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# Equipment and Techniques for Measuring Grass Quantity: Sward Height or Cover (kg DM/ha)



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# Equipment and Techniques for Measuring Grass

A range of equipment and practical techniques are available for measuring the quantity of grass also known as pasture/sward mass or field cover and these include:

1. Sward Samples
2. Visual Assessment
3. Sward Surface Height
4. Rising Plate Meter
5. Capacitance Probe
6. Ultra Sound
7. Satellite Images
8. Three Leaf Method

## I. Sward Samples

Cutting samples of the sward, weighing them and calculating the dry matter allows the yield (*kg DM/ha*) to be estimated. This method provides a very good guide to yield, and when used frequently can enable the farmer to improve the visual assessment of the yield of the sward by eye. As well as accounting for the height of the sward this method takes into account the density of the sward. This is particularly important where white clover makes up a significant proportion of the sward as there is a tendency as sward height increases to overestimate sward mass as the clover becomes very obvious yet lacks density below the leaf canopy. Sward mass may also be over-estimated when it is in early vegetative stage, leafy and actively growing yet low in dry matter and high in water content. It is also the method used to calibrate rising plate meter readings and cross check visual assessments.

### SWARD SAMPLING METHOD



Three quadrats of grass, 0.1m<sup>2</sup> in area, per hectare are cut (from a wire circle 36cm in diameter) with a record made of the fresh (weight 1) and the dry weight (weight 2) of each grass sample. Samples will be dry following 20 hours of drying at 80°C. Alternatively, dry in a microwaveable container or porous bag: set the timer for 1 minute and weigh, then repeat until the weight remains constant. Average the weight of the three samples for an accurate result.

Dry matter % = weight 2 / weight 1 × 100

Cover in kg DM/ha = weight 2 × 100

Visual assessment of cut herbage may also be used to estimate DM (%) content.

When cut herbage has:

- a large quantity of surface moisture - DM content approx. 10 to 13%.
- only a small amount of surface moisture - DM content approx. 14 to 16%.
- no surface moisture - DM content is approx. 16 to 18%.

## 2. Visual Assessment



Visual assessment is a popular method of estimating herbage quantity and works best when it is used in conjunction with periodic sward sampling to help cross check visual assessments. It is more accurate when the sward is evenly grazed with no poaching or contamination by dung / urine. A variety of visual “tools” have been developed to provide a rough guide to grass quantity; e.g. farmers compare the height of the sward against known pre and post grazing height target marks on a wellington boot; the height of a golf ball (4cm) or tennis ball (6cm), coke (11.5cm high, 6.5cm wide) or beer can (15.5cm high, 6.5cm wide). The information gained from sward sampling can then be used to convert the height to pasture mass.

### Visual Assessment using a Wellington to Estimate Sward Height / Mass

3cm ~1300 kg/DM/ha

12cm ~3000kg/DM/ha

16cm ~4000kg/DM/ha



### VISUAL ASSESSMENT METHOD

- Check the field is evenly grazed, if not consider using another method.
- Walk across a field in a W pattern looking at the height and density of the sward.
- Compare the height of the sward against an object of known height in at least 30 places avoiding gateways, hedge-lines and any areas that are not representative of the field in general.
- Make a record of the height and record whether it is increasing or decreasing compared to the previous reading and introduce or remove grazing stock according to sward surface height (SSH) guidelines.
- When grass is growing rapidly in spring consider walking the fields twice a week.

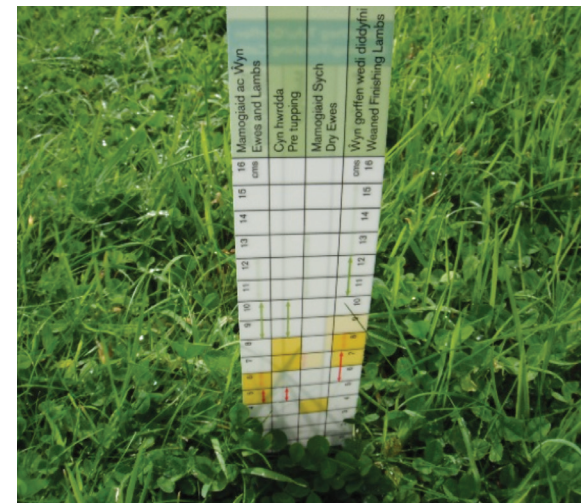
## 3. Sward Surface Height

Measuring sward surface height with a ruler or sward stick is an excellent practical indicator for use in grazing management. Initially developed for use in experimental work the researchers realised it was a simple and practical tool that could be used by farmers. This led to the development of grazing height guidelines for different classes of stock.

### SWARD SURFACE HEIGHT METHOD

- Walk across a field in a W pattern.
- Run the thumb down the ruler / sward stick until it touches the top of the grass leaf – do not measure stems and flower heads of weeds.
- Take at least 30 readings in each field, record them down as you go and then work out the average (*sward height record pads make this very easy*).
- Avoid gateways, hedge-lines and any areas that are not representative of the field in general.
- During the peak of growing season sward heights can change fairly rapidly so consider measuring twice a week.

### Sward Stick or Ruler used to Measure Sward Height



For sward surface height guidelines see the Farming Connect Factsheet - *Improving Grazing Management: Measure to Manage*.

## 4. Rising Plate Meter



The rising plate meter is a disc (plate) of known area (0.1m<sup>2</sup>) on a shaft. The plate is placed on the sward canopy while the shaft is held vertically and placed on the ground surface. This makes the plate rise up the shaft moving a counter that measures the height of the sward above the ground. The plate needs to be parallel to the ground for the most accurate reading. The placing of a plate meter has colloquially become known as “plonking”. Electronic Rising Plate meters will automatically store the data after each measurement is taken. The figure must be hand recorded if using the Manual Rising Plate Meter. Sward height measured with a plate meter is then converted to pasture mass / sward cover using a conversion formula.

### RISING PLATE METER METHOD

- Record the start reading on the counter
- Walk across a field in a W pattern
- Plonk the plate at least 30 times
- Record the end reading on the counter
- Calculate the difference between the first and last readings
- Divide the difference by the number of readings
- Convert the reading into sward mass/field cover using a conversion formula or ready reckoner.

### Conversion of Meter Readings to kg DM/ha: How an electronic plate meter works

Sward sampling over the season is the most accurate method of producing a conversion formula for individual farms. The dry matter yield results from sward sampling and grass height measurements are used in a regression equation to provide a measure of sward mass. In New Zealand conversion formulae have been calculated for different seasons and different regions. In the UK AHDB Dairy developed a widely used equation based on research results. Limited work on calibration has been undertaken for beef and sheep farmers under Welsh conditions.

A platemeter measures sward height and uses pre-set equations to convert sward height readings to kg DM/ha; kg DM/ha can be used for pasture budgeting to predict shortfalls or excess of grazing and estimate changes in grass availability.

An example of an equation is:

$$\text{kg DM/ha} = \text{average compressed sward height (cm)} \times 140 + 500$$

the “multiplier”      the “addor”

The multiplier (x140) reflects the dry matter % in the pasture (i.e. 14%); the ‘addor’ in the equation is to compensate for an amount of grass at the bottom of the sward that is not measured by the plate meter.

- Start with some basic equations that roughly fit the growing season as given in the platemeter handbook, and then make adjustments to the equation based on comparing oven dried grass sample values for kgDM/ha with the platemeter’s kgDM/ha readings.

*For grazing cover guidelines please see the Farming Connect Factsheet - Improving Grazing Management: Measure to Manage.*

## 5. Capacitance Probe/Pasture Probe

The pasture probe relies on differences in dielectric constants between air and herbage to measure the capacitance of the sward which provides an indicator of the surface area and therefore its mass. The probe is pushed into the sward to ground level and the capacitance of the sward is measured. Pasture probes usually incorporate a computing capacity that allows field numbers, areas and sward mass to be stored and simple calculations to be performed. This information can be downloaded to a computer which enables a comparison with previous pasture assessments.



### CAPACITANCE PROBE/PASTURE PROBE METHOD

See rising plate meter method, again it is preferable that a series of quadrat cuts and readings between probe readings and pasture mass is taken to develop specific calibration for local sward conditions.

## 6. Ultra Sound

Quad bike mounted sonic plate meters /grass sleds are available that take continuous readings across a sward. These ultrasonic reading devices have been developed to calculate the height of pasture in millimetres (mm) and incorporate a computing capacity that allows field numbers, areas and sward mass to be stored. The information can be used to automatically generate pasture recording and monitoring information and yield maps. The reading devices are incorporated into a "reading head" that can be attached to the front of a quad bike.

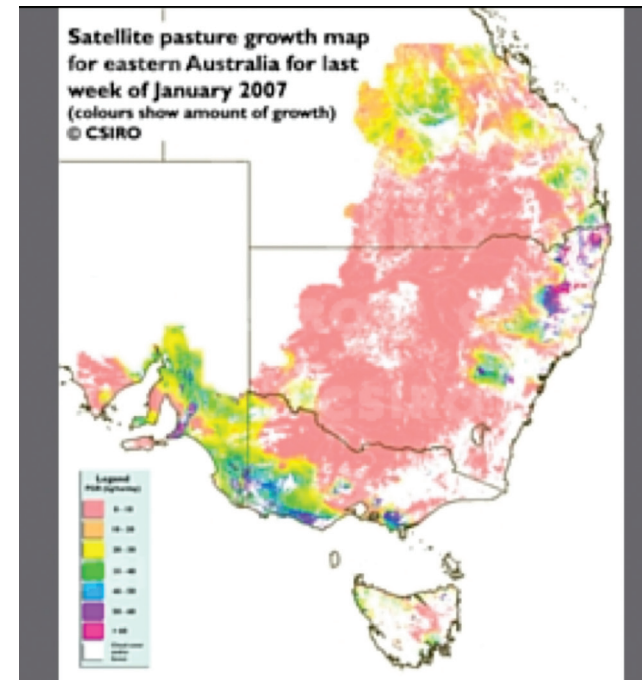
Quad bike fitted with ultra sound Sward Height Measurement Tool



## 7. Satellite Images

Research organisations in many countries including New Zealand and Australia are evaluating the use of satellite images to assess pasture growth. This technology has great potential for use on hill country but there are numerous technical barriers (e.g. slope, variation in pasture, cloud cover) to overcome.

Example of Satellite Pasture Growth Map



## 8. Three Leaf Method

Three leaf grazing is based on research that shows the optimal time to graze ryegrass swards under rotational grazing is when the plants have 3 live leaves. Rest and graze times are based on counting and averaging the number of live leaves.

### THREE LEAF GRAZING METHOD

- Pick ten ryegrass plants in the field that the stock are about to graze.
- Count the number of new leaves on each plant and record; ignore any leaves previously grazed, identified by cut ends.
- Work out the average number of leaves/tiller.
- Re-graze when the number of live leaves per plant averages as close to 3 as possible.
- Where there are less than 3 live leaves, the time taken to reach this stage can be estimated:

**STEP 1** Calculate leaf appearance rate

= number of days since last grazing / the number of leaves per plant

**STEP 2** Multiply result by 3 to get the average time for a plant to produce three leaves – indicating when it should be ready for grazing.

### REMEMBER

- Measurements are only a guide, no method gives an absolute measure and each has its merits. **The relative change in readings is as valuable as the measurements e.g. when calculating grass daily growth rate.** The greater the number of measurements the more accurate the results. Measurements do not take into account the **quality** of the sward i.e. dry dead material is low feed value.

*Further information about grazing measurement and systems can be found in the following Farming Connect Factsheet publications:*

*Grazing Systems*

*Calibrating platemeters for better grass measuring*

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