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**Lupin stubbles: getting the best with weaner sheep**

**Erratum**
Due to a pre-press error an incorrect graph was printed. The correct version of Figure 2. is in the supplement content.
By Keith Croker and Colin McDonald, Research Officers, and Jeremy Allen, Principal Veterinary Toxiciologist, Animal Industries Division

Sweet lupins are now grown on about a million hectares in Western Australia each year. If half of the State's seven million weaners were grazed as recommended on half of the lupin stubbles, it could generate about $15 million from reduced supplementary feeding, greater wool production and other advantages. But correct management is important, particularly knowing when to take weaners out. Research by the Department over the last five years is now indicating how this should be done.

Collecting every lupin seed at harvest is impossible and between 150 and 250 kilograms of seed per hectare usually remains on the ground after harvest. In fact, rates of 300 to 400 kilograms per hectare are common. Lupin seed makes excellent sheep feed and this fallen seed may be enough for between one and three months' grazing — depending on the stocking rate, development of lupinosis, risk of wind erosion and rainfall.

In the last five years we have conducted studies throughout the agricultural areas to establish recommendations on using Phomopsis-resistant lupin stubbles to the greatest advantage for grazing weaner sheep.

Safe stocking rates

Typically, weaner sheep show rapid weight gain and wool growth in the first few weeks of grazing stubbles, then reduced gain and weight loss as the seed is used. High seed intakes and rapid growth generally occur during early grazing regardless of stocking rate. However, heavy stocking means that the seed is used up fast, the rapid growth period is short and the weaners lose weight sooner than if stubbles are grazed at lower rates.

Our results show that lupin stubbles can be grazed by about 10 weaners per hectare for up to two months with good gains in weight. Longer grazing might be possible if body weights are allowed to drop back to their initial level, but attention to the available seed and ground cover is important. Grazing time will partly depend upon the pattern of weight change each farmer is prepared to accept.

Stocking can be higher than 10 weaners per hectare where farmers want to use the lupin stubble early in summer to prevent storms ruining its feed value. Therefore, stocking rates of up to 20 weaners per hectare are more common where summer rain is likely. Good weight gains can be achieved at these higher stocking rates, but the grazing time is usually shorter. Stocking rates higher than 10 to 15 weaners per hectare appear to increase the risk of the tender wool and lupinosis because the seed is eaten sooner.
Critical levels
As a rough guide, sheep tend to gain weight when there is more than 50 kg of lupin seed per hectare in the stubble and lose weight below this. This was borne out in 27 research station studies, covering different sites, years, stocking rates and amounts of seed per hectare at the start of grazing. Weaners reached their heaviest weights when the seed fell to about 50 kg/ha (range 20 to 75) and declined shortly after.

When seed falls below 50 kg/ha, we have found that early signs of lupinosis often develop. (Lupinosis is a disease which affects livestock that eat dead lupin stems colonised by the fungus Phomopsis leptostromiformis. The fungus produces toxins, called phomopsins, in warm moist conditions. When consumed, the phomopsins damage the liver which can result in the animal becoming jaundiced.) Wool fibre diameter also decreases rapidly after seed falls to 50 kg/ha. If left longer, a break in the wool could be expected. Therefore, it would be well worth counting seed in paddocks to determine when this level is reached.

To estimate the amount of seed, 20 random seed counts need to be done at about equal spacings while walking across the paddock. At each counting site, throw down a 0.1 square metre quadrat (roughly 32 centimetres square, for example a Hoegrass square) and count all seeds within it, on or just under the soil surface. Average the number of seeds counted at the 20 sites to determine how much is available in the paddock. Generally, four Gungurru seeds in 0.1 square metres is equivalent to about 50 kg/ha.

Stubble material and soil erosion
Sheep eat large amounts of stubble materials, especially when little seed is left. Many of the smaller fragments, such as shattered leaves, are trodden into the soil and wasted. Thus, 3 to 5 tonnes per hectare of stubble present at the start of grazing is typically reduced to 1 to 2 t/ha when sheep are removed.

According to soil experts, about 1.5 tonnes of material per hectare (150 grams per square metre) is needed to protect soils and minimise the risk of soil erosion. This equates to lupin stubble covering about 40 per cent of the ground.

Deferral of grazing
The main argument against saving lupin stubbles for grazing in late summer and autumn has been the fear of lupinosis caused by build-up of phomopsins. We examined the possibility that with Phomopsis-resistant lupins it may be possible to defer grazing of the stubbles.

Experiments with grazing in both December and February were conducted at Badgingarra (10 and 15 weaners per hectare, four replicates) and Nabawa (10 weaners per hectare, three replicates) with sheep from one original flock. The stubbles were from Gungurru crops that yielded 1.5 t/ha at Badgingarra and 1.2 t/ha at Nabawa.

Weaner growth followed a typical curve for sheep put on the plots at Badgingarra in December with substantial weight gains to a peak followed by a short period of weight loss after which the weaners were removed (see Figure 1). In contrast, the February groups showed a more erratic and inferior weight change pattern. This poorer performance was associated with significant rainfall.

As a result of the rain:
• Sheep tended not to forage during rain and typically lost weight
• Lupin seed was buried and there was widespread germination
• Moisture hastened the decline in stubble quality
• The moist conditions resulted in increased production of phomopsins.

Seed loss and the development of lupinosis were probably the most significant effects. We have noticed that rainstorms are not important unless the seed germinates. Late in summer, if temperatures are lower, conditions can remain moist following rain causing greater likelihood of germination and toxin production in the stubble.

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At Nabawa, the December group showed a typical growth curve (see Figure 2). But in contrast to the Badgingarra results, the February group showed better growth than the December group. No rain storms occurred at Nabawa during the experiment. Grazing of lupin stubbles can be deferred successfully provided there are no significant summer rains. However, by delaying the start of grazing, there is a risk of feed being wasted and lupinosis developing, risks that farmers will have to consider carefully.

### Farm studies

Farms from Geraldton to Albany and across to Esperance were used to study weaner grazing of stubbles and confirmed the research station results. Most stubbles were Gungurru with a few Merrit crops. Clinical lupinosis was not encountered on any of the farms, although sub-clinical lupinosis was detected at the end of grazing in some sheep on at least four farms.

On more than a third of the farms, paddocks were destocked a little before the heaviest rain occurred at Nabawa during the experiment. Grazing of others was stopped because of a lack of seed on the ground or liveweights decreased following rains which caused germination.

The problem of weaners tending to concentrate grazing within a few hundred metres from water was evident in most studies, but particularly on three farms with large paddocks in the northern and eastern wheatbelt. It appeared that unless conditions encouraged the weaners to go further afield, they tended to graze within about 800 metres of the water, so creating an erosion risk while stubble further out remained untouched.

On a farm at Watheroo, even utilisation of stubble was achieved by the use of movable, fibreglass tanks/troughs. In 1990-91 about four extra weeks of grazing was achieved without high risk of wind erosion. On another paddock in 1991-92, although the troughs were moved, regular strong easterly winds encouraged the weaners to graze to the paddock extremities. This resulted in even grazing.

### Critical measurements for weaners on lupin stubbles

1. Amount of lupin seed in the paddock (more than about 50 kilograms per hectare needed)
2. Amount of ground cover present (at least 40 per cent cover is recommended)
3. Liveweight and condition changes in a sample of weaners (rapid decreases can indicate lupinosis)
4. Signs of lupinosis (lethargic, yellowing around the eyes, loss of condition).

Because weaners grazed on Phomopsis-resistant stubbles can develop lupinosis, all four indicators need to be considered. Problems can arise rapidly if only one is monitored.

### Acknowledgments

Many Department staff throughout the agricultural areas have provided assistance in various phases of this study. Without their help it could not have been completed successfully.

The co-operation and help provided by the many farmers involved in the study is also acknowledged.

The project was partially funded by a grant from the Australian Wool Research and Promotion Corporation.

### Table 1. Some measures of sheep performances on the paddocks used in the on-farm studies of grazing Phomopsis-resistant sweet lupin stubbles

<table>
<thead>
<tr>
<th>Site</th>
<th>Date grazing started</th>
<th>Stocking rate (no./ha)</th>
<th>Starting weight (kg)</th>
<th>Growth to heaviest weight (g/head/day)</th>
<th>Days to heaviest weight</th>
<th>Total grazing period (days)</th>
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<tbody>
<tr>
<td>1990-91</td>
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<td>Watheroo</td>
<td>19 Dec</td>
<td>9.5</td>
<td>31.4</td>
<td>82</td>
<td>87</td>
<td>87</td>
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<tr>
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<tr>
<td>Watheroo</td>
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<td>8.3</td>
<td>30.2</td>
<td>69</td>
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<td>10</td>
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<td>120</td>
<td>49</td>
<td>56</td>
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<td>21</td>
<td>32.8</td>
<td>98</td>
<td>43</td>
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<tr>
<td>Green Range</td>
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<td>12</td>
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<td>198</td>
<td>42</td>
<td>56</td>
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<td>Allanooka</td>
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<td>32.0</td>
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