Stubble Management Guidelines



Stubble — if you don't measure it you can't manage it. Photo: UNFS

Measuring stubble loads in the field is the first step in managing the impacts of stubble loads following harvest.

A clear understanding of how much stubble remains in the paddock post harvest enables appropriate and economical stubble management practices to be implemented.

Monitoring stubble loads can be a useful tool to determine:

- summer feed budgets for livestock
- impacts on sowing, including machinery blockages, nitrogen tie-up, herbicide efficacy and plant establishment
- potential soil erosion risk post-harvest "No till with no stubble is no good."

Stubble loads vary from season to season and from crop to crop. The treatment at harvest, volume of breakdown over summer and amount grazed by livestock also affects total stubble loads and condition.

Field monitoring leading up to harvest provides guidance on the strategies to employ for effective stubble management, while still leaving adequate soil cover to prevent erosion. This proactive approach also will limit the negative impacts of stubble retention on the following season's sowing operations and early crop establishment and vigour.



Monitoring stubble

Key facts

- » Monitoring stubble loads before and at harvest allows informed decisions to be made about how to best manage stubble loads post-harvest.
- Stubble loads can impact on feed budgets, sowing operations and subsequent crop establishment and early vigour.
- » Assess both stubble loads and ground cover when monitoring stubble.
- » Assessments can be carried out using a harvest index, photo standards or in-field measurements.

Project information

This *Monitoring stubble* guideline has been developed for the Upper North Farming Systems Group (UNFS) as part of the Maintaining Profitable Farming Systems with Retained Stubble Initiative, funded by the Grains Research and Development Corporation (GRDC UNF00002).

The Stubble Initiative involves farming systems groups in Victoria, South Australia and southern and central New South Wales, collaborating with research organisations and agribusiness, to address challenges associated with stubble retention.

The GRDC, on behalf of growers and the Australian Government, is investing \$17.5 million in the initiative that has been instigated by the GRDC Southern Regional Panel and the four Regional Cropping Solutions Networks that support the panel.







What to look for when monitoring stubble

There are two primary elements to stubble monitoring:

- stubble load (volume of dry matter)
- ground cover (volume of material covering the soil surface).

The distribution and condition of stubble residues are also important factors to consider.

Stubble load is the total kilograms per hectare of stubble matter or crop residue remaining in the paddock.

Stubble load affects sowing operations and nutrient availability to the subsequent crop. The condition, (i.e. standing, rolled) and the amount of chaff or chopped stubble and its distribution behind the header also affects livestock accessibility to stubble nutrients, speed of breakdown and ease of sowing operations.

Ground cover is the amount of plant material (dead or alive) covering the soil surface. It is usually expressed in percentage terms — 100 per cent ground cover means the soil cannot be seen and 0% ground cover is bare soil. Ground cover is particularly important when assessing risk of soil erosion.

How do I monitor stubble?

There are three primary methods to monitor stubble loads (and assess ground cover):

- harvest index (HI) estimates
- photo standards
- in-field measurements

Harvest index (HI) estimates

Stubble management starts at harvest. An HI can be used to estimate stubble loads from estimated grain yield. This index is the ratio of grain yield to total above-ground biomass. For wheat the HI generally ranges from 0.3-0.5.

There can be large variations in HI depending on factors such as seasonal conditions, crop variety, soil type and fertility, fertiliser and lime use, disease levels and weed competition.

Research carried out by the Agricultural Machinery Research and Design Centre at the University of South Australia, showed wheat stubble levels amount to 1.3-2.8 times the grain yield, and start to create handling problems from stubble levels of 3-4 t/ha.

Photo standards

Photo standards can be used to compare actual stubble residues with a photo standard to estimate stubble loads.

After harvest, walk across the paddock looking at the stubble, estimate stubble loads at 10 or more random points, comparing the actual stubble with the photo standards shown in Figure 1 (do not avoid bare area or areas with uneven levels of stubble). Average the 10 estimates to gain an estimate of the stubble load in the paddock.

Stubble loads can be difficult to estimate where row spacings, harvest heights and crop types vary.

In-field measurements — stubble load

Using a $0.1m^2$ quadrat (30cm x 30cm square), cut stubble to ground level and collect loose straw and chaff off the ground. Repeat this 10 times along a path or transect across the paddock to enhance accuracy of the calculations. Combine all cuts and weigh the material. This will give stubble loads from $1m^2$.

A subsample (e.g. 100g) can be dried to calculate dry matter percentage (DM%), but stubbles are generally 95% DM. If the measurements are taken after rain or dew this may vary significantly.

Stubble load (kg DM/ha) = $1m^2$ quadrat average wet weight (g) x DM% x 10 (convert to kg/ha)

EXAMPLE: average wet weight in a $1m^2 = 300g$

Stubble load (kg DM/ha) = 300g x 95%

- = 285g DM/m²
- $= 285 \text{g DM/m}^2 \text{ x 10,000 (m}^2 \text{ to ha}) \div 1000 (\text{g to kg})$
- = 2850kg DM/ha

In-field measurements — ground cover

A handy method to estimate ground cover is to stand in a representative area of the paddock with feet 50cm apart. Imagine a square quadrat (50cm × 50cm) in front of your feet, look down and estimate the percentage of area covered by plant material. Do this 10 times across the paddock and average the results. Alternatively use a quadrat as described above.

It is often easier to estimate the percentage of bare soil and convert this to percentage ground cover than it is to estimate the ground cover itself.

There are a number of smartphone applications in development to assist in assessing ground cover. An easy-touse option is the Ground Cover App produced by the Local Land Services North West. Using the Basic Assessment Tool users walk a transect and record what they see at their toes with each step. This then gives a percentage ground cover. It is important if using a tool like this to ensure you go across the stubble rows and not along the rows!



Stubble loads can be difficult to estimate where row spacings vary. Photo: UNFS



Monitoring stubble

Figure 1. Photo standards for estimating stubble load in wheat and barley



Wheat stubble 30cm row spacing 0.9t/ha



Wheat stubble 18cm row spacing 2.2t/ha



Wheat stubble 23cm row spacing 2.3t/ha



Wheat stubble 30cm row spacing 2.2t/ha



Barley stubble 18cm row spacing 3.2t/ha



Barley stubble 25cm row spacing 3.3t/ha



Barley stubble 30cm row spacing 3.3t/ha



Wheat stubble 30cm row spacing 4.4t/ha



Barley stubble 30cm row spacing 5.1t/ha Photos: Brett Masters (PIRSA Rural Solutions SA)



Barley stubble 25cm row spacing 5.5t/ha



Wheat stubble 18cm row spacing 6.0t/ha





Photo standards can also be used to assess ground cover. Make a 30cm x 30cm quadrat (square) out of sturdy cardboard or wire (this quadrat is used to help focus the eye on a defined area for assessment.)

Along a pre-determined transect line, throw the quadrats out at random and visually assess the groundcover in the quadrant, comparing it with the photo standards shown in Figure 2).

When should I monitor my stubble?

The amount of stubble and its condition will vary throughout the fallow period depending on the management of the paddock. It is important to monitor the stubble load, ground cover and its condition before implementing any stubble management and, in the case of grazing, regularly throughout the treatment. The condition and amount of stubble can deteriorate rapidly under certain climatic and management conditions.

Have a clear understanding of how much stubble is desired at sowing and in what condition it needs to be in to ensure sowing is hassle free, pre-emergent herbicide efficacy is optimised and the desired plant establishment can be achieved, all while protecting soils from erosion. Figure 2. Photo standards for estimating ground cover



Pea stubble 25% ground cover



Pea stubble 75% ground cover Photos: Brett Masters (PIRSA Rural Solutions SA)



Pea stubble 50% ground cover



Pea stubble 100% ground cover

What else do I need to consider when monitoring my stubble?

How stubble is managed affects the distribution and condition of the stubble. This can have a significant effect on the next season's growing conditions.

Not all stubble is the same. This is particularly the case when considering stubble as a feed source for livestock.

While undertaking stubble load and ground cover assessments keep an eye out for the following:

- Uneven chaff distribution by the header can lead to nitrogen (N) tie up, areas of increased weed seed bank and clumping in the sowing equipment.
- Lodged stubble and excessive stubble heights result in hair pinning during sowing and reduced plant establishment.
- Weeds may become tangled in the sowing equipment.
- Consider break down of the stubble during summer.
 Above average rainfall can result in higher rates of stubble breakdown, especially in legume crops. As a rule of thumb, 20 per cent breakdown can occur with

low-quality dry feed and little summer rain. Average breakdown is 30–40 per cent. More than 50 per cent breakdown can occur with high-quality feed and above-average summer rains.

Keep in mind that standing stubble has limited feed value for livestock. Although a paddock may still have sufficient cover and DM, the nutritional value will deteriorate in a stubble paddock rapidly after spilt grain and leaf and chaff matter has been consumed. Cereal stubbles vary in their nutritional content depending on seasonal conditions. In dry seasons with minimal stubble loads nitrogen content of the stubbles is often high, leading to high palatability and rapid break down. In highproduction seasons, when grain yields are high, most nitrogen is moved out of the straw into the grain leaving low levels of nitrogen, making the stubbles relatively unpalatable and slow to break down. Understanding the feed quality of stubbles will improve the profitability of livestock enterprises.



Monitoring stubble

Additional stubble monitoring resources

- » Good stubble or bad stubble (CWFS).
- » Ground Cover measuring tool (Agriculture Victoria). Click
- Hunt, N and Gilkes, B (1992)
 Farm monitoring handbook.
 University of Western Australia,
 Nedlands Western Australia.
- » Primary Industries South Australia, 2003, Andrea Francis Rural Solutions SA, Richard Payne DWLBC, Fact sheet no: 8/01. Field methods for measuring soil surface cover.
- » Primary Industries South Australia, 1996, *Pasture Pics: easy estimation of pasture dry matter levels*, Appila / Bundaleer Pasture Group, Appila, SA.

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A range of useful resources are available to guide accurate stubble monitoring calculations. Photo: UNFS.

Disclaimer

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