Final Technical Report Template

Final Technical Report

Improving Crop Germination and Establishment of all Grains, Especially Canola, When Dealing with Non-wetting Soils, Stubble Loads and Different Stubble Types

Project code:	PROC-9176190
Prepared by:	Daniel Hester danielhester@pedaga.com.au Kylie Lockyer Kylie.lockyer@trialco.com.au
Date submitted to GRDC:	[day, month and year]

REPORT SENSITIVITY

Does the report have any of the following sensitivities?

Intended for journal publication	NO	
Results are incomplete	NO	
Commercial/IP concerns	NO	
Embargo date	NO	DATE DD/MM/YYYY

DISCLAIMER:

Any recommendations, suggestions or opinions contained in this publication do not necessarily represent the policy or views of the Grains Research and Development Corporation (GRDC). No person should act on the basis of the contents of this publication without first obtaining specific, independent professional advice.

The Grains Research and Development Corporation may identify products by proprietary or trade names to help readers identify particular types of products. We do not endorse or recommend the products of any manufacturer referred to. Other products may perform as well as or better than those specifically referred to. The GRDC will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on the information in this publication.

Caution: Research on Unregistered Pesticide Use

Any research with unregistered pesticides of unregistered products reported in this publication does not constitute a recommendation for that particular use by the authors or the authors' organisations.

All pesticide applications must accord with the currently registered label for that particular pesticide, crop, pest and region.

Abstract

There has been increased interest from growers at field days and via Western Panel tours seeking paddock-based solutions to combat non-wetting soils through traditional and non-traditional methods on their properties. This project aimed to effectively demonstrate and extend known surfactants and their fit as a short term solution as soil water repellence mitigation.

The project encompassed the medium rainfall area of the Southern Kwinana, Albany and Esperance port zones. Five small plot sites in each year, for a total of ten sites, were selected with water repellent sandy soils, were sown to either canola, wheat or barley. Sites were also chosen based on them having differing stubble types and loading and included lupin, barley and wheat stubbles.

In year one six types of commercial liquid surfactants were used across the trials and in year two four were used across the trial set. They were applied at seeding according to their related label specifications.

In both seasons, 2020 and 2021, there were no significant differences in crop establishment or yield production observed between soil surfactant treatments applied to non-wetting soil sites across the ten sites. In addition, no differences in plant biomass, NDVI or soil moisture percentage were detected between treatments.

Good early rainfall was received across all the sites for both seasons reducing the potential benefits of soil surfactants as the soil was able to wet up naturally and effectively germinate the crops with the need of a surfactant. Wetting agents or surfactants are most likely to be beneficial for dry sowing crops into water repellent soils. Early season good rainfall will reduce the ability of surfactants to give any beneficial result.

The outcomes from the project bring into question the implied benefit of using soil surfactants on a year in, year out, basis as a means to mitigate non-wetting soils and to improve germination, crop establishment and ultimately crop yield.

Further work is required to determine if there is a long-term benefit to using soil surfactants on a year in, year out, basis. Does the yield benefit from using soil surfactants in the marginal years more than cover the cost of using these products every season?

It is worth noting that previous research has demonstrated ‘on row’ seed placement is likely to be more significant for crop establishment moisture availability than the application of soil surfactants.

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Executive Summary

There has been increased interest from grain producers in WA seeking paddock-based solutions to combat non-wetting soils through traditional and non-traditional methods on their properties. This project aimed to effectively demonstrate and extend the use and benefits of known surfactants and their fit as a short-term solution to soil water repellence mitigation.

Management of water repellence is problematic, and strategies can be grouped into two categories, long term removal of water repellence through soil amelioration or short term, seasonal mitigation, of water repellence.

Removal of the problem of water repellence through soil amelioration is generally expensive and mechanical amelioration strategies are not suited to forest gravels due to the significant number of large rocks. Mechanical amelioration techniques include:

- Claying
- Spading
- Mould Board Ploughing

Mitigation of water repellence soils are strategies that will generally only influence the water repellence for one season, can be implemented over large areas or entire cropping programs and are implemented within the normal sowing or spraying operation. These techniques include:

- Application of wetting agents or surfactants to soils at or prior to sowing
- Near row (previous years row) sowing
- No-till with stubble retention

Mitigation strategies are much cheaper than amelioration strategies however, they need to be applied each year and the results can be inconsistent in regard to their impact on crop production.

Soil surfactants aim to reduce the surface tension between water and soil particles allowing the water to penetrate and wet soils more easily and evenly. A surfactant can promote the retention and absorption of moisture in soils.

There are currently many types of commercial soil surfactants (wetting agents) on the market. Modern wetting agents typically have both surfactant and humectant properties. Humectants are designed to counter excessive leaching of moisture in a low surface area (large particle size) sands and aid in moisture retention.

Soil surfactants can be applied as a blanket spray through a normal boom spray application, broadcast as a granular product or banded in a targeted application on the soil within the seeding furrow and this is applied within the seeding operation. This application can be sprayed either directly behind the seeding tyne, within the soil surrounding the seed or behind the press wheel.

This project examined strategies to overcome non-wetting issues of poor crop establishment of all grains, especially canola, when dealing with non-wetting soils, stubble loads and different stubble types. Commonly used soil surfactants were examined across a range of application methods, application rates and over a range of stubble types and loads.

The research work completed in both 2020 and 2021 demonstrated that poor crop establishment caused by water repellence can be alleviated by timing of early-growing season rainfall events to the extent that no further crop production advantages were gained by using liquid soil surfactants. In both 2020 and 2021, no significant differences in crop establishment or grain production between treatments, including the control, were observed between soil surfactant treatments applied to non-wetting soil on sites at Newdegate (x2), Cuballing, Gibson, Nyabing (x2), Dunn Rock (x2), East Pingelly and Munglinup. In addition, no differences in plant biomass, NDVI or soil moisture percentage were detected between treatments.

Good early rainfall was received across all the sites for both seasons reducing the potential benefits of soil surfactants as the soil was able to wet up naturally and effectively germinate the crops with the need of a surfactant. Wetting agents or surfactants are most likely to be beneficial for dry sowing crops into water repellent soils. Early season good rainfall will reduce the ability of surfactants to give any beneficial result.

The outcomes from the project bring into question the implied benefit of using soil surfactants on a year in, year out, basis as a means to overcome non-wetting soils and to improve germination, crop establishment and ultimately crop yield.

Further work is required to determine if there is a long-term benefit to using soil surfactants on a year in, year out basis. Does the yield benefit from using soil surfactants in the marginal years more than cover the cost of using these products every season.

It is worth noting the previous research has demonstrated on row seed placement is likely to be more significant for crop establishment moisture availability than the application of soil surfactants.

Contents

Background

Water repellent soils restrict the establishment of crops in south-western Australia, and many growers are investing heavily in soil amelioration techniques and seeding equipment set-ups to mitigate soil water repellence. For more than a decade, growers in the Esperance, Albany and Kwinana West port zones have been using commercial liquid surfactants at seeding in the absence of wide-scale trial data relating to crop responses to applied surfactants.

Canola is Western Australia’s third largest crop after wheat and barley and important as a rotational break crop. Sowing of canola often begins under marginal soil moisture conditions before the break of season and, given it’s small oilseed characteristics, does not readily germinate. Crop establishment of canola is particularly restricted in non-wetting soils which leads to problems in both weed control and crop production.

Stubble is thought to affect crop establishment in a number of ways and was therefore quantified at each site in the trial set. The advantages of stubble retention for improving soil moisture content are provided when stubble acts as a mulch or by creating pathways for water infiltration. However, stubble may also inhibit crop establishment by obstructing seed placement or, where liquid soil surfactants are applied, obstructing soil surfactants from reaching the soil. Sites in this project were chosen with differing stubble types and quantity of stubble was recorded to refer to in the event of crop establishment differences within the trials.

Project objectives

To demonstrate the effectiveness of liquid surfactants and related application methods at seeding on crop performance in non-wetting soils with differing stubble loads and types in the Albany, Esperance and Kwinana West port zones.

To provide information relevant to growers in the Esperance, Albany and Kwinana West port zones experiencing crop production issues with non-wetting sandy soils, so they can better understand the available options that may help them overcome water repellent soil constraints. Extension of information will be achieved via a fact sheet, pod cast and video, as well as site visits by growers during the trial period.

Methodology

Five small plot sites in each year for a total of ten sites, were selected with water repellent sandy soils, were sown to either canola, wheat or barley. Sites were also chosen based on them having differing stubble types and loading and included lupin, barley and wheat stubbles.

Pre-seeding site testing included soil nutrition testing (10cm increments to 30cm), Molarity of Ethanol Droplet (MED) testing, Predicta B screening and soil compaction testing. Pre-season site measurements included soil infiltration rates and pre-planting soil moisture.

In year one six types of commercial liquid surfactants were used across the trials, and they were applied in the following three methods, according to their related label specifications;

1. liquid stream at seeding banded with the seed,
2. liquid stream at seeding on-furrow, or,
3. hand boom immediately post-seeding.

In year two four types of commercial liquid surfactants were used across the trials, and they were applied in the following three methods, according to their related label specifications;

1. liquid stream at seeding banded with the seed,
2. liquid stream at seeding on-furrow, or,
3. hand boom immediately post-seeding.

In-season, each plot was assessed in the following ways;

- Crop plant establishment counts
- Crop plant biomass as NDVI (Normalized Difference Vegetative Index) using handheld GreenSeeker technology
- Soil Moisture percentage in furrow
- Crop Yield and Grain Assessment at harvest

Table 1: 2020 Soil surfactant treatments applied across the sites

Treatment		Rate	Appl
Name	**Rate**	**Unit**	**Description**
Nil			
Divine	2	L/ha	On Furrow
Divine	20	L/ha	Hand Boom
Soak N Wet	3	L/ha	Banded with seed
SE14	2	L/ha	Banded with seed
SE14	4	L/ha	Banded with seed
Precision Wetter	2	L/ha	Banded with seed
Rain Drover	2	L/ha	Banded with seed
Rain Drover	4	L/ha	Banded with seed
Bi-Agra Band	1.2	L/ha	Banded with seed

Note: Not all treatments were applied at each site.

Table 2: 2021 Soil surfactant treatments

Treatment Name	Rate	Rate Unit	Appl Description
Nil			
Divine	2	l/ha	On Furrow
Divine	20	l/ha	Hand boom
SE14	2	l/ha	Banded with seed
SE14	4	l/ha	Banded with seed
Soak N Wet	3	l/ha	Banded with seed
Bi-Agra Band	1.2	l/ha	Banded with seed

Note: All treatments were applied across all site

Location

NOTE: Where field trials have been conducted please include location details: Latitude and Longitude, or nearest town, using the table below (please add additional rows as required):

LOCATION - 2020

	Latitude (decimal degrees)	Longitude (decimal degrees)
Trial Site #1	S 33.58021 °	E 118.29582°
Nearest Town	Nyabing	
Trial Site #2	S 33.30305°	E 118.97353°
Nearest Town	Newdegate	
Trial Site #3	S 32.73238°	E 117.22676°
Nearest Town	Cuballing	
Trial Site #4	S 33.41710 °	E 119.60107°
Nearest Town	Dunn Rock	
Trial Site #5	S 33.686944°	E E121.93333°
Nearest Town	Gibson	

LOCATION - 2021

	Latitude (decimal degrees)	Longitude (decimal degrees)
Trial Site #1	S 33.30406	E 118.97341
Nearest Town	Newdegate	
Trial Site #2	S 33.703626	E 120.919988
Nearest Town	Munglinup	
Trial Site #1	S 33.41311	E 119.60573
Nearest Town	Dunn Rock	
Trial Site #2	S 33.56253	E 118.27917
Nearest Town	Nyabing	
Trial Site #2	S 32.52028	E 117.43834
Nearest Town	East Pingelly	

If the research results are applicable to a specific GRDC region/s (e.g. North/South/West) or Agro - Ecological Zone/s please indicate which in the table below:

Research	Benefiting GRDC Region (can select up to three regions)	Benefiting GRDC Agro-Ecological Zone (see link: http://www.grdc.com.au/About-Us/GRDC-Agroecological-Zones) for guidance about AE-Zone locations	
Experiment Title	Choose an item. Choose an item. Choose an item.	☐ Qld Central ☐ NSW NE/Qld SE ☐ NSW Vic Slopes ☐ Tas Grain ☐ SA Midnorth-Lower Yorke Eyre ☐ WA Northern ☐ WA Eastern ☐ WA Mallee	☐ NSW Central ☐ NSW NW/Qld SW ☐ Vic High Rainfall ☐ SA Vic Mallee ☐ SA Vic Bordertown-Wimmera ☐ WA Central ☐ WA Sandplain

Results

Table 3: Measurement on water repellence at trial sites in 2020 and 2021

Yr	Location	Crop	Infiltration rate mm/min	MED		
				0-10cm	10-20cm	20-30cm
2020	Cuballing	Canola	1.83	2	0	0
	Dunn Rock	Barley	12.00	2	0	0
	Gibson	Canola	1.66	4	0	2
	Newdegate	Wheat	0.78	3	1	0
	Nyabing	Wheat	2.00	2	0	0
2021	East Pingelly	Canola	8.60	2	0	0
	Dunn Rock	Barley	11.20	4	0	0
	Munglinup	Canola	N/A	4	0	0
	Newdegate	Canola	4.40	2	0	0
	Nyabing	Wheat	4.10	3	1	0

2020 Results

In 2020, no significant differences in crop establishment or yield production between treatments were observed between soil surfactant treatments applied to non-wetting soil sites at Newdegate, Cuballing, Gibson, Nyabing and Dunn Rock. In addition, no differences in plant biomass (NDVI) or soil moisture percentage were detected between treatments.

Only at the Cuballing site, was a difference in grain quality detected. The canola oil percentage was found to be 0.4% lower in the soil surfactant treatment plots (Divine and SE14) compared to the nil treatment.

Three different stubble types were experienced across the five trial locations (Table 1). No interactions between stubble presence and crop establishment were witnessed in these trials.

Table 1. Types and Mean Weight of stubble at five trial site locations.

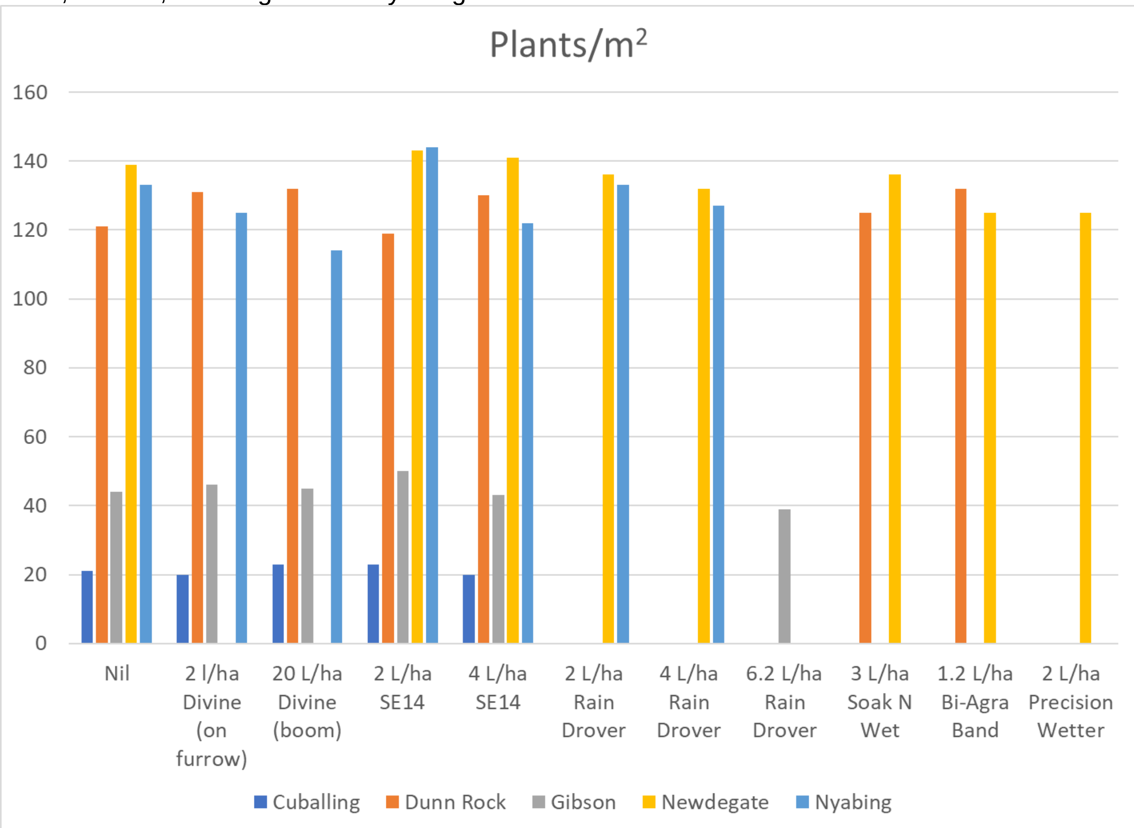
	Stubble type	Mean g/0.25m2 (dry)
Cuballing	wheat	24.44
Dunn Rock	barley	81.22
Newdegate	wheat	34.3
Nyabing	lupin	89.64
Gibson	barley	

Despite experiencing a low rainfall season at each site, the timing of rainfall events after seeding is likely to have mitigated the water repellence characters of soils at these sites. At Newdegate, the trial was sown on 19 May 2020. Six rainfall events were recorded in Newdegate in May 2020 (Table 2).

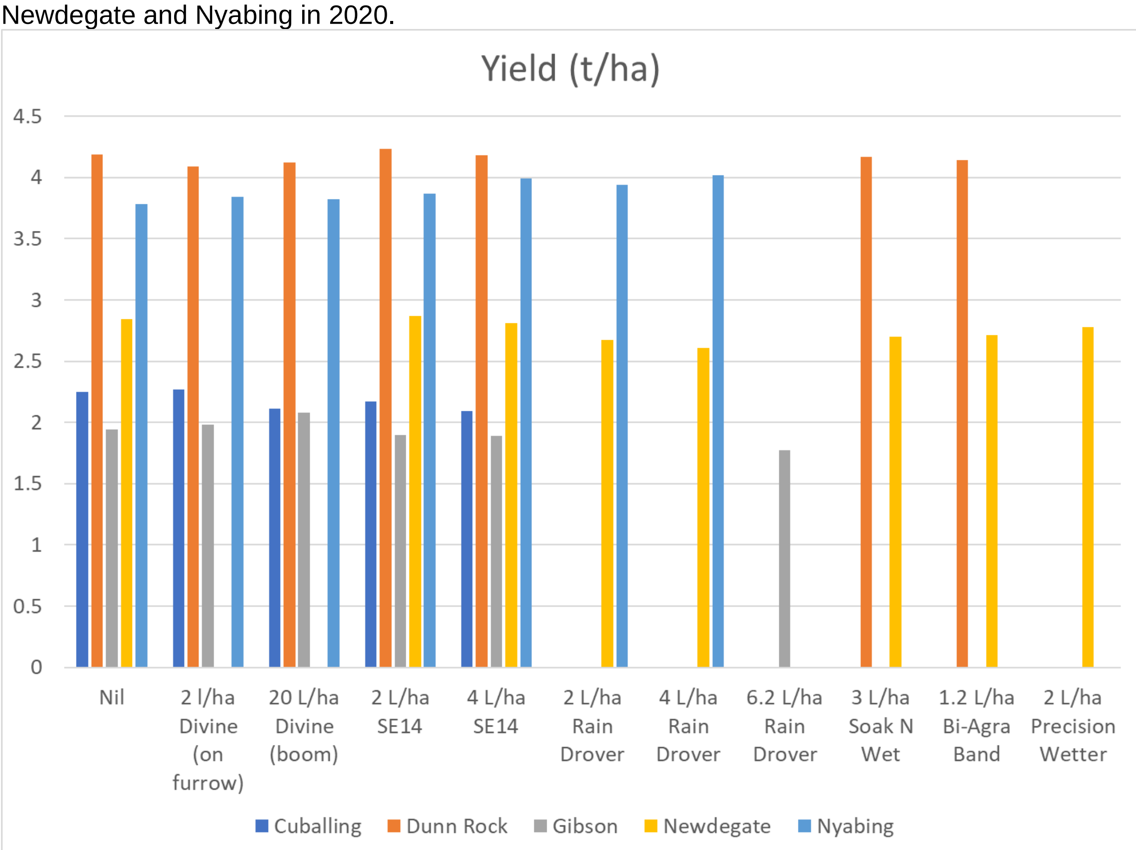
Table 2. Rainfall data for Newdegate trial site in May 2020.

5 May	23 May	24 May	29 May	30 May	31 May
38mm	5mm	5mm	10mm	11mm	16mm

Graph 1. Crop establishment (plant/m²) of the applied soil surfactant treatments at Cuballing, Dunn Rock, Gibson, Newdegate and Nyabing in 2020.



Graph 2. Crop yield (t/ha) of the applied soil surfactant treatments at Cuballing, Dunn Rock, Gibson, Newdegate and Nyabing in 2020.



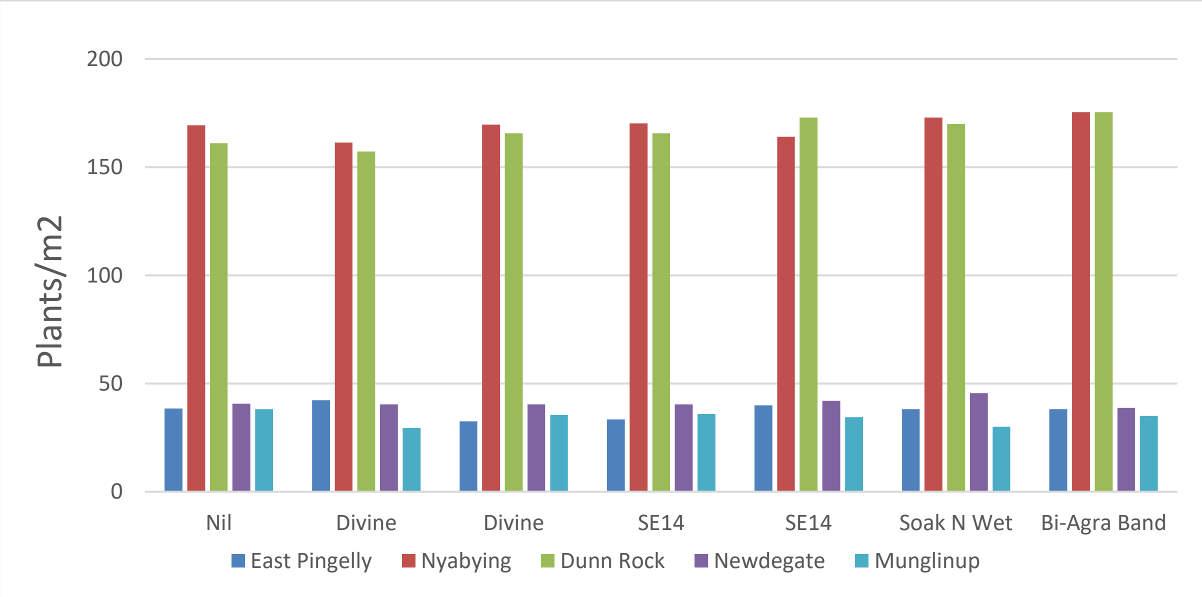
2021 Results

Similarly to the previous years results in 2021, no significant differences in crop establishment or yield production between treatments were observed between soil surfactant treatments applied to non-wetting soil sites at East Pingelly, Nyabing, Dunn Rock, Newdegate and Munglinup. In addition, no differences in plant biomass, NDVI or soil moisture percentage were detected between treatments.

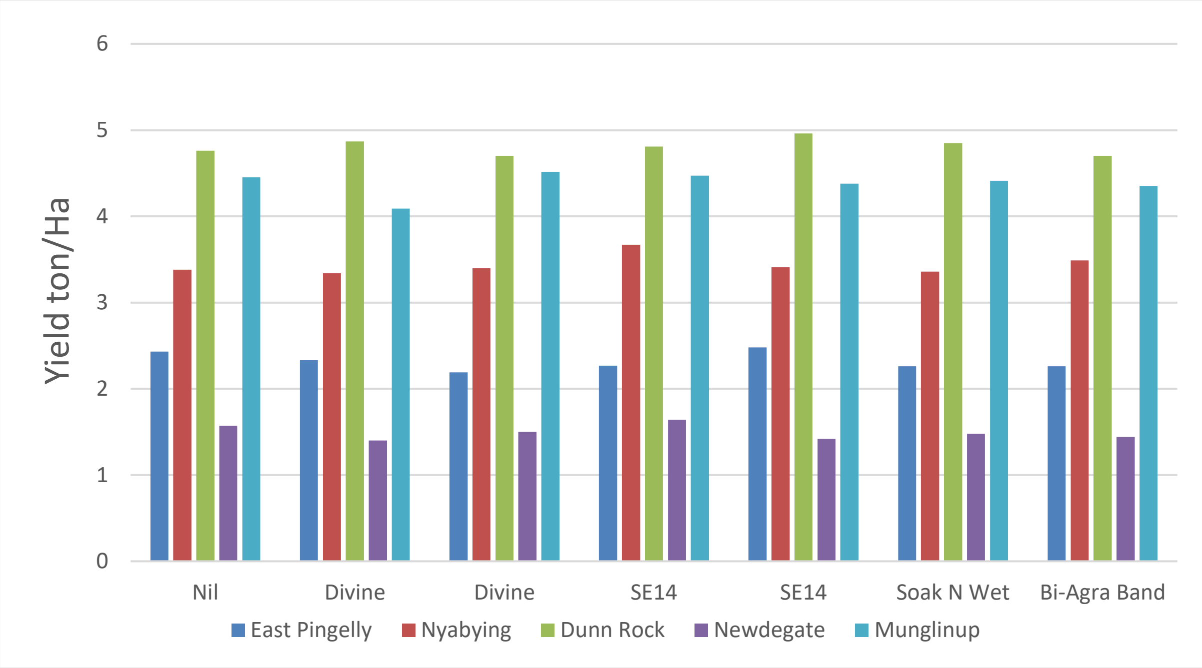
	Crop type	Stubble
East Pingelly	Canola	Cereal
Nyabing	Wheat	Canola
Dunn Rock	Barley	Cereal
Newdegate	Canola	Cereal
Munglinup	Canola	Cereal

It is worth noting the 2021 was an exceptional season in terms of rainfall received across the Southern region of the Western Australian wheatbelt mitigated any potential non wetting issues and soil moisture retention benefits of soils across these sites.

Graph 3. Crop establishment (plant/m^2) of the applied soil surfactant treatments at East Pingelly, Nyabing, Dunn Rock, Newdegate and Munglinup in 2021.



Graph 4. Crop yield (t/ha) of the applied soil surfactant treatments at East Pingelly, Nyabing, Dunn Rock, Newdegate and Munglinup in 2021.



Discussion of Results

A non-wetting soil is where a soil repels moisture instead of absorbing it, like water on wax. Water repellent soils are caused by the decomposition of hydrophobic (or water repelling) waxy materials originating from plant residues coating soil particles preventing the infiltration of water into the soil profile. Soils with a small surface area likes sands, are more prone to water repellency as it takes less hydrophobic material to coat individual particles, compared to silt or clay.

The results of water repellence is generally uneven water distribution in the soil profile which leads to patchy and uneven plant emergence. Moving from an alternately wet and dry soil can make it difficult to control the depth of sowing causing further problems with establishment. Water can remain ponded on the soil surface to be evaporated or lost as runoff. Lack of plant cover and heavy autumn or summer rains can result in significant runoff and erosion on sloping sites.

The susceptibility of a soil being or becoming water repellent will be determined not only by the presence of hydrophobic material, but also soil texture. Coarsely textured sandy soils that contain less than 5 % clay are very susceptible to becoming water repellent. In Western Australia, soils in coastal sand-plain regions generally have the greatest risk of water repellence.

Water-repellent ('non-wetting') soils are a major constraint to agricultural production in Western Australia's South Western region. Recent below average rainfall years have intensified the repellency of soils and farmers are observing poor crop establishment in sands where they have never observed the issue before.

The project examined strategies to overcome non-wetting issues of improving crop germination and establishment of all grains, especially canola, when dealing with non-wetting soils, stubble loads and different stubble types. Commonly used soil surfactants were examined across a range of application methods, application rates and over a range of stubble types and loads.

The research work completed in both 2020 and 2021 demonstrated that poor crop establishment caused by water repellence can be alleviated by timing of early-growing season rainfall events to the extent that no further crop production advantages were gained by using liquid soil surfactants. In both 2020 and 2021, no significant differences in crop establishment or grain production between treatments, including the control, were observed between soil surfactant treatments applied to non-wetting soil on sites at Newdegate (x2), Cuballing, Gibson, Nyabing (x2), Dunn Rock (x2), East Pingelly and Munglinup.

In 2020 good rainfall events were recorded in May, prior to and after the trials were sown. For example, the Newdegate site received a total of 85mm across 6 events in May with the trial sown on the 19th of May. Similar or better early rainfall events were experienced in 2021. The trials showed that sowing into good soil moisture combined with good follow up rainfall and moisture harvesting through furrow construction reduced the ability of soil surfactants s to perform as the soil was able to wet up naturally.

Stubble retention has many benefits to the over-arching cropping operation and has evolved to become a part of most producer's normal program. Stubble retention additionally has several benefits to overcoming water repellency by:

- Providing a conduit for water infiltration by preserving root pathways and allowing water to bypass repellent surface layers
- Reducing soil water evaporation and run off by providing soil cover
- Reducing soil temperatures in the upper layers
- Increases organic matter and soil water holding capacity

It is generally thought that the more stubble that is retained, the less likely water repellent soils are likely to be an issue. There is however, a lack of research to show a direct correlation between stubble load and improved crop establishment and final yield. Similarly, the effects of different stubble types (i.e. canola/lupin/wheat) on soil water repellency is also relatively unknown.

Adding to the complexity, high stubble loads may inhibit crop establishment by obstructing liquid soil surfactants from reaching the soil. This is particularly relevant to surfactants that are applied pre planting or applied as a broad spray through a normal boom operation.

Stubble load is expected to have minimal impact on applications during the seeding process that are streamed within the seed bed as the tynes push the stubble to the inter row leaving the furrow bare allowing the surfactant to be applied as desired.

Photo 2 & 3: 2020 stubble loads at Dunn Rock site (left), 19 June 2020 (3.25 MT/Ha) and Cuballing site (right), 18 June 2021 (0.98 MT/Ha)

The good seasonal conditions experienced in the two years of the research also impacted the ability of the trial work to draw any conclusions on the impact of the stubble load and stubble type on germination and crop establishment across different crop types. This is due to their being no significant differences between crop establishment and final yield across any of the stubble types or loads. Photo 2 shows the highest stubble load of the different sites chosen in 2020 at 3.25 MT/Ha dry weight of wheat stubble and photo 3 shows the lowest at 0.98 MT/Ha.

Additionally, the methodology of examining different stubble loads within one site proved to be difficult to accurately reflect normal conditions. The process of removing or adding stubble onto sites accurately and to replicate normal stubble conditions was not practical and therefore removed from the project. The results focused on different stubble loads between different sites.

Conclusion

Growers in the Esperance, Albany and Kwinana West port zones commonly face the issue of poor establishment of crops in water repellent soils under marginal moisture conditions. The trials in this project have shown that poor crop establishment caused by water repellence can be alleviated by timing of early-growing season rainfall events to the extent that no further crop production advantages are gained by using liquid soil surfactants.

Soil amelioration techniques for dealing with water repellent soils, such as claying, delving and soil inversion, are very costly for growers. Liquid soil surfactants present a method of mitigating water repellence over large areas within the normal seeding operation without severe soil disturbance and related machinery expense. However, soil surfactants still come at a significant annual cost per hectare and based on these trial results, the uncertainty of rainfall events in Western Australia's south-west agricultural area make the decision of investing in liquid soil surfactants difficult.

Further investigation into liquid soil surfactants in seasons where significant rainfall events do not occur for several weeks following seeding may improve our understanding of when, or if, liquid surfactants may help crop production. Potentially, the recommended rates and chemical properties of the surfactants themselves need further development.

The results of this project does not provide much to ease the difficulties of managing water repellent soils. While soil surfactants may work under certain seasonal conditions and on certain soil types, it is difficult to make the decision based on a positive cost benefit analysis. The results were unable to demonstrate any sort of economical return for the application of soil surfactants.

Further work is required across a wider range of seasonal conditions to better understand what conditions are required to generate a crop establishment, yield and economical return benefit and if there is a long-term return on the year in, year out, cost.

Ideally, an Integrated Mitigation Strategy (IMS) should be employed to reduce reliance on any one individual tool, such as soil surfactants. Long-term amelioration strategies for non-wetting should also be considered as part of an IMS and the cost of all strategies should be averaged across seasons. This is to determine the benefit costs analysis of the long-term yield response in relation to the annual cost of implementation.

Implications

The implications from this project are to bring into question the implied benefit of using soil surfactants on a year in, year out, basis as a means to overcome non-wetting soils and to improve germination, crop establishment and ultimately crop yield.

Across 10 small plot trials targeting non-wetting soils the project was unable to determine an example of when there was any sort of benefit to using soil surfactants. However, seasonal conditions did not favour the use of soil surfactants as good rainfall events were received over both seasons during the seeding and crop establishment periods.

A key issue remains that the seasonal events that determine if there will be a benefit to using soil surfactants, mostly occur after the seeding or application timing. Therefore, it remains a risk to not use the products in case the post seeding rainfall is marginal.

While there may be benefits to using soil surfactants in certain seasons with marginal opening rains the cost benefit analysis covering several seasons remains unknown. The question remains, does the yield benefit from using soil surfactants in the marginal years more than cover the cost of using these products every season?

The impact of stubble type and loads were unable to be fully explored in the project and therefore the implications of potential stubble management techniques and recommendations from this project were not material.

Recommendations

Many producers in southern Western Australia are using soil surfactants as a year in, year out, strategy to overcome non-wetting soil issues and to benefit from an improved crop germination, establishment and ultimately an increase in final yield. There are two key recommendations that have come from this project.

This project has shown that over 10 trials across two seasons there was no benefit to using soil surfactants. However, the seasonal conditions were not conducive to the soil surfactants being able to perform, as rainfall events around sowing time were sufficient to wet the soil to the extent that crops germinated well without any treatment. The first recommendation is that the project needs to be extended across a wider range of seasonal conditions which will enable the long-term cost benefit analysis of using soil surfactants as part of a year in, year out, program to be determined.

Based on a literature review, very limited work has been completed around the impact of stubble type and load on managing non-wetting soils and the best strategy to implement in relation to stubble management. The second recommendation is to devise an appropriate methodology and then authorise a project to understand the impact of stubble type and loads on managing non-wetting soils.

Appendix A. Appendix Title

Glossary and Acronyms

Below is a sample Abbreviations and Acronyms list. Be sure to include on this page all abbreviations and acronyms that appear in the report

DAFWA	Department of Agriculture and Food, Western Australia
DAP	di ammonium phosphate
DArT	Diversity Arrays Technology
DAT	days after treatment
Db	bulk density
DAFWA	Department of Agriculture and Food, Western Australia

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

References

This section provides the information a reader would need to locate the articles, journals, and/or other publications referred to in the report.

Social Media Posting

GRDC uses social media to showcase research investments and disseminate timely, relevant and practical information to key stakeholders in the grains industry. Our audiences are predominantly growers and agricultural advisers.

Social Media Accounts:

Facebook: https://www.facebook.com/theGRDC
Twitter: https://twitter.com/theGRDC
YouTube: http://www.youtube.com/user/theGRDC
LinkedIn: http://www.linkedin.com/company/thegrdc

Is there any reason why this report cannot be communicated on social media?

a. *(Insert info here)*

If no, please provide the following:

1. Who is the target audience for this content? (e.g., growers, adviser, researchers, policy makers, etc.)

    a. *(Insert info here)*

2. At what time of year is this content most relevant to the target audience?

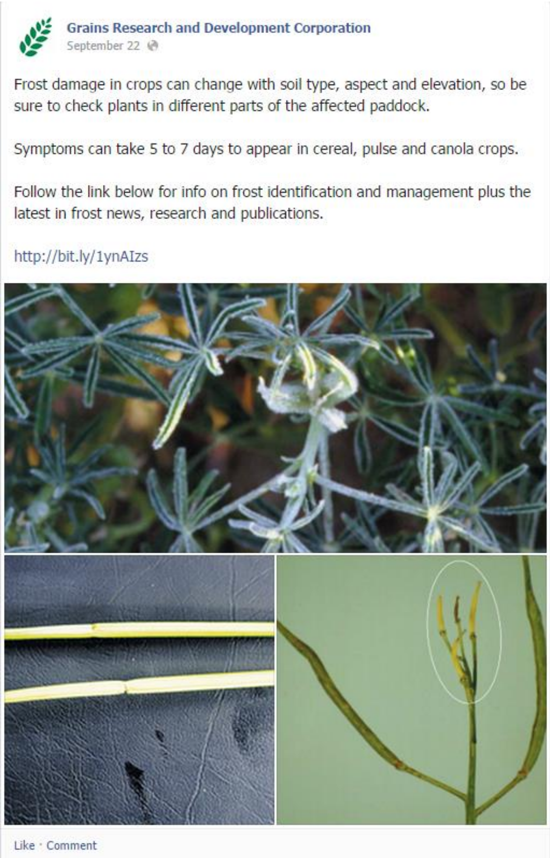
    a. *(Insert info here)*

3. On which of GRDC's social media accounts would you like this content posted? Please provide text (2-3 sentences for Facebook and LinkedIn and 140 characters for Twitter), images, graphs, or charts that support the content. Where applicable, please include any relevant Twitter handles (usernames) for project staff.

    a. (Insert info here)

Samples:

Facebook:



Twitter:

Contact the social media team at socialmedia@grdc.com.au with any questions.

Please note that publication of content to GRDC social media accounts is at the discretion of GRDC's social media team.