1982

Organic matter as a source of nitrogen.

A. Reincke

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Summary of Experimental Results 1982

ORGANIC MATTER as a Source of NITROGEN

A. Reincke
Plant Research Division
## 1982 Experimental Summary

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### Treatment Summary 1982

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** Signif. diff. to nil 5%
* Signif. diff. to nil 1%

Plots were not harvested.

Note: Large changes in min. N after incubation between sampling dates. The only significant increases in mineral nitrogen levels occurred where high levels of pasture occurred. Plots were not harvested.

Except for the high seeding rates of clover, the amount of nitrogen applied onto the Nil plots to maintain the production of the clover plots was less than 10 kg nitrogen/ha.

For the high rates of clover this was up to 30-40 kg Agran/ha.
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<th>1981 Treatment</th>
<th>Seed Rate</th>
<th>kg/ha DM (pasture)</th>
<th>%N</th>
<th>kg/ha N in pasture</th>
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### Treatment Seed Rate

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<td>D.wts kg/ha</td>
<td>at anthesis /m²</td>
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* Signif. different to NIL treat. 5% level

Anthesis yield = 2882 + 26.9 Min. N (+ Com) \( R^2 = .36 \)

Note:

Some very large dry matter responses occurred due to the presence of legumes. However, 'haying off' and Cu deficiency on the high dry matter plots caused large decreases in the grain yields.
## 1981 PASTURE DRY WEIGHTS AND N CONTENTS

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<td>30 kg/ha</td>
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Note: Pastures had high cape weed contents.
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** Signif. different from wheat treatments 1%
* Signif. different from wheat treatments 5%
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<th>% N</th>
<th>kg/ha N</th>
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Note:

Retaining the wheat stubble caused large decreases in plants germinated. Large differences occur in mineral N after incubation between sample dates. By 20.8.82 the wheat plots with the tops removed took up approximately 30% more nitrogen than the tops retained plots. No significant differences in nitrogen uptake occurred between any of the clover treatments. The wheat on clover plots had taken up amounts of nitrogen (~30 kg/ha) equivalent to applying 140 kg/ha Agran onto wheat (+ tops) and 50 kg/ha Agran onto wheat (- tops).

Dry matter yields at anthesis (21.10) show this to be higher.

Some 'haying off' had occurred in the grain yields.

5.3.82 - Soil sample 0-10cm.

Anthesis yield = 2436 + 70.6 Min. N (after inc.*) \( R^2 = 0.36 \)

Anthesis yield = 2520 + 97.1 Min. N (initial) \( R^2 = 0.16 \)

10.5.82 - Soil sample 0-10cm

Anthesis yield = 1093 + 72.5 Min. N (after inc. + COM) \( R^2 = 0.64 \)

Anthesis yield = 2284 + 55.1 Min. N (after inc. - COM) \( R^2 = 0.36 \)

* Mineral nitrogen after 2 wk. aerobic incubation.
### 1981 Treatment Data

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<th>Min. N after incubat.</th>
<th>6 week Anthesis D.wt. kg/ha</th>
<th>Anthesis D.wt. 19.10.82 kg/ha</th>
<th>3.8.82 kg/ha</th>
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<td>-</td>
<td>-</td>
<td>380</td>
<td>5555</td>
<td>2.06</td>
<td></td>
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</table>

Good correlation of min. N after incubat. and anthesis D.W.

### 1981 Data

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dry Matter kg/ha</th>
<th>kg/ha N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nungarin 2.5</td>
<td>1010</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>1300</td>
<td>30</td>
</tr>
<tr>
<td>90</td>
<td>1410</td>
<td>33</td>
</tr>
<tr>
<td>Northam 15</td>
<td>1470</td>
<td>35</td>
</tr>
<tr>
<td>90</td>
<td>1390</td>
<td>37</td>
</tr>
</tbody>
</table>
LAB 2:

The effect of different plant materials.

This incubation experiment involved adding 30 different plant materials collected from the field, to incubation vials at rates equivalent to 3,000 and 6,000 kg/ha on two soil types. (Table 1). When the mineral nitrogen produced is regressed against the nitrogen content of the organic material, the linear regression accounted for 84 to 95 per cent of the variation.

It may be expected that the water soluble or the inorganic nitrogen contents would reflect the more available nitrogen compared to the use of total nitrogen content of the organic material. However, the regression of mineral nitrogen after incubation against the inorganic and water soluble nitrogen of the organic matter, accounted for much less of the variation than the total nitrogen content of the organic matter.

The high regression between the mineral nitrogen and the per cent nitrogen (Figure 1) suggests that most plant materials found in the field may be characterized (for the purpose of their effect on mineral nitrogen levels) by their nitrogen contents. Further inspection of Figure 1 suggests that when all the plant materials which were partly or wholly green, are removed from the regression, the regression is further improved. However, it also demonstrates that nearly all the material found in the field in the dry state is less than 2 per cent nitrogen. This includes materials from pastures with a high proportion of clover in the dry matter. Therefore it may be expected that very little nitrogen will be released from the organic material in the short term.
<table>
<thead>
<tr>
<th>No.</th>
<th>Plant</th>
<th>Maturity</th>
<th>Chemical analysis</th>
<th>Mineral nitrogen after a two week incubation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>% C % N C/N</td>
<td>Wongan Hills</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3000 kg/ha 6000 kg/ha 3000 kg/ha 6000 kg/ha</td>
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<tr>
<td>1</td>
<td>Green clover (dried)</td>
<td>1</td>
<td>41.2 3.64 11.3</td>
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<tr>
<td>2</td>
<td>Nungarin pasture (15 kg/ha)</td>
<td>2</td>
<td>40.1 1.42 28.2</td>
<td>11 .6 9 1</td>
</tr>
<tr>
<td>3</td>
<td>&quot; (90 kg/ha)</td>
<td>2</td>
<td>39.1 2.69 14.5</td>
<td>23 24 25 31</td>
</tr>
<tr>
<td>4</td>
<td>Kondinin Rose pasture</td>
<td>3</td>
<td>40.8 2.06 19.8</td>
<td>16 18 20 17</td>
</tr>
<tr>
<td>5</td>
<td>Serena</td>
<td>4</td>
<td>42.9 1.06 40.4</td>
<td>8 1 7 1</td>
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<tr>
<td>6</td>
<td>Tornafield</td>
<td>3</td>
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<td>13 18 22 20</td>
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<tr>
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<td>Blue lupin leaves</td>
<td>3</td>
<td>42.9 1.77 24.2</td>
<td>15 7 14 4</td>
</tr>
<tr>
<td>8</td>
<td>&quot; stems</td>
<td>3</td>
<td>46.0 1.13 40.7</td>
<td>11 1 9 3</td>
</tr>
<tr>
<td>9</td>
<td>Lupin seeds</td>
<td>2</td>
<td>39.6 3.64 10.8</td>
<td>43 77 46 69</td>
</tr>
<tr>
<td>10</td>
<td>&quot; stems</td>
<td>2</td>
<td>45.5 1.49 30.5</td>
<td>9 2 14 6</td>
</tr>
<tr>
<td>11</td>
<td>&quot; leaves</td>
<td>2</td>
<td>42.8 3.56 12.1</td>
<td>51 79 43 64</td>
</tr>
<tr>
<td>12</td>
<td>&quot; roots (+ old nodules)</td>
<td>2</td>
<td>44.1 1.32 33.4</td>
<td>11 0 16 8</td>
</tr>
<tr>
<td>13</td>
<td>Young lupin roots nodules</td>
<td>1</td>
<td>38.4 6.61 5.8</td>
<td>96 160 109 196</td>
</tr>
<tr>
<td>14</td>
<td>&quot; stems</td>
<td>1</td>
<td>42.0 1.42 29.5</td>
<td>20 1 19 9</td>
</tr>
<tr>
<td>15</td>
<td>Dunn pea leaves</td>
<td>2</td>
<td>42.1 3.52 11.9</td>
<td>31 48 38 46</td>
</tr>
<tr>
<td>16</td>
<td>&quot; stems</td>
<td>2</td>
<td>43.9 2.15 20.4</td>
<td>27 24 30 27</td>
</tr>
<tr>
<td>17</td>
<td>Green brome grass</td>
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<td>42.6 3.03 14.0</td>
<td>42 36 32 41</td>
</tr>
<tr>
<td>18</td>
<td>Cape weed</td>
<td>3</td>
<td>39.1 2.00 19.5</td>
<td>17 18 13 6</td>
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<tr>
<td>19</td>
<td>Dry brome grass</td>
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<tr>
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<td>Rye grass</td>
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<tr>
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<td>Wild oat stems</td>
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<tr>
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<td>&quot; leaves</td>
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<td>0 0 0 0</td>
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<tr>
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<td>Green radish (dried)</td>
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</tr>
<tr>
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<td>Silver grass</td>
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<td>9 0 1 0</td>
</tr>
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<td>Thistle</td>
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<td>Wire weed (green)</td>
<td>4</td>
<td>44.9 1.84 24.4</td>
<td>6 0 6 0</td>
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<tr>
<td>27</td>
<td>Wheat tops (low N)</td>
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<td>44.1 1.9 23.2</td>
<td>15 8 16 13</td>
</tr>
<tr>
<td>28</td>
<td>&quot; (high N)</td>
<td>1</td>
<td>44.4 2.12 20.9</td>
<td>14 8 15 9</td>
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<tr>
<td>29</td>
<td>Rapeseed leaves</td>
<td>4</td>
<td>41.0 1.57 26.1</td>
<td>12 10 13 3</td>
</tr>
<tr>
<td>30</td>
<td>&quot; stems</td>
<td>4</td>
<td>42.5 0.46 92.3</td>
<td>10 0 6 0</td>
</tr>
</tbody>
</table>

1 Cut in spring
2 Cut at Early seed set
3 Cut at Late seed set
4 Cut at Maturity
The comparison of different organic materials collected from the field on the production of mineral nitrogen at their respective N contents. One rate (3000 kg/ha) was used on a Wongan Hills loamy sand.

Regression through all points.

Regression through dry organic material only.
The effect of soil type on mineral nitrogen.

An incubation experiment was conducted where organic materials were screened over 19 different soil types. The soils contained nitrogen levels which covered the range of soils in most of our agricultural areas.

A linear regression was obtained for each soil type when the mineral nitrogen produced after incubation was plotted against the nitrogen content of the organic materials. The mean slope of the 19 regressions was 17.21. When the nil organic matter treatment was extrapolated across onto the regression, the corresponding per cent N equivalent on the horizontal axis had a mean of 2.45.

The response of the organic matter on different soil types was dependant on the mineral nitrogen level of the 2mm soil incubated alone. Therefore each individual regression could be predicted by knowing this value and incorporating into the following general equation:

\[
\text{Mineral Nitrogen} = \text{Mineral N (Nil)} + (N - 2.45) \times 17.21
\]

OR

\[
\text{Mineral N} = (x - 2.45) \times 17.21
\]

where \(N\) = per cent N of the organic matter

Mineral N (nil) = mineral nitrogen produced by the 2mm soil incubated alone.

In this experiment where only one rate of addition was applied at one time period, the regression accounted for 98 per cent of the variation in the actual values.

To allow for the different rates of organic material which may be present, the equation may be written:

\[
\text{Min. N} = \text{Min. N (nil)} \times 0.9 - 10.5A + 4.3(A) \times N
\]

where \(A\) is the amount added in the organic matter.
The effect of different nitrogen contents of organic matter on the release of nitrogen with time.

In a glasshouse experiment, organic materials containing .94 per cent N (wheat straw), 3.96% N (clover tops) and 1.8% N (combination of above) were added to soils in pots. Wheat seedlings were grown in the pots, and harvested at intervals, up to a period of twelve weeks. Corresponding soil samples were also taken.

The addition of clover tops caused increased wheat seedling growth for the entire period through to maturity. This reflected the increased amounts of available nitrogen made available for plant uptake from the clover tops. After six weeks the plants took up no more nitrogen due to the exhaustion of all available nitrogen. However, only 22 per cent of the nitrogen applied in the organic matter was taken up by the plants. This indicates that only a small proportion of the added organic matter is made available to the plants. The amounts taken up would probably be less under leaching conditions in the field situation.

The addition of wheat straw resulted in the immobilization of soil nitrogen, and consequent poorer growth for the entire 12 weeks.

The addition of material containing 1.8% N initially caused immobilization for the first 4 to 5 weeks. After this nitrogen was released, resulting in better growth than the nil treatment. This indicates that remineralization of nitrogen probably occurred. The plants eventually removed only 11 per cent of the applied nitrogen. This is of the order of nitrogen release we may expect in the field situation. However, not all of this nitrogen may be taken up because of losses.