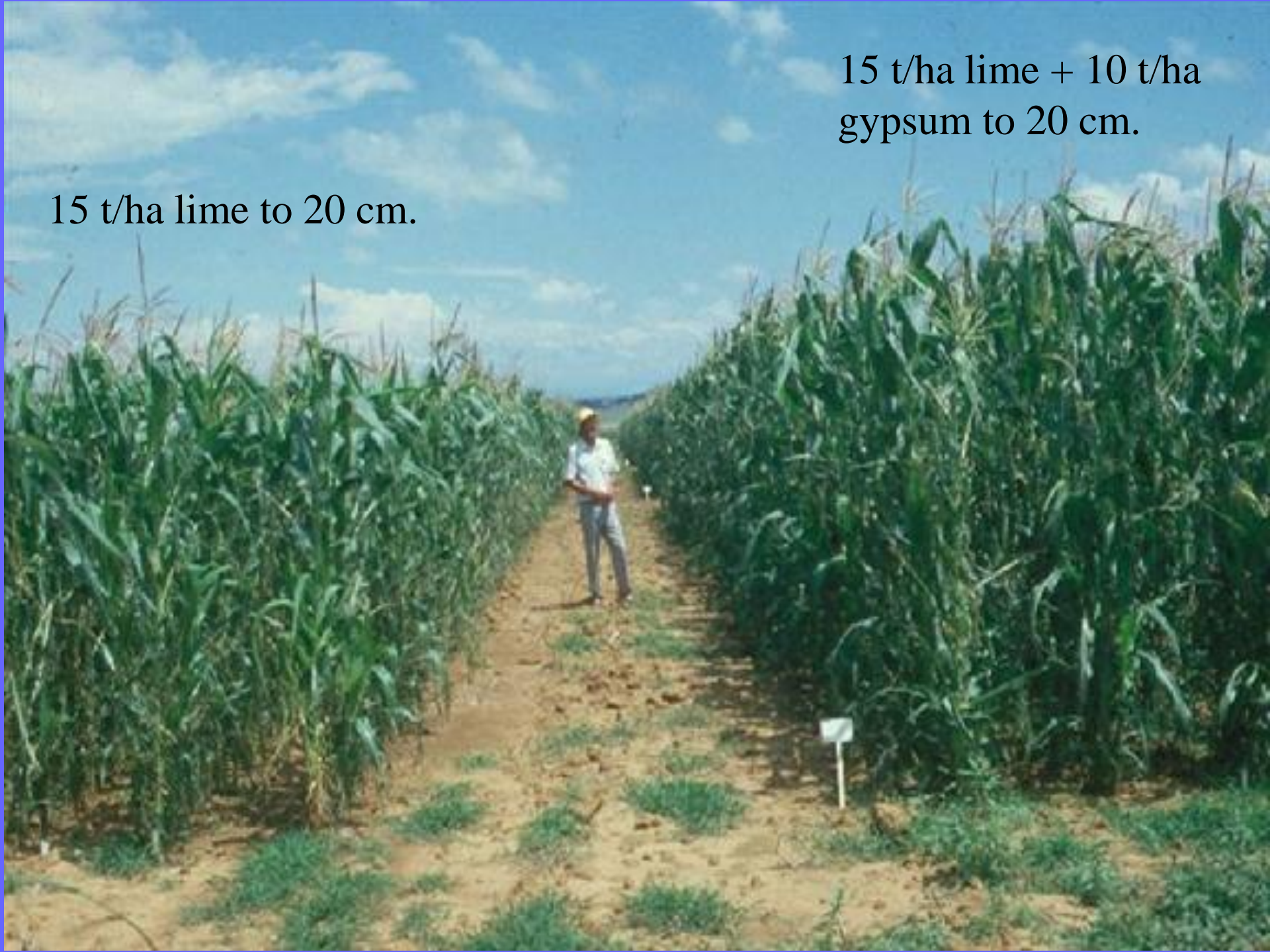
# USE OF GYPSUM AND LIME

# “Self-liming Effect” (Reeve and Sumner, 1972)

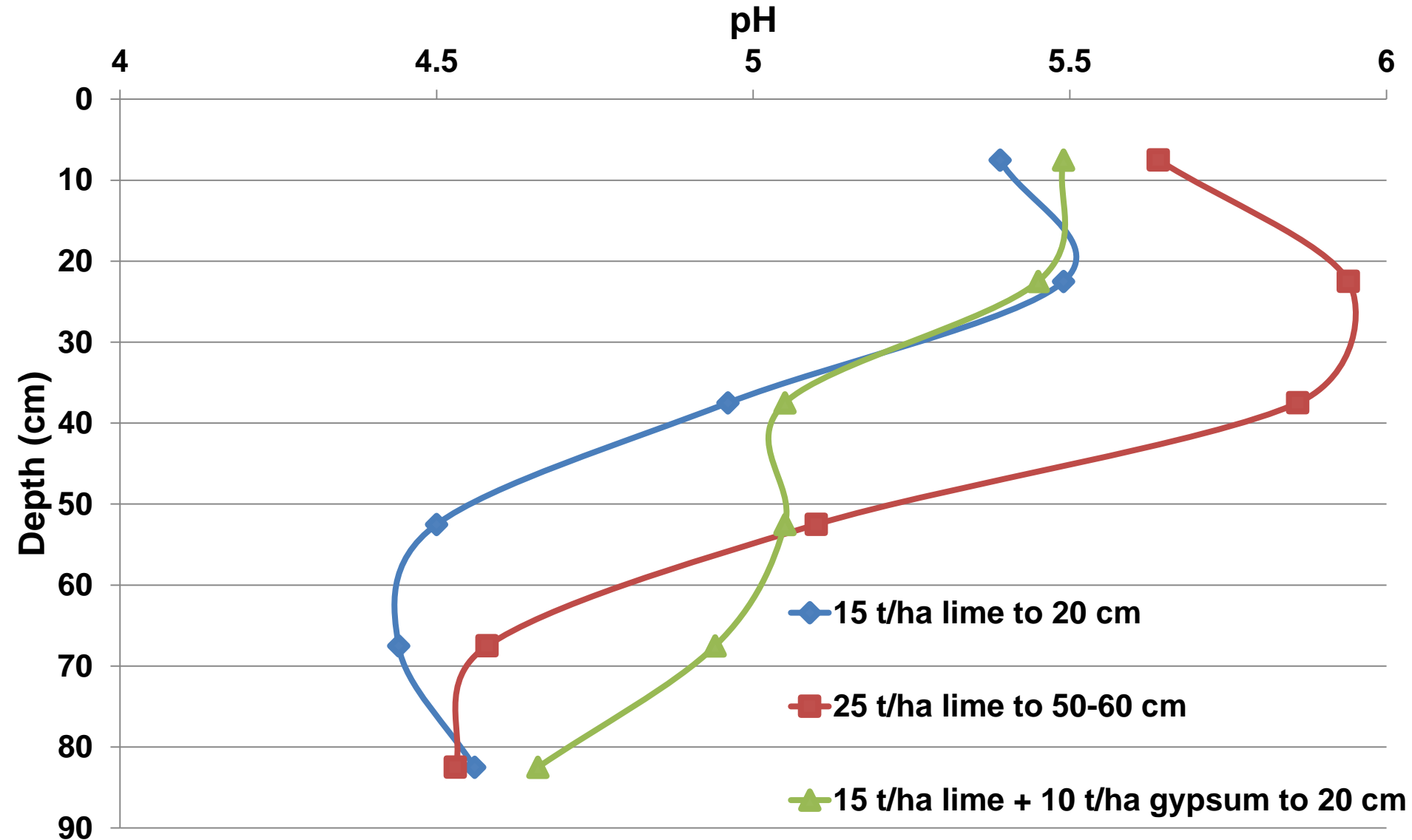


15 t/ha lime + 10 t/ha  
gypsum to 20 cm.

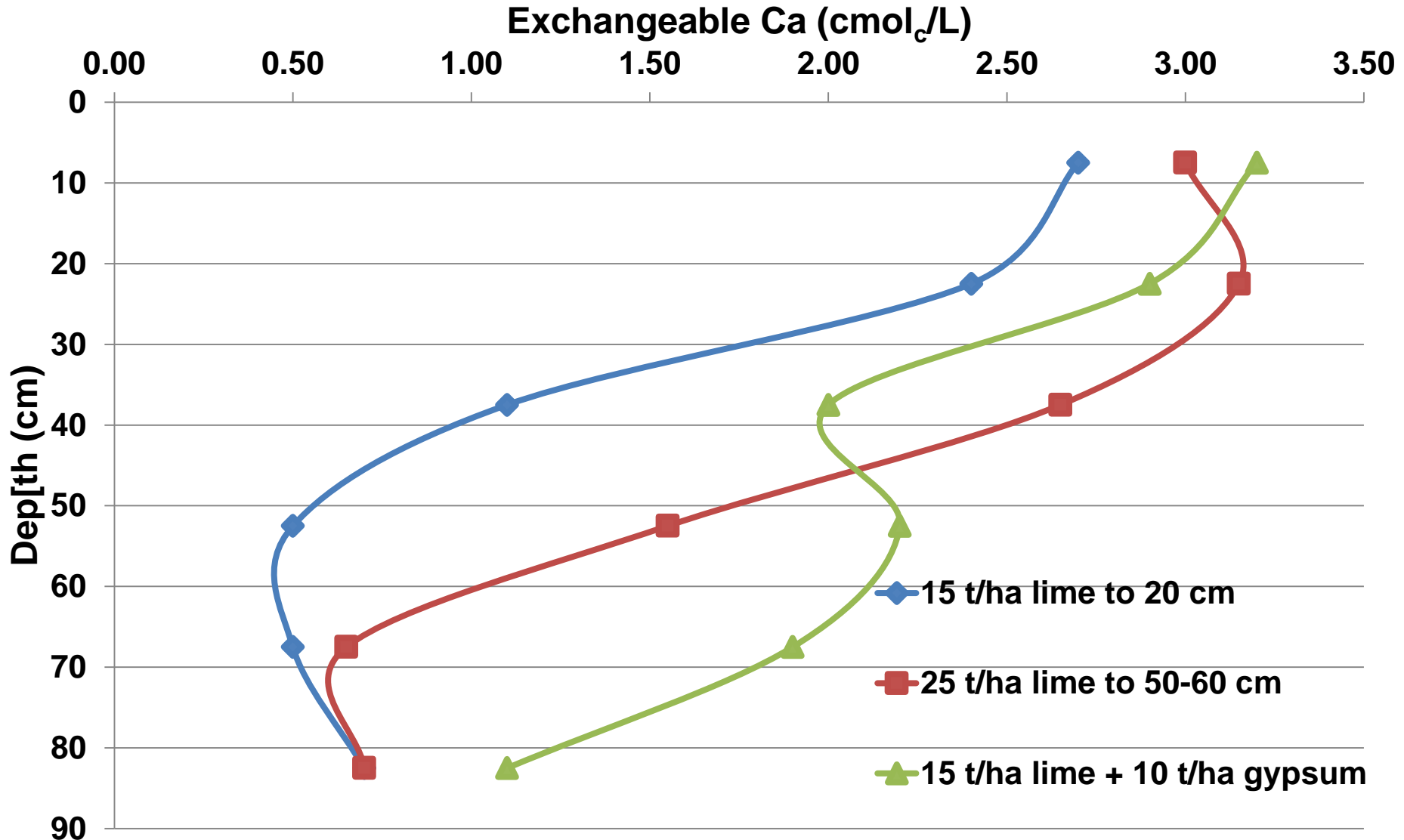
15 t/ha lime to 20 cm.



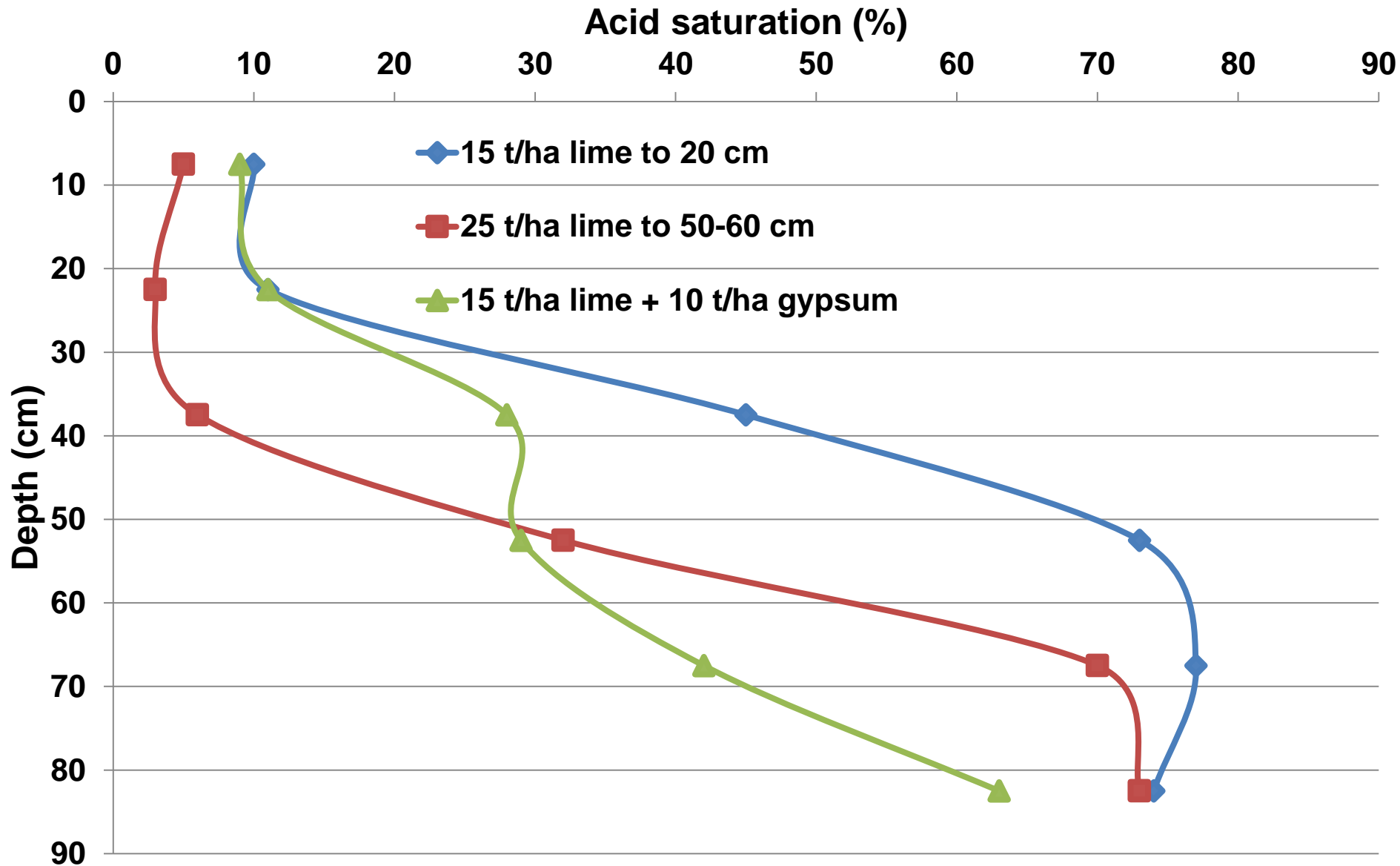
# Effect of Gypsum on Soil pH



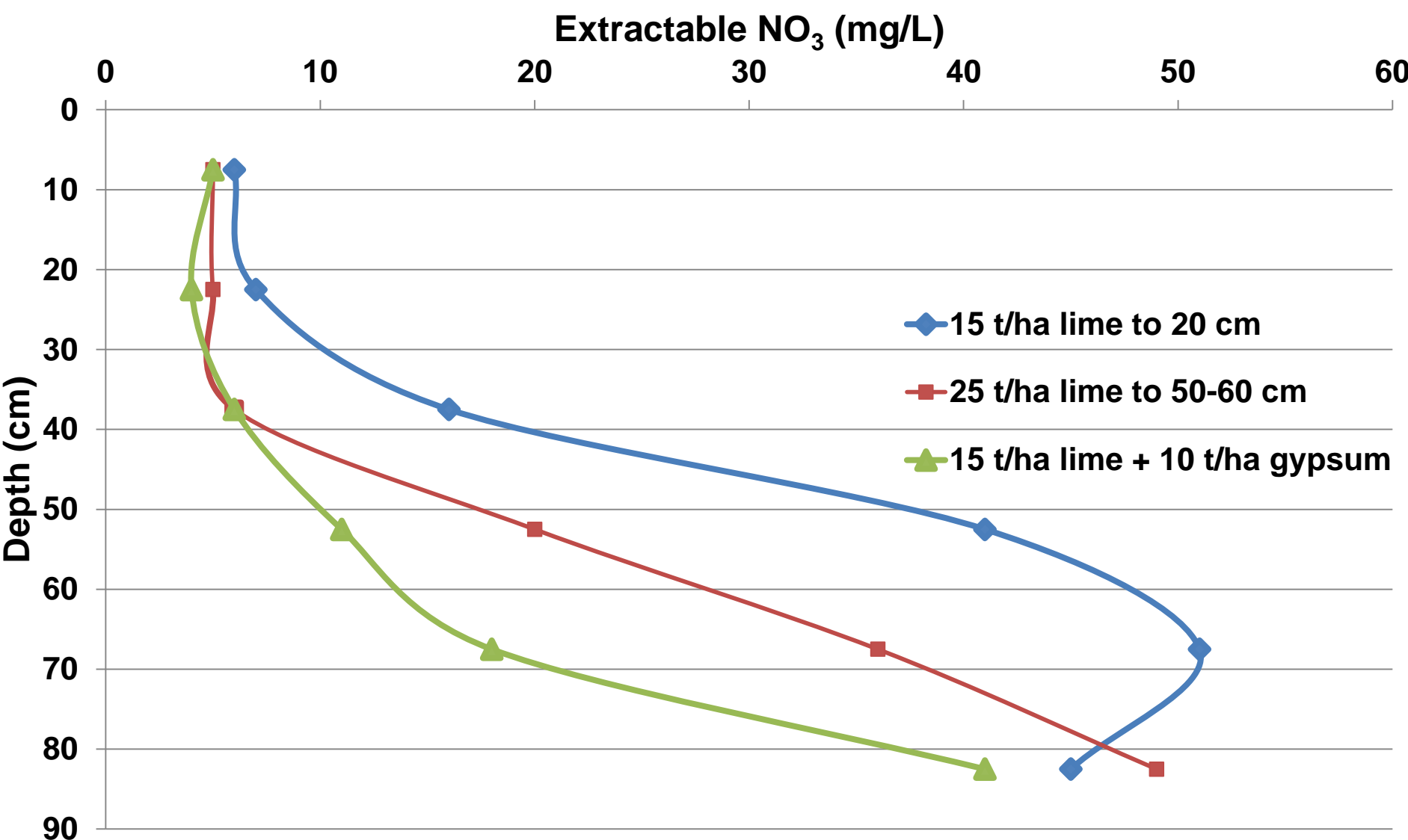
# Effect of Gypsum on Exchangeable Ca with Depth



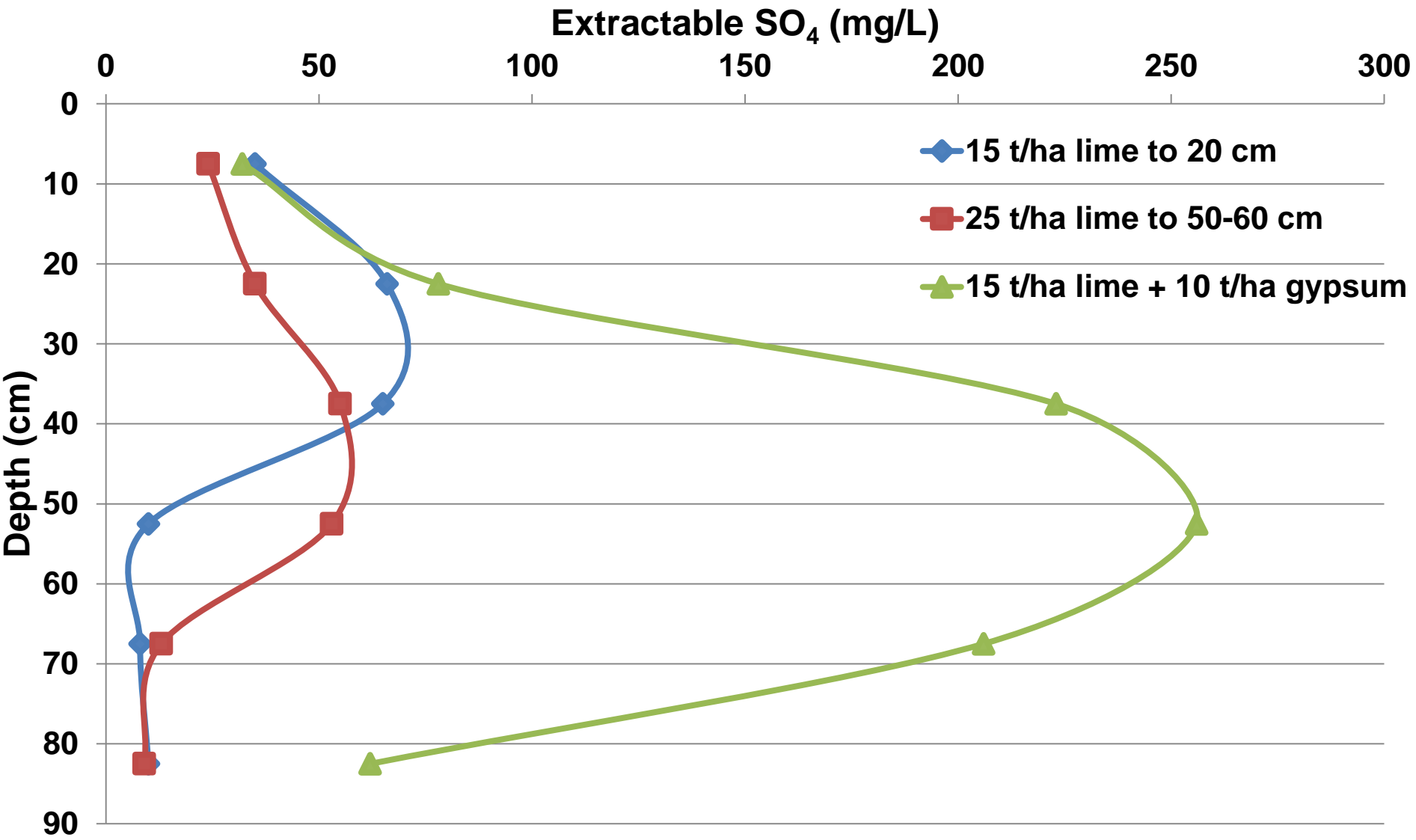
# Effect of Gypsum on Acid Saturation



# Effect of Gypsum on Extractable NO<sub>3</sub> with Depth



# Effect of Gypsum on Extractable SO<sub>4</sub> with Depth



# Gypsum effect on root development

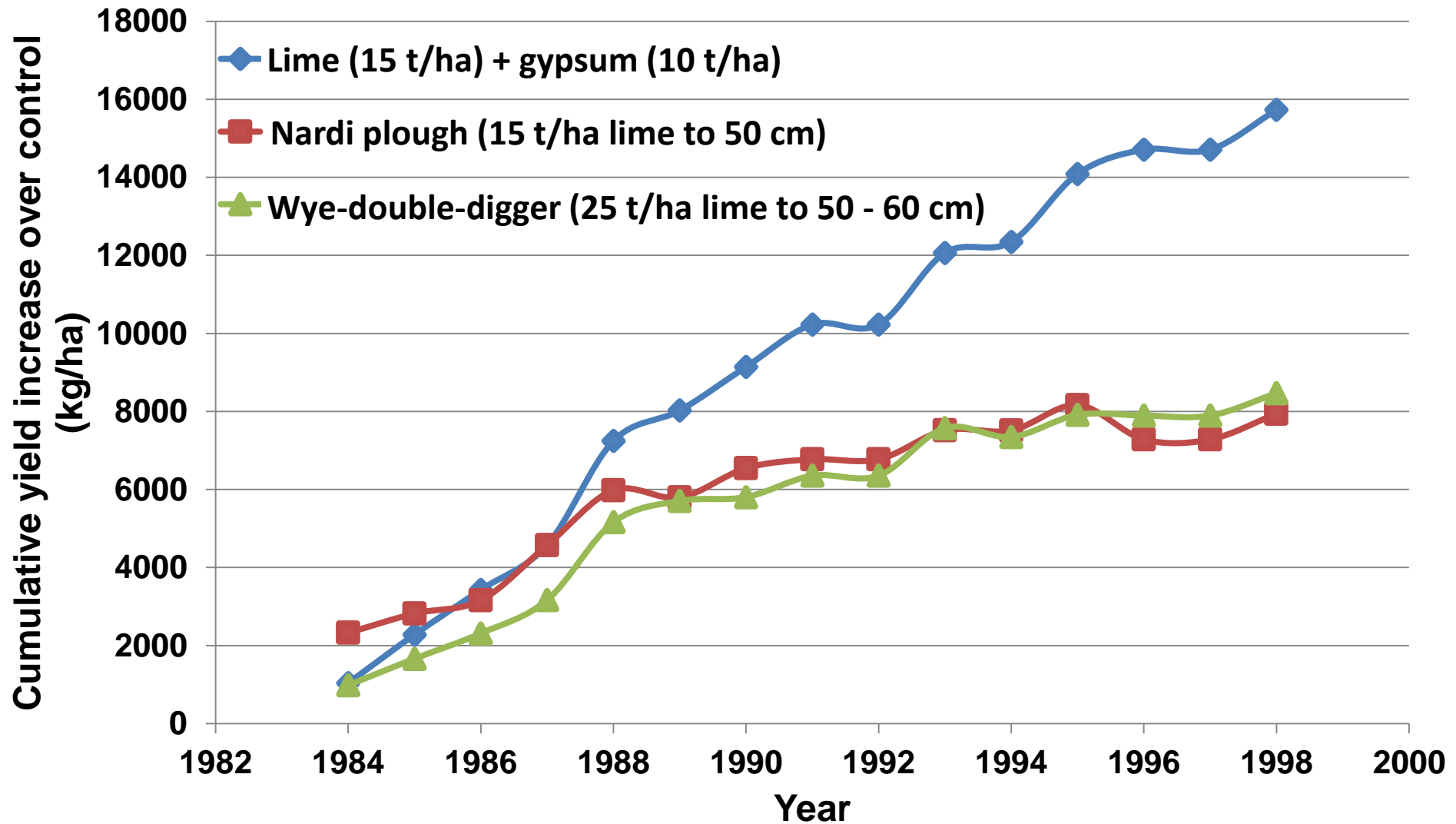


Lime + gypsum



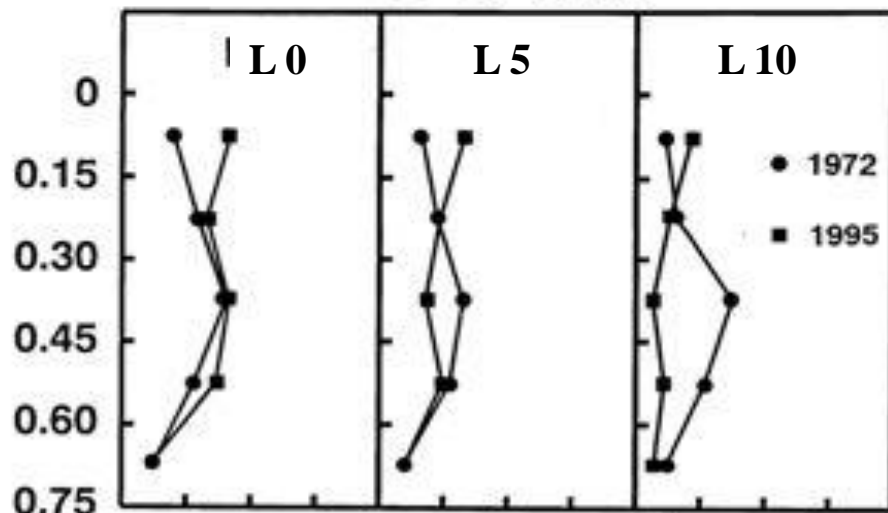
Lime only

# Longevity of Gypsum Effect

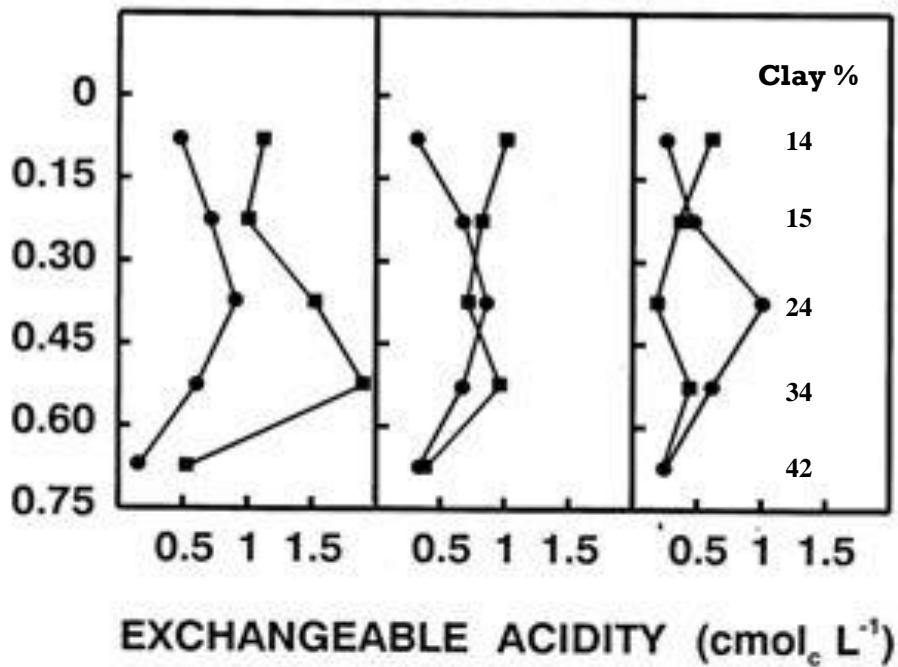


**AVOIDANCE**

100 kg N ha<sup>-1</sup>

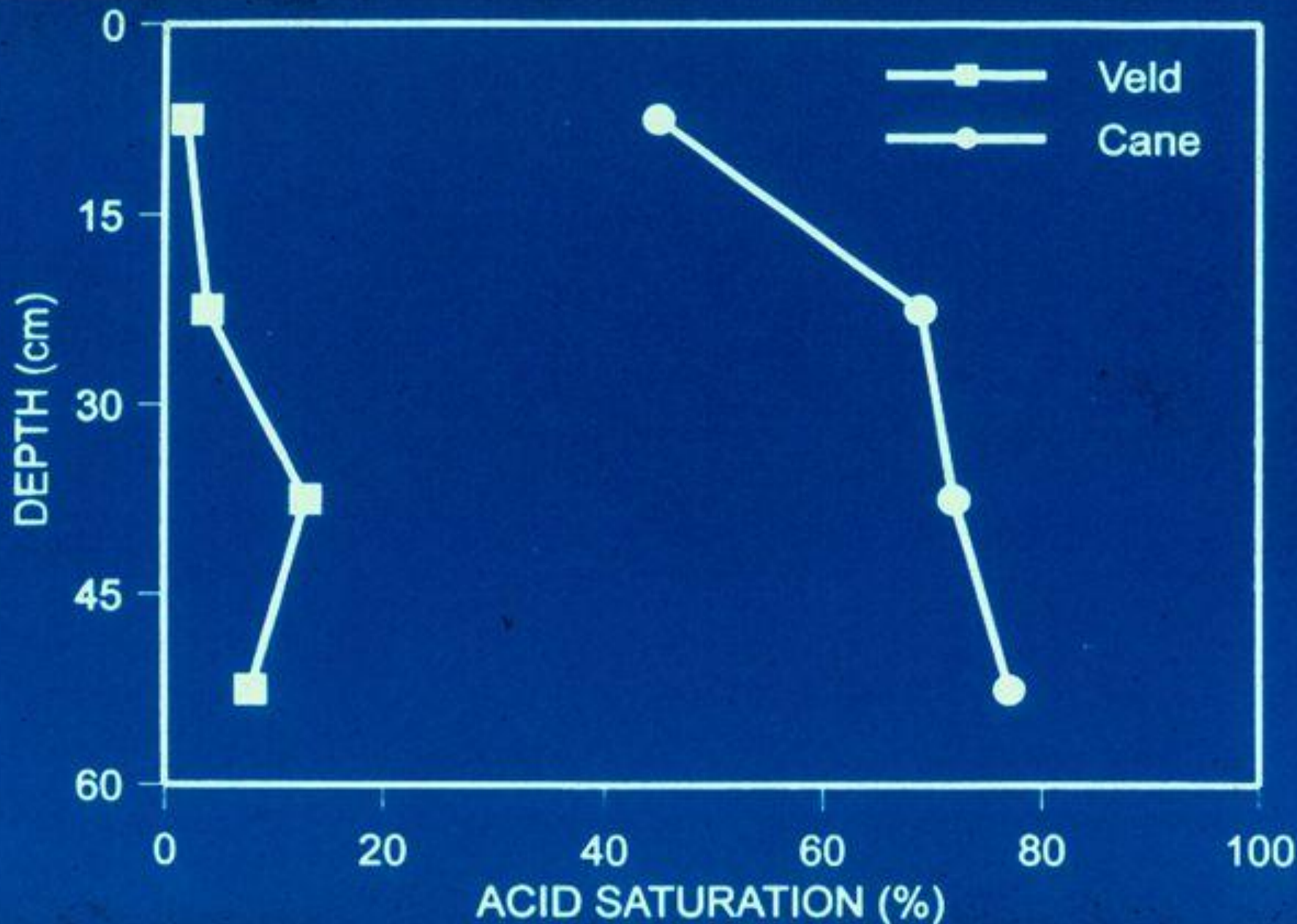


200 kg N ha<sup>-1</sup>



Effects of excess N on subsoil acidity

# Poor N management in sugarcane





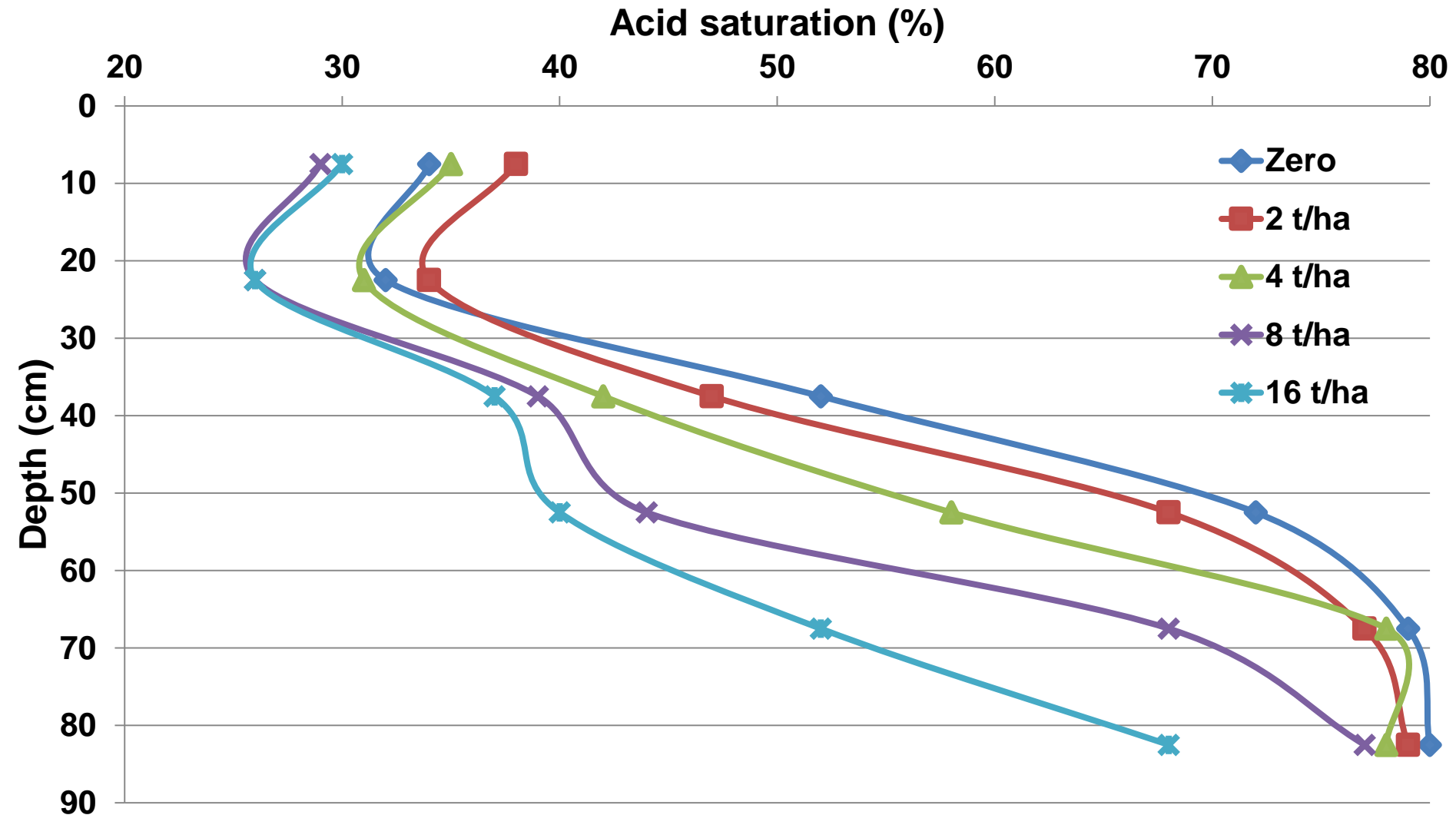


**PROBLEMS**





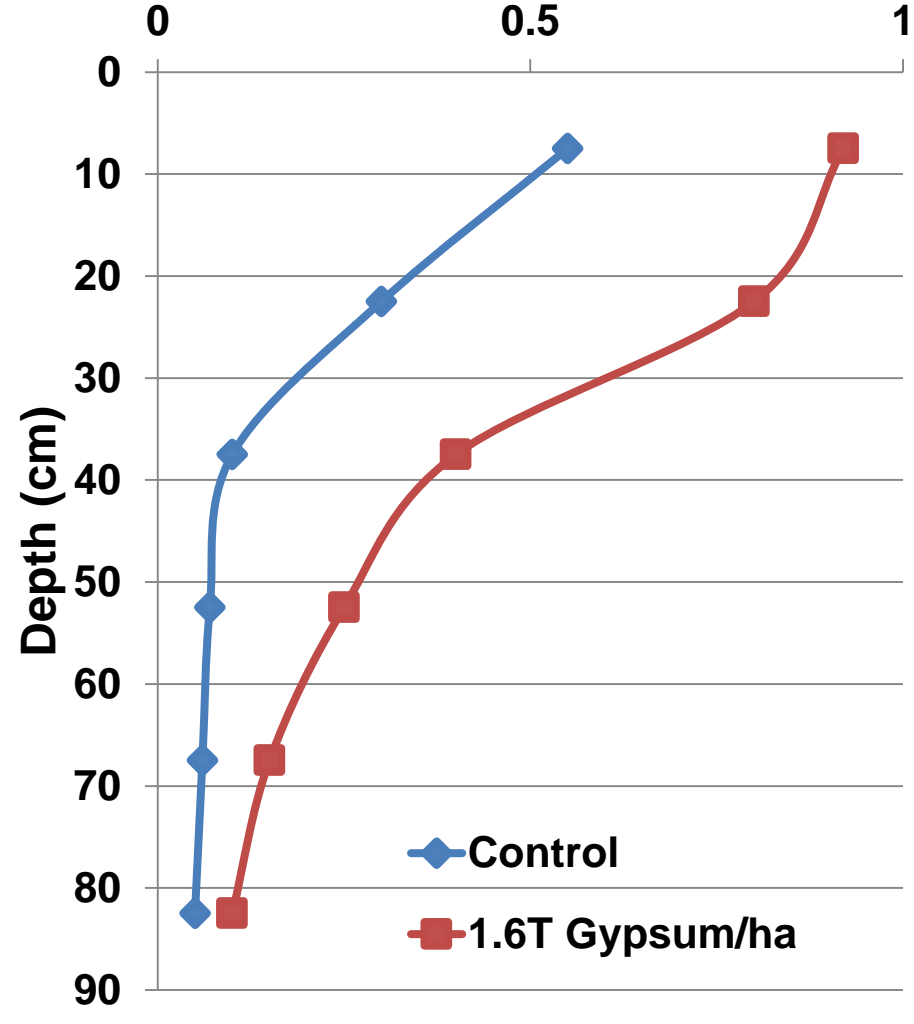
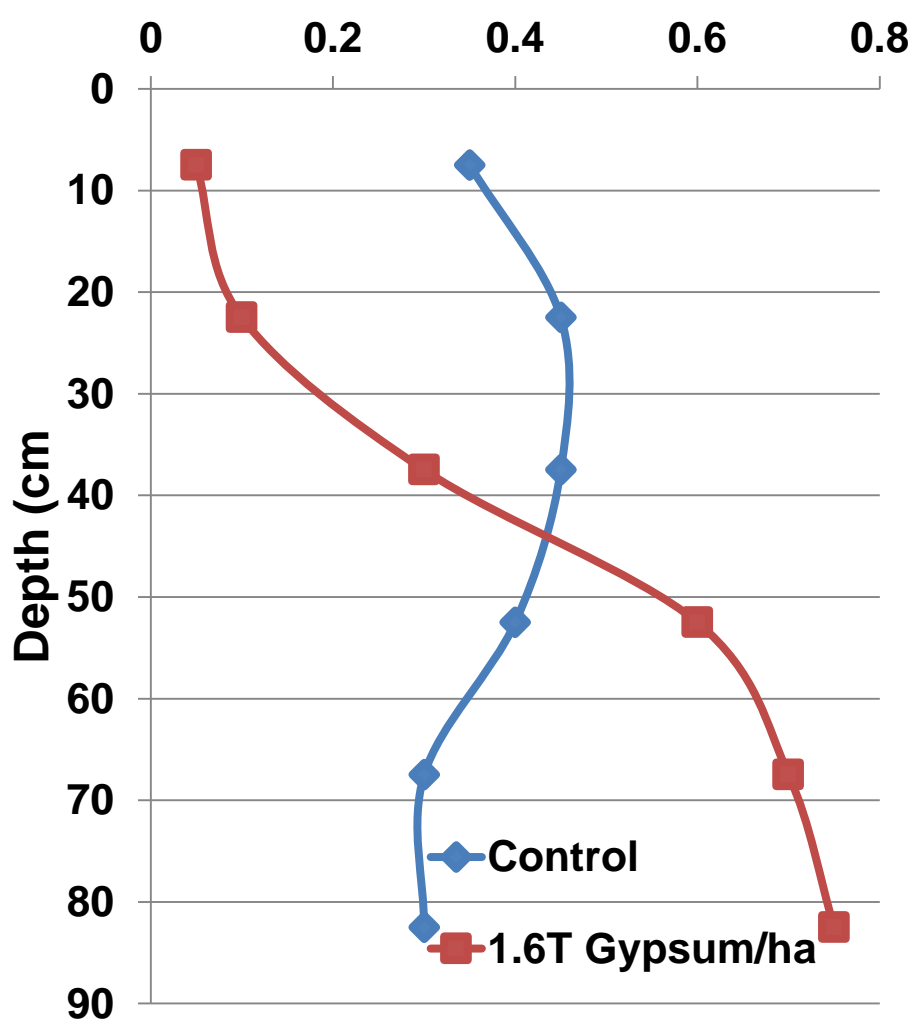
# Effect of Gypsum Rate on Acid Saturation After 12 Years



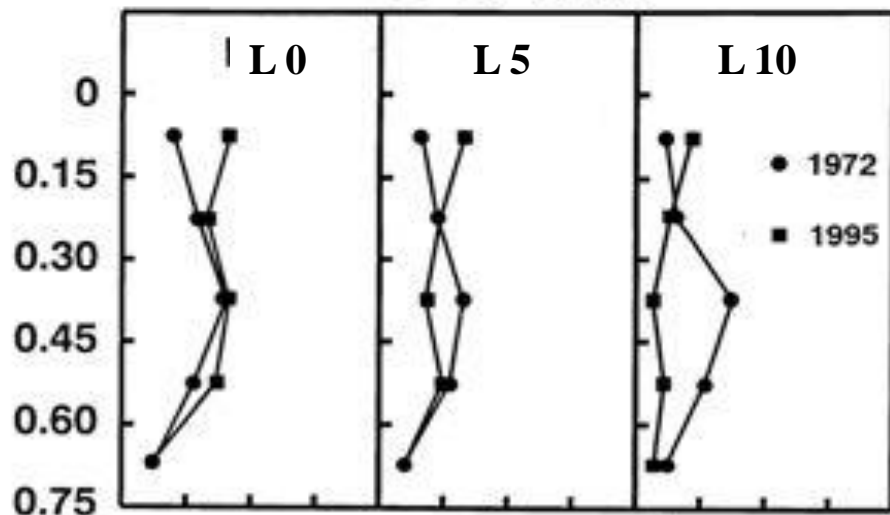
# Effect of Gypsum on Al and Ca with Depth in Acid Sandy Soil

Exchangeable Al (cmol<sub>c</sub>/kg)

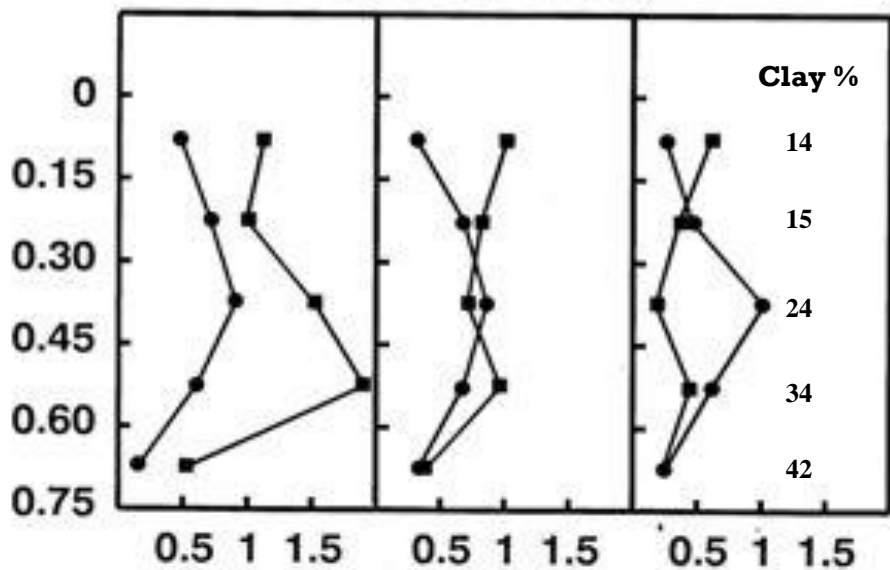
Exchangeable Ca (cmol<sub>c</sub>/kg)



100 kg N ha<sup>-1</sup>



200 kg N ha<sup>-1</sup>



Gypsum not effective

# SUMMARY

- Subsoil acidity is much more widespread in Southern Africa than is generally appreciated. Natural subsoil acidity is common where soils are dystrophic --- high rainfall --- and induced acidity, due to excess N (quantity and timing) or inadequate liming is cropping up more frequently.

- Options to ameliorate the problem include liming to pH levels near 6, incorporating lime to depth, and applying gypsum.
- Evidence available suggests that many naturally acidic subsoils are most effectively ameliorated with gypsum.
- However, management-created subsoils are not responsive to gypsum and it may have negative effects on sandy soils.

- Avoidance --- genotypic tolerance to Al--- is a possible strategy where lime and gypsum are not available.
- More attention to identifying the problem is needed (poor areas sampled to depth) and careful N and lime management is critical to prevent its creation or aggravation.
- Sustainable agriculture requires crops to have ready access to subsoil moisture reserves.

**Thank you for your  
patience**