1982

Grain legume agronomy programme.

G. H. Walton

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EXPERIMENTAL SUMMARY 1982

Grain Legume Agronomy Programme

G.H. Walton
Plant Research Division
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<th>Page</th>
</tr>
</thead>
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<td>23</td>
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<td>23</td>
</tr>
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<td>23</td>
</tr>
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<td>26</td>
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<td>28</td>
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<td>8. Fababean nodulation</td>
<td>33</td>
</tr>
</tbody>
</table>
OBJECTIVE

To quantify the limitations to grain yield from method of sowing, seed rate and fertilizer rate in the wheatbelt environment.

BACKGROUND

The sub optimal growth environment of the wheatbelt sandplain demands that the maximum lupin crop establishment be achieved as early as possible. Five experiments were set up to examine the effect of various sowing methods.

EXPERIMENT 82GE18 - John Stephens, Canna

Yellow-brown gravelly sand. Two years wheat crops prior to lupin crop. Basal fertilizer of 190 kg super/ha applied with the lupin seed. Chittick lupin cultivar sown in error. May to October rainfall=

Sowing methods:

<table>
<thead>
<tr>
<th>Sown dry</th>
<th>(i)</th>
<th>(ii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>direct sown with working tynes, no simazine</td>
<td></td>
<td>simazine applied at 1 l/ha before seeding</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sown after a weed germination</th>
<th>(iii)</th>
<th>(iv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>plots cultivated prior to seeding</td>
<td></td>
<td>no simazine</td>
</tr>
<tr>
<td>sprayseed (1.5 l/ha) + simazine (1 l/ha)</td>
<td></td>
<td>tank mix applied before seeding with tyned implement.</td>
</tr>
</tbody>
</table>

Seeding establishment (plants/m²)

<table>
<thead>
<tr>
<th></th>
<th>Dry sown (May 11)</th>
<th>Sown after break (June 22)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(i)</td>
<td>(ii)</td>
</tr>
<tr>
<td>Mean* lupin density</td>
<td>44</td>
<td>38</td>
</tr>
<tr>
<td>Ryegrass density</td>
<td>341</td>
<td>77</td>
</tr>
</tbody>
</table>

* Mean of four seeding rate treatments

AOV Seedling establishment: Date sown NS; Simazine NS; Seed rate ***, Interactions NS

Crop severely droughted by September, no lateral pod formed and experiment not harvested.
EXPERIMENT 82GE19 - John Stephens, Canna

Yellow-brown sand to depth, acid reaction subsoil. Two years wheat crops prior to lupin crop. Basal fertilizer of 190 kg/ha superphosphate + Molybdenum mix. Chittick lupin cultivar sown in error.

Sowing methods: (i) to (iv) as for 82GE18

<table>
<thead>
<tr>
<th>Seeding establishment (plants/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sown after break (June 22)</td>
</tr>
<tr>
<td>(iii)</td>
</tr>
<tr>
<td>(iv)</td>
</tr>
<tr>
<td>Mean* lupin density</td>
</tr>
<tr>
<td>36.5</td>
</tr>
<tr>
<td>37</td>
</tr>
</tbody>
</table>

* Mean of four seeding rate treatments

Lupin crop severely droughted by September, no pods formed on laterals, experiment not harvested.

EXPERIMENT 82GE20 - Eradu Lease Block

Yellow sandplan, lupins sown into wheat stubble. Chittick lupin cultivar sown in error. May to October rainfall =

Sowing methods: Sown dry and sown after weed germination, treatments (i) to (iv) as per 82GE18

Sub-plot: Superphosphate applied with seed at 120 kg/ha, 240 kg/ha (recommended rate) and 360 kg/ha. Seeding rates of 60 and 100 kg/ha.

<table>
<thead>
<tr>
<th>Seeding establishment (plants/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry sown (May 12) (i)</td>
</tr>
<tr>
<td>Sown after break (June 22)</td>
</tr>
<tr>
<td>(ii)</td>
</tr>
<tr>
<td>(iii)</td>
</tr>
<tr>
<td>(iv)</td>
</tr>
<tr>
<td>Mean* lupin density</td>
</tr>
<tr>
<td>32a</td>
</tr>
<tr>
<td>27b</td>
</tr>
<tr>
<td>33a</td>
</tr>
<tr>
<td>34a</td>
</tr>
<tr>
<td>Broadleaf weed** density</td>
</tr>
<tr>
<td>114</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>38</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

* Mean of fertilizer and seed rates
** Capeweed and doublegee

Letters following the density values indicate significant difference at 5%

AOV seedling establishment: Date sown x simazine interaction *; Simazine x seed interaction **; fertilizer rates, NS
Plots harvested November 12 (grain kg/ha)

<table>
<thead>
<tr>
<th>Super Rate</th>
<th>Seed Rate</th>
<th>Dry sown (May 11) (i)</th>
<th>Sown after break (June 22) (iii)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>60</td>
<td>893</td>
<td>810</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>853</td>
<td>1073</td>
</tr>
<tr>
<td>240</td>
<td>60</td>
<td>840</td>
<td>810</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>1000</td>
<td>1100</td>
</tr>
<tr>
<td>360</td>
<td>60</td>
<td>847</td>
<td>880</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>953</td>
<td>1100</td>
</tr>
</tbody>
</table>

EXPERIMENT 82NO38 - J.D. & T.J. Bateman and Son, Gwambygine

Red-brown loamy sand with buckshot gravel. Lupin crop sown into wheat stubble. Basal fertilizer 150 kg super/ha. May to October rainfall = 288 mm.

Sowing methods:

Dry sown (May 11) sprayseed (1.5 L/ha) on May 7, and simazine (1.5 L) and trifluralin (1.5 L/ha) applied May 25.

Sown at break (May 31) (i) sprayseed (2 L) + Simazine (2 L/ha) applied May 29 before seeding with tyned seeder.

(ii) sprayseed (2 L/ha) applied May 29 and diuron (2 L/ha) applied May 31.

Lupin cultivars: Chittick, Yandee sown at 80 kg/ha. Kiev mutant, Kiev skorospely, Ultra sown at 160 kg/ha on May 11, but at 180 kg/ha on May 31.

Seeding establishment (plants/m²)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Dry sown</th>
<th>Sown at break (i)</th>
<th>Sown at break (ii)</th>
<th>Lupin density LSD, Prob 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chittick density</td>
<td>37.5</td>
<td>52</td>
<td>48</td>
<td>Date mean = 7</td>
</tr>
<tr>
<td>Yandee</td>
<td>44</td>
<td>53</td>
<td>48</td>
<td>LSD</td>
</tr>
<tr>
<td>K. mutant</td>
<td>35</td>
<td>54</td>
<td>52</td>
<td>Cult. mean = 7</td>
</tr>
<tr>
<td>K. skorospely</td>
<td>41</td>
<td>57</td>
<td>49</td>
<td>LSD</td>
</tr>
<tr>
<td>Ultra</td>
<td>26</td>
<td>37</td>
<td>43</td>
<td></td>
</tr>
</tbody>
</table>

Weed density* 52 8 18.5

* Barley grass and doublegee
Plots harvested November 30 (grain kg/ha)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Dry sown</th>
<th>Sown at break</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(i)</td>
<td>(ii)</td>
</tr>
<tr>
<td>Chittick density</td>
<td>1522</td>
<td>1568</td>
</tr>
<tr>
<td>Yandee</td>
<td>1686</td>
<td>1521</td>
</tr>
<tr>
<td>K. mutant</td>
<td>1989</td>
<td>1966</td>
</tr>
<tr>
<td>K. skorospely</td>
<td>2013</td>
<td>2060</td>
</tr>
<tr>
<td>Ultra</td>
<td>1756</td>
<td>1639</td>
</tr>
</tbody>
</table>

EXPERIMENT 82N18 - Paddock 1E, Newdegate Research Station

Grey sand over gravel. Lupins sown into wheat stubble. Basal fertilizer of 150 kg super per ha. Yandee lupin cultivar sown at 80 kg/ha. May to October rainfall = 247 mm.

Sowing methods:

(i) Dry sown (May 14) with tynded seeder. Hoegrass (2 L/ha) applied June 18, Fusillade® (1.5 L/ha) applied July 14.

(ii) Sown at break (May 26) with tynded seeder. Hoegrass (2 L/ha) applied June 18, Fusillade® (1.5 L/ha) applied July 14.

(iii) Sown after break (June 15):

   (a) direct drilled with tynded seeder then simazine applied (2 L/ha)
   (b) plots cultivated befor seeding and simazine applied (2 L/ha)

(iv) Sown June 21:

   (a) as above
   (b) as above

(v) Sown July 6:

   (a) as above
   (b) as above
Plots harvested November 30 (grain kg/ha)

<table>
<thead>
<tr>
<th>Date seeded</th>
<th>Method</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 14</td>
<td>DD + Hoegrass</td>
<td>236</td>
</tr>
<tr>
<td>May 26</td>
<td>DD + Hoegrass</td>
<td>291</td>
</tr>
<tr>
<td>June 15</td>
<td>a</td>
<td>785</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>962</td>
</tr>
<tr>
<td>June 21</td>
<td>a</td>
<td>548</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>722</td>
</tr>
<tr>
<td>July 6</td>
<td>a</td>
<td>625</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>653</td>
</tr>
</tbody>
</table>

Note: Dry sowing resulted in heavy WRG and Bromegrass weed problem, not overcome by 'Fusillade'.

EXPERIMENT 82MA13 - T. Packard and Son, Bokerup

Gravelly sandy loam, redgum vegetation. Basal fertilizer plain super. Lupins sown with Diuron (2 L/ha) applied after seeding; Narrow leaf lupins sown at 80 kg/ha, Albus lupin cultivars sown at 150 kg/ha.

May to October rainfall =

Plots harvested December 21 - Grain yield (kg/ha)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Sown June 16</th>
<th>Sown July 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra</td>
<td>786</td>
<td>564</td>
</tr>
<tr>
<td>Hamburg</td>
<td>1067</td>
<td>447</td>
</tr>
<tr>
<td>Kiev mutant</td>
<td>1371</td>
<td>776</td>
</tr>
<tr>
<td>Kiev skorospely</td>
<td>1448</td>
<td>743</td>
</tr>
<tr>
<td>Yandee</td>
<td>2043</td>
<td>1292</td>
</tr>
<tr>
<td>Unicrop</td>
<td>1705</td>
<td>1121</td>
</tr>
<tr>
<td>Chittick</td>
<td>1586</td>
<td>957</td>
</tr>
</tbody>
</table>

CONCLUSIONS FROM SERIES 1

1. It is vital to obtain adequate weed control with early seeding of lupins. Dry sown without Simazine produced heavy weed content and yield reduction of 33% at Eradu and 76% yield reduction at Newdegate.

   At Eradu, the use of simazine with dry sowing gave a significant drop in crop establishment, however crop yields were still much higher through weed control.

2. On fertile medium soils in the York area (82NO38), the Kiev lupin cultivars outyielded the narrow leaf lupins. Establishing the crop with Diuron produced a yield decline in Chittick and Yandee cultivars but not in the Albus cultivars, the cause is not clear.
### Summary of Growth Factor interactions

<table>
<thead>
<tr>
<th>Factor</th>
<th>82GE20</th>
<th>82N038</th>
<th>82N18</th>
<th>82MA13</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yield</td>
<td>% of good yield</td>
<td>Yield</td>
<td>% of good yield</td>
</tr>
<tr>
<td></td>
<td>June 22:1249</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultivar</td>
<td>Kiev skor. 2060</td>
<td>99</td>
<td>Kiev mut. 1966</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Ultra 1756</td>
<td>85</td>
<td>Ultra 1756</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Yandee 1686</td>
<td>82</td>
<td>Yandee 1686</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Chittick 1568</td>
<td>76</td>
<td>Chittick 1568</td>
<td>76</td>
</tr>
<tr>
<td>Density</td>
<td>37 :1500</td>
<td>88.5</td>
<td>37 :1500</td>
<td>88.5</td>
</tr>
<tr>
<td></td>
<td>29 :1327</td>
<td></td>
<td>29 :1327</td>
<td></td>
</tr>
<tr>
<td>Simazine</td>
<td>+ :1500</td>
<td>67</td>
<td>+ :1500</td>
<td>67</td>
</tr>
<tr>
<td>(Weed control)</td>
<td>- :1000</td>
<td></td>
<td>- :1000</td>
<td></td>
</tr>
<tr>
<td>Fertilizer rate</td>
<td>360 :1320</td>
<td>92</td>
<td>360 :1320</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>120 :1320</td>
<td></td>
<td>120 :1320</td>
<td></td>
</tr>
<tr>
<td>Weed Competition</td>
<td>Cultiv-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ation + Simaz: 962</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.D. + Simaz: 785</td>
<td>82</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry Dry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sown,DD + Hoegr: 236</td>
<td>24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cultivation
+ Simaz: 962
D.D.
+ Simaz: 785 82
Dry
Sown,DD
+ Hoegr: 236 24
2. LUPIN AGRONOMY, SERIES 2 - HARVEST INDEX RESPONSE TO DENSITY
(File 2991 Ex)

OBJECTIVE:

To establish whether the harvest index of plants at crop density for maximum yield remains constant over environmental conditions and whether differences exist between cultivars.

BACKGROUND:

Grain yield is a function of biological yield and harvest index. If H.I. is constant over environments, it should be possible to extrapolate potential grain yield for any environment based on the potential biological yield.

The series continues in 1982 with three sites selected for a range in rainfall.

EXPERIMENT 82MT32 - Paddock E6, Mt Barker Research Station

Gravelly loamy sand, redgum vegetation. Basal fertilizer of 195 kg super per ha. Lupins are first crop after pasture sown June 23. Basal weed control of Sprayseed (2 L/ha) which was applied twice and Hoegrass (2 L/ha) applied August 4. Wild radish a major component of plots. Lupin growth restricted by wet soil conditions and not all plots harvested, and only half the plot length harvested. May to October rainfall = 373 mm.

Only plots in Replicate 2 harvested.

<table>
<thead>
<tr>
<th>Seed rate (kg/ha)</th>
<th>50</th>
<th>80</th>
<th>110</th>
<th>140</th>
<th>170</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yandee: Crop density</td>
<td>22</td>
<td>33.5</td>
<td>47</td>
<td>69</td>
<td>84</td>
<td>95.5 per m²</td>
</tr>
<tr>
<td>Biomass</td>
<td>5506</td>
<td>8701</td>
<td>6332</td>
<td>10909</td>
<td>15108</td>
<td>12510 kg/ha</td>
</tr>
<tr>
<td>Yield</td>
<td>1197</td>
<td>1395</td>
<td>2014</td>
<td>1789</td>
<td>1853</td>
<td>1745 kg/ha</td>
</tr>
<tr>
<td>H.I.</td>
<td>29.3</td>
<td>25.9</td>
<td>28.1</td>
<td>27.6</td>
<td>27.3</td>
<td>21.4 %</td>
</tr>
<tr>
<td>P23240: Crop density</td>
<td>30</td>
<td>44.5</td>
<td>56</td>
<td>72.5</td>
<td>67.5</td>
<td>93 per m²</td>
</tr>
<tr>
<td>Biomass</td>
<td>4193</td>
<td>5529</td>
<td>5814</td>
<td>8362</td>
<td>6415</td>
<td>6034 kg/ha</td>
</tr>
<tr>
<td>Yield</td>
<td>760</td>
<td>1182</td>
<td>1401</td>
<td>1303</td>
<td>1270</td>
<td>1485 kg/ha</td>
</tr>
<tr>
<td>H.I.</td>
<td>26.2</td>
<td>25.8</td>
<td>26.7</td>
<td>28.8</td>
<td>26.6</td>
<td>28.9 %</td>
</tr>
</tbody>
</table>

EXPERIMENT 82N19 - Paddock N3, Newdegate Research Station

Brown sand over gravel. Basal fertilizer 140 kg super/ha. The pasture had been spray-topped in 1981 and the paddock scarified prior to seeding (dry) on May 18. Considerable bromegrass occurred in the plots and the lupins suffered what appeared to be manganese deficiency which reduced seed size. May to October rainfall = 247 mm.
### EXPERIMENT 82M24 - Paddock 9c, Merredin Research Station

Reddish loamy sand, Morrel-Salmon Gum vegetation. The lupin plots were the first crop after pasture, sown (dry) on May 12. The site was ploughed and Simazine (2 L/ha) applied after seeding. Basal fertilizer of 140 kg super/ha. No weeds present but patchy establishment due to simazine toxicity in spray overlaps. May to October rainfall = 196 mm.

#### Seed rate (kg/ha)

<table>
<thead>
<tr>
<th></th>
<th>50</th>
<th>80</th>
<th>110</th>
<th>140</th>
<th>170</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yandee:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop density</td>
<td>25</td>
<td>44</td>
<td>51</td>
<td>66</td>
<td>73</td>
<td>93</td>
</tr>
<tr>
<td>Biomass</td>
<td>5078</td>
<td>7829</td>
<td>6522*</td>
<td>7350</td>
<td>8994</td>
<td>11632</td>
</tr>
<tr>
<td>Yield</td>
<td>534</td>
<td>779</td>
<td>892</td>
<td>1013</td>
<td>1101</td>
<td>838</td>
</tr>
</tbody>
</table>
| H.I.        | 27.0| 26.5| 17.8*| 25.8| 25.8| 23.2 |%
| **P23240:** |     |     |     |     |     |     |
| Crop density | 19  | 35  | 48  | 60  | 76  | 91  |
| Biomass     | 3372| 4955| 4281*| 8696| 7883| 9202|
| Yield       | 341 | 600 | 698 | 763 | 845 | 614 |
| H.I.        | 27.9| 29.7| 22.0*| 30.9| 29.2| 30.2 |%

* One replicate only

---

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## COMMENTS ON SERIES 2 - HARVEST INDEX

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Location</th>
<th>Density at max. yield</th>
<th>H.I. at max. yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yandee</td>
<td>Mt Barker</td>
<td>50</td>
<td>28.0</td>
</tr>
<tr>
<td></td>
<td>Newdegate</td>
<td>70</td>
<td>25.8</td>
</tr>
<tr>
<td></td>
<td>Merredin</td>
<td>75</td>
<td>30.5</td>
</tr>
<tr>
<td>P23240</td>
<td>Mt Barker</td>
<td>70</td>
<td>28.8</td>
</tr>
<tr>
<td></td>
<td>Newdegate</td>
<td>75</td>
<td>29.2</td>
</tr>
<tr>
<td></td>
<td>Merredin</td>
<td>45</td>
<td>30.8</td>
</tr>
</tbody>
</table>

The results tend to confirm 1981 conclusion that location influences the harvest index obtained, but the harvest index at maximum seed yield seems quite similar for conventional and the reduced branched lupin cultivars.
OBJECTIVE

To examine crop growth and yield response to fertilizer rates on problem soils.


Leached grey sand over pale yellow sand with a history of legume establishment failure due either to poor nutrition or nodulation failure.

Illyarrie lupin sown at 80 kg/ha on May 27 with treatments designed to show whether nodulation, superphosphate, potash, manganese or trace element mix were implicated.

The lupin plants were decimated by rabbits and the trial not harvested. Seedling establishment indicated no problem with nodulation or potash at this site.

EXPERIMENT 82MA14 - S. Johnson, Unicup.

Grey sand over gravel, selected as suitable for response to potash. New land, first crop. The farmer broadcast 200 kg/ha super No. 1 mix, another 200 kg/ha of super + manganese was broadcast on the plots after seeding and 197 kg/ha super No. 1 mix was sown with the seed. The plots were sown on May 19, Yandee at 80 kg/ha and Ultra at 150 kg/ha. Potash rates broadcast on plots four weeks after seeding.

From seedling establishment onwards, the growth of lupins was severely retarded. Crop analyses suggest that P-uptake and Cu-uptake by plants were below the 'critical values' irrespective of the quantity applied as basal to the plots.

EXPERIMENT 82M017 - G. Meadows, Lancelin

In 1981, Ultra lupin grew well on infertile sands at Lancelin and potash gave a greater yield response than manganese.

In 1982, we compared the lupin variety response to potash and manganese fertilizers. New land, cropped to wheat in 1981. Silicous sand with limestone outcrops. Basal fertilizer of 315 kg super + molybdenum/ha. MnSO₄ rates mixed with the basal fertilizer and sown with the seed. Potash broadcast on plots six weeks after seeding. May to October rainfall =

Excellent growth of both lupin cultivars. The Ultra commenced senescence earlier than Illyarrie and had severe Brown Leaf Spot infection on foliage.
Plots harvested November 30 - Grain yield (kg/ha)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Potash rate (kg/ha)</th>
<th>MnSO₄ rates (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Illyarrie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1865</td>
<td>2287</td>
</tr>
<tr>
<td>100</td>
<td>1895</td>
<td>2215</td>
</tr>
<tr>
<td>Ultra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1160</td>
<td>1670</td>
</tr>
<tr>
<td>100</td>
<td>1340</td>
<td>1325</td>
</tr>
</tbody>
</table>

Appears to be a response to manganese more so than potash. Yield responses arise from a response in seed number per plant, not seed size differences.

SUMMARY

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Illyarrie yield = 2453 kg/ha</th>
<th>Ultra yield = 1480 (60% of good yield)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer</td>
<td>Mn + K yield = 2453 kg/ha</td>
<td>Mn yield = 2215 (90% of good yield)</td>
</tr>
<tr>
<td></td>
<td>K yield = 1895 (77% of good yield)</td>
<td>Nil yield = 1865 (76% of good yield).</td>
</tr>
</tbody>
</table>
4. ERREGULLA LUPIN ROTATION PLOTS  (File 3434 Ex)

OBJECTIVE

To gather information on the potential of hardseeded Erregulla lupin to regenerate as a grain crop as well as improve cereal yields in crop rotation.

Four identical experiments were established in the Moora district in 1981, consisting of five lupin and five natural pasture species plots. All plots were sown to wheat in 1982, with rates of nitrogen treatments.

EXPERIMENT 81MO27 - R. Wilson, Lancelin

Site sprayed with Sprayseed (2 L/ha) and Banvel (500 ml/ha). Miling wheat sown on June 11. Basal superphosphate of 150 kg/ha, Agran treatments topdressed at seeding.

<table>
<thead>
<tr>
<th>Kg/ha Agran</th>
<th>0</th>
<th>40</th>
<th>75</th>
<th>118</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erregulla block</td>
<td>120</td>
<td>155</td>
<td>146</td>
<td>175</td>
</tr>
<tr>
<td>Natural pasture block</td>
<td>55</td>
<td>73</td>
<td>81</td>
<td>119</td>
</tr>
</tbody>
</table>

kg/ha wheat yield

EXPERIMENT 81MO28 - P. Shields, Dandaragan

Site ploughed, cultivated and sown to Miling wheat on June 19. Site sprayed with "Barrel" (0.75 L/ha) on August 1. Basal fertilizer of 90 kg/ha plain super. Agran treatments topdressed on July 5.

<table>
<thead>
<tr>
<th>Kg/ha Agran</th>
<th>0</th>
<th>42</th>
<th>84</th>
<th>123</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erregulla block</td>
<td>2104</td>
<td>2411</td>
<td>2456</td>
<td>2643</td>
</tr>
<tr>
<td>Natural pasture block</td>
<td>2240</td>
<td>2315</td>
<td>2429</td>
<td>2412</td>
</tr>
</tbody>
</table>

kg/ha wheat yield
EXPERIMENT 81MO29 - Waddell and Son, Moora

Site ploughed and Gamenya wheat seeded with a cultitrash on June 16. Basal fertilizer of 120 kg/ha super and the Agran treatments topdressed on June 21.

<table>
<thead>
<tr>
<th>Kg/ha Agran</th>
<th>0</th>
<th>41</th>
<th>82</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erregulla block</td>
<td>558</td>
<td>940</td>
<td>1052</td>
<td>1242</td>
</tr>
<tr>
<td>Natural pasture block</td>
<td>620</td>
<td>728</td>
<td>906</td>
<td>1058</td>
</tr>
</tbody>
</table>

EXPERIMENT 81MO30 - R. Spencer, Watheroo

Farmer seeded across the plots with Miling wheat and 113 kg/ha Agran No. 1 on June 16. Agran treatments topdressed on June 21.

<table>
<thead>
<tr>
<th>Kg/ha Agran</th>
<th>0</th>
<th>41</th>
<th>82</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erregulla block</td>
<td>176</td>
<td>240</td>
<td>242</td>
<td>240</td>
</tr>
<tr>
<td>Natural pasture block</td>
<td>160</td>
<td>160</td>
<td>160</td>
<td>168</td>
</tr>
</tbody>
</table>

Severe copper deficiency was detected in the grain, which helps explain the poor response to nitrogen.

SUMMARY

1. At most sites, heavy bromegrass infested the natural pasture blocks - weed competition confounded the yield responses to restrict the yield of the pasture blocks at higher Agran rates.

2. At two sites the natural pasture blocks yielded slightly higher than the yield following the low density Erregulla crops (in absence of Agran), probably due to greater of clover in the 'natural' pasture.
5.1 GRAIN LEGUMES FOR WHEATBELT ROTATIONS (File 3083 Ex)

OBJECTIVE

To compare the soil fertility after one year growth of different legume species.

BACKGROUND

Different grain legume species were established in trials in 1981. Soil samples have been taken from under these crops to establish if any increase in soil nitrogen has occurred. Wheat crops have been sown following the legume, this year and their yield compared with the yield response by wheat to fertilizer nitrogen.

EXPERIMENT 81GE6 - Fabling, Canna

Yellow sandplain, slightly acid pH soil.

The plots were sown to wheat, but the crop was droughted in August/September and not harvested.

EXPERIMENT 81TS3 - W. Stokes, West Arrino

Grey sand over gravel, Blackboy and Banksia vegetation. Plots sown to Gamenya wheat. Agran treatments topdressed after seeding.

<table>
<thead>
<tr>
<th>1981 crop</th>
<th>1982 Agran rate (kg ha⁻¹)</th>
<th>1981 N-available* (kg ha⁻¹)</th>
<th>Wheat yield (kg ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nungarin sub.</td>
<td></td>
<td></td>
<td>703</td>
</tr>
<tr>
<td>Illyarrie lupin</td>
<td>30.4</td>
<td></td>
<td>820</td>
</tr>
<tr>
<td>Derrimut pea</td>
<td>13.9</td>
<td></td>
<td>697</td>
</tr>
<tr>
<td>Lanquedoc vetch</td>
<td>7.3</td>
<td></td>
<td>697</td>
</tr>
<tr>
<td>Gamenya wheat</td>
<td>0</td>
<td>2.1</td>
<td>678</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td></td>
<td>1026</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td></td>
<td>1270</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td></td>
<td>1350</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td></td>
<td>1350</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td></td>
<td>1373</td>
</tr>
</tbody>
</table>

* N-available = Total N-uptake in 1981 crop - N-uptake in grain.
EXPERIMENT 81ME3 - A.W. & B. Ivey, South Bodallin

Yellow sandplain, wodgil vegetation. Plots sown to Halberd wheat on May 19, with super at 200 kg/ha. Agran rate treatments topdressed at seeding.

The plots had large wild oat and capeweed population which exacerbated the effects of the dry season.

<table>
<thead>
<tr>
<th>1981 crop</th>
<th>1982 Agran rate (kg ha(^{-1}))</th>
<th>1981 N-avail (kg ha(^{-1}))</th>
<th>1982 Biomass (kg ha(^{-1}))</th>
<th>Wheat yield (kg ha(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nungarin sub.</td>
<td>19.3</td>
<td>16.9</td>
<td>4.2</td>
<td>4.4</td>
</tr>
<tr>
<td>Illyarrie lupin</td>
<td>52</td>
<td>102</td>
<td>149</td>
<td>204</td>
</tr>
<tr>
<td>Derrimut pea</td>
<td>16.9</td>
<td>4.2</td>
<td>590</td>
<td>736</td>
</tr>
<tr>
<td>Lanquedoc vetch</td>
<td>52</td>
<td>102</td>
<td>896</td>
<td>878</td>
</tr>
<tr>
<td>Halberd wheat</td>
<td>0</td>
<td>4.4</td>
<td>597</td>
<td>681</td>
</tr>
<tr>
<td></td>
<td>52</td>
<td></td>
<td>681</td>
<td></td>
</tr>
</tbody>
</table>

The 1982 lupin plots gave a markedly inferior cereal colour and growth response, the cause of which is not known.

EXPERIMENT 81MO5 - J. Woods, Lancelin

Yellow siliceous sand over limestone.

Plots sown to Miling wheat on June 15, with plain super at 195 kg/ha. The Agran treatments were topdressed on July 12. Brominil M (1.0 L/ha) applied to site on July 12. The wheat gave poor tillering and reduced growth.

Animals grazed plots mid-way through harvesting.
1981 crop | 1982 Agran rate (kg ha\(^{-1}\)) | 1981 N-avail (kg ha\(^{-1}\)) | 1982 Biomass (kg ha\(^{-1}\)) | Wheat yield\(^{1}\) (kg ha\(^{-1}\))
---|---|---|---|---
Seaton Pk sub. | | | 990 | 400
Yandee lupin | 25.9 | 970 | 520
P23240 lupin | 24.3 | 1168 | 540
Chickpea | 13.7 | 1195 | 620
Fababean | 5.2 | (1648)\(^{1}\) | -
Adeza 64 vetch | 2.5 | 1115 | 460
Wheat | 0 | 896 | 460
50 | | (1421)\(^{1}\) | 620
100 | | 1366 | -
150 | | 2318 | 880
200 | | 2373 | 920
300 | | 2850 | 960

(l) one replicate only

EXPERIMENT 81M014 - J. Millsteed, Watheroo

Yellow sandplain, Tammar vegetation. Site had Sprayseed (2 L/ha) and DDT applied on June 15. The plots sown to Gamenya wheat and plain super at 165 kg/ha on June 16. Agran treatments topdressed immediately prior to seeding.

1981 crop | 1982 Agran rate (kg ha\(^{-1}\)) | 1981 N-avail (kg ha\(^{-1}\)) | 1982 Biomass (kg ha\(^{-1}\)) | Wheat yield (kg ha\(^{-1}\))
---|---|---|---|---
Nungarin sub. | | | 1081 ef | 453
Illyarrie lupin | 32.0 | 1280 def | 614
Derrimut pea | 26.3 | 1395 de | 619
Lanquedoc vetch | 10.0 | 1000 f | 419
Halberd wheat | 0 | 948 f | 414
50 | | 1477 d | 635
102 | | 1958 c | 860
154 | | 2393 b | 1009
200 | | 2870 a | 1076
282 | | 2996 a | 1034

Yields followed by the same letters do not significantly differ (Prob. 5%).

SUMMARY

1. Nitrogen uptake values show lupin and pea to be superior to vetch, chickpea and fababean.
2. Wheat biomass from grain legume plots compared with response curve to Agran fertilizer show field pea to give a yield equivalent to 50 kg Agran, followed by lupin at 33-35 kg Agran, subclover at 15 kg Agran/ha and vetch.

3. Comparison of wheat grain yield response after legume with the response to fertilizer show lupin and pea to yield the equivalent of 25-50 kg Agran per ha, subclover and vetch yield equivalent to 15-20 kg Agran/ha.

4. The yield response after the grain legumes are only 60% of the maximum yield response with fertilizer.

5. Very little difference between the normal branched lupin (Yandee) and reduced branching lupin (P23240) in following wheat yields.
5.2 GRAIN LEGUME SPECIES TRIALS (File 3250 Ex)

OBJECTIVE

To compare the growth and yield potential of a range of grain legume species.

EXPERIMENT 81E30 - Paddock E3b, Esperance Downs Research Station.

Caitup sand over gravel at 15 cm. Rainfall = 338 mm, May to October. Site had Sprayseed at 2 L/ha on June 3. Egret wheat was sown on all plots on June 11, with 120 kg super/ha. Hoegrass was applied at 1 L/ha on July 19.

Some Bromegrass throughout site and Rhizoctonia root rot patches.

<table>
<thead>
<tr>
<th>1981 Crop</th>
<th>1982 Wheat</th>
<th>1981 Crop Yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egret wheat</td>
<td>324</td>
<td>2063</td>
</tr>
<tr>
<td>Illyarrie lupin</td>
<td>1500</td>
<td>1280</td>
</tr>
<tr>
<td>Chittick lupin</td>
<td>1430</td>
<td>1066</td>
</tr>
<tr>
<td>Dundale pea</td>
<td>1458</td>
<td>1299</td>
</tr>
<tr>
<td>Dun pea</td>
<td>1458</td>
<td>1152</td>
</tr>
<tr>
<td>Derrimut pea</td>
<td>1199</td>
<td>1444</td>
</tr>
<tr>
<td>WP-7 pea</td>
<td>1347</td>
<td>816</td>
</tr>
<tr>
<td>Languedoc vetch</td>
<td>1190</td>
<td>1188</td>
</tr>
<tr>
<td>Popany vetch</td>
<td>1282</td>
<td>1034</td>
</tr>
<tr>
<td>Adeza 46 vetch</td>
<td>1625</td>
<td>305</td>
</tr>
<tr>
<td>Adeza 64 vetch</td>
<td>1283</td>
<td>574</td>
</tr>
<tr>
<td>Lathyrus sativus (310028)</td>
<td>1018</td>
<td>273</td>
</tr>
<tr>
<td>L. cicera (300010)</td>
<td>1523</td>
<td>615</td>
</tr>
<tr>
<td>L. ochrus (320004)</td>
<td>1116</td>
<td>355</td>
</tr>
<tr>
<td>Fababean (383A)</td>
<td>1190</td>
<td>337</td>
</tr>
<tr>
<td>Fababean (100020)</td>
<td>967</td>
<td>346</td>
</tr>
</tbody>
</table>

5.2.1 Medium to high rainfall zones, medium soils pH 5.5 to 7.0

EXPERIMENT 82N042 - M. Heath, Toodyay

Red brown loam, York Gum vegetation, third crop after clover pasture. Site ploughed and sown dry on May 19. Simazine applied (1.5 L/ha) before seeding on all except the wheat plots. Plain super at 120 kg/ha, Agran at 100 kg/ha topdressed on wheat plots. Heavy Lucerne flea damage to legumes, even though control was applied. Capeweed smothered prostrate legume crops.

All plots quadrat sampled for grain yield (g/m²).

May to October rainfall = 286 mm.
EXPERIMENT 82NA31 - T. Prowse, Darkan

Red gritty loam over pale laterite. Sheoak and Jam vegetation. Third crop after pasture. Site cultivated and Simazine applied (1.5 L/ha) on June 4. Plots sown into moist soil June 9 with 160 kg/ha plain super. Agran at 100 kg/ha topdressed onto wheat plots. Control required of RLEM and Lucerne flea damage and the Simazine reduced the wheat establishment. Significant growth difference over length of site corresponding to depth of coarse loam over gravel. Early maturing lines were quadrat samples for grain yield while the later maturing lines were machine harvested (g/m²).

May to October rainfall = 229 mm.

EXPERIMENT 82JE23 - G. Davis, North Needilup

Loamy sand over gravel, Mallee scrub. First crop after clover pasture. Sprayseed applied to first germination at 1.5 L/ha and the plots sown on June 11. Plain super at 100 kg/ha was topdressed on plots and Agran at 100 kg/ha applied to the wheat plots. Heavy seedling mortality from cutworm and RLEM attack, particularly on the lupin. Barley grass dominated the prostrate grain legume crops. The plots were hand harvested for grain yield.

May to October rainfall =

EXPERIMENT 82E26 - Paddock central W17, Esperance Downs Research Station

Gravelly sand over clay, first crop after pasture. Site sprayed with Sprayseed (1 L/ha) and Simazine (1.5 L/ha) tank mix the day before seeding (May 27). Manganese Super at 100 kg/ha topdressed over site and Agran at 100 kg/ha applied to cereal plots after seeding. Good weed control and no serious insect problem. The plots machine harvested for grain yield (g/m²).

May to October rainfall = 338 mm.

EXPERIMENT 82LG28 - B. Smith, Pingrup

Sandy gravel over gravel. Mallet vegetation. First crop after clover pasture. Site cultivated and then sown on June 10 with 120 kg/ha plain super. Simazine (1.5 L/ha) and DDT were applied the next day to all but the wheat plots. After sowing, the farmer accidentally seeded over two of the replications with wheat.

The early maturing lines were quadrat sampled in Replicate 1 for grain yield (g/m²).

May to October rainfall = 229 mm.
<table>
<thead>
<tr>
<th>Cultivar/accession</th>
<th>82NO42</th>
<th>82NA31</th>
<th>82JE23</th>
<th>82E26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>100.5</td>
<td>0</td>
<td>0</td>
<td>124.0</td>
</tr>
<tr>
<td>Illyarrie lupin</td>
<td>218.5</td>
<td>138.1</td>
<td>4.7</td>
<td>291.1</td>
</tr>
<tr>
<td>Derrimut pea</td>
<td>198.7</td>
<td>126.7</td>
<td>66.2</td>
<td>169.4</td>
</tr>
<tr>
<td>Popany vetch</td>
<td></td>
<td>18.7</td>
<td>24.2</td>
<td></td>
</tr>
<tr>
<td>Pink avago vetch</td>
<td>30.0</td>
<td>47.8</td>
<td>8.1</td>
<td>105.7</td>
</tr>
<tr>
<td>V. sativa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K34969</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>K35030</td>
<td>2.6</td>
<td>0</td>
<td>0</td>
<td>18.0</td>
</tr>
<tr>
<td>V. ervillia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VE5</td>
<td>5.5</td>
<td>13.2</td>
<td>0</td>
<td>36.1</td>
</tr>
<tr>
<td>VE6</td>
<td>21.1</td>
<td>32.2</td>
<td>23.2</td>
<td>66.1</td>
</tr>
<tr>
<td>K517</td>
<td>5.1</td>
<td>15.3</td>
<td>0</td>
<td>44.8</td>
</tr>
<tr>
<td>V. villosa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K33647</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24.3</td>
</tr>
<tr>
<td>L. sativus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L511</td>
<td>14.7</td>
<td>5.3</td>
<td></td>
<td>85.9</td>
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<tr>
<td>L512</td>
<td>5.9</td>
<td>5.3</td>
<td></td>
<td>52.2</td>
</tr>
<tr>
<td>L521</td>
<td>7.5</td>
<td>14.1</td>
<td></td>
<td>62.2</td>
</tr>
<tr>
<td>L533</td>
<td>5.0</td>
<td>3.8</td>
<td>24.3</td>
<td>76.5</td>
</tr>
<tr>
<td>L534</td>
<td>9.5</td>
<td>5.4</td>
<td>0</td>
<td>56.0</td>
</tr>
<tr>
<td>K1298</td>
<td>6.8</td>
<td>5.3</td>
<td>4.3</td>
<td>68.0</td>
</tr>
<tr>
<td>K287</td>
<td>2.6</td>
<td>5.3</td>
<td>5.1</td>
<td>68.0</td>
</tr>
<tr>
<td>L. cicera</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>300010</td>
<td>59.2</td>
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<tr>
<td>Tyson chickpea</td>
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</tr>
<tr>
<td>V. faba</td>
<td></td>
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</tr>
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<td>106.0</td>
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<td></td>
<td></td>
<td></td>
<td>100.5</td>
</tr>
<tr>
<td>Fiord</td>
<td></td>
<td></td>
<td></td>
<td>44.7</td>
</tr>
<tr>
<td>V. narvonensis</td>
<td>14115</td>
<td>18.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fenugreek, Barbara</td>
<td></td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.2.2  **Low rainfall, medium soils pH 5.5 to 7.0**

**EXPERIMENT 82ME41 - M. Fitzpatrick, North Nangeenan**

Gritty loam soil, Salmon Gum/Gimlet vegetation. Site burnt and Sprayseed (1.5 L/ha) and Simazine (1.5 L/ha) tank mix applied to the site except for cereal plots. The plots were sown dry on June 3 with 120 kg/ha plain super. The wheat plots had Agran at 100 kg/ha at seeding. Doublegee was the only problem encountered. The plots were quadrat sampled for grain yield (g/m^2).

May to October rainfall = 193 mm.

5.2.3  **Medium rainfall, calcareous soils pH > 7.5**

**EXPERIMENT 82ES35 - P. Curnow, Scadden**

Sandy loam over alkaline clay at 15 cm. Site cultivated, then a Sprayseed (1.5 L/ha) and Simazine (1.5 L/ha) tank mix applied to all plots except the cereal before seeding. Plots sown May 26 with 120 kg/ha plain super. Agran at 100 kg/ha was topdressed on cereal plots. Heavy ryegrass population in plots which contributed to early senescence of crops. Plots machine harvested for seed yield (g/m^2).

May to October rainfall = 202 mm.

**EXPERIMENT 82ES36 - J. Brown, Mount Nay**

Grey sand over calcareous clay at 12-15 cm. Black mallee and melaleuca scrub. New land, cropped in the previous year. Site cultivated, Sprayseed (1.5 L/ha) and Simazine (1.5 L/ha) tank mix applied to all plots except wheat. Plots seeded on May 26 with 250 kg super/ha topdressed and incorporated with seeding machinery. Agran at 100 kg/ha broadcast on wheat plots. Good weed control achieved. Plots hand harvested for grain yield (g/m^2).

May to October rainfall =

5.2.4  **Low rainfall, acid soil reaction (pH < 5.5)**

**EXPERIMENT 82TS25 - K. Delane, East Carnamah**

Yellow sand to depth, wheat sown in previous year. Sprayseed (1.5 L/ha) and Simazine (1.5 L/ha) applied to all plots except the wheat on May 21. Roundup applied before seeding. Plots sown dry on June 2 with 120 kg/ha super. Agran at 100 kg/ha broadcast over wheat plots. Crop establishment quite thin, poor nodulation on many species.

Plots quadrat sampled for grain yield (g/m^2) and pods of many species had shattered badly.

May to October rainfall = 180 mm.
EXPERIMENT 82ME39 - M. McGinniss, Merredin

Yellow sand to depth, Wodgil vegetation. Sprayseed (1.5 L/ha) and Simazine (1.5 L/ha) tank mix applied to all plots except the wheat. Sown dry on June 3 with 120 kg/ha plain super. Agran at 100 kg/ha broadcast on wheat plots. Good weed control, but crops had very poor establishment. The plots were quadrant sampled on the areas with some plant establishment for grain yield (g/m²).

<table>
<thead>
<tr>
<th>Cultivar/accession</th>
<th>82LG28</th>
<th>82ME41</th>
<th>82ES35</th>
<th>82ES36</th>
<th>82TS25</th>
<th>82ME39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
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<td>166.3</td>
<td>74.7</td>
<td>17.2</td>
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<tr>
<td>Illyarrie lupin</td>
<td>177.4</td>
<td>35.3</td>
<td>83.1</td>
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<tr>
<td>Derrimut pea</td>
<td>48.6</td>
<td>61.3</td>
<td>181.8</td>
<td>162.0</td>
<td>31.4</td>
<td>24.9</td>
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<tr>
<td>Popany vetch</td>
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<td>34.1</td>
<td></td>
<td></td>
<td>12.4</td>
<td>2.4</td>
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<tr>
<td>Pink avago vetch</td>
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<td>28.2</td>
<td>129.1</td>
<td>37.3</td>
<td>9.1</td>
<td>8.4</td>
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<tr>
<td>V. sativa K34969</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>V. sativa K35030</td>
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<td>0</td>
<td>17.2</td>
<td>0</td>
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<tr>
<td>V. ervillia VE5</td>
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<tr>
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<td>1.4</td>
<td>43.1</td>
<td>101.3</td>
<td>7.9</td>
<td>0.3</td>
</tr>
<tr>
<td>V. ervillia K517</td>
<td>0.9</td>
<td>41.2</td>
<td>38.9</td>
<td>4.4</td>
<td>0</td>
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<td>V. villosa K33647</td>
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<td>28.6</td>
<td>0</td>
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</tr>
<tr>
<td>L. sativus L511</td>
<td>1.8</td>
<td>11.4</td>
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<td></td>
<td></td>
<td>8.5</td>
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<tr>
<td>L. sativus L512</td>
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<td>6.3</td>
<td>134.0</td>
<td>13.6</td>
<td>3.6</td>
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</tr>
<tr>
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<td>0.6</td>
<td>5.8</td>
<td>70.6</td>
<td>14.0</td>
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<td>103.6</td>
<td>13.4</td>
<td>10.4</td>
<td></td>
</tr>
<tr>
<td>L. sativus L534</td>
<td>2.1</td>
<td>8.7</td>
<td>105.0</td>
<td>14.2</td>
<td>7.3</td>
<td></td>
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<tr>
<td>L. sativus K1298</td>
<td>0.9</td>
<td>16.8</td>
<td>87.5</td>
<td>13.2</td>
<td>6.3</td>
<td></td>
</tr>
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<td>99.0</td>
<td>0.6</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>L. cicera 300010</td>
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<td>54.4</td>
<td>151.2</td>
<td>8.1</td>
<td>7.2</td>
</tr>
<tr>
<td>L. cicera 300017</td>
<td>47.9</td>
<td>19.9</td>
<td>59.8</td>
<td>110.4</td>
<td>6.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Tyson chickpea</td>
<td>28.1</td>
<td>34.3</td>
<td>19.7</td>
<td></td>
<td>35.1</td>
<td>9.0</td>
</tr>
<tr>
<td>V. faba 100067</td>
<td>94.2</td>
<td>143.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V. narbonensis 14115</td>
<td>19.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

-24-
Sites that failed -

EXPERIMENT 82GE23 - G. Teakle, West Northampton

Red clay, Ti-tree and Mallee vegetation. Plots sown dry on June 1 and many of the species suffered heavily from Lucerne flea damage before being heavily grazed by kangaroos.

EXPERIMENT 82ME40 - Paddock 9c, Merredin Research Station

Red loamy sand, Gimlet vegetation. Plots sown dry on June 4. The species were damaged by RLEM attack and Simazine toxicity before being completely overrun by Barley grass.

EXPERIMENT 82JE18 - L. Gleeson, Gairdner River

Pale sand over gravel at 12 cm. Site ripped to a depth of 30 cm. First crop after pasture. Plots sown dry on May 28 and Wimmera ryegrass overran the trial. Only the Derrimut pea was hand harvested, it yielded 49.5 g/m².

SUMMARY

The lupin and field pea performed well on all medium soils, with the lupin superior on sands. On calcareous soils, the field pea outyielded the lupin, but the table was turned on the acidic yellow sand sites.
OBJECTIVES

To examine the yield response of field pea to crop density and investigate the influence of a cover crop of cereal rye on pea yield and ease of harvest.

BACKGROUND

Field pea is a crop that shows potential as a cash grain crop and as a legume for use in cereal crop rotation, especially in the southern wheatbelt and south coast. Many agronomic facets of field pea production have not been adequately examined, particularly in relation to ease of harvest.

EXPERIMENT 82LG27 - B. Smith, Pingrup

Sandy gravel over gravel at 25 cm. Mallet vegetation. First crop after clover pasture. Site cultivated then seeded on June 10 with plain super at 120 kg/ha. Imidan was applied after sowing as a precautionary measure against RLEM.

Plots sown with cone seeder enabling easy mixing of field pea and cereal rye seed rate treatments. The seedling establishment counts provided a measure of crop density and mixture ratios and showed that the WP-7 field pea established at 60% of the Derrimut field pea for the same seed rate. This was due to pea weevil damage to the seed sown. The total plant growth (Biomass) was quadrat sampled on October 14 and separation of selected treatments show that the cereal rye cover crop significantly reduced the field pea component in mixture.

The plots were machine harvested on November 17 and following the machine, each plot was quadrat sampled for seed remaining on the plot. The estimate of harvesting efficiency (due to presence of cover crop supporting the peas) made; seed harvested as a percent of total seed collected. This estimate is confounded by a hail storm just before harvesting which shattered some pods.

<table>
<thead>
<tr>
<th>CULTIVAR</th>
<th>Cereal Rye Rate</th>
<th>Field Pea Rate</th>
<th>Cereal Rye Density</th>
<th>Field Pea Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derrimut</td>
<td>0 0 1002 930 818 1396 1534 1463</td>
<td>5 15 630 814 842 990 1059 870</td>
<td>10 36 450 583 598 630 898 1064</td>
<td>15 51 352 358 711 663 659 619</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WP-7</th>
<th>Density 15 19 30.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 479 572 636</td>
<td></td>
</tr>
<tr>
<td>5 15 282 383 555</td>
<td></td>
</tr>
<tr>
<td>10 36 202 219 351</td>
<td></td>
</tr>
<tr>
<td>15 51 128 240 263</td>
<td></td>
</tr>
</tbody>
</table>
Harvest efficiency (% harvested/total seed)

<table>
<thead>
<tr>
<th>CULTIVAR</th>
<th>Cereal Rye Rate</th>
<th>Pea Rate</th>
<th>50</th>
<th>70</th>
<th>90</th>
<th>110</th>
<th>150</th>
<th>190</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derrimut</td>
<td>0</td>
<td></td>
<td>51</td>
<td>54</td>
<td>58</td>
<td>55</td>
<td>50</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>41</td>
<td>55</td>
<td>51</td>
<td>57</td>
<td>58</td>
<td>63</td>
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<td></td>
<td>41</td>
<td>39</td>
<td>33</td>
<td>45</td>
<td>57</td>
<td>60</td>
</tr>
</tbody>
</table>

COMMENTS

Field pea yield response to 50 plants/m² density. Large yield loss with addition of cover crop. No improvement in harvest efficiency with cover crop.

(File 2999 Ex)

OBJECTIVE

To compare field pea cultivars.

EXPERIMENT 82LG26 - B. Smith, Pingrup

Red gravelly loam over gravel. Mallet vegetation. Pasture paddock cultivated and site sprayed with Simazine (2 L/ha) after seeding. Plots sown on June 10 with 120 kg/ha plain super.

Each cultivar had a Benlate-T seed treatment to evaluate the potential for fungal control. None of the seed of field pea cultivars showed any presence of Ascochyta spp, so little influence, if any, of the Benlate was expected.

The plots were machine harvested on November 17 (peas and Lathyrus) and November 26 (lupins).

Grain yield (kg/ha)

<table>
<thead>
<tr>
<th>CULTIVAR</th>
<th>+ Benlate-T</th>
<th>Crop density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derrimut pea</td>
<td>962</td>
<td>991</td>
</tr>
<tr>
<td>Dundale pea</td>
<td>842</td>
<td>763</td>
</tr>
<tr>
<td>White Brunswick pea</td>
<td>410</td>
<td>636</td>
</tr>
<tr>
<td>WP-7 pea</td>
<td>853</td>
<td>963</td>
</tr>
<tr>
<td>Yandee lupin</td>
<td>388</td>
<td>434</td>
</tr>
<tr>
<td>Kiev mutant lupin</td>
<td>434</td>
<td>428</td>
</tr>
<tr>
<td>Ultra lupin</td>
<td>388</td>
<td>393</td>
</tr>
<tr>
<td>Lathyrus cicera</td>
<td>316</td>
<td>382</td>
</tr>
<tr>
<td>Lathyrus cicera (1)</td>
<td>889</td>
<td>926</td>
</tr>
</tbody>
</table>

(1) Quadrat sampled for yield
OBJECTIVE

To compare the yield and protein content of various mixtures of oat and lupins with pure crops.

EXPERIMENT 82B9 - J. Allen, Jindong

Red loamy sand, Redgum and Jarrah vegetation. Oat crop in previous year. Site cultivated for weed control and the component cultivars of Moore oat and Yandee lupin sown in separate operations into plots on June 21. A nitrogen treatment to the pure oat crop was provided by topdressing 100 kg/ha Agran at seeding.

Plots had a high dock population and oats had a Black Leaf spot fungal disease as well as suffering from severe nitrogen deficiency.

Plots harvested on January 7 for grain yield (g/m²)

<table>
<thead>
<tr>
<th>Seed Rate (oat:lupin)</th>
<th>Crop Density Ratio (oat:lupin)</th>
<th>Oat Yield</th>
<th>Lupin Yield</th>
<th>Total Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>50:0</td>
<td>100:0</td>
<td>372</td>
<td></td>
<td>372</td>
</tr>
<tr>
<td>50:0 + Agran</td>
<td>100:0</td>
<td>752</td>
<td></td>
<td>752</td>
</tr>
<tr>
<td>47.5:15</td>
<td>94:6</td>
<td>320</td>
<td>1105</td>
<td>1425</td>
</tr>
<tr>
<td>45:30</td>
<td>91:9</td>
<td>333</td>
<td>1376</td>
<td>1709</td>
</tr>
<tr>
<td>42.5:45</td>
<td>88:12</td>
<td>288</td>
<td>1869</td>
<td>2157</td>
</tr>
<tr>
<td>40:60</td>
<td>80:20</td>
<td>285</td>
<td>2032</td>
<td>2317</td>
</tr>
<tr>
<td>35:90</td>
<td>66:34</td>
<td>277</td>
<td>2050</td>
<td>2327</td>
</tr>
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<td>30:120</td>
<td>60:40</td>
<td>233</td>
<td>2176</td>
<td>2409</td>
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<tr>
<td>0:100</td>
<td>0:100</td>
<td>2366</td>
<td></td>
<td>2366</td>
</tr>
</tbody>
</table>

Mixture yield responds in direct proportion to lupin component.

EXPERIMENT 82Bul0 - Bramley Research Station

Gravelly loamy sand, Redgum vegetation. First crop after pasture, site cultivated for weed control and the Moore oat and Yandee lupin components sown in separate operations on May 31. The pure oats had an additional N-treatment of Agran at 100 kg/ha topdressed at seeding.

Good weed control and good crop growth, although establishment was patchy in some plots.
<table>
<thead>
<tr>
<th>Seed Rate (oat:lupin)</th>
<th>Crop Density Ratio (oat:lupin)</th>
<th>Oat Yield</th>
<th>Lupin Yield</th>
<th>Total Yield</th>
<th>LER</th>
</tr>
</thead>
<tbody>
<tr>
<td>50:0</td>
<td>100:0</td>
<td>1427</td>
<td>1427</td>
<td>1.000</td>
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</tr>
<tr>
<td>50:0 + Agran</td>
<td>100:0</td>
<td>1435</td>
<td>1435</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>47.5:15</td>
<td>95:5</td>
<td>1505</td>
<td>1.055</td>
<td>577</td>
<td>0.370</td>
</tr>
<tr>
<td>45:30</td>
<td>90:10</td>
<td>1156</td>
<td>0.810</td>
<td>656</td>
<td>0.420</td>
</tr>
<tr>
<td>42.5:45</td>
<td>84:16</td>
<td>1521</td>
<td>1.066</td>
<td>801</td>
<td>0.513</td>
</tr>
<tr>
<td>40:60</td>
<td>80:20</td>
<td>1277</td>
<td>0.895</td>
<td>1260</td>
<td>0.807</td>
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<tr>
<td>35:90</td>
<td>73:27</td>
<td>1352</td>
<td>0.846</td>
<td>1171</td>
<td>0.790</td>
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<tr>
<td>30:120</td>
<td>62:38</td>
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<td>0.722</td>
<td>1287</td>
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<td>0:100</td>
<td>0:100</td>
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</tr>
</tbody>
</table>

EXPERIMENT 82AL34 - J. Bailey, South Stirling

Grey sand over gravel, Mallee scrub. First crop after clover pasture. The pasture had Hoegrass applied in 1981 for grass weed control. Sprayseed at 2 L/ha applied twice over first germination of pasture and an additional weed kill with seeding machinery. Plots sown June 18.

The treatments included a range of Moore oat and Yandee lupin mixtures, and a comparison of crop establishment from sowing the component species as a seed mixture through the machine compared with sowing separately. The effect of applying Simazine (at 2 L/ha) on the oat component was also quantified.

Seedling establishment ratio (oat:lupin)

<table>
<thead>
<tr>
<th>Mixture oat/lupin seed rates (kg/ha)</th>
<th>Sown separately</th>
<th>Sown as mixture</th>
<th>+ Simazine</th>
</tr>
</thead>
<tbody>
<tr>
<td>50:0</td>
<td>100:0</td>
<td>100:0</td>
<td>100:0 (43%)</td>
</tr>
<tr>
<td>47.5:15</td>
<td>95:3</td>
<td></td>
<td>78:22 (42%)</td>
</tr>
<tr>
<td>45:30</td>
<td>87:13</td>
<td>89:11</td>
<td>64:36 (47%)</td>
</tr>
<tr>
<td>42.5:45</td>
<td>84:16</td>
<td></td>
<td>52:48 (36%)</td>
</tr>
<tr>
<td>40:60</td>
<td>77:23</td>
<td>76:24</td>
<td></td>
</tr>
<tr>
<td>35:90</td>
<td>72:28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30:120</td>
<td>58:42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0:100</td>
<td>0:100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The experiment suffered severely from moisture stress in spring and eventually was grazed by sheep prior to harvest.

(1) Oat density as a percentage of establishment without simazine.
SUMMARY

Mixtures of oats and lupin for grain feed ration again showed large yield increases over the highest yielding pure crop yield. Like previous results, the actual mixture ratio was not as critical as the quality of the grain ration required.

Whether the component species were sown separately or as mixed seed, had little effect on crop establishment (both density and proportion).

Use of Simazine for weed control in such mixtures cannot be supported because of a 60% drop in oat seedlings.
7.2 OAT/PEA MIXTURES FOR HAY  (File 2999 Ex)

OBJECTIVES

To evaluate the best ratio of oat and pea as mixtures for hay quantity and quality. To compare several legume species as companion crops in oat/hay mixtures.

EXPERIMENT 82PE21 - N. Kentish, Keysbrook

Sandy loam with Redgum vegetation. First crop after subclover pasture. Dock plants were spot sprayed with Roundup, then the site had Sprayseed at 2 L/ha on May 17, and was cultivated just before seeding on June 7. The Moore oat and legume components were mixed and sown together, with 200 kg/ha plain super.

The trial gave excellent growth, however, there was a heavy Wimmera ryegrass population in all plots. On October 20, the plots were mown with the oats at soft dough stage, the Dun pea apical pods were still green, but the early pods were dry, the Popany vetch pods had seeds just beginning to fill and the Lathyrus sativus was still flowering with young pods. The plots were raked and baled on October 26 and bale weights adjusted to oven-dry weight (having approx. 22% moisture).

Grab samples of the mown material were taken for botanical composition and the weight of the hay is given exclusive of the ryegrass component.

<table>
<thead>
<tr>
<th>Seed Rate (kg/ha) (oat:lupin)</th>
<th>Density Ratio (oat:lupin)</th>
<th>Yield (kg/ha)</th>
<th>Yield (% of oat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80:0</td>
<td>100:0</td>
<td>4430</td>
<td>100</td>
</tr>
<tr>
<td>72:44</td>
<td>87:13</td>
<td>5063</td>
<td>114</td>
</tr>
<tr>
<td>64:88</td>
<td>69:31</td>
<td>4944</td>
<td>112</td>
</tr>
<tr>
<td>56:132</td>
<td>66:34</td>
<td>5281</td>
<td>119</td>
</tr>
<tr>
<td>0:250</td>
<td>0:100</td>
<td>4030</td>
<td>91</td>
</tr>
</tbody>
</table>

Oat:popany

<table>
<thead>
<tr>
<th>Seed Rate (kg/ha) (oat:popany)</th>
<th>Density Ratio (oat:popany)</th>
<th>Yield (kg/ha)</th>
<th>Yield (% of oat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>64:20</td>
<td>74:26</td>
<td>4409</td>
<td>99</td>
</tr>
<tr>
<td>0:80</td>
<td>0:100</td>
<td>2465</td>
<td>56</td>
</tr>
</tbody>
</table>

Oat:Lathyrus

<table>
<thead>
<tr>
<th>Seed Rate (kg/ha) (oat:Lathyrus)</th>
<th>Density Ratio (oat:Lathyrus)</th>
<th>Yield (kg/ha)</th>
<th>Yield (% of oat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>64:60</td>
<td>77:23</td>
<td>4061</td>
<td>92</td>
</tr>
<tr>
<td>0:165</td>
<td>0:100</td>
<td>1377</td>
<td>31</td>
</tr>
</tbody>
</table>
EXPERIMENT 82KA37 - D. Holmes, Gnowangerup

Grey loamy sand over clay at 15-20 cm. Moort gum and Yate gum vegetation. Paddock cropped in previous two years. Site cultivated on May 20 and plots sown on May 31 with 140 kg/ha plain super and 150 kg/ha Agran topdressed. Hoegrass was applied at seedling stage for ryegrass control. The Forrest barley and Dun pea components were sown separately.

The plots were quadrat sampled on October 22 for total dry matter and botanical composition. After that, the plots were grazed to measure sheep grazing days. After grazing the plots were to be assessed by Mr Dan Carter on the degree of soil disturbance (erosion) using the wind tunnel.

<table>
<thead>
<tr>
<th>Seed rate Barley:Pea</th>
<th>Density ration Barley:Pea</th>
<th>D.M. yield (kg/ha) Barley</th>
<th>Pea</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>60:0</td>
<td>100:0</td>
<td>7710</td>
<td>7710</td>
<td></td>
</tr>
<tr>
<td>38:82</td>
<td>63:37</td>
<td>4870</td>
<td>1430</td>
<td>6300</td>
</tr>
<tr>
<td>30:82</td>
<td>48:52</td>
<td>6420</td>
<td>1250</td>
<td>7670</td>
</tr>
<tr>
<td>12:97</td>
<td>37:63</td>
<td>4040</td>
<td>2670</td>
<td>6710</td>
</tr>
<tr>
<td>6:117</td>
<td>26:74</td>
<td>3930</td>
<td>2750</td>
<td>6680</td>
</tr>
<tr>
<td>0:117</td>
<td>0:100</td>
<td>7640</td>
<td>7640</td>
<td></td>
</tr>
</tbody>
</table>

SUMMARY

At Keysbrook, the mixtures of oat and pea gave higher yields than the pure oat and will give better quality hay.

The vetch and Lathyrus did not yield as well as the pea, however, there were differences in maturity.

At Gnowangerup, the barley and use of Agran gave greater competition to the pea component and the mixture yields did not exceed that of the pure barley crop.
OBJECTIVE

To investigate the influence of inoculation techniques, time of sowing (temperature), Rhizobial strains and soil type on fababean nodulation and growth.

BACKGROUND

Fababean has given highly variable yields in trials over the previous years. Often it appears to have difficulty in nodulating. As a species more adapted to alkaline soils, perhaps the acidic soils of Western Australia do not provide a suitable environment for the rhizobia.

Experiments sown at two locations: Medina Vegetable Research Station representing calcareous sands of pH 8.0 and mild winter temperatures; and Manjimup Research Station representing fertile loams with pH 6.0 and cold winter temperatures.

EXPERIMENT 82MD16 - Medina Vegetable Research Station

Cottesloe coastal dune system. Two cultivars of fababean sown on May 11 and June 17 with different seed inoculation treatments. Site sprayed with Sprayseed (1.5 L/ha) and Treflan (2 L/ha). 200 kg/ha of super No. 1 mix plus cobalt and manganese topdressed before sowing. 100 kg/ha KCl broadcast six weeds after seeding. The fababean 100063 was also used to compare four Rhizobia spp for nodulation.

There was no visual difference in plant growth or colour to inoculation technique or rhizobial strains.

Grain yield (g/m²)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Treatment</th>
<th>Sown May 11</th>
<th>Sown June 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>100067</td>
<td>Nil inoculation</td>
<td>269.2</td>
<td>196.9</td>
</tr>
<tr>
<td></td>
<td>Gum slurry</td>
<td>324.5</td>
<td>199.4</td>
</tr>
<tr>
<td></td>
<td>Lime pelleting</td>
<td>284.4</td>
<td>215.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Rhizobial strain</th>
<th>Seedling wt (mg/pl)</th>
<th>Nodulation Score (0-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100063</td>
<td>Nil inoculation</td>
<td>4365</td>
<td>2.36</td>
</tr>
<tr>
<td></td>
<td>Commercial</td>
<td>5058</td>
<td>2.62</td>
</tr>
<tr>
<td></td>
<td>NZP5225</td>
<td>4716</td>
<td>2.56</td>
</tr>
</tbody>
</table>

(Nodulation score: 0 = nil, 1 = few, 3 = many nodules)

-33-
EXPERIMENT 32MN25 - Manjimup Vegetable Research Station

Red loam, Karri vegetation. The two fababean cultivars sown on May 14 and June 22 with different inoculation treatments. Site cultivated before sowing. 200 kg/ha plain super broadcast over site before seeding and 100 kg/ha KCl broadcast six weeks after seeding.

Four rhizobia spp were compared for nodulation of fababean cultivar 100063.

There was no visual difference between inoculation techniques, however, seedling growth and nodulation ratings showed a small difference between Rhizobial strains. By October, these differences had disappeared.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Treatment</th>
<th>Sown May 14</th>
<th>Sown June 22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiord</td>
<td>Nil inoculation</td>
<td>390.8</td>
<td>235.8</td>
</tr>
<tr>
<td></td>
<td>Gum slurry</td>
<td>369.1</td>
<td>210.6</td>
</tr>
<tr>
<td></td>
<td>Lime pelleting</td>
<td>412.9</td>
<td>280.2</td>
</tr>
<tr>
<td>100067</td>
<td>Nil inoculation</td>
<td>436.7</td>
<td>283.8</td>
</tr>
<tr>
<td></td>
<td>Gum slurry</td>
<td>387.9</td>
<td>311.5</td>
</tr>
<tr>
<td></td>
<td>Lime pelleting</td>
<td>405.6</td>
<td>309.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Rhizobial strain</th>
<th>Seedling wt (mg/pl)</th>
<th>Nodulation Score</th>
<th>Tap root</th>
<th>Laterals</th>
</tr>
</thead>
<tbody>
<tr>
<td>100063</td>
<td>Nil inoculation</td>
<td>892</td>
<td>1.52</td>
<td>2.70</td>
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</tr>
<tr>
<td></td>
<td>Commercial</td>
<td>1060</td>
<td>2.28</td>
<td>2.54</td>
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<tr>
<td></td>
<td>SU567</td>
<td>1107</td>
<td>2.18</td>
<td>2.64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NZP5225</td>
<td>1065</td>
<td>2.28</td>
<td>2.12</td>
<td></td>
</tr>
</tbody>
</table>

(Nodulation score: 0 = nil, 1 = few small, 4 = large nodules and well distributed)