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INTERCEPTOR DRAINS and waterlogging control

By J. W. Cox and T. R. Negus

Department of Agriculture trials of seepage interceptor drains from 1972 to 1983 primarily assessed the effects of such drains on salt encroachment. Although these trials showed that the drains had little influence on salt storage within the topsoil, they did reduce waterlogging downslope.

To investigate this drainage effect further, the Department's Narrogin office surveyed 35 drains on 14 properties in the winter of 1981, followed by detailed crop measurements in December that year. Provided the drains were properly designed, surveyed and constructed, and well maintained, they could be expected to increase crop yields during a waterlogging year by about 1000 kilograms per hectare (range 265 to 2072 kg/ha) on an average of 50 metres (range 30 to 120 m) downslope of the drain.

Site comparisons

A comparison of the 1981 season's crop yields from waterlogged and well-drained sites in the Narrogin and Cuballing Shires indicated crop losses of 89 per cent for severely waterlogged areas and 56 per cent for moderately affected areas.

For one of these yield monitoring sites on a farm 10 kilometres west of Cuballing, the construction technique for reverse bank seepage interceptor drains was developed in conjunction with Pingelly earthmoving contractor, Mr A. Neuzerling. The efficiency of these drains in controlling perched watertables was measured in 1983 when 311 millimetres of rain fell during the seven weeks from June 15 to August 6. A useful drainage effect was measured up to 80 m downslope of the drains, with some effect as far as 120 m downslope.

The same rainfall event caused havoc on many farms in the Narrogin and Cuballing Shires, reducing crop yields throughout these shires by 30 per cent in 1983 (Table 1). Many other shires to the north were similarly affected.

One farmer on the outskirts of Narrogin lost three-quarters of his wheat and barley crop from waterlogging. After inspecting the reverse bank seepage interceptor trial described previously, he asked the Department of Agriculture to prepare a conservation farm plan for his farm, with special emphasis on the control of hillside waterlogging using interceptor drains.

In February 1984, four paddocks that had been severely waterlogged and eroded the previous year were investigated using soil augers. Eight kilometres of interceptor drains were surveyed. The grade used was 0.8 per cent and the maximum drain spacing was 150 m. This wide spacing will allow additional drains to be constructed later, if necessary (see figure).

The total cost of the grader-built reverse bank seepage interceptor drains and a considerable amount of filling of erosion gullies was $3,000. This compares more than favourably with the $19,000 of lost crop income on these paddocks the previous year.
The 1984 growing season started early, in April. May was a very wet month. The worst affected paddock of the previous year was recropped and, despite the heavy rain at seeding, the entire paddock was sown to oats. This paddock had a history of becoming very boggy early in virtually every season.

The farmer is well satisfied with the performance of the drains. He has surveyed another two kilometres of interceptor drains on other areas known to be regularly waterlogged.

Amount of water intercepted

To determine the amount of water interceptor drains intercept in different soils and hill slope positions, weirs and automatic flow recorders were installed on drains at Narrogin and Mt Barker. These instruments measure both surface flows up-slope of the bank and seepage flows in the interceptor drain. Shallow wells were also installed to measure perched watertable levels.

Table 2 shows that closely spaced interceptor drains can remove a substantial amount of incoming rainfall from sand over clay—"duplex"—soils during seasons of above average rainfall.

Less water was intercepted on the cropped paddock than on the pasture which may be explained by differences in plant water use, drain spacing, soil type or slope.

In sloping land, interceptor drains are most effective on their downslope side. Crops were not waterlogged in an area ranging from three metres to 140 metres downslope of the drains.

Although reverse bank interceptor drains can reduce waterlogging, some areas will remain waterlogged despite the closeness of drains. These areas, which can develop at any position on the hill slope or along a particular drain, may be ‘undrainable’ by economically practical drainage techniques.

Based on yield data from 1981 to 1983, interceptor drains appear to be cost-effective in most areas susceptible to waterlogging and which are cropped relatively frequently. However, the mechanisms whereby interceptor drains control waterlogging are not completely understood. Further research to determine the optimum drain spacing for different soils and rainfall conditions has started.

Table 1. Effect of above average rainfall and waterlogging on crop yields

<table>
<thead>
<tr>
<th>Location</th>
<th>Crop yields (t/ha)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wheat</td>
<td>Barley</td>
<td>Oats</td>
<td></td>
</tr>
<tr>
<td>Narrogin Shire</td>
<td>1.32</td>
<td>1.29</td>
<td>1.33</td>
<td>0.97</td>
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<tr>
<td>Wet year 1983</td>
<td>Yield reduction in wet year</td>
<td>0.35</td>
<td>0.40</td>
<td>0.30</td>
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<tr>
<td></td>
<td>Yield reduction in wet year (%)</td>
<td>27</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td>Cuballing Shire</td>
<td>1.34</td>
<td>1.30</td>
<td>1.31</td>
<td>0.87</td>
</tr>
<tr>
<td>Wet year 1983</td>
<td>Yield reduction in wet year</td>
<td>0.47</td>
<td>0.50</td>
<td>0.34</td>
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<tr>
<td></td>
<td>Yield reduction in wet year (%)</td>
<td>35</td>
<td>39</td>
<td>26</td>
</tr>
</tbody>
</table>

Acknowledgements

The Barley Industry Research Committee of Western Australia funded the research programme of one of the authors, J. W. Cox. Valuable technical assistance has been provided by D. Warne and A. Ryder.

Table 2. Drain flow in interceptor drains

<table>
<thead>
<tr>
<th>Location</th>
<th>Land use</th>
<th>Drain spacing (m)</th>
<th>Rainfall* (for period of measurement) (mm)</th>
<th>Intercepted flow (surface and seepage) (mm)</th>
<th>Intercepted flow x 100 Rainfall (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrogin</td>
<td>Pasture</td>
<td>67</td>
<td>228</td>
<td>15</td>
<td>6.6</td>
</tr>
<tr>
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<td>Pasture</td>
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<td>228</td>
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<tr>
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<td>Oats</td>
<td>142</td>
<td>221</td>
<td>2</td>
<td>1.0</td>
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<tr>
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<td>Oats</td>
<td>141</td>
<td>221</td>
<td>65</td>
<td>21.1</td>
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<tr>
<td>Mt Barker</td>
<td>Wheat</td>
<td>99</td>
<td>394</td>
<td>144</td>
<td>36.5</td>
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<tr>
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<td>Oats</td>
<td>79</td>
<td>394</td>
<td>192</td>
<td>48.7</td>
</tr>
</tbody>
</table>

*Despite good rainfall early in the 1984 season, Narrogin experienced a relatively dry winter.

1. Rainfall for the growing season at Mt Barker was 14 per cent above average.
2. Presented rainfall data may be underestimated for Mt Barker.