Activity: Assessing Soil Aggregate Stability

Activity developed with support from Melissa Cann, Healthy Soils Officer, DPI

Curriculum connections

Use of this learning and teaching activity may contribute to achievement of the Standards. Indications of relevant Domains and Levels in the *Victorian Essential Learning Standards* are provided to assist teachers to make decisions about the appropriateness of the activity for their students.

Refer to introductory notes for VELS curriculum connections which define the relevant standards in greater detail.

***Victorian Essential Learning Standards* Domains and (Levels):**

Science (3,4,5)

Duration: 20 min - 24 hrs

Setting: The classroom

Summary

In this activity, students undertake simple tests to investigate the stability of soil aggregates and develop recommendations for soil improvement.

Student outcomes

This activity will enable students to:

- Understand the importance of stable soils for sustainable food and fibre production
- Observe and assess the stability of soil aggregates
- Recommend actions that can be undertaken to improve soil being investigated.

Background notes for teachers

The ability of soil to clump together (*aggregate*) and maintain this structure (*stability*) is important for plant growth. Pores within and between soil particles allow water and oxygen to move into plant roots freely, which is essential for optimal plant growth. Two factors affect the aggregate stability of soils - dispersion and slaking. The addition of gypsum and organic matter improves the stability of aggregates.

Dispersion: Dispersion occurs when soil aggregates separate from one another in moist soil and move about freely in water, appearing as 'cloudiness' in water. This is a problem as dispersed particles settle into soil pores and form a crust or seal over the soil surface. This restricts plant emergence and movement of water and air. Soil with a high sodium content tends to readily disperse in water.

Slaking: Slaking is a problem affecting surface soil. Slaking occurs when soil aggregates are immersed in water and they break open. Soils that slake are prone to water logging, crusting and reduced air and water movement into the soil's surface.

Non-Dispersive & Non-Slaking Soil
(High quality)

Slaking Soil
(Poor Quality)

Dispersive Soil
(Poor Quality)

Materials

- Air dried soil - soil may be air dried in a bucket, paper or cloth bag. Select 3 - 4 air dried aggregates (pea sized clumps) to test.
- Rain water or distilled water
- 3 – 4 flat bottom dishes eg. Petri dishes, shallow glasses or transparent plastic cups
- Worksheet: Soil Aggregate Stability

The activity

1. Introduce this activity by discussing how the roots of plants are living and need to be supplied with oxygen, water and nutrients obtained from the soil. Discuss how soil that slakes or disperses easily is prone to water logging which means that plant roots can not easily obtain oxygen or nutrients. Explain how the addition of gypsum and organic matter improves the stability of aggregates.

To test how dispersive soil samples are, half fill a flat bottomed dish with water.

2. Take three or four clumps of air dried soil of approximately 4-6 mm in diameter (pea sized) and place them in the flat bottomed dish containing water.
3. Leave the dish undisturbed for 24 hours and record your observations after 20 minutes, after 1 hour (if possible) and after 24 hours on the worksheet. Slaking can be observed in the first 20 minutes (this is only relevant for surface soil samples). Dispersion may take up to 24hrs to occur. If the soil is dispersive a cloud will cover the bottom of the dish.
4. As a class discuss how dispersive the soil sample is and what this means for soil quality. Non-dispersive soils are excellent soils and offer less problems to plant growth.
5. Compare class results and discuss what action may be taken to improve the quality of the soil samples tested.

Extension activities

Investigate the aggregate stability of soil at different levels, ie. surface soil and the upper and lower subsoils. Use the results gained from testing the different layers to decide how deep you will need to dig if gypsum or organic litter is to be used to improve the soil health ie. is it only the top layer of soil that needs to be manipulated.

Add gypsum or organic matter to your soil samples and test the stability of soil aggregates again to observe any change in soil stability.

Related LandLearn activities

Soils Ain't Dirt activity booklet on the *LandLearn Resources CD*. Activities include ‘Soil Texture’, ‘Soil Strength’, ‘Soil Colour’, ‘Measuring Soil Erosion’, ‘Soil Percolation Test’ and ‘Measuring Soil pH’.

Name: _____

Worksheet: Soil Aggregate Stability

Aim: To observe the stability of soil aggregates when placed in water. To recommend actions that can be undertaken to improve the soil being investigated.

Method :

1. Place three or four pea sized clumps (aggregates) of soil in a shallow dish filled with water.
2. Observe the clumps of soil after 20 mins, 1 hour and 24 hours.
3. Fill in the results table below by placing a tick in the row that best reflects what you observe after 20 mins, 1 hour and 24 hours.
4. If slaking or dispersing is occurring, rate it from 1 - 3 (1 = low and 3 = high).

Results:

Soil sample number and location collected: _____

	After 20 mins	After 1 hr	After 24 hrs
Unchanged			
Swollen			
Cloudy (Dispersing) Rate 1- 3			
Falling apart (Slaking *) Rate 1 -3			

Conclusion:

The soil sample we collected was **dispersive** / **non-dispersive** (circle one) and **slaking** * / **non-slaking** * (circle one).

This soil **does not** / **does** (circle one) need improving to allow better plant growth.

Improvements could be made to the soil by _____
_____.

Non-Dispersive & Non-Slaking Soil *
(Excellent quality)

Slaking Soil *
(Poor Quality)

Dispersive Soil
(Poor Quality)

* Slaking is only measured for surface soil.

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