Local Research and Development Results

February 2008

LiEBE GROUP

Working together in Agriculture

2008

Dear Liebe Group Members and Supporters,

It is with great pleasure we complete the Local Research and Development Results book for 2008. This book contains results from the majority of research and development conducted in the Dalwallinu, Coorow and Perenjori Shires from the 2007 season. Results not available at time of print will be printed in subsequent newsletters.

Many thanks to research and agribusiness organisations and growers who have conducted valued local research and development. We appreciate your continued support and enthusiasm, especially through dry years when trial work can be frustrating. We thank you for the opportunity to document the results in our 2008 book. Due to the 2007 growing season there were some trials and grower demonstrations that were not taken through to harvest and therefore their results are not presented this booklet. However, if similar trials were conducted elsewhere in the Northern Agricultural Region and were harvested the results have been included.

The increased research in technology adoption, livestock and cropping interactions and continued research into seasonal variability has provided greater value to Liebe members. We will strive for this to continue in 2008.

Agricultural technologies are developing at a rapid pace and we can all benefit greatly by fostering a **"Working Together in Agriculture"** approach.

Please interpret the results in this book carefully. Decisions should not be based on one season's data.

Throughout the book our major financial sponsors are promoted. All of our sponsors and supporters play a vital role in ensuring the continued success of the Liebe Group. We do acknowledge the invaluable support we receive from the Grains Research and Development Corporation (GRDC), Department of Agriculture and Food WA, National Landcare Program (NLP), CSBP, Rabobank, COGGO, Farm Weekly, Grower Group Alliance and many others.

All the best for the 2008 season and lets hope it brings plenty of rain!

Kind regards,

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LIEBE GROUP SUPPORTERS

The Liebe Group would like to thank the following organisations for their invaluable support:

- Grower Group Alliance
- Grains Research and Development Corporation
- Grain and Graze
- Northern Agricultural Catchments Council
- National Landcare Program
- CSIRO
- Department of Agriculture and Food WA
- University of Western Australia
- Farm Weekly
- Western Milling
- Shire of Dalwallinu
- Future Farm Industries CRC
- Department of Agriculture, Fisheries and Forestry through AgFund

LONG TERM RESEARCH SITE SUPPORTERS

GRDC Grains Research & Development Corporation

The Liebe Group would like to acknowledge and thank all sponsors and contributors to the Long Term Research Site (LTRS) for 2007. Without the generous support and assistance from the following supporters and contributors the LTRS management and sustainability would not be possible.

The following is a list of people/organisations that the Liebe Group would like to thank:

- **Grains Research and Development Coporation (GRDC).**
- **Summit Fertilizers** – fertiliser donation for the 63ha site and soil sampling the site at the start of the season.
- **Scholz Rural Supplies** – Chemical donations for the 63ha site and agronomic advice throughout the season.
- **Syngenta -** Chemical donations for the 63ha site.
- **Stuart McAlpine and Staff** – for seeding and harvesting the site and also agronomic assistance and monitoring the site throughout the season.
- **Michael Dodd and Staff –** For use of his machinery, agronomic assistance, spraying and monitoring of the site throughout the season.
- **Rod Birch and Staff** – For the use of his motorbike sprayer to apply microbial treatments to the Soil Biology Trial.
- **CBH Group** – Grain sampling.
- **CSBP labs** – Soil samples analysis.
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- **The University of Western Australia** – Daniel Murphy and sampling conducted by Yoshi Sawada.
- **The Department of Agriculture and Food** – Francis Hoyle.
- **Neil Blaxell** – For spraying the site when required.
- **CSIRO** – For information accumulated from the weather station throughout the season.

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UNDERSTANDING TRIAL RESULTS AND STATISTICS

We have tried to present all trial results in one format in this results book. However, due to differences in trial designs this isn't always possible. The following explanations and definitions should provide you with sufficient statistical understanding to get the most from trial results.

Mean

The results of replicated trials are often presented as the average (or mean) for each treatment. Statistics are used to determine if the difference between means is a result of treatment or natural variability (such as soil type).

Significant Difference

In nearly all trial work there will be some difference between treatments, ie one rate of fertiliser will result in a higher yield than another. Statistics are used to determine if the difference is a result of treatment or some other factor (ie soil type). If there is a significant difference then there is a very strong chance the difference in yield is due to treatments, not some other factor. The level of significance can also play a role. If we say $P<0.05\%$ this means we are greater than 95% sure that a difference is a result of treatment and not some other factor.

The LSD test

To determine if there is a significant difference between two or more treatments a Least Significant Difference (LSD) is often used. If there is a significant difference between two treatments their difference will be greater than the LSD. For example if we are comparing the yield of five wheat varieties (Table 1), the difference in yield between variety 4 and 5 is greater than 0.6 t/ha (LSD), therefore we can say this is a significant difference. This means we are 95% sure that the difference in yield is a result of variety not soil type or some other factor. Whilst there is a difference in yield between variety 1 and 2, it is less than 0.6, therefore we can't be sure the difference is a result of variety; it may be due to soil type.

Table 1: Yield of Five wheat varieties.

Treatment	Yield (t/ha)
Variety1	2.1
Variety2	2.4
Variety3	2.3
Variety4	2.9
Variety5	1.3
LSD (P=0.005)	0.6

Non-replicated Demonstrations

This book presents the results from a range of non-replicated demonstrations. In this case we cannot say for certain if a difference is the result of treatment or some other factor. Whilst the results from demonstrations are important, we need to keep in mind that they aren't statistically correct.

WHEAT NATIONAL VARIETY TRIAL - BUNTINE

Information from ACAS Ltd. (Australian Crop Accreditation System)

AIM

To evaluate new and existing wheat varieties.

BACKGROUND

The Grains Research and Development Corporation (GRDC) have initiated a change from the traditional crop evaluation system. Previously the trials were conducted on a state by state basis and were mostly an adjunct to the state's breeding efforts. The NVT is a national system that is inclusive for all potential new varieties of crops, regardless of the public or private company responsible for the breeding and release of the variety.

The NVT is of direct benefit to growers, with all costs of the NVT system in all states borne by GRDC, the exception being in Western Australia where a partnership arrangement exists between the GRDC and the Department of Agriculture and Food for the provision of pulse and course grains testing.

Acceptance of entries into NVT trials is conditional that the crop varieties under evaluation are very close to release or are currently available to growers. Crop varieties submitted for evaluation in the NVT will have already been evaluated by the respective breeding companies in those regions targeted.

TRIAL DETAILS

Property	Anton Wilson, West Buntine
Plot size & replication	1.76m x 12m x 3 replications
Soil type	Sandy loam
Sowing date	26/6/07
Seeding rate	75 kg/ha
Fertiliser (kg/ha)	31/5/07: 100 kg/ha Urea, 100 kg/ha MAPSZC
Paddock rotation	2005 = Wheat, 2006 = Lupins
Herbicides	31/5/07: 1.6 L/ha Trifluralin, 2 L/ha Glyphosate, 35 g/ha Logran
Insecticides	31/5/07: 1 L/ha Chlorpyrifos
Growing Season Rainfall	130mm

RESULTS

Table 1: Yield and quality of wheat varieties sown at Buntine.

Variety	Yield (t/ha)	Protein (%)	Weight (kg/Hectolire)	Screenings (%) *
AGT Scythe	1.25	14.3	71.2	11.05
Arrino	1.58	13.1	79.6	0.97
Axe	1.42	13.1	71.4	5.45
Barham	1.13	12.8	64.1	3.67
Binnu	1.38	13.1	79.0	4.46
Bullaring	1.43	12.4	71.2	11.67
Calingiri	1.27	13.3	77.7	2.3
Carinya	1.36	13.7	76.5	5.16
Carnamah	1.58	13.8	79.3	4.46
Cascades	1.58	13.0	77.0	3.37
Catalina	1.43	13.1	75.8	6.58
Correll	1.40	14.3	71.4	10.73
Datatine	1.37	12.1	71.8	18.00
EGA Bonnie Rock	1.87	13.0	80.1	4.09
EGA Gregory	1.28	13.4	75.2	7.43
EGA Stampede	1.52	12.0	77.2	7.25

EGA Wentworth	1.37	13.3	75.7	8.54
EGA Wills	1.25	13.4	75.6	3.83
GBA Sapphire	1.27	13.8	79.1	6.71
Gladius	1.62	13.2	76.1	4.45
Guardian	1.52	12.6	79.4	8.77
Kennedy	1.40	14.1	74.7	3.68
LRPB Crusader	1.38	13.9	80.5	2.19
LRPB Dakota	1.26	14.5	68.6	11.07
LRPB Hornet	1.16	14.6	69.5	21.56
LRPB Lincoln	1.46	13.6	76.9	4.04
Magenta	1.41	14.2	78.3	5.90
Sentinel	1.31	13.8	72.3	9.58
Tammarin Rock	1.48	13.0	73.6	6.89
Westonia	1.60	13.0	74.3	3.79
Wyalkatchem	1.51	13.1	80.0	1.71
Yandanooka	1.41	13.7	80.1	2.06
Yitpi	1.34	14.1	72.4	5.64
Young	1.74	12.4	78.9	6.47

COMMENTS

Peter Burgess from Kalyx Agriculture will be presenting NVT results at the Liebe Group Crop Updates, 19th of February, 2008.

CONTACT

For further information please refer to www.nvtonline.com.au

UDON NOODLE WHEAT VARIETY TRIAL, EAST DALWALLINU

Jenny Garlinge, CVT Project Manager, Department of Agriculture & Food

AIM

Evaluation of new and existing Udon Noodle wheat varieties.

BACKGROUND

Crop variety testing is the end evaluation of breeder lines prior to release. The crop variety program leads into the National Variety Testing program.

TRIAL DETAILS

Property	Steve & Lee Anne Carter, Xantippe
Plot size & replication	20m x 1.51m x 3 replications
Soil type	Red sandy loam
Sowing date	12/6/07
Seeding rate	50 kg/ha
Fertiliser (kg/ha)	12/6/07: 80 kg/ha Agras No. 1
Paddock rotation	2003 = Barley, 2004 = Wheat, 2005 = Field Pea, 2006 = Fallow
Herbicides	9/6/07: 1.2 L/ha Glyphosate 12/6/07: 2 L/ha Sprayseed 12/6/07: 1.6 L/ha Trilogy
Growing Season Rainfall	113mm

RESULTS

Table 1: Yield and yield as percentage of control of Udon Noodle wheat varieties at east Dalwallinu.

Variety	Yield (kg/ha)	% of Control (Calingiri)
Reeves	278	117
WAWHT2856	264	111
Kulin	262	110
Kennedy	253	107
Brookton	252	106
Arrino	249	105
Calingiri	237	100
Cadoux	226	95
Wyalkatchm	219	92
Yandanooka	208	88
Binnu	205	86
Nyabing	196	83
* = significant (p=0.05).		
Mean	271	
Av. SED	37	
CV	16.7	

COMMENTS

Pre Sowing: Dry seeded some breakout occurring.
Early Season: Very dry.
Mid Season: Very dry.
Pre Harvest: Dry and hot resulted in head tipping in most of the varieties.

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WHEAT GROWN ON ACID SOIL

Jenny Garlinge, CVT Project Manager, Department of Agriculture & Food

Department of Agriculture and Food

AIM

Evaluation of the ability of wheat varieties to tolerate acid/aluminum

BACKGROUND

Crop variety testing is the end evaluation of breeder lines prior to release. The crop variety program leads into the National Variety Testing program.

TRIAL DETAILS

Property	Dale Goodwin, Xantippe
Plot size & replication	20m x 1.51m x 3 replications
Soil type	Sandy loam
Sowing date	11/6/07
Seeding rate	50 kg/ha
Fertiliser (kg/ha)	11/6/07: 80 kg/ha Agras No. 1
Paddock rotation	2003 = Pasture, 2004 = Pasture, 2005 = Triticale, 2006 = Pasture
Herbicides	14/5/07: 1.2 L/ha Glyphosate 11/6/07: 2 L/ha Sprayseed + 1.6 L/ha Trilogy
Growing Season Rainfall	113mm

RESULTS

Table 1: Yield and yield as percentage of control of wheat varieties at east Dalwallinu.

Variety	Yield (Kg/ha)	% of Control (Wyalkatchem)
Gladius	364	166*
WAWHT2750	353	161*
Arrino	346	158*
Westonia	344	157*
Magenta	331	151*
EGA Bonnie Rock	329	150*
Yitpi	323	147*
TammarinRk	319	145*
WAWHT2856	310	141*
WAWHT2730	304	138*
Spear	293	133*
Calingiri	276	126*
Correll	276	126*
Cascades	265	121*
Yandanooka	249	113
BT-Schmbrk	248	113
Wyalkatchem	220	100
GBA Sapphire	208	95
Schomburgk	183	83*
* = significant (p=0.05).		
Mean	295	
CV	8.3	

COMMENTS

Pre Sowing: Dry seeded some moisture delow seeding depth.
Early Season & Pre Harvest: Dry and hot days caused tipping.

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BARLEY TOLERANCE TO ACID/ALUMINIUM

Jenny Garlinge, CVT Project Manager, Department of Agriculture & Food

Department of Agriculture and Food

AIM

Evaluation of the ability of barley varieties to tolerate acid/aluminum soils.

BACKGROUND

Crop variety testing is the end evaluation of breeder lines prior to release. The crop variety program leads into the National Variety Testing program.

TRIAL DETAILS

Property	Dale Goodwin, Xantippe
Plot size & replication	20m x 1.51m x 3 replications
Soil type	Sandy loam
Sowing date	11/6/07
Seeding rate	75 kg/ha
Fertiliser (kg/ha)	11/6/07: 20 kg/ha Agras No. 1
Paddock rotation	2003 = Pasture, 2004 = Pasture, 2005 = Triticale, 2006 = Pasture
Herbicides	14/5/07: 1.2 L/ha Glyphosate 11/6/07: 2 L/ha Sprayseed 11/6/07: 1.6 L/ha Trilogy
Growing Season Rainfall	113mm

RESULTS

Table 1: Yield and yield as a percentage of control of barley varieties at east Dalwallinu.

Variety	Yield (kg/ha)	% of Control (Stirling)
Hindmarsh	204	149*
Lockyer	189	138*
Hamelin	168	123
Hannan	167	122
Baudin	152	111
WABAR2315	147	107
Stirling	137	100
Roe	129	94
Stirling	112	82
Gairdner	101	74
Vlamingh	83	4.0
WABAR2312	70	4.0
* = significant (p=0.05).		
Mean	222	
Av. SED	37	
CV	20.2	

COMMENTS

Pre Sowing: Dry seeded some moisture below seeding depth.
Early Season: Dry struggled.
Mid Season: Dry.
Pre Harvest: Dry and hot days caused tipping.

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AH/APW WHEAT VARIETY TRIAL - WATHEROO

Jenny Garlinge, CVT Project Manager, Department of Agriculture & Food

Department of Agriculture and Food

AIM

Evaluation of new and existing wheat varieties classified as AH or APW.

BACKGROUND

Crop variety testing is the end evaluation of breeder lines prior to release. The crop variety program leads into the National Variety Testing program.

TRIAL DETAILS

Property	Brian Stacy, Watheroo
Soil type	Loamy duplex
Sowing date	26/6/07
Seeding rate	75 kg/ha
Fertiliser (kg/ha)	26/6/07: 80 kg/ha Agstar Extra
Paddock rotation	2003 = Lupins, 2004 = Wheat, 2005 = Wheat, 2006 = Lupins
Herbicides	26/6/07: 1.5 L/ha Treflan 26/6/07: 1.5 L/ha Sprayseed 31/7/07: 1.5 L/ha Hoegrass 31/7/07: 0.6 L/ha Jaguar 31/7/07: 5 g/ha Ally 31/7/07: 150 mL/ha Lontrel L 4/9/07: 10 g/ha Logran

RESULTS

Table 1: Yield and yield as a percentage of control of wheat varieties at Watheroo.

Variety	Yield (kg/ha)	% of Control (Wyalkatchem)
WAWHT2838	1886	110*
Reeves	1836	107*
WAWHT2981	1836	107*
WAWHT2971	1833	107*
WAWHT2960	1824	106*
Westonia	1807	105*
WAWHT2975	1794	104
WAWHT2976	1789	104
WAWHT2952	1784	104
EGA Bonnie Rock	1779	104
Correll	1778	103
Tammarin Rock	1777	103
WAWHT2974	1769	103
WAWHT3017	1764	103
WAWHT2977	1761	102
WAWHT2836	1747	102
WAWHT2973	1737	101
Wyalkatchem	1719	100
Carnamah	1682	98
WAWHT2972	1681	98
WAWHT3018	1669	97
Yitpi	1665	97
WAWHT2979	1658	96
WAWHT3016	1658	96
Spear	1652	96
WAWHT2886	1639	95*
WAWHT2980	1626	95*
EGA Blanco	1624	94*
WAWHT3026	1625	95*

Kennedy	1620	94*
WAWHT2885	1618	94*
WAWHT3019	1613	94*
Brookton	1582	92*
WAWHT2750	1572	91*
Cadoux	1567	91*
WAWHT2982	1564	91*
WAWHT2978	1560	91*
Magenta	1540	90*
Cascades	1536	89*
WAWHT2793	1530	89*
Nyabing	1489	87*
WAWHT3013	1445	84*
* = Significant (P=0.05)		
Wheat Mean Wheat Ave SED Wheat CV.	1682 86 4.1	

COMMENTS

NOTE: Wimmera Rye Grass. Score 6 (Early season (01 JUN)). 1 (Mid season (17 SEP)).
NOTE: DROUGHT Score 5 (Mid season (17 SEP)).
NOTE: Radish. Score 6 (Early season (01 JUN)). 1 (Mid season (17 SEP)). 2 (Pre harvest (01 NOV)).

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UDON NOODLE WHEAT VARIETY TRIAL - WATHEROO

Jenny Garlinge, CVT Project Manager, Department of Agriculture & Food

AIM

Evaluation of new and existing Udon Noodle wheat varieties.

BACKGROUND

Crop variety testing is the end evaluation of breeder lines prior to release. The crop variety program leads into the National Variety Testing program.

TRIAL DETAILS

Property	Brian Stacy, Watheroo
Soil type	Loamy duplex
Sowing date	26/6/07
Seeding rate	75 kg/ha
Fertiliser (kg/ha)	26/6/07: 80 kg/ha Agstar Extra
Paddock rotation	2003 = Lupins, 2004 = Wheat, 2005 = Wheat, 2006 = Lupins
Herbicides	26/6/07: 1.5 L/ha Treflan 26/6/07: 1.5 L/ha Sprayseed 31/7/07: 1.5 L/ha Hoegrass 31/7/07: 0.6 L/ha Jaguar 31/7/07: 5 g/ha Ally 31/7/07: 150 mL/ha Lontrel L 4/9/07: 10 g/ha Logran

RESULTS

Table 1: Yield and yield as a percentage of control of Udon Noodle wheat varieties at Watheroo.

Variety	Yield (kg/ha)	% of Control (Calingiri)
WAWHT3006	1702	110*
WAWHT3124	1693	110*
WAWHT3127	1673	108*
Kulin	1662	108*
WAWHT2944	1633	106*
Reeves	1604	104
Wyalkatchem	1597	103
WAWHT3128	1578	102
WAWHT2939	1567	101
WAWHT3126	1553	101
Calingiri	1544	100
Binnu	1542	100
Arrino	1525	99
Kennedy	1493	97
WAWHT3098	1489	96
Brookton	1484	96
WAWHT2770B	1480	96
Cadoux	1477	96
WAWHT2945	1475	96
WAWHT2770A	1460	95
WAWHT2856	1458	94*
Nyabing	1449	94*
Yandanooka	1427	92*
WAWHT3125	1309	85*
* = Significant (P=0.05)		
Wheat Mean Wheat Ave SED Wheat CV.	1534 59 4.7	

COMMENTS

NOTE: Wimmera Rye Grass & Radish. Score 3 (Early season (01 JUN)). 1 (Mid season (17 SEP)). 2 (Pre harvest (01 NOV)).
NOTE: DROUGHT Score 5 (Mid season (17 SEP)).

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PRACTICE FOR PROFIT

Peter Rees, Research Agronomist, Kalyx Agriculture

AIM

This trial was designed to investigate the crop growth, yield and gross margin response of a number of wheat varieties commonly grown in the district to changes in management input strategy.

BACKGROUND

This trial was designed to investigate the response of four commonly grown wheat varieties (Arrino, Wyalkatchem, Calingiri and Bonnie Rock) to increasing seeding rate, fertiliser, disease management and weed management strategies. Low, District, High and Active Management strategies that ranged in cost from $68-$242 /ha were applied to each variety. Crop growth, disease infection, yield and gross margin were measured. Management practices are explained below.

- **Low** input treatments are based on a farmer delivering grain to the bin at the lowest possible cost, regardless of seasonal conditions ($68.35 /ha).
- **District** average inputs are based on what is considered common grower practice in the Liebe Group area ($113.17 /ha).
- **High** input treatments simulate a paddock with high yield potential matched with increased management inputs to maximize yields and profitability ($242.32 /ha).
- **Active** treatments are dependent on seasonal conditions and are determined by the Liebe R&D Committee ($107.45 /ha).

This trial is intended to run over 10 seasons, with this being the seventh year.

TRIAL DETAILS

Property	Steve & Lee Anne Carter, Xantippe
Plot size & replication	12m x 10m x 3 replications
Soil type	Sandy loam
Sowing date	3/6/07
Seeding rate	50-80 kg/ha as per protocol
Fertiliser (kg/ha)	As per protocol
Paddock rotation	2003 = Pasture, 2004 = Wheat, 2005 = Wheat, 2006 = Pasture
Herbicides	As per protocol
Growing Season Rainfall	113mm

RESULTS

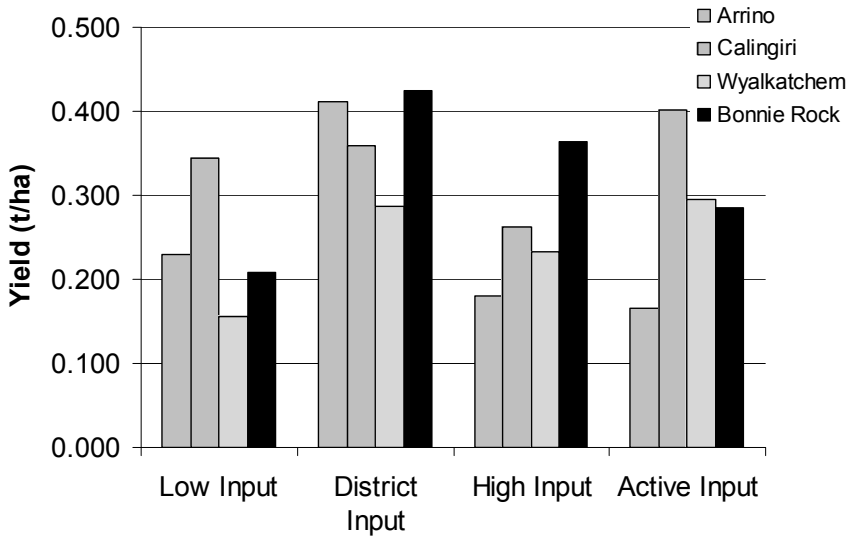

Figure 1: Yield (t/ha) for each variety relative to Management Strategy.

Table 2: Results and Analysis of Variance for Yield (t/ha), Grain Quality and Gross Margin ($/ha).

Treatment		Yield t/ha	Protein %	Specific Wt kg/hL	Screenings %	Gross Margin $/ha
1	LOW Arrino	0.23	15.5	79.0	1.1 c	21.55 a
2	LOW Calingiri	0.34	13.9	80.1	1.3 bc	68.45 a
3	LOW Wyalkatchem	0.16	14.9	80.0	0.9 c	-7.31 abc
4	LOW Bonnie Rock	0.21	14.8	65.1	2.5 a	12.64 a
5	DISTRICT Arrino	0.41	15.1	79.9	1.3 bc	48.63 a
6	DISTRICT Calingiri	0.36	15.1	77.6	1.9 ab	26.11 a
7	DISTRICT Wyalkatchem	0.29	14.6	78.0	1.1 c	-1.84 ab
8	DISTRICT Bonnie Rock	0.42	14.5	79.2	2.5 a	51.53 a
9	HIGH Arrino	0.18	15.5	79.2	1.4 bc	-131.13 d
10	HIGH Calingiri	0.26	15.5	79.3	1.2 c	-139.76 d
11	HIGH Wyalkatchem	0.23	15.7	78.8	1.3 bc	-151.85 d
12	HIGH Bonnie Rock	0.36	15.3	78.3	2.2 a	-100.43 cd
13	ACTIVE Arrino	0.17	15.5	79.0	0.9 c	-177.52 d
14	ACTIVE Calingiri	0.40	14.9	79.4	1.4 bc	-85.42 bcd
15	ACTIVE Wyalkatchem	0.30	14.9	79.5	1.0 c	-127.21 d
16	ACTIVE Bonnie Rock	0.28	14.9	79.9	2.3 a	-131.05 d
LSD (P=.05)		**NSD**	**NSD**	**NSD**	**0.76**	**95.52**
CV		**45.95**	**3.9**	**6.92**	**29.93**	**0**
Replicate F		**5.162**	**1.093**	**0.892**	**0.838**	**4.647**
Replicate Prob(F)		**0.0121**	**0.3485**	**0.4212**	**0.443**	**0.0178**
Treatment F		**1.347**	**1.901**	**1.302**	**4.678**	**6.76**
Treatment Prob(F)		**0.2381**	**0.0672**	**0.2645**	**0.0002**	**0.0001**

Means followed by the same letter so not significantly differ (P=0.05, LSD).

COMMENTS

This trial was severely limited by dry conditions, with yields ranging from 0.16 to 0.42 t/ha, with no significant differences between any variety or management input level.

Highest gross margins were associated with lowest expenditure (as would be expected in a very dry year), and there was no significant difference between any of the low or district management practices for any variety grown. Additional spending on the High or Active treatments simply lead to higher losses, as in a year with only 113 mm growing season rainfall, crops were unable to benefit from additional inputs.

ACKNOWLEDGEMENTS

- Liebe Group
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- Farmanco

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CROPPING GROSS MARGINS

David Scholz, Merchandise Manager, Elders Dalwallinu

AIM

This trial aims to compare the returns of barley, canola, wheat and triticale.

BACKGROUND

Barley and canola have long been touted as medium-high rainfall crops. However, with excellent prices and better varieties available through breeding directed towards lower rainfall environments in recent years, more growers are making the switch toward barley and canola as part of their rotation and chasing higher gross margins.

TRIAL DETAILS

Property	Steve & Lee Anne Carter, Xantippe
Plot size & replication	20m x 1.8m x 4 replications
Soil type	Sandy loam
Sowing date	6/6/07
Seeding rate	100 kg/ha Wheat, Barley, Triticale; 5 kg/ha Canola
Varieties	Mundah & Vlamingh Barley ;Wyalkatchem & Binnu Wheat ; Speedee & Tahara Triticale; Tanami & Bravo Canola
Fertiliser (kg/ha)	6/6/07: 80 kg/ha Agstar Extra (Banded) + 20 kg/ha Urea (Banded) 6/6/07: 4 L/t Activist Zn (On seed, except Canola); 20 L/t Activist Zn (Canola only)
Paddock rotation	2003 = Pasture, 2004 = Wheat, 2005 = Wheat, 2006 = Pasture
Herbicides	6/6/07: 2 L/ha Sprayseed + 2 L/ha Trifluralin + 400 mL/ha Chlorpyrifos 14/7/07: 2 L/ha Atrazine + 250 mL/ha Select + 1% Hasten (Canola) 26/7/07: 600 mL/ha Tigrex (Cereals) 30/8/07: 20 mL/ha Scud (Canola)
Insecticides/Fungicides	6/6/07: 1 L/ha Baytan (Cereals), 400 mL/ha Intake (all)
Growing Season Rainfall	113mm

RESULTS & COMMENTS

On the 14th July, 39 days after sowing, canola plants were 2 leaf and small in relation to the expected season length at this site. Barley plots were also looking healthy, but again were small due to delayed germination from low rainfall after seeding. Moisture stress was evident at the site when visited on the 15th, 20th and 30th August. This trial was not harvested due to the very low yield potential in all plots. This trial was sown 4 days after a small rainfall event but the soil had already begun to dry out and the seed bed was dry at seeding. A cloddy seed bed and moisture loss from soil disturbance meant germination was slow. However, a neighbouring wheat trial ("Practice for Profit") sown just prior to this rainfall, and with a different knife point, did produce heads and fill grains sufficient to warrant harvest. This has again demonstrated the value of sowing time in relation to rainfall in low yielding/low rainfall seasons and also the importance of knife point design.

CONCLUSIONS

This trial was drought stressed, however barley and canola do look attractive with the right choice of variety in a more typical season.

ACKNOWLEDGEMENTS

Steve Carter for provision of site.

PAPER REVIEWED BY: PETER CARLTON.

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DUAL PURPOSE CEREALS

Janette Drew, Development Officer, Department of Agriculture & Food

Department of Agriculture and Food

AIM

To measure the productivity and recovery of cereals under simulated grazing regimes.
To determine the number of times cereals can be grazed without affecting yield.

BACKGROUND

The autumn/winter feed gap is a common problem in mixed farming systems (Anon 2005). Dry matter is generally limited after the break of season when plants regenerate after a dry summer through to winter when cold temperatures restrict growth. Supplementary feeding is often required to make up for this period of low production (Anon 2005). Overgrazing of annual pastures in autumn can lead to significant reduction in pasture seedling density, especially within the first 12 days after the break of the season. As a result the productivity of pastures during winter will be lower because there are fewer plants (Devenish and Hyder 2001).
Dual purpose cereals such as wheat and oats are currently being used by farmers in the eastern states to fill the autumn and winter feed gap. Dual purpose cereals are more versatile than sown pasture varieties as they provide a source of winter feed, can be conserved as fodder and provide economic return from harvested grain. Winter wheats can be grazed between tillering and stem elongation without adversely affecting yield (Sharma et al 2005). Commercially produced varieties have the potential to better fit the lower rainfall areas in Western Australia in a dual purpose capacity as the longer growing season of winter wheats are not as suited to the lower rainfall areas of Western Australia. Grazing cereals research in the past 3 years has indicated that dual purpose cereals may have a place in the Northern Agricultural Region (NAR) farming system but more research into this is required.

This trial was carried out at four sites in the Northern Agricultural Region, Dalwallinu, Badgingarra, Mingenew and Binnu. This article includes results from the Dalwallinu and Badgingarra sites which were sites that experienced vastly different seasons.

TRIAL DETAILS

Property	Steve & Lee Anne Carter, Xantippe	Badgingarra Research Station
Plot size & replication	8m x 1.54m x 3 replications	8m x 1.54m x 3 replications
Soil type	Sandy Loam	Sandy Loam
Sowing date	13/6/07	4/5/07
Fertiliser (kg/ha)	13/6/07: 80 kg/ha Agras No. 1	4/5/07: 100 kg/ha Agstar extra 4/5/07: 80 kg/ha Urea 7/6/07: 90 kg/ha Urea
Paddock rotation	2006 = Wheat, 2005 = Volunteer Pasture, 2004 = Volunteer Pasture	
Herbicides	9/6/07: 2 L/ha Glyphosate 12/6/07: 500 mL/ha Diuron 12/6/07: 2 L/ha Sprayseed 11/8/07: 1 L/ha Broadside	4/5/07: 1 L/ha Sprayseed 23/5/07: 0.001 L/ha Wetter 23/5/07: 20 g/ha Glean 26/6/07: 500 mL/ha Jaguar
Insecticides	17/8/07: 125 mL/ha Dominex	4/5/07: 100 mL/ha Fastac Duo 2/10/07: 200 mL Fastac Duo
Growing Season Rainfall	113.5mm	399.2mm

RESULTS

Table 1: Dry matter production (kg DM/ha) and date of grazing from east Dalwallinu and Badgingarra in 2007.

	1 graze		2 grazes		3 grazes
Variety Date of Grazing	**Dalwallinu 31/7/07**	**Badgingarra 3/7/07**	**Dalwallinu 28/8/07**	**Badgingarra 30/7/07**	**Dalwallinu 18/9/07**
Ryegrass/cadiz	78	792	397	1554	341
Volunteer Pasture	459	2505	304	1856	526
Calingiri Wheat	407	850	741	1202	588
Baroota Wonder Wheat	442	732	1201	1856	794
Eagle Rock Wheat	456	615	913	1609	636
Carrolup Oats	518	975	1044	1574	770
Monstress Triticale	521	938	1065	1422	732
Taipan Oats	545	1120	1016	2110	562
Saia Black Oats	548	1059	953	1688	719
Cereal rye	572	910	998	1689	666
Wyalkatchem Wheat	577	724	828	1939	601
Pallinup Oats	584	1529	1168	1284	764
Barque Barley	599	1333	929	1673	925
Speedy Triticale	672	1537	1039	1165	470

Table 2: Final grain yield (t/ha) for number of grazings treatments at Badgingarra.

Variety	Ungrazed	1 graze	2 graze
Calingiri Wheat	2.59	2.4	1.95
Baroota Wonder Wheat	1.46	1.46	1.19
Eagle RockWheat	2.14	2.34	1.9
Carrolup Oats	2.50	2.84	2.31
Monstress Triticale	3.74	3.53	2.86
Taipan Oats	1.36	1.75	1.42
Saia Black Oats	1.52	1.63	1.33
Cereal Rye	3.49	3.05	2.48
Wyalkatchem Wheat	1.19	2.24	1.82
Pallinup Oats	2.39	2.87	2.33
Barque Barley	3.05	3.15	2.55
Speedee Triticale	2.06	2.47	2.00

COMMENTS

The dry matter production results from both the Dalwallinu and Badgingarra sites show that Speedee triticale shows better early vigour than the other varieties, with the exception of the volunteer pasture at Badgingarra. The volunteer pasture at Badgingarra was composed mostly of radish which was very quick to respond to rain at the beginning of the season. The wheat varieties show that they had produced less biomass by the time of the first graze than the barley, oat and triticale varieties. The dargo ryegrass and cadiz serradella mix did not perform very well at either site. This could have been the result of the late break to the season.

The grain yields at Badgingarra show that a simulated graze early on in the season did not significantly affect the yield, with the yields for the ungrazed plots very similar to the plots that were grazed once. The yields for most of the varieties that were grazed twice were reduced. The height of the twice grazed plots was also affected with the grazed plots being shorter than the ungrazed. The effect wasn't as noticeable on plots that were only grazed once. Simulated grazing was carried out using a conventional lawnmower, with the blades set 5cm from the ground.

Grain yields at the east Dalwallinu site were extremely low and many plots were not harvested. This site was severely affected by drought.

CONCLUSIONS

- Grazing once early in the season did not affect grain yield.
- Grain yields were reduced when varieties were grazed late in the season.
- Oats and barley showed better early vigour than the wheat varieties.

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WHEAT TRAITS FOR WATER LIMITED ENVIRONMENTS

Steve Milroy, Greg Rebetzke and Allan Rattey, CSIRO Plant Industry

AIM

To assess the relative value of different traits that have been suggested as providing an advantage for wheat production in water limited situations.

This is a national project and aims to cover a range of likely environments where water stress may be a common limitation.

BACKGROUND

There are a number of traits that have been proposed as providing an advantage for wheat production in water limited situations. The value of these traits will vary between locations and hence the sort of stress the crop is likely to experience. For example, in the Western Australian wheatbelt, in-season rainfall can often match or exceed plant water needs up to about anthesis, with the crop experiencing abrupt terminal drought. In south-east Australia, the terminal drought is less abrupt as the rainfall declines more gradually. In the northern cropping region of eastern Australia, where rainfall is summer dominant, crops are predominantly grown on stored soil moisture on heavy soils. The impact of the traits may also differ depending on the genetic background in which they are used. The relative merits of these traits have not been compared in the field under the range of drought conditions likely to be experienced.

Scientist from three CSIRO groups (Canberra, Brisbane and Perth), are running a set of field trials to compare a number of these traits in the three main production regions. The traits being assessed are: restricted tillering potential, early vigour, canopy temperature, water-soluble carbohydrate storage and transpiration efficiency. We want to determine which of these traits are likely to have a real benefit in the different production environments.

The basis for the selection of these traits is given below.
Restricted tillering potential: may allow better use of dry matter for grain filling, may have a greater dry matter allocation to roots.
Early vigour: may allow growth to be maximised while water supply is better.
Canopy temperature: Cool canopies during the onset of terminal drought means the crop is still transpiring. This may imply either that water has been conserved or that the crop is better able to access water in the soil.
Water soluble carbohydrate storage: Wheat uses sugars stored in the stem around anthesis to fill grain if concurrent photosynthesis is unable to meet the demand.
Transpiration efficiency: a high transpiration efficiency means the leaves fix more carbon from the atmosphere for each molecule of water used.

We are also testing some lines from CIMMYT which appear to perform particularly well under water limited conditions in the southern Queensland.

TRIAL DETAILS

Five trials were established in 2007: two in New South Wales and one each in South Australia, Queensland and Western Australia. The WA trial site was at the Liebe long-term trial site on Stuart and Leanne McAlpine's property.

For each trial, a sub-set of lines was selected from an overall set compiled prior to starting the experiments. The main comparison in each case is the performance of lines with high versus low

expression of the trait of interest, but a common set of controls was also used across all the sites. These include released varieties that have been developed for use in water limited situations.

COMMENTS

Results from 2007 are currently being compiled from around the country, when available they will be published in the Liebe Group Newsletter. The design of the 2008 trials will be based on the outcome of these analyses. A sandplain site will again be used.

Average yields for each site varied widely between the locations: from 0.8 to 4 t/ha. This should allow a good exploration of the value of the traits.

PAPER REVIEWED BY: DR JENS BERGER.

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ANGUSTIFOLIUS LUPIN VARIETY TRIAL

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Department of Agriculture and Food

AIM

Evaluation of new and existing Angustifolius lupin varieties.

BACKGROUND

Crop variety testing is the end evaluation of breeder lines prior to release. The crop variety program leads into the National Variety Testing program.

TRIAL DETAILS

Property	Steve and Lee Anne Carter, Xantippe
Plot size & replication	20m x 1.51m x 3 replications
Soil type	Sandy loam
Sowing date	24/5/07
Seeding rate	90 kg/ha
Fertiliser (kg/ha)	24/5/07: 80 kg/ha Big Phos
Paddock rotation	2003 = Pasture, 2004 = Pasture, 2005 = Pasture, 2006 = Wheat
Herbicides	24/5/07: 2 L/ha Sprayseed 24/5/07: 1.1 kg/ha Gesatop
Insecticides:	24/5/07: 100 mL/ha Talstar
Growing Season Rainfall	113mm

RESULTS

Table 1: Yield and yield as a percentage of control of lupin varieties sown at East Dalwallinu.

Variety	Yield (kg/ha)	% of Control (Tanjil)
Jenabillup	213	168*
Mandelup	187	148*
Quilinock	184	145*
Belara	170	134*
Coromup	155	122
Tanjil	127	100
Danja	120	95
* = significant (p=0.05).		
Mean	181	
Av. SED	21	
CV	14	

COMMENTS

Pre Sowing: Dry seeded.
Early Season: 1st section sand blasted.
Mid Season: Dry very short.
Pre Harvest: Some aborting of flowers due to hot conditions.

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THE EFFECTS OF SOWING TIME AND RADISH DENSITY ON LUPIN YIELD

Martin Harries, Grain Legume Agronomist, Department of Agriculture Food

Department of Agriculture and Food

AIM

The aim was to assess the impacts of delayed sowing and radish infestation on lupin yield. By doing this we can better understand the extra weed control required to make delayed sowing profitable.

BACKGROUND

Lupins were sown at two times, May 22 and June 25. Radish was seeded at different rates with the lupins. This resulted in a range of densities of radish plants which competed with the lupins. The effects of the delay in sowing and the competition with radish were monitored.

TRIAL DETAILS

Property	Wongan Hills Research Station
Plot size & replication	18m x 1.75m x 6 replications
Soil type	Yellow sandy over gravel
Sowing dates	TOS1: 22/5/07; TOS2: 25/6/07
Seeding rate	100 kg/ha Mandelup lupins
Fertiliser (kg/ha)	80 kg/ha Big Phos, deep banded at seeding
Herbicides & Insecticides	Knockdown immediately before each sowing. At seeding: 100 mL/ ha Talstar®. At 6 leaf crop stage 250 mL/ha Select®.
Growing Season Rainfall	241mm

RESULTS

Establishment

Lupin establishment averaged 49 plants per square metre. Lupin plant density declined as radish densities increased due to competition from radish plants. Radish populations followed the expected trend and density ranged from 0 to 8 plants per square metre.

Biomass

When sampled on September 20 the denser radish populations had suppressed lupin growth.

Protein

Grain protein was lower in lupins sown on May 22 compared to those sown on June 25; 33.7 per cent and 35.0 per cent respectively. Radish density affected protein content of the lupin grain. Lupins grown in plots with high numbers of radish had the highest grain protein content. This response was more dramatic for plants sown later; on June 25 rather than those sown on May 22.

Yield

Average yield from sowing on May 22 was 1481 kg/ha. This compared to an average yield of 830 kg/ha when sown on June 25. Hence delaying sowing cost 651 kg/ha or 19 kg/ha/day.

Average yield from the control without radish infestation was 1392 kg/ha. This compared to an average yield of 926 kg/ha at the highest radish populations; a loss of 466 kg/ha.

The response of lupin yield to radish infestation fitted a linear decline for each time of sowing (Figure 1). When the lupins were sown on May 22 each radish plant per square metre reduced yield by 79 kg/ha. When the lupins were sown on June 25 each radish plant per square metre reduced yield by 71 kg/ha.

Yield loss caused by one radish plant per square metre was between 70 and 80 kg/ha regardless of sowing time. Considering that yield loss per day was approximately 19 kg/ha the yield loss caused by one radish per square metre was equivalent to the loss from delaying sowing by three or four days.

Table 1: Effect of time of sowing and radish infestation on lupin grain yield (kg/ha).

	Target radish density (plants/m^2)					
Time of sowing	**0**	**3**	**6**	**12**	**24**	**Av. TOS**
22 May	1617	1635	1467	1401	1287	1481
25 Jun	1166	998	788	631	565	830
Av. radish density	1392	1317	1127	1016	926	
TOS lsd (5%)						**88.6
Radish density lsd (5%)						**89.1
Interaction lsd (5%)						*133.1

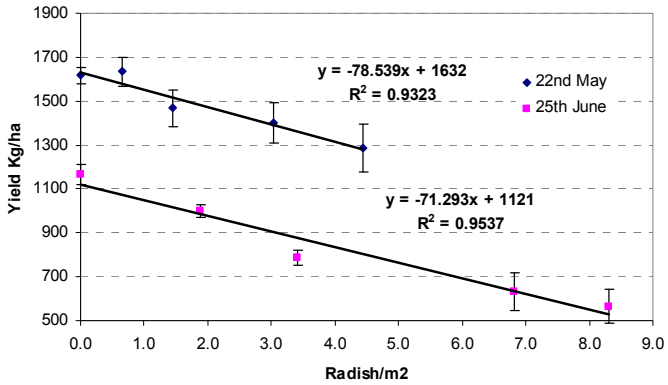

Figure 1: Lupin yield decline caused by radish infestation when lupins were sown on May 22 and June 25.

COMMENTS

The practice of dry sowing was promoted heavily in the 1980's and early 1990's. Many growers are reluctant to delay sowing, particularly in lower rainfall areas, because of the yield losses that are incurred. Consequently there is still a large proportion of the states lupin crop that is dry sown. Under a dry sowing regime selective herbicides are relied on to control almost all the weeds. Weeds, particularly ryegrass and radish, are developing resistances to many selective herbicides and are becoming increasingly difficult to control. Wet sowing or delayed sowing ensures the first germination of weeds is effectively controlled by mechanical tillage and non-selective herbicides.

CONCLUSIONS

- Lupin yield loss caused by delaying sowing by 3 or 4 days is similar to the yield loss caused by 1 radish plant per square metre growing within the crop.

- As more populations of wild radish develop resistances to common herbicides it becomes critical to obtain effective weed control before and at seeding.

ACKNOWLEDGEMENTS

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INTERACTION OF TIME OF SOWING AND WEED MANAGEMENT ON LUPIN YIELD

Martin Harries, Grain Legume Agronomist & Jo Walker, Technical Officer, Department of Agriculture and Food

Department of Agriculture and Food

AIMS

- To better understand the trade-offs between lupin yield and weed management when lupins are sown using different strategies; dry sowing vs delayed sowing.
- To investigate if shielded spraying can effectively control the large weed populations that often arise after dry sowing.

BACKGROUND

This trial included lupins sown using three strategies; Dry sown vs sowing sown soon after an opening rain, vs delayed sowing so as to control the first flush of weeds prior to sowing.
The lupins were sown in two row spacings, 25cm and 50cm. For each row spacing some plots were left un-weeded as controls and some were sprayed as per normal. An additional treatment of shielded herbicide application was used on some of the 50cm row plots.

Growers need to know the effect of altering time of sowing and sowing tactic (dry sown vs wet sown) on costs in terms of lupin yield and the benefits in terms of weed control. Shielded herbicide application is one method that might be used to enable continued early sowing and effective weed control. A wide range of herbicides can be applied through plastic shields that direct chemical between the rows of the lupin crop. Because non selective herbicides can be used the impact of weeds that have developed resistances to selective herbicides is reduced.

TRIAL DETAILS

Property	Bruce White, Winchester
Treatments	3 times of sowing 2 row spacings; 25cm and 50cm Weed management used : 25cm unsprayed 25cm sprayed as per normal 50cm unsprayed 50cm sprayed as per normal 50cm Shield sprayed with non selective herbicide applied between rows and selective herbicides applied on the row.
Plot size & replication	20m x 2m x 4 replications
Soil type	Gravelly sand
Sowing dates	23/4/07 (Dry), 28/5/07 (Soon after rain), 26/6/07 (Delayed sowing)
Seeding rate	100 kg/ha Mandelup lupin
Fertiliser (kg/ha)	At seeding 100 kg/ha Superphos, deep banded
Paddock rotation	2004 = Lupin, 2005 = Wheat, 2006 = Barley
Herbicides	Immediately before each sowing knockdown and 1.5 L/ha Simazine 10/7/07: Select 250 mL/ha. 18/7/07: Shielded herbicide treatment applied to lupins sown on 23/4/07 and 28/5/07. 100 mL/ha Brodal® & 400 mL/ha Simazine directed onto row. 1.0 L/ha Spray-seed® between rows. 18/7/07: Broadcast herbicide treatment applied to lupins sown on 23/4/07 and 28/5/07. 100 mL/ha Brodal® & 400 mL/ha Simazine. 31/7/07: Shielded herbicide treatment applied to lupins sown on 26/6/07. 100 mL/ha Brodal® & 400 mL/ha Simazine directed onto row. 1.0 L/ha Spray-seed® between rows. 31/7/07: Broadcast herbicide treatment applied to lupins sown on 26/6/07. 100 mL/ha Brodal® & 400 mL/ha Simazine.
Growing Season Rainfall	148mm

RESULTS

Crop establishment averaged 43 plants per square metre. Establishment was better at later sowings, in better soil moisture. Time of sowing 1 averaged 40 plants per square metre and time of sowing 3 averaged 45 plants per square metre. The biomass production of lupin plants sown at the first time of sowing was also reduced compared to the other times of sowing; due to the lower plant density. Unsprayed plots contained on average 30 weeds, shielded sprayed plots 23 weeds and those sprayed with conventional herbicide 11 weeds. Hence in this instance shielded spraying was not as effective at controlling weeds as broadcast herbicide application.

Yields averaged 697 kg/ha. Plots sown at the first time of sowing yielded the most, 747 kg/ha. Plots sown at the last time of sowing yielded the least, 654 kg/ha. Shield sprayed plots yielded poorly compared to conventionally sprayed plots; 589 kg/ha compared to 744 kg/ha. This occurred because lupin plants were damaged by herbicide drift during the shield spraying operation. It is important to note that due to the dry start to the season lupin plants were small when the weeds required spraying. This reduced the safety of shielded spraying compared to what has been achieved in previous years. Where drift damage had not occurred these 50cm plots out-yielded the 25cm plots. When the shield sprayed treatment was not included in the analysis the 50cm plots yielded 806 kg/ha compared to 643 kg/ha for the 25cm spacings. This is consistent with previous research showing that in dry seasons wide row spacings are a good option.

Table 1: Lupin establishment, biomass, grain protein and weeds per plot.

			Establish-ment (p/m2)		**Weeds per plot 26/9**		**Biomass 5/9**		**Biomass 26/9**		**Grain protein (%)**	
Sowing time	Row spacing	Weed management	Av.	SE	Av.	SE	Av.	SE	Av.	SE	Av.	SE
23/4/07	25cm	Nil	36	1	13	2	132	17	142	6	33.5	0.4
	25cm	Broadcast	36	4	11	6	120	32	136	18	33.0	0.3
	50cm	Nil	41	1	34	15	121	20	96	19	34.2	0.5
	50cm	Broadcast	44	3	9	4	115	17	126	22	32.6	0.1
	50cm	Shield spray	42	7	23	9	104	23	102	21	34.8	0.3
28/5/07	25cm	Nil	37	3	40	4	156	13	156	14	34.7	0.4
	25cm	Broadcast	45	2	7	3	112	12	149	20	33.8	0.5
	50cm	Nil	42	5	35	9	104	19	123	14	33.5	0.2
	50cm	Broadcast	46	3	11	5	115	17	143	13	33.1	0.6
	50cm	Shield spray	50	4	29	11	118	11	126	32	34.1	0.3
26/6/07	25cm	Nil	38	1	17	7	92	10	95	3	33.7	0.3
	25cm	Broadcast	42	4	14	7	106	9	111	12	33.9	0.2
	50cm	Nil	50	3	39	18	102	5	125	24	33.6	0.4
	50cm	Broadcast	47	4	17	7	92	23	130	12	33.3	0.2
	50cm	Shield spray	51	5	18	6	107	6	102	10	34.1	0.4
Average			43	3	21	8	113	16	124	16	34	0.3

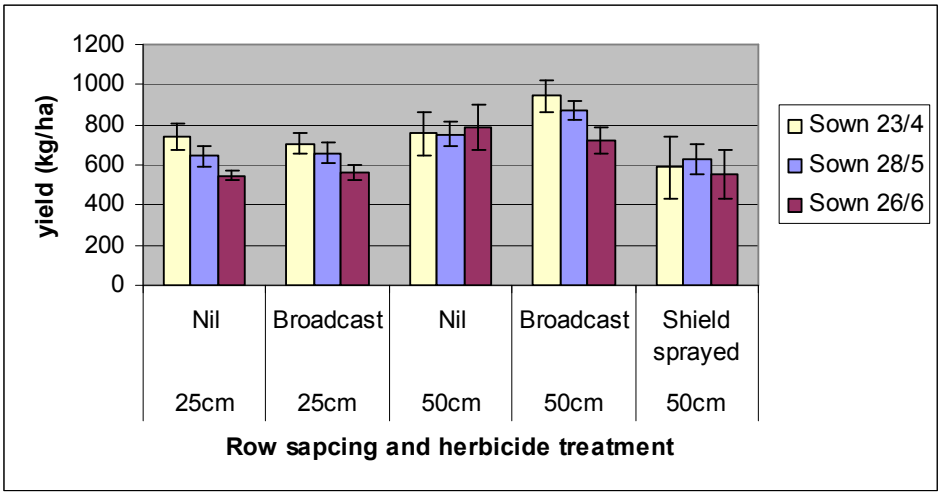

Figure 1: Yield of lupins sown at different times in either 25cm or 50cm row spacings under a range of herbicide treatments.

Table 2: Lupin yields (kg/ha).

		Weed management				
Sowing time	**Row spacing**	**NIL**	**Broadcast**	**Shield sprayed**	**Av. TOS**	**Av. Row spacing**
1	**25**	741	706		747	643
	50	757	943	586		734
2	**25**	642	660		712	
	50	754	872	631		
3	**25**	546	561		634	
	50	786	724	551		
Av. weed management		704	744	589		
Sowing time lsd 5%						142 ns
Row spacing lsd 5%						57 hs
Weed management lsd 5%						69 hs

COMMENTS

Spray-seed® drift during shielded spraying damaged the lupin plants in this trial.
Lupins yielded well when sown in rows 50cm apart.

ACKNOWLEDGEMENTS

Thank you to the Liebe Group for suggesting trial treatments and help with trial management; Bruce White for hosting the trial; the Geraldton Research Support Unit for seeding and harvesting the trial and GRDC for continuing financial support.

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COMPARISON OF LUPIN INOCULANTS

Chris Poole, Technical Manager, ALOSCA Technologies Pty Ltd

ALOSCA Technologies Pty Ltd

AIM

To evaluate new Lupin inoculation initiatives in high background populations of naturalised *Rhizobium* strains in medium–low rainfall cereal/lupin rotation.

BACKGROUND

It has become common practice to rely on the naturalised background strains of root nodule bacteria for the nitrogen fixation needs of lupin cropping in the WA northern agricultural grain belt. A survey conducted throughout the northern agricultural region in 2005 by the Centre for *Rhizobium* Studies (CRS) at Murdoch University collected, isolated and measured the nitrogen fixation efficiency of naturalised strains resulting in elite strains being identified and subsequently field evaluated.

Growth promoting microbes with beneficial attributes other than *Rhizobium* are also being isolated and evaluated by programs within the CRS. These developments coupled with improvements in the convenience and efficacy of new microbe delivery methods combine to have the potential to improve grower returns from lupin/cereal rotations.

TRIAL DETAILS

Property	Steve and Lee Anne Carter, Xantippe
Plot size & replication	18m x 1.54m x 4 replications (plot demesions represent seed yield harvest cut)
Soil type	Sandy loam
Sowing date & details	1/6/07: knife points & press wheels, at depth 2.5 cm, low-adequate moisture.
Seeding rate	100 kg/ha Mandelup narrow leaf lupin
Fertiliser (kg/ha)	1/6/07: 150 kg/ha Single super phosphate (banded at sowing)
Paddock rotation	2003 = Wheat, 2004 = Pasture, 2005 = Pasture, 2006 = Pasture
Herbicides	1/6/07: 2 L/ha Sprayseed 1/6/07: 1 L/ha Chlorpyrifos 1/6/07: 1.1 kg/ha Simazine 24/7/07: 200 mL/ha Brodal
Growing Season Rainfall	113mm

TREATMENT DETAILS

Trt no	Treatment	Treatment detail/objective
1	Nil (no inoculation)	• Primary control plot • Common seeding practice in NAR. • Benchmarks efficacy of background strain in established cereal/lupin rotation
2	ALOSCA NIB only @ 8 kg/ha	• Secondary control assessing efficacy of NIB interaction with background strain only
3	Peat WSM471	• Industry standard peat based treatment • Carrier comparison
4	ALOSCA WSM471 @ 8 kg/ha	• Standard ALOSCA Lupin inoculation treatment • Carrier comparison • Control for NIB treatment 5
5	ALOSCA WSM471 + NIB @ 8 kg/ha	• Standard ALOSCA Lupin inoculation treatment combined with NIB • Benefits measured in 2006 work
6	ALOSCA WSM4024 @ 8 kg/ha	• New strain treatment • Yield & quality responses 10-20% over control measured in low yielding trial in 2006 • Control for NIB treatment 7
7	ALOSCA WSM4024 +NIB @ 8 kg/ha	• New strain & NIB treatment • Yield & quality responses circa 30% over control measured in low yielding trial in 2006

RESULTS

Table 1: Root nodulation scores, winter shoot dry weight, seed percentage total nitrogen and seed yield, expressed as percentage of the Nil (no inoculation) Control. Bold figures represent treatments returning results significantly better than the Nil control taking into account standard error calculation across the replicates.

Trt no.	Treatment	Winter Dry weight 23/07/07	Nod-score 23/07/07 (0-10)	Nod-score 31/08/07 (0-10)	Seed % total Nitrogen	Seed Yield (t/ha)
1	Nil (Mandelup) control	100%	100%	100%	100%	100%
2	ALOSCA NIB only	**124%**	98%	92%	99%	118%
3	Peat WSM471	**121%**	89%	97%	103%	108%
4	ALOSCA WSM471	104%	96%	99%	105%	128%
5	ALOSCA WSM471 + NIB	**124%**	106%	101%	94%	103%
6	ALOSCA WSM4024	**124%**	97%	95%	**110%**	78%
7	ALOSCA WSM4024 + NIB	**121%**	81%	84%	102%	114%

The results reveal few instances whereby the applied treatments significantly out performed the Nil control (treatment 1). Given this, the applied treatments did generally trend positively over the Nil control and suggest inoculation may return a yield (Figure 1) and seed quality (Figure 2) benefit under the low growing season rainfall conditions. Nodulation scoring (23/7 & 31/8) was compromised by staggered plant germination and made representative root sampling difficult. The considerable error bars with the seed yield data (Figure 1) reflect the variance across the treatment replicates which was amplified by the yield limiting conditions.

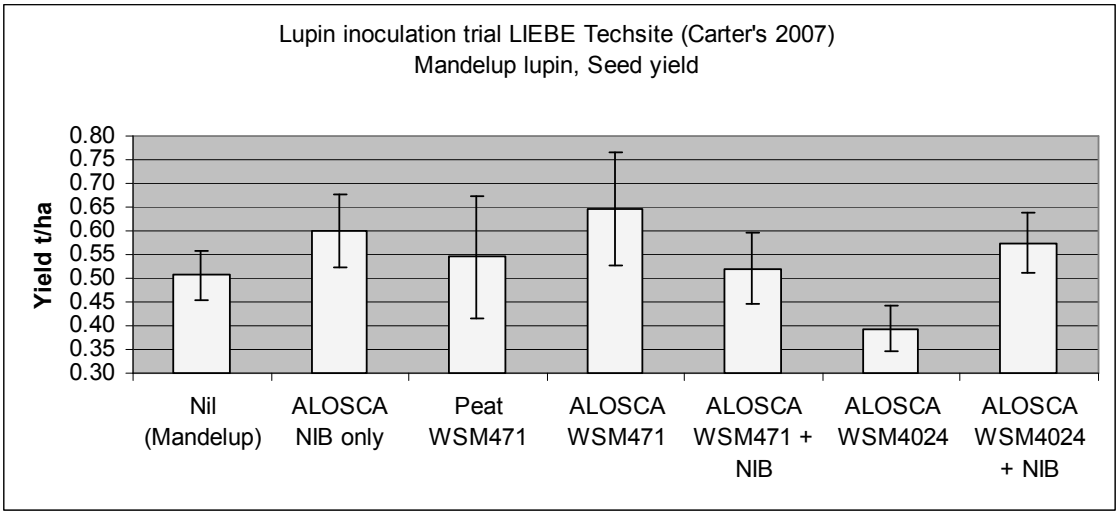

Figure 1: Mandelup Lupin, seed yield.

The seed % total nitrogen analysis (see figure 2 below) may offer the best insight into how results may have presented had seasonal conditions not impacted so negatively with treatments 1,3 and 4 showing an improvement trend with inoculation and the use of dry granules and treatment 6 going onto highlight the benefit of the new WSM4024 strain.

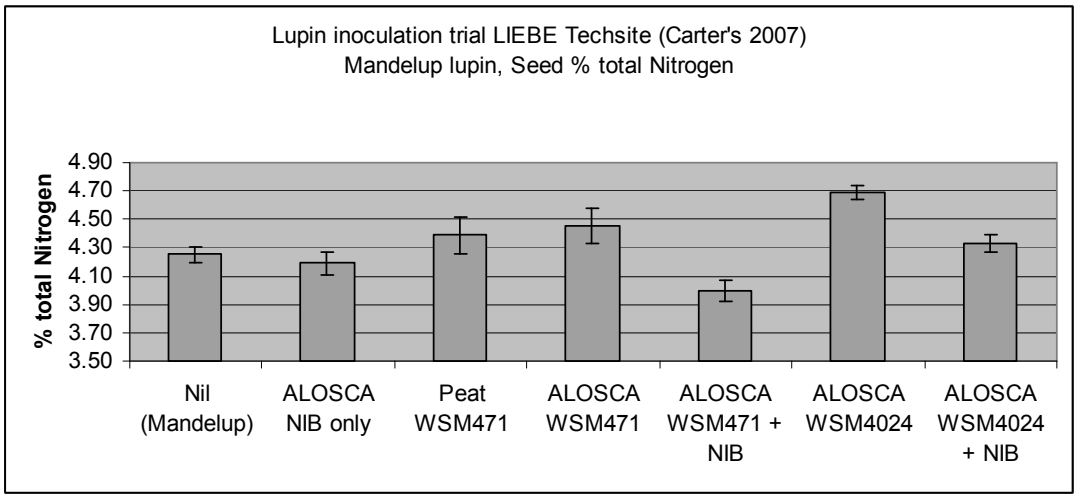

Figure 2: Mandelup Lupin, seed % total Nitrogen.

ECONOMIC ANALYSIS

Table 2: Yield based economic analysis ($/ha).

Treatment	Yield (t/ha)	Gross Return ($/ha)	Additional treatment cost ($/ha)	Return on treatment ** ($/ha)
Nil (Mandelup)	0.51	151.77	0.00	$0.00
ALOSCA NIB only	0.60	179.70	Not on market	NA
Peat WSM471	0.54	163.43	4.00	$7.66
ALOSCA WSM471	0.65	193.70	10.00	$31.93
ALOSCA WSM471 + NIB	0.52	156.30	Not on market	NA
ALOSCA WSM4024	0.39	118.25	10.00	-$43.52
ALOSCA WSM4024 + NIB	0.57	172.46	Not on market	NA

Based on Price $300/tonne; **Note no quality parameters taken into account

COMMENTS

Overall the results returned from this trial were confounded by low growing season rainfall and high temperatures during spring. This was reflected in the poor seed yields and significant variation across the treatment replicates reducing the confidence with which results can be drawn from the data.

Despite the difficulties presented by low growing season rainfall over the past two years, the picture for potential benefits of improved lupin *Rhizobium* strains and other beneficial microbes is becoming clearer. Further controlled environment (glasshouse) work with DPI NSW supports earlier WSM4024 strain evaluations done at the Centre for *Rhizobium* Studies (CRS), Murdoch University with improvements measured over the existing commercially Group G (WU425) strain. Field evaluation is indicating there are benefits to be gained from lupin inoculation and lupin inoculation in combination with other beneficial microbes however the challenge lies with how to improve occupancy of the new strain/microbe, that is, to have it infect the plant before the less effective naturalised/background strain satisfies the nodulation initiation process.

ACKNOWLEDGEMENTS

Trial design and results analysis were collaboratively prepared with the assistance of the Centre for *Rhizobium* Studies, Murdoch University.

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METRIBUZIN AND OTHER HERBICIDES PRE-SOWING OF LUPINS

Peter Newman, Weeds Research Officer, Department of Agriculture & Food

AIM

Discover alternative herbicide options for wild radish, annual ryegrass and doublegee control in lupins.

TRIAL DETAILS

Property	Mike Bothe, Coorow	Wongan Hills Research Station
Plot size & replication	12m x 3m x 3 replications	28m x 3m x 3 replications
Soil type	Yellow gravelly sand	Yellow sand
Sowing date	8/5/07 (dry)	29/5/07 (wet)
Seeding rate	90 kg/ha Mandelup	100 kg/ha Mandelup
Fertiliser (kg/ha)	TSP 50 kg/ha	Big Phos + Mn 80 kg/ha banded
Growing Season Rainfall	170mm	212mm

Coorow site had plus and minus basal Simazine (2 L/ha). Wongan site had no basal simazine pre sowing (some treatments included Simazine 2 L/ha pre). Sown with knife point / press wheel seeding machinery (Coorow 18" row spacing, Wongan 9" row spacing).

RESULTS

Table 1: Ryegrass / m^2 or flowering wild radish per plot (0.7m x 12m) and lupin yield for a range of herbicide treatments plus and minus Simazine 2 L/ha pre sowing – Mike Bothe, Coorow : Capeweed density (per m^2) and lupin yield for a range of herbicide treatments at Wongan Hills Research Station.

Treatment	Coorow					Wongan Hills	
	Ryegrass /m^2		Flowering radish / plot				
	minus sim	plus sim	minus sim	plus sim		capeweed / m^2	yield (kg/ha)
Nil	50	49.2	7.33	5.33		52.25	2057
Metribuzin 200g/ha Pre	67.9	**26.7**	5.67	3.67			
Metribuzin 300g/ha Pre	48.8	**27.1**	**2.33**	**1.67**		**11.5**	2011
Metribuzin 400g/ha Pre	62.9	33.3	**1**	**1.33**			
Metribuzin 600g/ha Pre	**30**	**14.6**	**3**	**0.67**			
Metribuzin 300g/ha + Simazine 2 L/ha Pre						**1.6**	2196
Metribuzin 600g/ha + Simazine 2 L/ha Pre						**0.17**	2090
Boxer Gold 1.5 L/ha Pre						48.3	2011
Boxer Gold 2.5L/ha Pre	**16.2**	**22.1**	6.67	**0.67**		**38.2**	1971
Boxer Gold 5 L/ha Pre	**13.8**	**6.7**	7	4.67		**23.2**	2050
Boxer Gold 2.5 L/ha + simazine 2 L/ha Pre						**4.5**	2097
Boxer Gold 2.5 L/ha + Diuron 2 Lha Pre						**8**	2249
PN002 Pre	**5.4**	**4.6**	6.33	2			
Kerb 2 kg/ha Pre	**2.9**	**5**	8	4.67			
Kerb 2 kg/ha PSPE	**10.4**	**7.5**	10	6.33			
Trifluralin 1.6 L/ha Pre	63.3	40.4	12.67	4.33		**41.17**	1905
Dual Gold 500 mL/ha Pre						**44.6**	1918
Dual Gold 1 L/ha Pre						46.25	1971
Simazine 2 L/ha Pre						**5.4**	2123
Diuron 2 L/ha Pre						**12.2**	2176
LSD	19.8	19.8	3.6	3.6		6.1	ns

Values in bold are significantly different from the Control (nil treatment).

COMMENTS

Metribuzin This research and other trials at Mingenew suggest that metribuzin may be safe pre-sowing of lupins. However 2006 and 2007 were very dry seasons which may have contributed to this crop safety in trials in both years. At the Mingenew and Coorow sites, a small area in some of the metribuzin treatments was watered by hand with an additional 30mm of simulated rainfall. There was no phyto-toxicity observed in these patches. This gives a small amount of confidence that metribuzin pre-sowing will be safe in a wet season. Further research is required to confirm this. A similar trial in 2006 (also a dry season) had similar results.

Metribuzin gave some useful suppression of wild radish, capeweed and ryegrass, particularly when added to basal simazine. Where metribuzin was applied at Mingenew (results not shown) pre sowing at 600 g/ha followed by more metribuzin post emergent, crop phyto-toxicity was responsible for approximately 20% reduction in lupin biomass. This did not result in a yield reduction. In summary, metribuzin shows some promise for use pre-emergent in lupins but is not currently registered at this timing. Future research in wet conditions will give more confidence of crop safety.

Boxer Gold® is a new pre-emergent ryegrass herbicide for use in wheat. Syngenta® are currently evaluating the use of this product in lupins. This research indicates that Boxer Gold® is safe when applied at the label rate of 2.5 L/ha pre-sowing of lupin. Unfortunately the Wongan site did not have any ryegrass. Boxer Gold® did demonstrate some suppression of capeweed at this site as it did in another wheat trial in 2007. At the Coorow site Boxer Gold® gave only 45% control of ryegrass. This trial was conducted under very dry conditions and the crop was sown on 45cm row spacing, hence the lack of ryegrass control with trifluralin.

Kerb® (propyzamide) is not registered in lupins and probably never will be. Kerb® achieved good ryegrass control in the Coorow trial, probably due to the trial being sown on very wide rows.

PN002 is an experimental herbicide that was included under a confidentiality agreement. Crop safety and ryegrass control with herbicide both appear to be excellent at these early stages.

ACKNOWLEDGEMENTS

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RYEGRASS AND LEGUMES: INTENSIVE PASTURE PRODUCTION

Jared Nelson, Agronomist, Elders Carnamah

AIM

This site, though expensive to establish, can take pressure off other pasture paddocks, to give excellent production and add benefits to the follow-crop in a season with a more typical rainfall pattern. Late Flexi-N can be an option.

BACKGROUND

Liebe members requested this trial to understand the benefits of inter-sowing legumes with ryegrass pasture. The intention was to have the ryegrass predominate the inter-furrow and have the legumes establish directly into the furrow. Therefore we were looking at a system with early production and high energy from the ryegrass combined with a late flourish from the legumes with the benefits of nitrogen fixation and protein source.

TRIAL DETAILS

Property	Steve & Lee Anne Carter, Xantippe
Plot size & replication	1.5 ha Demonstration Plot
Soil type	Sandy loam
Sowing date	11/5/07
Seeding rate	18 kg/ha: Winterstar ryegrass (Spread & IBS) 10 kg/ha: Erica Serradella, Dalkeith & Losa Subclover (Sown in Furrow) (Figure 1)
Seeding Machinery	Knife points & Press wheels on 9" spacings
Fertiliser (kg/ha)	11/5/07: 60 kg/ha MAP (Banded) 30/8/07: 50 L/ha Flexi N + 50 L/ha Water 2006: Group C Innoculant on middle runs 2006: Group S ALOSCA over whole site
Paddock rotation	2003 = Pasture, 2004 = Pasture, 2005 = Pasture, 2006 = Wheat
Herbicides	1/6/07: 500 mL/ha Lorsban + 300 mL/ha Talstar 8/7/07: 1.5 L/ha Bromicide + 25 g/ha Broadstrike + 110 mL/ha Lemat + 0.25% BS1000
Growing Season Rainfall	113mm

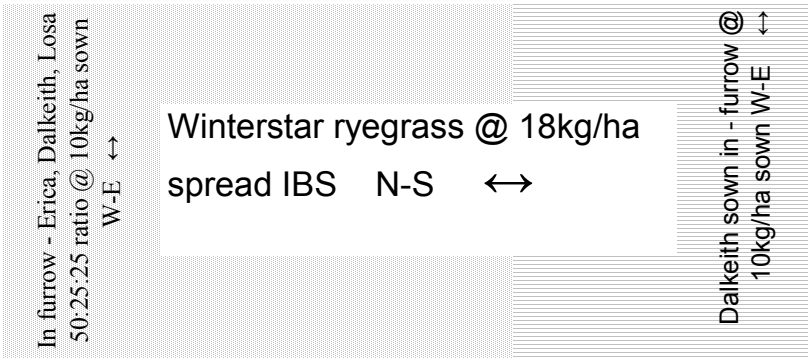

Figure 1: Seeding and field layout of pasture legume and ryegrass treatments in 2007.

RESULTS & COMMENTS

The site was seeded dry 11th May. Ryegrass was topdressed (N-S) using the air seeder bar but not covered. The ryegrass was incorporated whilst seeding the legume component (W-E) so that the ryegrass was placed in the inter-furrow and legumes were in the furrow. The site received 8mm rainfall 28th May, but plants only began to emerge, with around 20% emergence and legumes at 2 cotyledon stage on 1st June. The Bromicide/Broadstrike provided adequate control of capeweed, however the site needed grazing pressure to control brome grass and to promote ryegrass tillering and

growth when viewed on 26th July. Grazing needs to be timely and stocking rates directed to the feed on offer to maximise production from ryegrass based pasture.

By the 15th August clovers were showing good growth and ryegrass was well tillered. Sheep were introduced to the site 19th – 24th August at approximately 50DSE. Pasture was grazed hard and ryegrass plants were down to stumps on tillers with no leaves visible by the time animals were removed.

The ryegrass had appeared N deficient so 50L Flexi-N was applied (30th August). Soil report indicated very low N levels prior to seeding (2 mg/kg nitrate N and 4 mg/kg ammonium N) and very little N was applied at seeding. Plant regrowth was just sufficient to produce the beginnings of a leaf before Flexi-N was applied (Figure 2).

Figure 2: Regrowth of Winterstar ryegrass after sheep were removed. The ryegrass had been grazed hard and no green leaf material was visible on the tillers. 50L Flexi-N was applied at this time.

The Flexi N improved ryegrass biomass from virtually nil to 2-2½ cm tall, aided by rain and warm temperatures coming in over the 12 day duration between application and the field day (13th September). Some plants in low competition areas were up to 4cm high with strong tillering and growth. This in a period of less than two weeks was very encouraging.

Winter pasture production from this trial site was disappointing. This was partly due to low soil N levels and low nitrogen fertiliser rate at seeding, but mostly due to low rainfall. Ryegrass has a shallow root system and the low rainfall during June would have retarded growth. Grazing opportunities during the season were quite limited because of these restrictions. The original objective of the trial; to have ryegrass inter-furrow with legumes in the furrow to produce a system with early production and high energy from the ryegrass combined with a late flourish from the legumes, did not eventuate, although the late Flexi-N application did improve pasture growth significantly during September. Sheep were re-introduced to site for the 13th September field day.

CONCLUSIONS

Drought has affected this trial however it was still possible at the field day to see how good management can result in a reasonably pure stand of ryegrass and clover.

ACKNOWLEDGEMENTS

Steve Carter for provision of site.

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NEW LEGUME PASTURES

David Scholz, Merchandise Manager, Elders Dalwallinu

AIM

This was a demonstration trial to illustrate some of the new pasture species and varieties that have recently become available to growers.

BACKGROUND

Legume pastures have diminished in popularity in this area due to poor weed control, a greater focus on cropping and the overuse of SU herbicides. Two varieties were on display in this demonstration: Angel medic (a cultivar tolerant to SU residue) and Sothis (Eastern Star) clover which has a unique delayed germination to allow weed control. These two varieties are compared to the burr medic, Scimitar.

TRIAL DETAILS

Property	Steve & Lee Anne Carter, Xantippe
Plot size & replication	30m x 1.8m x 4 replications
Soil type	Sandy loam
Sowing date	5/6/07
Seeding rate	12 kg/ha
Varieties	Angel Strand Medic Scimitar Burr Medic Sothis Eastern Star Clover
Fertiliser (kg/ha)	5/6/07: 120 kg/ha Agstar extra 5/6/07: ALOSCA (AM, AL, C) applied with seed
Paddock rotation	2003 = Pasture 2004 = Pasture 2005 = Pasture, 2006 = Wheat
Herbicides	1/6/07: 500 mL/ha Lorsban + 300 mL/ha Talstar 26/7/07: 25 g/ha Broadstrike + 55 g/ha Diuron 26/7/07: Glean Treatments – 0.1, 1 & 15 g/ha 20/8/07: 250 mL/ha Select + 250 mL/ha Lemat + 0.5% Uptake
Growing Season Rainfall	113mm

RESULTS & COMMENTS

This trial was seeded dry and had no herbicide applied IBS. Broadleaf weeds (radish & capeweed) were controlled with a mix of broadstrike + diuron. This was used as it is relatively soft on most pasture legume species. Angel looked to tolerate the herbicide however the Sothis looks to be quite sensitive to Broadstrike/Diuron. On 15th August (20 days after application, DAA) the Sothis had yellowed as much as the capeweed. By 20th Aug (25DAA) it was evident that Angel and had tolerated Broadstrike/Diuron well, however Sothis was showing reduced biomass and leaf tip burn with senescence of youngest leaves. It was also observed that aphids were present on Sothis but not on the medics. By 30th August (35DAA) Sothis was still not showing signs that it was recovering from Broadstrike/Diuron.

Angel strand medic demonstrated its better tolerance of SU herbicides at this site. Observations made on the 20th August (25DAA) indicated Angel was not affected by 0.1 or 1g/ha Glean when compared to the neighbouring untreated areas. However there was a 50% reduction in biomass at 15g Glean/ha indicating the advantage of Angel over other medics is in tolerance to residue levels and it will not tolerate direct application through the season.

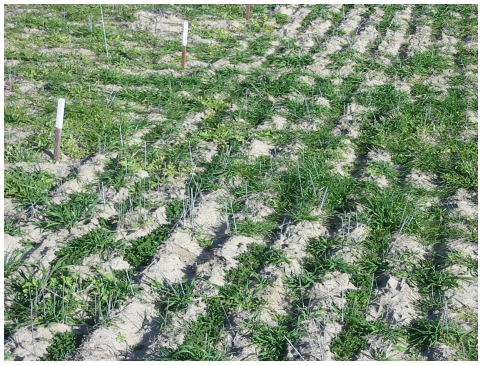

Figure 1: Growth of Angel strand medic 35 days after application of 0.1 & 1g/ha Glean.

Figure 2: Growth of Angel strand clover 35 days after application of 15g/ha Glean.

Angel was also more vigorous than Scimitar in the untreated areas with approximately 20% better growth. The higher sensitivity of Scimitar to SU's was easily seen in the Glean strips. Scimitar showed a reduction in biomass at 0.1 g/ha and at 15 g/ha there was a 70% reduction in biomass. Sothis also showed a rate response from 0.1g/ha, indicating sensitivity to the SU's.

Figure 3: Growth of Sothis eastern star clover 35 days after application of 15g/ha Glean.

This trial was sown 4 days after a small rainfall event but the soil had already begun to dry out and the seed bed (top one inch of soil) was dry at seeding. A cloddy seed bed and moisture loss from soil disturbance meant germination and emergence was slow. Total biomass production from each of the 3 varieties was lower than expected. This can be attributed partly to the poor seasonal rainfall, but is also related to seeding, demonstrating the value of sowing time in relation to rainfall in low yielding/low rainfall seasons and also the importance of knife point design.

CONCLUSIONS

- Angel strand medic looks to have a good fit given its tolerance of SU residues and good biomass.
- Sothis, the new Eastern Star Clover, looked good early but was damaged by herbicide application. It has a delayed germination characteristic, allowing the use of a knockdown herbicide for weed control.

ACKNOWLEDGEMENTS

Steve Carter for provision of site.

PAPER REVIEWED BY: PETER CARLTON.

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FIELD EVALUATION OF *BITUMINARIA BITUMINOSA* VAR. *ALBOMARGINATA* FOR LOW RAINFALL AREAS OF SOUTHERN AUSTRALIA

Dr. Daniel Real, Senior Plant Breeder, Future Farm Industries CRC
Department of Agriculture and Food, Pasture Science Group

FUTURE FARM INDUSTRIES CRC
PROFITABLE PERENNIALS™ FOR AUSTRALIAN LANDSCAPES

AIM

To evaluate the potential of *Bituminaria bituminosa* var. *albomarginata* as a prospective new perennial legume for cropping areas of southern Australia.

BACKGROUND

Bituminaria bituminosa var *albomarginata* is a perennial forage legume native to Lanzarote, Canary Islands Spain. Lanzarote Island has a Mediterranean climate with an annual rainfall that varies from 150mm to 300mm, and 3 to 5 months with almost no rainfall. This species behaves as a perennial plant under those harsh conditions and retains green leaves during the whole summer. The Spanish collaborators from the Canary Islands and Murcia are targeting this species as the most drought tolerant plant for their low-rainfall Mediterranean environments. We have accessed their germplasm through bi-lateral agreements and we are evaluating it in the low-rainfall Mediterranean environments of WA to evaluate its adaptability to our wheatbelt conditions.

TRIAL DETAILS

Property	Liebe Group Long Term Research Site, west Buntine
Plot size & replication	25m x 3m x 3 replications
Soil type	Sandy loam
Transplanting date	11/7/06
Spaced plants	225 plants, transplanted in a 1m x 1m grid
Fertiliser (kg/ha)	11/7/06: Equivalent to 300 kg/ha (3.68 N, 11.23 P, 5.88 K, 5.29 S, 13.97 Ca, 0.09 Cu, 0.07 Zn and 0.01 Mo)
Plant Material	15 accessions/origins
Herbicides	12/7/06: 1 L/ha Glyphosate (covering transplanted plants)
Annual Rainfall	335mm

RESULTS & COMMENTS

This proof of concept/adaptation trial established in July 2006 (Figure 1a) at Buntine has confirmed that *Bituminaria bituminosa* var. *albomarginata* is a very drought tolerant plant.

The trial consisted of single spaced plants of 15 different accessions and was ungrazed during 2006 and 2007, except for some defoliation by locusts in 2006.

Figure 1: (a) Transplanted seedling in July 2006 and (b) adult plant in March 2007.

Ninety-five percent of the individual plants that were alive after transplanting in July 2006, were still alive and green in November 2007. Plants retained green leaf throughout the summer of 2006/07 (Figure 1b), one of the driest years on record at Buntine. In November, all the plants were cut simulating a grazing during the early summer and the regrowth during the dry period will be studied. It is anticipated that the trial will be maintained until at least July 2008.

Bituminaria bituminosa is one of the key species that the Future Farm Industries CRC is starting to breed for low rainfall Mediterranean environments.

ACKNOWLEDGEMENTS
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SELECTION AND EVALUATION OF AUSTRALIAN LEGUMES FROM THE GENUS *CULLEN* FOR PERENNIAL PASTURE PHASES – NORTH EASTERN WHEATBELT TRIAL

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THE UNIVERSITY OF WESTERN AUSTRALIA

AIM

Evaluation of a group of Australian perennial legumes to select species useful for perennial pastures adapted to the northern wheatbelt's low rainfall and acid soils.

BACKGROUND

Several species of *Cullen* have agronomic traits which are suitable for perennial pastures. For example, *Cullen australasicum* has good nutritional value and had similar productivity and persistence as lucerne when trialed in the medium rainfall belt of New South Wales. Also, studies from Queensland on *C. australasicum*, *C. discolor*, *C. pallidum* and *C. patens* revealed that they could have deep roots to 4.3 m, equivalent productivity to lucerne when cut at 3 or 6 month intervals and an ability to persist and regenerate after grazing by cattle. These results suggest that these species and potentially other *Cullen* species may have agronomic traits making them suitable perennial pasture plants in WA.

The above studies were based on locally adapted populations from species naturally occurring in the areas. Unfortunately, there are no *Cullen* species naturally occurring in WA's wheatbelt. This makes the selection of species and populations adapted to WA's wheatbelt difficult. A broad-scale analysis of herbarium records to identify species adapted to WA's wheatbelt climate and soils showed that *Cullen* species naturally occur across many different soil types and a large range of climates. It identified ten perennial, herbaceous species that are adapted to areas with less than 650mm average annual rainfall, seven of which occurred on acidic or waterlogged soils. Many species came from areas with less than 250mm annual rainfall. So we expect that some populations from these seven *Cullen* species will be adapted to WA's wheatbelt.

All of the species which had good agronomic attributes in NSW and Queensland were included in the seven species selected in the climate and soil analysis, except *C. pallidum*. So we expect that some of these *Cullen* species may contain populations that have both adaptations and agronomic traits that make them suitable for use as perennial pastures in the low rainfall, Mediterranean climate of WA's wheatbelt. The study presented here tested this, by comparing the persistence and productivity of 120 germplasm collections from nine Australian *Cullen* species to two perennial *Lotus* species and to two lucerne cultivars between September 2006 and September 2008.

TRIAL DETAILS

Property	Liebe Group Long Term Research Site, west Buntine
Plot size & replication	Total size – 25m by 45m. Three replicates, each with three plants of 104 collections – 945 plants in total
Soil type	Loamy sand, pH in water ~ 5
Sowing date	Seedlings were established for 5 weeks in the glasshouse and then planted out on the 6th of September, 2006
Seeding rate	Single plants spaced 1 metre apart
Fertiliser (kg/ha)	None
Paddock rotation	Paddock has come out of wheat into lupins which were sprayed out a month before sowing
Herbicides	None

RESULTS

Persistence and productivity of populations in September

Compared to the best performing lucerne cultivar, 23 populations of *C. australasicum* had higher persistence, 10 populations of *C. australasicum* had higher average biomass and 7 populations were higher in both measures (Figure 1). All *Cullen* species except *C. patens* had populations which persisted better than Sardi 10 (Figure 1). The combined productivity and persistence of the best performing *C. australasicum* population was more than double that of Sardi 10 and around four times that of Sceptre (49.0, 24.2 and 13.0 g per established plant, respectively).

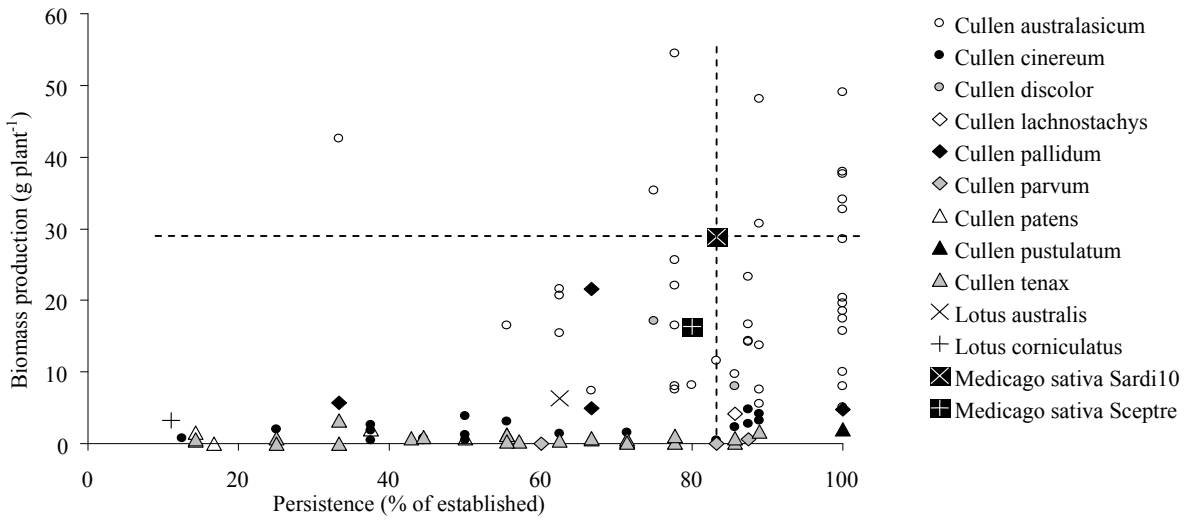

Figure 1: Persistence (percentage survival of established plants) and productivity in September (biomass after 8 months regrowth) of all *Cullen* populations trialed, two lucerne cultivars (Sceptre and Sardi 10), *Lotus australis* and *L. corniculatus*. Dashed lines are centred over Sardi 10, the best performing lucerne cultivar.

Seasonal persistence and productivity of species

When considered at the species level, *Cullen australasicum* and *C. pustulatum* both persisted better through the whole year than the best lucerne cultivar, Sardi 10 (Table 1). *L. corniculatus* displayed the poorest survival with one plant remaining alive in April which then persisted through to September. Of the *Cullen* species, *C. patens* had the poorest persistence with around one quarter of plants surviving in September. All species except *C. discolor* and *C. leucanthum* persisted better over the winter period between April and September than the preceding dry period between establishment and April. The persistence of *C. cinereum* was the poorest of all species over the April to September period; 19% of plants died.

Cullen australasicum, *C. pustulatum* and *C. lachnostachys* all had higher productivity ratings in April than Sardi 10 lucerne, the best lucerne cultivar (Table 1). However, the September productivity rating of *C. australasicum* was second best to Sardi 10 lucerne, whereas the September productivity rating of *C. pustulatum* and *C. lachnostachys* dropped further to the third and sixth lowest, respectively. *Cullen tenax* and *C. parvum* had consistently low productivity ratings. Productivity ratings of the lucerne cultivars were lowest in April and highest in September.

Table 1: Average persistence and productivity of nine native *Cullen* species, one native *Lotus* species, two lucerne cultivars, Sardi10 and Sceptre and *Lotus corniculatus* cv. San Gabriel between October 2006 and September 2007 at a field site 20km west of Buntine in WA's low rainfall wheatbelt. Persistence values are percentages of established seedlings and productivity scores are ratings out of 10.

Spp	# populations tested	Persistence in April (SE)	Productivity in April (SE)	Persistence in September (SE)	Productivity in September (SE)
C. australasicum	39	88 (3.1)	4.4 (0.32)	85 (2.9)	5.0 (0.27)
C. cinereum	22	71 (8.5)	3.3 (0.06)	52 (5.0)	2.2 (0.22)
C. discolor	2	92 (10.2)	2.6 (0.35)	81 (12.3)	3.7 (0.43)
C. lachnostachys	1	100 (0.0)	5.1 (1.50)	83 (20.4)	2.5 (0.61)
C. pallidum	4	75 (10.2)	3.2 (0.28)	67 (11.8)	3.6 (0.23)
C. parvum	3	79 (7.3)	1.1 (0.07)	79 (7.3)	1.4 (0.12)
C. patens	6	33 (9.4)	2.4 (0.58)	24 (7.3)	2.1 (0.30)
C. pustulatum	1	100 (0.0)	5.3 (2.13)	100 (0.0)	1.8 (0.74)
C. tenax	22	68 (7.4)	1.7 (0.16)	58 (10.0)	1.6 (0.16)
L. australis	1	61 (24.5)	2.2 (0.95)	61 (24.5)	2.7 (0.82)
L. corniculatus	San Gabriel	11 (13.6)	0.0 -	11 (13.6)	3.0 -
Lucerne	Sardi 10	94 (6.8)	4.0 (0.40)	83 (0.0)	5.9 (0.50)
Lucerne	Sceptre	85 (9.4)	2.9 (1.16)	79 (3.0)	4.2 (0.95)

COMMENTS

The most important findings of this study are that populations from eight *Cullen* species persisted better and seven populations of *C. australasicum* both persisted better and were more productive than Sardi 10 lucerne under the trial conditions. These results provide strong support for our expectation that some populations from *Cullen* species will have both adaptations and agronomic traits that make them suitable for use as perennial pastures in the low rainfall, Mediterranean climate of WA's wheatbelt.

Cullen australasicum was the best *Cullen* species overall, in terms of productivity and persistence throughout the year. *Cullen australasicum* contained the most productive populations in the study based on September productivity and was more productive as a whole than Sardi 10 in April. This is an important result, considering that wild germplasm is being compared to lucerne cultivars that have had many years of intensive breeding effort. This result may be somewhat expected because the September harvest was of eight months regrowth. It has been shown in the past that longer cutting intervals favour the cumulative productivity of *Cullen* species relative to lucerne and it was expected that lucerne was not highly productive in April as it is better adapted to winter growth, loses its leaves under drought conditions and was affected by pasture webworm. Nevertheless, this result shows that *C. australasicum* may be particularly useful when allowed to accumulate as a 'living haystack' which can be used strategically to fill feed gaps in summer or autumn, or during drought.

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NEW SUB-TROPICAL GRASSES FOR SOUTHERN AUSTRALIA

Geoff Moore, John Titterington and Brad Wintle
Department of Agriculture and Food, Pasture Science Group

AIM

To develop new sub-tropical grasses specifically for the soils and climate of southern Australia with improved persistence, out-of-season dry matter production and feed quality.
To test promising lines of *Panicum maximum* (panic grass) in a range of environments (Muresk, Buntine, Mingenew).

BACKGROUND

Summer-active, sub-tropical grasses are showing considerable promise in the northern agricultural region, especially where the rainfall is more than 450mm. One of the most promising commercial species across a range of sites are the panic grasses (*Panicum maximum*), often known by the common names 'green' panic and 'Gatton' panic. Panic grasses are leafy bunch grasses with good feed quality (65-70% dry matter digestibility) which respond rapidly to rainfall and are often preferentially grazed by stock.

A project in the CRC for Future Farm Industries commenced in December 2003 to develop new sub-tropical grasses for the soils and climate of southern Australia, given that all of the current commercial varieties were developed for very different environments, like sub-tropical and tropical Queensland. A wide range of germplasm has been evaluated at the main sites of Badgingarra Research Station, north Wellstead in WA and in northern NSW. From the initial evaluation trials, a number of promising accessions of *Panicum maximum* have been identified. These accessions show excellent persistence through both hot, dry summers and cold winters and have excellent biomass production. The promising accessions have superior dry matter production following summer rain and also in spring, than the control varieties (Gatton, green panic). There was a need to evaluate these promising accessions in a wider range of environments, so satellite trials were established at Muresk, Buntine and Mingenew in spring 2006.

TRIAL DETAILS

Property	Liebe Group Long Term Research Site, west Buntine
Plot size & replication	Row trial with 13 accessions x 5 replications with 0.5m spacing between rows
Soil type	Deep loamy sand
Establishment date	21/9/06
Fertiliser (kg/ha)	23/4/07: 150 kg/ha of super:potash 3:1 23/4/07: 100 kg/ha ammonium sulphate (20 units of N)
Herbicides	Nil applied in 2007
Annual rainfall	Sept - Dec 2006 30mm; Jan - mid-Dec. 2007 144mm

RESULTS

Only 174mm of rainfall has fallen in the 16 months since the trial was established in September 2006. The grasses have been regularly monitored for persistence, tolerance to moisture stress and low winter temperatures, seeding and biomass production (grasses are cut back to a height of 5-7cm after each measurement). There have been three biomass measurements at the Buntine site in the first 16 months compared with 5 biomass measurements at the Mingenew site over the same period. Results from the Mingenew site show the rapid recovery following the rain in mid-June after the extended dry period from late 2006 (Table 1).

Table 1: Winter, early spring biomass production at the Mingenew row nursery (please note: 50g/m of row ~1.0 t/ha, while 60g/m of row ~1.2 t/ha).

Accession	Biomass 10/7/2007 (g/m of row)	Biomass 30/8/2007 (g/m of row)
Panmax062	55.3	64.6
Panmax011	47.5	62.7
Panmax060	47.6	61.7
Petrie-Green	44.9	53.9
Panmax059	47.2	51.8
Panmax049	47.7	51.5
Panmax055	37.1	50.1
Panmax067	34.8	49.7
Panmax050	33.6	48.3
Gatton	47.8	47.8
Panmax057	28.5	45.7
Panmax045	40.1	44.0
Panmax010	49.0	39.1
LSD 5%	8.7	9.9

COMMENTS

Although the panic grasses at the Buntine site have shown excellent persistence (>99%), despite the extended dry conditions, there remains a question-mark over the role of sub-tropical grasses in the north-eastern wheatbelt. This is based on the results from this trial and the neighbouring Quantity and Quality variety trial (Ross Fitzsimons, west Buntine). With the cool conditions over winter and occasional frosts there is little or no growth from late June through to early September. This compares with areas to the west and north where the sub-tropical grasses continue to grow actively through most of the growing season and are producing similar biomass (in some seasons greater biomass) than the annual pastures, in addition to the production outside the growing season.

However, across a range of other sites the promising accessions of panic grass are showing considerable potential and in spring 2008 larger scale field trials will be established to evaluate their persistence and production under grazing. The plan is to release a new variety of *Panicum maximum* under Trademark following the grazing studies.

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NITROGEN TIMING AND SEEDING RATES

Erin Cahill and James Easton, CSBP

Grow to your full potential.

AIM

To test the "canopy management" theory on nitrogen fertiliser management.
To demonstrate the value of Flexi N applications across the season.

BACKGROUND

Canopy management is a practice developed in high yielding parts of Europe and NZ, and is based on the concept that cereal productivity is determined by the size and duration of the green canopy. The main idea is to limit excessive early crop growth and water use, and maximise the photosynthetic area in the later stages of the crop's development with applications of nitrogen fertiliser and fungicides. There is some uncertainty whether this concept is applicable to regions where soils have poor water holding capacity and rainfall is variable, especially during grain filling. The aim of the trial is to evaluate canopy management strategies involving Flexi-N applications at different plant densities.

Unfortunately, due to one of the driest seasons on record, the Liebe trial was not harvested and no data was collected during the year. Some interesting observations were recorded during the year which mirrored observations at two other trial sites that CSBP were running with the same design, one with WANTFA and one with the Mingenew- Irwin Group. The data presented below is from the WANTFA trial site.

TRIAL DETAILS

Property	Colin Pearse, WANTFA main trial site, Meckering
Plot size & replication	20m x 2m x 3 replications
Soil type	Loamy sand
Sowing date	18/5/07
Seeding rate	50 kg/ha (122 plants m^2) and 100 kg/ha (186 plants m^2) Calingiri wheat
Fertiliser (kg/ha)	18/5/07: 150 kg/ha MOP basal, 120 kg/ha MacroPro Extra basal
Paddock rotation	2005 = Wheat (2.2 t/ha), 2006 = Wheat (2.5 t/ha)
Herbicides	18/5/07: 1 L/ha Sprayseed, 2 L/ha Trifluralin, 35 g/ha Logran 300 mL/ha Chlorpyrifos
Growing Season Rainfall	200mm

RESULTS

Table 1: Yields, protein and protein yields for wheat sown at WANTFA site, Meckering on 18/5/07.

Trt	Seeding Rate (kg/ha)	Flexi-N Application (L/ha) Banded	Z14	Z30	Z37	Yield (t/ha)	Protein %	Protein Yield (kg/ha)	Total N (kg/ha)
1	50	-	-	-	-	2.23	8.7	196	12
2	50	100	-	-	-	2.88	8.8	253	54
3	50	-	-	100	-	3.29	8.2	271	54
4	50	50	-	50	-	3.18	8.0	253	54
5	50	50	-	100	-	3.80	8.4	320	75
6	50	50	-	100	50	3.80	9.1	345	96
7	50	50	50	50	50	3.70	8.9	329	96
8	100	-	-	-	-	2.22	8.4	187	12
9	100	100	-	-	-	3.11	8.0	248	54
10	100	-	-	100	-	3.36	7.7	260	54
11	100	50	-	50	-	3.30	7.8	258	54
12	100	50	-	100	-	3.46	7.9	274	75
13	100	50	-	50	50	3.91	8.7	341	96
14	100	50	50	50	50	3.81	8.5	323	96
					Prob	<0.001	nsd	<0.001	
					LSD	0.55	-	55	

Table 2: Economic analysis of the WANTFA results.

Treatment	Total Nitrogen (kg/ha)	Yield (t/ha)	Gross Return ($)	Nitrogen Cost ($/ha)	Extra seed cost ($/ha)	Return after extra nitrogen and seed costs ($/ha)
1	12	2.23	931	basal		931
2	54	2.88	1204	61		1143
3	54	3.29	1365	67		1298
4	54	3.18	1317	67		1250
5	75	3.80	1585	98		**1487**
6	96	3.80	1594.	135		1459
7	96	3.70	1548	135		1413
8	12	2.22	926	basal	21	905
9	54	3.11	1288	61	21	1206
10	54	3.36	1386	67	21	1298
11	54	3.30	1363	67	21	1275
12	75	3.46	1431	98	21	1312
13	96	3.91	1632	135	21	1476
14	96	3.81	1587	135	21	1431

Based on AWB EPR for 8/1/08 ASW Base Price $414/tonne +/- Golden Rewards
Flexi-N $468/tonne ($1.46/kg N), $6/ha application costs for post emergent applications

RESULTS & COMMENTS

This trial was sown into good moisture at 50 and 100 kg/ha to target plant densities of 100m^2 (122 achieved) and 200/m^2 (186 achieved) based on 93% germination, average grain weight of 40.9mg and 86% establishment.

Early growing conditions favoured efficient N recovery and growth responses to banded Flexi-N were rapidly apparent. Plant tests confirmed the responsiveness of this site to N (Total N 4.6%, Nit N 300ppm at 6WAS without Flexi-N). All other nutrients were adequate.

The site had favourable growing conditions in spring and grain yields at the end of the year were good. There was a big grain yield response of up to 1.7 t/ha to Flexi-N split into applications between banding and during the season (i.e. a yield increase from 2.2 t/ha to 3.9 t/ha at the high seed rate). The recovery of applied N was extremely efficient and profitable (up to 25kg grain/kg N) and yields trended slightly higher (and protein lower) at the higher seeding rate.

Low grain proteins indicated that yields may have increased with even higher rates of Flexi-N applied up to Z30. Flag leaf (Z37) applications of 50 L/ha Flexi-N increased protein by up to 0.8%, but higher rates would have been required to lift the grain into 'Noodle' grade.

Nitrogen recovery (protein yield) was similar at both seeding rates.

High hectolitre weights (79-81kg/hL) and low screenings (2-4%) were unaffected by the Flexi-N or seed rate treatments.

CONCLUSIONS

This trial showed very strong responses to Flexi-N with applications split between banding and during the season increasing yield from 2.2 t/ha up to 3.9 t/ha. Recovery of applied Flexi-N was extremely efficient. Grain protein was low and while Flexi-N applied at flag leaf emergence (Z37) increased protein, 50 L/ha was insufficient to lift the harvested grain into the 'Noodle' grade.

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SULPHUR RATES AND SOURCES IN WHEAT

Pete Rees, Research Agronomist, Kalyx Agriculture

AIM

To investigate the response of Tammarin Rock wheat to applications of Sulphur at 3, 6, 12 and 24 kg/ha in both the Elemental (S90) and Sulphate (Maxam) forms either banded at seeding or topdressed IBS.

BACKGROUND

Sulphur (S) is one of the major elements required for plant growth and is taken up by crops in the plant available sulphate form. When S is present in the sulphate form it can be subject to rapid leaching on light textured soils. Elemental sulphur, a slower release form of S, must undergo chemical and microbial transformation prior to being taken up by plants.

Currently Summit supply cropping products with a mixture of both elemental and sulphate S, intended to ensure adequate S supply throughout the growing season, however this trial aimed to compare the effectiveness of elemental and sulphate Sulphur for wheat crop nutrition, on a low S, light textured soil. Sulphate S was applied in the form of Summit's Granulated Sulphate of Ammonia product MAXam, while elemental Sulphur was applied as S90. All treatments received identical rates of N, P and K.

TRIAL DETAILS

Property	Liebe Group Long Term Research Site, west Buntine
Plot size & replication	20m x 1.76m x 3 replications
Soil type	Sandy loam
Sowing date	19/6/07
Seeding rate and Variety	80 kg/ha Tammarin Rock wheat
Fertiliser (kg/ha)	19/6/07: MOP 80 kg/ha IBS, MAP 45 kg/ha Banded. N and S as per protocol
Paddock rotation	2004 = Lupins, 2005 = Wheat, 2006 = Lupins
Herbicides	19/6/07: 1.6 L/ha Trifluralin 19/6/07: 1 L/ha Chlorpyrifos 19/6/07: 35 g/ha Logran 19/6/07: 2 L/ha Roundup Powermax 23/7/07: 25 g/ha Monza 30/7/07: 600 mL/ha Giant 30/7/07: 3 g/ha Ally 30/7/07: 300 mL/ha Lontrel 30/7/07: 0.1 % v/v BS1000
Growing Season Rainfall	127mm

RESULTS

Table 1: Summit soil test analysis for trial site.

Soil Test Analysis	
Phosphorus	25 mg/kg
Potassium	30 mg/kg
Sulphur	5 mg/kg
Copper	0.2 mg/kg
Zinc	0.15 mg/kg
Organic Carbon	0.34 %
Phosphorus Retention Index (PRI)	3
pH (CaCl2)	4.4 Z00
Electrical Conductivity	0 mS/cm

From table one it can be seen that the site was low in sulphate sulphur, low in organic carbon (a possible source of sulphur mobilization over the growing season) and light in texture, increasing the likelihood of leaching. Therefore a good S response at this site was anticipated.

Crop vigour ratings occurred at both 28 and 106 days after seeding, however no significant differences were found at either timing.

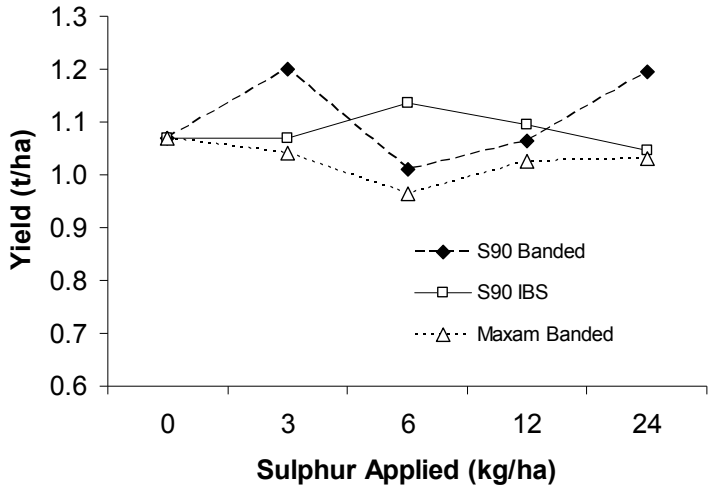

Figure 1: Tammarin Rock wheat yield (t/ha) relative to rate, form and placement of Sulphur.

Figure 1 shows yields achieved for each sulphur treatment. Yields ranged from 0.96-1.19 t/ha, however there were no significant differences between any treatments, nor were any Sulphur responses recorded at the site, with all treatments yielding the same as the untreated control.

ECONOMIC ANALYSIS

Table 2: Gross Margin Calculations and Analysis of Variance for Sulphur treatments.

Sulphur Treatment	Rate (kg/ha)	Gross Margin ($/ha)
Untreated	0	359.60
S90 Banded	3	410.29
S90 Banded	6	333.43
S90 Banded	12	351.33
S90 Banded	24	396.56
S90 IBS	3	358.41
S90 IBS	6	383.21
S90 IBS	12	363.84
S90 IBS	24	345.42
Maxam Banded	3	347.86
Maxam Banded	6	315.70
Maxam Banded	12	337.45
Maxam Banded	24	333.74
LSD (P=.05)		**NSD**
CV		**10.57**
Replicate F		**23.008**
Replicate Prob(F)		**0.0001**
Treatment F		**1.259**
Treatment Prob(F)		**0.2805**

Gross Margins were calculated based on list prices for fertilisers and cash grain prices correct as at 15/12/07. Margins are calculated based on AH wheat and allow for the costs of N/S treatments, which vary between treatments. No deductions are made for fixed costs, or variable costs that apply evenly across all treatments.

S90 at 3 kg S/ha had the highest gross margin at $410 /ha, while Maxam at 6 kg S/ha, at $315 /ha was lowest, despite this there was no significant difference between any sulphur strategy.

COMMENTS

Due to a very dry season, yield potential was low and there were no responses to applied sulphur either as elemental or sulphate sulphur.

Differences in gross margin were partly due to the differences in the cost of sulphur sources, which varied from $63-76 /ha, with S90 costing more than Maxam for equivalent treatments. Relatively small and statistically insignificant increases in yield also resulted in large changes to gross margins through high wheat prices.

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BLACK UREA V WHITE UREA

Chris O'Callaghan, R&D Co-ordinator, Liebe Group

AIM

To look at the potential of black urea in terms of lifting yields through better nitrogen efficiency.

BACKGROUND

Black urea is normal chemical urea coated with humic acid. This humic acid coating aims to reduce much of the nitrogen losses that occurs from application to plant uptake. 'Advanced Nutrients', who developed the product, claim the coating helps by holding the nitrogen content of the urea in place, potentially reducing losses through ammonium volatilisation, nitrate leaching and biological denitrification. The coating also potentially stimulates biological activity in the soil, allowing the urea nitrogen to be converted to ammonia and nitrate (plant available nitrogen forms) more quickly and efficiently, hence accelerating the uptake process. Once the plant has acquired the nitrogen, the coating, being an energy source may increase plant conversion of nitrogen to amino acids. Pot trials using black urea have so far been very successful. This experiment aims to test the effectiveness of black urea against that of conventional white urea in a field demonstration.

The demonstration was designed to test different rates of the two types of fertilizer against a control of no (additional) fertilizer. Advanced nutrients recommended rate for black urea is of 75% of what would normally be applied of white urea at. So consequently the two rates used were 75 kg/ha and 100 kg/ha and this then allows a direct comparison to be made between the two products and the two rates.

TRIAL DETAILS

Property	Anton Wilson, west Buntine
Plot size & replication	150m x 18m x 3 replications
Soil type	Sandy Loam
Sowing date	20/6/07
Seeding rate	80 kg/ha Stirling barley
Fertiliser (kg/ha)	20/6/07: 80 kg/ha AgFlow (75%) + AgNP (25%)
Paddock rotation	2005 = Wheat; 2006 = Lupins
Herbicides	20/6/07: 1.2 L/ha Trifluralin 20/9/07: 800 mL/ha MCPA LVE
Growing Season Rainfall	130mm

RESULTS

Table 1: Yield and grade of barley sown at Buntine.

Variety	Yield (t/ha)	Gross Return ($/ha)	Variable Costs ($/ha)	Gross Margin ($/ha)
Black Urea 100 kg/ha	1.27a	387.35	207.52	179.83
Control (No Urea)	1.21b	369.05	134.52	234.53
White Urea 75 kg/ha	1.20b	366.00	175.92	190.08
Black Urea 75 kg/ha	1.15c	350.75	189.72	161.03
White Urea 100 kg/ha	1.15c	350.75	189.72	161.03
LSD (P=0.05)	0.04			

Means follow by same letter do not significantly differ

Based on Feed Barley price of $305/t on the 27/12/07. Variable costs based on the Farm Budget Guide 2008 – *Farm Weekly*.

COMMENTS

Table 1 showed there was no benefit in applying black urea at 75 kg/ha or white urea at 75 or 100 kg/ha over the control. There was a small yield benefit over the control when black urea was applied at 100 kg/ha (Table 1). The dry season severely affected the outcome of this trial and plant demand never outstripped soil supply so there was little demand for applied nitrogen, Hence the highest gross margin was achieved for the control of nil urea (Table 1). The dry finish (34mm in August, September & October) was further detrimental to accurately achieving the aim of this project to assess the effectiveness of black urea as an alternative to conventional white urea. Further testing of this product is required in a better season.

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GRAIN & GRAZE WHOLE FARM FEED SUPPLY – GRAZING DAYS/SEASON/PASTURE TYPE

Brianna Peake, Executive Officer, Liebe Group

AIM

To understand how a range of pasture types combine to form a whole farm feed supply.

BACKGROUND

The aim of the Northern Agricultural Region (NAR) Grain and Graze project is to maximize farm profitability through the successful integration of perennial pastures into the whole year feed resource, complementing grain and annual pasture production. The NAR Grain and Graze project is a partnership between the Liebe Group, Evergreen Farming, Mingenew-Irwin Group, the Shire of Victoria Plains, the Department of Agriculture and Food (DAFWA) and Northern Agricultural Catchments Council (NACC).

The Liebe Group is located in the low to medium rainfall zone of the WA wheatbelt. In the past there has been limited trialing of perennials pastures in this area. However perennial fodder shrubs such as Saltbush have proven to grow successfully on salt affected land. Due to the uncertain reliability of perennial pastures and the dominance of cropping enterprises in the Liebe region the project is locally focused on better matching total feed supply with livestock demand so as to better manage the whole farm feed resource.

One of the project objectives is to collect grazing records from focus farms in order to determine an overview of the feed resources growers in this region currently have available and how these are being utilised. This information allows us to further focus the project on the feed resources that are providing the most value to the farm and identify where growers can potentially be better utlising these feed resources.

KEY FINDINGS AND COMPARISONS FROM THE 05/06 SEASON 06/07 SEASON:

1) **The effect of drought:** The Liebe area has experienced drought in 2006 and 2007 with 160mm and 162mm falling at Dalwallinu for the growing season in each year, respectively. This has subsequently resulted in less pasture and crop production. Stock therefore had to be supplementary fed or agisted off farm. These grazing calculations and records only account for in-paddock grazing and the value of feed grown in that paddock, as the aim of the project is to investigate the value of different pasture types. The records do not account for supplementary feeding or for when the stock are agisted away from the farm. Therefore if the livestock were supplementary fed in a certain paddock the value of the supplementary feed was subtracted from the total grazing value of the paddock using a simple calculation of: 1kg of supplementary feed = 1 grazing day. Grazing days are calculated by multiplying the DSE/ha for each paddock with the number of days the sheep were in the paddock.

2) **Main components of the grazing system in the Liebe area:** The Liebe region is a predominantly cropping focused area. Livestock are generally included in the enterprise mix as a risk management tool and weed control tool. Although many farmers are implementing fodder shrubs, cereal sown for fodder and some improved pastures, the main components of the grazing system in this area are volunteer pasture in winter and spring and crop stubbles in summer and autumn.

3) **Cropping comparisons from 05 to 06 season:** Using paddock grazing data from three average farms in the Liebe region (see below) it can be seen that between these farms the average area of crop sown was reduced from 62% in the 05 season to 48% in the 06 season. However the grazing value of crop stubbles over these two years remained approximately the same at 32-34%. Generally if the area of crop planted reduced and the season faced was poorer it would be assumed that the value of grazing the stubbles would decrease also. After discussion with the three focus farms two reasons

were put forward. 1) The stubbles from the poorer seasons were thought to have higher nutritive value than in normal rainfall years due to reductions in biomass and poor grain fill. 2) The growers agreed that there would have been much less ground cover left after grazing in the 06/07 summer and autumn than the 05/06 summer period.

4) **Volunteer pasture comparisons from 05 to 06 season:** Volunteer pasture in the Liebe region is comprised mainly of ryegrass, capeweed and radish with some barley and brome grass. Using paddock grazing data from the three focus farms it can be seen that between these farms the area of land left for volunteer pasture increased from 23% in the 05 season to 34% in the 06 season. However the grazing value of volunteer pastures over these two years remained approximately the same at 43-44%. The area of volunteer pasture increased over the two years for two reasons. 1) In 2005 there were more annual legume pastures sown and therefore less area for volunteer pasture, and 2) More paddocks were left out of cereal production due to the poor season which meant the paddocks were assigned to volunteer pasture as sowing annual legumes was a risky option given the season. Even though the area of volunteer pasture increased from 05 to 06 it is likely that the grazing value to volunteer pasture did not follow the increased trend due to the pastures producing less biomass due to lack of rain.

5) **Alternative grazing options – Do they have a role in the Liebe area?**
Legume pastures: More legume pastures were sown in 05 than in 06 and 07. The years that legume pastures were sown they only accounted for small areas of the farm between 4-13% and the grazing value ranged from 3-14%. However from grower feedback it seems that they are still not a significant pasture option for this area as they aren't able to produce the amounts of biomass required at the start of the season.
Cereal fodder: Sowing cereals as a grazing option increased from 05 to 06. However cereal fodder is only sown on small areas, between 3-11% of the farms and is contributing 2-20% of the total grazing value. The growers believe this is something that is likely to increase in the coming years as the cereals have good early vigour and are able to provide the early feed required to keep sheep off establishing pastures. Cereals also have the ability to produce large amounts of biomass which is looking more attractive as the growing seasons exhibit continued variability.
Saltbush/Bluebush/Perennials: The areas sown to saltbush increased slightly from the 05 to 06 season. As well as this two of the focus farms have planted more areas to saltbush in 2007 and plan to continue this to provide a drought proofing mechanism in the future. Even though the current figures show that saltbush, bluebush and perennial areas only account for 1-2% of farm areas and value, this value can be significant at the right time of year and in drought conditions. Fodder shrubs especially play a special role in drought feedlot areas and also keep the livestock off establishing pastures in the autumn.

RESULTS

CASE STUDY FARM 1:

Property	Keith, Rosemary and Boyd Carter, East Wubin
Arable ha	6,000
Cropped ha	4,200
No. Breeding ewes	Usually: 2,500 Currently: 1,750
Flock Structure	Self replacing merino
Lambing	May
Ave. Annual Rainfall	285mm

Table 1: Summary of grazing records for the period of June 2005 to May 2007.

June 05 May 06

Feed type	DSE/ha	Total DSE grazing days	Area (ha)	% Total area	% Total grazing days
Volunteer Pasture	2.2	750,771	924	17	33
Volunteer Pasture with sub clover base	2.1	214,101	281	5	9
Cadiz, Charano	1.1	184,658	380	8	8
Cadiz 2nd yr	3.4	241,969	194	4	11
Crop Stubble	0.7	950,387	3537	65	41
Perennials	2.1	23,966	31	1	1

June 06 May 07

Feed type	DSE/ha	Total DSE grazing days	Area (ha)	% Total area	% Total grazing days
Volunteer pasture	0.9	499,558	1,461	26	31
Legume pasture	1.0	232,796	637	11	14
Perennial pasture	0.9	9,986	31	1	1
Crop stubbles	0.7	878,116	3,625	63	55

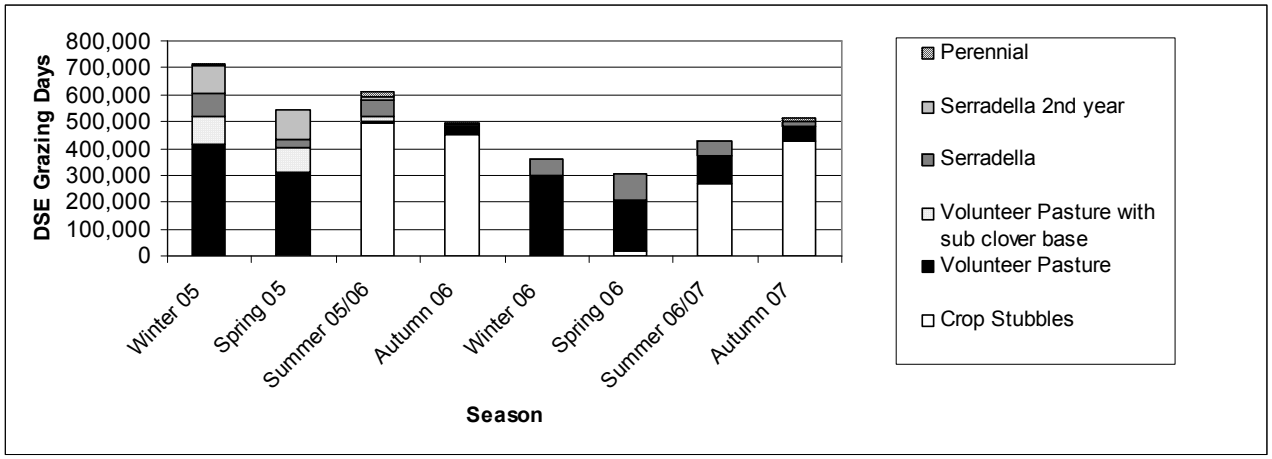

Figure 1: Total DSE grazing days per season per feed type from June 2005 to May 2007.

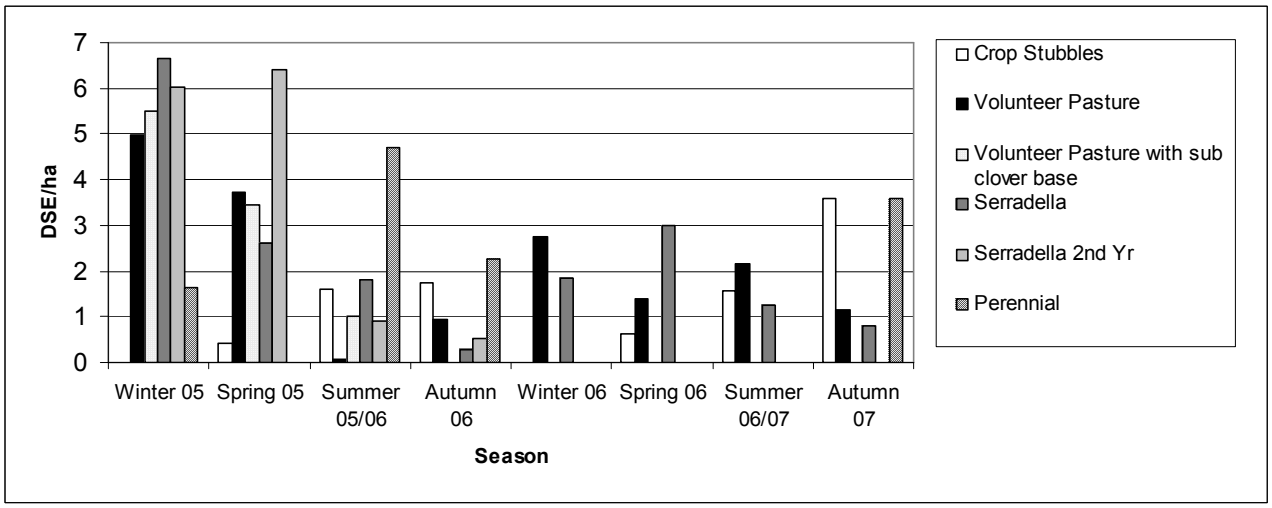

Figure 2: DSE/ha per season per feed type from June 2005 to May 2007.

CASE STUDY FARM 2:

Property	Gary, Kerry and James Butcher, east Pithara
Arable ha	2,800
Cropped ha	2,200
No. Breeding ewes	Usually: 1,600, Currently: 1,250
Flock Structure	Self replacing merino
Lambing	Jun
Ave. Annual Rainfall	300mm

Table 2: Summary of grazing records for the period of June 2005 to May 2007.

June 05 May 06

Feed type	DSE/ha	Total DSE grazing days	Area (ha)	% Total area	% Total grazing days
Volunteer Pasture	4.1	339,480	226	9	31
Caliph medic	1.4	81,693	158	6	8
Cadiz & Oats	2.5	248,489	267	10	23
Oats	1.0	82,804	231	9	8
Crop Stubbles	0.3	211,666	1907	65	19
Saltbush	0.8	2,304	8	0	0
Saltbush & Perennials	0.5	4,064	22	1	0

June 06 May 07

Feed type	DSE/ha	Total DSE grazing days	Area (ha)	% Total area	% Total grazing days
Volunteer Pasture	1.2	327,058	721	29	40
Medic and VP	1.3	60,458	128	5	7
Medic	1.3	159,939	334	13	19
Oats harvested/hay	0.5	51,583	268	11	6
Saltbush and perennials	1.1	9,055	22	1	1
Saltbush/bluebush	0.1	1,593	33	1	0
Standing cereal fodder	0.3	6,465	65	3	1
Crop stubbles	0.6	204,273	939	37	25

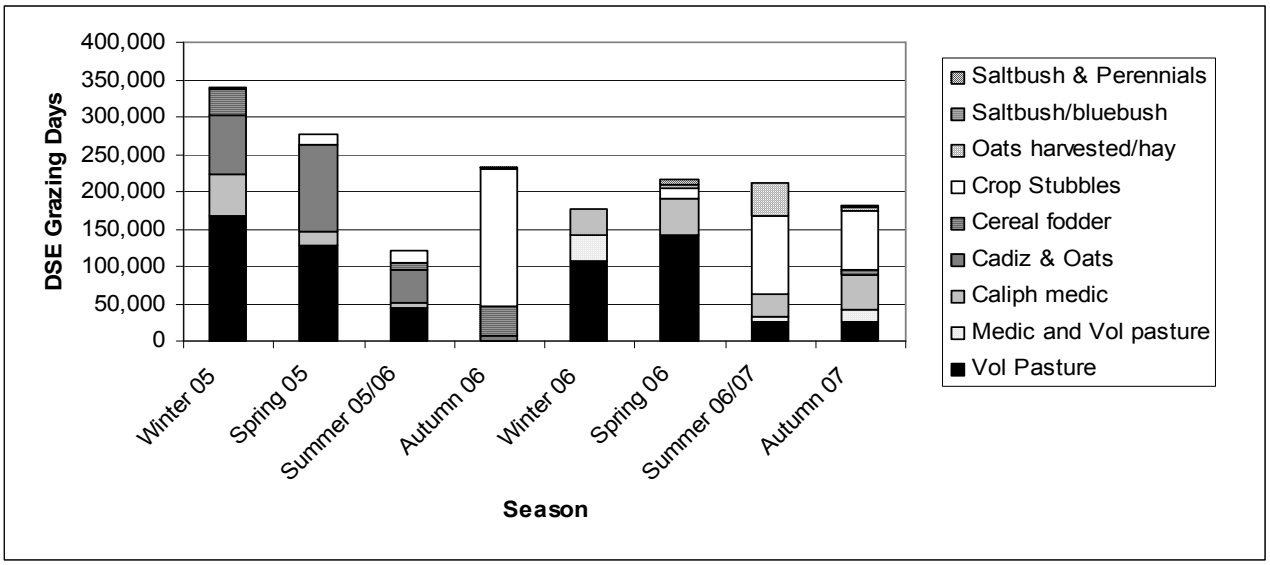

Figure 3: Total DSE grazing days per season per feed type from June 2005 to May 2007.

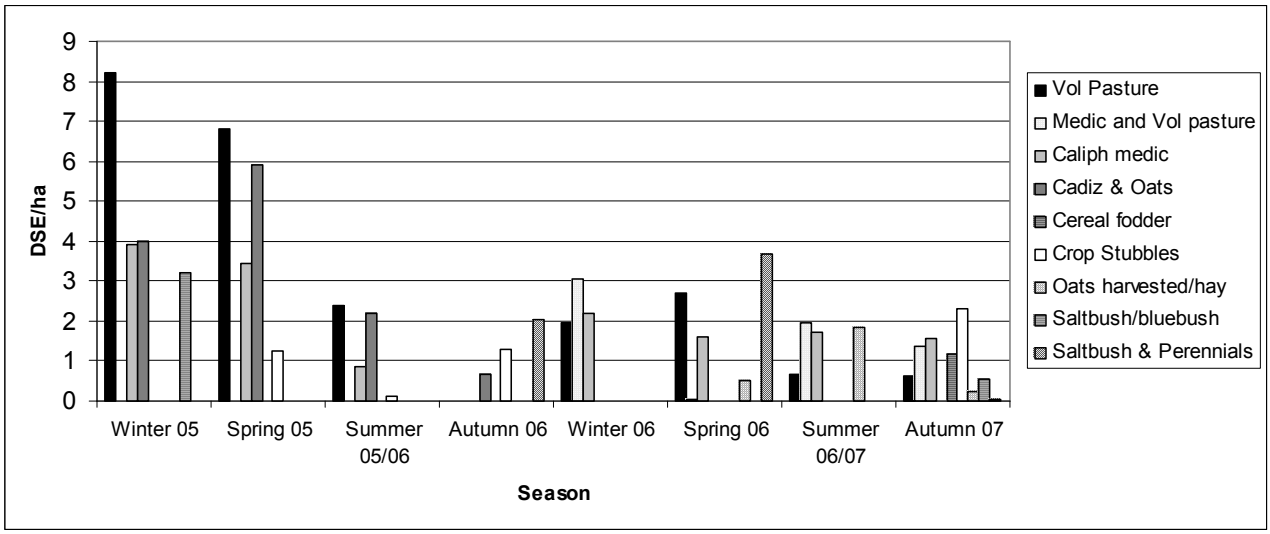

Figure 4: DSE/ha per season per feed type from June 2005 to May 2007.

CASE STUDY FARM 3:

Property	Ross and Lyn Fitzsimons, east Buntine (main property) + 1,100 ha west Buntine
Arable ha	4,800
Cropped ha	2,200
No. Breeding ewes	Usually: 1,600, Currently: 950
Flock Structure	Self replacing merino
Lambing	Late April/early May
Ave. Annual Rainfall	325mm

Table 3: Summary of grazing records for the period of June 2005 to May 2007.

June 05 May 06

Feed type	DSE/ha	Total DSE grazing days	Area (ha)	% Total area	% Total grazing days
Volunteer Pasture	1.4	941,844	1,823	43	65
Crop Stubble	0.6	505,236	2,372	57	35

June 06 May 07

Feed type	DSE/ha	Total DSE grazing days	Area (ha)	% Total Area	% Total grazing days
Volunteer Pasture	1.1	841,303	2,064	47	68
Cadiz	0.8	40,390	141	3	3
Saltbush/Bluebush	0.9	19,116	56	1	2
Crop Stubbles	0.4	301,419	1,993	45	24
Triticale standing	0.5	29,740	163	4	2

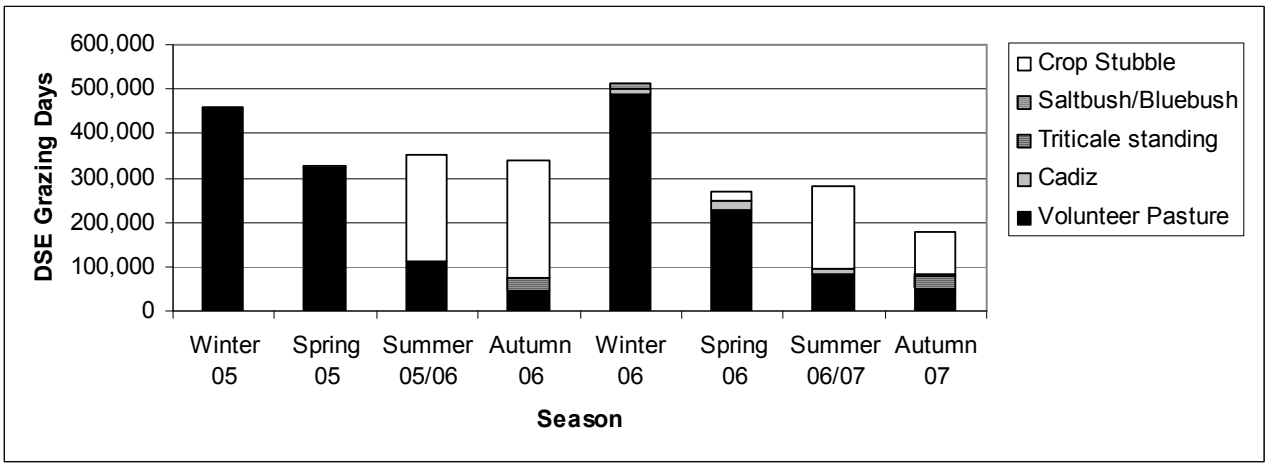

Figure 5: Total DSE grazing days per season per feed type from June 2005 to May 2007.

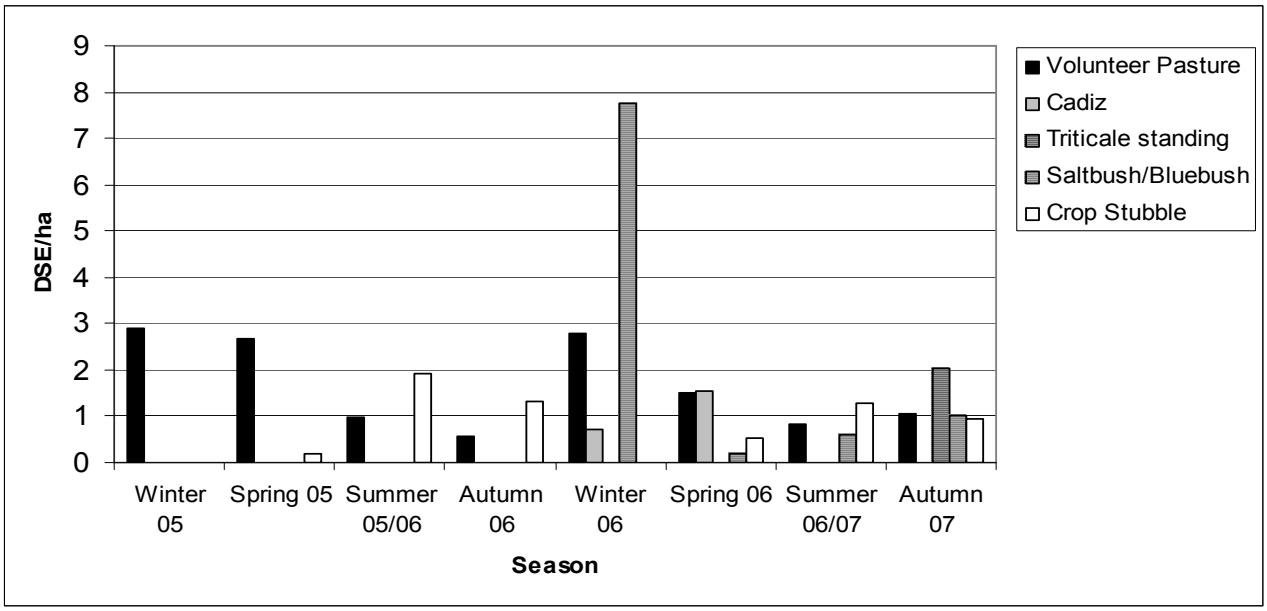

Figure 6: DSE/ha per season per feed type from June 2005 to May 2007.

ACKNOWLEDGEMENTS

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LIEBE GROUP SOIL BIOLOGY TRIAL

Emma Glasfurd, Project Coordinator, Liebe Group

AIM

To investigate the potential of biological and organic matter inputs to increase soil water storage, target long-term yield increases and soil improvement.

BACKGROUND

This trial forms part of the Liebe Group's GRDC funded adoption project, '**Growers critically analysing new technologies for improved farming systems**'. This project continues work from the GRDC funded soil health project **'A sustainable dryland community achieved through proactive research on effective management of the soil resource'.**

This long term trial was established to address management of soil constraints limiting yield, specifically the biological component. The trial site was selected as it had no significant chemical or physical soil constraints and is intended to demonstrate the capacity for increasing grain production through improving moisture conservation and enhancing the soil biota. The basic treatment structure of the trial was established in 2003 with a lupin crop, followed by two consecutive years of wheat in 2004 and 2005 to establish differences in grain yield between treatments.

In 2004, wheat (cv. Wyalkatchem) grown either after brown manured lupins or after the addition of 20 t/ha organic matter (barley straw) yielded 500-600 kg/ha (18-22 %) more grain than the control treatment (harvested lupins). Any additional treatments that aimed to increase yield through encouraging microbial activity, failed to improve grain yield further (e.g. zeolite and humate).

In 2005, wheat (cv. Wyalkatchem) was again sown to assess the residual value of treatments and determine the ongoing improvement to the soil resource. The yields obtained reflect what many farmers encounter in the initial phases of converting to a full stubble retention system as opposed to stubble burning, and these yield differences relate mostly to a change in the C:N balance affecting nitrogen supply and microbiological processes that occur in soil. The highest yielding treatment in 2005 was burnt stubble, yielding 560 kg/ha or 25% greater than full stubble retention (control).

In 2006, lupins were used in rotation to control weeds and provide a break crop for cereal disease. Along with the yearly treatments the 3yr treatments were also applied which included brown manuring and organic matter load up of 20 t/ha canola chaff. Harvest cuts were not obtained in the lupin phase and so yield results and gross margins have not been presented in this report.

In 2007, the trial was sown to wheat (cv. Wyalkatchem). The aim was to assess the combined effect of the residual and new organic matter and brown manure treatments together with the continued annual treatments, on the soil resource. However, a significant weed burden was observed during the season within the trial and despite attempts to control the weeds through post emergent herbicide options, the decision was made, late in the season to use a broad spectrum knock down (2 L/ha Sprayseed) on the trial site to reduce weed numbers for the 2008 wheat crop. Although grain harvest in 2007 was prevented, additional biomass was removed from the site using normal harvesting management.

TRIAL DETAILS

Property	Liebe Group Long Term Research Site, west Buntine
Plot size & replication	80m x 10.5m x 3 replications
Soil type	Yellow sand
Sowing date	25/06/07- 27/06/07
Seeding rate	80 kg/ha
Fertiliser (kg/ha)	25/06/07- 27/06/07: 100 kg/ha NPK Vigour
Paddock rotation	2002 = Wheat, 2003 = Lupins, 2004 = Wheat, 2005 = Wheat, 2006 = Lupins, 2007 = Wheat
Herbicides	25/7/07:25 g/ha Monza 5/9/07: 300 mL/ha Lontrel, 500 mL/ha Paragon, 1 L/ha Cheetah 5/10/07: 2 L/ha Sprayseed
Growing Season Rainfall	127mm

TREATMENTS APPLIED IN 2007

All treatments (Table 1 and 2) received basal fertiliser (see above) and retained stubble unless otherwise specified.

Table 1: Treatment descriptions.

Treatment #	Treatment description
1	**Control (District fertiliser practice, full stubble retention)**
2	Treatment 1 + Humate
3	Treatment 1 + Custom Compost
4	Treatment 1 + Microbes (foliar application)
5	Treatment 1 + Humate + Custom Compost + Microbes (foliar application)
6	**Brown manure lupin (applied 2003 and 2006) - control**
7	Treatment 6 + Humate
8	Treatment 6 + Custom Compost
9	Treatment 6 + Microbes
10	Treatment 6 + Humates + Custom Compost + Microbes
11	**Tilled soil (stubble incorporated) - control**
12	Treatment 12 + organic matter (applied 2003 and 2006)
13	Treatment 12 + organic matter (applied 2003 and 2006) + stubble decomposing agent
14	Treatment 12 + stubble decomposing agent
15	**Burnt stubble (stubble burnt after cereal phase only - 2004, 2005)**

Table 2: Rate and application method of various treatment components.

Treatment	Rate	Application Method
Organic matter (barley straw 2004, canola chaff 2007)	20 t/ha	Spread pre seeding by hand
Brown manure Lupin (2003 and 2006)	5 t/ha biomass (2003) 1.3 t/ha biomass (2006)	Foliar Desiccant (1 L/ha Glyphosate)
Custom Compost (2007)	50 kg/ha (50% mix with conventional fertiliser)	Down the tube at seeding.
Humate (2004, 2005, 2006, 2007)	5 kg/ha	Top dressed pre seeding
Stubble decomposing agent (2004, 2005, 2006, 2007)	10 L/ha brewed concentrate	Pre seeding spray
Microbes (2004, 2005, 2006, 2007)	20 L/ha brewed concentrate	Post emergent foliar spray

RESULTS

In 2007, the Soil Biology Trial was 'knocked down' in October with the intention of significantly reducing the weed burden at the site to improve crop potential for the subsequent wheat crop forecasted to be grown in 2008. The site was harvested to remove the biomass following the knockdown, to eliminate any offset effects the residual biomass may have had on the treatments applied to the site. Although, no yield results were taken from the site in 2007 evaluation of the soil resource (Table 3) continued throughout the year.

Table 3: Soil analysis for 0-10cm as sampled 28th August 2007.

	EC (Ds/m)	pH ($CaCl^2$)	Organic Carbon (%)	Nitrate N (mg/kg)	P (mg/kg)	K (mg/kg)	Sulphur (mg/kg)
Control	**0.047**	**5.57**	**0.76**	**8.33**	**34.67**	**80.00**	**8.50**
+ Humate	0.042	5.57	0.83	6.33	28.33	90.67	8.10
+ Custom Compost	0.045	5.27	0.69	9.00	28.00	70.00	8.33
+ Microbe	0.044	5.33	0.80	5.33	36.33	73.67	9.50
+ Humates+ Custom Compost +Microbes	0.045	5.57	0.78	7.33	31.33	98.67	8.20
Brown Manure	0.037	5.37	0.84	8.67	29.67	130.67	7.00
+ Humate	0.047	5.30	0.74	9.00	32.67	64.33	9.40
+ Custom Compost	0.045	5.63	0.75	11.33	29.67	79.67	7.37
+ Microbe	0.044	5.40	0.76	9.00	32.00	63.33	8.23
+ Custom Compost +Humate+Microbe	0.051	5.37	0.87	6.00	33.67	68.00	8.83
Tilled Soil	0.037	5.23	0.68	7.67	27.00	59.00	7.93
+ Organic Matter	0.121	6.10	**0.95**	**15.67**	**52.83**	**292.83**	**24.62**
+ Organic Matter + decomposing agent	0.111	6.07	**1.00**	**19.33**	**53.00**	**298.67**	20.93
Burnt Stubble	0.039	5.17	0.63	7.00	30.67	68.67	6.67
LSD (5%)	ns	ns	0.168	5.123	11.9		13.06

NB: Bold figures treatment results that are significantly different from the control

A significant increase in total soil organic carbon (soil sieved to < 2 mm) was observed for treatments where organic matter (barley hay, canola chaff) was added to plots (Table 3). This compares to the remainder of treatments where the total organic carbon pool was not observed to have changed in the short term.

Whilst it is difficult to illustrate changes in soil nitrogen reserves as the season progresses without an expensive and intense sampling procedure, the results of topsoil analysis (Table 3) sampled in August, suggest soil nitrogen (measured as nitrate-N) is higher in treatments where organic matter has been loaded up in comparison to both the stubble retained and cultivated soil control treatments. They also show significantly higher phosphorus, potassium and sulphur levels in comparison to the controls. This was reflective of previous treatments in 2003, where higher potassium concentrations were measured in organic matter treatments and illustrates one of the longer term benefits that can be achieved under a stubble retention system.

The nutrient values of stubbles can vary depending on crop type, fertiliser history and growing season conditions. For example, previous studies (Brennan *et al. 2000)* have shown canola chaff applications to increase crop yields and also the levels of macronutrients: nitrogen, phosphorus and potassium in the soil. From laboratory examinations conducted in this study, increases in nutrients were found depending on the rate of chaff applied. The results showed increases of 60 to 80% of potassium and from 0 to 30% of phosphorus in soil test analyses following 9 week's incubation of stubble in moist soil.

Research in Australia has shown stubble retention can lead to an improved soil resource. Potential benefits include an increase in soil water and plant available water, increases in soil organic carbon, a decrease in soil erosion, decrease in soil bulk densities (i.e. looser, or less compacted soil), improved biological fertility (Perry *et al. 1992*) and a generally improved soil structure. Due to the large size of the total soil organic carbon pool and the relatively small annual contributions in organic matter in WA, it is difficult to establish that stubble retention has a positive effect on total soil organic carbon (Perry *et al.* 1992). However, the effect of retention on the more labile (or available) pools of carbon is reflected in greater nutrient availability (Table 3).

Whilst changes in soil properties are difficult to identify between treatments so early in the life of this trial, the addition of organic matter and incorporation of residue in current farming systems suggests

continuing improvement in the soil resource. Although the addition of large amounts of organic residues (such as the 20 t/ha of canola chaff) is unlikely to be a viable practice for the majority of growers, it clearly illustrates the benefits of organic matter to the soil and perhaps what might be achieved after many years of stubble retention.

Small changes in organic carbon did not result in significant changes to soil moisture profiles measured to depth (Figure 1).

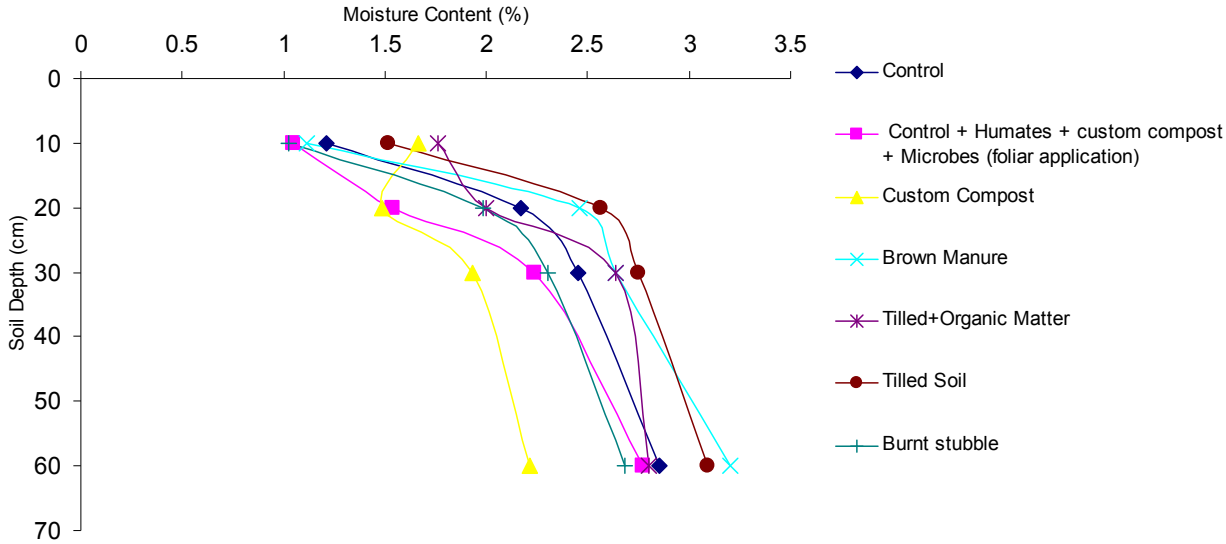

Figure 1: Gravimetric soil moisture (%) of selected treatments at six soil depths (0-10, 10-20, 20-30 and 30-60cm) in 2007. Measurements were taken in June 2007. LSD 5% (0.997).

One of the main aims of this trial is to demonstrate improvements that can be obtained from improving soil condition, including the importance of biological aspects of soil health. Soil micro-organisms mineralise organic matter to obtain carbon, nitrogen and other nutrients for their own metabolism and growth (Murphy *et al,* 2007). Microbial activity is measured by carbon dioxide evolution and reflects a range of biological processes in the soil. This is dependent on soil moisture, temperature and labile carbon (Murphy *et al,* 2007).

Management practices influence microbial activity by altering carbon availability and conditions reflecting rapid changes in the biological function of the soil (Murphy *et al,* 2007). This may be the reason a significant increase in microbial biomass for treatments with added organic matter in 2007 (Figure 2). In this treatment the microbes were exposed to a dramatic increase in the availability of carbon, as well as other nutrients through the 20 t/ha canola chaff applied pre-seeding. The application of suitable food substrates (carbon) and/or introduction of beneficial micro organisms to soils is however largely untested.

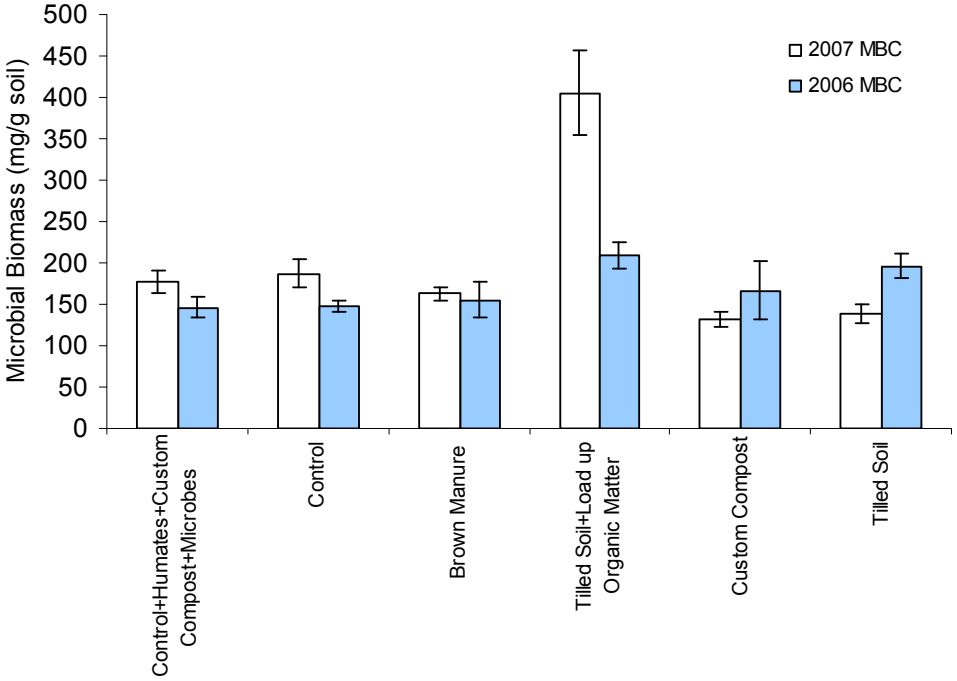

Figure 2: Microbial biomass measured in 2006 and 2007 for selected treatments (± standard error). Samples were taken in July 2006 and August 2007 (LSD 5% 2007 = 71; 2006 = 40).

There were no significant differences between treatments for bulk density in either 2006 or 2007. Bulk density of the control plot was 1.38 g/m^3 in 2006 and 1.22 g/m^3 in 2007.

CONCLUSIONS

This trial was designed to improve long term yield increases through improved water storage and soil biology. As such, it will continue into the future with the ongoing collection of valuable data to assist in the evaluation of the treatments being trialed.

Management practices influence microbial activity by altering carbon availability and conditions reflecting rapid changes in the biological function of the soil, although the research is still in preliminary stages this has been highlighted where increased microbial biomass (approximately 50% greater than the control) and nutrient availability was associated with plots receiving high amounts of organic matter.

ACKNOWLEDGEMENTS

Liebe Group would like to acknowledge GRDC for funding the project and the assistance of the Dan Murphy, University of Western Australia and Fran Hoyle, Land and Water Australia.

Initial soil biological measurements were conducted as part of the GRDC Soil Biology Initiative. Currently the soil biological measurements are conducted as part of the Land and Water Australia Healthy Soils Program in partnership with GRDC and funded through the Australian Government Natural Heritage Trust.

Thank you to Scholz Rural Supplies, Syngenta, Summit Fertilizers and Wesfarmers Federation Insurance and all other supporters of the Long Term Research Site for the generous sponsorship of products, advice and support throughout the year.

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DEEP PLACED LIME INCREASES CROP YIELD IN A DRY SEASON

Stephen Davies, Chris Gazey and David Gartner, Department of Agriculture and Food

AIM

To assess the capacity of surface applied and deep placed lime to improve subsoil pH and productivity of deep acid (Wodjil) sand.

BACKGROUND

The site was established in 2005 as part of the Liebe Group soil health project. Deep ripping and deep placed lime treatments were applied using a shallow leading tyne ripper with 45cm tyne spacings. Lime treatments were either placed on the surface only, placed on the surface and then deep ripped to aid incorporation or placed directly into the subsoil behind the tynes of the deep ripper (see treatment list Table 1).

TRIAL DETAILS

Property	Colin Bryant, Latham
Plot size & replication	60m x 3m x 3 replicates
Soil type	Wodjil
Sowing date	11/5/07
Seeding rate	70 kg/ha Calingiri wheat
Fertiliser (kg/ha)	11/5/07: 50 kg/ha DAPSZ 11/5/07: 300 mL/ha Customer Formulated Fertiliser
Paddock rotation	2004 = Lupin; 2005 = Wheat; 2006 = Pasture
Herbicides	1.5 L/ha Trifluralin; 220 g/ha Diuron; 20 g/ha Logran; 500 mL/ha LVE MCPA; Logran 5 g/ha + Ally 4 g/ha + Wetter 0.1%
Growing Season Rainfall	116mm

RESULTS

The soil, in particular the subsoil, is strongly acidic with a subsoil pH less than 4.0 between 10-50cm (Figure 1).

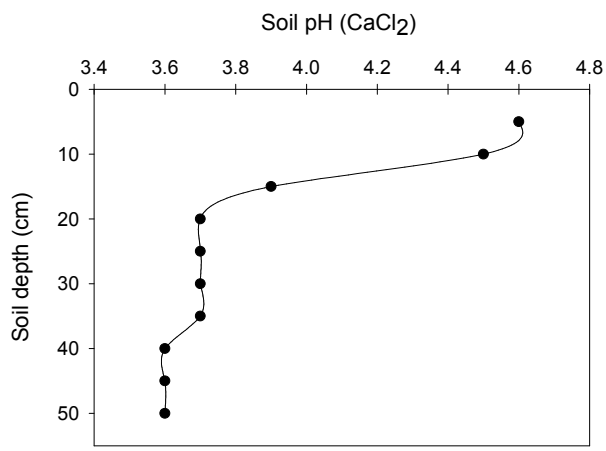

Figure 1: Soil pH of the untreated soil sampled 7/11/07.

Crop responses on the limed seams were clearly visible with distinct lines of improved crop growth. Harvest index cuts were taken to assess growth and yield improvements and yield components (Table 1). Deep placed lime to 31cm had 20% higher grain yield and deep placed lime to 51cm (in two passes) had 40% higher grain yield compared with their corresponding deep ripped but not limed treatments (Table 1). This improved yield was a result of increases in the number and weight of grain in each head. The number of heads was not affected.

Deep placed lime to 51cm increased machine harvest grain yield by 44% (180 kg/ha) compared with the ripped to 51cm only treatment (Table 2). Deep placement of lime to 31cm and deep ripping of surface applied lime gave no additional yield benefit over lime applied to the surface without deep ripping. There was no residual benefit from deep ripping compared with the unripped control.

Table 1: Shoot and grain yield and yield components taken from hand cuts.

Treatment	Shoot weight (kg/ha)	Grain weight (kg/ha)	Harvest Index	1000 grain weight (g)	No. of heads/ m^2	No. of grains/ m^2	No. of grains/ head	Weight of grain/ head
Control (no deep ripping, no lime)	1160	512	0.44	31.3	121	1633	13.7	0.43
Lime applied to the surface at 2.5 t/ha	1262	559	0.44	31.1	126	1794	14.3	0.44
Lime applied to the surface at 2.5 t/ha then deep ripped to 310mm	1301	571	0.44	31.3	124	1836	14.8	0.46
Deep ripping to 310mm	1133	510	0.45	30.9	119	1653	14.0	0.43
Deep ripping to 310mm + deep placed lime at 2.5 t/ha	1304	610	0.47	32.7	122	1871	15.5	0.51
Deep ripping to 510mm in two passes	1128	493	0.44	30.2	110	1622	15.1	0.46
Deep ripping to 510mm in two passes + deep placed lime at 2.5 t/ha each pass (5 t/ha total)	1531	687	0.45	33.4	119	2052	17.3	0.58
LSD (0.05)	175	86	n.s.	1.9	n.s.	225	2.1	0.07

ECONOMIC ANALYSIS

The deep placed lime treatments were the only treatments to substantially increase yield and gross margin with benefits of $25 for the deep placed lime to 31cm and $61/ha when the profile was limed to 51 cm (Table 2). The treatment costs for this trial were incurred in 2005 so they haven't been included in the 2007 season gross margin calculations. We estimate that the costs for deep banding 2.5 t/ha of lime to 30 cm is $150-200/ha and the cost of deep banding 5 t/ha of lime to 50cm to be of the order of $300-350/ha. These estimates are contract rates for deep ripping and a lime cost of $27.50/t delivered and include estimates of fuel, maintenance and labour costs determined from Bankwest benchmarks.

Table 2: Grain yield and grain quality of wheat from machine harvest and gross margin.

Treatment	Yield (t/ha)	Protein (%)	Screenings (%)	Grade	Gross Return	Variable Costs	Gross Margin
Control (no deep ripping, no lime)	0.42	14.0	2.9	ASW	152	70	83
Lime applied to the surface at 2.5 t/ha	0.44	14.4	3.0	ASW	159	70	90
Lime applied to the surface at 2.5 t/ha then deep ripped to 310mm	0.44	14.1	2.6	ASW	159	70	90
Deep ripping to 310mm	0.39	14.0	3.2	ASW	141	70	72
Deep ripping to 310mm + deep placed lime at 2.5 t/ha	0.49	13.5	1.9	ASW	177	70	108
Deep ripping to 510mm in two passes	0.41	13.6	3.1	ASW	148	70	79
Deep ripping to 510mm in two passes + deep placed lime at 2.5 t/ha each pass (5 t/ha total)	0.59	13.1	2.1	ASW	214	70	144
LSD (0.05)	0.05	0.3	0.8				

Based on EPR for 10/01/08 ASW Base Price $414/tonne.

COMMENTS

Deep placed lime can improve yields on acidic soils in a very dry season but significant yield increases were only achieved when lime was placed directly into the subsoil to depths of 31 or 51cm. Higher grain number per head indicates that the yield benefit was derived from better water and nitrogen availability early when grain number was being set but not early enough to improve the number of heads. Grain yield was strongly correlated with total shoot yield with both increasing with the deep lime-placement treatments resulting in no change in the harvest index. Larger yield improvements may have been achieved had narrower tyne spacings been used when incorporating the lime given that distinct lines of improved crop growth and yield were observed at the 45cm tyne spacing. Deep placed lime improved yields of wheat by 18% for both liming depths in 2005, the year the trial was established, and by 44% in 2007 for the lime placed to 51cm. Deep placed lime in a trial at Bodallin has increased the yield of 4 cereal crops grown over 6 seasons. Cereal yields in the Bodallin trial were increased by 16% in the first year and by 30% or more in subsequent cereal crops. Despite the high estimated cost of establishing the deep-placed lime treatments they are likely to be profitable over the medium term as it is anticipated that additional cereal crop yield increases will be seen in future seasons. Crop yield responses from deep placed lime have been recorded in either the year of application or 1-2 years after application. Generally, responses to surface applied lime take several years to develop as the surface applied lime takes a number of years to treat subsurface acidity.

ACKNOWLEDGEMENTS

Ben Parkin (formerly Liebe Group), Emma Glasfurd (Liebe Project Coordinator) for their assistance with the trial work. Colin Bryant for being willing to host the trial. Adam Clune and Breanne Best (DAFWA) for technical assistance. The financial support of the Grains Research and Development Corporation is acknowledged.

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VARIABLE RATE APPLICATIONS OF NUTRIENTS

Emma Glasfurd, Project Coordinator, Liebe Group

AIM

To determine the effects of Variable Rate Technology (VRT) through variable nutrient management across high, medium and low performing soil types, and also the effects of seeding rate across these soil types.

BACKGROUND

This trial is an on-farm demonstration for the Liebe Group's GRDC funded adoption project '**Growers critically analysing new technologies for improved farming systems**'. The site was selected by the farmer as it was a large paddock with even variation of soil types across the paddock, which defined the zones trialed. The zones include Good soil (1) which is a shallow loam over gravel, Poor Soil which is a very shallow sand over gravel, Medium Soil which is a deeper loam over sand and Good Soil (2) which is a heavy clay over sand.

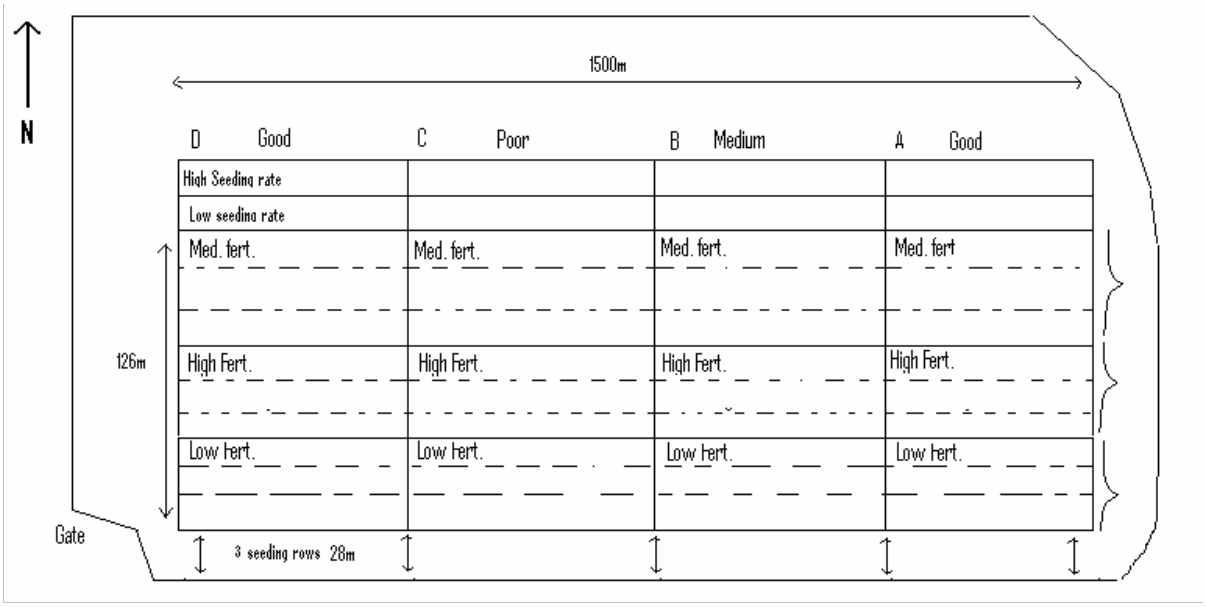
VRT is a precision agriculture management strategy which utilises variable rates of inputs to 'better match' soil variability to agronomy. The benefits of VRT applied in collaboration with other precision agriculture technologies have been evaluated by Robertson *et al.* (2007). VRT is however, a seemingly controversial subject in current agricultural systems.

The trial aims to test how adjusting fertiliser levels to match yield potential as determined by soil type affects the final yield and gross margin of a wheat crop.

TRIAL DETAILS

Property	Lance and Robyn Kennedy, Miling
Plot size & replication	375m x 13m x 3 replicates
Soil types	As above
Sowing date	16/6/07
Seeding rate	High 85 kg/ha, Medium 65 kg/ha, Low 45 kg/ha, Bonnie Rock @ 10 inch spacing
Fertiliser (kg/ha)	Compound Potassium and Phosphorus granular fertiliser rates: High 80 kg/ha, medium 60 kg/ha and low 0 kg/ha. UAN liquid fertiliser rates: High 50-60 kg/ha, medium 40 kg/ha and low 10-20 kg/ha
Paddock rotation	2002-2007 = Wheat
Herbicides	16/6/07: 2.3 L/ha Duet 16/6/07: 10 g/ha Glean PSPE: 700 mL/ha Roundup Powermax PSPE: 250 mL/ha Ester POST: 600 mL/ha MCPA LVE
Growing Season Rainfall	127mm

TRIAL DESIGN



NB. From left to right, 'Good' represents good soil type (1, shallow loam over gravel), Poor represents poor soil (very shallow sand over gravel), Medium represents medium soil (deeper loam over sand) and Good represents Good Soil (2 is heavy clay over sand). Each treatment is 375m long and has 3 replicates (indicated by the staggered lines within each box).

RESULTS

Results obtained from this demonstration represent how variable rate can influence a crop in a below average season. Adjusting fertiliser levels to yield potential as determined by soil type affects the final yield and gross margin of a wheat crop, this influence has been evaluated through the following results.

The highest yielding treatment was the deep loam over sand (medium soil) with applications of fertiliser at 60 kg/ha compound fertiliser and 40 kg/ha UAN liquid fertiliser (medium application) (Figure 1 and Table 1). This same treatment also obtained the highest gross margin of all treatments (Table 1). Low fertiliser on the shallow gravel over sand (poor soil) was the lowest yielding (Figure 1). However, the high fertiliser on the poor soil obtained the lowest gross margin (Table 1).

The high fertiliser application obtained the lowest gross margin of all treatments (Table 1).

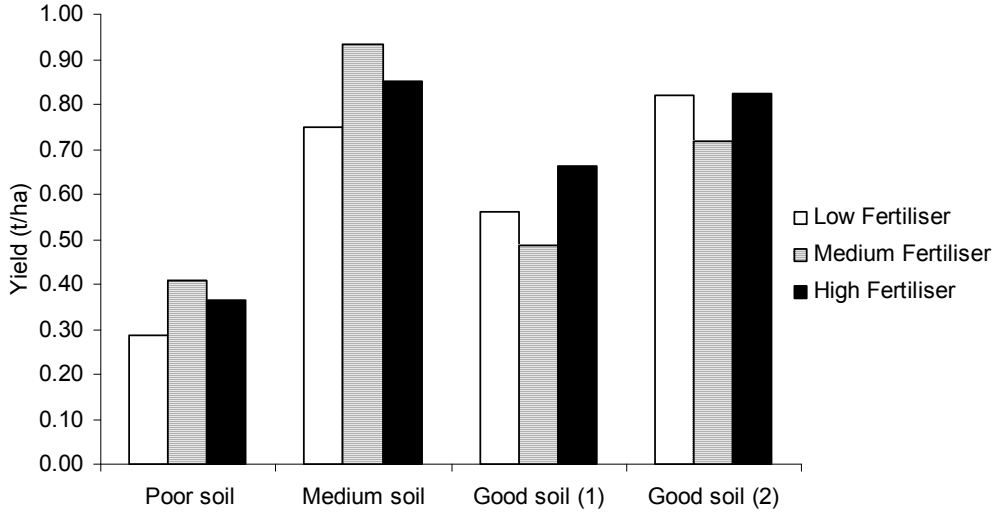


Figure 1: Yield comparisons between high, low and medium fertiliser rates for good, poor and medium soil types examined within the demonstration trial (LSD 5% 0.0757).

Table 1: Yield, quality and gross margins for Bonnie Rock wheat sown on 16/6/2007 for variable fertiliser rate across variable soil types.

Soil Type	Fertiliser	Yield (t/ha)	Protein (%)	Screenings (%)	Hectolitre (g)	Gross Return ($/ha)	Variable Costs ($/ha)	Gross Margin
Good soil (1)	Low Fertiliser	0.56f	11.5	3.30	402.1	237.73	153.96	83.77
Good soil (1)	Medium Fertiliser	0.49g	14.4	6.54	400.1	205.58	191.68	13.9
Good soil (1)	High Fertiliser	0.66e	12.9	5.05	403.8	280.45	253.8	26.65
Poor soil	Low Fertiliser	0.29i	11.0	9.64	393.0	120.56	153.96	-33.4
Poor soil	Medium Fertiliser	0.41h	11.2	7.12	402.8	171.74	191.68	-19.94
Poor soil	High Fertiliser	0.36h	11.3	8.70	384.7	153.55	253.8	-100.25
Medium soil	Low Fertiliser	0.75d	11.5	4.27	414.0	315.98	153.96	162.02
Medium soil	Medium Fertiliser	0.93a	11.7	3.23	408.0	394.24	191.68	202.56
Medium soil	High Fertiliser	0.85b	12.4	7.41	404.8	359.13	253.8	105.33
Good soil (2)	Low Fertiliser	0.82bc	13.0	3.72	408.5	347.28	153.96	193.32
Good soil (2)	Medium Fertiliser	0.72de	12.4	7.72	403.7	303.29	191.68	111.61
Good soil (2)	High Fertiliser	0.82bc	14.3	5.38	403.2	348.55	253.8	94.75
LSD (5%)	0.0757							
LSD (5%) Fertiliser	0.0378							
LSD (5%) Soil Type	0.0437							

Means followed by same letter do not significantly differ.
Based on EPR for 27/12/2007 APW Base Price $423/tonne

Assuming all soil types within the paddock occupy 25% of the area for the paddock, by applying the 'best package' (highest gross margin) to each soil type versus just applying a medium rate of fertiliser to the whole paddock, the gross margin would be $38/ha more than applying a medium fertiliser rate across the whole paddock. In addition, applying a low fertiliser rate to the poor soil, medium rate to the medium soil and high rate to the two good soils versus just applying a medium rate of fertiliser to the whole paddock results in a gross margin of $4.4/ha less than only applying the medium fertiliser rate (Table 1).

The results comparing seeding rates (Table 2) show only slight differences. These treatments were implemented without replicates as representations of potential results for the growers own interest. The low seeding rate obtained the highest yield, however this is most likely related to the limited plant available water applicable to the season. Gross margins were much greater for the low seeding rate in comparison to the medium and high seeding rates.

Table 2: Yield, quality and gross margins for Bonnie Rock wheat sown on 16/6/2007 for variable seeding rates across all soil types.

Seeding Rate	Soil Type	Yield (t/ha)	Protein (%)	Screenings (%)	Hectolitre (g)	Gross Return ($/ha)	Variable Costs ($/ha)	Gross Margin
High	Good (1)&(2), Medium, Low	0.75	11.9	5.33	400.9	368.16	153.13	215.03
Medium	Good (1)&(2), Medium, Low	0.64	12.4	5.63	403.6	316.827	229.53	87.30
Low	Good (1)&(2), Medium, Low	0.89	11.8	4.47	411.2	268.71	191.33	77.38

Based on EPR for 27/12/2007 APW Base Price $423/tonne

COMMENTS

An analysis of the soils PAWC needs to be conducted to determine yield potential of the soils types analysed to draw meaningful conclusions from these results.

There are no solutions to ameliorate shallow soils and it is not economically viable to do so. It is therefore important to manage these zones accordingly to obtain the best possible gross margin on these particular zones. In this case it was applications of medium fertiliser rates applied to the poor soil types which achieved the greatest gross margins.

There are trends or small increases in profit that suggest that zone management may have merits, however the 2007 season may have prevented the treatments applied in this demonstration from achieving their full response.

ACKNOWLEDGEMENTS

Liebe Group would like to acknowledge GRDC for funding the project. Thanks also to Lance and Robyn Kennedy for hosting the trial site and assistance with seeding, harvesting and implementing the trial.

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BEST TM21 FERTILISER TRIAL

Stuart McAlpine, Area Manager, BEST

AIM

The experience from trial work with TM21 in Canada and Vietnam has been that farmers have been able to reduce some of their inputs as well as maintain or increase their yield. BEST Australia set up a long-term trial at the Liebe Group Long Term Trial Site (LTRS) comparing fertiliser rates at three different input levels. This trial will continue over the next few years. During that time, BEST will be evaluating the trial at LTRS to show that fertiliser efficiency increases by using TM21 in Australia.

BACKGROUND

TM21 is a biostimulant that feeds and increases the population of beneficial micro-organisms in the soil. BEST believes that some of the farming practices used in the past and some practices that farmers are presently doing, though necessary to stay profitable, are destroying the soil structure and the soil microbial life. Examples include:

- Tilling the soil
- Deep ripping
- Compaction
- Fungicide use
- Insecticide use
- Chemical use
- Fertiliser use
- Crop rotation

BEST believe that once segments of the micro-life family are lost, many other microbes shut down; as they need each other to exist. They will stay dormant until the right conditions in the soil reappear. When an entire microbe community is re-established by repopulating the soil, numerous benefits are brought back to the soil and to the plants that grow in it. BEST advises that, due to current farming practices, TM21 needs to be applied every year. TM21 is showing benefits in early use of this product in Australia.

TRIAL DETAILS

Property	Liebe Group Long Term Research Site, west Buntine
Plot size & replication	20m x 2.1m x 4 replications
Soil type	Sandy loam
Sowing date	21/6/07
Seeding rate	75 kg/ha Tammarin Rock Wheat
Fertiliser (kg/ha)	21/6/07: 60 kg/ha Urea
Paddock rotation	2002 = Wheat, 2003 = Lupins, 2004 = Wheat, 2005 = Wheat, 2006 = Lupins
Herbicides	21/6/07: 2 L/ha Roundup Powermax 21/6/07: 1.6 L/ha Trifluralin 21/6/07: 35 g/ha Logran 21/6/07: 1 L/ha Chlorpyrifos
Growing Season Rainfall	130mm

RESULTS

Table 1: Treatment Details & Yield Results

No	Treatment	Rate	Timing	Yield
1	MAPSZC Plus	60 kg/ha	banded at seeding	0.70
2	MAPSZC Plus	80 kg/ha	banded at seeding	0.81
3	MAPSZC Plus	100 kg/ha	banded at seeding	0.69
4	CFF MAPSZC Plus CFF	250 mL/100 kg 60 kg/ha 250 mL/ha	on seed banded at seeding Z13	0.74
5	CFF MAPSZC Plus CFF	250 mL/100 kg 80 kg/ha 250 mL/ha	on seed banded at seeding Z13	0.81
6	CFF MAPSZC Plus CFF	250 mL/100 kg 100 kg/ha 250 mL/ha	on seed banded at seeding Z13	0.84
	LSD (P=0.05) **CV**			**NSD** **19.08**

COMMENTS

The 2007 growing season was extremely dry and proved extremely difficult for trials. BEST looks forward to seeing the trial evolve over the next few years.

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CUSTOMER FORMULATED FERTILISER (CFF) DEMONSTRATION TRIALS

Emma Glasfurd, Project Coordinator, Liebe Group

Grains Research & Development Corporation

LiEBE GROUP Working together in Agriculture

AIM

The purpose of this trial is to determine if there are benefits from applications of a biological based product developed by Basic Environmental Systems and Technology (B.E.S.T) namely 'Customer Formulated Fertiliser' (CFF).

BACKGROUND

This trial is an on-farm demonstration for the Liebe Group's GRDC funded adoption project '**Growers critically analysing new technologies for improved farming systems**'. The site was selected by the farmer as it was reasonably flat with a consistent poor soil type.

The amount of organic matter in a soil (measured as organic carbon) is often used as an indicator of the potential sustainability of a system. Soil organic matter plays a key role in nutrient cycling and can help improve soil structure (Pluske *et al*, 2007).

Carbon makes up approximately 50% and nitrogen 0.5 to 10% (dependent on residue type) of the molecules in organic matter; some of which turns over rapidly (labile fraction) and is available to plants, whilst other more recalcitrant forms contribute to the stable (passive, slow turnover fractions) organic matter pools (Pluske *et al*, 2007).

Although significant amounts of organic carbon are present in soils, some of this is relatively inert. Soil organic matter is made up of different pools which vary in their turnover time or rate of decomposition. The labile pool which turns over relatively rapidly (< 5 years), results from the addition of fresh residues such as plant roots and living organisms, whilst resistant residues which are physically or chemically protected are slower to turn over (20-40 years). The protected humus and charcoal components make up the stable soil organic matter pool which can take hundreds to thousands of years to turnover (Murphy *et al,* 2007).

Soil microorganisms mineralise organic matter to obtain carbon, nitrogen and other nutrients for their own metabolism and growth (Murphy *et al,* 2007). Management practices influence microbial activity by altering carbon availability and conditions reflecting rapid changes in the biological function of the soil (Murphy *et al,* 2007).

Microbial activity is measured by carbon dioxide evolution and reflects a range of biological processes in the soil. This is dependent on soil moisture, temperature and labile carbon (Murphy *et al,* 2007).

The application of suitable food substrates (carbon) and/or introduction of beneficial microorganisms to soils is largely untested but provides an opportunity to identify alternate strategies to enhance crop production and possibly contribute to longer term soil health.

Customer Formulated Fertiliser (CFF) is a product developed by Basic Environmental Systems and Technology (B.E.S.T). BEST describe CFF is a 'biostimulant' which they claim aims to feed and increase the population of beneficial micro organisms in the soil.

TRIAL 1 DETAILS

Property	Colin and Ruth Cail, east Wubin
Plot size & replication	330m x 3 replications
Soil type	Sandy loam
Sowing date	29/6/07
Seeding rate	60 kg/ha Wyalkatchem
Fertiliser (kg/ha)	29/6/07: 60 kg/ha AgflowCZ Moly (75%) + Sulphate of Potash (25%) blend 8/8/07: 10 L/ha Flexi N
Paddock rotation	2005 = Wheat, 2006 = Pasture
Herbicides	28/6/07 1.2 L/ha Treflan, 30 g/ha Logran, 1 L/ha Sprayseed 8/8/07 550 mL/ha MCPA, 167g/ha Diuron, 5 g/ha Glean
Growing Season Rainfall	100mm

RESULTS

Table 1: Yield, quality and gross margins of Wyalkatchem wheat sown with and without CFF in 2007.

Variety	Yield (t/ha)	Protein (%)	Screenings (%)	Weight (g)	Gross Return ($/ha)	Variable Costs ($/ha)	Gross Margin ($/ha)
Control	0.385	12.03	5.69	416.2	162.85	120.1	42.75
CFF	0.359	12.33	6.95	411.7	151.86	170.1	-18.24
LSD (5%)	0.063	0.346					

Based on EPR for 27/12/2007 APW Base Price $423/tonne

There are no significant differences in yields between the control (no CFF applications) and the CFF plots (Table 1).

TRIAL 2 DETAILS

Property	Colin and Ruth Cail, east Wubin
Plot size & replication	330m x 3 replications
Soil type	Wodjil (Highly acidic sandy soil)
Sowing date	29/6/2007
Seeding rate	60 kg/ha Wyalkatchem
Fertiliser (kg/ha)	29/6/07 60 kg/ha Agflow CZ Moly (75%) + Sulphate of Potash (25%) blend 8/8/07 10 L/ha Flexi N
Paddock rotation	2005 = Wheat, 2006 = pasture
Herbicides	28/6/2007 1.5 L/ha Treflan, 30 g/ha Logran, 1 L/ha Sprayseed, 8/8/07 550 mL/ha MCPA 500, 167 g/ha Diuron 900, 5 g/ha Glean
Growing Season Rainfall	100mm

RESULTS

Table 1: Yield, quality and gross margins of Wyalkatchem wheat sown with and without CFF in 2007.

Variety	Yield (t/ha)	Protein (%)	Screenings (%)	Weight (g)	Gross Return ($/ha)	Variable Costs ($/ha)	Gross Margin ($/ha)
Control	0.388	13.7	5.31	410.9	164.1	120.1	44.0
CFF	0.344	14.1	5.25	412.2	145.5	170.1	-24.8
LSD (5%)	0.826						

Based on EPR for 27/12/2007 APW Base Price $423/tonne

There are no significant differences in yields between the control (no CFF applications) and the CFF plots on a wodjil soil type (Table 1).

The trials will be run again in 2008 to further investigate any potential yield differences between growing a crop with and without applications of CFF.

ACKNOWLEDGEMENTS

The Liebe Group would like to acknowledge GRDC for funding the project. Thanks also to Colin and Ruth Cail for hosting the trial site and assistance with seeding, harvesting and implementing the trial.

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CUSTOMER FORMULATED FERTILISER DEMONSTRATION TRIAL

Chris O'Callaghan, Research & Development Co-ordinator, Liebe Group

AIM

The purpose of this trial is to determine if there are benefits from applications of a biological based product developed by Basic Environmental Systems and Technology (B.E.S.T) namely 'Customer Formulated Fertiliser' (CFF).

BACKGROUND

The amount of organic matter in a soil (measured as organic carbon) is often used as an indicator of the potential sustainability of a system. Soil organic matter plays a key role in nutrient cycling and can help improve soil structure (Pluske *et al*, 2007).

Carbon makes up approximately 50% and nitrogen 0.5 to 10% (dependent on residue type) of the molecules in organic matter; some of which turns over rapidly (labile fraction) and is available to plants, whilst other more recalcitrant forms contribute to the stable (passive, slow turnover fractions) organic matter pools (Pluske *et al*, 2007).

Although significant amounts of organic carbon are present in soils, some of this is relatively inert. Soil organic matter is made up of different pools which vary in their turnover time or rate of decomposition. The labile pool which turns over relatively rapidly (< 5 years), results from the addition of fresh residues such as plant roots and living organisms, whilst resistant residues which are physically or chemically protected are slower to turn over (20-40 years). The protected humus and charcoal components make up the stable soil organic matter pool which can take hundreds to thousands of years to turnover (Murphy *et al,* 2007).

Soil microorganisms mineralise organic matter to obtain carbon, nitrogen and other nutrients for their own metabolism and growth (Murphy *et al,* 2007). Management practices influence microbial activity by altering carbon availability and conditions reflecting rapid changes in the biological function of the soil (Murphy *et al,* 2007).

Microbial activity is measured by carbon dioxide evolution and reflects a range of biological processes in the soil. This is dependent on soil moisture, temperature and labile carbon (Murphy *et al,* 2007).

The application of suitable food substrates (carbon) and/or introduction of beneficial microorganisms to soils is largely untested but provides an opportunity to identify alternate strategies to enhance crop production and possibly contribute to longer term soil health.

Customer Formulated Fertiliser (CFF) is a product developed by Basic Environmental Systems and Technology (B.E.S.T). BEST describe CFF as a 'biostimulant' which they claim aims to feed and increase the population of beneficial micro organisms in the soil.

TRIAL DETAILS

Property	Stuart & Leanne McAlpine, west Buntine
Plot size & replication	200m x 12m x 5 replications
Soil type	Sandy loam
Sowing date	3/7/07
Seeding rate	60 kg/ha Wyalkatchem
Fertiliser (kg/ha)	3/7/07: 50 kg/ha Macropro plus 3/7/07: 250 mL/ha BEST CFF on Seed (only on non-control plots) 8/8/07: 250 mL/ha BEST CFF as Foliar Spray (only on non-control plots)
Paddock rotation	2005 = Lupins, 2006 = Wheat
Herbicides	3/7/07: 0.8 L/ha Glyphosate, 1.1 L/ha Triflur X, 0.3 kg/ha Diuron, 25 mL/ha Hammer 8/8/07: 350 mL/ha LVE MCPA, 350 mL/ha Tigrex
Growing Season Rainfall	127mm

REP 1		REP 2		REP 3		REP 4		REP 5	
BEST CFF	CONT.	BEST CFF	CONT.	BEST CFF	CONT.	BEST CFF	CONT.	BEST CFF	CONT.

Figure 1: Trial Layout indicating position Customer Formulated Fertiliser and control treatments at West Buntine.

RESULTS

Table 1: Yield, quality and gross margin of Wyalkatchem wheat grown with and without the application of TM21 (Customer Formulated fertilizer).

Treatment	Yield (t/ha)	Protein (%)	Screenings (%)	Weight (g)	Gross Return ($/ha)	Variable Costs ($/ha)	Gross Margin ($/ha)
Control	0.46	13.12	1.99	408.36	194.58	119.11	75.47
BEST CFF	0.55	13.2	1.65	409.22	232.62	144.11	88.51
LSD (P=0.05)	n.s						

Based on EPR for 20/12/07 APW Base Price $423/tonne. Variable cost obtained from Farm Budget Guide (*Farm Weekly*).

COMMENTS

There was no statistically significant difference between the control and the CFF treated plots (Table 1). Through visual observation it was noted that radish numbers and Rhizoctonia incidence was lower in the CFF treatment plots, however further studies need to be conducted in this area to accurately determine the effect of CFF on disease and weed levels.

The average yields were used in the economic analysis and at these yield levels it proved $13/ha more beneficial applying 2 applications of CFF at $12.50 per application (Table 1). It must be noted however there was high variation between replicates and future demonstrations will need a radomised plot design.

The dry conditions experienced in 2007 impacted on this demonstration which indicated a need for further research into the effectiveness of this product in a more favourable season.

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UNDERSTANDING POOR PERFORMING PATCHES IN PADDOCKS

Chris O'Callaghan, R&D Co-ordinator, Liebe Group & Roger Lawes, Research Scientist, CSIRO

Australian Government
Department of Agriculture, Fisheries and Forestry
National Landcare Program

AIM

To identify consistently poor performing zones in paddocks of 6 local farmers, reasons for their poor performance and generate management plans for these zones.

BACKGROUND

Throughout the Northern Agricultural Region there are approximately 160 thousand ha of soil with acidic topsoil (pH <4.5), 70 thousand ha of soil with acidic subsoil with another 1.9 million ha at risk of sub-surface acidity, 1.7 million ha of soils with high susceptibility to compaction and 1.4 million ha of land at risk of becoming saline.

When cropped, these low production areas are prone to soil erosion and weed infestation, as the crops do not establish well and have poor root development. They are unable to provide soil cover or compete with weeds and these limitations translate into poor yields and poor water use efficiency.

The Liebe Group has received National Landcare Program (NLP) funding to carry out a new project which is targeted at these particular areas of a paddock. The project, '**Increase profitability and sustainability by managing soil type variability within farm'** is being conducted in collaboration with CSIRO and has engaged 6 local farmers to work with.

Many farmers are now using yield monitoring equipment, attached to grain harvesters. Yield maps have been produced using commercial software and these maps help identify portions of the paddock that perform well and portions that perform poorly. Some portions of the paddock consistently yield poorly, while some regions yield well in one season but poorly in another. CSIRO Scientists have developed a method to interpret multiple yield maps in a paddock to determine what type of 'problem soil' a paddock has.

The Liebe Group, in conjunction with CSIRO have processed yield maps from 6 farms to help identify consistently poor regions and regions that are poor in some years but not in others. We briefly summarised the problem regions identified by classifiying 39 paddocks from Ian Hyde's property. We have provided more detailed descriptions of the high and low yielding regions in two paddocks where soil was sampled to a depth of 70cm.

TRIAL DETAILS

Property	Ian Hyde, Dalwallinu
Soil types	Consistently Poor: Gravelly sands, deep white & grey sand Occasionally Good: Heavier red & grey clays Consistently Good: Red loam, sandy loam, deep yellow sands, duplex sand over clay
Average Rainfall	358mm

RESULTS

In general, poor performing patches matched farmer knowledge and were associated with clear differences in soil type. Consistently poor performing regions of the paddock either had gravel present on the surface or a gravel layer very close to the surface. Other poor performing regions had Aluminium present at depth and extremely low pH (3.9). Deep white – grey sands also performed poorly.

Some regions performed well occasionally. Typically, these regions were heavier soils, and included red and grey clays, often with poor structure. The grey clay had a tendency to seal over and suffer from

poor water infiltration. In addition, a valley floor had tendency to become frosted, but, when conditions suited, had the capacity to produce high yielding crops.

The higher yielding regions were generally the red loams, sandy loams, duplex sand over clays or deep yellow sands. By definition these soils would have reasonable water infiltration, and in the case of the red loams, sandy loams and duplex soils a capacity to store soil moisture. These robust high performing soils should be monitored closely for pH, compaction and weeds to ensure they remain productive.

Case Study 1 - Paddock D6

Wheat crop in 2006, fallowed in 2007, sowing aborted due to late start.

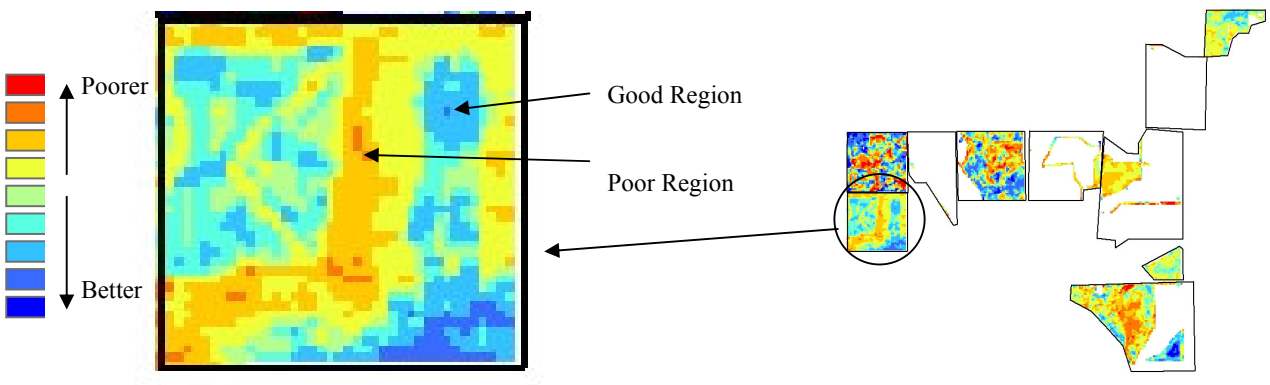

Figure 1: Analysis of 5 years yield mapping indicating different zones of yield performance in Paddock D6 on Hyde's property, Dalwallinu.

Poor Region – Site Description

Top slope, with evidence of surface crusting, cracking, slumping, poor infiltration and calcareous deposits on the surface. There is little cover, as the paddock had been fallowed and grazed. There were no weed problems. Generally produces good biomass, but can run out of moisture at the end of the season and the crop will hay off as a result.

Table 1: Soil profile descriptions for a poor region in paddock D6 on Hyde's property, Dalwallinu.

Depth (cm)	Classification	Description	pH (H_20)
0-10	light medium clay	reddish brown	8.1
10-25	light clay	reddish brown	8.4
25-40	light clay	reddish brown10% calcareous deposits and white mottling	8.4
40-50	clay loam	20% calcareous deposits and white mottling	8.6

Good Region – Site Description

There is slight cracking and crusting on the surface, but no slumping of the furrows. No evidence of a hardpan.

Table 2: Soil profile descriptions for a good region in paddock D6 on Hyde's property, Dalwallinu.

Depth (cm)	Classification	Description	pH (H_20)
0-10	loam to clay loam	reddish brown	8.4
10-20	silty clay loam	reddish brown	8.4
20-40	clay	reddish brown	8.4
40-60	light medium clay	reddish brown, 5% white mottling	9.0

Paddock D6 Summary

The pH at depth may reduce root penetration and restrict yield in dry finishes. The good region could still fail to finish. However water infiltration in the better region is superior to the poor region. The poor region requires gypsum and organic matter to improve soil structure.

Case Study 2 - Paddock D5

Wheat crop in 2007, 40 kg N + 65 kg DAP at sowing.

Poor Region – Site Description

A poor performing part of the paddock that suffers from water-logging in a wet year.
The stubble had been grazed and there were low levels (< 1 t/ha) of cover. Low levels of cover were a result of the poor crop, not overgrazing.
There was no evidence of a weed or compaction problems.
The surface had crusted, there was clodding and some erosion.
Tilled furrows had flattened, indicating a breakdown in soil structure.
The surface appeared to be a cracking clay.

Table 3: Soil profile descriptions for a poor region in paddock D5 on Hyde's property, Dalwallinu.

Depth (cm)	Classification	Description	pH (h_20)
0-10	sandy clay loam	dark brown	5.5
10-30	graduated sandy loam	grey brown	5.9
30-50	clay loam	yellow, 10% gravel	5.2
50-70	light clay	yellow brown, no gravel	5.1

Good Region – Site Description

A high yielding part of the paddock near the bottom of a gully that accumulates water.
There was no evidence of crusting, rocks or erosion on the surface. It appeared to be a good friable soil with good water infiltration. There was significantly more cover than the poor site. Even so, it was still low, in the order of 2 t/ha.
There was no evidence of weed or compaction problems.

Table 4: Soil profile descriptions for a good region in paddock D5 on Hyde's property, Dalwallinu.

Depth (cm)	Classification	Description	pH (H_20)
0-10	sand	grey brown	6.7
10-30	sandy clay loam	red brown, good structure	7.0
30 +	clay loam		7.0

Paddock D5 Summary

The poor region is highly acidic at depth. pH in water is generally 0.5 units higher than the equivalent in $CaCl_2$. In addition the soil had poor structure and water infiltration is poor. The poor region in this paddock would need continued applications of lime, gypsum and organic matter to ensure pH does not get worse, and soil structure improves. It will be difficult to correct the low pH at depth with surface applications of lime. If there were large areas of this soil type in a paddock, alternative options, other than cropping may need to be considered.

CONCLUSION

By identifying consistently poor performing regions of paddocks then decisions can be made about future management practices. These areas, through poor crop growth, may be contributing to other problems such as salinity through poor water use efficency, wind erosion through lack of cover and increased weed burden through reduced competition. If these kinds of problems are occurring then, alternative land uses could be explored.

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YIELD PROPHET SIMULATIONS FOR WHEAT PRACTICE FOR PROFIT TRIAL

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Australian Government
Department of Agriculture, Fisheries and Forestry
National Landcare Program

AIM

To determine the effectiveness of the yield forecasting tool Yield Prophet (A commercialised version of Agricultural Production Systems Simulator (APSIM)) in predicting wheat yields for different varieties and input treatments in the Liebe Group Wheat Practice for Profit trial.

BACKGROUND

The aim of this project is to assess the benefits of the yield prediction tool Yield Prophet to determine whether it can be beneficial to farmers in terms of yield prediction and if so can it be used as a future tool to help with seeding and nutrition application decision making.

Yield Prophet – is an on-line crop production model designed to provide grain growers with real-time information about the crop during growth. To assist in management decisions, growers enter inputs at any time during the season to generate reports of projected yield outcomes showing the impact of crop type and variety, sowing time, nitrogen fertiliser and irrigation. Yield Prophet® does not generate recommendations or advice. It uses the computer simulation model APSIM together with paddock specific soil, crop and climate data to generate information about the likely outcomes of farming decisions.

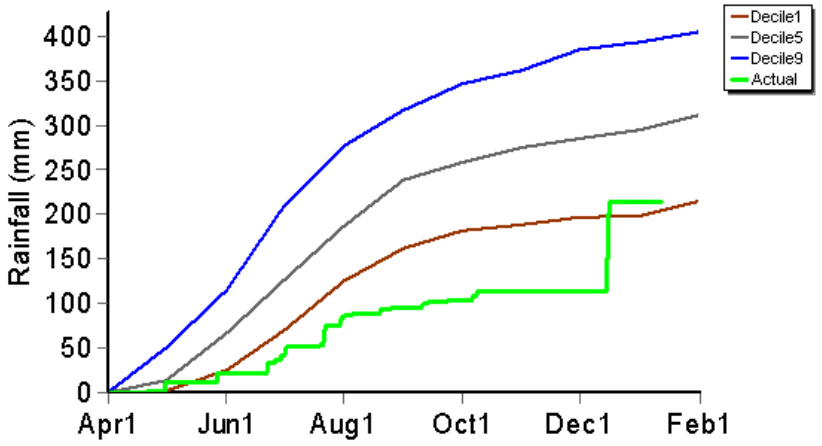

Figure 1: Rainfall received in 2007 in comparison to historical rainfall deciles 1, 5 and 9 for the 2007 Main Trial Site, Xantippe.

TRIAL DETAILS

The Wheat Practice for Profit trial is designed to investigate the yield obtained for different wheat varieties with low, district-average, high and seasonally-active input treatments. Yield Prophet outputs were obtained for this trial in order to assist the R&D Committee with decision making about the seasonally active input treatment. As well as this the Practice for Profit trial is a good test for the accuracy of the yield prediction model.

The Liebe Group did not have the capacity to characterise the Main Trial Site soil type for Yield Prophet therefore a similar previously characterised soil type was used to determine soil parameters. In 2003 Neal Dalgliesh and Peter Carberry of CSIRO, Toowoomba visited WA to initiate 'Soil Matters' workshops throughout the state. At this time six soil types within the region were characterised. Since 2003 many other soil types in the region have been characterised by CSIRO through their GRDC-funded precision agriculture initiative. A previously characterised sandy soil

type soil type was found to be the most similar to the Main Trial Site soil type. The soil parameters from this characterisation were entered into Yield Prophet and used for the yield modelling for the Main Trial Site.

Yield forecasts were recorded from Yield Prophet throughout the growing season and presented in Climate Risk Bulletins for members.

As Yield Prophet only takes into account nitrogen input and water availability the units of nitrogen applied for each input treatment for the Practice for Profit trial in 2007 have been included:
Low: 9 kg/ha
District: 29 kg/ha
High: 73 kg/ha
Active: 30 kg/ha

RESULTS

Table 1: Yields (t/ha) generated throughout the growing season using Decile 1 rainfall finish and the final yield, for each input treatment generated using total growing season rainfall compared to the actual yield for each treatment (L=low, D=district, H=high and SA= seasonally Active) in 2007.

Treatment	Yield Forecast (decile 1) 30th August	Final Prophet Yield	Actual Yield			
			L	D	H	SA
Calingiri	0.3	0.3	0.3	0.4	0.3	0.4
Arrino	0.3	0.4	0.2	0.4	0.2	0.2
Wyalkatchem	0.3	0.4	0.2	0.3	0.2	0.3
Bonnie Rock	0.3	0.4	0.2	0.4	0.4	0.3

COMMENTS

Before conclusions are drawn from these results it is most important to remember that 2007 was a drought year and therefore yield comparisons are being made from a low yield base to begin with. It is the third year that Yield Prophet has been validated on farm in the Liebe region with two of the years being drought years (2006 and 2007). It is also important to remember that the soil type of the site was not specifically characterised. The main purpose was to determine if Yield Prophet is able to simulate yield in a realistic vicinity and to adjust the way the tool is operated, if required, for better yield forecasting in the future.

- The results show that Yield Prophet predicted the overall poor yields that were achieved (02-0.4 t/ha) at the site.
- The variability seen in the actual yields was not statistically significant and therefore was more likely due to variation in measurement, patchy establishment and uneven growth as a result of the poor year.
- When Yield Prophet was run in August with seasonal conditions to date and a range of projected finishes to the season, the average simulated yield was similar to the final actual yield (within 200 kg/ha). This shows that the poor yield for the season was already locked in in August and the impact of the remainder of the season was minimal.
- Poor rainfall seasons do not allow the Yield Prophet tool to be used to it's full potential. Due to the dry season there are fewer input management decisions to be made and therefore some facets of the model including running nitrogen scenarios can not be used.
- Yield Prophet is able to give an estimate of soil nitrogen content throughout the growing season, taking into account starting soil nitrogen, applied nitrogen, mineralization and leaching and nitrogen used by the crop. The trial site soil type had approximately 120 kg/ha of soil nitrate at seeding. This is enough nitrogen to reach well over the yield potential for that soil type for the 2007 growing season rainfall. Due to this high level of nitrogen in the soil there was no significant difference in yield predicted by the model for the different input treatments. There was enough

nitrogen in the soil to achieve maximum yield without the large applications of the district and high input treatments.

- When it came time to assess whether the seasonally active treatment would require extra nitrogen throughout the season the model indicated that there was still enough nitrogen to produce the potential yield and therefore no further nitrogen was applied and topdressing was not justified.

CONCLUSIONS

- Yield Prophet can simulate the extremely low yield achieved in 2007, giving confidence that it can capture the full range of yields possible under a range of seasons, soil types and management.
- Measuring soil nitrogen content before seeding is beneficial as it gives an accurate indication of soil nitrogen content and what is required to reach a target yield. This is extremely important in a dry year.
- Yield Prophet helps track the nitrogen use by the plant during the season and therefore assists with nitrogen application decision making.
- The complexities and ability of Yield Prophet were not highlighted with lack of management options in a dry year and the high starting soil nitrogen.

ACKNOWLEDGEMENTS

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SLENDER ICEPLANT HERBICIDE TRIALS 2007

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Department of Agriculture and Food

AIM

To investigate herbicide control options for Slender Iceplant (*Mesembryanthemum nodiflorum*). The focus is on finding possible herbicide options that may allow for legume and grass pastures between bluebush or saltbush.

BACKGROUND

The topsoil inhabited by slender iceplant is maintained in a saline condition, advantageous for the iceplant, but undesirable for anything else. Slender iceplant has also been found to contain oxalate levels up to 35.78%, which is well above the minimum level of 2% that may cause stock poisoning.

Literature from Israel suggests that slender iceplant produces three sets of seed, which exhibit different levels of dormancy. Slender Iceplant has a staggered germination pattern and may germinate at the break of the season, during the winter months and also again after spring rains.

The spread of slender iceplant has been facilitated by soil disturbance events (e.g. floods in 1999) and our lack of understanding of the biology of iceplant, resulting in inappropriate management practices. It is suspected that if the iceplant could be controlled, then some mild saltland could be allowed to leach of salts and possibly be returned to production. Ultimately if these areas could be returned to cropping, there could be much to gain for the farmer.

TRIAL: HERBICIDE CONTROL OF SLENDER ICEPLANT (*MESEMBRYANTHEMUM NODIFLORUM*) 2007

Property	Damian Ryan, Morawa	Shaun Sparkman, Perenjori	Ian Syme, Buntine
Plot size & replication	3m x 20m x 3 reps	3m x 20m x 3 reps	3m x 20m x 3 reps
Soil type	Red loam over brown hardpan at 20cm & ferruginous layer at 1m	Shallow loam over alluvium basement	Sand over laterite
Soil cover	No cover	Minimal cover, some bell & creeping saltbush	Thick iceplant stubble
Spraying Date	Pre–em 8/6/07 Post–em 28/8/07	Post–em 28/8/07	Pre–em 8/6/07
Paddock Rotation	2006 = Pasture	2006 = Barley	Persistent monoculture
Growing Season Rainfall	83mm	130mm	125mm

RESULTS

Table 1: Percentage slender iceplant control, visually rated on 19/10/2007, for a range of pre-emergent treatments.

Group	Pre-emergent Herbicide Treatments	Morawa (% Iceplant kill)	Buntine (% Iceplant kill)	Cost ($/ha) GST exc.
D	2L Pendimethalin (330 g/L) (Stomp®)	94	88	13.00
C	1L Diuron (500 g/L)	84	90	8.60
C	500ml Diuron (500 g/L)	32	24	4.33
C	200ml Diuron (500 g/L)	2	30	1.73
B	20g Flumetsulam (800 g/kg) (Broadstrike®)	77	5	13.44
B	10g Flumetsulam (800 g/kg) (Broadstrike®)	74	9	6.72
B	5g Flumetsulam (800 g/kg) (Broadstrike®)	52	5	3.36
C	500ml Terbutryn (500 g/L) (Igran®)	26	32	11.00
C	200ml Terbutryn (500 g/L) (Igran®)	0	16	4.40
G	200ml Oxyfluorfen (240 g/L) (Goal®)	81	61	6.60
C	500ml Linuron (500 g/L)	74	45	19.75
C	200ml Linuron (500 g/L)	2	13	7.90

Pre-emergent Trial

- Trials indicate that good pre-emergent iceplant control was achieved with Stomp® at 2 L/ha, diuron at 1 L/ha and Goal® at 200 ml/ha. Goal needs to be trialed further at higher rates.
- Broadstrike® also appeared to have good pre-emergent activity at the Morawa site, which was consistent with results achieved in 2006, where treatments containing 25g Broadstrike® gave 81-99% control.
- Slender iceplant stubble heavily shaded the soil at the Buntine site. With little growing season rainfall, this may be the reason why Broadstrike® had poor activity in Buntine.
- The Stomp® and Goal® treatments were particularly interesting as a number of medics had germinated through them.
- It seems that iceplant control should focus on pre-emergent options, as there are a number of germinations throughout the season.

RESULTS

Table 2: Percentage slender iceplant control, visually rated on 19/10/2007, for a range of post-emergent treatments.

Group	Post-emergent Herbicide Treatments	Morawa (% Iceplant kill)	Perenjori (% Iceplant kill)	Cost ($/ha) GST exc.
D	2L Pendimethalin (330 g/L) (Stomp®)	0	0	13.00
D	1L Pendimethalin (330 g/L) (Stomp®)	0	0	6.50
C	1L Diuron (500 g/L)	12	10	8.60
C	500ml Diuron (500 g/L)	3	3	4.33
C/B	250ml Diuron +25g Flumetsulam (Broadstrike®)	31	11	18.96
B	25g Flumetsulam (800 g/kg) (Broadstrike®)	21	0	16.80
C	800ml Terbutryn (500 g/L) (Igran®)	48	12	17.60
C	400ml Terbutryn (500 g/L) (Igran®)	7	0	8.80
G	500ml Oxyfluorfen (240 g/L) (Goal®)	2	10	16.50
G	250ml Oxyfluorfen (240 g/L) (Goal®)	0	0	8.25
B	7g Metosulam (714 g/kg) (Eclipse®)	0	0	8.33

Post-emergent Trial

- Generally all of the post-emergent treatments performed poorly on slender iceplant in 2007.
- Both trial sites were hot and dry at the time of spraying and only received 10mm rainfall, 2 months after spraying.
- Post-emergent treatments including Igran® at 800 mL/ha and diuron at 1 L/ha performed best, however both are likely to perform better in moist conditions. These treatments killed small iceplants, but only burnt the top leaves of larger plants causing some reduction in biomass.
- Broadstrike® appeared to turn the iceplant leaves a yellow and red colour, suppressing further growth. Due to the dry conditions it is not known if Broadstrike® would have enough activity for post-emergent use.

Herbicide Use in Saltland Pastures

- There are no herbicides registered for use in saltbush, bluebush or other saltland pastures.
- It is important to know the herbicide tolerance of saltbush and bluebush before attempting to control slender iceplant in these situations.
- Dicamba, 2,4-D amine, diuron, atrazine and Igran®, are known to cause severe damage to bluebush. **(See article on "Herbicide Tolerance of Saltland Pastures")**
- Stomp®, Goal® and Broadstrike® appear to be most useful when controlling slender iceplant before it emerges and may allow for volunteer regeneration of legume and grass pastures. These options may have some use in saltland systems, however more work is required.

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HERBICIDE TOLERANCE OF SALTLAND PASTURES

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AIM

To find herbicide options that may be safe to use in saltland pasture systems wherein a farmer can maintain the productive capacity of his saltland by controlling his weeds. Trials also aim to explore weed control options during saltbush germination.

BACKGROUND

One of the major constraints to the widespread adoption of saltbush-based saltland pastures has been the lack of cheap and reliable methods for establishing the plants by seed. Seeding methods have not been revisited until only recently since the 'niche seeder' was developed in the 1970's. By removing bracteoles and priming the seed in water or dilute solutions of plant growth regulators (gibberellic acid, kinetin and salicylic acid), improved saltbush establishment has been demonstrated.

However, the saltbush seed is only small and contains little stored energy, resulting in poor seedling vigor when germinating. Weed competition became a major limitation for the success of the 'niche' seeding technology. Weeds can exacerbate moisture deficiencies, which in an already osmotically challenging (saline) environment, this becomes a more imperative issue.

The lack of agronomic knowledge that allows a farmer to 'farm' his saltland along with his other land types could be limiting whole farm productivity. There are a range of weeds that a farmer may like to control in his saltland. Slender iceplant appears to be one of the most obvious in the Northern Agricultural Region, given it may contribute to poor pasture establishment and some stock poisoning.

If iceplant was to be controlled, it is suspected that some mild saltland could be returned to production or existing saltland production could be improved. Herbicide options exist to control slender iceplant in cereal, lupin and canola crops. However these herbicides do not cater for pasture situations, nor do we know if they are safe to use over saltbush and bluebush.

To improve the establishment and maintain profitable saltland pastures, a range of agronomic tools must be developed.

The purpose of this herbicide tolerance work is three fold, and includes;
a) Developing weed control regimes suitable for establishing bluebush and saltbush by seed.
b) Developing weed control regimes suitable for establishing bluebush and saltbush by seedlings.
c) Developing weed management options for established saltland pasture systems.

TRIAL 1: PRE-EMERGENT HERBICIDE TOLERANCE OF GERMINATING OLDMAN, RIVER SALTBUSH & BLUEBUSH

Site	Site 1	Site 2
Property	Ian Tubby, Gutha	UWA, Greenhouse
Plot size & replication	3m x 6m x 3 reps	13 treatment pots x 4 reps
Soil type	Red-brown loamy earths, over laterite, over granite	Gingin red sand (5% clay)
Oldman (*Atriplex nummularia*) Seed Treatment	Not treated	Bracteoles removed
River (*Atriplex amnicola*) Seed Treatment	Not treated	Bracteoles removed & gibberelic acid
Bluebush (*Maireana brevifolia*) Seed Treatment	Not treated	Bracteoles removed & gibberelic acid (no results)
Spraying & Sowing Date	3/7/07	8/8/07
Paddock Rotation	2006 = Oats	-
Growing Season Rainfall	95mm	-

RESULTS: SITE 1, IAN TUBBY - GUTHA

Table 1: Summary of herbicide effects on germinating oldman saltbush, river saltbush and bluebush, as a percentage of the number of plants germinating in the control plots. Herbicides were ranked in order of least damaging to most damaging.

Group	Herbicide Treatments	Germination							Cost ($/Ha) GST exc.
		Bluebush	Rank 1	Old Man Saltbush (%)	Rank 2	River Saltbush (%)	Rank 3	Rank 1+2+3	
D	2L Pendimethalin (330 g/L) *	77%	1	76	1	84	1	3	13.00
D	1L Trifluralin (480 g/L) *	72%	2	73	2	82	2	4	5.94
J	1kg 2,2-DPA (740 g/kg) *	66%	3	56	4	48	4	11	11.48
D	2L Trifluralin (480 g/L) *	35%	7	51	5	52	3	15	11.88
D	1L Pendimethalin (330 g/L) *	42%	6	40	6	37	5	17	6.50
C	2L Simazine (500 g/L)	34%	8	68	3	29	6	17	11.54
K	500ml S-Metolachlor (960 g/L)	61%	4	36	7	19	7	18	13.47
J	2kg 2,2-DPA (740 g/kg) *	55%	5	15	9	18	8	22	22.96
K	750ml Propyzamide (500 g/L)	15%	9	18	8	16	9	26	33.00
K	1500ml Propyzamide (500 g/L)	4%	10	7	10	5	10	30	66.00
B	25g Flumetsulam (800 g/kg)	3%	11	7	10	0	11	32	16.80
C	15g Chlorsulfuron (750 g/kg)	0%	12	0	12	0	11	35	1.05

* Herbicide treatments incorporated by sowing (IBS)

RESULTS: SITE 2, POT TRIAL – UWA GREENHOUSE

Table 2: Summary of herbicide effects on germinating oldman and river saltbush germination as a percentage of the number of plants germinating in the control pots. Herbicides were ranked in order of least damaging to most damaging.

Group	Herbicide Treatments	Germination					
		Oldman saltbush (%)	Rank 1	River saltbush (%)	Rank 2	Ranks 1 + 2	Cost ($/Ha) GST exc.
J	2,2 DPA (2 kg/ha) (Propon®)	100	1	34	2	3	22.96
J	Oxyfluorfen (250 ml/ha) (Goal®)	56	2	36	1	3	8.25
D	Trifluralin (1L/ha)*	47	4	25	4	8	5.94
D	Oryzalin (2 L/ha) (Surflan®)*	41	6	33	3	9	162.8
D	Oryzalin (1 L/ha) (Surflan®)*	47	3	17	7	10	81.40
J	2,2 DPA (4 kg/ha) (Propon®)	43	5	19	6	11	45.92
G	Oxyfluorfen (500 ml/ha) (Goal®)	31	8	20	5	13	16.50
D	Trifluralin (2 L/ha)*	36	7	9	8	15	11.88
B	Flumetsulam (25 g/ha) (Broadstrike®)	9	10	8	9	19	16.80
D	Pendimethalin (1L/ha) (Stomp®)*	9	9	0	11	20	6.50
K	S-Metolachlor (1L/ha) (Dual Gold®)*	0	11	3	10	21	13.47
K	Propyzamide (1.5 kg/ha) (Kerb®)*	0	11	0	11	22	66.00
D	Pendimethalin (2 L/ha) (Stomp®)*	0	11	0	11	22	13.00

* Herbicide treatments incorporated by sowing (IBS)

TRIAL 2: POST-EMERGENT HERBICIDE TOLERANCE OF SMALL-LEAVED BLUEBUSH (*MAIREANA BREVIFOLIA*)

Property	Ian Tubby, Gutha
Plot size & replication	3m x 40m x 3 reps
Soil type	Red loamy earths over red-brown alluvium hardpan
Spraying Date	28/8/07
Paddock Rotation	Mature bluebush for more than 20yrs
Growing Season Rainfall	95mm

RESULTS

Table 3: Herbicide damage of mature bluebush, as a percentage of biomass reduction, compared to the control plot, visually rated on 19th October 2007.

Grp.	Herbicide Treatments	Common Product Name (e.g.)	% Bluebush Damage	Cost ($/ha)
B	5g Metsulfuron-Methyl (600 g/Kg)	Ally®	3	0.55
B	15g Chlorsulfuron (750 g/Kg)	Glean®	8	1.05
B	25g Triasulfuron (750 g/Kg)	Logran®	8	2.75
B	7g Metosulam (750 g/Kg)	Eclipse®	5	8.33
B	25g Flumetsulam (800 g/Kg)	Broadstrike®	0	16.80
C	1L Atrazine (500 g/L)	Atrazine	70	5.88
C	2L Simazine (500 g/L)	Simazine	36	11.54
C	800ml Terbutryn (500 g/L)	Igran®	60	17.60
C	1L Diuron (500 g/L)	Diuron	95	8.66
D	2L Pendimethalin (330 g/L)	Stomp®	15	13.00
F	250ml Diflufenican (500 g/L)	Brodal®	5	18.00
G	500ml Oxyfluorfen (240 g/L)	Goal®	8	16.50
I	800ml 2,4-D amine (625 g/L)	Amicide®	100	4.67
I	320ml Dicamba (500 g/L)	Kamba®	98	11.54
I	300ml Clopyralid (330 g/L)	Lontrel®	5	16.50

COMMENTS

a) Developing weed control regimes suitable for establishing bluebush and saltbush by seed.

Table 1 and 2 indicate varying trial results between the glasshouse pots and the field situation. Herbicides appeared generally more damaging in the pots compared to similar treatments used in the field. This may be due to low soil clay and organic matter content in the pots and possibly also reduced herbicide activation in the drought affected field.

Overall trial results indicate that Goal®, trifluralin and 2,2-DPA, could possibly be used when germinating oldman and river saltbush. These could be useful for controlling grasses and Goal® would also be useful for controlling slender iceplant. There is reasonable likelihood of developing and registering, pre-emergent grass controlling herbicides in germinating saltbush. Table 1 and 2 has indicated a possible fit for Goal®, trifluralin and 2,2-DPA.

Stomp® at 2 L/ha ranked highest in the field trial and could be useful for controlling ryegrass and slender iceplant, while germinating saltbush. Pot trials indicated that Stomp® at 2 L/ha was actually damaging. Data in Table 1 and 2 represent only one trial, thus none of the herbicides mentioned are recommended, nor are any herbicides registered for this use.

However, the likelihood of finding a single broadleaf, pre-emergent herbicide is slim in this situation. Simazine, Kerb®, Broadstrike® and Glean® were damaging to germinating saltbushes. Common pre-emergent, broadleaf herbicides, are known to be generally damaging to most broadleaf plants, and even in the crops that they are registered. Tolerances to these herbicides is generally a factor of high seed starch reserves, strategic seed placement or escape mechanisms (tap roots). Saltbush seeds are small and must be sown near the surface.

Common annual grasses and agricultural broadleafs (ryegrass, capeweed, medic and double gee) would not be expected to germinate after mid July (assuming an average break). Standard farmer practice of "pasture topping" the paddock at or before flowering in the previous year, followed by one or more knock down applications around the seasons break, remain the best practice.

b) Developing weed control regimes suitable for establishing bluebush and saltbush by seedlings.

Dry seasonal conditions, prevented trials from going ahead on young halophyte seedlings. The results presented in Table 3 are from herbicide treatments over well established, mature bluebush.

Results from Table 3 could indicate that a wide range of broadleaf herbicide options may be used for the planted halophyte seedlings. Stomp® at 2 L/ha would appear promising as a grass and slender iceplant control, as would Goal® up to 500 mL/ha. Broadstrike® at 25 g/ha also appeared to be well tolerated by mature bluebush, however further work is required here.

c) Developing weed management options for established saltland pasture systems.

As mentioned above, a wide range of herbicide options may exist for safe use on mature halophyte forage shrubs. From only one trial, Table 3 results would indicate Ally®, Glean®, Logran® may be safe to use on mature bluebush, which would be useful in controlling slender iceplant. However caution should be taken as SU products are known "root pruners", are damaging to other saltland species and are not registered for this use.

Brodal® and Broadstrike® would also be useful in controlling slender iceplant in bluebush, but best control is achieved if they are used before iceplant emergence. Broadstrike® is perhaps the most exciting herbicide option as it appears to also reduce roly poly (*Salsola spp.*) pre-emergent. Broadstrike® is registered for post-emergent control of a range of broad leaved weeds including doublegee.

The commonly used broadleaf herbicides such as dicamba, 2,4-D amine, atrazine, diuron and Igran®, cause severe damage to well established, mature bluebush. This may also be the case for oldman and river saltbush, thus would not be useful in the management of weeds in saltland pasture systems. Further work is required here to find suitable options for herbicide registrations.

CONCLUSIONS

- Standard farmer practice of 'pasture topping' in the previous year, followed by a knock down around the seasons break, remain the best practice before sowing saltbush or bluebush by seed.
- Trifluralin, Stomp®, Goal® and 2,2-DPA may be the best options for weed control while sowing saltbush and bluebush by seed. More work is required here, especially in the field.
- Post-emergent herbicide tolerance of oldman and river saltbush remains unknown.
- Dicamba, 2,4-D amine, atrazine, diuron and Igran® cause severe damage to mature bluebush. More work is required here to determine the tolerance of other saltland species.
- Stomp®, Goal® and Broadstrike® may be the most useful when controlling slender iceplant in the inter-rows of established saltbush systems, allowing for legume pastures to regenerate or be sown.
- There are no herbicides currently registered for weed control in bluebush or saltbush. Further trial work is required to obtain herbicide registrations.

ACKNOWLEDGEMENTS

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SALINITY EXTENSION AND REHABILITATION PROJECT- ADVICE AND INCENTIVES DELIVERED ON GROUND

Jessica Hasleby, Development Officer, Department of Agriculture and Food

AIM

To provide farmers in the Northern Agricultural Region with on ground salinity management advice, and a fencing incentive to assist with management of saline land.

BACKGROUND

This project was developed in response to the Northern Agricultural Catchments Council (NACC) Natural Resource Management Strategy which identified a gap in the provision of unbiased advice on salinity management and the need to assist farmers with on ground works. The project employs a saltland development officer, a saltland agronomist and an extension hydrologist. This team from the Department of Agriculture and Food's Geraldton office has spent the past 18 months visiting farmers who have expressed an interest in receiving a farm visit.

Each farm visit provides property maps showing Landmonitor information, using an EM38 to provide an instant soil salinity reading, groundwater trend information, surface water control information, water testing, saltland agronomy advice and revegetation advice. Each farmer is also eligible for a $1500/km fencing incentive to help manage their salt affected areas.

The project focuses on farms which are located in the Irwin River, Yarra Yarra and Moore River Catchments, of which the Liebe Group makes up a large part.

RESULTS

	Total	Liebe
Number of farms visited to date	104	52
Area to be fenced (ha)	10837	7058

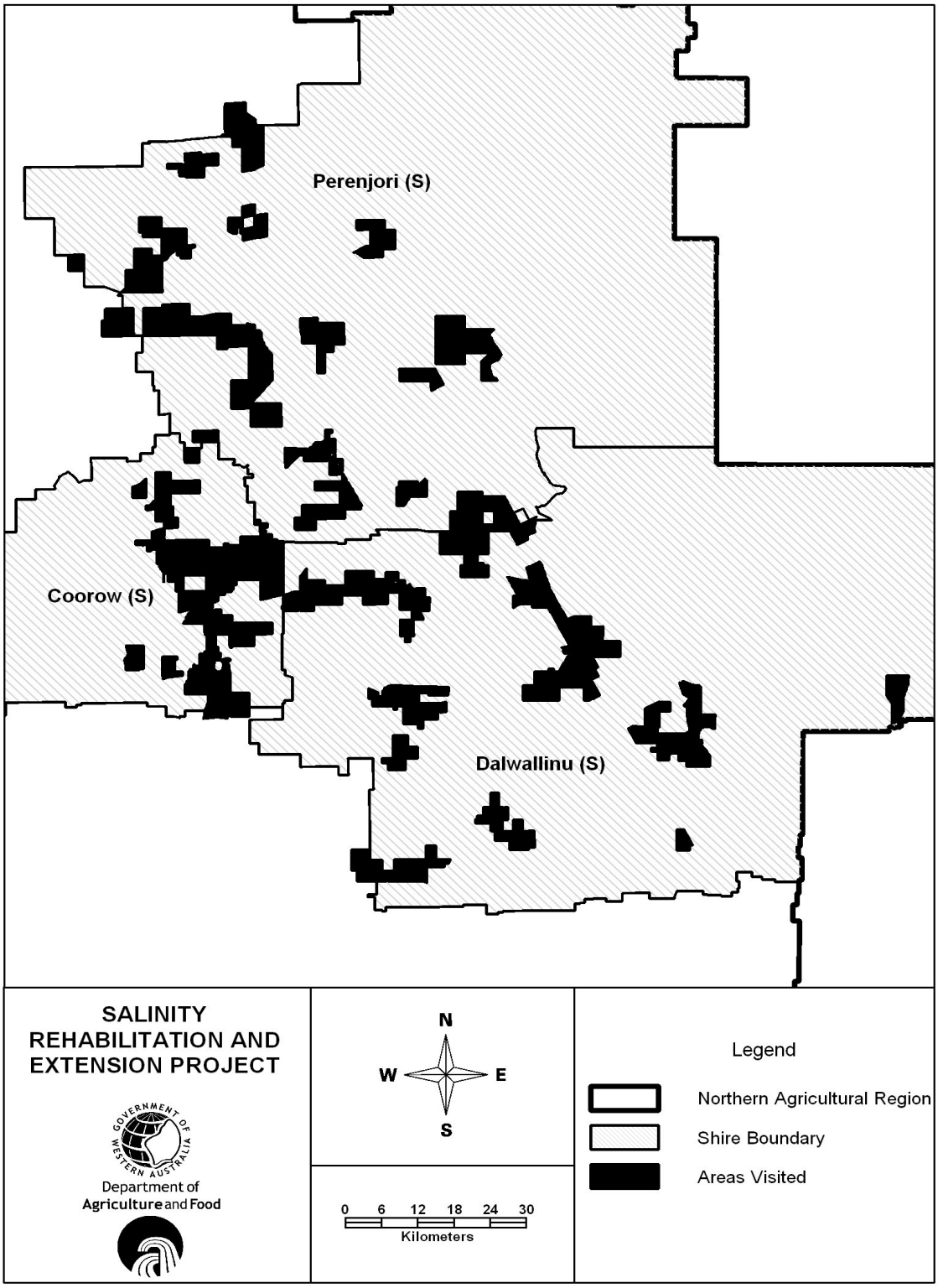
COMMENTS

The project has been highly successful with more than nine times the original target area in hectares signed up for fencing incentives. Throughout the region, farmers have welcomed the opportunity for on-farm advice and incentives to help them manage their saltland in the most sustainable and productive ways possible. We have received many comments on the usefulness of information such as groundwater trends, agronomic advice and revegetation options that are site specific.

In the two years this project has been running, the Northern Agricultural Region has seen two of the driest years on record. Many landholders, who have salt-affected land which they had previously thought unprofitable and unproductive, have now implemented a variety of methods which have helped them to carry stock through drier times. These methods include planting saltland pastures and tree crops such as broombush, implementing rotational grazing practices and fencing saline areas off from their non-saline areas to allow regeneration. There is a growing awareness amongst farmers of the grazing value of saltland plant species.

We have been very well supported by landholders in the Liebe Group, with exactly half the number of farm visits being to people in the Liebe Group area. The project is still looking for farmers who are interested in participating.

Figure 1: Areas visited in the Liebe Group region.



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BIRD SPECIES SURVEY, BIODIVERSITY IN GRAIN AND GRAZE

Wayne Parker, Development Officer, Department of Agriculture & Food

AIM

Bird surveys conducted as part of the project Biodiversity in Grain and Graze (BiGG) are attempting to gain a measure of the extent at which mixed farming, cropping and grazing, supports native biodiversity.

BACKGROUND

One of the goals of the BiGG project is to gain an understanding of the influence of a mixed farm on native biodiversity. To best answer this question four paddocks/areas under four broad management techniques were surveyed. These were Cropping, Rotation, Pasture and Remnant Vegetation paddocks. Cropping paddocks were predominantly cropped continuously. Rotation defines paddocks that undergo a crop/pasture rotation. Pasture relates to paddocks under a sub tropical perennial grass. Remnant vegetation was defined as pieces of undisturbed, usually fenced, ungrazed vegetation.

Since clearing, native birds and animals have become confined to small areas of uncleared remnant patches. These patches still play a part in the ecology of the region. In some instances they prevent erosion, slow water table rise and provide shelter to birds and animals. The health of these patches is readily indicated by the type, number and species diversity of the birds that inhabit these areas. A large patch will always support more bird species than a small patch though it is important to remember that all patches have value whether small or large. The fauna living in these patches will have an impact on their surrounding paddocks. It is useful to know which species inhabit these patches so we can estimate their influence on neighbouring crops and pastures. This paper identifies those species present in each of the surveyed patches and future work will determine the relative impact of each species.

SURVEY DETAILS

The surveys were conducted in the format as laid out by Birds Australia's Atlas survey. An area of two hectares is searched over a period of twenty minutes. The area is covered by walking a route that zig zags almost randomly through the dedicated region.

Property	Gary and Kerry Butcher, Pithara
Plot size & replication	2 hectares in 20 minutes, walking a zig zag through the plot. Four areas surveyed - remnant, cropping, a cropping pasture rotation, and a perennial pasture.

RESULTS

Table 1: Birds identified on Butchers property when surveyed during August and November.

Common name of the birds identified			
Remnant Vegetation	**Perennial Pasture**	**Rotation**	**Cropping**
Australian ringneck	Australian raven	Galah	Galah
Black faced woodswallow	Banded lapwing	Nankeen kestrel	Richard's pipit
Brown falcon	Black faced cuckoo shrike	Singing honeyeater	Yellow throated miner
Brown headed honey eater	Crimson chat		
Common bronzewing	Magpie lark		
Chestnut rumped thornbill	Yellow throated miner		
Crimson chat	White backed swallow		
Crested pigeon	White fronted chat		
Galah	White winged triller		
Grey fantail	White winged wren		
Grey shrike thrush	Willie wag tail		
Inland thornbill			
Magpie lark			

Remnant Vegetation
Pallid cuckoo
Red capped robin
Rufous whistler
Singing honeyeater
Spotted nightjar
Striated pardalote
Tree martin
Weebil
White browed babbler
White fronted chat
White winged triller
Willlie wag tail
Yellow rumped thornbill

COMMENTS

The number of species is dictated by the habitat. The high number of species found in the perennial pasture paddock is the result of sown tree lines and larger trees in a neighbouring drainage line. While the larger open spaces of the cropping and rotation paddocks don't provide the shelter required by smaller birds.

Over and above their aesthetic value birds have practical implications for the farm on which they live. Many birds feed on the insects and weed seeds from the paddocks surrounding their habitat. Further investigation, to be completed during the first part of 2008, will determine the level of impact birds have on neighbouring paddocks in this region. From this work it is hoped the links between paddock production and remnant inhabitants can be better understood.

Two of the more interesting species found in this survey are the white browed babbler and the brown headed honeyeater. The habitat of both the birds has largely made way for agriculture. Eucalypt forests and woodlands are required for habitation from where they can forage for insects and seeds. Populations of these birds are fragmented through the western wheatbelt and further decline is expected as habitat decreases.

ACKNOWLEDGEMENTS

- Thank you to Gary and Kerry Butcher for allowing us to complete this work on their property.
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BANKWEST BENCHMARKS DATA FROM THE DALWALLINU & CARNAMAH AREA IN 2006/07

BankWest Business | Grow with us

The BankWest Benchmarks are a survey of the financial and production performance of WA farm businesses.

BankWest Benchmarks allow farm businesses to quantify their performance in comparison to other farmers in their district and region. Farmers can identify the strengths and weaknesses of their operations and look at the factors that help lift the top performing farms above the others.

Definition of terms

Capital Expenditure ($/Eff Hectare) – Expenditure on any capital items including land purchases with respect to the area farmed.

Crop Insurance ($/Eff Hectare) – Cost of crop insurance with respect to the area farmed.

Crop Insurance ($/Crop Hectare) – Cost of crop insurance with respect to the area cropped.

Effective Area (Hectare) – Land area used directly for the purposes of producing crops or livestock. Does not include non-arable land such as salt lakes, rocks and bush.

Farm Income – All income produced from farm related activities. Includes proceeds from the sales of all produce, CBH and diesel fuel rebates and receipts from contracting farm equipment.

General Insurance ($/Eff Hectare) – Insurance costs on buildings and vehicles etc. excluding crop insurance costs with respect to the area farmed.

Long Term Debt ($/Eff Hectare) – Equals liabilities less seasonal or short term liabilities such as funds drawn on an overdraft account and hire purchase expense, with respect to the area farmed.

Operating Costs – Relates to any payments made by the farm business for materials and services excluding capital, finance and personal expenditures.

Overhead Cost Subtotal ($/Eff Hectare) – Total of all indirect costs incurred by the farm business.

Paid Labour ($/Eff Hectare) – Payments made to any person for working on the farm business with the exception of the partners, family labour and work undertaken by contractors with respect to the area farmed.

Rainfall (mm) – Growing season rainfall (May-Oct). Bureau of Meteorology averages for each district.

Repairs Buildings, Fence & Water ($/Eff Hectare) – Cost of repairs and maintenance on buildings, fences and water supplies with respect to the area farmed.

Tax Liability ($/Eff Hectare) – Measures the provisional tax payable with respect to the area farmed.

Term Debt Repayment ($/Eff Hectare) – Principal repayments on long term debt with respect to the area farmed.

Total Income – Includes all farm income plus interest received, funds from sale of capital items, any loan funds advanced and any income derived from off-farm investments or other activity.

Total Personal (Inc. Super) ($/Eff Hectare) – All personal expenses incurred by the principals of the farm business including contributions to superannuation with respect to the area farmed.

Total Cash Outgoings – All expenses incurred by the farm business including all operating costs as well as capital, finance and personal expenditures.

Total Sheep Income ($/WGHa) – Income derived from sheep and wool sales with respect to winter grazed area.

Winter Grazed Hectares – Total effective area less the area cropped.

Wool Cut (Kg/WGHa) – Amount of wool cut with respect to winter grazed area.

Equity (%) – The % of owned assets. Calculated as total assets less total liabilities divided by total assets.

Low 25% - The average of the low 25% of farms in the group surveyed ranked by operating profit.

Other 75% - The average of the farms surveyed in each group, excluding the top 25% of farms ranked by operating profit.

Top 25% - The average of the top 25% of farms in the group surveyed ranked by operating profit.

Comments: ***These results have been extracted from the 'BankWest Benchmarks 2006/2007' report.*** For more information please contact Daniel Fels at the BankWest Agribusiness Centre on 9420 5178 or Gavin de Gruchy, BankWest Manager Dalwallinu on 9661 1101.

Also, anyone who has not previously participated and would like to, please contact Gavin for details. This enables the database to be expanded improving the accuracy of the information. You will also receive a report comparing your own data to the district data as soon as it is extracted.

DALWALLINU - COMPARATIVE ANALYSIS OF DISTRICT PERFORMANCE 2006/2007

	District Average	Top 25%	Other 75%	Bottom 25%	Region Average
Capital Analysis					
Effective Area (Ha)	4,874	5,143	4,762	3,784	4,272
Assets ($/Eff Ha)	1,442	1,230	1,530	1,462	1,390
Debt ($/Eff Ha)	241	176	267	251	248
Long Term Debt ($/Eff Ha)	138	118	147	204	129
Equity (%)	81%	85%	80%	78%	80%
Long Term Debt to Income (%)	144%	61%	179%	245%	155%
Return to Capital	-2.3%	3.3%	-4.6%	-9.3%	-3.6%
Machinery Value ($/Eff Ha)	220	240	212	223	214
Rainfall (mm)	165	186	157	176	144
Operating Analysis					
Farm Income ($/Eff Ha)	178	213	163	131	175
Operating Costs ($/Eff Ha)	144	136	147	147	147
Operating Return ($/Eff Ha)	34	78	16	(16)	28
Operating Profit ($/Eff Ha)	12	54	(5)	(38)	7
Operating Cost/Farm Income (%)	84%	64%	93%	112%	104%
Grain % of Farm Income	80%	82%	79%	80%	72%
Sheep & Wool % of Farm Income	15%	15%	15%	14%	20%
Costs					

Operating Costs					
Seed & Treatments ($/Eff Ha)	5	4	5	6	5
Crop Insurance ($/Eff Ha)	1	0	1	1	1
Pesticides/Herbicides ($/Eff Ha)	24	22	25	26	24
Fertiliser ($/Eff Ha)	34	30	36	38	37
Contract ($/Eff Ha)	3	1	4	4	2
Fuel & Oil ($/Eff Ha)	17	16	17	17	16
Repairs & Maintenance ($/Eff Ha)	10	9	11	11	12
Conservation ($/Eff Ha)	0	0	0	0	0
Repairs BFW ($/Eff Ha)	2	1	2	2	2
Paid Labour ($/Eff Ha)	9	9	8	7	7
Overhead Costs					
Rates ($/Eff Ha)	4	4	4	4	4
Licences ($/Eff Ha)	3	1	3	2	3
General Insurances ($/Eff Ha)	4	4	4	3	4
Professional Fees ($/Eff Ha)	4	3	4	4	3
Telephone & Electricity ($/Eff Ha)	1	1	1	2	1
Overhead Costs Sub Total ($/Eff Ha)	18	15	20	18	18
Other Costs					
Total Personal Expenditure ($/Eff Ha)	25	21	26	22	26
Taxation ($/Eff Ha)	4	6	4	3	5
Loan Repayments ($/Eff Ha)	14	18	12	23	23
Hire Purchase & Lease ($/Eff Ha)	17	16	17	26	18
Capital Expenditure ($/Eff Ha)	33	57	23	13	36
Interest on Loans ($/Eff Ha)	19	13	21	18	17
Cropping Analysis					
Total Crop Area (Ha)	3,022	2,878	3,082	2,063	2,429
Crop % of Effective Area (%)	59%	53%	62%	56%	54%
Machinery Value ($/Crop Ha)	403	549	343	398	453
Crop Yields					
Wheat (T/Ha)	0.92	0.98	0.89	0.93	0.88
Barley (T/Ha)	1.11	1.23	1.02	0.98	1.04
Lupins (T/Ha)	0.59	0.80	0.52	0.57	0.47
Canola (T/Ha)	0.41	0.50	0.36		0.32
Crop Cost Analysis					
Seed & Treatment ($/Crop Ha)	8	8	7	9	9
Crop Insurance ($/Crop Ha)	1	1	2	2	3
Pesticides and Herbicides ($/Crop Ha)	42	43	42	49	47
Fertiliser ($/Crop Ha)	59	61	58	65	76
Fuel & Oil ($/Crop Ha)	29	34	27	30	34
Repairs & Maintenance ($/Crop Ha)	18	18	18	21	25
Paid Labour ($/Crop Ha)	15	19	13	12	14
Sheep Production					
Total Sheep Shorn (Head)	2,978	4,042	2,535	1,553	2,530
Winter Grazed Hectares (Ha)	1,852	2,265	1,680	1,721	1,843
Total Sheep Income ($/WGHa)	70	70	70	47	60
Sheep Costs ($/WGHa)	61	57	63	50	56

Wool Cut (Kg/Head)	4.11	3.11	4.57	4.36	4.31
Wool Cut (Kg/WGHa)	7	7	7	4	6
Wool Price ($/Kg)	4.07	3.98	4.11	3.29	4.54
Average Sheep Sale Price ($/Head)	43	47	41	42	39
Lambing Rate %	77%	86%	73%	58%	80%

CARNAMAH - COMPARATIVE ANALYSIS OF DISTRICT PERFORMANCE 2006/2007

	District Average	Top 25%	Other 75%	Bottom 25%	Region Average
Capital Analysis					
Effective Area (Ha)	3,287	3,735	3,052	3,503	2,975
Assets ($/Eff Ha)	2,298	2,587	2,194	2,230	2,079
Debt ($/Eff Ha)	290	100	350	503	279
Long Term Debt ($/Eff Ha)	118	48	138	245	125
Equity (%)	86%	93%	84%	76%	85%
Long Term Debt to Income (%)	110%	41%	132%	225%	121%
Return to Capital	-2.5%	3.4%	-4.9%	-11.6%	-3.9%
Machinery Value ($/Eff Ha)	388	386	397	343	336
Rainfall (mm)	144	132	159	118	119
Operating Analysis					
Farm Income ($/Eff Ha)	264	323	247	151	213
Operating Costs ($/Eff Ha)	214	194	228	224	187
Operating Return ($/Eff Ha)	50	129	19	(73)	25
Operating Profit ($/Eff Ha)	11	91	(21)	(107)	-8
Operating Cost/Farm Income (%)	105%	59%	123%	178%	104%
Grain % of Farm Income	72%	71%	72%	64%	67%
Sheep & Wool % of Farm Income	19%	22%	18%	23%	19%
Costs					
Operating Costs					
Seed & Treatments ($/Eff Ha)	6	6	8	6	4
Crop Insurance ($/Eff Ha)	1	2	1	0	1
Pesticides/Herbicides ($/Eff Ha)	37	32	37	34	26
Fertiliser ($/Eff Ha)	52	56	54	49	47
Contract ($/Eff Ha)	2	1	3	5	3
Fuel & Oil ($/Eff Ha)	20	18	21	17	18
Repairs & Maintenance ($/Eff Ha)	17	10	20	17	16
Conservation ($/Eff Ha)	0	1	1	-	0
Repairs BFW ($/Eff Ha)	5	3	6	9	3
Paid Labour ($/Eff Ha)	10	9	11	14	7
Overhead Costs					
Rates ($/Eff Ha)	5	4	5	5	4
Licences ($/Eff Ha)	2	2	3	3	2
General Insurances ($/Eff Ha)	6	6	6	5	5
Professional Fees ($/Eff Ha)	3	4	3	3	3
Telephone & Electricity ($/Eff Ha)	2	1	2	2	2
Overhead Costs Sub Total ($/Eff Ha)	23	21	24	24	31
Other Costs					
Total Personal Expenditure ($/Eff Ha)	55	68	53	37	49
Taxation ($/Eff Ha)	16	20	15	12	13

Loan Repayments ($/Eff Ha)	13	24	15	9	15
Hire Purchase & Lease ($/Eff Ha)	12	0	16	9	22
Capital Expenditure ($/Eff Ha)	77	42	86	88	55
Interest on Loans ($/Eff Ha)	17	6	20	27	14
Cropping Analysis					
Total Crop Area (Ha)	1,633	1,608	1,680	1,419	1,263
Crop % of Effective Area (%)	57%	44%	64%	54%	46%
Machinery Value ($/Crop Ha)	927	1,463	599	558	1009
Crop Yields					
Wheat (T/Ha)	1.27	1.66	1.17	0.97	0.91
Barley (T/Ha)	0.99	1.30	0.99	1.15	0.89
Lupins (T/Ha)	0.69	1.03	0.57	0.27	0.57
Canola (T/Ha)	0.39	0.99	0.24	0.06	0.30
Crop Cost Analysis					
Seed & Treatment ($/Crop Ha)	11	11	13	12	9
Crop Insurance ($/Crop Ha)	2	3	2	1	3
Pesticides and Herbicides ($/Crop Ha)	70	90	54	55	60
Fertiliser ($/Crop Ha)	89	122	77	70	139
Fuel & Oil ($/Crop Ha)	39	51	33	27	48
Repairs & Maintenance ($/Crop Ha)	39	49	29	27	44
Paid Labour ($/Crop Ha)	18	22	17	22	19
Sheep Production					
Total Sheep Shorn (Head)	2,503	3,773	2,364	2,159	1,783
Winter Grazed Hectares (Ha)	1,653	2,127	1,372	2,084	1,712
Total Sheep Income ($/WGHa)	1,219	122	1,699	2,848	77
Sheep Costs ($/WGHa)	2,032	85	2,876	4,934	61
Wool Cut (Kg/Head)	3.52	4.89	3.30	1.85	3.72
Wool Cut (Kg/WGHa)	8	14	9	1	8
Wool Price ($/Kg)	4.76	5.24	4.36	3.28	4.90
Average Sheep Sale Price ($/Head)	52	54	50	53	49
Lambing Rate %	85%	96%	78%	62%	84%

2007 RAINFALL REPORT

	Perenjori mm	Latham mm	Coorow mm	Wubin mm	Dalwallinu mm	Goodlands mm	Kalannie mm
Jan 07	7.5	18.7	15.8	31.6	50.1	47.8	48.8
Jan ave	13.9	13.4	12.4	13.4	15	17.9	15
Feb 07	8	5.2	1	3.2	6.1	18.6	29.1
Feb ave	16.9	14.7	14.9	14.1	16.3	16.4	16.4
Mar 07	12.5	0.6	4	0.2	3.6	0.6	11.8
Mar ave	22.8	19.2	20.9	21.4	24	24.6	23.4
Apr 07	1.8	1.4	3.4	7.3	3.8	8.8	10
Apr ave	24.1	24.5	23.8	20.8	21.1	22.8	23.3
May 07	15.7	14.7	18.3	7.9	15	10.8	10.8
May ave	46.7	42.2	51.3	43.3	46.4	45.5	42.5
Jun 07	10.9	16	21.4	19.4	27.3	14.2	14.3
Jun ave	59.7	54.3	76	59.3	64.9	51.2	54.9
Jul 07	36.1	60.1	71.1	49	58.1	56.6	46.9
Jul ave	51.5	50.9	68.1	52.3	59.4	46	48.5
Aug 07	7.9	17.2	22.8	19.6	25.2	19.2	14.6
Aug ave	40.3	38.6	53.3	40.9	45.6	35.7	37.6
Sep 07	8.1	12.2	17.2	13.4	17.1	15.6	14.6
Sep ave	19.8	18.7	30.1	20.2	25.1	21	19
Oct 07	8.6	10.6	19.3	15	15.6	9	13.2
Oct ave	13.1	11	18.6	13.3	16.8	12.1	13.1
Nov 07	1.3	1.6	0.7	0	1.2	0	0.6
Nov ave	9.8	9.6	9.8	9.7	11.8	11	9.3
Dec 07	0.6	20.6	37.6	54.4	62.2	22.6	27.6
Dec ave	8.3	8.7	8.6	5	11	11.7	10.3
2007 TOTAL	**119**	**178.9**	**232.6**	**221**	**285.3**	**223.8**	**242.3**
Average TOTAL	330.6	306.7	388.1	314.3	357.2	316.11	311

2007 LIEBE GROUP R&D SURVEY RESULTS

Total of 46 surveys received from survey presentation at the Liebe Group Spring Field Day.

What are the major issues on your farm?

AGRONOMIC	
Lack of a profitable legume in cropping rotation/diversity	7
Weed Resistance	4
Ryegrass	3
Correct varieties for grain & pulses for our area	2
Wild Radish	
Integrated Weed Management	
Use of summer moisture	
Spear grass in wheat	
Non-wetting sands	
Frost	
GPS systems	
No GMO's	
SEASONAL	
Rainfall	24
Wind Erosion	5
Weather forecasting mistakes	
Climate trends	
SOIL HEALTH	
Salinity	8
Soil Acidity	7
Soil Health	2
Soil compaction	
Soil structure	
Soil residues	
PASTURES & LIVESTOCK	
Early feed growth	2
Should we go to livestock	
Stock feed at critical parts of the year	
Managing sheep – deferred grazing pre seeding	
SOCIAL	
Competent labour	2
Ageing Infrastructure	
Communication between generations	
FINANCIAL/MARKETING	
Input Costs	3
Transport costs	
Fertilizer costs	
New marketing systems	
High cost of input V risk	
OTHER	
Pest control – Kangaroos, Emus etc.	

Major issues in your farm business?

MARKETING	
Grain Marketing	7
Declining terms of trade – impacting potential expansion	2

Hedging
TECHNOLOGY/OFFICE
Office work 3
Technology updates to make good decisions on investment on & off farm.
Telecommunications & internet
Office work – GST, Tax as you go, super payments
Red Tape/Paperwork
Recording all spraying
EMPLOYMENT
Labour Shortages 9
Time Management 5
Shearers
Keeping staff employed with lack of income not work
Restructuring for a 1 man operation
FINANCIAL
Increasing costs 11
Return on investment – margins 5
Financing after a dry year 4
Lack of capital
Advisor fees
FARM BUSINESS
Succession 5
Long Term Sustainability 2
Growing the business
Replacing machinery
Declining Infrastructure & support
OTHER
CBH proposal to increase handling charges at some sites.
Sheep

<u>What sort of training and workshops would you like the Liebe Group to run next year?</u>

MECHANICAL/ELECTRICAL
More welding & auto-electrics 4
Forklift 3
Air-conditioning course
Hydraulics,
Tyres
Small Motors
AGRONOMIC
Diversification 2
Disease/Nutrition identification
Nutrition after a drought
Soil Health
Chemcert
Soil amelioration – gypsum, lime, dolomite, trace elements
Managing poor seasons
TECHNOLOGY
Computer literacy with regard to major farm software – Agrimaster 3
GPS, Autosteer & VRT 2
Use of yield mapping software
Internet
BUSINESS/OFFICE/MARKETING
Succession 3

Business Management – Grain Trading (Globally), Risk Management, off farm investment/succession planning. 3
Time management 2
Marketing 2
Office Organisation
Financial planning
Farm planning – layout & setting up for controlled traffic
Selling wheat without the single desk
Economic management
Theoretic potentials – what are our potentials in this area.
Charting of commodities
Curtin University grain marketing workshop

LIVESTOCK

Butchering
Animal health
Feedlotting sheep & cattle

OTHER

Womens FESA training 2
Home brewing & distilling 2
Looking outside of the square workshop – holistic management
Farm Safety
Young Farmer
Community building

<u>Are you interested in any concept/products/practices that you would like tested on-farm?</u>

PASTURES/GRAZING

Pastures for light ground (Wodjil)
Salt tolerant pastures for between saltbush/tree lines
New pasture legumes – new bladder clovers esp those to be released 2008 & eastern star clover.
Saltland pastures, lucerne, subtropicals, iceplant, saltbush
Pasture Trials, Cereal Grazing,
Enrich fodder shrub trials (NACC funding), more perennial trials – what species work on what soil types. Opportunities for backgrounding cattle so don't need to keep breeders through summer.
Grazing Cereals

FERTILIZERS

Seed treatments – trace elements & main elements
Potash rates, phosphate vs Potash

BARLEY

Feed barley trials

CANOLA

GM Canola trials
Partner planting – ie Peaola – Canola & peas

CHICKPEAS

Any new work on Chickpeas

SOIL HEALTH

Soil wetter for non-wetting soils to get a better germination for crops.

SEEDING

Seeding practices – conventional, min till, bullet drill – all relating to cost of growing a crop or pasture

WEEDS

Ice plant

OTHER

Telstra telecommunications – the ultimate system

<u>Can you please provide us with specific feedback on the SFD?</u>

NON FIELD PRESENTATIONS
New displays – vet & welding were very good 2
Great to have Telstra & Kondinin Group
Tyre Repair demonstration would be great.
Machinery demo's a positive for the day and to be commended.
More hands-on demos like the Welding
Missed Keynote speaker after lunch as in previous years
FIELD TRIALS
Include some chemical trials eg Metrabuzin, dual gold
Probably need to water parts of plots to see what would happen in a normal year. 2
Carry on with all trials – very good.
Long term trials on farming systems
Excellent, well presented, Good diversity in presentations
CVT's & Techniques are always informative. Sundry trials are good value for something different
Trials could be closer together
GENERAL
Well organised – one of the best yet. 4
Good results for a dry year.
Need to be a bit more regulated as groups seemed to just wonder off & it was difficult to thank the presenter.
Flexibility in the Agenda is good.
Nice & compact, is it possible to have a session examining past trial results pertinent to present trials
Put the page number of the trial on presentations table
Each chairperson needs to say what page to look at.

LIEBE GROUP STRATEGIC PLAN 2007 – 2012

Updated: March 2007

Vision

Vibrance and innovation for rural prosperity.

Mission Statement

A progressive group working together to improve rural profitability, lifestyle and natural resources.

Core functions

- Agricultural research, development, implementation and validation
- Provide information, education, skills and training opportunities to members and wider community
- Strengthen communication between growers and industry and whole community

Our 2012 targets

- Recognised by stakeholders as a leading farmer group involved in rural profitability, lifestyle and natural resources.
- 20% increase in membership, as measured by land area in Dalwallinu, Coorow and Perenjori shires.
- 20% increase in attendance at major events.
- 100% of Liebe Group members have made an effective decision concerning the adoption of new technology assisted by the Liebe Group.
- All committee positions willingly filled.
- We will be a 'best practice' community group measured by an external audit.
- We will have one year's overhead costs in reserve.
- The Liebe Group will be viewed by the industry as a desired place of employment.

Objectives

1. Conduct high-priority research, development, implementation and validation.
2. Provide information, education, skills and training opportunities for members and wider community.
3. Target specific industry bodies and community media to raise awareness of successes in the agriculture industry and the needs of farmers.
4. Maintain sound financial base of the Liebe Group.
5. Support and maintain high performing staff.
6. Follow corporate governance strategies correctly and maintain group process.

Liebe Group Values

- Member-driven, honesty, co-operation, innovation and passion

Key:
EO- Executive Officer; **AM**- Administration Manager; **PC** Project Coordinator; **R&D Coord –** R&D Coordinator, **SC** – Sponsorship Coordinator
Committees:
MGT – Management Committee; **R&D Com -** Research & Development Committee; **Finance** – Finance Committee; **EAC**- Employment Advisory Committee; **Women's** – Women's Committee, **Ethics** – Ethics Committee
Industry Bodies:
GGA- Grower Group Alliance; **GRDC** – Grains Research and Development Corporation; **DAFWA** – Department of Agriculture and Food WA.

OBJECTIVE 1
Conduct high-priority research, development, implementation and validation.

STRATEGIES	WHO	WHEN
1. Attract and form partnerships with agribusiness and research organisations.		
• Key organisations on Liebe newsletter mailing list	EO	Ongoing
• Maintain close relationship with Department of Agriculture and Food (local officers and Regional Manager) and CSIRO project partners	EO	Ongoing
• Keep abreast of GRDC research priorities and maintain close relationship with Western Panel and grower group contact (Stuart Kearns)	PC & Staff	Ongoing
• Develop and maintain partnerships other industry and research bodies when opportunities arise	R&D Coord, PC and EO	Ongoing
• Distribute Liebe R&D priorities and trial site details to major research organisations and agribusiness	R&D Coord	Jan
• Invite key personal to R&D planning meeting.	R&D Coord	Feb
2. Develop trials and demonstrations to address local priorities at Main Trial Site (MTS), Long Term Research Site (LTRS), satellite sites & on-farm		
• Determine research and development priorities from annual member survey and R&D planning meeting	R&D Coord	Sept and Feb
• Develop trial program for the MTS using agribusiness and research organisations partners	R&D Coord	Feb, March
• Develop trial program for the satellite sites in conjunction with DAFWA and agribusiness	R&D Coord	Feb, March
• Organise and conduct on-farm demonstrations	R&D Coord	Ongoing
• Discuss Strategic R&D priorities at general meeting	MGT	Ongoing
• Ensure we seek R&D opportunities that encompass a whole systems approach	EO and R&D Coord	Ongoing
• Maintain soil biology trial at LTRS	PC	Ongoing
• Raise profile of LTRS and attract research bodies wishing to conduct trials of a long term nature to the site	PC	Ongoing
• Maintain trial program at LTRS	PC	Ongoing
• Ensure R&D protocols are adhered to	PC and R&D Coord	Ongoing
3. Increasing adoption of new technologies		
• Benchmark adoption level of Liebe members	PC	Feb 2007
• Conduct final audit to assess the influence of the project on growers decision making processes towards technology adoption.	PC	2009
• Conduct farmer case studies and economic analysis on growers that have adopted new technology	PC	2007/2008 2009
• Conduct on-farm demonstrations and economic modelling with growers that are considering technology adoption	PC	2007/2008/ 2009

OBJECTIVE 2
Provide information, education, skills and training opportunities for members and wider Community.

STRATEGIES	WHO	WHEN
1. Extend Liebe Group research, development, implementation and validation results.		
• Conduct a Spring Field Day at the Main Trial Site	R&D Coord & EO	Sept
• Field walk at the Satellite Trial Sites	R&D Coord	Aug/Sept
• Field walk at the LTRS	PC	Aug/Sept
• Hold Crop Update to prepare growers for coming season	R&D Coord & EO	March
• Promote results in R&D Results Book and review priority research at Trials Review day	R&D Coord	Feb
• Promote results to wider community	R&D Coord, PC & EO	Ongoing
• Assist in attracting members to events by having high profile guest speakers	Staff	At events
2. Workshops and study tours		

• Use member survey and feedback to identify member requirements.	Staff	Sept & Ongoing
• Conduct high priority workshops annually (e.g. Agronomic, Management, Financial, Skills based, Communication)	AM and staff	Ongoing
• Conduct Intra or Interstate tours, visiting innovative, interesting and sustainable farming systems	EO and AM	Annually or on demand
3. Communication		
• Members informed of local, relevant and timely information and case studies in monthly newsletters	AM and staff	Monthly
• Early notification of all dates and opportunities to provide members with plenty of time to schedule time off the farm. Add dates to GGA calendar and check with local organisations to avoid clashes	AM	Ongoing
4. Encourage all sectors of community to attend Liebe Group activities		
• Conduct events that encourage young farmers and women to be involved	Committees, staff and Women's	As required
• Encourage mentorship within the Liebe Group through encouraging interaction processes at events	Committees and staff	Ongoing
• Ensure we are being inclusive when catering for events	Relevant Committees	Ongoing
5. Member Development.		
• Encourage greater input from non-involved members to come along to Liebe events. Bring a buddy philosophy.	Committees	Ongoing
• Promote external workshop or development opportunities to members via email and newsletter	EO	Ongoing
• Investigate sources of financial assistance for members to take up development opportunities or investigate possibility for the Liebe Group to provide financial assistance	EO and MGT	Ongoing
• Review standard proposal for members to receive remuneration for voluntary time (e.g. $/hr and travel cost).	MGT	Prior to AGM
• Ensure members are being well serviced and areas for improvement are sought by phone interviews, farm visits and talking with them at events	Staff	Ongoing
• Ensure a sense of fun is incorporated at all Liebe Group events	Staff	Ongoing

OBJECTIVE 3
Target specific industry bodies and community media to raise awareness of successes in the agriculture industry and the needs of farmers.

STRATEGIES	WHO	WHEN
1. Develop & maintain linkages with agribusiness, government agencies, tertiary institutions and political organisations		
• Maintain friends list for newsletter with all industry contacts made throughout the year and review each year	EO	Jan
• The prospectus to be made available to above bodies with an update occurring when necessary	AM	Ongoing
• Liebe Group website to be maintained monthly and placed under high priority as our 'industry face'	AM and staff	Ongoing
• Encourage relevant industry to attend General Meetings.	EO and MGT	As required
• Attend an Agricultural Industry Workshop developed by GGA and similar opportunities	EO, staff and MGT	Oct- Annually
• Encourage attendance of above bodies to Liebe Group events	EO & Staff	For events
• Maintain industry profile so that we are approached to facilitate contact if farmers individual opinions are required.	EO and MGT	As required
2. Promote agricultural successes in rural and non rural media		
• Maintain partnership with Farm Weekly produce monthly Liebe updates for the paper	AM and staff	Monthly
• Invite media to main Liebe Group events and publish appropriate press releases	AM	As required
• Develop contact and build rapport with the West Australian and Sunday Times to promote agriculture outside the agriculture industry	EO	Ongoing
• Publish monthly updates in local papers	AM	Ongoing
3. Celebrate Liebe and members success		

• Keep abreast of awards and nominate appropriate members / group	Staff and MGT	Ongoing
• Hold an annual Liebe Dinner	AM and staff	Oct
• Cater for post event celebrations	Staff	At events
• Promote great achievements and member success in Liebe newsletters	AM and staff	Monthly
• Maintain and develop Liebe Group identity through staff uniform and badges to be worn at all events, promote sale of Liebe shirts and jumpers on membership flyer	Staff	Ongoing
• Develop system to recognise farmers that have contributed significantly to the Liebe Group	AM	By July 2007

OBJECTIVE 4
Maintain sound financial base of the Liebe Group.

STRATEGIES	WHO	WHEN
1. Finance Committee to oversee Liebe finances and budget.		
• Review project funding timeline	Finance	Ongoing
• Prepare budget and allocations for subcommittees	Finance	As required
• Approve finance for expensive purchase items	Finance	Ongoing
• Track progress of income and expenditure areas	Finance	Ongoing
• Committee meets regularly and when necessary	Finance	Quarterly
2. Seek funding.		
• Maintain strong links with Sponsors and Partners	SC and AM	Bi-Annually
• Seek new sponsors and partners	SC and AM	Ongoing
• Review sponsorship guidelines and return on investment for each	SC and AM	Ongoing
• Identify & target high-return sources of funding (sponsors, programs, membership and subcontracting)	Finance, SC and staff	Ongoing
3. Develop membership contributions.		
• Review stability of membership numbers and ensure members are being well serviced	Finance, MGT and staff	Prior to AGM
• Recommendation of fees and value of membership.	Finance	AGM

OBJECTIVE 5
Support and maintain high performing staff.

STRATEGIES	WHO	WHEN
1. Support and develop Liebe Group employees each year.		
• Review performance appraisal document	EAC	Annually
• Review performance, competitive salary, goals and objectives taking care to enhance employee's areas of special interest	EAC	Dec
• Conduct annual performance appraisals. Include self and team assessment process (SWOT)	President & Staff	Nov
• Review new employee induction program. Guided by protocol and list of required training.	EAC & EO	As required
• Provide staff with professional development	EO	Ongoing
• Conduct fortnightly team meetings	Staff	Ongoing
• Ensure Management Committee adopt ethos of supporting staff	MGT	Ongoing
• Review mentor program for employees	EO	Ongoing
2. Maintain and increase employment base in order to meet group requirements.		
• Review list of all roles and responsibilities, delegating each responsibility to appropriate staff member.	EO	Oct
• Identify "gaps" in roles and skills, and investigate employment options	EO	Oct
• Seek external contracting of funding specialist	EO	As required
• Seek feedback from employees to develop and maintain a conducive working environment.	EAC	Ongoing

OBJECTIVE 6
Follow corporate governance strategies correctly and maintain group process.

STRATEGIES	WHO	WHEN
1. Management Committee, Sub-committee and reporting structure		
• Management Committee meets on a monthly basis at a General Meeting	MGT and staff	Monthly

(except May, Nov and Jan)		
• Sub-committees meet as required	Committee chairs	As required
• Finance, R&D, Women's and Ethics sub-committees report to the Management Committee	Finance, Ethics, MGT R&D Com, Women's	When required
• Employment sub-committees report to the EO	EAC and EO	When required
• EO must sit on every Liebe Group committee	EO	Ongoing
• Review Management Committee and sub committee operation and responsibilities annually	Committees	Pre AGM
• After each AGM review responsibility of each committee (esp. Governance responsibilities)	All committees	After AGM
• Analyse resources, skills and interests required for successful Liebe Group management and sub committees and individually approach members to be involved in various committees	EO and staff	Prior AGM
• Identify training and educational opportunities for all Liebe Group committee members	Committees / Staff	Ongoing
• Distribute folder for subcommittee members and include guidelines for effective committee meetings	EO	AGM
• Follow succession strategy to increase member involvement on committees, as per succession protocol	Committee	As required
2. Effective Group Process		
• Develop 5 year strategic plan and review objectives annually as a working document	Staff and MGT	Annually
• Ensure inclusive processes are always used	All	Always
• Maintain transparency in processes	All	Always
• Develop written protocols on Liebe Group process to aid in transition of staff and group positions	Staff	Ongoing
• All committees and staff are to operate by Liebe Group Code of Ethics	Ethics	Annually

LIEBE GROUP CALENDAR OF EVENTS 2008

EVENT	DATE	LOCATION	CONTACT
Liebe Group AGM & General Meeting	Monday, 11th February	Buntine Bowling Club	Sophie Keogh (08) 9664 2030
Liebe Group Crop Updates	Tuesday, 19th February	Buntine Hall	Chris O'Callaghan (08) 9664 2030
March General Meeting	Monday, 10th March	Liebe Office	Sophie Keogh (08) 9664 2030
April General Meeting	Monday, 14th April	Liebe Office	Sophie Keogh (08) 9664 2030
June General Meeting	Monday, 9th June	Liebe Office	Sophie Keogh (08) 9664 2030
Women's Field Day	Wednesday, 18th June	Buntine Hall	Sophie Keogh (08) 9664 2030
Post Seeding Field Walk, Pizza and Port Night and July General Meeting	Monday, 14th July	TBC	Chris O'Callaghan (08) 9664 2030
August General Meeting	Monday, 11th August	Liebe Office	Sophie Keogh (08) 9664 2030
September General Meeting	Monday, 8th September	Liebe Office	Sophie Keogh (08) 9664 2030
Spring Field Day	Thursday, 11th September	Main Trial Site– Ian & Clint Hunt, Marchagee	Chris O'Callaghan (08) 9664 2030
October General Meeting	Monday, 13th October	Liebe Office	Sophie Keogh (08) 9664 2030
Liebe Annual Dinner	TBC – October	TBC	Sophie Keogh (08) 9664 2030
December General Meeting	Monday, 8th December	Liebe Office	Sophie Keogh (08) 9664 2030