

Helping you get the most out of your mixed farming business



2014 Trial Results

An overview and analysis of trial site results for grazing
crops and pastures in rotation in Western Australia





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Grain and Graze 3 aims to boost whole farm profitability and sustainability of mixed farming enterprises across Australia.



The Grain and Graze 3 program is engaging with farmers and advisers through on-farm research trials, grower groups, paddock walks, field days and publications.

Through a range of projects, Grain and Graze 3 is assisting farmers and advisers to develop new skills; make better decisions; adopt new management practices and technologies in order to deliver more productive, adaptive and resilient mixed farming systems.

Grain and Graze 3 is funded by the Grains Research and Development Corporation (GRDC).

Grain & Graze 3 Activity Locations



Grain and Graze 3 - Group Activities and Projects

West Midlands Group (WMG)

Grain and Graze 3 is working with members of the Livestock R&D sub-committee of the West Midlands group to improve the performance of pastures that form part of their cropping rotation. On the poorer sandy soils of the region, where subclover struggles, cropping has increased in frequency in recent years, but is rarely practised continuously, so a pasture phase is often incorporated. Growers are increasingly looking to use Serradella as their annual pasture legume on this soil type. A number of WMG members travelled to Esperance in 2013 to look at pastures, and all came home highly motivated to try new things in 2014. A Grain and Graze sponsored bus tour in September 2014 shared local experiences of growing Serradella, Bladder Clover and Biserrula with the wider WMG membership. Phil Barrett-Lennard from agVivo is working with WMG on behalf of Grain and Graze 3.

Moora Miling Pasture Improvement Group (MMPIG)

Grain and Graze 3 is working with members of the MMPIG to investigate the use of grazing crops in mixed farming systems. MMPIG is currently hosting a small MLA funded trial (coordinated by Ed Riggall) which is attempting to quantify the impacts on both the crop and livestock enterprise when grazing crops. The group meet

throughout the year to discuss the management of the trial. Phil Barrett-Lennard from agVivo is also providing the group with technical support.

Kellerberrin Discussion Group

The Kellerberrin Discussion Group is exploring the use of grazing crops in a low rainfall environment, continuing the work they started in Grain and Graze 2. In 2014, they investigated the use of low stocking rates on early sown cereal crops to reduce the risk of incurring costly yield penalties from grazing and frost. Geoff Fosbery of ConsultAg supports the Kellerberrin group with their annual trial program.

Facey Group

Managing frost risk is one of the priorities of the Facey Group from Wickepin. Grain and Graze 3 is working with the Facey Group to explore the role that grazing crops has in managing some of this risk. A replicated small plot trial was sown in 2014 that explored both the early and late sowing of a wide range of wheat, barley and oat varieties, with and without grazing. While it is well known that some cereals have more frost tolerance than others (e.g. oats>barley>wheat), the impacts of grazing on flowering date and canopy temperature is less well understood. A similar trial will be conducted in 2015, with more grazing treatments included to better understand some of these interactions.

Muchas Gracias Group

The Muchas Gracias Group is a small group of innovative mixed farmers from the Wagin, Arthur River and Woodanilling areas. They work closely with Planfarm consultant Paul Omodei and DAFWA researcher Perry Dolling on improving the transitioning from crop to pasture and pasture to crop. In 2014, they explored the use of sown cereals in the first year of the pasture phase to boost early winter feed, and the use of pulses (peas, vetches) to fix N and produce a high quality standing fodder crop. The group use a "blog" to share ideas, ask questions, and provide feedback to each other.

Badgebup LTEM Group

The Badgebup (east of Katanning) Group started when a group of local farmers completed a Life Time Ewe Management (LTEM) course with Paul Omodei from Planfarm. They wanted to improve their pasture management which led to their involvement in Grain and Graze 3. Some of the issues they are keen to explore include (1) comparing the newer aerial seeding annual legumes such as Margarita Serradella and Bladder Clover to sub clover, (2) scratching in cereals to boost early winter feed in low density pasture paddocks, and (3) grazing crops to provide extra early winter feed. The Badgebup group work together with input suppliers such as Landmark and CSBP and the nearby Nyabing Farm Improvement Group.



Southern DIRT

Grain and Graze 3 is utilising well-known farmer and consultant Joe Young to work with a number of local Kojonup farmers who have previously completed the LTEM course. They are keen to explore the use of grazing crops in their mixed farming systems. In 2014, they hosted a paddock scale replicated trial site that explored wheat varietal suitability when sowing early and grazing. In 2015, they intend to conduct more on-farm trials, exploring a number of different ways of incorporating grazing crops into their current farming system.

Stirlings to Coast Farmers

Tight cropping rotations, weeds, diseases and soil fertility decline are starting to rear their ugly head on the South Coast. To provide some options, the Stirlings to Coast Farmers group is working with Grain & Graze 3 to explore the role of pastures in the cropping rotation. They are being helped by DAFWA researcher Perry Dolling, who is conducting on-farm trials comparing the productivity and N fixation of a range of different annual legume pasture species.

North Stirlings LTEM Group

Ed Riggall, a well-known sheep industry consultant, is working with an ex LTEM group in the North Stirlings area as part of Grain and Graze 3. The majority of the group members run mixed farming systems with a 60:40 crop to pasture ratio. One of the issues of interest to

them is improving the productivity of first year pasture paddocks, and in 2014 they explored the use of scratched-in cereals. They are also interested in the use of grazing crops to boost early winter feed, and the use of winter manipulation in the last year of the pasture phase to set up paddocks for cropping.

Lakes Grower Group

Paul Omodei of Planfarm is working with a number of mixed farming families in the Lakes district as part of Grain and Graze 3. They are keen to explore the performance of some of the newer annual legumes pastures, as well as methods to improve the nodulation and N fixation of existing pasture species. Another area of interest is the use of sown cereals for early sheep feed, be it specialist forage varieties such as Moby barley, or the typical malting or feed barley varieties commonly used in the area.

RAIN

The RAIN group has members north, south, east and west of Ravensthorpe, and as you might expect the soil types and rainfall vary considerably. Although this often makes it hard for farmers to directly compare with others, the collective experience of the group is vast as almost all pasture species and varieties have been trialled by someone, somewhere! Perry Dolling of DAFWA is working with the group to help them decide if, when and where pastures should be re-sown.

ASHEEP

The ASHEEP group from Esperance has worked very closely with researchers from DAFWA and Murdoch University over the last few years to equip themselves with the skills and knowledge needed to successfully grow the newer aerial seeding annual legume pasture species. Through Grain and Graze 3, they are able to explore some other areas of interest to them. These include quantifying the impacts of using species such as Italian ryegrass and Vetch in the pasture phase on subsequent crops production. Greg Warren from Farm & General is working with the group on Grain and Graze 3 projects.

SEPWA

For a number of years, farmers in the Esperance region have been at the forefront of using grazing crops to improve their mixed farming businesses. They are constantly looking to improve, so they jumped at the opportunity to work with Grain and Graze 3 and explore varietal suitability when early sowing and grazing. Trial work in 2014 compared a wide range of wheat and barley varieties, comprising both winter and spring types. It showed that some of the winter wheats compare favourably to Urambie winter barley (the current favourite) when sowing in March and early April, and that some of the later maturing Spring barley varieties (e.g. Oxford) fit nicely when sowing in mid-late April. Greg Warren from Farm & General is working with the group on Grain and Graze 3.





The impacts of early sowing and crop grazing on the grain yield and quality of a range of winter and spring cereal varieties

Philip Barrett-Lennard, agVivo; Sheree Blechynden, Facey Group; Joe Young, Southern DIRT; Greg Warren and Michelle Handley, Farm & General

Key Messages:

- A small number of winter and later maturing spring cereal varieties are suitable for early sowing and grazing in the medium and high rainfall zones of WA
- Early sowing significantly increased the amount of crop biomass available for livestock in mid-winter
- Grazing reduced grain yield in 2 out of 3 experiments

Aim:

The use of crop grazing by mixed farmers can enable total farm productivity to be increased. The area of winter pasture required is reduced, as livestock spend some of their time grazing crops. This allows a greater percentage of the farm to be allocated to cropping for the same number of livestock. Or alternatively, a greater number of livestock can be run for the same area of crop/pasture.

To maximise the benefits from crop grazing, sowing some of the crop program early is critical to produce livestock feed in late autumn and early winter, when pasture is scarcest. However, most farmers in WA don't sow their cereal crops (utilising early-mid maturing spring cereal varieties) until May or early June. From a crop grazing perspective, this relatively late sowing date severely restricts both the amount of crop biomass available for grazing and the length of the grazing window.

To make use of early sowing opportunities, winter type cereals, with a vernalisation requirement for flowering, are needed when sowing in March and early-mid April, and late maturing Spring type cereals, with slow development, are needed when sowing from mid-April to early-May.

The aim of these trials was to assess the impacts of early sowing and crop grazing on the grain yield and quality of a range of winter and spring cereal varieties.

Method:

Trial sites were established at Wickepin, Kojonup and Esperance.

Wickepin:

A small plot (plots 1.5m wide x 10m long) trial was conducted on Gary Lang's farm, 15km NE of Wickepin. The experiment tested 11 varieties, 2 times of sowing (April 23 and May 27) and +/- grazing. There were 3 replicates per treatment. Grazing of the grazed plots was simulated using an auto scythe, with a cutting height of 5cm. The first time of sowing was grazed twice (June 10 and July 15) while the second time of sowing was only grazed once (July 15). Quadrat cuts were used to determine the amount of edible biomass (plant material >5cm in height) available at each grazing. A small plot harvester was used to measure grain yield.

Kojonup:

A large plot (plots 12m wide x 200m long) trial was located on Wayne and Pip Crook's farm, 30km SSW of Kojonup. The experiment tested 7 varieties, 1 time of sowing (May 6) and +/- grazing. There were 3 replicates per treatment. Sheep grazed the grazed plots twice (June 25 to 27 and July 16 to 18), down to a height of approximately 5cm. Quadrat cuts were taken to assess crop biomass pre and post-grazing. A small plot harvester was used to measure grain yield.

Esperance:

A large plot (plots 18m wide x 300m long) trial was located on David Cox's farm, 25km NE of Esperance. The experiment tested 7 varieties, 1 time of sowing (April 16) and +/- grazing. There were 4 replicates of the Urambie barley +/- grazing treatments, but only one replicate of all other treatments. Cattle grazed the grazed plots twice (June 4 to 17 and July 7 to 15), down to a height of approximately 5cm. A large combine harvester and weigh trailer were used to measure grain yield.



Rainfall:

Table 1: Monthly rainfall (mm) at the Wickepin, Kojonup and Esperance trial sites in 2014.

SITE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Wickepin	0	0	7	25	72	24	62	54	36	36	5	0	321
Kojonup	0	22	2	11	136	53	113	70	57	61	16	0	540
Esperance	10	9	1	14	78	46	114	48	60	97	46	0	523

Results:

Wickepin:

Edible dry matter production up to mid-July from the first time of sowing (23 April) was significantly greater than the second time of sowing (27 May) at Wickepin (Table 2). Oats were more productive than barley and wheat, and the "spring" varieties more productive than the "winter" varieties.

Table 2: The impact of variety and time of sowing on "edible" dry matter production (kg/ha >5cm in height) up to mid-July at Wickepin

VARIETY	TIME OF SOWING	
	23-APR	27-MAY
Wheat		
Mace	822	116
Magenta	619	118
Forrest	561	82
Currawong	434	107
Wedgetail	459	114
Manning	285	133
Barley		
Hindmarsh	732	83
Oxford	522	85
Urambie	420	45
Oats		
Bannister	923	79
Eurabbie	805	80
Average	599	95
P-value	<0.001	
LSD (p=0.05)	109	

Table 3: The impact of variety, time of sowing, and grazing on flowering date (Z65 for wheat, Z45 for barley and oats) at Wickepin

VARIETY	TIME OF SOWING			
	23-APR		27-MAY	
	GRAZED	UNGRAZED	GRAZED	UNGRAZED
Wheat				
Mace	19-Sep	28-Aug	19-Sep	19-Sep
Magenta	19-Sep	29-Aug	23-Sep	23-Sep
Forrest	30-Sep	19-Sep	10-Oct	9-Oct
Currawong	23-Sep	19-Sep	3-Oct	3-Oct
Wedgetail	26-Sep	19-Sep	3-Oct	3-Oct
Manning	17-Oct	16-Oct	24-Oct	24-Oct
Barley				
Hindmarsh	29-Aug	11-Aug	4-Sep	2-Sep
Oxford	31-Aug	19-Aug	16-Sep	11-Sep
Urambie	31-Aug	26-Aug	12-Sep	11-Sep
Oats				
Bannister	9-Sep	22-Aug	11-Sep	10-Sep
Eurabbie	9-Sep	5-Sep	16-Sep	16-Sep
Average	16-Sep	5-Sep	23-Sep	22-Sep

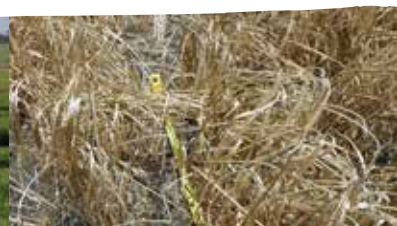


Table 4: The impact of variety, time of sowing, and grazing on grain yield (t/ha) at Wickepin

VARIETY	TIME OF SOWING			
	23-APR		27-MAY	
	GRAZED	UNGRAZED	GRAZED	UNGRAZED
Wheat				
Mace	2.5	3.6	3.2	3.8
Magenta	2.6	4.1	3.7	3.8
Forrest	2.8	3.9	3.1	3.4
Currawong	3.3	3.9	3.9	3.7
Wedgetail	2.9	3.7	3.0	3.2
Manning	2.1	2.8	1.1	1.2
Barley				
Hindmarsh	2.8	4.6	3.7	4.2
Oxford	3.5	5.3	3.9	4.1
Urambie	3.1	3.4	3.3	3.6
Oats				
Bannister	3.0	4.1	4.1	4.5
Eurabbie	2.7	3.9	3.7	4.1
Average	2.8	3.9	3.3	3.6
P-value	<0.001			
LSD (p=0.05)	0.4			

Grazing significantly delayed the date of flowering in the first time of sowing, but not the second time of sowing (Table 3). The delay in flowering was significantly longer in "spring" varieties (11 to 22 days) when compared to "winter" varieties (1 to 7 days). Early sowing enabled the late maturing wheat varieties (Forrest, Currawong, Wedgetail) to flower in the optimal mid-late September period. Early-mid maturing varieties (Mace, Magenta) also flowered at this time, but only when sown late, or sown early and grazed. When sown early but not grazed, they flowered in late August (a high frost risk period). The very late maturing Manning wheat always flowered in mid-late October, regardless of management.

Grazing reduced grain yield in both early and late sown crops, although the impact was less in late sown crops (Table 4). When sown early, the two earliest maturing cereal varieties (Mace wheat and Hindmarsh barley) suffered the most from grazing. This is most likely due to grazing removing initiating heads. In all varieties, except the very late maturing Manning wheat, early sown grazed crops yielded less than late sown ungrazed crops.

Kojonup:

Grazing did not have a significant impact on yield, but it did on grain quality at Kojonup (Tables 5 & 6). Small foreign seeds, ergot and screenings all increased under grazing. The increase in ergot and small foreign seeds suggests grazed crops contained more ryegrass than ungrazed crops. Weed numbers were not assessed.

Table 5: The impact of variety and grazing on grain yield (t/ha) at Kojonup

VARIETY	GRAZED	UNGRAZED
Calingiri	4.6	4.7
Currawong	5.2	5.1
Forrest	4.2	5.2
Magenta	4.1	4.6
Revenue	4.7	4.4
Scout	4.2	4.3
Wedgetail	4.3	4.6
Average	4.5	4.7
P-value	0.2	
LSD (p=0.05)	1.1	

Table 6: The impact of grazing on grain quality at Kojonup

	GRAZED	UNGRAZED	P-VALUE	LSD (P=0.05)
Small Foreign Seeds (%)	0.7	0.2	<0.001	0.2
Ergot (cm)	5.8	2.4	0.005	1.8
Screenings (%)	2.7	2.1	0.005	0.3

Esperance:

Grazing significantly reduced grain yield by 0.5 ton/ha at Esperance (Table 7). Insufficient replication made it impossible to determine if there was an interaction between grazing and variety, even though the data suggests the two spring barley varieties (Grange and Oxford) were least affected by grazing. Einstein wheat was the highest yielding ungrazed variety, while Oxford barley was the highest yielding grazed variety. Mace wheat was the lowest yielding grazed variety, and third lowest yielding ungrazed variety, showing there are far better options available when sowing early and grazing.



Table 7: The impact of grazing on grain yield (t/ha) at Esperance

	GRAZED	UNGRAZED	P-VALUE	LSD (P=0.05)
Grain Yield	3.1	3.6	0.06	0.54

Table 8: The impact of variety and grazing on grain yield (t/ha) at Esperance

VARIETY	GRAZED	UNGRAZED
Wheat		
Mace	2.3	3.3
Currawong	2.8	3.2
Einstein	3.4	4.7
Revenue	3.1	3.7
Barley		
Grange	3.2	3.1
Oxford	3.5	3.5
Urambie	3.1	3.6
P-value	0.68	
LSD (P=0.05)	1.6	

Head loss in grazed barley was significantly less than in ungrazed barley at Esperance (Table 9). Varietal differences in head loss were large, with Urambie barley far worse than Grange and Oxford.

Table 9: The impact of variety and grazing on barley head loss (heads/m²) at Esperance

VARIETY	GRAZED	UNGRAZED
Grange	12	30
Oxford	4	34
Urambie	62	81

Conclusion:

In these experiments, cereal crops were sown 2 to 4 weeks earlier than standard district practise. This significantly increased the amount of crop biomass available for grazing in early to mid-winter. As an example, the increase in available biomass at Wickepin from early sowing was over 600% (599 vs 95 kg/ha). Clearly, if additional livestock production is a major priority from grazing crops, early sowing is a must.

Grazing did reduce grain yield in 2 out of the 3 experiments. Care must be taken when grazing to avoid inducing large and costly yield penalties. Based on other Grain & Graze research, we know that the timing and amount of crop biomass left when livestock are removed are key factors in determining the size of any yield penalty. In all 3 experiments, livestock were removed from crops in mid-July. We suggest this was either too late, or the amount of biomass remaining after grazing was too little. Confining crop grazing to just the month of June, when pasture availability is most limited, might be one way to reduce the risk of incurring yield penalties. Experimentation in 2015 will explore this.

Grazing did delay crop flowering, especially when crops were sown early and grazed for an extended period. Care needs to be taken when grazing early sown spring varieties with early-mid maturity as they rapidly reach Z30 and grazing can remove developing heads. Winter varieties can be sown as early as February and March without the worry of them rapidly reaching Z30, as this is controlled by their requirement for vernalisation.

The earlier maturing varieties of winter cereals such as Urambie barley and Currawong wheat appear to have a good fit when sown early in the medium and high rainfall zones. Ideally these would be sown in March or early April utilising early autumn rain and/or carryover subsoil moisture. The very late maturing winter cereals such as Revenue and Manning wheat appear to be unsuited to WA conditions due to the risk of moisture stress during grain fill.

Oxford, a high yielding, later maturing spring feed barley, appears to be an excellent option for sowing in mid-late April to provide grazing in early winter, and a high grain yield come harvest. To minimise the risk and size of any yield penalty, grazing could be confined to early winter (i.e. June).

High yielding, early-mid maturing spring cereal varieties such as Mace wheat and Hindmarsh barley should not be sown early with grazing used to hold back their development. Significant yield penalties are likely to occur with this strategy. A better strategy is to sow these in their normal sowing window (May) and graze very lightly in mid-winter (i.e. early July) if livestock feed is in short supply.

Key Words: Grazing, Crops, Cereals

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Paper reviewed by James Hunt, CSIRO



Grazing Crops in Practise

Name:

Kolindale Merino & Poll Merino Stud

Producer:

Luke Ledwith

Location:

Dudinin

Farm Size:

8000 ha

Average Annual Rainfall:

325mm

Soil Type:

Mixed duplex

Enterprise Mix:

Mixed crop and livestock

Luke Ledwith runs a mixed crop and livestock farm east of Dudinin and have been grazing their crops for around five years. The Ledwith's have a merino sheed stud and with contacts made through this, they decided to begin grazing crops.

The Ledwith's see grazing as a tool within their farming system to ensure additional food is available for their livestock, and allows them to put in more crop while being able to run the same amount of sheep each year. Luke estimates that by grazing they are able to increase their cropped area by around 10%. Grazing crops also allows them to spray out all of the grass weeds in their pastures as they can be confident that there will be sufficient supplementary feed. Ultimately it allows them to set up pastures for following years and provides an excellent feed source.

Most cereal and canola crops can be grazed when set up and managed appropriately, but the Ledwith's primarily graze early sown barley and oats due to their tendency to have vigorous early growth. Wheat is generally not grazed on their property as they have found the impact on yield seems to be greater and there is not as much feed available early on. Through trial work with Facey Group and DAFWA, as well as personal experience, Ledwith's currently ensure all grazing is done by mid to the end of July so as not to impact on yield.

The Ledwith's use twin sowing of sub clover with canola to effectively control grass weeds in one year. This eliminates weed pressure in the following year when the paddock is in pasture, and also means the paddock is clean when planted into cereals and grazed in subsequent years. As weeds are seen as the number one issue with grazing crops these practises are utilised by the Ledwith's to ensure paddocks are as clean of grass weeds as possible.

Some of the challenges faced over the years, besides an ongoing battle with weeds, include working out how late in the season crops can be grazed without

impacting on yield. Mid-late July has become their standard as well as only grazing oats and barley, as they found there was less impact on yield than wheat.

Luke also believes using older sheep for grazing can be better than the younger ones as they digest the feed better resulting in lower instances of flystrike. Supplementing with hay /straw in addition to grazing also seemed to make the green feed more palatable. Some calcium/magnesium supplements are also used but as they mainly graze barley and oats they haven't found lack of nutrition to be a major issue.

The Ledwith's have been involved in trials with Facey Group and DAFWA, researching the impact of grazing different crop varieties, changing the dates of grazing and looking at the amount grazed. They have been great supporters of local research and are keen to see the findings of the Grain and Graze 3 project over the next few years. The 2014 Grain and Graze 3 small plot trial at Wickpin was set up to look at the impact of (and interaction between) grazing and frost damage on the grain yield and quality of a range of winter and spring cereal varieties sown at two times of sowing. Another trial will be set up in 2015 utilising the feedback, findings and learning's from 2014. Luke would like to see more research into grazing crops, particularly nitrogen rates, topping up with nitrogen during the season and time of sowing, especially for wheat as it tends to have a less vigorous initial growth than barley and oats.

As extension to the Grain and Graze 3 project Facey Group ran one Discussion Group and Field walk in August 2014 and are having a follow up meeting and Discussion Group in February 2015. The purpose of these discussion groups is to discuss the objectives and management of the trial site and ensure research is locally relevant. It is envisioned that the Grain and Graze 3 project will give more growers the knowledge base to utilise grazing crops as part of their farming system, such as what the Ledwith's are already doing.



Facey Group Discussion Group August 2014 at the Grain & Graze 3 trial



Grain and Graze 3 Time of Sowing 1 wheat plots after first grazing cut with lawnmower (10th June 2014).



Bannister, grazed and ungrazed Time of Sowing 1 (23rd April 2014). Grazed plot on the left (grazed twice) is later maturing than the ungrazed plot on the right.



Bannister, grazed and ungrazed Time of Sowing 2 (27th May 2014). Grazed plot on the left (grazed once) has very similar maturity to the ungrazed plot on the right.

Key Steps in Luke's Experience for successfully grazing crops:

- Graze early sown barley and oats for vigorous early growth
- Ensure all grazing is done by mid to late July so as not to impact on yield
- Use twin sowing of sub clover with canola to control grass weeds in one year
- Using older sheep for grazing is better as they digest feed better resulting in lower instances of flystrike

More information

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Crops reaping the benefits of Serradella pastures

Name:
Jucasta West

Producer:
A & R McIntyre

Location:
Neridup Farm, 40km north-east of Esperance

Farm Size:
1700ha

Average Annual Rainfall:
450mm; $\frac{3}{4}$ of which falls in the growing season

Soil Type:
Gravelly sands to deep sands; pH: 4.7-6

Enterprise Mix:
2/3 crop; 1/3 sheep

Mixed Phase Farming or Continuous Cropping?

It's not unusual for producers in the Esperance region to grapple with the question what would be more profitable, mixed phase farming or continuous cropping? In years gone by growing season rainfall has helped those with properties in the higher rainfall and sandier soil areas of the region make their decision. Their properties are often too waterlogged to be continuously cropped but as growing season conditions have become drier over the last 10 years or so the question "will moving to continuous cropping be easier to manage and make us more profit?" has been less easy to answer.

It's a question Alistair and Robyn McIntyre have considered more than once as they approach each new season on their Neridup property Jucasta. They know their canola crop is the most profitable element in their farming enterprise and it's very tempting to chase its returns year after year.



Alistair assessing regeneration of his Serradella pasture in January 2015, following a barley crop in 2014

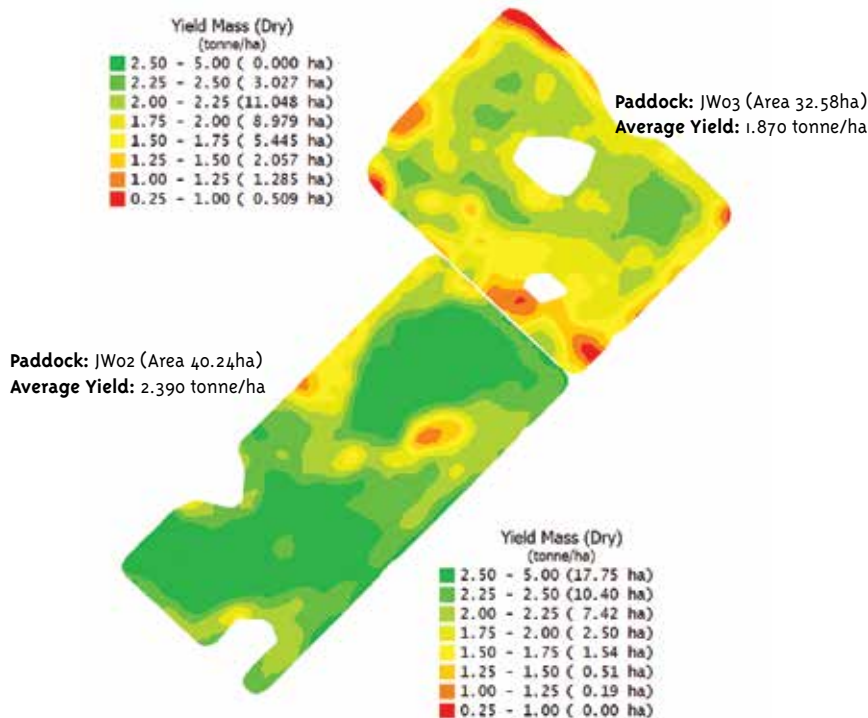
Alistair grew up on Jucasta and he knows he is interested in farming it for the long term. He instinctively takes into consideration questions of long-term sustainability and understands the importance of soil fertility. So for Alistair and Robyn using legume pastures to improve soil condition plays an important role in their farming enterprise, believing their use will result in a higher probability of better crops yields with fewer inputs. The pasture species they have chosen is Serradella.

Serradella Pasture Phase Benefits Crop Yield

Jucasta West's current rotation is now Serradella/Canola/Cereal, a decision that Alistair has justified through improved cereal yields following Serradella pasture, as compared with those grown on traditional clover/grass pastures. The 2013 yield map shown below highlights this trend. Canola grown in paddock JW02, sown following a regenerated Serradella pasture, yielded 520kg/ha better than paddock JW03, sown after a regenerated clover/grass pasture. Barley was sown into JW02 in 2014, a below average rainfall year with only 120mm falling up until June 30 resulting in patchy germination in the non-wetting soils



Transferring harvested Serradella pods for storage



2013 Canola Harvest Yield Map for Paddocks JW02 and JW03

present in this paddock. It still averaged 3.6 tonnes/ha with only 36kg/ha of applied Nitrogen. This compares with up to 80kg/ha normally required to achieve cereal yields after canola on Jucasta – a significant input cost reduction.

With each year of a Serradella pasture phase they have also seen additional benefits such as an increase in earthworm activity and an improvement in clover density when it had been on the decline on Jucasta until Serradella was first grown.

Establishing Serradella Pastures for Longevity

We've often heard of Serradella's reputation as a proven legume for acidic sandy soils that is hard to get established in non-wetting sands, but this hasn't been Alistair's experience on Jucasta. His method for establishment is simple –

"I sow a paddock every year, treat it like a crop, seed it at high density, and make sure it has every chance for maximum seed set. I aim to have Serradella pods touching each other on the ground at seed set, my pastures are then set up for life and my cropping rotation is made simpler."

Alistair has not been swayed by the move towards Summer Cropping to establish Serradella. He waits until his canola programme is sown, achieves a good chemical knockdown of weeds and then sows his Serradella using harvested pod from the previous year's seed paddock. To get seed to sow the harvested pods are de-hulled, which results in enhanced pods and bare seed. Due to plant breeder rights (PBRs) rules, in the past Alistair has used the enhanced pods himself and collected the bare seed and sold it through registered seed houses. Because the PBRs have now expired on Santorini either enhanced pods or bare seed can be used and traded directly. Alistair's reasoning for autumn sowing is that while summer sown Serradella may provide more early feed, weed control and achieving a high plant density is a lot harder; and achieving high plant density in the establishment year is his first priority.

Alistair's main objective with his Serradella stand, other than more annual pasture, soil nitrogen fixation and soil condition improvement, are to achieve good ryegrass and broadleaf weed control. All of this contributes to setting up his cropping rotation, combined with

maximum seed set of the Serradella to ensure good regeneration after the two year cropping phase.

Alistair brown manures his Serradella stands by applying Paraquat no later than the end of October from the second year onwards (it must be left alone in the establishment year to maximise seed set), for two important reasons:

1. To maximise moisture conservation for the following cropping phase and
2. To maximise control of ryegrass seed set before they are viable, but after the Serradella has set viable seed.

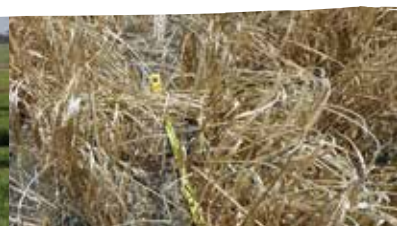
Brown mulching also results in thick Serradella mulch being left on the ground which has surprised Alistair in how effective it is in reducing the emergence of summer weeds.

Options to deal with Serradella Vines at Seeding

Serradella can be hard to deal with when it has not been harvested for seed as the vines can form a dense mat that is challenging to seed crop in to with precision. What may get around this problem, though Alistair is yet to test it, is to lightly graze the paddock intended for crop in the summer, followed by slotting with disc equipment to put furrows into the thick vines and then seeding into these furrows with discs or tines with RTK 2cm GPS accuracy.

Prioritising Paddocks for Serradella

When Alistair sets priorities for which paddocks will be sown to Serradella he considers what will maximise return from each hectare of the property. In his view, better paddocks will support better pastures, which will then grow better crops with reduced input costs so he has prioritised his best country for investment in Serradella pastures. On poorer country Alistair doesn't have the financial capacity to sow the whole lot down in one year so he takes a step by step approach to establishing Serradella on this country.



Santorini Serradella pasture on 15 March 2013, a week after 90mm rain. Santorini is moderately hard seeded, has good early vigour, dry matter production and good insect tolerance



Santorini Serradella pasture (taken from same spot as photo left) on 22 March 2013, 2 weeks after 90mm rain

Key Steps in Alistair's Experience for establishing Serradella:

- In the establishment year treat it like you would a crop and it will be set up for longevity.
- Don't summer sow it
- Seed after achieving a good chemical knockdown of weeds.
- Seed it densely. If you achieve good seed set in the 1st year it's hard to muck it up.
- Always inoculate seed.
- If you can afford it, maintain Phosphorus and Potassium nutrition (it does perform without it if need be).
- Brown Manure the stand, from the second year onwards, no later than the end of October.



More information

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Muchas Gracias Trials (Arthur River)

Cropping into pastures

Principles learnt from the Grain and Graze sites

- Where the pasture density is low sowing cereals into pastures dry or semi-dry before the break improves total biomass because of their fast growth rates and the increase in plant density. The key benefit of sowing cereals into pasture is that increases early biomass.
- When the pasture density is high (>1000-2000 plants per m²) sowing cereals into pasture may still increase total biomass depending on the pasture composition. Cereals are faster growing than ryegrass and legumes but have similar growth rates to capeweed and barley grass
- If the pasture has a high content of brome, barley and silver grasses then cereals are likely to be impacted by root diseases although this was not examined at the sites
- Unwanted species are removed later in the season as feed becomes more plentiful and therefore less valuable
- Under a rotational grazing situation after two grazing events cereals will be a minor component of the pasture (<10%)
- For pastures that have a high broadleaf content and a low legume content cereals can fill the void if these broadleaves are removed during the season rather than grass weeds replacing the broadleaf weeds
- Topdressing of cereals is a low cost way of "sowing" cereals into pasture but will only work on loose soil (sandy soils or cropped the previous year)
- Cultivation can stimulate ryegrass germination although at one site the impact was small (the seed bank was low) and the other site was too variable to determine if this occurred
- Cultivation may also improve water penetration but this was not explored at the sites
- Inclusion of pasture legumes with the cereals at two sites improved the legume content but the impact was small because of insect damage and deep sowing which highlights that these species need greater attention than cereals
- The key to sowing cereals into pasture into dry soil is to only shallow seed (tip sowing). Deep sowing using knife points will result in increased bare ground as soil will be thrown into the inter row burying pasture seeds.
- Tip sowing makes such a small impact in terms of soil stability so that early dry sowing is possible. Dry sowing as per a crop will leave the paddock susceptible to wind and water erosion. The other option is discs, but this is another machine and more \$.
- Tip sowing dry also gets the seeder ready and tested before cropping starts, this alone could earn the whole cost of the pasture sowing exercise by increasing crop yields due to earlier sowing

Pastures in Rotation 2014 trial results



Brad Wooldridge

South paddock (40 ha) and Jarrah paddock (40 ha)

Background

South paddock was pasture in 2013 and it was spraytopped in spring as it had high ryegrass density. Previous history involved lupins (2 t/ha) in 2012, oats in 2011 and pasture in 2009-10. Due to the spraytopping the plant density may be low so the aim was to increase density by sowing barley, canola and balansa (also providing N) as well as to stimulate further weed germination. On the 7 May 2014 85 kg Baudin barley, 11 kg canola & 1 kg balansa/ha was shallow seeded into marginal soil moisture. The paddock was rotationally grazed every 3 weeks for 4 days. The paddock was grazed heavily and spraytopped with paraquat in October 2014.

Jarrah paddock had lupins (2 t/ha) in 2013 after 10 years of pasture. The reason for the lupins is because the pasture was declining in quality and health. The lupin crop had some ryegrass post-seeding. Minimal control of this ryegrass occurred to provide feed in the following pasture phase. Previous experience indicates that the lupin stubble provides an N input to the ryegrass. In the case of the Jarrah paddock, the ryegrass was not in high density all over so oats was topdressed at 200 kg/ha in February to provide supplementary feeding and to increase early feed production. The paddock was rotationally grazed every 3 weeks for 4 days. 20 kg N/ha was applied on the 10 August.

Results

Plant densities

In South paddock there were high ryegrass numbers which is surprising given that it was spraytopped last year (Table 1). Control strips (no tillage and no seed and tillage no seed) did not show any differences (results are not shown) due to the variability of both the sub-clover and ryegrass. There were high RLEM numbers and this killed some of the balansa and canola. The topdressing of oats into Jarrah resulted in good plant numbers (Table 1). There was also high ryegrass and sub-clover numbers.

Table 1. Median plant densities (plants per m2) on the 21st May 2014

SPECIES	SOUTH	JARRAH
Sub-clover	100	600
Ryegrass	2,550	2,000
Cereal	296	200
Canola	37	
Balansa	83	
Total	3,574	3,200
% Bare ground	30	20

Composition & biomass

On the 5th June in both paddocks cereals are contributing around a quarter to the food on offer (FOO, Table 2). Cereals are erect and therefore nearly all of this FOO is available to the stock. Both paddocks had not been grazed at this stage

On the 18th July there has been a major shift in composition compared to measurements made on the 5th June (Table 2). At both sites the clover content has increased by 14-17% and the cereal content declined by 18-22%. Ryegrass content has remained roughly the same. Both these paddocks had been grazed twice for 3-4 days each time. The overall farm stocking rate is 10.5 DSE/ha.

Table 2. Average food on offer (FOO) and composition

	5TH JUNE 2014		18TH JULY 2014		25TH SEPTEMBER	
PARAMETER	SOUTH	JARRAH	SOUTH	JARRAH	SOUTH	JARRAH
FOO (kg/ha)	756	833	1625	1247	1228	971
Clover %	36	29	53	44	64A	48
Ryegrass %	38	38	33	45	26	47
Cereal %	23	27	5	5	0	1
Other %	3	6	5	2	10	4
% Bare ground	10	8	4	4	0	0

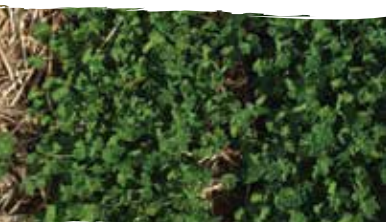
A6% balansa

In South paddock, the clover content was 11% higher than in July. Ryegrass content declined by 7% compared to the July measurement. In Jarrah paddock, the composition of the pasture was similar to the July measurement with small increases in the clover and ryegrass content. This paddock will remain in pasture next year.

Conclusions

Sowing and topdressing of cereals into two pasture paddocks improved early (May to the end of June) available biomass and most likely increased the total biomass. Both paddocks had high levels of ryegrass which may have had higher growth rates if the cereal was not present. However, ryegrass is slower growing than cereal in autumn and winter and therefore compensatory growth may have been limited.

The other advantages of sowing cereals and legumes (in the case of South) were to simulate ryegrass germination via cultivation and to provide nitrogen to the soil. We could not determine if the ryegrass density was higher due to paddock variation and the high numbers (>2000 plants per square meter) but the legume composition increased as the season progressed.



Bryan Kilpatrick

Background

The aim was to dry seed a cereal and legume into a pasture paddock to improve feed quality and quantity and to stimulate weed germination. The paddock has been in pasture for a number of years. The paddock may have low density possibly because it is close to yards and is heavily grazed at times. On the 24th April 40 kg Oats and 8 kg Dalkeith sub-clover/ha was sown into dry soil using narrow points. There were two control strips; light tillage and seed, no tillage and no seed. The paddock was grazed three times during the year, Flexi N was applied mid-July and the paddock was spraytopped in October.

Plant densities

Sowing oats and sub-clover (Till & seed) resulted in good oat plant densities and a small increase in the sub-clover densities (Table 3). The sub-clover density was also less variable than in the no till and no seed strip. The sub-clover may have suffered from being sown too deep possibly caused by heavy rains washing soil into the furrow. There was a strip which had light tillage and the sub-clover densities were much higher but the oats was less. The tillage operation also increased the amount of bare ground and reduced the capeweed and erodium (mainly soft) densities possibly because soil was thrown into the inter-row burying the seed. It is also stimulated ryegrass germination.

Table 3. Median plant densities (plants per m2) on the 21st May 2014

SPECIES	TILL & SEED	LIGHT TILL & SEED	NO TILL & NO SEED
Sub-clover	139	422	100
Ryegrass	33	NR	0
Cereal	190	80	0
Capeweed	489	NR	700
Erodium	117	NR	250
Total	1,252	NR	1,400
% Bare ground	55	40	20

NR = not recorded

Composition & biomass

On the 18th June, the seeding of oats has resulted in no change in total pasture food on offer (FOO) compared to the no till and no seed strip but the oats has replaced capeweed (Table 4). Capeweed is a valuable pasture species but as part of the mix and not dominant as it is in the no seed strip. The oats is performing strongly even with the competition from the capeweed and Erodium. On the 12th June 600 ml/ha of MCPA was sprayed on the pasture to control the broadleaves followed by grazing 10 days later. The MCPA had not affected the composition when the measurements were taken on the 18th June.

Table 4. Average FOO and composition on the 18th June 2014

PARAMETER	TILL & SEED	LIGHT TILL & SEED	NO TILL & NO SEED
FOO (kg/ha)	1212	1201	1245
Oats	31%	20%	0
Sub-clover	4%	17%	7%
Capeweed	37%	29%	55%
Soft erodium	21%	27%	25%
Ryegrass	6%	5%	6%
Other	1%	1%	8%

"Spray graze" with MCPA has had a dramatic impact on the composition (Table 5). The broadleaf content has decreased by 34% in the strip sown with oats and clover (Till and seed strip) and 48% with no oats and clover (No till and no seed strip). The reduction in these two species allowed the ryegrass and to a less extent the clover and oats to be more competitive and their composition has increased. The benefit of seeding the oats continues to pay dividends as the oats has replaced winter grass (others). The spray graze technique has come at a small cost to the FOO but this is minor compared to the improvement in quality of the pasture. The value of seeding shallow for the sub-clover continues to show through (light till and seed strip).

On the 26th September, compared to the July measurement the sub-clover content has increased, the oat content decreased and the silver grass content increased (most of the other % in Table 6). In the area which was seeded the clover content was slightly higher, the ryegrass was higher and the silver grass content (other %) was lower compared to the area not seeded. The total biomass was lower in the area seeded mostly likely because there was a greater percentage of the more palatable species.

Pastures in Rotation 2014 trial results



Table 5. Average FOO and composition on the 21st July 2014

PARAMETER	TILL & SEED		LIGHT TILL & SEED	NO TILL AND NO SEED	
	NO MCPA	MCPA	MCPA	NO MCPA	MCPA
FOO (kg/ha)	1248	883	899	1235	954
Oats %	20	29	19	0	0
Sub-clover %	9	14	36	8	25
Capeweed %	38	17	7	55	16
Soft erodium %	23	10	6	17	8
Ryegrass %	7	25	21	13	25
Other %	4	6	10	7	26

Table 6. Average FOO and composition on the 26th September 2014 (MCPA treated)

PARAMETER	TILL & SEED	NO TILL AND NO SEED
FOO (kg/ha)	1814	2335
Oats %	7	0
Clover %	40A	35B
Capeweed %	11	15
Soft erodium %	2	3
Ryegrass %	23	12
Other %	17	35

A 2% Gland clover

B 3% Gland clover

Conclusions

Cultivation via the seeding operation increased the ryegrass plant density improving the pasture quality and allowed these plants to be controlled by spraytopping late in the season in preparation for cropping. Seeding of oats into the pasture allowed pasture to be manipulated using the spray-graze technique to improve the pasture quality. The sub-clover content in the early part of the season was low and reducing the broadleaves where there was no oats led to an increase in the prickly grasses (brome, barley and silver grasses). That is the oats suppressed the prickly grasses and this effect lasted until at least the end of September.

Inclusion of sub-clover in the mix seeded did not impact greatly on the sub-clover content mainly because most of the seed was sown too deep. In-fill with drying seeding followed by a large rainfall event contributed to the seeds being covered with soil. Modifications to the air-seeder will reduce this effect in future years.

Seeding oats into pasture did not increase the total biomass. However, the quality of the pasture would have been improved. This is because in the early part of the season the oats reduced the capeweed content and after the spray-graze the oats suppressed the prickly grasses.





Stirlings to Coast Trials

Key messages

The trials were established to give farmers the opportunity to observe a range of pasture varieties and species in their environment rather than relying on data from outside the area. There was interest in determining data on productivity mainly in relation to N fixation to benefit subsequent crops. However, further work is required to determine the practical realities of management such as weeds, disease and livestock management. In terms of nitrogen fixation, if the legumes are well nodulated (which they were) then in general the quantity of nitrogen fixed will be related to the biomass. Both trials clearly show that the species which grow rapidly in spring produced the most biomass. These species are all aerial seed producing. Sub-clover is generally not as productive as these species. The trials had minimal grazing under more intensive grazing a different result may have occurred as sub-clover is more tolerant of grazing compared to the other species.

Iain Mackie's Trial west Mt Barker

Background

- Canola/barley rotation
- Barley stubble burnt in mid-April
- 20 mm rain on the 27th April, soil moisture was ideal
- Site harrowed with Phoenix harrows on the 28th April
- Pasture legumes top-dressed using a 12 volt spreader on the back of a ute on the 29th April
- 80 kg of CSBP MacroPro Boost top-dressed on the 29th April after top-dressing the seeAd
- The site harrowed after topdressing of seed and fertiliser on the 29th April
- The site was grazed twice during the season
- 12 pasture legume species and cultivars compared
- Plot size 15 m by 50 m with two replications
- Seeding rate approximately 10 kg/ha
- All clovers were peat inoculated with Group C (WSM1325) and lime pelleted. The serradellas had ALOSCA Group S (WSM471) on the day of seeding at the recommended rate of 10 kg/ha.

Stephen Beech's Trial west Kendenup

Background

- Canola/barley rotation for the last 4 years
- Heavy barley stubble
- 17 mm rain on the 27th April, soil moisture was ideal
- Pasture legumes top-dressed using a 12 volt spreader on the back of a ute on the 29th April
- The site was harrowed multiple

times using Phoenix harrows after topdressing of seed on the 29th April

- The site had no weeds at establishment as it had been dry up to the rain on the 27th April
- The site was grazed in early to mid-June
- A grass selective was used to control self-sown barley
- There were some issues with waterlogging early in the season and non-wetting at establishment but not all plots were affected
- 13 pasture legume species and cultivars compared
- Plot size, replications, seeding rate and inoculation as per Mackie's site

Results

Plant density on 3rd July 2014 and nodules on the 11th August 2014

The total plant densities at both sites are acceptable first year stands for all treatments. However, there were significant background sub-clover densities; 55 and 39 plants/m² at Iain's and Steve's sites respectively. If the background densities are removed from the total densities then some of the sown densities are low especially the medic plots. The medic seed used was 6 year old seed highlighting the importance of using fresh seed. Stephen's site also had some low densities because of high stubble load and parts of the site were waterlogged while other parts have non-wetting issues.

Pastures in Rotation 2014 trial results



Table 1. Plant densities (plants/m²) at Iain Mackie (site 1) and Stephen Beech's (site 2) sites (Sown species refers to plant densities with the background sub-clover removed from the total) and nodule ratings (scale 0 no nodules to 8 extremely abundant) on the 11th August 2014

PASTURE CULTIVAR/ SPECIES	TOTAL		SOWN SPECIES		NODULE RATING	
	SITE 1	SITE 2	SITE 1	SITE 2	SITE 1	SITE 2
	1	2	1	2	1	2
Arrowleaf clover	130	101	92	84	5.0	5.5
Bindoon sub-clover	196	89	138	50	5.3	5.8
Biserrula	231	130	106	87	5.3	2.4
Bladder & MarguritaA	164	123	133C	102C	5.0	5.7
Crimson clover	113	101	70	67	5.3	5.8
Dalkeith sub-clover	172	145	113	105	5.0	6.0
Mackie mixB	145	160	89D	120D	5.7	6.5
Margurita French serradella	208	116	127	60	4.7	6.6
Medic	85	58	2	4	5.3E	5.8E
Narrikup sub-clover	187	86	133	47	5.7	5.2
Santorini yellow serradella	189	164	126	113	3.7	6.4
Dalkeith 5 kg/ha		130		91		6.1

AThe seed consisted of 70% Bladder clover & 30% Margurita French serradella. The seeding rate was adjusted so that 10 kg/ha of Bladder was applied
 BMackie mix = 20% Paradana balansa clover, 30% Dalkeith sub-clover, 30% Trikkala sub-clover and 20% Narrikup sub-clover.
 BMargurita plant densities were 51% at Site 1 and 34% at Site 2
 CBalansa plant densities were 41% at Site 1 and 45% at Site 2
 DSub-clover

October biomass

At Mackie's, nearly all of the pasture species and cultivars produced more biomass than Dalkeith sub-clover (the district control) (Table 2). The most productive legumes were Santorini yellow serradella and the Mackie mix (which was dominated by balansa). The second most productive species include Crimson clover, Arrowleaf clover, Bladder clover and Margurita French serradella (Table 2). The sub-clover cultivars were in general not as productive as most of the aerial seeding species (Table 2). The trial had been un-grazed since early September.

At Beech's, most of the pasture species and cultivars produced more biomass than Dalkeith sub-clover (Table 3). The most productive legume was the Mackie mix. The second most productive species include Bladder clover, Arrowleaf clover and Crimson clover (Table 3). The sub-clover cultivars were in general not as productive as most of the aerial seeding species (Table 2). The trial had been un-grazed since June.

Table 2. Biomass on the 14th October 2014 at Iain Mackie's (sampled from areas of high plant density, SD = standard deviation, two replications)

PASTURE CULTIVAR/ SPECIES	BIOMASS (T/HA)	% OF DALKEITH	SD
Arrowleaf	7.35	134	1.59
Bindoon	6.13	112	0.45
Biserrula	5.29	96	0.56
Bladder & Margurita	7.01	128	0.09
Crimson	7.46	136	2.74
Dalkeith	5.49	100	0.90
Mackie mix	8.42	153	1.58
Margurita	6.82	124	0.77
MedicA	6.43	117	1.10
Narrikup	5.25	96	0.73
Santorini	8.52	155	0.73

ABackground sub-clover

Table 3. Biomass on the 13th October 2014 at Stephen Beech's (sampled from areas of high plant density, SD = standard deviation, two replications)

PASTURE CULTIVAR/ SPECIES	BIOMASS (T/HA)	% OF DALKEITH	SD
Arrowleaf	7.74	150	3.06
Bindoon	6.46	125	0.66
Biserrula	5.44	106	1.16
Bladder & Margurita	7.86	153	2.00
Crimson	7.43	144	1.80
Dalkeith	5.15	100	0.35
Mackie mix	9.45	184	0.31
Margurita	6.10	118	1.89
MedicA	5.27	102	0.33
Narrikup	5.34	104	1.44
Santorini	6.00	117	0.21
Dalkeith 5 kg/ha	6.28	122	0.32

ABackground sub-clover



Renovating pastures improves profits at West River

Name:
West River Downs

Producer:
L & A Caelli

Location:
West River, south coast of WA

Farm Size:
2,200ha, arable 1,900 ha

Average Annual Rainfall:
425mm

Soil Type:
Sand over gravel & sand over clay

Enterprise Mix:
Merino sheep & cropping

2014 pasture area:
1,150 ha

Winter grazed stock numbers:
5,500 with 1,850 breeding livestock

Major pasture species:
sub-clover, serradella, Rhodes grass, lucerne, Veldt grass

Luke and Annette Caelli have been actively re-sowing pastures on their West River farm. Over the last five years they have found that a number of species have stood out. One of these is French serradella. The hard seeded varieties Margurita and Erica have been sown with the following benefits:

- It is easy to get established and to persist,
- You can harvest it yourself,
- You can top dress the pod out using the summer sowing establishment technique,
- It compliments Rhodes grass,
- It can be cut for hay,
- It is nitrogen fixing and the rhizobia seems to persist,
- It is not fussy about soil type,
- There are no disease issues and
- There are no grazing or sheep health issues to consider.

The French serradella varieties have been sown with discs and also broadcast with pod. If they are sowing it is done in May with 5 kg/ha of peat inoculated seed. If they are summer sowing then pod is broadcasted at 30 kg/ha without inoculate in February, March or April. The paddocks targeted are the ones with a low legume seed bank. They have established 450 ha of the hard seeded French serradellas. Most of these paddocks also have a sub-clover base.

The Caelli's rarely put French serradella sowing it in a mix with yellow serradella as the yellow serradella is more likely to persist than French serradella. However, French serradella is more productive than yellow serradella. French serradella really gets up and grows, yellow serradella does not germinate until late May. French serradella can germinate in February and if you have follow up rains you will have a lot of feed. With yellow serradella with early rains weeds germinate but

the yellow serradella does not germinate until May so it is difficult for the plants to compete against the weeds. The advantage of yellow serradella is that it is more prostrate than yellow serradella so it is more tolerant of grazing. It is also more tolerant to bud worm. Another advantage is that you can spraytop yellow serradella because it flowers and sets seed earlier than French serradella.. Yellow serradella is a better fit but difficult to get higher enough plant numbers. A softer variety would be better. With Santorini you need a lot of seed to get the plant numbers due to the high hard seed levels.

Other species that have done well include Scimitar medic it established well when sown with a crop, although it was a good season. A total of 100 ha was established under barley using knife points. It was sown at 0.5 kg/ha using peat inoculated seed. In the second season it regenerated well with high plant numbers, it is not as hard seeded as yellow serradella. It also has prolific early growth. Medic has greater early growth than sub-clover but it is for a specific heavier soil type. A disadvantage of medic is that everything eats it including insects.

The Caelli's also have a paddock of biserrula and they see this as a replacement for sub-clover. However, photo-sensitivity can be an issue with sheep, they do not like health issues with the stock. Biserrula is a prolific seeder but it is sensitive to broadleaf herbicides. It will continue to grow if there is late rain, it can also be grazed heavily.

Perennials have also been successful. Lucerne is used for its high water usage to reduce salinity. Other strengths include great growth, there are no grazing issues, it is nitrogen fixation, it makes good hay and you have the ability to spray or graze out ryegrass. They have established 120 ha of lucerne over the last five years. They sow 5 kg/ha of peat inoculated seed in July using discs without using a cover crop. They have tried other techniques in the past but found July sowing as a pure stand the most reliable. If Luke had an herbicide resistance issue or any weed problems he would use lucerne as you can use broad spectrum herbicides. Lucerne fits

Pastures in Rotation case study



in with cropping, it is a phase system (not a self-regenerating system) and its major advantage with cropping is control of herbicide resistant ryegrass and input of nitrogen into the soil. Ideally, I would like 20% of the farm in lucerne to hold back salt and control summer weeds.

Rhodes grass is valuable because it can be set stocked in drought, it is prolific in summer, it lets serradella come through in winter and there are no sheep health issue when it is grazed. Over the last five years 150 ha of Callide has been sown with 3.5 kg/ha of pelleted seed. It has been sown with discs in November as a pure stand and in March under oats which was grazed in May. The third perennial that has done well is winter active Tall fescue. It persists, it is palatable and it is drought tolerant. They see it as a possible fit with winter dormant lucerne. A total of 20 ha has been sown with discs in July using 2-3 kg/ha of seed.

What determines the pasture and crop phase length?

French serradella is grown for 1-2 years followed by a maximum of 2 years in crop. A short pasture phase is used as there is a need to use up nitrogen in crop rather than have weeds. This rotation reduces pest or disease build up. Yellow serradella is grown for one year and then followed by 4 years of crop. It is too hard seeded to have good competitive stand to have it in pasture more than one year. If a good stand of legume is grown then generally it is followed up with crop the following year. If you have another pasture year then you get weeds, rubbish and you wish you put it into crop.

Rhodes grass may go for 10 years. However, if numbers dropped or there is weed build up or the stand becomes unproductive then it will be returned to crop. Lucerne is grown for 3-5 years followed by 3-4 years of crop. It goes back into crop when numbers drop back a bit and when it has used up excess water and therefore not as productive.

In general, each paddock is assessed to determine if the crop phase can go another year. The paddock will return to pasture if there are too many weeds, there is a lack of nitrogen, if salinity is increasing or the water table is rising or if the legume base (seed bank) is running down.

Dealing with seasonal variation

The rainfall in West River is very variable so the Caelli's have developed a system to try and maximise the opportunities and to minimise the impact of low rainfall years. Summer rain is common, 40% of the total yearly rain falls during summer. I do not have a formula; I recognise the signs from season to season," says Luke.

The reason why they tried alternate annual legumes is because in 2000 they had a failure with sub-clover. Every paddock died. They had 14 inches of

rain in January, February and March and then 4 inches for the rest of the year. Sub-clover plants were stressed in May and it got affected by a virus. French serradella and other pasture systems on the farm give diversity. The serradella's are not affect by false breaks compared to sub-clover, you get less growth but they do not die. Another example of where seasonal variation and having a mix of pasture species provides opportunity is that in October 2014 we received 3 inches of rain the paddock was under wheat but French serradella germinated. At harvest time in late November there was a good stand of French serradella which we could graze or harvest the seed. Each species has limitations so there is a limit to how much French serradella you can have as with all species. Perennials which are drought tolerant and can respond to rain at any time of the year has also added to diversity.



Rhodes grass and French serradella



Aaron Caelli (10 months) in a stand of French serradella which germinated in October under a crop of wheat

One of the ways to deal with seasonal variability is to not have a high stocking rate. Winter stocking rate is around 5 DSE/ha (all sheep and lambs). The Caelli's find it difficult to maintain a high stocking rate because the soil is prone to wind erosion when there is a dry year. They often use a lick feeder in the paddock to supplement what they are getting from the paddock. Lambing commences in the last week of May. All sheep are merinos with an average micron of 18.5 to 19 cutting 6-7 kg of greasy wool per head. Generally, all wether and one-third of the ewe lambs are sold as lambs but this can change depending on lamb meat prices, the availability of feed and prices for shippers. For example, in 2014 there was plenty of rain in spring resulting in extra feed so the Caelli's have kept the cast-for-age ewes and cull ewe hoggets. This feed will allow them to grow more wool and has helped to control the weeds. Having wool based system with sufficient dry sheep gives you flexibility to easily change the numbers.

Increasing the crop area and crop grazing is another tool that can be used to manage seasonal variation. In 2013, there was good early rainfall (5 inches in March) allowed them to put in 800 ha of crop which was higher than average plus Rhodes grass established under oats. It also resulted in us grazing some crop. A good start to the season results in surplus feed and that results in opportunities. We established a crop in early April and we started grazing in early May and grazed the crop until the middle of June. Generally, we have sufficient feed by July so the benefit of crop grazing is early feed. If the crop is sown in May then the first opportunity to graze will not be until late June to early July at this time of the year it is of less benefit as we have sufficient feed.

Managing pastures to benefit crop and livestock

A well-managed legume stand provides nitrogen in the slow release form to the crop phase and they are not reliant on buying in so much fertiliser nitrogen.

The Caelli's only use nitrogen fertiliser on wheat after canola. Crop after pasture only receives some starter nitrogen at seeding. For example, in 2014 Luke applied 45 kg of MAP/ha to a wheat crop after one year of a French serradella pasture, there was no follow up nitrogen and the paddock yielded 3.5 t/ha of Hard 2.

The Caelli's use grazing and herbicides to control weeds for paddocks going into crop the following year. They spray top and then graze heavily, however in some years they just graze. Also in some years the pastures are manipulated, in 2014 they used Verdict and Select. Spraytopping and herbicide manipulation also reduces the grass seeds in wool.

In spring time when there is a lot of feed Luke will put stock on paddocks where he needs to control ryegrass. I have sub-clover based pastures which I can graze them heavily and graze them out. Lucerne is another pasture type that can be grazed heavily in spring to control ryegrass and radish.

For persistence the aerial seeders, Margurita and Erica French serradella need to go to seed every second year. In some years such as 2014 the serradella's are still green in December. Ideally, the seed needs to be dry before grazing. The seed is high up in the plant as the seed is on the growing points; it sits up so it is vulnerable to being grazed. French serradella is a prolific seeder so it is worth while letting it set seed.

Normally Margurita and Erica suits a year in year out with crop but it is hard to get ryegrass control. You can use selective herbicides but if you are having problems with resistance then there is an issue. I have found it hard to spraytop French serradella and not affect the seed set. Sub-clover is really good as it sets seed before you need to spraytop and therefore you do not affect seed set. With French serradella it is better to spraytop early rather than later. French serradella

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Lucerne planted in July 2014

regenerates after spraytopping. Generally, French serradella is flowering at the same time as the ryegrass is flowering. When you spraytop you kill small pods and flowers but often you get late rain so you get more flowers and you allow that to go to seed. The biggest issue in French serradella is controlling ryegrass and turnip. Sub-clover can handle spraytopping and with sheep you can graze the weeds out and the sub-clover will set seed. However, French serradella has prolific growth, it is double the feed of sub-clover if the season keeps going. Sub-clover can die but French serradella keeps going. I have also had problems with read-leaf clover syndrome affecting sub-clover. However, the seed of French serradella is susceptible to bud worm damage.

As the Caelli's have a number of paddocks of French serradella as well as sub-clover, not all of these paddocks need to go to seed so they graze them if I have to. I am not terribly troubled by the lack of seed set because I can harvest French serradella pod. Luke top-dresses this onto the paddock in summer and it germinates in autumn, I do not use

rhizobia and I have never had a problem with inoculation. The rhizobium appears to be on the pod. When spreading compared to drilling it is harder to get sufficient plant numbers due to weed competition so you have to use higher rates.

Luke generally does not graze the Rhodes grass paddocks in spring and will use them in summer and autumn. These paddocks have French serradella so it sets seed as well ryegrass. Luke prefers to have ryegrass than barley grass. Rhodes grass is set stocked as it is tolerant of heavy grazing. As the Rhodes grass holds the soil together the Caelli's are able to maintain stock numbers during autumn.

More information

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The Key aspects of the Caelli's farm business:

- **A range of species allows us to exploit rainfall at any time of the year or minimise the impact of dry spells**
- **Legumes provide nitrogen to the following crops reducing the requirement for fertiliser nitrogen**
- **Pastures are an effective way to control weeds to minimise the impact in the crop phase**
- **A wool based livestock system with sufficient percentage of dry sheep which can be kept or sold at any time depending on prices and feed availability**



Transition from Crop to Pasture

Producer:
B & J Kilpatrick

Location:
Wagin

Farm Size:
1700ha

Better transitions between crops and pastures and managing both phases well are the keys to lifting farm profitability in WA's southern medium and high rainfall zones.

That is the advice from Planfarm consultant Paul Omodei, who is working with the Muchas Gracias grower group in Arthur River and Wagin to evaluate a range of tactics for optimal integration of pastures into cropping rotations - and improving pastures coming out of a cropping phase.

Managing these transitions better and pushing pasture productivity in this region have potential to increase both crop and livestock production, reduce weeds for the cropping phase and boost whole farm income.

The keys to this strategy are to dry sow and create density in pastures to run adequate stocking rates that make money, while attacking the annual ryegrass (*Lolium rigidum*) seed bank problem for the cropping phase.

Pasture density comes from sown cereals and stimulated hard seeded annual ryegrass and subclovers that may have stayed dormant without the physical soil disturbance. The cereals and grasses drive the winter livestock carrying capacity and the clovers produce the nitrogen (N) for following crops - as well as setting seed and contributing to the clover hard seed bank, which will be there following the next crop rotation.

Three-year, on-farm demonstration trials have been set up by Muchas Gracias group members in conjunction with the Department of Agriculture and Food, Western Australia (DAFWA) through the GRDC-funded Grain and Graze 3 project 'Crops to pasture - pasture to crops'.

Wagin growers Bryan and Jane Kilpatrick have a trial investigating pasture-crop rotations, the effects of cultivation on weed germination and the amount of extra feed produced from adding N in the pasture phase.

In the first year of the trial - in 2014 - they sowed Wandering oats (at a rate of 40 kilograms per hectare) and Dalkieth clover (at a rate of 8kg/ha) using narrow AGMOR™ sowing boots into dry pasture on April 24.

There was no pre-seeding herbicide used and they applied 40kg/ha of MAP (Monoammonium Phosphate) fertiliser.

Bryan says the aims were to boost soil water infiltration and plant density, stimulate a weed germination and provide early feed for livestock. This led to a cultivation effect on weed numbers and growth in that first year.

Geranium (*Erodium* species) and capeweed (*Arctotheca calendula*) got away early and started smothering the clover and oats, forcing Bryan to undertake a spray graze using a phenoxy herbicide.

After that treatment, they had a good stand of oats, clover and annual ryegrass and were able to use this for two intensive grazing periods in June and July.

Part of this trial is to assess how much extra stock feed is produced by the sown pasture, as they usually experience a feed gap between seeding and lambing (in early July). The oats certainly provided a bulk of feed early in the season, which was very helpful and - in a different year and on a bigger scale - could be crucial because they carry a high percentage of lambing ewes.

Bryan says a combination of improved pasture paddocks prepared earlier in the year, deferred grazing on to long term grazing paddocks and some crop grazing is ideal to set up paddocks for his lambing period.

He says crop grazing has a place in the system and is used when conditions allow, on well established paddocks with low weed burdens.

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The Kilpatricks use spray topping in spring to reduce the grass component of pasture paddocks, while being mindful of the clover setting seed.

"Our preferred strategy is to defer as much as possible on to planned wheat paddocks - sow canola, oats and barley as quickly as possible and then slow right down to finish the wheat," says Bryan.

"This spreads our wheat sowing dates and allows pastures to get away."

Paul says this is an integral component of the dry sowing cereals strategy. The additional annual ryegrass and weeds stimulated by cultivation can then be controlled by a 'hay freezing' technique - using glyphosate or paraquat - after the clover has set seed in later spring. That way, the legume component of the system is

protected and the grass weeds are almost 100 per cent controlled, which is what they want for the cropping system.

Bryan says the plan for this year is to leave the improved pasture in the Grain and Graze 3 trial and set it up for a short term cropping program in 2016. Pasture benefits of the first two years will hopefully produce higher crop yields in the third year.

DAFWA research officer Perry Dolling is monitoring the Kilpatrick's trial for amount and timing of N applications, pasture growth rates, dry matter production per mm of rain and number of grazing days.

The Muchas Gracias group also runs a Blog (for members only), which allows sharing of wide-ranging discussions, observations, photographs and trial results.

More information

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Crops on Crops Make Great Pasture

Name:
North Stirlings Group

Producer:
North Stirlings, WA (various trial sites)

Tight crop pasture rotations make it very difficult to establish high density feed at the break of the season and in early winter and in early winter before clover can get established enough to maintain stock. To overcome this farmers are increasingly sowing cereals and canola with clover or into established clover pastures to fill this gap.

In the wheat belt, mixed farming enterprises are generally 60% to 80% : Crop – Stock ratio. This means that pasture fazes are very short, generally 1-2 years with 3-4 years of crop in between. Current day cropping leaves no room for error and weed management and crop hygiene is an integral part of getting the best return on crop investment.

The unfortunate result of this for the sheep is that all grasses are enemy number 1! Why is this an issue when there are other plants such as clover for sheep to eat? Unfortunately these really don't get going until August or later in a bad season, whereas members of the grass (including cereals) family are much quicker to establish. To fill this feed gap farmers are increasingly looking towards sowing cereals & canola with clover or into clover pastures.

This raises issues of variety, sowing rate, time of sowing, manipulation, impact on stock and crop in following year and risk management. These issues were on the minds of a group of North Stirling farmers when they decided to look closer at the subject.

The North Stirling's group observed several options on different farms. Wheat, barley and oats were sown, while canola was spread onto a pasture.

Early observations in June were that the canola had not germinated, the barley at cereal at 20kgs lacked density and that 40kgs was in the lower end of what needed to be sown.

Sowing decisions had been driven by different reasons - oats had been selected over barley on farm due to concerns over disease affecting performance of the barley. Others selected what they had in the silo or what tended to yield the best on their farm. In the case of the canola it was opportunistic. Seeding Fertiliser was applied at a minimum rates, enough to get it out of the ground.

The main observation from the various sites was similar, as one of the members stated "with modern cropping systems unless you sow something into pastures nothing is going to grow. The farming system has changed yet some are expecting sheep to perform the way they did without any inputs."

The results are that pastures that might otherwise run 3 DSE are running 6 DSE easily. The impact this has on sheep systems is significant on several levels:

1. Stocking rate;
2. Ewe and lamb survival- applying Life Time Ewe Management Principles - ewes in better condition have heavier lambs and lower mortality. Lambs with mothers on better pastures have higher survival rates and better growth rates.
- 3 Risk management in poor seasons - Pastures in the wheat belt that aren't bulked up with cereals struggle enough in average seasons , however in poor seasons they are shocking and any sheep are too many. Generally with a poor season (late break) on an average pasture we see a steady decline in the pastures potential. For example, as the date

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of break gets pushed back we see a steady decline in stocking rate potential- i.e. from 6-5-4 . However with poor pastures the potential drops far more quickly 6-5 -1! This obviously has implications on the year in year out stocking rate that can be run with any sort of confidence.

The increased carrying capacity of the pastures had other impacts on the system. The major one being that pastures could be manipulated with confidence during winter/spring due to the knowledge that there was enough pasture density to run stock on once undesirables, such as barley grass, had been removed. This has benefits to the crop and pasture as the clover then thrives, lays down more nitrogen and seed and the following years crops has less weed competition.

Other key observations were:

- **Barley did have some disease issues that limited its production at one site but not at another, however this was mainly later in the season;**
- **A minimum of 40 kg's of seed should be sown to get enough early density;**
- **Clover seed set won't be compromised at higher rates 40-50 kg's if grazed or manipulated appropriately;**

All who participated or observed the sites agreed that bulking up pastures with cereals is the key to running reasonable stocking rates with their current crop/ stock rotations. The next challenge going forward is to refine pasture manipulation for the benefit of stock in the current year and crop in coming year.

More information

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Lucerne as a phase pasture at Badgebup

Producer:
Tim Clegg

Location:
Badgebup, WA

Tim Clegg is no stranger to Lucerne in his pasture and cropping phase however in 2013 he decided to experiment with two methods of establishment in a barley crop – Skip Row and Under-sown. In 2014, the Badgebup group followed this establishment into the pasture phase along with a traditional regenerated sub clover paddock out of barley right next door.

Tim has been establishing Lucerne in wetter parts of the landscape for 3-5 years of pasture and back into a short crop rotation (2-3 years depending on seasons and weed control).

His skip row establishment has been far more successful with nearly double the retention of Lucerne plants into the second year. This entails a double pass operation at seeding i.e. seed barley in first pass then use RTK guidance to shallow sow Lucerne between the barley rows. There is an additional seeding cost in year of establishment but worth it in the pasture phase.

Tim prefers to spray the Lucerne totally out in the year prior to cropping rather than 'Pasture Crop' mainly because he believes in doing one enterprise better rather than have a bit of both.

In conjunction with chaff cart dumps, Lucerne provides a 'complete' ration of energy, fibre and protein for growing stock in particular. Tim aims to use it mainly for lambs or young ewes. Early feed is a significant benefit as this can assist increasing energy requirements of ewes once stubbles are exhausted.

Measurements during the season showed the Lucerne paddock to have significantly more dry matter on both occasions (520kgs/ha more in June and 1,100kgs/ha more in September).

Tim's system is so flexible that if a weed blow out does occur in a crop phase he can then pull the paddock into a pasture phase with an establishment technique that provides longevity of Lucerne.



Lucerne established as a skip row with barley in 2013 and regenerated in 2014 with 38 plants/m² and measuring 3.9t/ha Dry matter.

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Regenerated sub clover established after barley in the adjacent paddock measuring 2.8t/ha dry matter



Skip row sowing of Lucerne sowing barley stubble between Lucerne rows



Use of chaff carts dumps to provide a "full" ration in the paddock

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Grain and Graze 3 Business Discussion Groups

A series of business discussion groups have been established across WA to discuss the linkages between on-farm production, profitability and risk management. They are a chance for farmers to discuss their business, share their learnings and explore their business goals with one another in a confidential setting.

For more information on joining a Business Discussion Group, please contact one of the facilitators below.

Business Discussion Group facilitators

Gerard Birkbeck
Farmanco, 0427 501 555

Danielle England
AgInnovate, 0429 676077

Ashley Herbert
Agrarian Management, 0427 007 396

David Pfeiffer
Synergy Consulting, 0429 990 596

Ed Riggall
Ed Riggall Consulting, 0428 299007

Carly Veitch
AgAsset, 0429 966 678

Ben Whisson
ConsultAg, 0428 651 626

Eastern Wheatbelt – Merredin and surrounds

One Eastern Wheatbelt based group is made up of 6 farm businesses, all within a 150km radius of Merredin. Five businesses are mixed cropping and livestock, with one 100% cropping. Major topics of discussion so far have been succession planning, management of heavy soil types, and planning for and in-season management of dry seasons.

The group has been underway for a year now, but may be willing to consider new like-minded farm business members. Please contact Carly Veitch on 0429 966 678 for any further information.

Avon Valley – Northam and surrounds

Another new group is about to kick off, based in the Avon Valley region. The first meeting will be in mid-March. The group is open to new members who are interested in open but confidential discussions around business management and driving farm business profit. The group has a particular interest in the finding the best balance between cropping and sheep enterprises to maximise overall business profit. Please contact Carly Veitch on 0429 966 678 for any further information.

Esperance

A small group of 5-8 businesses is operating in and around Esperance. Over the next three years they want to improve the way they run their businesses, improve management at a holistic level, have fun, with a respecting peer group and to share their knowledge and learnings along the way. This is a closed group with a confidentiality agreement in-place. This group is being facilitated by Eric Nankivell and Gerard Birkbeck, Farmanco Esperance. For more information please contact Gerard on 0427 501 555.

Lake King

This group plan to meet three times a year on different participating farm businesses. They will tour the farm, have a look at the financials and undertake a SWOT analysis for the host business. This is strictly a closed group with a confidentiality agreement in-place. This group is being facilitated by Eric Nankivell and Gerard Birkbeck, Farmanco Esperance. For more information please contact Gerard on 0427 501 555.

Merredin/Kellerberrin

This group has met once and will meet again before seeding. The primary focus of the group will be to discuss business decisions, future business plans, and strategic management of the business. The group is open to new members who are interested in similar farm management issues. For more information about this group please contact David Pfeiffer on 0429 990 596.

Other groups

Other groups are in development in the Moora/Miling, Cranbrook, Varley, Katanning and Narrogin areas. These groups are open for new members. For more information on these groups please contact Danielle England on 0429 676077.

For more information

Visit the Grain and Graze website www.grainandgraze2.com.au or
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 www.facebook.com/GrainandGraze

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