Protocols for collecting herbage samples in the field - for research

Taking herbage samples in the field

Herbage samples are collected for a variety of reasons. Usually determining the dry matter (DM) present in the paddock or plot is the prime motivation, but it can also be for botanical composition and chemical analysis of the pasture. If the herbage sample collection will be on-going, a decision needs to be made as to whether an exclosure cage is needed or not. An exclosure cage is used if livestock of any sort are likely to be grazing (either rotationally grazed or set stocked) in the same paddock as the pastures being monitored. The cage will protect the herbage growing within the cage from being grazed, so must be securely fastened to the ground to avoid being moved by the stock. Obviously, if there is not going to be any stock in the paddock being measured, there is no need for a cage.

There are several techniques for pinning the exclosure cage to the ground:

1. Bang a hooked, steel peg approximately 30 cm long, into the ground at two diagonally opposite corners of the cage. This method is normally adequate wherever sheep are the only stock that will be able to contact the cage.
2. Bang a peg into the ground at each corner on one of the long sides of the cage and a 3rd peg in the middle of the other long side, so three pegs per cage.
3. Bang one peg into the ground at each corner of the cage, making four pegs in total.
4. Bang a half-length flat standard or waratah into the ground at each corner of the cage and use substantial cable ties to secure the cage to them.

The exact site to place the cage must be chosen with great care. The closer the site is to accurately representing the quantity and quality of the pasture in the whole paddock, the greater the integrity of the data that will come from the process.

One important thing to be aware of is the potential damage to the pasture immediately around the cage by any grazing stock. This is not normally an issue with sheep but cattle often use the cage as a congregation point. This high stock density can lead to pugging and consequent plant death, especially in intensively grazed, irrigated paddocks. This can be mitigated to an extent by putting an electric fence wire around the cage site.

If a cage is required, the next decision is whether to move the cage to a new site after each herbage cut or leave it where it is at each successive harvest.

i) If the cage is to be moved, the herbage grown since the cage was placed at this position needs to be harvested. This is best done by placing a quadrat (usually

measuring 0.2 m^2, with dimensions of 60 cm x 33 cm) over an area that is representative of the pasture within the cage and cut to within about 1 – 2 cm of the ground, then put the cut herbage in an appropriately labelled bag. An alternative is to cut the entire cage (as long as the dimensions of each cage are measured) and either retain the whole sample and take in for drying or to weigh the entire sample as is in the field and bag a representative sub sample of 100g to be taken in for drying. The cutting can be done with a pair of manual hand shears or a set of electric or battery powered clippers. The more recently available cordless battery powered ones are much more practical, light and very effective, but it pays to have a spare, fully charged battery available. The herbage growing at the new site selected for the cage must be trimmed down to the same height as the quadrat cut area and the trimmings discarded before the cage is re positioned and pegged down. This is most easily done with a standard lawnmower if the site is accessible enough and not too stony. Otherwise the same clipper that was used for cutting the quadrat can be used.

ii) If the cage is not being moved at each harvest, either of the 2 cutting methods described above can be used. If the quadrat method is used, the quadrat cut needs to be done first and put in a labelled bag. Then the remaining area within the cage has to be cut to the same level, the trimmings discarded and the cage re-pinned in the same spot. This trimming can also be done either with a lawnmower or a clipper.

> **Note: for research we do not endorse this method**. Keeping the cage in a fixed location over multiple rotations means you will effectively be documenting the effect of "cutting" as pastures under grazing regrow with a different canopy structure and composition to those under direct grazing. The result over time is likely to be non-representative of the pasture outside the cage. Additionally, the camping behaviour surrounding the cage can be exacerbated. The death of plants immediately surrounding the cage leaves bare compacted ground. This means more access to light, water and nutrients for plants protected within the cage.

Processing the herbage samples

The next step in determining the dry matter yield of the paddock is to dry the herbage that has been cut, weigh it and then use that dry weight to calculate the kilograms of dry matter per hectare (kg DM/ha).

i) If the whole exclosure cage has been cut, the quantity of herbage will be large and will need to be sub sampled. First though the total sample needs to be weighed fresh. This can be done by placing the cut herbage in a tared bag and weighing on a set of scales accurate to at least 10 grams. Record the weight, then empty the herbage on to the ground or the deck of a ute. Randomly select several small handfuls of herbage and place in a smaller, labelled bag and weigh again. The remaining herbage can be discarded. This procedure should be done for each cage cut. The sub samples can be accumulated in a chilly bin with an ice pack and then dried in a forced-air drying oven at 65 °C or a microwave when back at the lab. If using a microwave, it is important to place a cup partly filled with water in as well. The sample will take much longer to dry

in the oven than the microwave. In both cases weigh the sample after a period of time, this time on a set of scales preferably accurate to 1 gram, then put back in oven. After another period of time, weigh again. Continue this cycle until consecutive weights don't change, meaning the sample is completely dry. If drying in an oven the sample should be left in for at least 24, and preferably 48, hours but in a microwave it could take as little as 3 minutes.

ii) If only a quadrat size cut is taken from within the cage, the quantity of herbage will be less but may still need to be sub sampled. The same procedure as above applies. If sub sampling is not required, no fresh weights need to be taken because the area of the quadrat from where the herbage was cut is known.

Calculating the dry matter yield (kg DM/ha)

i) If the whole exclosure cage has been cut, the calculation to determine the dry matter in the whole sample is:

Sub sample dry weight/subsample wet weight x whole sample wet weight

Then to calculate the kg DM/ha, convert the weight from grams to kilograms and multiply by the area of the cage as a proportion of a hectare.

Example 1: Whole sample wet weight = 1550 g

Sub sample wet weight = 300 g

Sub sample dry weight = 45 g

Cage area = 0.8 m^2

Calculation: 45/300 x 100 = 15%

1550 x 15 = 232 g DM/0.8 m^2

232/0.8 = 290 g DM/m^2

290 /1000 = 0.290 kg DM/m^2

0.290 x 10,000 = 2900 kg DM/ha

ii) If a quadrat has been used, the wet weight is not needed because the sample won't need sub-sampling. Simply dry the entire sample, weigh and calculate the kg DM/ha by the same method as above.

Example 2: Whole sample dry weight = 65 g

Quadrat area = 0.2 m^2

Calculation: 65/0.2/1000 x 10,000

= 3250 kg DM/ha

There is a shortcut method for calculating kg DM/ha when the sample has been cut from a known area. It uses a factor based on the known area:

Area cut (m^2)	Factor to use as multiplier of dry weight of herbage
0.1	100
0.2	50
0.3	33.3
0.4	25
0.5	20
0.6	16.7
0.7	14.2
0.8	12.5
0.9	11.1
1.0	10
1.1	90.1
1.2	8.3
1.3	7.7
1.4	7.1
1.5	6.7

E.g. 1: If sample dry weight is 232 g DM and the cage measures 0.8 m^2, the calculation is 232 x 12.5 = 2900 kg DM/ha

E.g. 2: If sample dry weight is 65 g DM and the quadrat measures 0.2 m^2, the calculation is 65 x 50 = 3250 kg DM/ha