SOIL WETTER FACT SHEET

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Managing water repellence at seeding: soil wetting agents

Soil water repellence causing patchy and poor crop establishment depends upon seasonal conditions, but wetting agents can mitigate the risks.

Photo: Jack Desbiolles

Soil wetter (wetting agent) chemistries vary and can affect the extent of early crop establishment benefits at any given site.

KEY POINTS

- Modern soil wetting agents comprise surfactant blends that combine penetrant (promoting water infiltration) and humectant (promoting water retention) properties
- Significant crop establishment benefits have been achieved in recent trials in South Australia from soil wetting agents applied in the seed zone or split-applied between the seed zone and furrow surface
- Crop establishment and grain yield benefits seem to be greatest when combined with stable furrows that remain effective for water harvesting over the growing season
- It is difficult to predict which soil wetter chemistry is best suited to different local water repellence contexts, but all soil wetting agents have some potential to provide benefits under best practice

Properties of soil wetting agents

Soil wetter chemistries are varied and complex; little is known of their individual suitability to local water repellence. Modern soil wetter chemistries consist of surfactant (surface-active agents) blends, classified mostly as 'non-ionic' type (that is, have no charge and do not react with ions in water). These multi-action surfactant blends have 'penetrant' and 'humectant' properties.

- Surfactants with penetrant properties lower the surface tension of a liquid, allowing it to infiltrate more readily and spread into a water-repellent soil.
- Surfactants with humectant properties contain 'block copolymers' that effectively promote the retention of the liquid within a target zone, such as the furrow seed zone. Humectant properties are important to counter the risk of leaching.

Soil wetting agents may have residual effects in the year following the initial application, but this is normally limited (McDonald and Davies, 2018).

Best practice application

In exposed sandy paddocks, furrows experiencing infill or collapse after seeding are common. The risk is significantly lower when inter-row sowing into standing stubble and using large, 'open V' press-wheel tyres with side shoulders to help stabilise furrows (Figure 1).

As dry sowing into water-repellent sands without standing residue protection is very risky, recent research has focused on the use of soil wetting agents when sowing after the opening rainfall into partially wetted profiles. Here are recommendations to help secure best outcomes.

- Liquid delivery achieves a continuous stream of application along the seed row. This is easier to achieve at higher application volumes (for example, 80 to 100 litres per hectare).
- With some new chemistries now applied in the seed zone, it is critical that liquid systems are checked for delivery accuracy (a coloured dye can be used for calibrating delivery). This is particularly important for deep furrow tilling systems designed to backfill the lower furrow and for paired row seeding systems ensuring that liquid delivery reaches both seed outlets.
- For products applied behind the press-wheel, it is also important to ensure the liquid stream reaches the base of the press-wheel furrow with minimal fluctuation from wind or vibrations. Label requirements often state the need to apply the wetter onto a settled furrow surface and not to mix into loose backfill. Narrow spray pattern nozzles able to achieve a two to three centimetre wide spray footprint (Figure 2) can help maximise infiltration over the width of lateral seed spread beneath, using penetrant-type surfactants.
- Dual-zone placement, with a penetrant-type surfactant on the furrow surface and a humectant-type surfactant in the seed zone, has the potential to improve the reliability of soil wetter benefits. However, this higher-cost choice also doubles the volume of application and requires a dual delivery system.

Do soil wetters perform?

While many growers have tried soil wetters, few have experienced reliable benefits. Field-based research in Western Australia has had mixed results (Davies et al., 2019). International research also points to some complexity of interactions, whereby specific soil wetter chemistry can modify the extent of water repellence over repeated applications.

Table 1 summarises the latest outcomes of soil wetter evaluation on wheat or barley crops involving nine site-years (a mix of small plot replicated trials and large plot demonstrations in SA) conducted between 2018 and 2021. Approximately 48 per cent of the soil wetter treatments evaluated achieved significant yield benefits. Among these treatments, plant density increases of up to 55 to 80 plants per square metre at five weeks after sowing were obtained at four of the nine site-years, leading to grain yield gains of 50 to 100 per cent.

Results to date support the general hypothesis that the full potential of soil wetters (including in-season benefits) is best able to be expressed where effective water-harvesting furrows can be maintained over the season. This potential may be highest under low-decile growing season rainfalls, which is in accordance with Western Australian experience.

Maximising water-harvesting furrows

The water-harvesting potential of furrows is maximised when:

- large V-profile press-wheel tyres with side shoulders are used (for example, 150mm wide tyre with 110mm wide V at 105° included angle – see Figure 1);
- sufficient downforce pressure is applied (2.5 to 3 kilograms per cm width) to effectively consolidate the furrow surface; and
- excessive furrow disturbance is avoided (via controlled speed and reduced furrow depth) to minimise furrow-ridging and press-wheel 'rooster tail'.

A uniform water-harvesting furrow system is easier to achieve with wide row spacings.

Care should be taken to position water-harvesting furrows across slopes to control surface run-off and erosion risks. Achieving stable water-harvesting furrows is challenging in exposed non-wetting sands due to the high risk of furrow infill under dry conditions. Field evidence suggests that furrow infill risks can be mitigated by inter-row sowing or accurately edge-row sowing into standing stubble to help protect from high winds.

Photos: Jack Desbiolles

Figure 1: Water-harvesting stable furrows (left) shaped by wide V-shouldered press-wheel tyres (right) help soil wetter effectiveness, while maintaining standing stubble is often best practice for minimising furrow infill over time.

Table 1: Improvements in crop response due to soil wetter treatments (T = number of wetter treatments tested at each site) relative to controls over nine site-years in recent SA-based research (2018–21).

Site, T, year (context)	Control crop, plant density (plants/m²) and yield (t/ha)	Plant density increase (plant/m²)	Grain yield increase (%)	GSR (Apr–Oct) (mm)	Furrow condition
Murlong I, 13, 2018 (grazed wheat stubble, cross-sowing)	**Wheat** 48 & 1.02	0–58 Av. 27	0–21 Av. 7.2	**Decile 2** 193	Early furrow infill
Murlong I, 13, 2019 (standing wheat stubble, inter-row sowing)	**Barley** 27 & 1.10	0–56 Av. 17	23–97 Av. 44	**Decile 1** 174	Stable wide V-furrows between standing stubble
Murlong II, 3, 2019 (standing wheat stubble) – Inter-row sowing – Edge-row sowing – On-row sowing	**Barley** 6 & 0.58 61 & 1.45 100 & 2.0	 +22 +39 0	 +63 +15 0	**Decile 1** 174	Wide furrows between standing stubble
Younghusband I, 2, 2020 (lentil stubble, cross-sowing)	**Wheat** 144 & 2.78	0 (ns)	0–6	**Decile 8** 251	Wide furrow
Younghusband I, 2, 2021 (standing wheat stubble, inter-row sowing)	**Barley** 24 & 0.93	71–82	47–50	**Decile 2** 169	Wide V-furrows between standing stubble
Younghusband II, 1, 2021 (standing wheat stubble, cross-sowing)	**Barley** 81 & 0.68	25	56	**Decile 2** 169	Wide V-furrows
Coombe (flat), 3, 2020 (lucerne pasture)	**Barley** 120 & 4.38	14–17	0–5	**Decile 5** 308	Early furrow infill
Coombe (rise), 3, 2020 (lucerne pasture)	**Barley** 90 & 2.37	0–15	0–10	**Decile 5** 308	Early furrow infill
Wharminda (rise), 2, 2021 (grazed fallow, inter-row sowing)	**Wheat** 89 & 1.70	0–43	0 (ns)	**Decile 6** 228	Narrow furrows and ridging

GSR = growing season rainfall.

Cost of applying soil wetters

The chemical cost per hectare is driven by the choice of chemistry, number of application zones and the rate applied. The optimal combination of these factors is a function of the severity of water repellence.

In a small well-controlled replicated plot trial over 2018-19, 13 different products and combinations were evaluated where the product costs ranged between $12 and $41 per hectare.

The financial cost can be mitigated by treating only paddock zones where water repellence is strongest by turning on/off a dedicated liquid supply line. Over the two-year period integrating one poor and one excellent response season, the value of crop yield gains per treated hectare reached 2.5–9.7 times the product cost recovery threshold.

Figure 2: Application of soil wetter behind water-harvesting 'open V' press-wheels via a narrow (15 degree) flat fan nozzle achieving a stable 3cm wide spray footprint at the base of a firm furrow.

Photo: Jack Desbiolles

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Crop establishment snapshot at 5 weeks after sowing: Some soil wetter chemistries showed consistent benefits (e.g. bottom) relative to a no-wetter control (top) over 2 seasons at Murlong, SA.

MORE INFORMATION

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McDonald GP, Davies SL (2018). **Soil wetting agents can carry over to following seasons on repellent loamy gravels**. ResearchGate website. researchgate.net/publication/338501889

GRDC CODE

CSP1606-008RMX (CSP00203)

USEFUL RESOURCES

GRDC fact sheet: ***Diagnosing Sandy Soil Constraints: Water Repellence and pH*** (2022). grdc.com.au/diagnosing-sandy-soil-constraints-water-repellence-and-ph-south-west

GRDC fact sheet: ***Seeding Sandy Soils*** (2022). grdc.com.au/seeding-sandy-soils-national

GRDC Update Paper: ***Seeder-based approaches to reduce the impact of water repellence on crop productivity*** (2020). grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2020/02/seeder-based-approaches-to-reduce-the-impact-of-water-repellence-on-crop-productivity

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