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Economic impact of growing
Phomopsis-resistant lupins

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The planting of Phomopsis-resistant lupins will increase net farm income. They will also alter the traditional blend of pastures and cropping, depending on grain and wool prices. In mixed farming areas of Western Australia's southern wheatbelt, they will allow more land to be sown to lupins rather than cereals on farms in which the lack of sheep feed over summer severely restricts wool production.

The benefits of Phomopsis-resistant lupins arise from a reduction in sheep deaths due to lupinosis, a longer safe grazing period (free from lupinosis) on lupin stubbles, a decrease in the need for supplementary sheep feed over summer, improvements in sheep body weight (and possibly wool growth), and increases in harvested grain yield.

Farmers should prepare now for this major shift in farm management.

Results of grazing trials

This article summarises the results of sheep grazing trials on Phomopsis-resistant and susceptible lupin stubbles in the summers of 1985-86, 1986-87 and 1987-88 at various sites in the south-west of Western Australia. These results were used to predict the economic consequences of growing Phomopsis-resistant lupins on farms, particularly in the area around Corrigin and Wickepin, where Phomopsis-resistant lupins may have a major impact. The Department of Agriculture's whole-farm computer model, MIDAS (Model of an Integrated Dryland Agricultural System), which takes into account alternative rotations on different soil types and the interaction of different enterprises within the farming system, was used in this analysis. MIDAS has been developed for several regions in Western Australia and in this case the model for the Corrigin and Wickepin area was used.

Twenty sheep-grazing trials during 1985-86, 1986-87, and 1987-88 were designed with several Phomopsis-susceptible (Yandee, Chittick, Danja) and Phomopsis-resistant (Gungurru, Yorrel) varieties in neighbouring plots of about one hectare each. Stocking rates ranged from 15 to 26 sheep per hectare, which are greater than normal farm stocking rates, to...
increase the likelihood that lupinosis would develop. Only Yandee and Gungurru varieties were present in every trial. Grazing on each variety was stopped when the average live weight declined to 90 per cent of peak weight, or when more than 20 per cent of the sheep developed jaundice because of lupinosis.

Table 1 shows the results of these trials for varieties Yandee and Gungurru. Gungurru always had much lower visible symptoms of Phomopsis stem blight than Yandee at harvest.

The use of Phomopsis-resistant lupins increased the available grazing period by about 36 per cent or an average of 425 sheep-days per hectare. Sheep grazing Phomopsis-resistant Gungurru stubbles weighed on average 2.6 kg more than sheep grazing susceptible Yandee stubbles. Sheep on Gungurru also had fewer signs of clinical lupinosis. Acute lupinosis occurred on Yandee stubbles at two sites, and sheep were removed immediately, but sheep on Gungurru stubbles continued grazing safely.

**Economic benefits of Gungurru lupins**

Results show that Gungurru lupins will increase the safe period for grazing lupin stubbles, which in turn allows more complete use of these stubbles. Other grazing benefits, such as improved body weight and wool growth, have not been quantified and were excluded from this analysis. Sheep deaths due to lupinosis have also been excluded, although these may be substantial in individual cases. The grazing benefits presented here are therefore the minimum that could be expected.

Gungurru lupins have a higher harvested seed yield in the Corrigin/Wickepin area than Yandee lupins. These benefits of grazing and grain yield have been added to the model separately so as to highlight the impact of sowing Gungurru lupins rather than the Phomopsis-susceptible varieties Yandee (lower-yielding than Gungurru) or Danja (yield equivalent to Gungurru).

**Assumptions of the model**

MIDAS represents a ‘typical’ farm in the Corrigin/Wickepin region. The farm is assumed to consist of six soil classes (poor light, good sandplain, medium light, medium, valley duplex, heavy) each with different grain yields and pasture production. For example, lupins are assumed to be an option on the light to medium soils, with yields ranging from 0.65 t/ha to 1.05 t/ha. For soil conservation reasons it is assumed that only half the stubble produced may be eaten by sheep. Stubble quality and quantity decline at a monthly rate from November. Stubble may be eaten by sheep until the end of January, by which time the risk of lupinosis is too high to continue grazing. The toxicity of Danja lupins is assumed to be the same as that of Yandee. Prices for wool are assumed to be 550c/kg greasy net on-farm and for lupins $185/tonne. No account has been taken of additional machinery that may be required to grow lupins.

Yield of Gungurru is assumed to be 14 per cent more than that of Yandee and equal to that of Danja, based on results from the Department of Agriculture’s M4 zone crop variety testing trials. Grazing of Gungurru stubble is assumed to increase from 75 to 135 days after harvest (from the end of January to the end of March) compared with that from Yandee or Danja. (The M4 zone boundaries are explained in Department of Agriculture Bulletin 4127 “Crop Varieties and 1989 Sowing Recommendations for Western Australia”, page 8.)

**Table 1. Phomopsis stem ratings of lupins, days of grazing by sheep, liveweight changes in sheep and the occurrence of clinical lupinosis in grazing trials comparing the lupin cultivars Gungurru (Phomopsis-resistant) and Yandee (Phomopsis-susceptible)**

<table>
<thead>
<tr>
<th>Lupin variety</th>
<th>Mean Phomopsis stem rating (%)</th>
<th>Mean sheep days of grazing per ha</th>
<th>Mean peak liveweight gain (kg)</th>
<th>Mean liveweight gain at end of grazing (kg)</th>
<th>Proportion of trials in which clinical lupinosis occurred (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gungurru</td>
<td>6</td>
<td>1590</td>
<td>5.6</td>
<td>3.7</td>
<td>25</td>
</tr>
<tr>
<td>Yandee</td>
<td>46</td>
<td>1165</td>
<td>3.1</td>
<td>1.1</td>
<td>80</td>
</tr>
</tbody>
</table>

Harvesting lupins.
Results of the model

On a typical farm, net farm income from growing Gungurru increased by about $3,000 relative to that from Danja because of the extended period of grazing provided by Gungurru (Figure 1). This profit mainly results from a reduced need for grain feeding of sheep in March. The higher seed yield of Gungurru, compared with that from Yandee, is worth an additional $4,000. Replacing Yandee with Gungurru will result in $7,000 additional profit, while replacing Danja with Gungurru provides $3,000 additional profit.

These results are based on a wool price of 550¢/kg greasy and a lupin price of $185/tonne. Given the recent variability of wool and lupin prices, it is worth examining the impact of different prices on the results.

At a lower wool price (400¢/kg) cropping becomes more favourable and there are greater benefits from replacing Yandee with Gungurru lupins: $10,000 increase in net farm profit (Table 2). This is largely from the greater seed yield of Gungurru.

At a higher wool price (700¢/kg) the optimum proportion of farm in crop declines, and the increase in farm profit ($7,000, Table 2) from using Gungurru rather than Yandee arises mostly from the extended grazing period of Gungurru.

At lower lupin prices ($165/t) the difference in profit between Yandee and Gungurru is less, about $6,000. However, profit per hectare of Gungurru is higher because the area planted to lupins declines and the stubbles are grazed for longer.

The area of farm in lupins increases from 10 to 15 per cent when lupin prices are assumed to be $205/tonne. Consequently the per hectare value of Gungurru declines, even though whole farm profit increases by about $9,500.

Table 2. Effect of wool and lupin price on benefits of replacing Yandee lupin with Gungurru

<table>
<thead>
<tr>
<th></th>
<th>Wool (¢/kg greasy) net on-farm</th>
<th>Increase in profit ($/ha of Gungurru)</th>
<th>Increase in net farm profit ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wool</td>
<td>400</td>
<td>26</td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td>550</td>
<td>34</td>
<td>7,000</td>
</tr>
<tr>
<td></td>
<td>700</td>
<td>43</td>
<td>7,000</td>
</tr>
<tr>
<td>Lupins</td>
<td>165</td>
<td>185</td>
<td>205</td>
</tr>
<tr>
<td></td>
<td>185</td>
<td>205</td>
<td>205</td>
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<td></td>
<td>205</td>
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</tbody>
</table>

Further reading


Substantial economic benefits

These results quantify the earlier encouraging report which suggested that Phomopsis-resistant lupins increased the safe grazing period and reduced the lupinosis toxicity of lupin stubble (Allen and Cowling, 1986). There are substantial economic benefits in changing to Phomopsis-resistant lupins, even without accounting for improvements in sheep bodyweights and wool growth, or reductions in deaths caused by lupinosis.

Although this study has been confined to the Corrigin/Wickepin area similar results are likely to apply to other cereal-growing areas. For example, in drier regions where increases in lupin yield have not been recorded, the value of Phomopsis-resistant lupins depends on the current level of cropping. If cropping levels are low, then most benefits will be from extended grazing. Phomopsis-resistant varieties are likely to be more profitable for farmers with low cropping percentages, whilst at higher levels of cropping Danja may be the preferred option. The economic benefit of Phomopsis-resistant lupins will be less if supplementary feeding does not start until April (rather than March) because there is surplus cereal stubbles.

Individual farms will have different optimum cropping areas and proportions cropped to Gungurru, depending on soil types and location. However, the results suggest that farmers will have to re-evaluate the role of all farm enterprises when changing to Phomopsis-resistant lupins. The average farmer in the Corrigin/Wickepin area could increase the proportion of the farm in lupins. This area has only 4 to 5 per cent of arable land planted to lupins, whereas the MIDAS results suggest that this could be increased and so increase whole farm profit.

Lupins have already caused one cropping 'revolution' in the northern wheatbelt of Western Australia and Phomopsis-resistant lupins may result in a new era of farming in the southern regions.