



# The dynamic penetrometer for assessment of soil mechanical resistance

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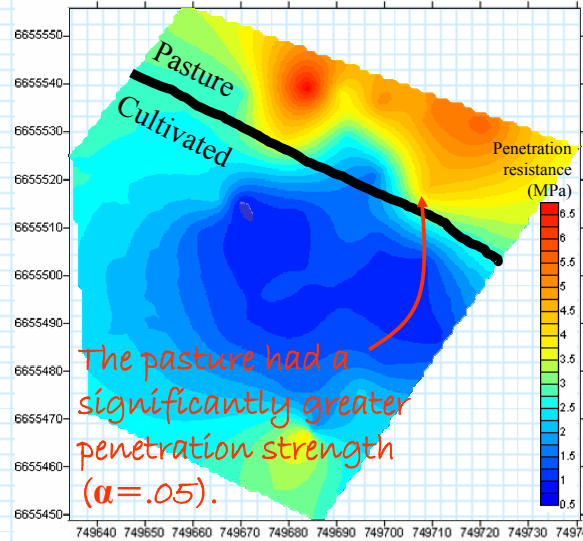


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## Introduction

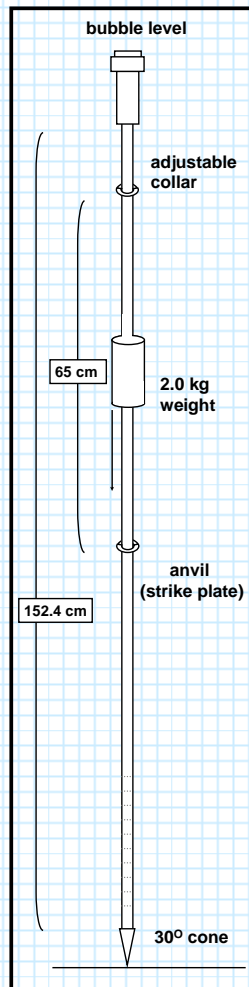
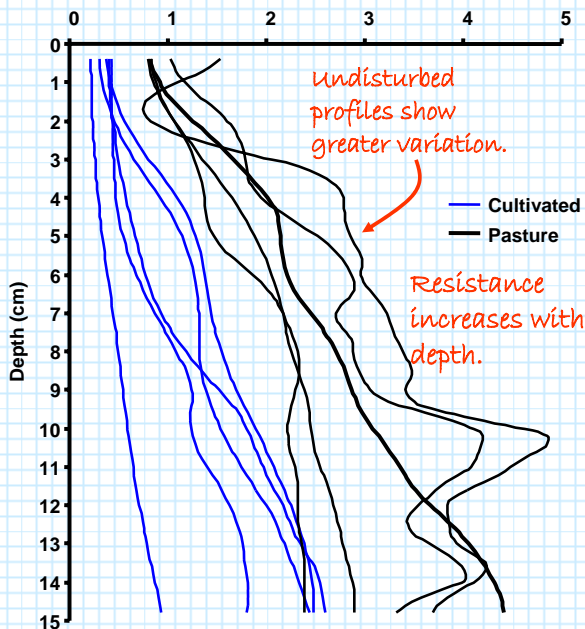
Penetration resistance is an important mechanical property which can be used to indicate compaction, **soil structure** and is important in determining the least limiting water range. Our study presents the use of a dynamic penetrometer (as described in *Herrick and Jones, 2002*) to determine the **soil strength** of a black vertosol in pasture and under cultivation.

## Penetration resistance (0 - 15cm)



## Penetration resistance profiles

Penetration Resistance (MPa)



## Theory

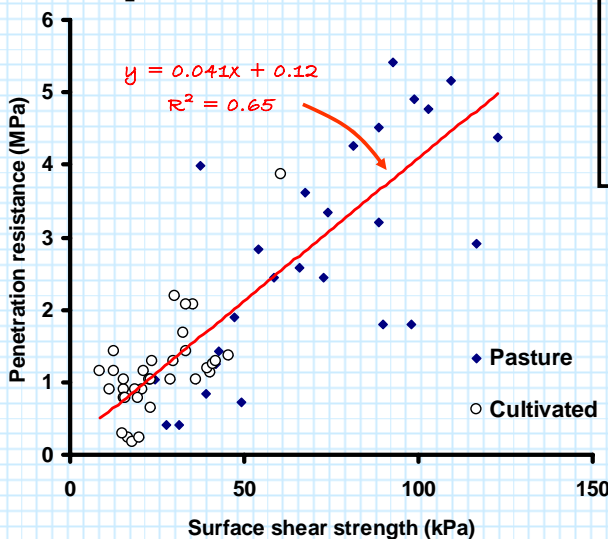
The dynamic penetrometer uses a calculated amount of kinetic energy to move a specialized cone a certain distance through the soil. This is converted to penetration resistance utilizing the gravitational constant and the **Dutch formula**.

$$R = \frac{mgH}{A\Delta z} \frac{m}{m+m'}$$

where:

- $R$  = resistance to penetration (Pa),
- $A$  = basal area of the cone ( $m^2$ ),
- $g$  = gravitational constant ( $9.81 \text{ m s}^{-2}$ ),
- $m$  = mass of the hammer (kg),
- $m'$  = mass of the shaft (kg),
- $\Delta z$  = depth of penetration (m).

## Comparing surface shear strength to penetration resistance



## Conclusion

The \$200, 4.2kg **penetrometer** provided quick, repeatable measurements. Non-traditional analysis such as profiling (recording the distance travelled with each hit) proved effective at identifying areas with greater penetration resistance which was likely caused by **tillage**.