

Measuring pasture dry matter production - for farmers

Measuring pasture dry matter (DM) production is an invaluable tool to help monitor feed supply throughout the year. Data can be collected as a one-off exercise or, if done over an extended period, it can be accumulated and summarised by season and, eventually, by year.

There are a variety of methods available for doing this e.g. by

- using a plate meter,
- a pasture probe or
- the “cut and dry” method.

Using a plate meter or a pasture probe is adequately described elsewhere but the cut and dry method (destructive sampling) is described here. It involves clipping a sample of pasture from a known area, drying it in an oven or microwave and finally recording the weight when fully dry. From the dry weight of the sample, the yield can be calculated as kg DM/ha. The samples that are taken for drying can be cut from an area of the paddock that is protected by gates or similar, or by an enclosure cage that has been positioned earlier. If using gates, it is important to clearly mark the exact area where the pasture has been cut from within the gated area because it can be very difficult to relocate this area when it is time for the next cut, after regrowth has occurred. It is also most important to secure the gates to the ground with waratahs or similar because sheep, and especially cattle, can easily move the gates.

An enclosure cage (Plate 1) protects the herbage growing within the cage from being grazed, but it must also be secured to the ground to avoid being moved by the stock. One peg in diagonally opposite corners is usually enough to stop sheep shifting the cage. However, if cattle are grazing in the paddock, a half-length flat standard in each corner is best, and securing the standards to the cage with cable ties gives added protection. Don't underestimate the effect of stock rubbing on the cage or gates.

To stop cattle from having direct access to the cage it can be positioned near to a fence line that already has a hot wire and ring fence the cage. Avoid positioning the cages in non-representative areas of the paddock – the selected area for the cage needs to represent the paddock “average” or the data won't be of much use when feed budgeting (i.e. avoid, stock camps, tracks, gateways, toughs, etc.). An alternative is to ring fence and use a solar powered unit to hot up the wires, as shown in Plate 2. In this example note that the two hot wires have been positioned so that cattle are excluded but sheep can still get under to graze right up to the cages. Also the waratahs have an alkathene sleeve with a hot wire spiralled around them to reduce the chances of the cattle rubbing on them.

All stock will show an interest in the cage and it can become a congregation point. Generally, sheep won't do too much permanent trampling damage around the cage site but cattle can and will unless they are fenced off, especially on lowland irrigated pastures.





Plate 1: An example of an enclosure cage. Note the sloping sides which allow the cages to be stacked for transport and the short pins sticking out at each corner, which prevent the cages jamming together when they are stacked and being transported.



Plate 2: Two poliwire surrounding 2 enclosure cages to keep cattle away from the cages. Power is supplied by a solar powered electric fence unit.

Site selection and sample cutting

Select a site that is as representative as possible of the whole paddock to be measured, avoiding obvious urine patches and uneven ground. Before placing the cage for the first time, all herbage must be removed from an area the size of the cage to a height of 1 – 2 cm above ground level and discarded. (record the pre-trim height – this will be the height you harvest to later to determine how much has grown). This can be done with a pair of cheap hand shears (Plate 3 (right) – cost about \$35) or if there is a plan for the cutting to be done on a more regular basis, there are cordless sheep clippers available for about \$500 (Plate 3 (left)) which do an excellent job and make sampling much easier and quicker. After the pre-trim, place the cage on the cut site and install the pegs/standards.



Plate 3: Examples of grass cutting equipment. On the left is a cordless, sheep clipper and on the right a set of hand, grass shears.

For subsequent cuts, the whole cage area can be cut (again to 1 – 2 cm) or a quadrat (of a known area - usually measuring 60 cm x 33 cm = 0.2 m²) can be used to give an exact, smaller area to be cut. There are pros and cons for both systems. The former method is a bit more work in the long run with slightly more challenging calculations required but gives a smaller sample (after sub-sampling) to be dried, which can save precious time in the kitchen later. If the entire cage is cut, the dimensions of each cage must be measured and recorded and the whole cut sample must be weighed fresh in the field. Then a weighed, 100 g representative sub sample must be taken for drying to establish the dry matter % of the sub sample. The remaining cut sample can then be discarded. A set of electronic kitchen scales accurate to 1 gram are ideal for this weighing. The weighed sub samples can be accumulated in the field by placing in a chilly bin with an ice pack inside to reduce their deterioration before being dried later.

If a quadrat is used, place the quadrat over the most representative portion of the pasture within the cage. The quantity of pasture cut from the quadrat will determine whether the entire sample is retained for drying, (in which case it does not need to be weighed green) or, if the sample is larger, the same sub-sampling method described above can be used. These



quadrat cuts can also be accumulated in a chilly bin. After bagging the sample cut from the quadrat, the rest of the area within the cage must be cut down to a similar level as the quadrat cut and discarded, so at the next cut the quadrat can be placed anywhere within the cage.

Drying the samples

All cut samples need to be dried to enable calculation of the dry matter yield for the pasture being measured. The drying can be done in any type of oven but best to avoid meal preparation time!! If using a microwave, place a mug of water in the oven at the same time to remove the risk of the sample catching fire. Similarly, any temperature over 175 °C in a standard oven risks burning the sample. A pasture sample of 100 g will only require about 3 minutes in a microwave to get to the “crisp” stage of dryness but will take longer in a standard oven. Larger samples will take proportionately longer to dry in both oven types. However more samples can be dried at the same time in a standard oven at about 100 °C. Whichever oven type is used, the samples should be weighed after several minutes drying, then returned to the oven. Samples are not completely dry until two consecutive weights are the same.

Note: ensure there is no soil in the sample prior to drying

Calculating the kilograms of dry matter per hectare

Whole cage cut method

Remember the fresh weight of the whole and sub-samples should have been recorded at harvest time. The first thing to determine is the dry matter % of the sub-sample

$$\text{Dry sample wt (g) / fresh sample wt (g) x 100}$$

Then this DM% is applied to the whole green weight

$$\text{Whole fresh wt (g) x DM\%}$$

Eg 1: Whole fresh wt = 1300 g
Sub-sample fresh wt = 103 g
Sub-sample dry wt = 15 g
DM% = $15/103 \times 100 = 15\%$
DM (in whole sample) = $1300 \times 15\% = 195 \text{ g}$

If the cage measures 1.0 m by 0.75 m, this is an area of 0.75 m². To calculate the kg DM/ha, divide the DM calculated above by the area, 0.75. Then divide by 1000 to convert from grams to kilograms and then multiply by 10,000 to convert from m² to hectares

$$\begin{aligned} \text{kg DM/ha} &= 195 / 0.75 / 1000 \times 10,000 \\ &= 2600 \text{ kg DM/ha} \end{aligned}$$



Quadrat cut method

If the sample has been cut from a quadrat and has been sub-sampled, the same procedures and calculations described above apply. However if no sub-sampling has been done, and because the cut sample has come from a known area, no fresh weights need to be taken and the calculation is shorter

$$\begin{aligned}\text{Eg 2: Dry wt} &= 52 \text{ g} \\ \text{Quadrat area} &= 0.2 \text{ m}^2 \\ \text{kg DM/ha} &= 52 / 0.2 / 1000 \times 10,000 \\ &= 2600 \text{ kg DM/ha}\end{aligned}$$

Quick Summary

- Choose an area to cut that is representative of the whole paddock.
- Protect the chosen sampling site with either gates or a cage to exclude grazing stock.
- Either cut the whole area within the cage or just cut a quadrat from within the cage.
- Sub-sample if the whole cage is cut and weigh both samples fresh.
- Dry samples in oven until 2 consecutive weights are the same.
- Follow equations above for calculation of kg DM/ha.

Remember

- This process does not require a peer-reviewed, replicated, published science paper level of accuracy. This is farmer level science - indicative accuracy only required.
- There will be more variation in the site you choose than the small variations in cutting level or drying techniques of 1 or 2%.
- It is likely that to justify any decisions to change your management, species etc. will require differences in yield of, say, 25%.
- It's best to over design your stock exclusion system because one cage moved by stock can prejudice a whole seasons work.
- Whatever you do, it will be hugely more accurate than your best guess or conventional wisdom.

