# Maintaining profitability in retained stubble systems on upper Eyre Peninsula

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## *Guideline 10: Stubble management during the break phase*

All growers implement some form of stubble management at harvest depending on the farming system, the phase in the rotation, harvest timeliness and equipment, weed or pest issues and the seeding system. The 'break' phase on upper Eyre Peninsula is a self-regenerating pasture and livestock phase, or a break crop phase such as canola, vetch, lentils or other pulses. The stubble management implemented will depend on the break crop selected and other issues in the paddock such as weeds or pests.

### When do I need to manage cereal stubbles leading into a break phase?

- When establishing small seeded break crops such as canola and sown medic.
- When grazing stubbles, especially with low stubble cover.
- If pests are an issue, such as mice or snails, and stubble load or feed source needs to be reduced.
- If weeds are an issue and harvest weed seed management is implemented or stubble is baled.

### Sowing small seeded break crops

The successful establishment of small seeded species is critical to the productivity of break crops or pastures. Establishment of adequate plant numbers when sowing small seeded crops into cereal stubble requires planning well before harvest of the preceding cereal and will depend on the seeding system used[1].

Tined seeders drag through the soil so stubble residues need to be a shorter straw length, and spread evenly to allow the stubble to move through the shanks and prevent build up and clumping. Harvesting the previous cereal crop as low as possible and spreading the chopped residues evenly is important for the following crop establishment, especially with small seeded crops. Other methods to reduce the stubble loads may be grazing, baling, working using a prickle chain or Kelly disc chain, or burning[2].

With the move to direct drilling, tined seeders have generally been adapted from units already on farm, resulting in cost effective seeders with a wider range of features to suit different soil types with greater soil disturbance than disc systems, for disease control and early nitrogen mineralisation, increased seedling vigor and better herbicide efficacy. Some issues with tined seeders may be excessive soil throw resulting in potential crop damage due to increased herbicide concentration. With tined seeders there is also a higher risk of fertiliser toxicity closer to the seed[2], especially with small seeded species.

Generally disc seeding systems can handle greater stubble loads, require less horsepower than tined seeders, have less soil disturbance and hence lower weed germination. Disc seeders are generally more expensive to buy but have lower operating costs as less draught is required and they can operate at higher speeds[2].

Disc seeders can give greater accuracy of seed placement but may have issues with crop emergence if stubble is 'hairpinned'. Disc seeders work well in

*Canola is a commonly used break crop on Eyre Peninsula*

standing stubble (inter-row sowing) but this can have issues in mixed farming systems where stubbles are grazed after harvest. Coulters in front of the disc will help clear stubble residue in front of the disc seeder. Herbicide and seed separation for crop safety is a greater issue with disc seeders, so herbicides incorporated by sowing (IBS) are preferred, rather than post sowing pre-emergent. However because there is less soil disturbance, weed germination will be lower, and weed seed survival will be reduced[2].

Accurate seed placement at the correct sowing depth is important to maximise seed germination. For most small seeds the seeding depth should be around 1 cm[1], unless soil moisture is limiting then sowing into moisture to increase establishment is important. Deeper placement of fertiliser, away from the seed, is recommended to prevent fertiliser toxicity.

Inter-row sowing with small seeds is recommended to improve plant establishment. Having seeding equipment to easily and consistently implement inter-row or on-row seeding is required, although it can be implemented manually. The equipment to reliably and accurately implement accurate seed placement along the entire length of the paddock, especially in variable terrain, usually involves a GPS tracking system with auto steer with repeatable accuracy (2 cm).

On upper Eyre Peninsula early sowing of canola, from mid-April, had the largest positive impact on canola yield. Sowing on 22 April improved yields compared to 29 April sowing date. Different management practices are needed to establish canola on different soil types under marginal moisture conditions. On a loamy soil at Minnipa deeper sowing (to 4 cm) produced the highest yields, whereas shallower sowing (1 cm) produced the highest yields at Piednippie on light calcareous sand, particularly with a smaller seeded variety (ATR Stingray)[3].

Sowing pulse break crops into standing cereal stubble provides early protection of both small plants and soils from wind damage. Research in the Mid North (Clare, SA) showed sowing pulses into standing cereal stubble can benefit yield, but no yield response has occurred at Minnipa so far. However, in 2011 substantial differences in growth were achieved at Minnipa; increased pea growth and height occurred in standing cereal stubble which may aid harvestability of field peas, particularly in shorter seasons with less biomass[4]. Similar results were achieved at Hart, with lentils sown into stripper front stubble and medium height standing stubble. Stubble resulted in taller and more erect plants with higher pods and improved harvestability[5].

### Livestock and grazing stubbles

If the break phase is a self-regenerating medic pasture for grazing, harvesting the cereal stubble higher may improve harvest timeliness, with less material going through the harvester, provide more feed and protection for livestock, and lower soil erosion risk when moving into a pasture phase.

Stubble quality and grazing value can vary between crops and seasons and can change quickly across a paddock, particularly once grazing commences or after summer rain[6]. The value of feed is determined by the amount of residual grain and green plant growth present, including summer weeds and shot grain. The efficiency of modern harvesting methods and better weed control means there is now less grain and fewer weeds are left in stubbles[6].

Digestibility is the main factor that determines feed intake and the energy of that feed. Sheep and cattle will eat the most digestible feed first (grain and green) and leave the least digestible (straw) until last. Grains such as barley or lupins are 80-90% digestible and provide a high energy diet, whereas straw and trash have generally lower digestibility (35-55%) and provide less energy[6].

Protein is also very important, with higher requirements during late pregnancy and lactation. Cereal grains generally contain between 8-15% protein, and legume grains 20-36% protein. However, straw contains less than 5% protein which is too low to sustain sufficient microbial growth in the rumen and may restrict fibre digestion, so an additional source of protein is generally needed[6].

A feed test will accurately measure the nutrient level of your grain and stubble components. Research carried out as part of the Grain & Graze initiative measured the feed quality of a range of crops across south eastern Australia to determine the average value of crop components (Table 1). Using feed tests, you can deduce whether stock are getting the nutrients they need according to their respective class (Table 2) [6].

***Table 1 Average feed value of crop components***

| Feed Value | Wheat & Barley stubble | | | | Oats | Lentils | |
|---|---|---|---|---|---|---|---|
| | Grain | Green | Straw | Loose trash | Grain | Grain | Straw |
| Digestibility DMD (%DM) | 82-87 | 59-73 | 38-40 | 40-41 | | 92 | 36 |
| Metabolisable energy (MJ/kg DM) | 12.7-13.2 | 8.5-11.0 | 5.0-5.3 | 5.3 | 9.0-11.0 | 13.1 | 4.6 |
| Crude protein (%) | 9.5-13.5 | 15.9-18.7 | 1.2-2.8 | 2.0-4.0 | 6.0-12.0 | 27.5 | 6.7 |

Source: Grain & Graze, (2004-2007, 2016)

***Table 2 Nutrient requirements of different sheep classes***

| | Maintenance of 70 kg dry ewe | Lactating 70 kg ewe | | 40 kg weaner lamb | |
|---|---|---|---|---|---|
| | | # of lambs | | Growth rate | |
| | | Single | Twin | 250 g/day | 300 g/day |
| Daily DM intake (% of liveweight) | 1.9 | 2.8 | 2.8 | 3.3 | 3.8 |
| Feed intake (kg/animal/day) | 1.3 | 2 | 2 | 1.3 | 1.5 |
| Metabolisable energy (MJ/day) | 10.3 | 15.7 | 19.8 | 10.6 | 12.3 |
| Protein (g/day) | 104 | 229 | 306 | 171 | 199 |

Source: Adapted from NRC (2007). DM = dry matter

The feed value of stubbles is variable and can be difficult to measure accurately. Recording liveweight and condition score of stock will give you the best measure of livestock wellbeing, where stock must be maintaining or increasing weight. Livestock may begin to lose weight on a stubble paddock by, if not before, six weeks of grazing, depending on type of stubble, season, paddock size and the stocking pressure (number and class of animal). At Minnipa, barley, wheat and canola stubbles were sampled prior to grazing, then regularly over a four-month period. Table 3 shows the quantity and quality measurements of whole stubble samples from the first monitoring on 14 December immediately after harvest. It shows the influence that low quality straw and trash has on overall nutrition. The value of the grain fell within the ranges presented in Table 2, with much higher digestibility, protein and energy. The feed value of the stubbles after 14 December fluctuated, however a common outcome for all stubble types was that quality deteriorated rapidly following summer rainfall. Stubble quantity remained high throughout the sampling period due to low stocking rate and conservative grazing practices[6].

***Table 3 Quantity and quality of stubble feed components sampled at Minnipa on 14 December 2015 prior to grazing over 2015/16 summer***

| | Quantity | | | | | Feed quality of whole stubble sample | | | |
|---|---|---|---|---|---|---|---|---|---|
| Stubble type | Trash (t/ha) | Straw (t/ha) | Grain (kg/ha) | Shoots (kg/ha) | Ground cover (%) | Dry matter (%) | Crude protein (%DM) | Digestibility DMD (%DM) | Metabolisable energy (MJ/kg DM) |
| Barley | 1.4 | 2.4 | 65.4 | 7.4 | 82.2 | 89.2 | 2.2 | 47.5 | 6.6 |
| Wheat | 2.8 | 1.6 | 149.5 | 4.6 | 78.3 | 88.3 | 2.6 | 41.0 | 5.4 |
| Canola | 1.8 | 1.8 | 11.8 | 22.9 | 77.8 | 89.5 | 2.7 | 28.3 | 4.1 |

Rain during summer and autumn can reduce the digestibility of the stubble, mainly through leaching of the soluble/digestible components of the straw. However more importantly, germination of grain and weeds after rain can create very useful feed. Stubbles following a drought, that have hayed off, or suffered frost or heat damage, often contain more nutrients than usual. If a crop dies quickly after flowering, less energy and protein can be deposited into grain, so it remains in the stem and leaves, providing more nutrition[6].

Stubbles after a good season can vary in feed value depending on weather events. If harvest is uneventful weatherwise, crops have less feed value as tall heads are efficiently harvested and less grain is left in the paddock. Stock will quickly graze off any grain in crop stubbles before moving to fence lines searching for other weed seeds. On the other hand, spring rains can induce late tillers that are lower in height, may not be collected at harvest, and that will contain feed value. Crops, particularly high yielding crops, may also suffer in windy weather from lodging, cereal head loss or loss of legume grains, dropping grain to the ground that cannot be picked up at harvest[6].

***Figure 1 Standing stubble 50% cover*** *[Source: Stubble Management – A Guide for Mallee Farmers, Mallee Sustainable Farming 2013]*

It is recommended that a minimum of 50-70% ground cover (about 1-1.5 t DM/ha) (Figure 1) remains on paddocks to prevent wind erosion. Note that over time it may appear that groundcover is increasing, as sheep knock the standing stubble down as they graze. However, it's preferable to have some standing stubble, with research indicating that standing, anchored stubble 10 cm high is twice as effective at reducing wind erosion compared with loose flat stubble. When cover in a paddock is reduced below 50% and the paddock is exposed to winds of 30 km/h or more, loosened soil starts to move. To reduce the likelihood of overgrazing, decisions should be made early to either sell stock, hold stock on less erosion-prone paddocks, or place stock into containment. In a low rainfall mixed farming system, livestock can help better manage the economic impacts of seasonal variability[6].

**Pests**

In situations with high pest numbers, such as mice or snails, stubble management may need be implemented before a break phase. Mice numbers tend to be limited by low survival over winter; however environmental conditions may lead to population increases such as mild winter conditions and less disease[7], easy digging and nesting opportunities[8], high crop and grain production levels which leave greater food source in paddocks, lower temperatures over summer which allow juveniles to survive, and early autumn rains which germinate volunteer cereals and weeds to allow the population to survive and reach peak populations, causing plagues[7]. Mice generally begin breeding in spring and increase in numbers until the last of the grain in the paddock after harvest is consumed or germinates over summer. Heavily grazing stubbles immediately after harvest will reduce the amount of grain and feed in the paddock limiting the population.

Snail numbers may require implementation of some stubble management during the break phase. In late spring/early summer snails are dormant, with a period of inactivity triggered by dryness and high temperatures. In summer, round snails favor resting places off the ground on stubble, vegetation and fence posts, while pointed snails are often found on the ground in cool shady places[9]. Stubble bashing may be required to knock snails onto the hot soil surface during summer to dehydrate and kill them. This can be achieved by grazing or mechanical stubble bashing. Rolling, slashing and cabling standing cereal or canola stubble are effective techniques for killing snails. In paddock trials, kill rates ranged between 50 to 90% providing the temperature was greater than 35°C. This compares to about 30% kill from grazing[9].

Slashing is of some benefit to snail control but is relatively slow, leaves short stubble for snails to escape the hot soil surface and can be a fire risk, especially in stony paddocks. Rubber tyre or steel

rollers can be used to flatten stubble. One pass is sufficient for cereal and canola stubble, while barley stubble generally requires two passes. In light soils and thin stubbles, steel ribbed rollers can reduce the likelihood of soil erosion. Dragging an old punt cable with a connecting safety chain or 20 to 25 mm chain between two tractors, driven about 300 m apart, has proved a fast and effective method to bash stubble and knock snails onto the ground. Kill rates are on average 70% from one pass, providing there is no dew at night to enable the snails to rehydrate[9].

See Guideline 3: Mice and stubble management on upper EP and Guideline 4: Snails and stubble management on upper EP for detailed management information.

**Harvest weed seed management**

Managing grass weeds and herbicide resistance may influence stubble management. Narrow windrow burning has been widely adopted as a weed management tool[10]. Other weed management options for stubble at harvest are using chaff carts for chaff and weed seed collection, which also provides a livestock feed option; harvest weed seed destructors, or baling hay or the stubble. Burning narrow windrows, mainly for ryegrass weed management, is an option growers are currently implementing[10].

See Guideline 11: Stubble management and weed control for more information.

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