Crop Row Placement - 10 things to consider

IN THEORY, a seed row can be placed at any distance desired from the previous crop row with the right equipment. Conventional practice is to aim for sowing in the inter-row which is the maximum distance from the previous crop row in order to optimise the seeding operation for residue handling, herbicide incorporation and to reduce disease risk associated with stubble from previous crops.

Water repellent sands in particular present challenges for crop establishment due to their gradual and localised wetting patterns, leading to slow and patchy seedling emergence, staggered over time, sometimes continuing up to 3-4 months post-seeding, depending on rainfall and seed placement. Research on low rainfall sands has highlighted the benefits of strong early crop establishment and nutrition (Unkovich et al. 2015).

Experiments in Western Australia have shown that the use of on-row sowing, or edge-row sowing as close as practical to the previous crop row without disturbing that row, can provide a pathway for water infiltration using the intact root system of the previous crop, with the effect of increasing crop establishment and biomass (Roper et al. 2015. Management options for water-repellent soils in Australian dryland agriculture, Soil Research 53, 786-806).

WHAT ARE THE PRACTICAL IMPLICATIONS TO ACCURATELY SOW ON ROW/EDGE ROW?

It is important to note that on-row sowing entails specific agronomic and practical challenges. For example, tine seeders can generate potentially significant residue clumping and face blockage issues while disc seeders can suffer residue hair pinning and associated crop establishment losses. While much of the research to date was done comparing ‘on-row’ vs ‘inter-row’ techniques, the challenge for widespread adoption lies in the ability of the seeding technology to reliably edge-row sow without disturbing the existing stubble row to maintain protection. Edge row sowing with tine seeders requires side banding technology at best but due to the difficulties of automating GPS guidance correction between up/back runs season after season, current practice often uses centre-row or paired-row seeding systems.

While RTK auto-steer tractor guidance is necessary for inter-row sowing at common row spacing of 220-300mm, the tracking stability of the seeder bar and
air-cart combination becomes increasingly important at the narrower row spacings. Edge-row/on-row sowing additionally require a very stable implement tracking and, at best, an active or passive implement guidance system (e.g. iGuideTM, AgGPS TrueGuideTM, Pro-TrakkerTM, I-till®) to assist with more accurately following the desired guidance path at the seeding system level.

→ WHAT STUBBLE LOADS ARE REQUIRED TO GENERATE INTER-ROW SOWING BENEFIT?

The benefits of unhindered residue handling start to be realised at stubble loads greater than 2.5t/ha, while it is often the case that Mallee stubble loads are less than 2t/ha by the time of sowing.

→ WHAT IS THE EFFECT OF ROW PLACEMENT ON CROP ESTABLISHMENT?

On non-wetting sands we have always measured increased plant establishment numbers when the crop is sown near the previous crop row. The effect on crop establishment is likely to be greatest when autumn rainfall is marginal.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>ON-ROW (plants/m²)</th>
<th>INTER-ROW (plants/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>82</td>
<td>68</td>
</tr>
<tr>
<td>2015</td>
<td>69</td>
<td>19</td>
</tr>
<tr>
<td>2016</td>
<td>87</td>
<td>31</td>
</tr>
<tr>
<td>2017</td>
<td>89</td>
<td>68</td>
</tr>
</tbody>
</table>

The same effects are not usually measured on other Mallee soil types. Inter-row seeding can help to avoid establishment issues associated with seeding into large stubble loads sometimes found on the higher producing soil types following a good season.

WHAT ABOUT DISEASE RISK?

Soil borne vs stubble borne. There is more disease inoculum for the key diseases rhizoctonia, TakeAll and Fusarium in the on/edge row position. However, an interesting finding has been that while there might be more inoculum for rhizoctonia, the level of rhizoctonia infection was actually equal or less when sown on-row in non-wetting soil. This effect was related to enhanced microbial diversity in the on-row position providing competition for the disease inoculum.

Where TakeAll pressure was high we have measured increased disease infection with on-row sown plots, but this did not cause a significant yield effect. Fusarium infection has not been a significant limitation at the sites we have experimented with.

Stubble can be a source of pathogen for some foliar diseases such as Eye spot, Septoria tritici blotch, Yellow leaf spot, Net blotches of barley. So in continuous cereals stubble retained systems, varietal selection and crop row placement could have implications to the overall disease management.

→ WHAT ABOUT NUTRITION?

Moving the seeding row to a closer proximity to the previous row has implications for the supply of N. Given it is the location of the highest stubble load, it is anticipated that there will be an early season immobilisation effect and this was measurable in pre-sowing mineral N levels in 1 of 9 site years. The on-row environment not only has higher levels of carbon, but also microbial biomass and this has implications for improved N supply potential during the growing season with 38 vs 51kg N/ha/season inter vs on-row in 2016 and 35 vs 46kg N/ha/season in 2017 at Karoonda.

→ WHAT ABOUT AVAILABLE WATER?

In sandy soils in particularly, stubble rows offer an infiltration pathway for rain water and are usually the first part of the landscape to wet up. We have consistently measured benefits of extra water in the surface layer and up to 40cm depth in the on/edge-row position. While the amounts of water are relatively small (3-5mm in the top 10cm and up to 15mm in the top 40cm), the effect of on-row sowing on establishment indicates that they are important.

→ WHAT ABOUT WEEDS?

The effect on the brome grass population from on-row sowing on non-wetting sands has been one of the most consistent and promising outcomes of the on-row sowing research work with up to 80% reduction.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>ON/EDGE ROW (brome seeds/m²)</th>
<th>INTER-ROW (brome seeds/m²)</th>
<th>% REDUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>389</td>
<td>1859</td>
<td>80</td>
</tr>
<tr>
<td>2015</td>
<td>2022</td>
<td>7332</td>
<td>72</td>
</tr>
<tr>
<td>2016</td>
<td>5381</td>
<td>7256</td>
<td>26</td>
</tr>
<tr>
<td>2017</td>
<td>1960</td>
<td>4339</td>
<td>45</td>
</tr>
</tbody>
</table>
in brome seed set. These reductions in seed set were achieved on a paddock with a very long cereal history (5+ years). These results identify crop competition as a key driver of brome grass control and with limited herbicide options for brome, it is a critical component of an integrated weed management strategy for brome.

ON WHAT SOILS IS ON/EDGE-ROW SOWING SHOWING THE GREATEST BENEFITS?
It is on non-wetting sands that we have measured the most consistent and tangible benefits of on-row sowing. Given the potential benefits of inter-row sowing on other Mallee soil types such as improved trash flow (in the higher yielding heavier soils) and reduced disease risk, options for soil-specific application of on-row sowing require consideration.

AND WHAT DOES THIS MEAN FOR YIELD?
While on-farm anecdotal evidence suggests sometimes noticeable grain yield benefits (Roper et al., 2015), we have not measured significant yield benefits of on-row sowing in research trials at the 5% significance level. Non-wetting sands are highly variable in nature and our experience is that a yield benefit in excess of 30% is sometimes required to be statistically significant.

WHEN WILL IT PAY?
On-row seeding on non-wetting sand has reliably improved crop establishment and crop competition with weeds but has not always led to yield gains due to the nature of the seasons and the low production potential of the sandy soils. Using the bio-economic model Brome RIM allows the weed control benefits to also be considered. Assuming on-row seeding on non-wetting seed increases crop establishment by the equivalent of increasing cereal seeding rate from 60kg/ha to 90kg/ha, the results show that average gross margins over the crop sequence would increase by approximately 12% on those soils, in addition to reducing erosion risk.

Image 1. On row/edge row sowing into last years crop stubble
A full list of research cited in this Farm Talk is available at www.msfp.org.au
See also ‘Seeder Tracking and guidance considerations for guided row sowing’
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