



Humus in Soil - Teacher's Notes

Humus is living material that has been broken down and composted by worms, insects, fungi and bacterial to create a magnificent soil conditioner. Humus does not usually add fertiliser to the soil but it provides the chemical conditions which allows important elements such as nitrogen, magnesium and potassium to be bound to soil's mineral grains and remain available to plants. In our poor "gutless" soils fertiliser can wash straight through the soil and enter the aquifers and rivers causing algal blooms. The added ability of humus to retain water means that dissolved fertiliser becomes more available to plants.

Materials per student or group

- About 2 tablespoons of garden soil. Make sure to collect samples from below the mulch layer.
- A container that seals. An empty cool drink bottle or jam jar are fine. If students use test tubes they must be careful to seal the top with their fingers or thumbs.
- Water in a jug
- A piece of scrap paper and a pencil

Method

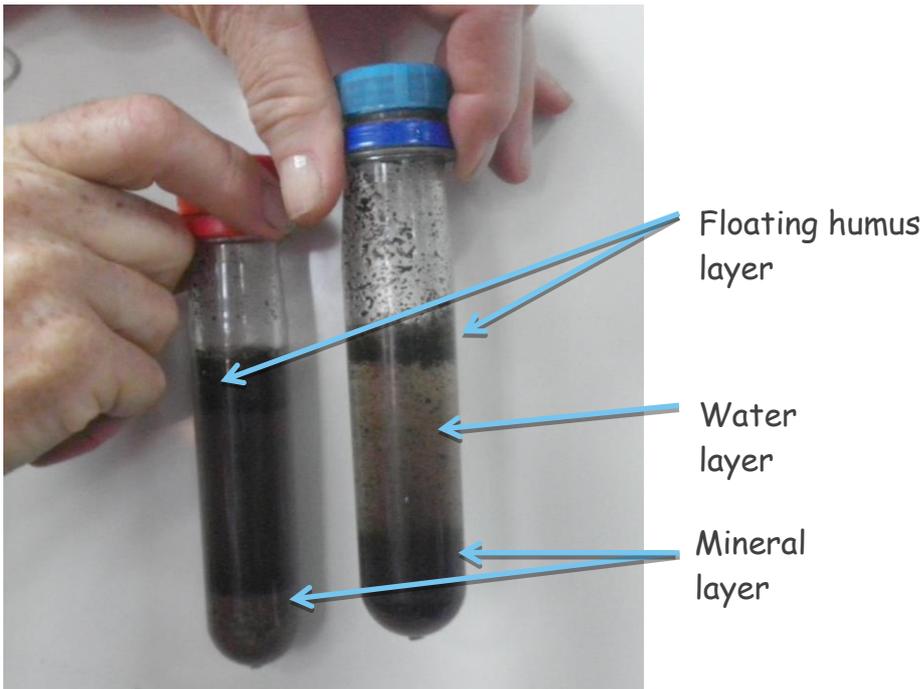
1. Place a specimen of soil in the container.
2. Lay the paper alongside the soil and make a mark to measure the soil level in the container.
3. Half fill with water.
4. Seal and give it a good shake for 1 minute
5. Hold upright without moving for at least two minutes to allow the soil settle. Clay rich soils may take longer to settle.
6. Lay the paper along the container and measure the thickness of the humus layer





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Dark humus (dead and living component) will float to the surface of the water and lighter coloured but heavier fragments of broken rock will sink to the bottom.



Two specimens of soil (one from the garden and one from the nature strip along the roadside)

7. Estimate the fraction of the original soil that was humus by finding out how many times the humus measurement will fit into the total soil measurement. (In most established school garden soils the fraction of humus in soil is about $\frac{1}{4}$).

The richer the soil, the higher proportion of soil will be humus. If the school has its own worm farm students will be able to see how worms and other creatures breakdown plant and animal matter into humus. If students can use magnifying glasses they may be able to see the fungal filaments and tiny arthropods that also work there to enrich soil. They can also see small



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pieces of rock.

Broken down rock minerals in soil feed not only the plants and animals on land but also those in the sea. Rocks are broken down into small pieces of gravel, sand and clay initially by weathering and by mosses and lichen. They are further digested and chemically altered by microscopic bacteria and fungi. Worms and insects mix and aerate the humus allowing water and air to enter.

More information about humus

Humus can hold up to 90% of its weight in water. Most plants need at least 10% humus in the soil to grow. Humus has a negative charge which means that ammonium (a source of nitrogen), calcium, magnesium and phosphorous are attracted to it. This stops rainwater washing these precious nutrients away. Adding too much organic matter can make the soil too acid. It will not break down quickly forming a peat layer that is only suited to a few plants.

Mulch and compost

Mulch is organic or inorganic material that is added to cover the surface of the soil. This keeps it cool, retains some water and reduces weed growth. Mulch can be dead leaves, newspaper, and black plastic or even stones. When the Israelis were revegetating the Sinai desert they placed at least three large stones around each tree planting to aid plant survival. Mulch can take 10 to twenty years to breakdown. Leaves from some Australian trees, such as eucalypts actually need to remove nitrogen from the soil to break down.

Compost is organic matter that is in the process of decomposition.

A good gardener has a layer of mulch above a layer of compost and then a humus rich soil.

