# 2. Which soil holds the most water?

1 hour
40 mins

Experiments are set up to discover which type of soil best retains sufficient water to help the plant growth. There is an extension opportunity to investigate different soil types from mixtures of sand, compost and soil.

## OBJECTIVES

- Setting up simple practical enquiries, comparative and fair tests
- Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions
- Recognise that soils are made from rocks and organic matter

## APPROXIMATE DURATION

1 hr 40 minutes (and 60 minutes optional extension activity).

## RESOURCES

(Per group of 4)

- Activity sheet 2b (Years 5-6) or sheet 9 (Years 3-4)
- 2 x 100 ml measuring cylinders
- 2 beakers (100 ml or 250 ml)
- 2 funnels
- 2 filter papers
- Large yogurt pot full of each: compost, sand, gravel, garden soil and peat
- Large yogurt pot

## ADVANCE PREPARATION

Two soil samples are prepared as follows (a plant pot or yogurt pot being a 'unit'):

- Sample 1 (sandy)
    - 2 units compost
    - 1 unit sand
    - 1 unit gravel
- Sample 2 (loam)
    - 2 units compost
    - 1 unit peat
    - 1 unit garden soil

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## INTRODUCING THE ACTIVITY (10 minutes)

Years 5-6 refer to Activity sheet 1b and Years 3-4 to Activity sheet 9. Both contain a letter from the Sports Turf company, asking for information about the amount of water needed by both the grass and the amount of water retained by different types of soil. As the company points out, the licence from the Environment Agency is expensive, and therefore need as much accuracy as possible.

Begin by discussing the types of soil commonly found. The letter lists three types of soil. In what way might these soils hold onto the water? Questions to encourage ideas could include:

- What happens when the tide comes and goes on sandy beaches?
- What happens to water on pebbly, gravelly beaches?
- If the ground was very sandy, how might water soak into it?
- What happens to rain water on the school field/garden?
- Does it lie on the surface after heavy rain?

## MAIN ACTIVITY (1 hour)

The groups are provided with the two samples of soil, sandy and loam.

When planning their investigation, encourage the children to think carefully about the design of the work. They need to consider aspects such as:

- Whether to use the same amount of soil and water
- Should the soil be pressed down?
- Should the water be added at the same time?
- Should they measure how much water comes through in a certain period of time?
- Should they record the amount of water coming through after certain intervals of time?

Younger or less able children can be provided with a structured test, if felt appropriate:

1. Place a piece of filter paper in a funnel and fill it with the soil sample.
2. Place the funnel on top of a measuring cylinder.
3. 100 ml of water is poured carefully onto the sample, and the water running through the soil is collected in the cylinder.
4. The quantity collected is subtracted from the original 100 ml to calculate how much has been retained by the soil.

## PLENARY (30 minutes)

The results of the investigations should be collated, and the children asked to suggest which types of soil retain water, and which allow it to soak through quickly. Discussion can highlight various points.

- *Why is this information important to the Sports Turf company?*
- *Could ground staff alter the characteristics of the soil on the sports ground?*
- *What could they do to achieve this?*
- *Would it be worth doing, bearing in mind the cost of water licences?*

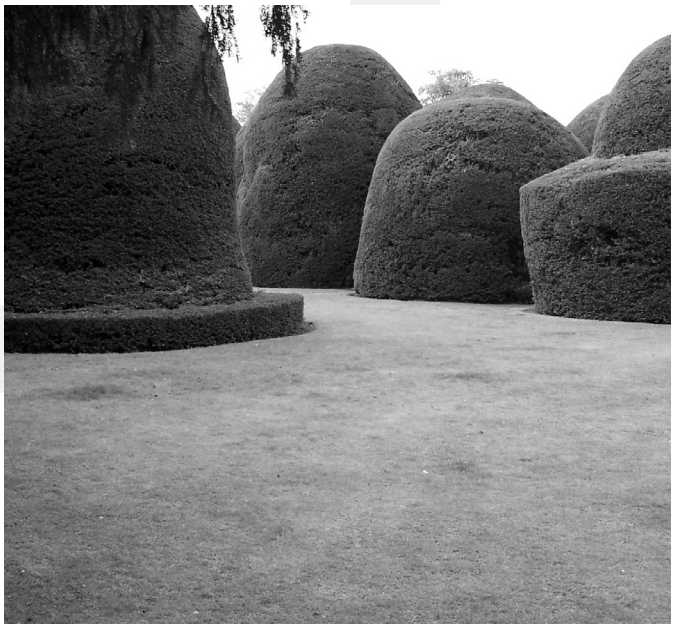
## **EXTENSION ACTIVITIES** (1 hour each)

1. 1. Some children could be encouraged to investigate the type of soil in the school grounds, or from their own garden. The investigation can be set up as above, using a sample of the soil. The results can be compared to the results from the samples used in the main activity, so that the children can suggest what sort of soil is present locally. The children could then try to alter the characteristics of the soil by adding compost and/or sand to achieve a particular water retention.
2. 2. Children can plot the data from one of the tables shown in Appendix 3 (either manually or using a computer spreadsheet) to decide on the most hard-wearing, disease- resistant grass types. This data has been obtained by professional researchers. Appendices 1-2 provide additional data to compliment the research of enthusiastic Year 5 or 6 scientists!

# Appendix 1

## TYPES OF GRASSES

The grasses used for luxury lawns, with the bowling green look, are fine-leaved compact types. These are the Bent grasses and Fescues, which are slow growing. However, it does not stand up to very hard wear, such as children playing on it or people constantly walking along the same track on it. Some common examples are Bents such as Brown top and Creeping Bent, and Fescues like Chewings Fescue and Creeping Red Fescue. This last type is widely used in the production of sports turf.



*The classic English luxury lawn using Bent and Fescue grasses*

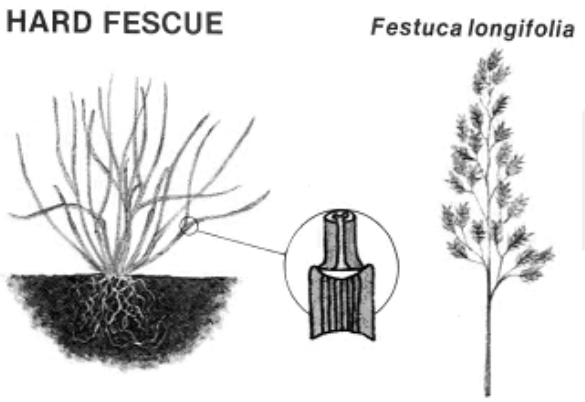
Harder wearing grasses are usually broad leaved types such as perennial ryegrass. These grow quickly in late spring and summer and need frequent cutting. They will stand children playing games on them, people walking over them and even cycling on them. Common examples of these grasses include meadow grasses, ryegrass and grasses such as Timothy.

*Harder wearing grasses like Ryegrass and Meadow grasses*

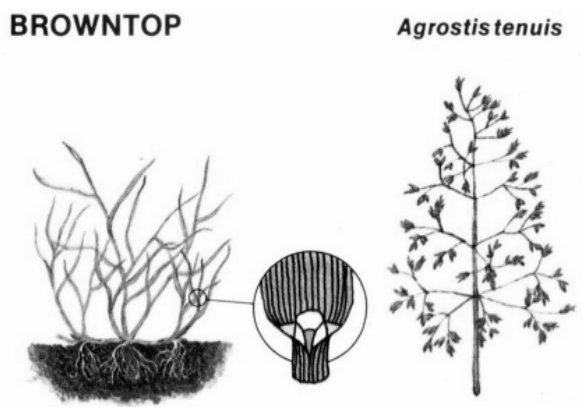
# Appendix 2

## GRASS IDENTIFICATION PICTURES AND DETAILS

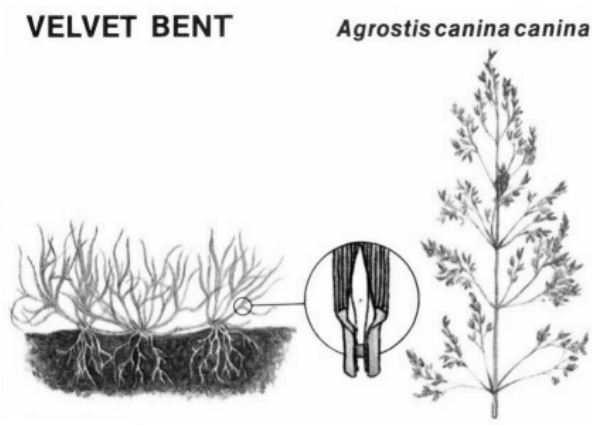
The following grasses are used in sowing high quality lawns and sports turfs. They are slow growing and fine leafed varieties:




*Grows in all soils, apart from heavy clays. Succeeds in dry areas.*

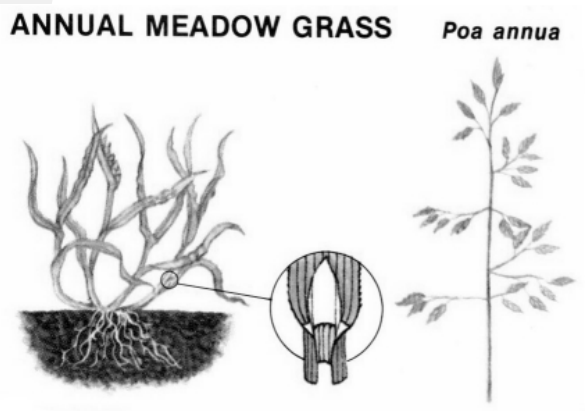



*Grows in all soils and is well suited to dry and acid soils.*

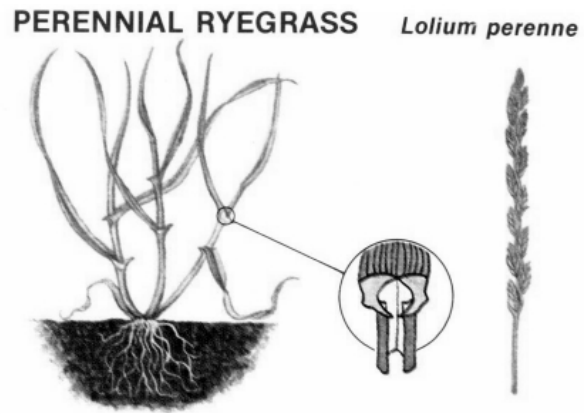



*This grass favours damp conditions and will tolerate shade.*

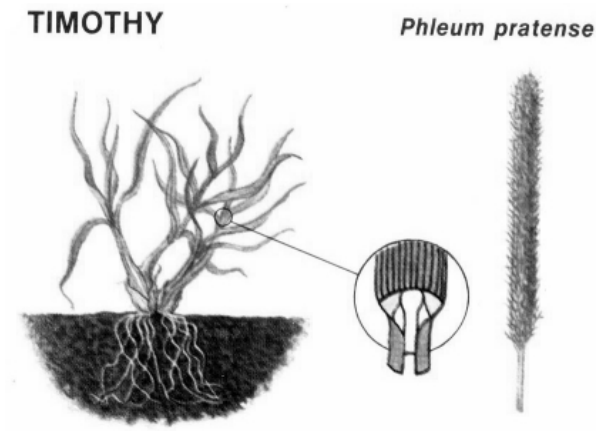
The following grasses are called utility lawn grasses, and are broad leafed, quick growing varieties:




*Grows in all soil types.*




*This grass grows in all soil types, thriving in moist fertile land.*




*Succeeds in heavy wet soils. It is shallow rooting and is not suitable for thin dry land*

# Appendix 3

## GRASS TESTING DATA

*Taken from the Sports Turf Research Institute 'Turfgrass Seed 2002' Data book, STRI, Bingley, West Yorkshire BD16 1AU.*

The STRI was set up in 1929 to undertake research and provide advisory services to golf clubs. This work has now expanded to include all other sports and amenity grass areas, and STRI is recognised as a world centre for research into grass surfaces.

The Institute has developed tests to evaluate various types of turf grasses. The fine turf grasses are evaluated for use in close mown turf for golf and bowling greens, ornamental lawns, golf fairways and for low maintenance uses. Course turf grasses are tested for use in football and rugby pitches, lawns and low maintenance situations.

The data given here is condensed (for use by children) from the STRI to facilitate the use of the numerical information as part of their data handling work. In Extension Activity 1, the children should identify the particular properties that are important for the situation, and choose grasses which score well for those characteristics.

## **TABLE 1:** Perennial ryegrass for winter pitches (In order of how well they withstand wear)

In the tables the bigger numbers are better, so that a grass with a score of 8.0 for shoot density would produce thicker turf with lots of grass shoots than those with a score of 7.0. There are two tables for perennial ryegrass, the first one in order of wear tolerance (how well it will stand lots of people running on it), and the second one in order of shoot density and slow regrowth under frequent cutting. A grass which stands up to lots of running about on it would be good for football and rugby pitches used a lot in the winter, and a high number for slow regrowth would mean that the grass would not need to be mowed so often to keep the grass at a reasonable height. You should not choose grasses just because they are at the top of the list - look at other properties as well. For instance, football and rugby pitches may be better if the grass seed used is a type which does not easily get diseases like red thread disease, but still stands up to heavy wear. You should look for the particular things that are important for the sports ground, and choose grasses which score well for those characteristics. For instance, you might decide that your football pitch should be planted with Ritmo grass seed, because it will resist disease well (7.4) but will still stand up to wear quite well too (7.0). It will also produce quite a lot of shoots to make the turf fairly thick (6.7).

You can choose the greenness of the grass as well if you wish, but this does not affect the way it grows!

**TABLE 1** (Continued)

| Grass type | Wear (mean) | Shoot density | Leaf fineness | Slow growth | Disease resistance | Greenness |
|---|---|---|---|---|---|---|
| Aberimp | 7.4 | 6.4 | 6.3 | 7.9 | 5.0 | M |
| Barlinda | 7.2 | 5.5 | 6.1 | 5.7 | 5.4 | D |
| Verdi | 7.2 | 6.5 | 5.2 | 7.1 | 5.4 | M |
| Essence | 7.1 | 7.5 | 7.0 | 6.4 | 5.3 | M |
| AberElf | 7.1 | 7.0 | 6.7 | 5.9 | 6.2 | D |
| Eden | 7.0 | 5.3 | 4.8 | 5.7 | 5.8 | D |
| Ritmo | 7.0 | 6.7 | 6.8 | 6.7 | 7.4 | D |
| Concerto | 6.8 | 7.3 | 5.6 | 6.7 | 6.0 | D |
| Greenstar | 6.8 | 6.5 | 6.1 | 5.4 | 5.3 | M |
| Disco | 6.7 | 6.4 | 5.9 | 5.7 | 5.3 | M |
| Bardessa | 6.7 | 6.0 | 6.4 | 6.1 | 6.9 | M |
| Darius | 6.6 | 7.4 | 7.3 | 6.9 | 5.2 | D |
| Claudius | 6.6 | 5.4 | 5.1 | 6.2 | 6.6 | M |
| Troubadour | 6.5 | 5.7 | 6.4 | 5.9 | 5.6 | D |
| Lex 86 | 6.4 | 7.4 | 6.8 | 6.7 | 5.2 | M |
| Evita | 6.4 | 6.7 | 7.9 | 6.0 | 7.4 | D |
| Ballet | 6.3 | 6.9 | 6.5 | 6.9 | 5.8 | D |
| Lorettanova | 6.2 | 6.0 | 6.9 | 6.1 | 7.3 | M |
| Barmona | 6.2 | 6.9 | 6.6 | 6.3 | 5.2 | D |
| Superstar | 6.0 | 6.9 | 6.4 | 5.7 | 5.7 | M |
| Sauvignon | 5.9 | 7.9 | 8.4 | 6.2 | 4.2 | D |
| Queens | 5.8 | 6.2 | 5.6 | 6.3 | 6.0 | M |
| Capri | 5.8 | 6.2 | 6.4 | 5.9 | 7.0 | M |
| Lorina | 5.7 | 6.2 | 6.8 | 6.8 | 5.0 | M |
| Dali | 5.6 | 7.9 | 7.5 | 5.9 | 5.6 | M |
| Juwel | 5.0 | 4.8 | 4.5 | 5.9 | 5.3 | M |
| Barcredo | 4.9 | 6.0 | 6.4 | 5.6 | 5.8 | M |

*The final column refers to the winter colour: L - Light Green; M - Mid-Green; D - Dark Green*

## **TABLE 2:** Perennial ryegrass for lawns, cricket fields etc. (In order of shoot density, fineness of leaf, and slow regrowth)

A high number in the first column indicates that the grass will stand being cut short (cs), has a good shoot density (sd), finer leaves (fl)and a slow growth (sg) between regular mowing. The number is the average of all four things. The second column shows how cleanly the grass will cut. The third column gives a number for short growth. Choosing a shorter growing grass like AberImp (7.5) which also has a high score for slow regrowth (average 8.3) will help the groundsman if they cannot mow the grass frequently.

The last two columns let you choose the colour of grass you would like to see in summer and winter, but this does not affect the growing of the grass!

| Grass type | Average (cs, sd, fl, sg) | Cleanness of cut | Short growth | Summer greenness | Winter greenness |
|---|---|---|---|---|---|
| AberImp | 8.3 | 7.0 | 7.5 | M | M |
| Sauvignon | 8.0 | 6.8 | 6.8 | M | D |
| Evita | 7.6 | 5.2 | 5.9 | D | D |
| AberElf | 7.4 | 6.8 | 7.7 | D | D |
| Darius | 7.2 | 7.0 | 7.9 | D | D |
| Dali | 7.1 | 6.8 | 6.7 | M | M |
| Lorina | 7.1 | 7.6 | 7.9 | M | M |
| Ritmo | 7.0 | 7.0 | 5.6 | D | D |
| Ballet | 6.8 | 6.6 | 7.4 | M | D |
| Lex 86 | 6.7 | 6.6 | 6.6 | M | M |
| Lorettanova | 6.6 | 6.3 | 6.4 | M | M |
| Barmona | 6.5 | 5.8 | 5.9 | L | D |
| Bardessa | 6.5 | 6.3 | 6.1 | M | M |
| Essence | 6.4 | 6.5 | 5.6 | L | M |
| Superstar | 6.4 | 3.9 | 6.0 | M | M |
| Concerto | 6.3 | 6.9 | 5.2 | D | D |
| Greenstar | 6.1 | 5.8 | 6.4 | D | M |
| Disco | 6.1 | 6.4 | 5.8 | D | M |
| Queens | 6.1 | 6.0 | 6.0 | M | M |
| Capri | 6.0 | 5.9 | 5.0 | D | M |
| Verdi | 6.0 | 6.2 | 6.2 | L | M |
| Barcredo | 6.0 | 6.9 | 6.0 | D | M |
| Troubadour | 6.0 | 5.8 | 5.6 | M | D |
| Eden | 5.9 | 6.1 | 7.7 | M | M |
| Barlinda | 5.8 | 5.2 | 6.3 | M | D |
| Claudius | 5.6 | 5.0 | 7.3 | M | M |

*Colour code: L - Light Green; M - Mid-Green; D - Dark Green*