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DRILLED VERSUS TOPDRESSED SUPERPHOSPHATE FOR CEREAL PRODUCTION

By A. LOUTIT, P. STALLWOOD and W. J. COX

CEREAL growers in Australia usually use a drill or combine to apply their seed and superphosphate in one operation. However, during the last few years, there has been a rapid increase in the amount of super broadcast before seeding.

This change to broadcast super has occurred because of:

- the superphosphate distribution plan;
- time saved at seeding;
- convenience in not having to handle superphosphate if it is spread by a contractor.

As a result of transport and delivery problems, farmers are encouraged to take delivery of a portion of their superphosphate requirements before February each year. Because of on farm storage problems, and to take advantage of bulk handling facilities, a large proportion of this early super is applied in February and March.

Valuable time is saved during seeding time if all or some of the super is broadcast beforehand. With more super now being handled in bulk it is often more convenient to topdress the year’s cropping paddocks as soon as the super arrives on the farm (usually before the opening rains) than to store and use it later. This gives the advantage of bulk handling on the farm and saves valuable storage space.

Experimental work

Experiments conducted in 1961 by McDowell and others compared wheat yields of crops sown with drilled super at seeding, with yields from crops for which the super had been topdressed beforehand. The experimental site, near Narrogin, was on white gum country which had a total super history of 800 lb. per acre. The yields were 3 bushels per acre in favour of the drilled super and confirmed the results of similar trials in Victoria. Such results suggested that the method of applying super would cause greater yield differences on new land, than on land with a history of super applications. On land requiring only maintenance super dressings the method of application could be immaterial.

During 1966 and 1967, 14 cereal trials were planted to compare the two methods of superphosphate application—topdressing before seeding and drilling with the seed.

Results

When superphosphate at rates recommended for drilling was topdressed there was a loss in yield compared with yields for crops sown with drilled super. The size of this loss depended on the soil type, previous super applied and the time of spreading.

In one trial on a property at North Cunderdin, 80 lb. per acre drilled at seeding gave the same yield as 240 lb. per acre topdressed in March. The gravelly sandy loam had received 1,080 lb. of superphosphate since 1937. If 160 lb. per acre of
super had been topdressed instead of drilled a 4 bushel per acre reduction in yield would have resulted. This would represent a loss in income of $4.60 per acre.

Effect of super history

The results in the table show that on soils of low super history and high requirement, topdressing superphosphate at drill recommended rates results in much lower yields than if the same rates are drilled. If the same yield is required, two to three times the normal drilling rate of superphosphate should be topdressed.

On soils of high previous super application (where more than 1,200 lb. per acre has been applied on heavy land or 1,600 lb. per acre on light land) reductions in yield are considerably less and only one and a half to two times the drilling rate of superphosphate is required. Topdressing the cropping super should only be considered on old land, providing the convenience of the operation warrants the loss in yield (where only the normal rate is topdressed) or the extra cost (where additional super is topdressed beforehand).

Effect of time of application

Reductions in yield will probably be greater the earlier the superphosphate is applied, depending on:
- the fixing power of the soil;
- the intensity and amount of summer rainfall.

The effect of summer rainfall can be particularly serious in some seasons, especially in the Eastern Wheatbelt. It causes soil reactions which reduce the availability of applied phosphate.

In one trial on light land the average yield was 0.8 bushels per acre less from plots topdressed in mid-December compared with those topdressed in mid-March.

Conclusions

- Where medium to high (more than 90 lb. per acre) rates of superphosphate are needed rates of broadcast super should be more than double those for drilled superphosphate.
- Where lower rates of superphosphate (less than 90 lb. per acre) are needed, losses in efficiency from topdressing will be smaller.
- The earlier super is broadcast for cropping the greater the reduction in efficiency.
- Where broadcast super gave the same yield as drilled super at the same rate, there was no response to superphosphate.
- Drilling 35 lb. per acre superphosphate with the seed, after topdressing part of the requirement, is better than topdressing alone but not as good as drilling alone.
- Differences in yield between topdressed and drilled superphosphate at any one rate are greatest on light land and least on heavy land of the same super history.
Effect on wheat yields of methods of superphosphate application — Trial results, 1966 and 1967

<table>
<thead>
<tr>
<th>Locality</th>
<th>Soil description</th>
<th>Vegetation</th>
<th>Super history</th>
<th>Yield (no super)</th>
<th>Yield as a percentage of yield without super (average of all rates)</th>
<th>E.R.</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cunderdin</td>
<td>Gritty sandy loam over clay at 6 in.</td>
<td>Tamma scrub</td>
<td>1,080 since 1937</td>
<td>7.4</td>
<td>196</td>
<td>142</td>
<td>3</td>
</tr>
<tr>
<td>Ballidu</td>
<td>Wongan loamy sand</td>
<td>Scrubplain</td>
<td>1,300</td>
<td>21.7</td>
<td>119</td>
<td>108</td>
<td>120</td>
</tr>
<tr>
<td>Cunderdin</td>
<td>Sandy gravel over clay at 6 in.</td>
<td>Tamma scrub</td>
<td>270 since 1954</td>
<td>11.9</td>
<td>118</td>
<td>106</td>
<td>4</td>
</tr>
<tr>
<td>Cunderdin</td>
<td>Sandy gravel over clay at 6 in.</td>
<td>Tamma scrub</td>
<td>1,200 (450 since 1954)</td>
<td>29.4</td>
<td>110</td>
<td>106</td>
<td>1.1</td>
</tr>
<tr>
<td>Narrogin</td>
<td>Loamy sand over sandy clay loam</td>
<td>White gum</td>
<td>800</td>
<td>15.0</td>
<td>133</td>
<td>115</td>
<td>4</td>
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<tr>
<td>Merredin</td>
<td>Merredin clay loam</td>
<td>Salmon gum gimlet</td>
<td>1,300</td>
<td>14.8</td>
<td>102</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>Narrogin</td>
<td>Gravely sandy loam over loam</td>
<td>White gum</td>
<td>2,240</td>
<td>39.9</td>
<td>101</td>
<td>104</td>
<td>1</td>
</tr>
<tr>
<td>Merredin</td>
<td>Yellow sand over gravel 2-3 ft.</td>
<td>Wodgil</td>
<td>540</td>
<td>7.9</td>
<td>152</td>
<td>102</td>
<td>119</td>
</tr>
<tr>
<td>Merredin</td>
<td>Merredin clay loam</td>
<td>Salmon gum, gimlet</td>
<td>1,600</td>
<td>29.6</td>
<td>101</td>
<td>101</td>
<td>101</td>
</tr>
<tr>
<td>Merredin</td>
<td>Merredin clay loam</td>
<td>Salmon gum, gimlet</td>
<td>2,100</td>
<td>31.8</td>
<td>98</td>
<td>98</td>
<td>99</td>
</tr>
<tr>
<td>Bejoording</td>
<td>Red brown clay loam</td>
<td>York gum</td>
<td>1,000 since 1946</td>
<td>23.8</td>
<td>103</td>
<td>100</td>
<td>103</td>
</tr>
<tr>
<td>Goomalling</td>
<td>Gravely loam</td>
<td>Mallee</td>
<td>1,350 since 1940</td>
<td>37.2</td>
<td>104</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>Nangeenan</td>
<td>Sand over clay 0-6 in.</td>
<td>Mallee</td>
<td>1,200 since 1930</td>
<td>111</td>
<td>1</td>
<td>Infested by weeds</td>
<td></td>
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<tr>
<td>Nangeenan</td>
<td>Sand over clay 0-6 in.</td>
<td>Mallee</td>
<td>930 over 30 years</td>
<td>111</td>
<td>111</td>
<td>114</td>
<td>1.3</td>
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<tr>
<td>Nangeenan</td>
<td>Grey sandy loam</td>
<td>Tamma</td>
<td>1,200</td>
<td>10.7</td>
<td>111</td>
<td>100</td>
<td>103</td>
</tr>
<tr>
<td>Nangeenan</td>
<td>Grey sandy loam</td>
<td>Tamma, wodgil</td>
<td>850</td>
<td>14.2</td>
<td>111</td>
<td>110</td>
<td>111</td>
</tr>
<tr>
<td>Coorow</td>
<td>4 in. grey sand over yellow loamy sand</td>
<td>Wodgil</td>
<td>794 since 1955</td>
<td>16.6</td>
<td>128</td>
<td>100</td>
<td>117</td>
</tr>
<tr>
<td>Salmon Gums</td>
<td>Circle Valley loamy sand</td>
<td>Oleosa</td>
<td>1,384 since 1949</td>
<td>25.9</td>
<td>103</td>
<td>102</td>
<td>103</td>
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<tr>
<td>Merredin</td>
<td>Sand over loamy sand at 12 in.</td>
<td>Wodgil</td>
<td>824 since 1951</td>
<td>7.8</td>
<td>122</td>
<td>118</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Equivalent Ratio (E.R.) = the number of pounds of super applied by topdressing that are needed to give the same yield as would 1 pound drilled at seeding.
• If the requirement for drilled super is less than 80 lb. per acre and it is all broadcast, yields will be reduced. Alternatively costs will be increased because of the extra super required (150 lb. versus 75 lb.).

RECOMMENDATIONS
• Where medium to high (more than 90 lb. per acre) rates of superphosphate are needed all the super should be drilled with the seed and none topdressed.
• Where only low rates of superphosphate (less than 90 lb. per acre) are needed the super should still be drilled with the seed for greatest efficiency. If an alternative is required—
  • Drill 30 to 40 lb. per acre (depending on seeding rate) and topdress double the difference between 30 to 40 lb. and the required rate, e.g., if 75 lb. per acre should be drilled, broadcast 80 lb. and drill 35 lb.
• Where it appears profitable to topdress super because of the time saved, earlier seeding, etc., it should be spread evenly and as close to seeding as possible.

ACKNOWLEDGMENTS
The trials were a joint project between officers of the Wheat and Sheep, and Plant Research Divisions. The following farmers on whose properties the trials were located are thanked for their cooperation: Mr. V. D. Cahill, Nangeenan; Mr. B. Olds, Ballidu; Mr. W. Adams, Coorow; Mr. P. Syred, Bolgart; Mr. P. Godfrey, Cunderdin; Mr. I. Flockhart, Merredin; Mr. R. Waterhouse, Goomalling; Mr. R. Mussared, Cunderdin; and Mr. W. Shepherd, Narrogin.

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