MANAGEMENT OF ACID SOIL

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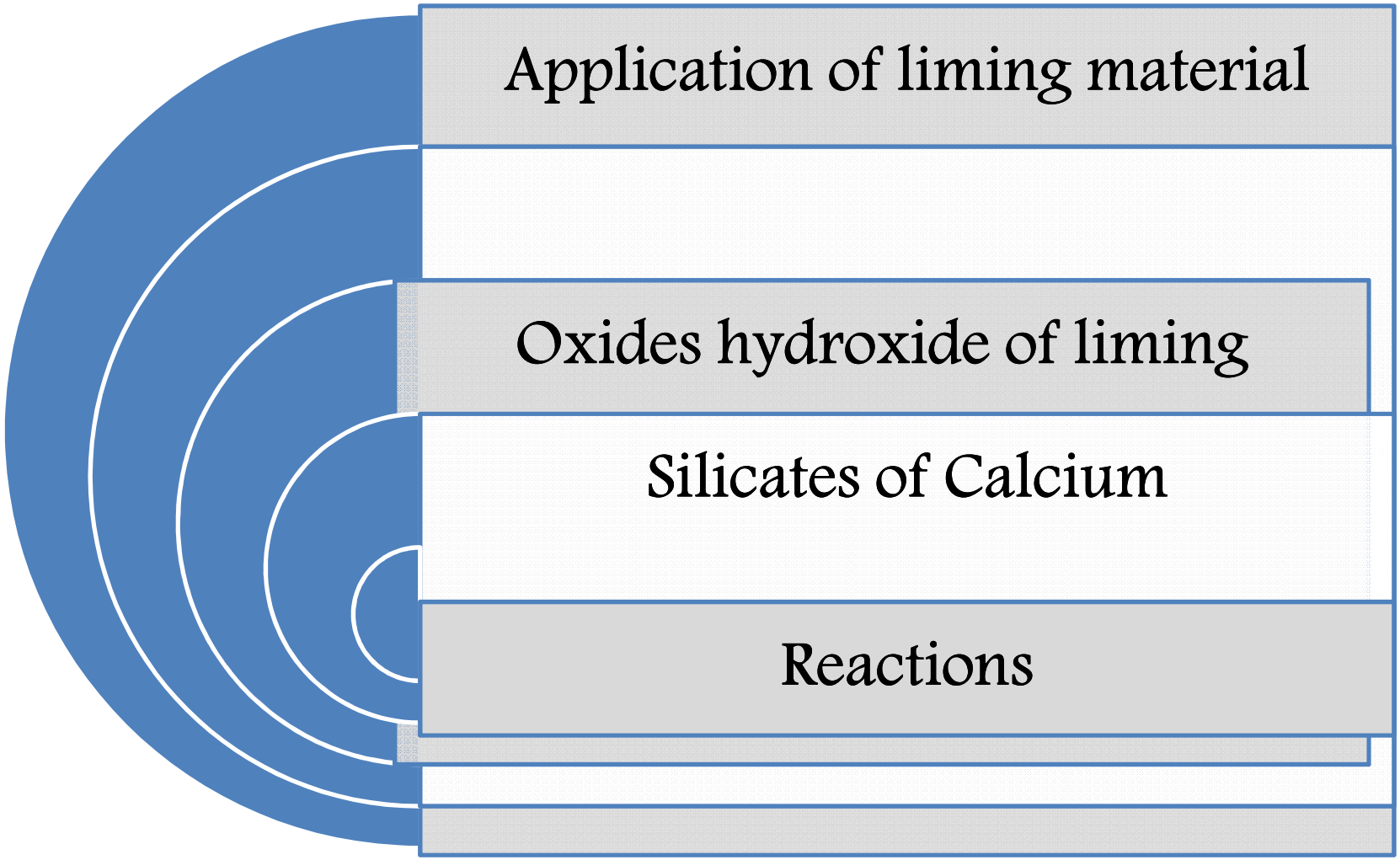
MAIN THEMES OF MANAGEMENT OF ACID SOIL POLLUTION



MAJOR TYPES OF POLLUTION

Calcium carbonate $CaCo_3$

Particle size distribution and efficiency

Crop residues

Natural Resources

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Application of liming materials

Different liming material to reclamation of acid soil

- Oxides - CaO
- Hydroxides - $Ca(OH)_2$
- Carbonates - $CaCO_3$
- Silicate of calcium - $CaSiO_3$

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Calcium carbonate $CaCO_3$

Lime is dissolved (slowly) by moisture in the soil to produce Ca^{2+} and hydroxide (OH^-):

$$CaCO_3 + H_2O\,(\text{in soil}) \rightarrow Ca^{2+} + 2OH^- + CO_2(\text{gas})$$ Equation (3)

Newly produced Ca^{2+} will exchange with Al^{3+} and H^+ on the surface of acid soils:

$$Ca^{2+} + [\text{Soil particle} + Al^{3+} \text{ and } H^+] \rightarrow [\text{Soil particle} + Ca^{2+}] + Al^{3+} + H^+$$ Equation (4)

Lime produced OH^- will react with Al^{3+} to form solid $Al(OH^-)_3$, or it will react with H^+ to form H_2O as shown in equations 5 and 6.

$$3OH^- + Al^{3+} \rightarrow Al(OH)_3(\text{solid})$$ Equation (5)

$$OH^- + H^+ \rightarrow H_2O$$ Equation (6)

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Oxides of lime

$2CaO + Soil\ (H^{+}+Al^{3+}) + H_2O \longrightarrow Soil(Ca)+Al(OH)_3$

Hydroxides of lime

$2Ca(OH)_{2+}\ Soil\ (H^{+} + Al^{3+}) \longrightarrow Soil\ (Ca)+ Al(OH)_3 + H_2O$

Silicates of Calcium

$2CaSiO_3 + 3H_2O + Soil\ (H^{+}+Al^{3+}) \longrightarrow Soil\ (Ca)+2H_2SiO_3 + Al(OH)_3$

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Solubility and qualities of lime

- Lime is lowly soluble in water- particles must be finely ground to neutralize soil acidity.
- Very small changes in the sizes of the particles have a major effect on the time required to dissolve them.
- Effectiveness depends - Purity of the liming material & how finely it is ground.
- The lower the CCE value, the more lime you will need to neutralize the soil's acidity

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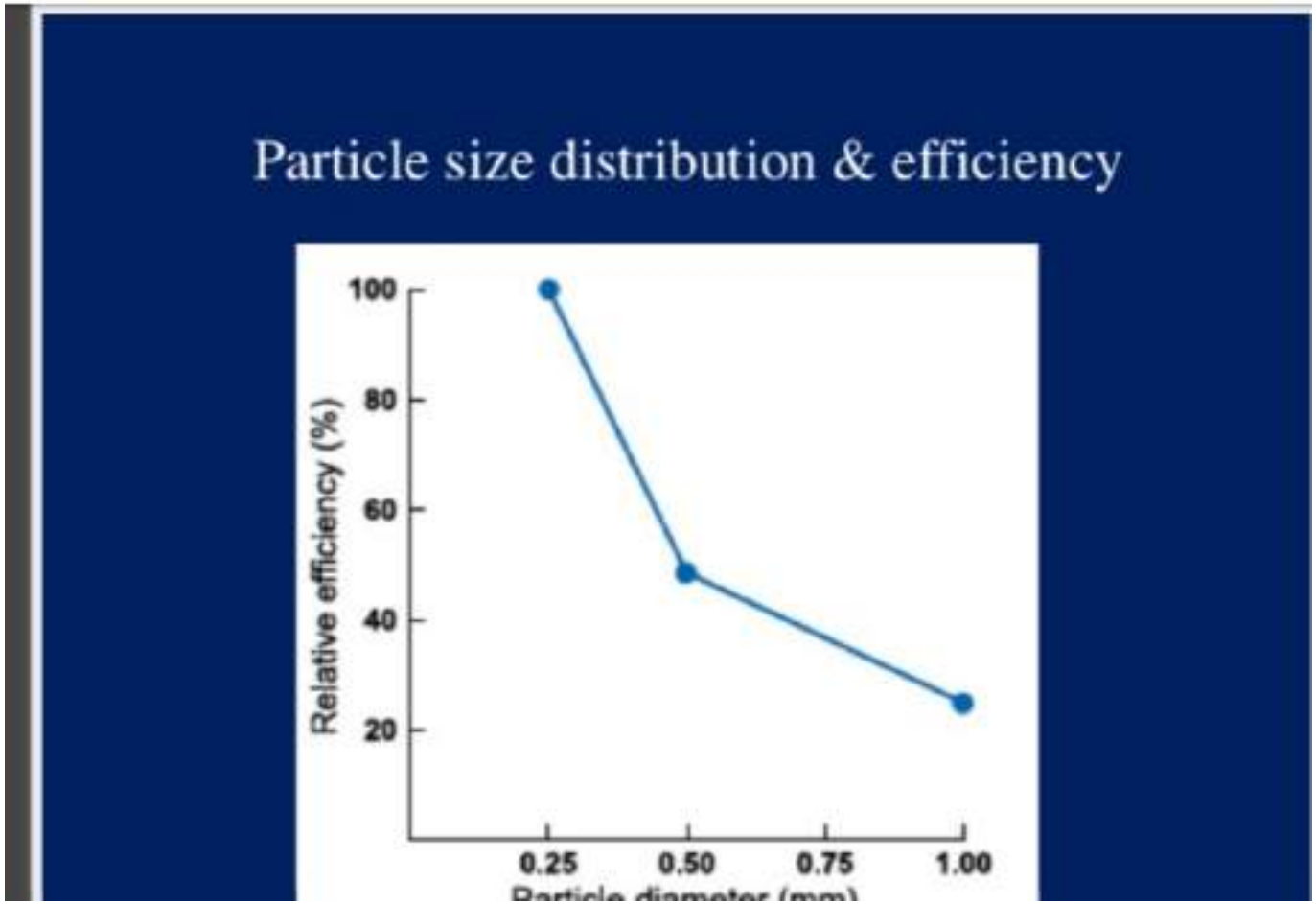

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- liming eliminates toxic Al^{3+} and H^{+} through the reactions with OH^{-}.
- Excess OH^{-} from lime will raise the soil pH, which is the most recognizable effect of liming.
- Another benefit of liming is the added supply of Ca^{2+} as well as Mg^{2+}

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Effects of over liming

- Deficiency of Fe, Cu, Zn, P, K
- Increment of OH^- activity may cause root injury
- Over liming Boron deficiency occur
- Too much application of lime increase the pore space in the soil- soil dries up- efficiency of water use is low

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Crop residues

- Soil pH changes after the addition of chickpea & canola residues.
- The greatest increase in soil pH occurred after chickpea addition as it is easily mineralized.
- Chickpea has a potential alkalinity.
- The soluble fraction was the main source of alkalinity

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- Basic cations which are released during decomposition of crop residues increase the pH (Noble and Randall, 1999).
- The excess cation content, indicative of ash alkalinity, represents the liming potential of residues (Noble *et al., 1996).*

Table 1. Chemical properties of the residues.

Residue	C:N ratio	Ash Alkalinity (cmol/kg)
Chickpea	21:1	150
Canola	40:1	130
Wheat	64:1	45

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- The increase of Mg saturation was observed only with Karongi unburned lime application.
- Use of 2.8 t/ha of Rusizi or Musanze unburned lime as alternative to the agricultural burned lime – decrease soil acidity.

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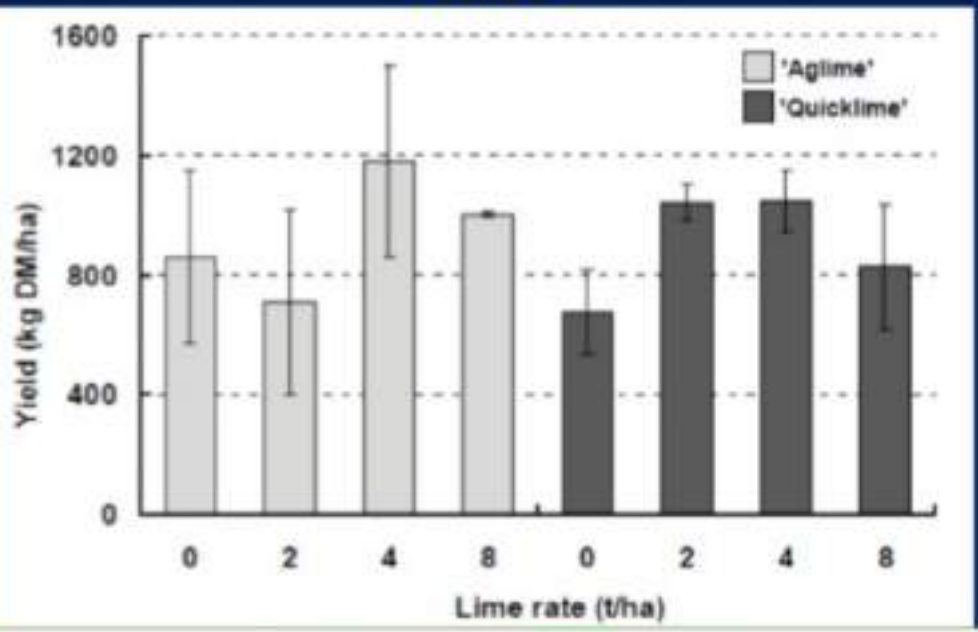
Comparison of agricultural lime and quick lime



Moir *et al* 2009

Crop: **Lucerne**

Agriculture lime : Increased pH from **5.3 to 5.6**

Reduced Al level from **2 to 1.3 me/100g**

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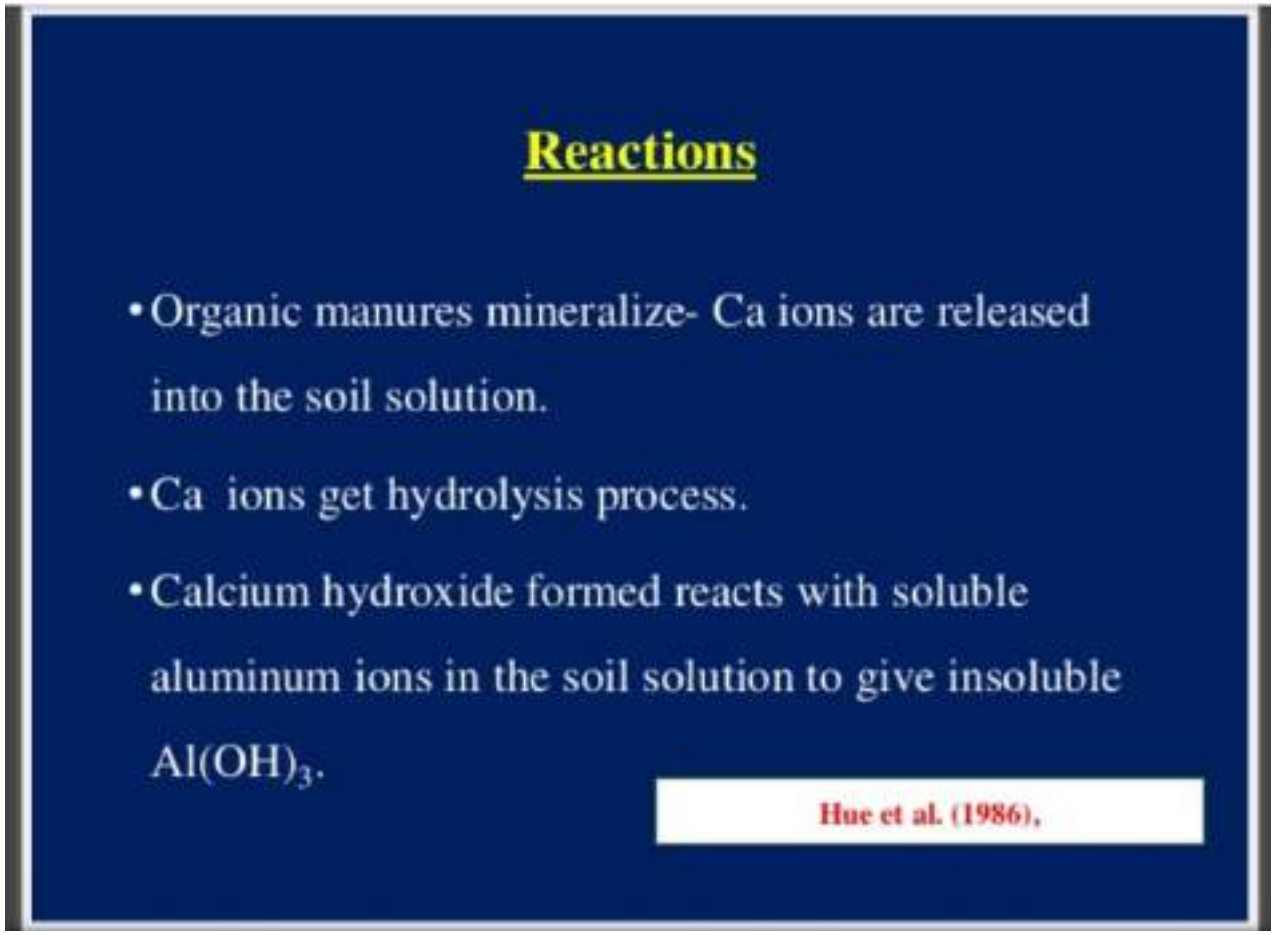

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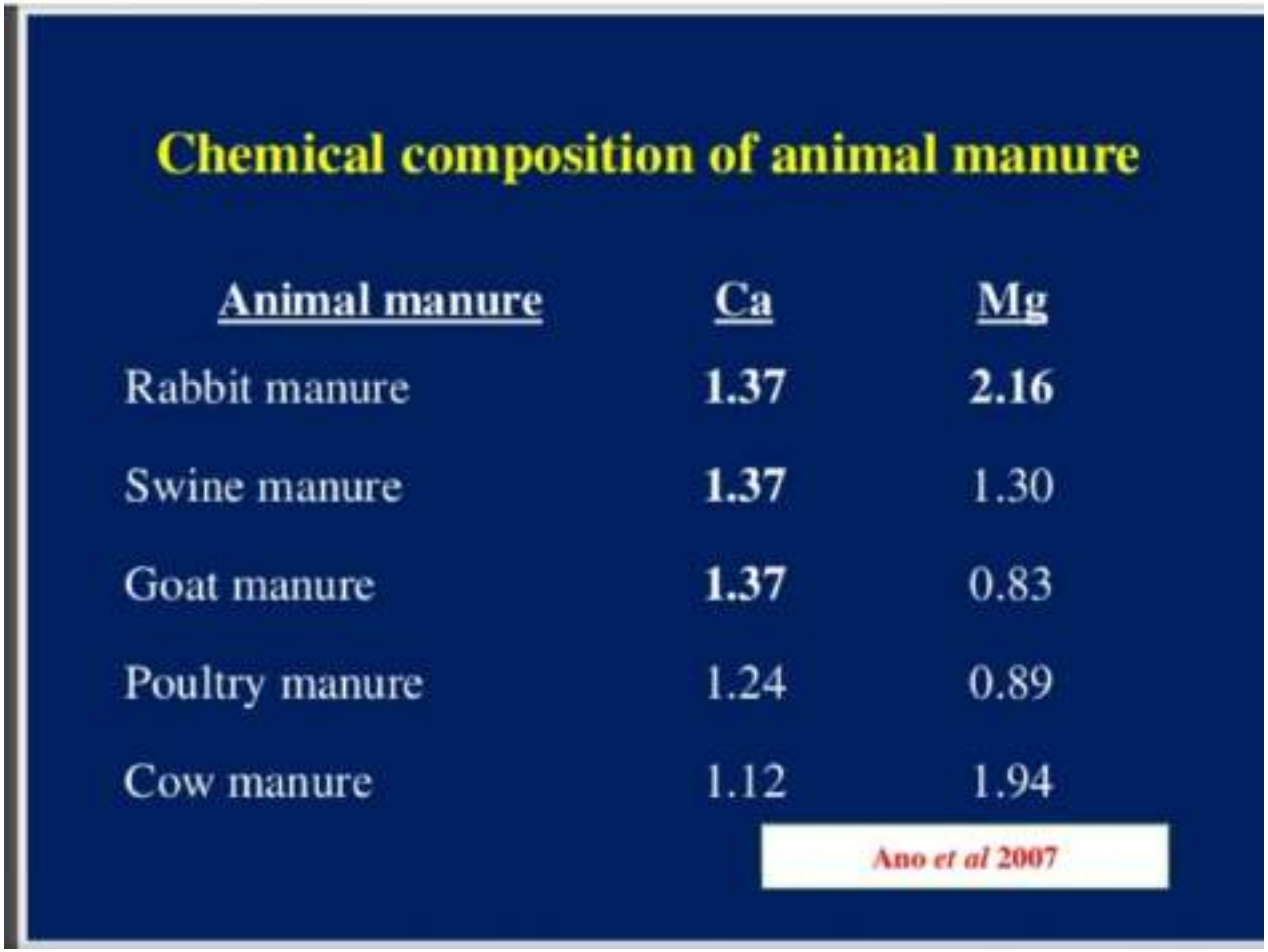

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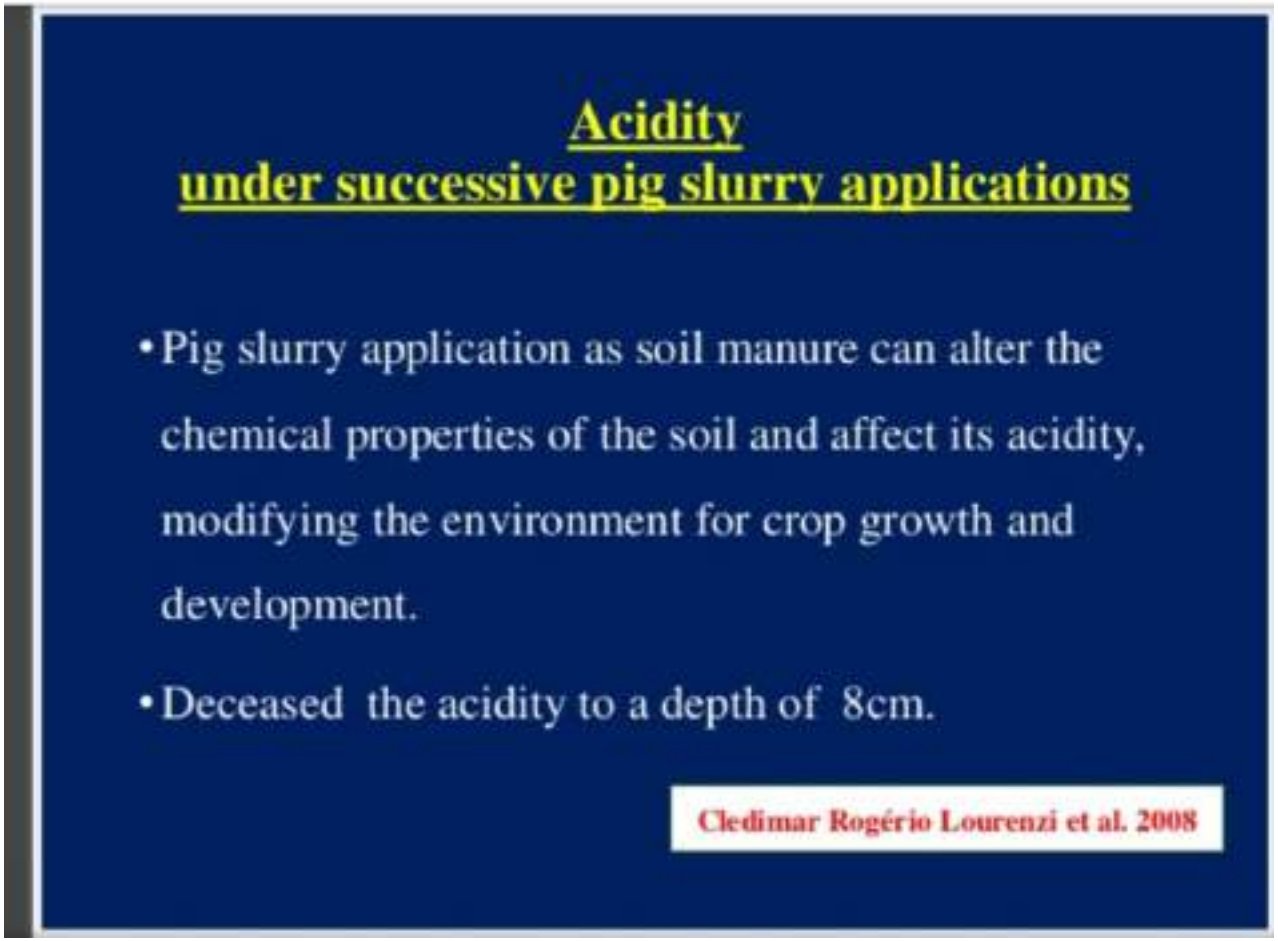

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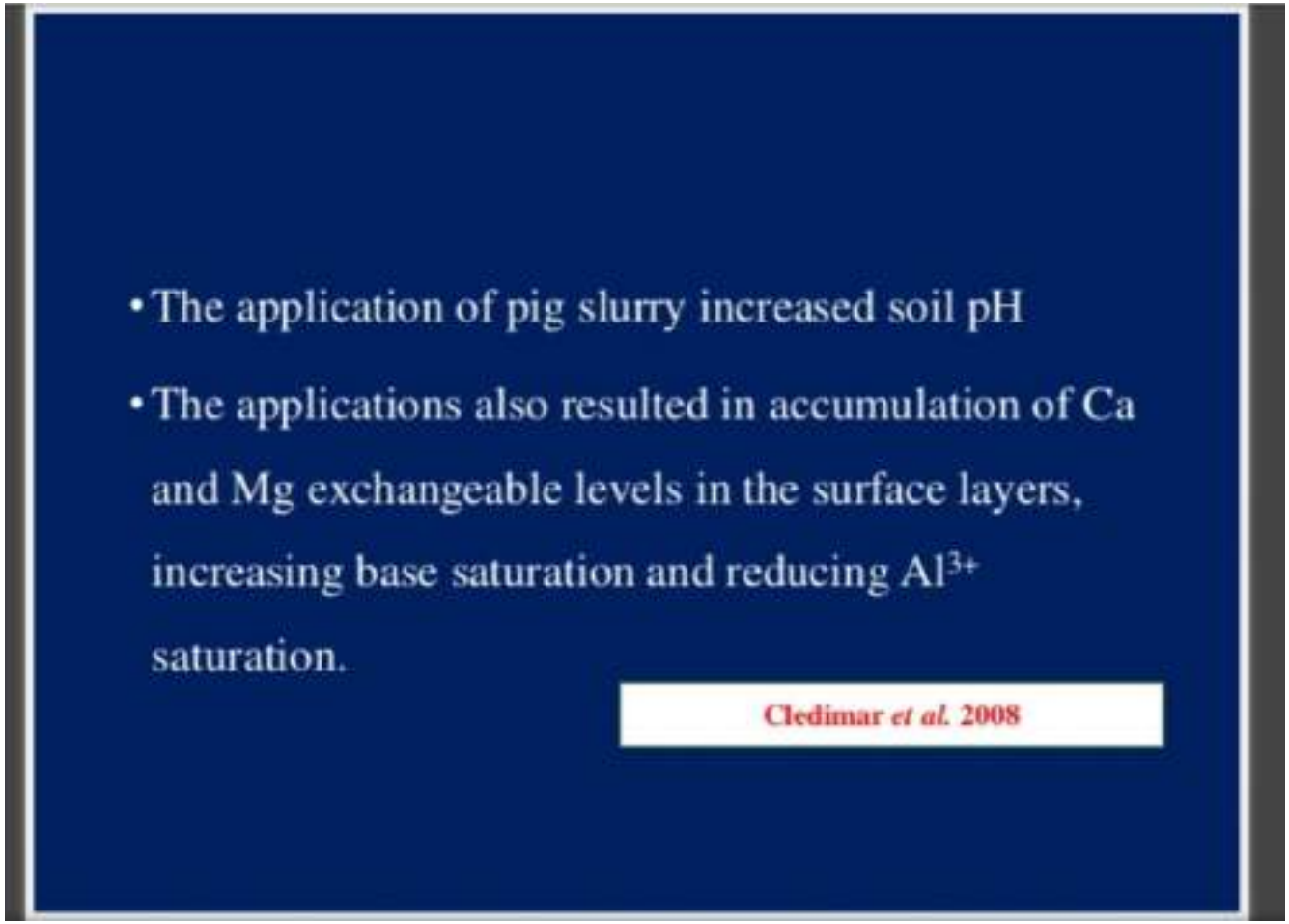

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Natural resources

- **Nitrate leaching** considered to be the dominant mechanism for accelerated acidification
- The growing of deep-rooted perennial pastures (lucerne) is seen as an answer to slowing the acidification process **(Ridley *et al.* *1998*).**
- This could be achieved by perennial plants using available nitrogen more efficiently thereby reducing nitrate leaching.
- The native eucalypts increase the surface soil pH **(Wilson 2002)**

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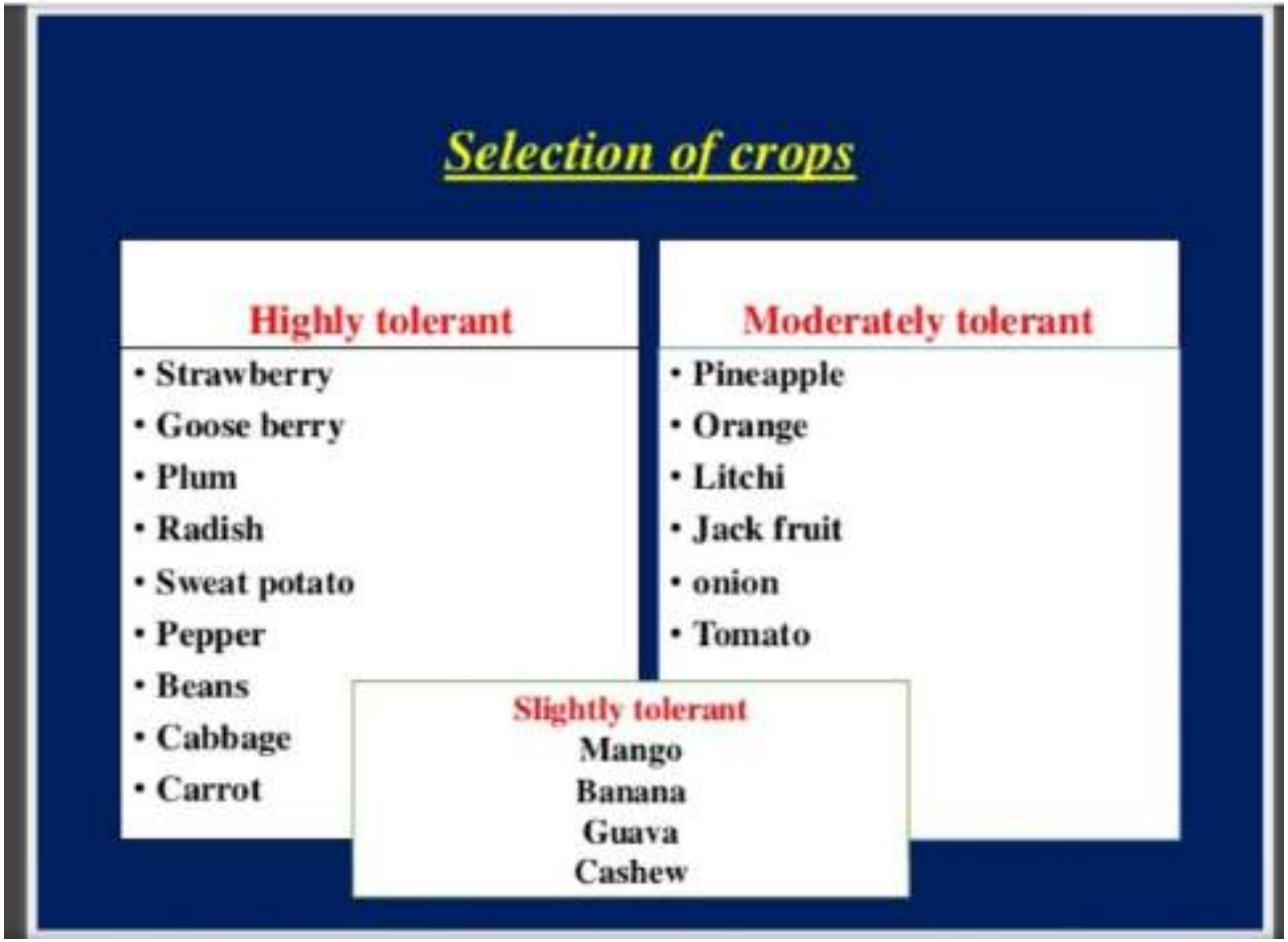

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Conclusion

- Soil acidity is a serious problem in agricultural land
- We improve soil health – practice various management practices
- Based on soil test value recommend the fertilizer
- Judicious application of nitrogenous fertilizer
- To advice the farmer should know about soil test technology


WE NEED EVERYONE'S HELP TO STOP POLLUTION
IT'S YOUR WORLD... HELP KEEP IT CLEAN!


THANK YOU!