LEADA

Stubble Guidelines

Assessing Stubble and Management Options on Lower Eyre Peninsula:

A guide to maintaining profit and limiting negative impacts of stubble retention

Local Management Guideline for the GRDC Stubble Initiative Project (LEA0002)

It is important to be clear about what your objectives for stubble retention are, so that these aims can always be assessed against the costs. Retaining stubble doesn't have to be an all-or-nothing decision. Striking the balance between benefits and costs in any given season will ensure profit maximization over the long term.

The main aims of retaining stubble

Soil protection (from wind and water erosion)

Stubble cover of 60-70% protects topsoil from erosion. Standing stubble is more effective at reducing wind speed and should be adopted on lighter soils. Where water erosion is a concern, have a greater proportion of surface/mulched stubble to reduce impacts of raindrops on the soil surface and increase infiltration.

It is important that management actions that reduce stubble load early in summer do not result in insufficient cover later in summer. Light grazing, cabling and rolling on LEP stubbles will generally maintain sufficient cover come seeding time.

Moisture conservation

Moisture conservation in stubble retained systems is highly variable. Surface residues will delay but not stop evaporation of surface water. In summer, where evaporation is high, it is unlikely that moderate rainfall will be conserved even by the heaviest stubble. Where follow-up rainfall occurs soon after, or where the initial rainfall is substantial, soil water can be driven lower in the profile where it may be conserved. Surface residue at seeding and through autumn is beneficial, especially with sporadic opening rains, where cover delays drying out of the seedbed long enough to allow germination and establishment. At this time of year a moderate amount of retained stubble (3 t/ha) is likely to reduce evaporation.

Nutrient	Wheat Stubble (4 t/ha)	Canola Stubble (3 t/ha)	Lupin Stubble (3 t/ha)
Nitrogen	20 ($26)	12 ($15.60)	27 ($35)
Phosphorous	2 ($7)	9 ($31.50)	2 ($7)
Potassium	60 ($78)	75 ($97.50)	60 ($78)
Sulphur	2 ($1.60)	3 ($2.40)	2 ($1.60)

Table 1 - Approximate nutrient content of some crops commonly grown on the LEP in kg. Indicative estimate of nutrient value in brackets

Nutrient retention

Table 1 gives an approximate proportion and dollar value of nutrients contained in stubble. The flow of nutrients in farming systems depends on management actions. For instance, burning stubble will almost totally remove nitrogen, carbon and sulfur (80-100% removal) whilst retaining a larger proportion of phosphorous, potassium and calcium. Grazing removes some of these nutrients but some is released back to soils through microbial breakdown of manure.

Soil Organic Carbon

Soil organic carbon (SOC) is a key driver of nutrient mineralization. Furthermore, soil organic matter, from which SOC is derived, plays an important role in soil aggregation and development of soil structure. However, recent evidence suggests the gains in SOC expected to arise as a result of stubble retention have not materialized and are unlikely to do so without further intervention.

Research undertaken on the LEP as part of the New Horizons project is demonstrating considerable

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benefits of organic matter incorporation on lighter soil types. Whilst the exact drivers of yield increases associated with organic matter incorporation are still being studied, those farmers who are able to handle more stubble may choose to do so for this reason.

Assessing the crop/stubble to determine what action will be required

Once your reasons for retaining stubble are clear, deciding how to manage crop residues to achieve the desirable characteristics is the next step. This starts with assessing the crop.

On the LEP a 4 t/ha wheat crop often produces upwards of 6 t/ha of residue in any one season. Where this residue is not broken down fully over the previous year, the combined stubble mass often exceeds 10 t/ha.

Other considerations at this stage may be variety or seasonal effects. What you're left over with after you harvest 'just below the heads' may differ from season to season, or from variety to variety. This may influence how you want to handle your stubble management overall.

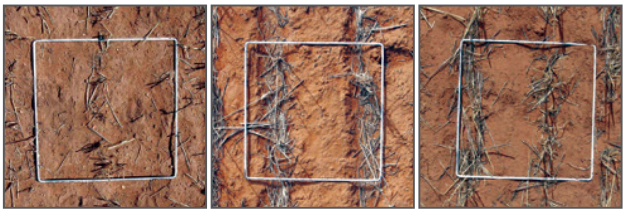
If unsure of the stubble load in a paddock post-harvest, it is worth doing a quick assessment. Select an area 50 to 100 m into the paddock where you know the crop was heaviest for that paddock. Collect all stubble from within a standard 30cm x 30cm quadrant used for crop/weed assessments. Repeat this process several times across a full header width to pick up variation from the spreader. Place all samples in a bag of known weight, weigh the bag.

Stubble load is:

STUBBLE LOAD (T/HA)= (SAMPLE WEIGHT (G) – BAG WEIGHT (G)) / NO. OF SAMPLES / 100.

Remember that there is little that can be done to reduce the stubble weight over summer on LEP. If your assessment suggests a stubble load in excess of your requirements (i.e. 3 t/ha for erosion control) and you are concerned about next year's seeding or pest management, then aim to change the characteristics of the stubble (length, orientation, etc.).

Standing Stubble % Cover and Stubble kg/ha estimates



20% cover = 450kg/ha *30% cover = 720 kg/ha* *40% cover = 1000kg/ha*

50% cover = 1400kg/ha *60% cover = 1800kg/ha* *70% cover = 2400kg/ha*

80% cover = 3300kg/ha *90% cover = 4000kg/ha* *100% cover = 6000kg/ha +*

No photo but no soil visible

Wheat Yield t/ha	4.0	3.6	3.2	2.8	2.4	2.0	1.6	1.2	0.8
Stubble Yield t/ha	7.4	6.7	5.9	5.2	4.4	3.7	2.9	2.2	1.5
Barley Yield t/ha	3.8	3.4	3.0	2.6	2.2	1.3	1.4	1.0	0.6
Stubble Yield t/ha	6.8	6.0	5.3	4.6	3.9	3.2	2.4	1.8	1.0
Oat Yield t/ha	2.0	1.8	1.6	1.4	1.2	1.0	0.8	0.6	0.4
Stubble Yield t/ha	6.0	5.4	4.8	4.2	3.6	3.0	2.4	1.8	1.2
Canola Yield t/ha	2.2	2.0	1.8	1.6	1.4	1.2	1.0	0.8	0.6
Stubble Yield t/ha	8.8	8.0	7.2	6.4	5.6	4.8	4.0	3.1	2.3
Lupin Yield t/ha	2.0	1.8	1.6	1.4	1.2	1.0	0.8	0.6	0.4
Stubble Yield t/ha	6.0	5.4	4.8	4.2	3.6	3.0	2.4	1.8	1.2
FabaBean Yield t/ha	4.6	4.2	3.8	3.4	3.2	2.8	2.4	2.0	1.6
Stubble Yield t/ha	9.4	8.6	7.8	7.4	7.0	6.2	5.7	5.1	4.4

Seeder limitations

Ensuring next year's crops can be sown effectively is the primary concern when making decisions about stubble management. Knowing the limitations of your current or next seeder is important, particularly when seasonal conditions change stubble characteristics.

Tined seeders vary greatly in their trash handling capacity. Problems generally start to arise when stubble exceeds 2 to 3 t/ha. These conditions generally are the minimum on LEP.

A substantial amount of research has shown that stubble handling in tined seeders is largely dependent on 3 factors:

- **Clearance:** Stubble height should be less than 60% of the distance from the ground to the first major obstruction on the tine or bar.
- **Inter-tine spacing:** Stubble should be less than half the distance of any two tine components, in any direction. Thus, having the same number of tines over an extra rank will allow greater straw length to be handled.
- **Tine design:** Straight tines with a slight angle back allow straw to ride up and around. Curved tines or tines that meet the ground at 90 degrees tend to catch more stubble. Narrow, square tines tend to cause long stubble to wrap around.

Disc Seeders rely on their ability to cut through straw. Most discs will go through significant straw provided it is reasonably dry. Inter-row sowing between standing stubble is likely to provide better results. Where stubble is moist and flat, 'hair pinning' occurs, and establishment reductions in the order of 10-30% are reported. A one-off trial on the LEP demonstrated a 13% reduction in plant establishment where a disc seeder was compared with a common tined seeder under wet conditions. Ongoing monitoring on LEP has shown that stubble loads more than 10 t/ha can be successfully sown into with a disc seeder provided conditions are matched to the capacity of the disc seeder.

Tools and technologies for managing stubble

Harvester

This is the simplest, and often most time-efficient, way of managing stubble. Cutting at 'beer can height' and spreading the chopped straw and chaff is still the most common approach on the LEP. However, in heavy stubbles common on LEP, this strategy is likely to increase harvest time, thereby increasing exposure to potential weather damage. An assessment in 2015 over a variety of harvesters showed that raising the cutter bar approximately 150-200mm reduced straw intake by 1.5 t/ha and thus increased harvest speed by an average of 31%, with a 33% fuel saving.

If the harvester is the preferred and only form of stubble management, ensure the chopper and spreader is achieving a fine chop of all straw and a good even spread. Rows of un-spread, partially mulched straw are likely to be the greatest cause of concern next year. Harvesting in dry, warm conditions, especially the heaviest crops, so that straw is chopped more cleanly with every piece of shorter than 200mm is an effective strategy. However other risks such as fire need to be considered.

Inter-row sowing

The advent of 2cm RTK guidance for seeding systems allows for greater stubble retention, particularly of tall standing stubble, by allowing it to be avoided when sowing successive crops. Wider row spacing (> 25cm) will assist, as will ensuring seeding operations are carried out in the same direction as previous years. This will avoid 'crabbing' caused by differences in topography. Such systems are standard now and can also be retrofitted to older tractors.

Rollers

Rollers are cheap and effective. They increase ground contact of stubble; accelerating breakdown of stubble (but not always prior to seeding); Under the right conditions they can crack stubble up into smaller chunks; are effective on snails; and may also improve herbicide efficacy by 'opening' up the soil surface to sprays. Monitoring on the LEP has shown that stubble mass is not significantly reduced over summer however overall stubble accumulation is reduced. This suggest that rollers accelerate stubble breakdown in autumn and spring. The key to using rollers may be in timing – rolling stubbles in cooler, moist weather may only lie stubble down, creating an issue at seeding, whereas rolling hot, dry stubble has been shown to crack stubble up, making it easier to sow through.

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Cabling

Cabling can be useful and is a cheaper alternative to rolling. However, as cabling only knocks stubble over without breaking or splitting it up, some of the benefits of rolling may not be fully realized. Cabling may also cause further problems as straw is laid down intact across the soil surface. While it will increase stubble breakdown, there is little evidence of much breakdown over summer on LEP. Cabling should only be seen as a way of increasing breakdown long term, rather than being a suitable strategy for reducing an excess stubble load over summer in any one season. Cabling can assist in snail management though has not proven sufficient on its own.

Trashcutter

A trashcutter may be of great interest to those who want to maintain full stubble but are having issues seeding into it. Two gangs of large diameter discs are pulled behind a set of 'lay bars' which fold straw down in front of discs. Discs can be run straight or angled slightly, with angling providing some level of shallow tillage. This implement requires dry conditions and, in local testing, consumed 55 L/h fuel when pulled by a 345 hp JD tractor at 17 km/h. Hair-pinning is an issue in moist conditions and on lighter soils.

Slashers

Slashing is time consuming, however continues to be used effectively on the LEP, particularly in tall canola stubbles. Slashing does not always reduce stubble into 200mm lengths so harvest height should be kept to below 400mm if planning on slashing.

Disc Chain

These implements comprise a gang of heavy concave discs, 'strung' together somewhat like a chain. Their effect is somewhat like a light disc plow. The heavy discs knock down and cut or score the stubble, leaving it partially mulched on the soil surface on a lightly tilled seedbed. It is likely that under wet, cool conditions, the discs may not be aggressive enough to sufficiently chop stubble, however stubble breakdown will nonetheless be accelerated from autumn onwards.

Seeder small modifications

Relatively low cost options that may be worth considering where seasonal stubble conditions exceed the capacity of the seeder. These include coulters, tine covers (to create a rounded profile on the leading edge of the shank) and the Aricks Wheel which clears residue in front of the seeding mechanism.

Crop Rotations

Widening crop rotations to include a legume will also reduce stubble load over time. Cereals and canola produce more stubble than legumes, and legume stubbles also break down quicker.

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