BENEFITS OF RETAINING STUBBLE —TASMANIA

Key points

- In the past stubble has been burnt to control weeds but retaining stubble has several advantages for soil fertility and productivity.
- Retaining stubble can decrease soil erosion and increase soil water content.
- Retaining stubble can increase earthworm numbers and microbial carbon, which indicates greater biological fertility of soil.
- If controlling weeds is the aim, burning windrows is more effective than burning standing stubble and also decreases erosion risk.

Background

Historically, stubble has been burnt because it improves weed control and creates easier passage for seeding equipment. However, the practice of burning stubble has recently declined due to concerns about soil erosion and loss of soil organic matter. Instead of being burnt, stubble is increasingly being retained, which has several advantages for soil fertility and productivity (figure 1).

Figure 1: *Inspecting stubble after sowing with a disc opener.*

Reducing erosion risk

One of the main benefits of stubble retention is reduced soil erosion. Retaining stubble decreases erosion by lowering wind speed at the soil surface and decreasing run-off. To minimise erosion approximately 50% ground cover is required and adequate stubble needs to be maintained for 6–8 weeks following seeding (Leonard, 1993). It is generally considered that 50% ground cover is achieved by 1 t/ha of cereal stubble, 2 t/ha of lupin stubble and 3 t/ha of canola stubble.

Improving soil structure and increasing soil water content

Another advantage of retaining stubble is that it improves soil structure by reducing bulk density (figure 2) and reducing resistance to root growth (figure 3). Retained stubble increases soil water content (figure 2) by decreasing run-off and increasing infiltration. However, the potential benefits of decreased run-off and increased infiltration will depend on the timing and intensity of rainfall as well as the quantity and orientation of stubble. Late summer–early autumn rains have more chance of improving the germination and establishment of the next crop. In addition, increased infiltration of water over summer can result in greater nitrogen mineralisation and availability for the subsequent crop.

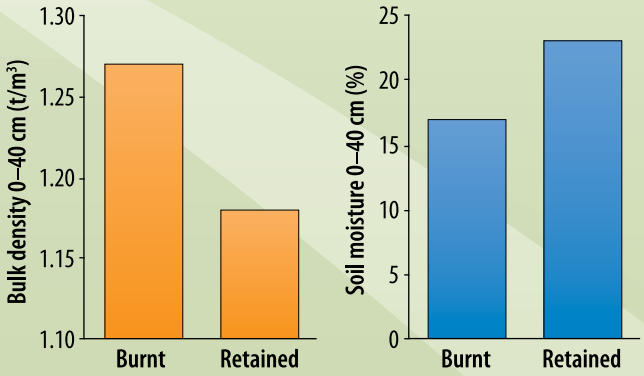

Figure 2: *The influence of retaining or burning wheat stubble on bulk density (orange) and soil moisture content (blue) (Dean and Smith, 2009).*

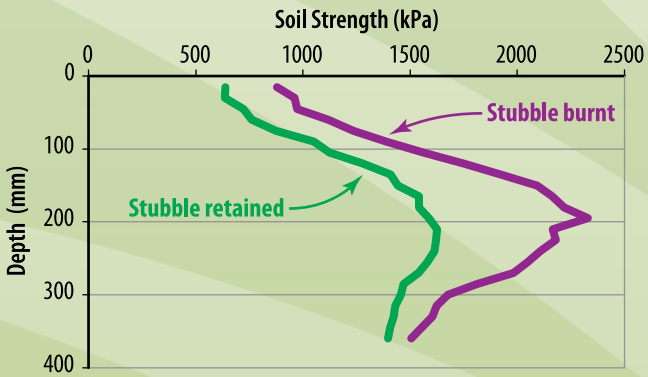

Figure 3: *The influence of retaining (green) or burning (purple) stubble on soil strength as determined by penetration resistance (Dean and Smith, 2009).*

Increasing biological fertility of soil

Retaining stubble increases the input of carbon to soil. Stubble is approximately 45% carbon by weight and therefore represents a significant input of carbon to soil. It can take decades of retaining stubble to increase the amount of total organic carbon in soil that you can measure on your soil test.

However, retaining stubble can have a much faster impact on the biological activity in the soil. Microorganisms in soil require organic carbon to obtain the carbon, nutrients and energy they need to live. Management practices that increase inputs of organic carbon to soil, such as retaining stubble, can increase the number of microorganisms in soil and also cause them to be more active (table 1). A field experiment at Perth in Tasmania found that after only 3 years of retaining stubble, the carbon in the microbial biomass had increased by 20% (table 1). Beneficial earthworms had also increased but so had the number of slugs. The stubble is a suitable habitat for slugs which then eat emerging crop seedlings. Slugs can destroy significant amounts of the crop and need to be treated with the application of bait.

Table 1: *The effect of retaining stubble on biological soil properties (Dean and Smith 2009).*

BIOLOGICAL SOIL PROPERTY	STUBBLE BURNT	STUBBLE RETAINED
Microbial biomass carbon 0–10 cm (µg/g)	56.0	67.2
No. worms (spade test)	0.2	1.6
No. slugs (tile trap)	4	8

Reasons to consider burning stubble

Stubble is burnt in Tasmania to eliminate slug habitat, reduce stubble load for following direct drill operations and to control weeds. Cereal yields in Tasmania are typically 4–8 t/ha, which leaves a similar amount of stubble on the paddock. This is too much stubble cover for direct drill machinery to handle and so the amount of straw needs to be reduced by baling and removing, or burning. Burning windrows in paddocks can be a useful way to control weeds, especially populations of weeds that are herbicide resistant. Burning chaff in windrows is more effective for controlling weeds than burning whole paddocks. This is because the weed seeds are exposed to higher temperatures for a longer period (Walsh and Newman, 2007). For example, 20% of ryegrass seeds emerged when standing stubble was burnt but only 1% emerged when windrows were burnt (Walsh and Newman, 2007). However, without a high temperature fire, viable weed seeds will be concentrated in strips. Also, when chaff is collected in windrows, less of the field is burnt. This means a greater area with stubble cover is retained and the erosion risk is decreased. When chaff is collected in narrow windrows of 50–70 cm, only 10% of the paddock is burnt.

Burning whole paddocks can decrease stubble borne diseases in several cereal crops including wheat (yellow spot—*Pyrenophora tritici-repentis*, septoria nodorum blotch—*Phaeosphaeria nodorum*, septoria tritici blotch—*Mycosphaerella graminicola*) and barley (net blotch—nettype *Pyrenophora teres* f.sp. *teres*, net blotch—spot-type *Pyrenophora teres* f.sp. *maculata*).

However, stubble-borne diseases can be managed without burning by use of resistant cultivars and crop rotation. In addition, burning whole paddocks has little effect on soil borne diseases.

Further reading and references

Dean G and Smith A (2009) Long term comparison of stubble management strategies. Project summary for Grains Research and Development Corporation. Tasmanian Institute of Agricultural Research.

Leonard (1993) *Managing for stubble retention*. Department of Agriculture Western Australia Bulletin 4271. (online)

Walsh MJ and Newman P (2007) Burning narrow windrows for seed destruction. *Field Crops Research* **104:** 24–30.

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