Effect of rates, application timing and soil type on the activity of Lure H20 soil wetting agent in West Midlands region

Richard Devlin, Managing Partner, Living Farm Research and Agronomy
Hellene McTaggart, West Midlands Group

11WMG02, 11WMG03, 11WMG04

Purpose:	To investigate the influence of rate, application timing and soil type of the activity of Lure H20 as a pre-sow soil wetting agent in the cropping phase

BACKGROUND

Non-wetting (water repellence) has been identified by West Midlands Group (WMG) members as the key barrier to increasing productivity of both cropping and pasture operations. The nature of non-wetting sands and gravels results in uneven moisture penetration leading to a staggered weed and crop germination. This patchy establishment impacts on the effectiveness of initial weed knockdowns as well as in-season weed and crop nutrition management. With the recent climatic trend of late opening rains (season break) a uniform weed and crop germination is vital in maximizing productivity in the West Midlands region.

The use of Lure H2O as a soil wetting agent has been well documented in other areas of the W.A Wheatbelt, but little work has been done in the West Midlands Group (WMG) membership area.

The National Adaptation & Mitigation Initiative project coordinated by Birchip Cropping Group gave West Midlands Group the opportunity to trial this surfactant treatment in West Midlands environment.

Living Farm was sub-contracted by the WMG to independently test the product on three soil types typical of the area: a quality “pea” gravel (‘Warilada’, J & E Scotney), a blackbutt sand (‘Wathingarra’, Jeff Fordham) and a deep banksia sand/conglomerate gravel (‘Kerry Downs’, B & H McTaggart). All three sites were chosen due to a strong history of water repellency.

At each of the three sites Lure H20 was applied at 3 different rates (10, 20 and 40l/ha) and at two different timings (March and April).

Paddocks were then treated as per a normal cropping cycle, with trial areas subsequently sprayed and sown by the participating grower.

Wheat was sown on Fordham’s yellow sand, barley on McTaggart’s sandy gravel site and canola was sown on Scotney’s loamy gravel.

TRIAL DESIGN

Complete randomised block trial treatments specified in table 1

Table 1: *Trial treatments applied at all sites*

Trmt.	Treatment description	Product Rate / ha	Timing
1	Untreated check	-	-
2	Lure H20 10L March application	10L	March 16th
3	Lure H20 20L March application	20L	March 16th
4	Lure H20 40L March application	40L	March 16th

5	Lure H20 10L April application	10L	April 14th
6	Lure H20 20L April application	20L	April 14th
7	Lure H20 40L April application	40L	April 14th

SITE DETAILS

Site 1- Yellow deep sand

Location: 'Wathingarra', North West Road, Badgingarra (J & W Fordham)

Soil profile:

Horizon	Depth (cm)	Description
A1	0-10	dark greyish brown (10YR 4/2 moist) loamy sand; moderately moist soil; apedal,; pH 6 (soil paste); clear boundary.
A21	10-50	brownish yellow (10YR 6/8 moist) clayey sand; moderately moist soil; apedal,; pH 5.5 (soil paste); diffuse boundary.
A22	50-100+	brownish yellow (10YR 6/8 moist) clayey sand; dry soil; apedal,; pH 6 (soil paste).

Ground cover: 60-90% clover / capeweed stubble, some standing stubble.

Rotation: 2010: Pasture

Crop details: DBS bar- Calingiri wheat @ 85kg; Morris bar- Calingiri wheat @ 100kg

GSR: 433 mm

Site 2- Shallow sandy gravel

Location: 'Kerry Downs', Agaton Road, Dandaragan (B & H McTaggart)

Soil profile:

Horizon	Depth (cm)	Description
A1	**0-10**	very dark greyish brown (10YR 3/2 moist) loamy sand; dry soil; apedal,; 30% subrounded ferruginous ironstone medium sized gravel and 10% subrounded tabular ferruginous ironstone coarse sized gravel; water repellent; pH 6.5 (soil paste); clear boundary.
A2	**10-30**	dark greyish brown (10YR 4/2 moist) clayey sand; dry soil; apedal,; 30% subrounded ferruginous ironstone medium sized gravel and 30% subrounded tabular ferruginous ironstone coarse sized gravel; water repellent; pH 6 (soil paste); gradual boundary.
B1	**30-40**	yellowish brown (10YR 5/8 moist) sandy loam; dry soil; apedal,; 40% subrounded ferruginous ironstone medium sized gravel and 10% subrounded tabular ferruginous ironstone coarse sized gravel; pH 6 (soil paste).
	40+	strongly cemented, massive, ferricrete pan.

Ground cover: 20-60% ryegrass and lupin stubble, some cow manure

Rotation: 2010: Vol grass pasture

Crop details: Buloke Barley @ 70kg on 7 June 2011

GSR: 329mm

Site 3- Shallow loamy gravel

Location: 'Warrialda', Badgingarra Road, Badgingarra (J & E Scotney)

Soil Profile:

Horizon	Depth (cm)	Description
A1	**0-12**	dark brown (10YR 3/3 moist) humic loamy fine sand; apedal,; 40% subrounded ferruginous ironstone gravel; water repellent; pH 6 (soil paste); clear boundary.
B1	**12-35**	dark yellowish brown (10YR 4/4 moist) fine sandy loam; apedal,; 50% subrounded ferruginous ironstone gravel; water repellent; pH 6.5 (soil paste);Lot of old roots thru profile.
m	**35+**	strongly cemented, massive, ferricrete pan.

Ground cover: 30-60% clover stubble, wheat stubble present

Rotation: 2010: pasture

Crop details: Thunder Canola @ 5kg on 17 May 2011
GSR: 448.2 mm

SITE 1 YELLOW SAND- RESULTS & DISCUSSION

Soil moisture

Surface soil moisture contents were measured using a soil moisture probe on 19 May 2011- after all treatments had been applied. There had been 14mm of rain at this site in the week prior to measurement. Results ranged from 10.5-12% however there was no significant difference between treatments. The texture of the top soil (loamy sand) indicates that field capacity is typically around 14%.

Emergence, crop vigour and biomass

Table 2 lists the in-season measurements taken at the 'Wathingarra' yellow sand site on the plots sown with the DBS bar. No assessment of any treatment indicated a response to Lure application. Assessments were also taken of the plots sown with the Morris bar and the rolled DBS plots however there was no significant difference for any of the seeding systems.

Table 2: *summary of in-season measurements of DBS plots*

Type of assessment	Date of assessment	Average across all treatments	Summary of results observed
Weed count/ emergence	26 April	1.2 weeds/ m2 quadrat	No significant difference was observed
Percent Groundcover (Weeds)	19 May	43.57%	No significant difference was observed
Crop Emergence	16 June	24.2 plants/ meter row	No significant difference was observed
Crop Vigour	23 July	76.2%	No significant difference was observed
Normalized Difference Vegetation Index (NDVI)	9 August	0.58 NDVI	No significant difference was observed

Yield and grain quality

- There was no significant difference in yield between the treatments in either the DBS, DBS + Rolled or the ribbon seeded plots.
- DBS + Rolled plots generally yielded higher than the DBS alone or the ribbon seeder. This is more likely due to site differences than to the effect of the rolling on the DBS.
- Quality testing was only conducted on the DBS plots. There was no significant differences in protein, hectolitre or screenings between any of the treatments.

SITE 2 SANDY GRAVEL- RESULTS & DISCUSSION

Weed and crop germination

Weed emergence counts were taken shortly after the break-of-season but prior to the pre-seeding knockdown. A high number of small (1 leaf) ryegrass were present throughout all plots at this timing, however ryegrass were confined to previous year's furrows with virtually none present in the inter-row. Counts were done on Untreated plots and the top rate (40L/ha Lure H2O) treatments to establish if differences were present, however there were no differences in numbers between these plots so a % Groundcover rating was attempted. Again, this did not show any conclusive differences. No significant difference (p=0.05) was observed.

Biomass

At approximately 8WAS a “GreenSeeker” was run across all trial plots. GreenSeeker technology measures Normalized Difference Vegetation Index (NDVI) and can be used to provide a quantitative measure of the amount of green leaf or biomass in each plot.

No significant differences in NDVI were recorded however there was a slightly higher NDVI for all plots receiving Lure H2O when compared to the Untreated check.

Yield and grain quality

The Untreated Check plot returned the lowest yields of all treatments, however this was statistically non-significant (p=0.05), refer to Table 3.

There was significant differences in proteins at this site, however results show no clear trends or suggest a treatment effect. There were no other significant quality differences observed at this site.

Table 3. *Yield Data & Grain Quality Data for ‘Kerry Downs’ sandy gravel site.*

Trmt.	Treatment description	Product Rate / ha	Timing	Yield t/ha*	Protein %		Colour	Screenings %	H/weight kg/hL
1	Untreated check	-	-	1.366	12.2	abc	56.5	0.65	56.7
2	Lure H20 10L March application	10L	March	1.695	11.6	bc	56.5	0.71	56.6
3	Lure H20 20L March application	20L	March	1.510	12.9	A	56.2	0.74	56.3
4	Lure H20 40L March application	40L	March	1.583	11.7	bc	56.2	0.69	57.4
5	Lure H20 10L April application	10L	April	1.631	11.5	C	56.1	0.59	57.5
6	Lure H20 20L April application	20L	April	1.584	12.6	ab	56.4	0.90	56.2
7	Lure H20 40L April application	40L	April	1.770	11.5	C	56.3	0.61	58.0
F prob				***NS***	***0.0417***		***NS***	***NS***	***NS***
CV %				***NS***	***4.4***		***NS***	***NS***	***NS***
LSD				***NS***	***0.939***		***NS***	***NS***	***NS***

**Note: Yield adjusted to 11% moisture.*

SITE 3 LOAMY GRAVEL- RESULTS & DISCUSSION

Soil moisture

Surface soil moisture contents were measured using a soil moisture probe on 19 May 2011- after all treatments had been applied. There had been 14mm of rain at this site in the week prior to measurement. Results of significance are illustrated by figure 1.

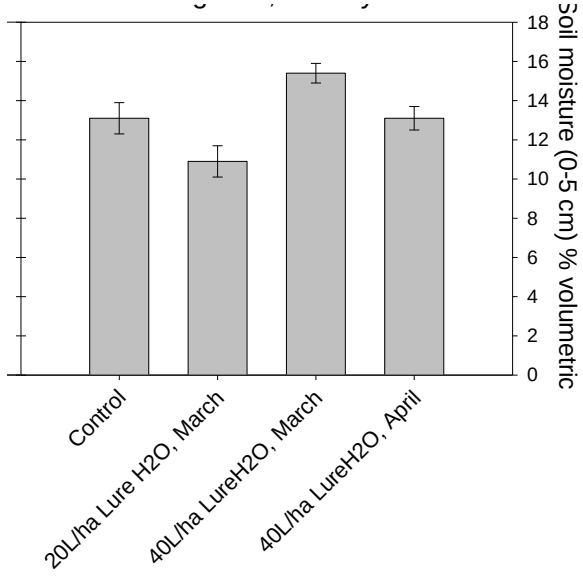

Figure 1: *soil moisture measurements (0-5cm) of selected treatments at 'Warialda' loamy sand trial site*

The surface soil moisture content was significantly higher than the control only for the 40L/ha LureH_2O treatment that was applied in March, which had an average soil moisture content of over 15% compared with 13% for the control treatment. Again the topsoil at this location was textured as loamy fine sand so it would be expected to hold marginally more moisture than the topsoil of a typical West Midlands yellow sand. The occurrence of drier soil was higher in the control plots with 8 of the 36 measurements (22%) having a moisture content of <8% compared whereas none of the 36 measurements in the LureH_2O treatment applied in March had readings less than 8%, indicative of more consistent wetting up of the soil.

Weeds, crop emergence and crop vigour

Weed emergence counts were taken shortly after the break-of-season but prior to the pre-seeding knockdown. No significant differences (p=0.05) were observed.

Lure H2O had a significant effect on crop emergence where best emergence was observed in those plots which received higher rates of Lure H20 (20l/ha and 40l/ha) at the earlier timing) (figure 2).

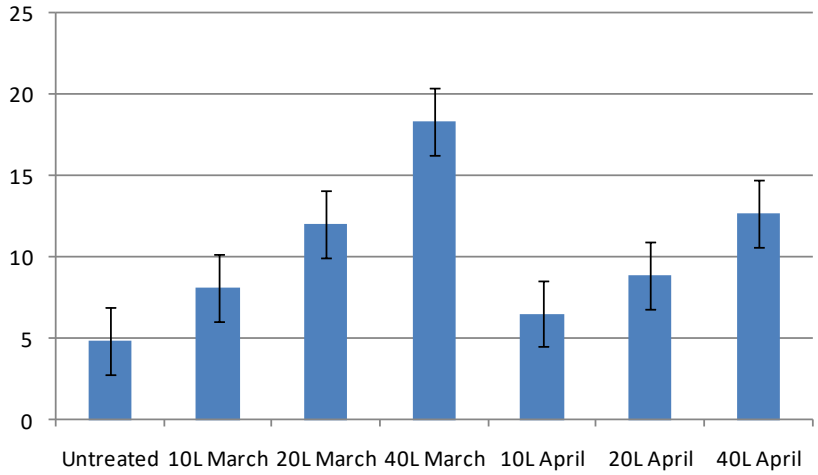

Figure 2: *Crop (canola) emergence assessment (plants per meter row) at 'Warrialda' loamy gravel site*

The trial site was monitored throughout the season for differences in vigour between plots (table 4). Vigour scores at this site closely mirrored the emergence count data with greatest vigour coming from those plots with good early emergence (March 20l/ha and 40l/ha).

Table 4: *Weeds and crop emergence measurements at 'Warrialda' loamy gravel site*

Trmt.	Treatment description	Product Rate / ha	Timing	Crop Vigour % ^	
1	Untreated check	-	-	46.7	e
2	Lure H20 10L March application	10L	March	56.7	de
3	Lure H20 20L March application	20L	March	75.0	bc
4	Lure H20 40L March application	40L	March	95.0	a
5	Lure H20 10L April application	10L	April	60.0	d
6	Lure H20 20L April application	20L	April	66.7	cd
7	Lure H20 40L April application	40L	April	46.7	e
F prob				**0.0001**	
CV %				**10.19**	
LSD				**12.4**	

**41 Days after March application, 13 Days after April application (26 April)*
***64 Days after March application, 36 Days after April application (19 May)*
****85 Days after March application, 57 Days after April application (9 June)*
^129 Days after March application, 101 Days after April Application (23 July)

Biomass

At approximately 8WAS a “GreenSeeker” was run across all trial plots. Significant differences were recorded at the ‘Warrialda’ site from the two high (20l/ha and 40l/ha) rates of Lure H20, regardless of application timing (Table 5). The impact of the product was visually noticeable (illustrated by figure 3).

Table 5: *Green leaf/ biomass Assessment Data (NDVI) for ‘Warrialda’ loamy gravel site*

Trmt.	**Treatment description**	**Product Rate / ha**	**Timing**	**NDVI^**	
1	Untreated check	-	-	0.8370	c
2	Lure H20 10L March application	10L	March	0.8481	bc
3	Lure H20 20L March application	20L	March	0.8837	ab
4	Lure H20 40L March application	40L	March	0.9121	a
5	Lure H20 10L April application	10L	April	0.8588	bc
6	Lure H20 20L April application	20L	April	0.8781	abc
7	Lure H20 40L April application	40L	April	0.8904	ab
F prob				**0.022**	
CV %				**2.64**	
LSD				**0.0410**	

^146 Days after March application, 118Days after April Application (9 August)

Untreated control

Lure @ 10 L/ha applied in March treatment

Lure @ 20 L/ha applied in March treatment

Lure @ 40 L/ha applied in March treatment

Figure 3: *Images of March Lure H2O treatments taken on 23 July 2011at 'Warrialda' loamy gravel site*

Yield & grain quality

Table 6: *Yield Data & Grain Quality Data taken from 'Warrialda' loamy gravel site*

Trmt.	Treatment description	Product Rate / ha	Timing	Yield t/ha*	Protein %	Oil %
1	Untreated check	-	-	2.165	21.4	41.8
2	Lure H20 10L March application	10L	March	2.149	22.2	40.9
3	Lure H20 20L March application	20L	March	2.081	21.9	41.7
4	Lure H20 40L March application	40L	March	1.956	22.2	41.4
5	Lure H20 10L April application	10L	April	2.071	21.8	41.2
6	Lure H20 20L April application	20L	April	2.098	21.8	41.4
7	Lure H20 40L April application	40L	April	2.022	21.5	41.4
F prob				**NS**	**NS**	**NS**
CV %				**NS**	**NS**	**NS**
LSD				**NS**	**NS**	**NS**

**Yield adjusted to 11% moisture*
Note: There was a 10-20% pod shatter across the site with some lodging also noted.

Despite the differences in crop emergence, crop vigor and biomass there were no significant differences in yield. It is hypothesized that the extremely soft finish to the season allowed the untreated plots to compensate for lower plant populations/emergence. There were no significant differences in protein or oil contents between any of the treatments.

REVIEWED: Ben McTaggart

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