

This guide outlines good practice where maize forage is sold on a dry matter basis. It is a summary of the information contained in the Code of Practice for the Trading of Maize Forage.

In this guide, the term **forage** means fresh material prior to ensiling. The **wet weight** is the weight of a quantity of fresh forage including the moisture it naturally contains. **Dry matter** is the weight of forage after the moisture has been removed. A **sample** is a representative quantity of forage material that is suitable for dry matter analysis, and a **composite sample** is one that is produced by combining several samples together to create one overall sample. The term **stack** includes stacks formed on top of the ground and a pit or bunker that has walls to contain the forage.

When forage is traded on a dry matter basis, the grower, contractor and buyer all want to know the actual amount of dry matter involved. Forage trading also involves significant financial transactions.

Accurate measurement of dry matter requires:

- Accurate weights of each truckload harvested (wet weight).
- Representative samples for analysis from trucks or stacks.
- Accurate laboratory tests to determine the dry matter percentage (DM%) of those samples.

Weighing

Weighing and measuring equipment used for trade must be of an approved type (Weights and Measures Act 1987). The term **use for trade** means any weighing or measuring instrument that is used to determine a quantity, which is used to establish the basis for a financial transaction between two parties. Equipment approvals are carried out by the Measurement and Product Safety Service (MAPSS) of the Ministry of Consumer Affairs.

Each weighing device must have a mark of verification stamped on it. In addition MAPSS strongly recommend that weighbridges are tested annually and issued with a Certificate of Accuracy. Verification and accuracy testing can only be carried out by an Accredited Person (someone approved by the Ministry to test weighing and measuring equipment in compliance with weights and measures legislation).



A Certificate of Accuracy assures buyers that the weighbridge has been independently tested.

Portable weighbridges must be used according to the manufacturer's instruction manual and the conditions set by the Ministry of Consumer Affairs in their approval of the weighbridge for trade use. This will cover things such as set up and levelling of the weighbridge and correct operating procedures. A copy of the conditions can be obtained from the manufacturer or the Ministry. Buyers must be provided with a delivery note, invoice or weighbridge ticket stating the net weight of the forage delivered.

The Measurement and Products Safety Service has several advisory fact sheets available and can be contacted with queries by phone (0508 627 774) or by visiting: www.consumeraffairs.govt.nz

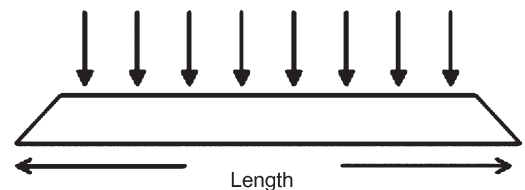
Stack Sampling

Stacks can be sampled once they are completed (and before covering), using an auger corer, the approved hand held push corer, (a more simple and less expensive option) or by taking hand scoop samples. The auger corer and the push corer have a tube approximately 1.3m long and 45mm in diameter. The auger corer is powered so that the tube rotates and is bored down into the stack. An auger inside the tube removes the maize forage material from the tube and conveys it into a sample bag. The push corer requires no electric power and is simply pushed into the stack in 30cm increments. Both corers produce identical results (FAR research work carried out in 2006).

The hand scoop method involves using one or two hands in a cupped fashion to remove the forage sample. Several scoops are taken from a particular sampling position to make up a sample of approximately 1kg.

When sampling stacks, the important steps are:

- The stack must be sampled as soon as possible after all compaction is finished (and preferably no more than 8 hours after the stack is completed, as the DM% decreases as ensiling progresses).
- Take the samples down the centre line (spine) of the stack at equal spacings over the entire length of the stack (see graph on the next page for number of samples required).



- Remove the top 150 to 200mm of forage before taking a sample, as silage on the stack surface may have lost moisture from evaporation.
- Do not pick and choose when selecting the forage material to be sampled.
- Take enough material from the one sample position to make up a sample that is approximately 1kg.
- Make sure no forage material is lost from the sample bags as they are removed or filled from the corers, or hand scoop. If material is spilled, cob and stover may be lost in differing proportions (and the sample should be discarded).
- Label the samples to clearly identify the stack that they have been taken from. It is good practice to label the sample containers beforehand.
- Follow the manufacturer's instructions so that corers are maintained and used correctly and safely.

Truck sampling

Truck samples are taken by hand scoop from the top of the load or from the load once it has been tipped off. The hand scoop method involves using one or both hands in a cupped fashion to collect the forage sample and with trucks, a composite hand scoop sample is sent for analysis (see below).

Samples from trucks should be spaced out over all loads going to the stack. For example, if there are 40 loads in total and 20 being sampled, then every second truck would be sampled.

There are specific hazards associated with truck sampling. For example, the person taking the sample may need to climb up a truck to access the load, or need to watch out for other vehicles (trucks, stack tractors etc) when sampling a tipped off load. A safe working procedure must be implemented by those responsible for sampling.

When sampling trucks, the important steps are:

- The top 150 to 200mm of forage must be removed before taking a sample from the top of a truck, as the load surface can dry out in transit.
- Take the required number of samples (see graph below). With truck sampling, four samples (each approximately 1kg) are taken, one from each corner (quadrant) of the load and mixed together in a bucket. A single composite sample (approximately 1kg) is taken from the bucket and sent for analysis to provide a result for that truck load. Research has shown that it does not matter where samples are taken from within the load (top, middle or bottom).
- Do not pick and choose when selecting the forage material to be sampled.
- Make sure no forage material is lost from the sample bags as they are filled. If material is spilled, cob and stover may be lost in differing proportions.
- Label the sample containers to clearly identify the truck they have been taken from, the time of sampling and the stack they relate to. It is good practice to label the sample containers beforehand.

Sample numbers

The DM% of maize forage can vary significantly within a crop and the accuracy of the DM% test result will increase as more samples are taken. While accuracy is important, it has to be balanced with the number of samples that can practically and cost effectively be managed. When deciding on a sampling regime, there are several factors to be considered:

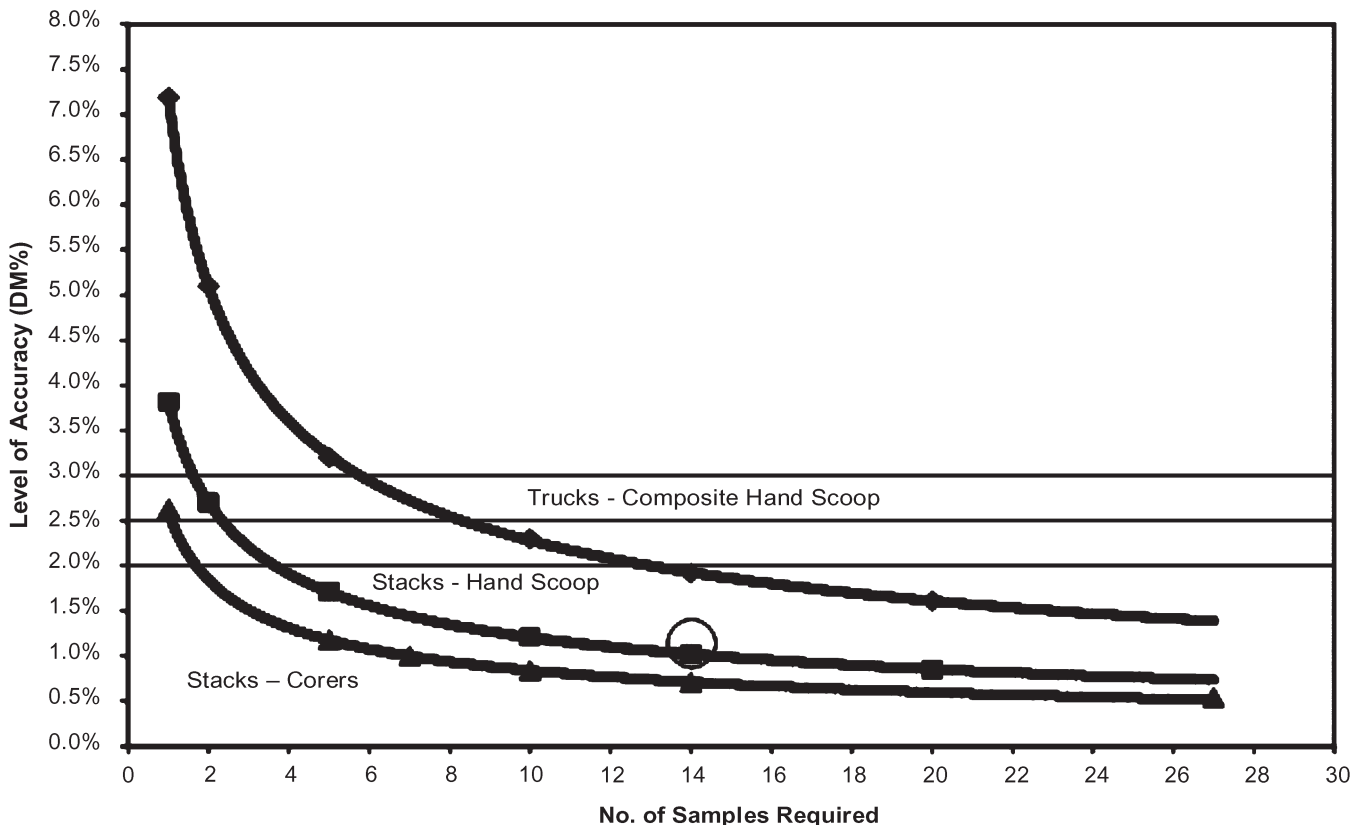
1. What level of accuracy is acceptable to all parties involved?
2. Will samples be taken from stacks (by corers or hand scoop) or from trucks (by hand scoop)?
3. Is the stack sourced from more than one grower? (If this is the case, the samples will need to be taken from trucks.)
4. Is there a need to reduce the number of samples sent for analysis? (See next page for information on sample reduction.)

The graph below shows the level of accuracy that can be achieved with different sampling methods and different numbers of samples taken. Having selected a sampling method and decided on a level of accuracy, the graph can be used to see how many samples need to be taken. **Note that in each case, all the samples taken must be sent for analysis.**

Example:

1. **Samples will be taken from the stack by hand scoop.**
2. **The grower and buyer have agreed on a level of accuracy of $\pm 1.0\%$ DM. This means that if the samples taken result in a stack DM% of 34.5%, the true stack DM% could be as low as 33.5%, or as high as 35.5%.**
3. **Using the graph, it can be seen that 14 samples need to be from the stack to give a 1% DM level of accuracy.**

The sampling regime to be used and the agreed level of accuracy should be stated in contract or purchasing documents.



Sample reduction (sub sampling)

Reducing the number of samples sent for analysis can save on costs of transport and testing. With sample reduction, the original field samples are combined and a sample splitting device or procedure is used to obtain representative sub-samples. Research has shown that a riffle box is the most accurate means of reducing samples.

In a riffle box, the forage is poured into a dividing head and runs through passages that alternately run in opposite directions into two or more collecting trays. The operation can be repeated as many times as necessary until the required sub-sample size has been obtained.

When using a riffle box, the samples must be evenly spread over the entire width of the dividing head. It may be necessary to empty samples into a larger container and pour out of this into the riffle box. The riffle box must be cleaned (brushed out) between each lot of samples.

The tables below show the level of accuracy obtained with a riffle box. Depending on the level of accuracy required, either one or two sub-samples are sent to the laboratory for analysis. If only one sample is sent for analysis, it is recommended that the other sub-sample is retained and immediately frozen in case a further DM test is required.

Example:

1. **Samples will be taken from the stack by either corer types.**
2. **The grower and buyer have agreed on a level of accuracy of $\pm 1.0\%$ DM.**
3. **From Table 3 it can be seen that 10 samples need to be taken from the stack and 2 sub samples from the riffle box need to be sent for testing.**

Table 1: Truck sampling - composite hand scoop

| No. of riffle box samples | Level of accuracy (\pm DM%) | | | | | |
|---------------------------|--|-----|-----|-----|-----|-----|
| | No. of trucks sampled (one composite sample per truck) | | | | | |
| | 1 | 2 | 5 | 10 | 14 | 20 |
| 1 | 7.2 | 5.1 | 3.3 | 2.4 | 2.0 | 1.7 |
| 2 | 7.2 | 5.1 | 3.2 | 2.3 | 2.0 | 1.7 |

Table 2: Stack sampling - hand scoop

| No. of riffle box samples | Level of accuracy (\pm DM%) | | | | | |
|---------------------------|---------------------------------|-----|-----|-----|-----|-----|
| | No. of hand scoop samples taken | | | | | |
| | 1 | 2 | 5 | 10 | 14 | 20 |
| 1 | 3.8 | 2.8 | 1.8 | 1.4 | 1.2 | 1.1 |
| 2 | 3.8 | 2.7 | 1.8 | 1.3 | 1.1 | 1.0 |

Table 3: Stack sampling - corers

| No. of riffle box samples | Level of accuracy (\pm DM%) | | | | | |
|---------------------------|--------------------------------|-----|-----|-----|-----|-----|
| | No. of cores taken | | | | | |
| | 1 | 2 | 5 | 10 | 14 | 20 |
| 1 | 2.6 | 1.9 | 1.3 | 1.1 | 1.0 | 0.9 |
| 2 | 2.6 | 1.9 | 1.2 | 0.9 | 0.8 | 0.8 |

Sample reduction should be carried out in a suitable environment and by competent personnel. This means:

- Exposure of the sample to the environment should be minimised throughout the process (to minimise the effect of heating in the sun, rain, or drying from wind).
- The area should be kept clean to prevent contamination of samples and there should be adequate space available for sample storage and handling.

- Procedures need to be in place to make sure samples from different lots cannot be accidentally mixed, and that sub-samples can be traced to the original field samples.
- Sub-samples should be placed in new sample containers and handled as outlined below.

Sample handling

When air (oxygen) is available, respiration continues to occur in fresh forage material after it has been harvested. This can lead to significant changes in DM%. When handling samples it is important that:

- Samples are placed in containers, packed tightly and have as much air removed from the container as possible before sealing. Plastic bags that are durable and able to be sealed make good sample containers.
- Sample containers are labelled legibly so that the information cannot be lost from the bag, and so that the sample can be traced, to where and when it came from. If labels are placed in the sample container, they should be made from a non-porous material that will not absorb moisture.
- Samples are placed in cool storage ($< 10^\circ\text{C}$) as soon as possible after they have been taken and where they will be protected from damage and sunlight.
- If samples are not going to be analysed within 24 hours of being taken, they must be frozen.
- Any specific instructions on sample handling and submission from the testing laboratory must be followed.

Dry Matter Testing

While determination of dry matter in the laboratory is a relatively simple process, several issues can affect accuracy and reproducibility of results. Recent work has resulted in a standard method which is described in the Code of Practice.



Testing laboratories need appropriate controls in place to ensure that test results are accurate and repeatable. Forage buyers and sellers need to have confidence in laboratory results, and should preferably use a laboratory that has either IANZ (International Accreditation New Zealand) accreditation or ISO9000 certification. If the laboratory is not accredited, there should be specific quality controls in place for dry matter testing. This means:

- Balances should be calibrated against traceable standards.
- Drying ovens should be checked to ensure the internal temperature is correct, and constant throughout the oven drying space.
- Documented procedures should exist for sub-sampling and dry matter testing.
- There should be systems to ensure that samples are identified and tracked throughout the process.

An additional recommendation is that laboratories check their performance by participating in an Inter-Laboratory Comparison Program (ILCP). This involves dividing a bulk sample into a number of equivalent samples and sending one sub-sample to each participating laboratory. The dry matter results are reported back and collated for all laboratories.

Dry matter calculations

The total dry matter is calculated using the wet weight of the forage and the DM% results.

- A. Add up all the wet weights of the loads that relate to the stack or paddock to get a total wet weight (in kilograms or tonnes).
- B. Calculate the average DM% result for the stack or paddock. The average is calculated by adding all results together and dividing by the number of samples.
- C. Multiply the average DM% by the total wet weight and divide by 100 to obtain the total dry matter for the stack or paddock (in kilograms or tonnes).

$$\text{Total Dry Matter} = \text{Total Wet Weight} \times \text{DM\%} / 100$$

Forage Trading Contracts

It is recommended that a formal contract is used for all forage trading. This ensures that all relevant issues have been discussed and agreed upon and the interests of both buyers and sellers are protected. The issues that should be considered include: the quantity of forage and how the dry matter at harvest will be measured; purchase price; crop specification; payment terms; harvest details; quality parameters; inability to supply; termination; mediation and arbitration; and, risk management. This list is not exhaustive and is described in more detail in the Code of Practice.

Trading arrangements should be fair to all parties and traders need to be aware of legislation that impacts on how they deal with buyers.

- Traders must ensure that forage meets certain quality requirements at the time of delivery. Forage cannot contain harmful residues that could end up in primary produce, and cannot have the potential to harm animals in any way (Agricultural Compounds & Veterinary Medicines Act 1997 and Regulations).
- The Fair Trading Act 1986 protects buyers against being misled or treated unfairly by traders. The Act applies to all people in trade and it cannot be contracted out of.
- The Sale of Goods Act 1908 applies to goods sold that do not fall within the Consumer Guarantees Act (such as forage) and gives the buyer rights to a refund and compensation in certain circumstances.

It is recommended that legal assistance is obtained to prepare the final contract document.

Forage contracts help avoid disputes. Disputes are also less likely when:

- The practices recommended in this guide are followed.
- There is good communication during the crop growing and harvesting periods.
- When any problems that do occur are resolved quickly rather than letting them drag on to become disputes.

With any dispute, the initial approach should be to communicate with the other party (either in writing or verbally) and to try to negotiate a resolution. It may be useful to obtain professional help, e.g. a farm consultant, to help with this process. Disputes should be dealt with under the contract between the parties. If a dispute occurs and there is no written contract, the parties may still agree to refer their dispute to mediation and/or arbitration.

The Disputes Tribunal is another option. A Tribunal Referee helps both parties try to reach an agreement and can deal with claims up to \$7,500 (or up to \$12,000 if both parties agree). Information on the Disputes Tribunal process can be obtained from the local District Court.

As a last resort, if negotiation, mediation or arbitration has failed (and the amounts involved are over \$12,000), proceedings can be filed with a Court. Where the issues concern fraud or criminal intent, the Courts are the only avenue.



For further information on forage trading or to obtain a copy of the Code of Practice for the Trading of Maize Forage contact the Forage Trading Development Group:

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