Measurement of air space in soil

Rationale

Soil air and roots

A very important component of soils is the air space (pores, voids and cracks) between the soil particles and between the aggregates. It is in these air spaces where all the action, such as water and air movement, takes place. It is where soil organisms live and work. It is where plant roots grow. Roots need air to breathe and the air spaces make it possible for the roots to spread out in search of food. (Extract from Farmer Field Schools Facilitators' manual)

The amount of air space in the soil at a location is thus an important soil physical property. This experiment gives a simple method to measure it.

Hypothesis or Theory

The amount of air space will depend upon the size and shape of the soil particles, how they have been managed and the vegetation and water in the volume. When a known volume v of soil with air spaces a, is mixed with the same volume of water v, then the air in the soil escapes and the volume of the mixture, will be 2v-a. Thus a can be measured and the air space density calculated as a/v.

Methodology

The method is directly taken from:

Farmer Field Schools Facilitators' manual
Vol 1, Integrated soil, water and nutrient management in semi arid Zimbabwe
O. Hughes and J.H.Venema (eds), 131 pages,
Dept of Agricultural Research and Extension, and FAO of the UN
Harare, Zimbabwe, Feb 2005
ftp://ftp.fao.org/agl/agll/docs/ffsfm_zim.pdf

Field Study 1.6. How Much Air Does the Soil Contain?

Objective: To find out the amount of air in different kinds of soils
Time required: 1-2 hours
Materials

- 2 small tins
- 1 large bowl
- tool for stirring
- water
- knife, nail
- soil samples

Procedure

1. Explain the objectives of the study.
2. Get two empty cylinders (coffee or margarine tins will do). Perforate one tin with a nail, making 5-6 holes at the bottom.
3. Turn the perforated tin upside down and press the open end firmly into the ground until the tin is completely filled with soil. Turn the tin upright and level the soil at the brim of the tin with a knife. The soil in the tin is now arranged in the same way as it was, in the ground. Fill the other tin with water (see figure A).
4. Mix all the soil and water from the two tins in a bowl and stir the mixture until no bubbles of air are seen to escape. Let the mixture in the bowl rest for a few minutes (figure B).
5. Carefully pour the mixture back into the two tins. First fill one tin and then continue pouring into the second tin (figure C).
6. You will see that the second tin is not completely full – although it was full earlier. Mark the height of the water level. The remaining empty space in the tin is equal to the volume of air that was contained in the soil sample.
7. Repeat the experiment with other soil types (clay, loam, sand).
8. Discuss the results and compare the amount of air in different types of soils.

Figure A **Figure B** **Figure C**

Source: Secondary Agriculture. Kenya Institute of Education, 1999