final report

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High Production Annual Forage in Perennial Systems

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Abstract

The Perennial Pasture Systems (PPS) group was formed in 2007 with the focus of increasing the amount of perennial pastures on member farms. This has proven to be very successful with large productivity gains made possible along with the environmental benefits that deep rooted perennials can bring to grazing systems. The productivity gains were demonstrated in several projects and the PPS Mooney's Gap "EverGraze" site, established in 2009 is a good example. Stocking rate gains averaged 157% when measured against a control pasture of degraded volunteer annuals. The productivity gains are still apparent ten years after the pasture establishment.

Although the benefits of perennial pastures were clearly apparent to group members, it was realised that these pastures required levels of management, especially in dry autumns, that restricted grazing periods as perennial pasture persistence is an important issue in long term sustainability. PPS studied the effects of management on the persistence of phalaris; the main perennial grass sown in the region, in the MLA funded project B.FDP.0051 which enhanced the management of phalaris based pastures on member farms. The use of stock containment areas and autumn saving of phalaris based pastures has become a feature of grazing systems in the region. Some members have gone further and are now treating some of their phalaris pastures as specialist lambing paddocks; an idea that came, partly, from the PPS study tour to New Zealand in 2015.

Perennial pasture establishment is an important part of the productive lamb/beef and wool producing systems in the region but it is an expensive process ($450/ha estimate) and carries significant risk of failure due to the possibility of lower than average annual rainfall with late autumn breaks. Many producers are complimenting their perennial pastures by sowing a percentage of their farms to high producing annual forage. This is evident in the PPS pasture survey from 2016 which showed a large increase in the establishment of short term ryegrass based pastures in the region; this trend has continued since the first survey in 2012.

This reflects producers attempting to fill a feed deficit during early winter when high quality pasture is required for pregnant or lactating ewes. This process also gives producers the ability to protect their long term perennial pastures from overgrazing early in the season. This has a positive effect on perennial pasture persistence and may reduce risks associated with grazing phalaris pastures (phalaris staggers & phalaris sudden death) in dry autumns.

This MLA PDS project 'High Production Annual Forage in Perennial Systems' sought to clarify the value of adding annual varieties to increase overall production in grazing systems based on perennial pastures.

Executive summary

The increased use of annual ryegrass and the slower than expected uptake in the usage of grazing cereals in the Upper Wimmera region of Victoria prompted PPS to develop a demonstration project to show the value of adding annual varieties to increase overall production in grazing systems based on perennial pastures.

While a number of PPS members were using high production annual forages, the observation was that they were often achieving sub optimal results due to sub optimal soil fertility and sowing rates of the annual forages. Significant production opportunities are being missed in the pursuit of reducing establishment costs.

Other considerations such as including sub clovers or attempting to salvage grain from grazing cereal can also compromise the results. Research has determined the economic optimum sowing rate in Annual and Italian ryegrass but these rates are rarely applied to lamb grazing enterprises in the drier regions of Central Victoria.

It is often believed that lower rainfall requires a lower annual forage sowing rate. However, Harmer, Sewell & Salmon (2012) found a high sowing rate in annual forage increases production during winter when water is non-limiting, fulfilling the intended purpose of sowing the annual forage. The producers who are currently using high

producing annual forage have recorded production and management system gains, but they are looking to quantify the economic gains from its use.

The aim of this project was to demonstrate the production, financial and grazing management benefits of high production annual forage systems in perennial grazing systems in low to medium rainfall regions (500 to 550 mm) of Central Western Victoria. PPS believes that it was successful in this aim and there has been an increase in the level of establishment of high production annual forages by PPS members over the course of the project. PPS expects this continue in coming years based on the project results.

The project was able to show the large increases in dry matter production that was possible at vital times, especially in mid winter, with the use of high production annuals.

- Increases of over 70% in dry matter production when compared to winter dormant phalaris were recorded in annual ryegrass pastures. The use of annuals in the system allowed for more strategic use of perennial varieties to build feed wedges and assist in the persistence of perennial grass species.
- The use of higher seed rates of ryegrass was investigated and suggest that the best results from using higher seed and input rates are achieved in high fertility soils. Soil constraints need to be addressed before there is likely to be a reliable response to the higher inputs.
- The demonstration also reinforced the potential of using grazing cereals in lamb and wool production systems to fill winter feed gaps.
- Where seasonal conditions allowed grazing cereals to be harvested for grain or hay after grazing, gross margins in excess of $1,000/ha were possible.

A focus change was also noted where producers put the grazing value of the cereals at the forefront rather than comprising the length of grazing to try to salvage grain yield. The current favourable sheep and lamb prices have assisted in this adjustment but the gains in animal production and well being will make it a permanent change. No financial analysis of the change in grazing cereal management was possible due to the scope of the project but would be a worthwhile exercise.

The demonstration clearly showed the benefits of early establishment and many producers are now dry sowing into previously prepared weed free paddocks. The rate of dry sowing is increasing and the 2019 PPS Annual Pasture survey showed that 48% of the 5,013 ha of pasture and grazing cereal establishment were sown before the autumn break

PPS conducted projects surveys prior to and at the completion of the demonstration this showed increases in both knowledge and confidence resulted from the project.

PPS members were asked to rate their current knowledge of the costs and benefits of using short term forages to fill feed gaps early in the project in 2017. The survey was repeated at the end of the project in February 2020. A rating of 0 indicated no knowledge and a rating of 10 was used to indicate that the respondent had all the knowledge required. A scale of 0 – 10 was used for the respondent to indicate where they rated their level of knowledge.

- The pre project average response was 6 with a range of 2 – 9, the post project response increased to an average of 7 with a range of 3 – 10.

Participants were also asked to rate their confidence in using short term annuals using a similar 0 – 10 scale with 0 being poor confidence and 10 being excellent.

- The pre project average response was 7 with a high of 10 and a low of 2, the post project response increased to an average of 8 with a range of 3 – 10.

PPS believes that the demonstration has been worthwhile in increasing the uptake of the use of high production annuals and has improved the management of them on farm. The project has complimented other completed PPS projects which have been aimed at improving pasture production and farm sustainability.

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1 Background

1.1 The Perennial Pasture Systems Group (PPS)

The Perennial Pasture Systems (PPS) group was formed in mid-2007 at a meeting in Hall's Gap, reacting to concerns about the lack of research and extension into productive pastures in the Upper Wimmera and Central Highlands region of Victoria.

Since its inception in 2007, 182 farm businesses across the Southern Wimmera and Central Victoria have joined PPS. Farm amalgamations and farmer retirements result in fluctuations in membership and current membership is 130 farm businesses.

Members are involved in prime lamb, mutton, wool and beef production. PPS also has 35 members involved in agribusiness and agronomic services. The total area farmed by producers who have joined PPS is 204,949 hectares (ha) and they manage approximately 1,350,000 Dry Sheep Equivalents (DSE), made up of 750,000 sheep and 28,000 cattle; cropping and export hay operations are also conducted on many of the farms. The smallest farm in the group is 20 ha and the largest is 8,200 ha. The average farm size is 1,101 ha and an average of 7,010 DSE is managed by group member enterprises.

The aim of the group is to push the boundaries of perennial pasture research in the Upper Wimmera and Central Highlands region of Victoria, and to provide information on productive pasture management to PPS members.

The PPS group have actively engaged producers in multiple research projects since 2007 including the PPS/MLA Producer Demonstration Site (PDS) pasture variety trials which are full scale variety comparisons, two EverGraze supporting sites at Mooney's Gap and Tottington, a Producer Research Site (PRS) on phalaris persistence, a PDS of the use of Gibberellic Acid as well as demonstrations including cocksfoot cultivar comparison, subsoil amelioration and a variable rate liming project.

The PPS/MLA PDS sites and the PPS/EverGraze Supporting Sites have had a focus on pasture persistence and although they have officially been completed, they will be monitored and measured by PPS for several years to come.

For the Producer Demonstration Site (PDS) Annual Forage demonstration project, an advisory group of three PPS producers (Charlie de Fegely, Lachie Green and Duncan Thomas) and the group project manager oversaw the planning and implementation of the project and reported back to the wider group. Eight PPS member farms participated directly in the project, hosting sites for the annuals demonstration.

2 Project objectives

2.1 High Production Annual Forage in Perennial Systems

By March 2020, the PPS will demonstrate the value of optimal high production annual forage in perennial grazing systems on 12 member farms and demonstrate the impact that the improved pasture production has on lamb production systems. As a result of this project (assuming a positive outcome):

- 60 members will have or will be planning to implement a high production annual forage system on their properties and will have the skills and knowledge to do so.
- 200 people will have increased knowledge and awareness of the benefits/drawbacks of a high production annual forage pasture in this region and will have increased their skills on how to establish a high production annual forage system.

3 Methodology

3.1 Project overview and design

As with all PPS projects, an advisory group of PPS members was appointed to oversee the project and assist the PPS project manager in the implementation and management of the project.

PPS GA Advisory Group member:

- Charlie de Fegely "Quamby" Dobie
- Lachie Green "Mokepilly South" Lake Fyans
- Duncan Thomas "Windy Hill" Ararat

- Project data collection, recording, analysis and reporting were carried out by PPS Project Manager; Rob Shea and project consultant, Lisa Miller.

Demonstration sites in the three years of the project were established to evaluate the use of short term ryegrass and grazing cereals in the grazing systems of PPS members. They are described in section 3.1.1.

3.1.1 Demonstration sites

Sites were established each year to demonstrate;

(1) The performance of high production short term annual ryegrass pastures and the value of using high seed rates and fertiliser when compared to recommended rates.

(2) The performance of grazing cereals in comparison to established pastures and how they fit in the grazing system. The cereals were also evaluated for any value post grazing as they were in most cases cut for hay or harvested for grain.

Dry matter production was measured using pasture cages, mower cuts and oven drying of samples. Feed quality tests were recorded and animal production data was collected. The data was analysed and estimated financial results were produced.

Table 1. Demonstration Sites 2017

Site	Species, Cultivar & Sowing date	High Production Annual	Control
Mokepilly South	Knight Italian Ryegrass 22nd April	32 kg/ha ryegrass & 160 kg/ha MAP. Urea applied to part of demo in early Sept.	16 kg/ha ryegrass & 80 kg/ha MAP. Urea applied to part of demo in early Sept.
Jallukar Park	Oats cv Winteroo & Arrowleaf Clover 8th May	100 kg/ha oats & 8 kg/ha clover. 80 kg/ha MAP (+Cu & Zn) 60 kg/ha potash, 50 kg/ha urea	Volunteer annual pasture (25% sub clover) + 80 kg/ha single superphosphate.
South Glengowan	Oats cv Winteroo clover 15th April	140 kg/ha oats & 80 kg/ha Granulock +Zn & Cu)	As Above

Fig. 1; Ryegrass at “Mokepilly South”, Lake Fyans

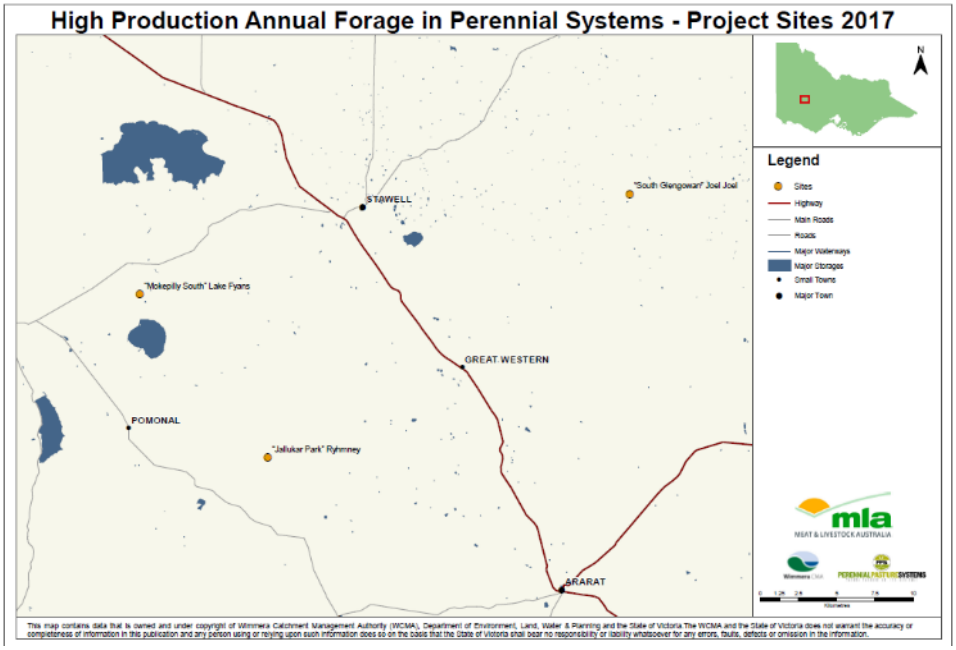

Fig. 2; 2017 demonstration site locations

Table 2. Demonstration Sites 2018

Site	Cultivar	High Production Annual	Control
Mokepilly South	Italian Ryegrass cv Knight 20th April	32 kg/ha ryegrass with MAP at rates of 100 kg/ha and 200kg /ha	16 kg/ha ryegrass with MAP at rates of 100 kg/ha and 200kg /ha
Paradoo	(1) Annual Ryegrass cv Tetila 7th April (2) Barley cv Moby 18th April	(1) 27 kg/ha ryegrass & 80 kg/ha MAP. Urea was applied twice at 80 & 100 kg/ha (2) 80 kg/ha Moby Barley & 80 kg/ha MAP. Urea was applied once at 120 kg/ha	Established Australian Phalaris pasture
Quamby	Long rotation ryegrass cv Barberia (regenerated from 2017 sowing)	20 kg/ha ryegrass (sown in autumn 2017) + 55 kg/ha MAP applied in 2017	Holdfast GT Phalaris based pasture sown in 2010. 55kg/ha MAP applied in 2017
Overdale	Barley cv Moby 25th April	67 kg/ha barley + 100 kg/ha single superphosphate & 80 kg/ha MAP (+Mo)	Winteroo oats sown 23 April at 80 kg/ha & 80 kg/ha MAP (+Mo)
South Glengowan	Oats cv Winteroo 8th May	140 kg/ha (cross sown @ 70 kg/ha) oats & 80 kg/ha MAP	Volunteer annual pasture

Fig. 3; Moby barley at Overdale, late spring 2018

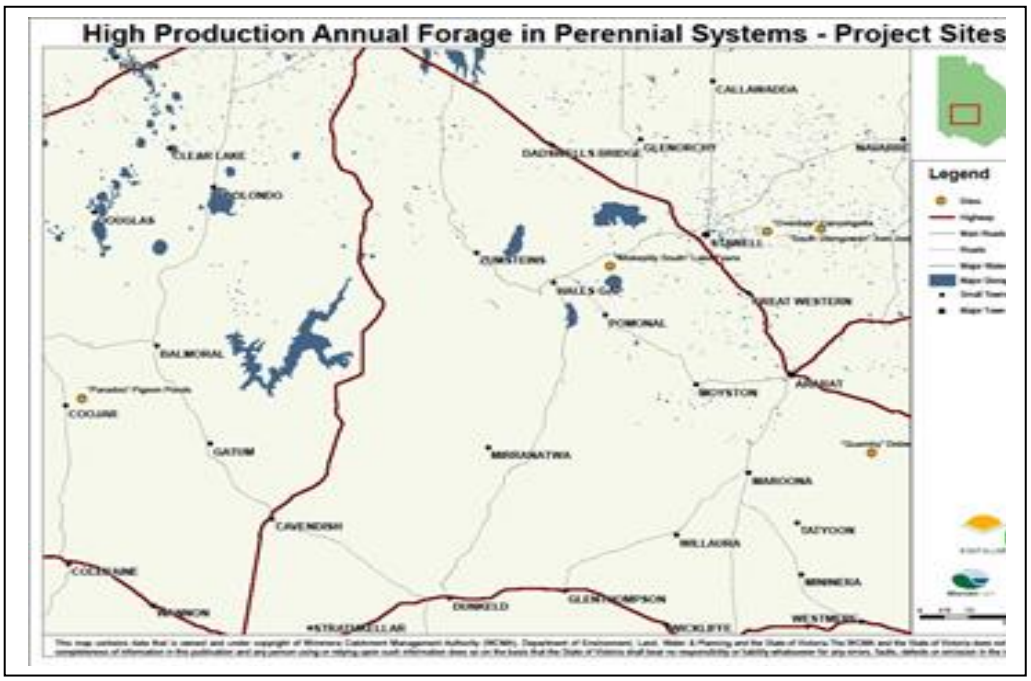

Fig. 4; 2018 demonstration site locations

Table 3. Demonstration sites 2019

Site	Cultivar & sowing date	High Production Annual	Control
Mokepilly South	Annual Ryegrass cv Tetila 10th May	32 kg/ha ryegrass with 80 kg/ha DAPZ. Urea applications on part of demonstration.	32 kg/ha ryegrass with 80 kg/ha DAPZ. Urea applications on part of demonstration.
Paradoo	Annual Ryegrass cv Prine 9th April	27 kg/ha ryegrass & 80 kg/ha MAP. 80 kg/ha of urea applied during winter	(1) 27 kg/ha ryegrass & 80 kg/ha MAP. 80 kg/ha of urea applied during winter (2) Established Holdfast GT Australian Phalaris pasture
Aramis	Annual Ryegrass cv Prine & long rotation ryegrass Barberia 20th April	20 kg/ha Each ryegrass 10 kg/ha + 80 kg/ha MAP. 70 kg/ha urea applied in winter	10 kg/ha Prine ryegrass & 5 kg/ha Barberia ryegrass + 80 kg/ha MAP. 70 kg/ha urea applied in winter
Overdale	Barley cv Moby 26th June	80 kg/ha Moby Barley + 80 kg/ha MAP	90 kg/ha Echidna oats + 80 kg/ha MAP
South Glengowan	Oats cv Bannister & Italian Ryegrass 28th April	100 kg/ha oats & 15 kg/ha ryegrass. 100 kg/ha single superphosphate + 100 kg/ha MAP. 80 kg/ha of urea was applied in winter	Phalaris & volunteer annual pasture
Challicum View	Private demo*	Bennett White Wheat	Revenue Red Wheat

*Done separately by producer, limited support data taken.

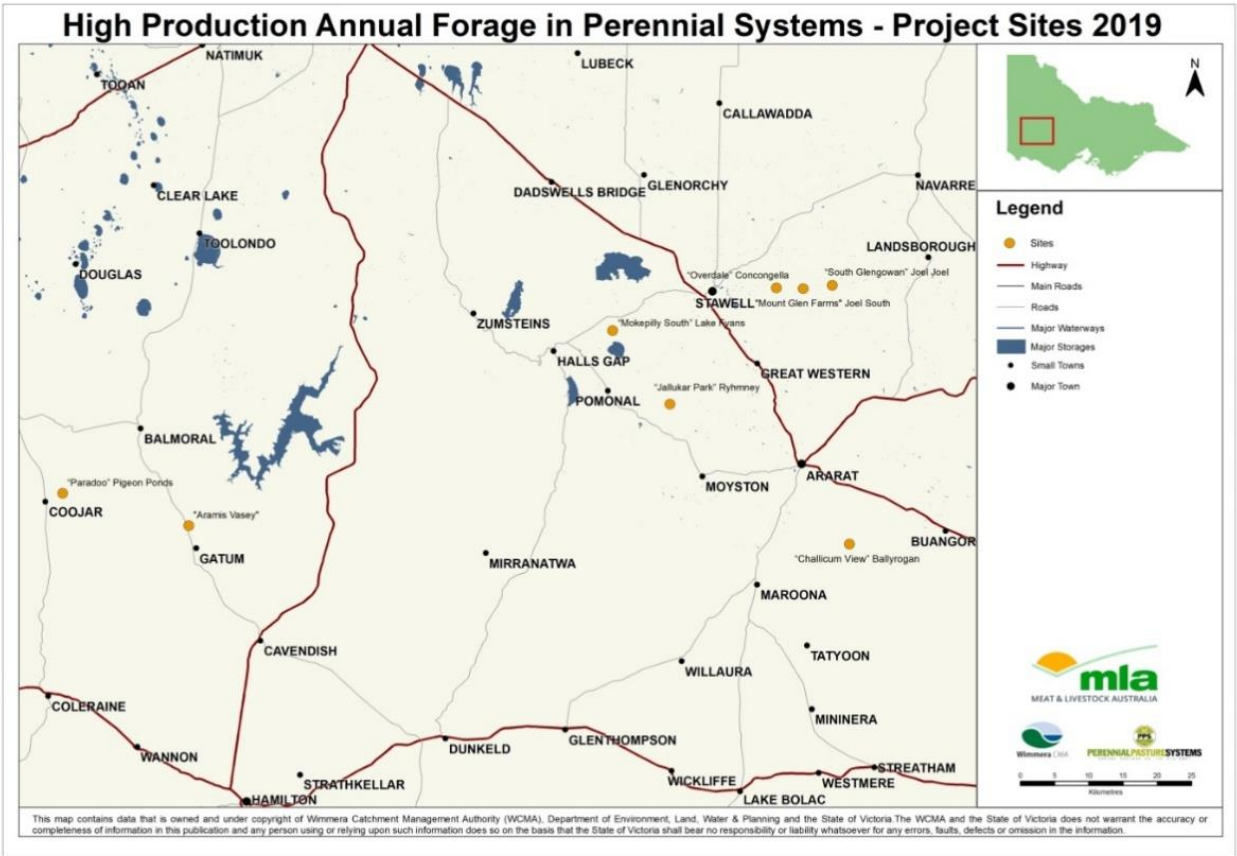

Fig. 5; 2019 demonstration site locations

4 Results

4.1 Use of annuals in the perennial systems

4.1.1 Annual Ryegrass

Background

It is known that higher sowing rates grow more early feed provided moisture and fertility is not constraining production (Harmer, Sewell & Salmon 2012). This demonstration investigates use of short lived ryegrass in the perennial system and examines the costs and benefits of sowing higher seeding rates of annual ryegrass and the strategic use of nitrogen in a drier region.

The report refers to annuals, but some of the Italian and Hybrid ryegrass species can live for longer than one year. Table 4 describes the terminology used in the report to distinguish between different ryegrass types (Information courtesy of Duncan Thomas; PGG Wrightson).

In the demonstrations, Tetila and Prine have been used and are examples of Annual ryegrass. Other ryegrasses used were Knight which is an Italian ryegrass and Barberia which is categorised as a long rotation hybrid ryegrass. The Italian ryegrass is more expensive, but is considered the most desirable short term ryegrass for a lot of environments given their ability to grow a huge quantity of feed for as long as the season lasts rather than being limited to the reproductive cycle of the plant. They also hold quality much better later in the season than an annual (which will produce mainly high lignin stems late in the season).

Table 4. Ryegrass types

Wimmera ryegrass *Lolium rigidum*	**Annual ryegrass** *Lolium multiflorum subspecies westerwoldicum*	**Italian ryegrass** *Lolium multiflorum*	**Hybrid ryegrass** *Lolium hybridum* or *Lolium boucheanum*		**Perennial ryegrass** *Lolium perenne*
			Short rotation	**Long rotation**	
A weed in most systems. Genetically very diverse hence likely to get herbicide resistance. Can cause ARGT especially in young sheep.	Survive for 1 season. Traditional types are often called 'Westerwold' and are true annuals, these often have 'tetila' or …T in their name but not always. These varieties will die after going reproductive regardless of how much it rains. These are normally the early annuals. Other varieties, Ascend, Winterstar II, Mach1, Zoom etc. often have a small component of Italian genetics in them. These varieties, while still true annuals, have the ability to grow some green leaves after going reproductive and in a very soft summer can have a small number plants survive into the second year. These are normally the mid/late annuals.	Traditionally called the 'biennial ryegrasses', these in theory should last 2 years. However this is really only the case in NZ and in the high rainfall dairy zones of Australia. In many environments between 20-80% of plants survive into year 2 and a farmer decides whether to 'top up' with some more seed in year 2. These have the benefit of growing until the rain stops, after going reproductive they will go back vegetative and produce more green leaves for as long as they can. Some of these will also contain a novel endophyte to help survival into the second year wherever insect pressure is high (root aphid, argentine stem weevil, African black beetle etc.).	This is a difficult category to define as it relies on hybridisation of multiple species. The most common hybrids are Italian/perennial with a varying ratio of the two depending on the growth habit required.	There often isn't much difference between a long rotation ryegrass and a true perennial, especially in terms of persistence. Example Barberia. The key difference as a definition is the presence of awns (tails) on the seed. A true perennial ryegrass must not have any awns present, if it does it cannot be called a perennial ryegrass. This is where the term 'functional perennial' came from, varieties like Banquet II fall into this category, we see no difference in agronomic performance compared to a true perennial.	The true perennial ryegrass, with no awns on seed. Even within the perennial group there is significant difference in persistence (largely driven by novel endophyte) and production (largely driven by genetic origin).

2017

SITE 1; Mokepilly South

Location: Mokepilly South, Lake Fyans **Site Hosts:** Lachie and Minnie Green

Background

In high rainfall areas, the higher the sowing rate, the more early feed grown but does it work in drier regions?

Trial Inputs and Design

Knight short rotation ryegrass (Italian diploid ryegrass) sown at "conventional" rate of 16 kg/ha with 80 kg/ha of MAP fertiliser versus "double" rate of 32 kg/ha and 160 kg/ha of MAP. Only a section of the paddock was sown with the double rate. Paddock size was 17.5 ha. The pasture was sown on April 22nd 2017. The whole paddock had received a capital application of 150 kg/ha of single superphosphate + Molybdenum in the summer prior to the ryegrass establishment.

Dry Matter production

The results at the annual ryegrass site at Mokepilly South showed a large DM increase (154%) in the winter measurement in the ryegrass sown at the higher rate but only minor differences were recorded in the two spring cuts indicating the advantage of the higher sowing rate had diminished.

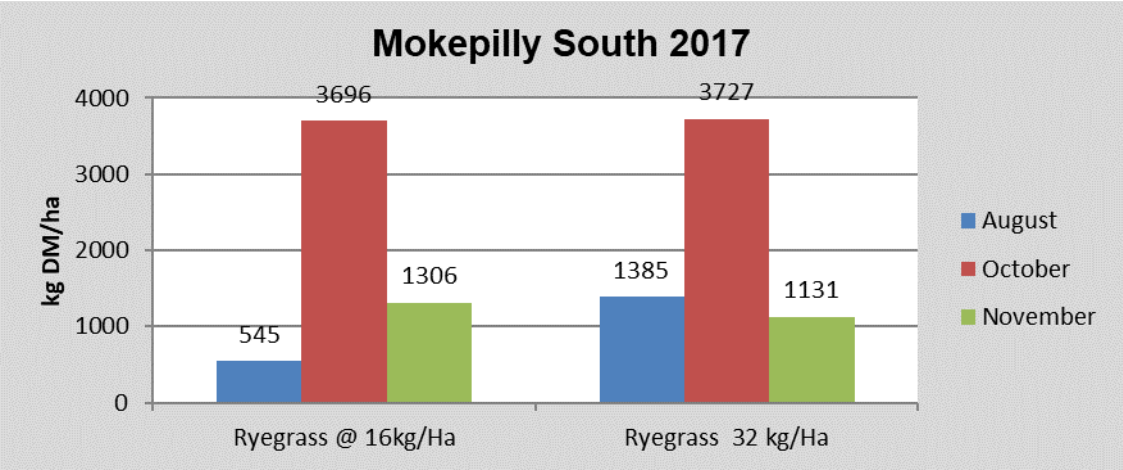

Fig. 6; Dry matter results at Mokepilly South

Two of the replicates in both seed rate demonstrations had urea applied in early September at approximately 100 kg/ha. The added nitrogen prompted a large response in both (+1667 & 1541 kg DM/ha) the 16 kg and 32 kg seed rate areas.

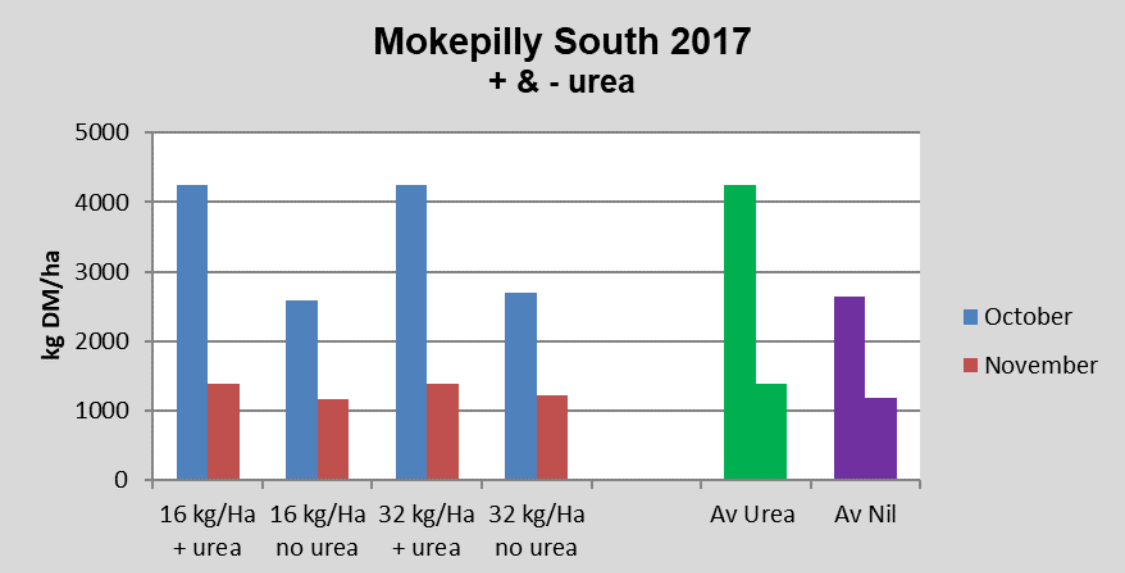

Fig. 7; Nitrogen response at Mokepilly South

The paddock was grazed with approximately 120 XBD ewes (65 kg) with 120% lambs rotationally grazed July – Dec (123 days total), leaving residue of 1000 kg/ha on 31st December 2017. Stocking rate was 6.9 ewes/ha. Lambing occurred in late autumn.

Income/Benefits

As the site was rotationally grazed, and both treatments were within the same paddock, potential benefits have been estimated rather than a gross margin produced.

Table 5. Estimated benefits of high input versus standard input.

Benefits	High input vs Standard input	Comments	Calculation
Extra Dry Matter, grown in Aug as measured by cuts	0.84 DM t/ha	Worth the equivalent of $159/ha in a poor year if you needed to supplementary but cost an extra $169/ha to produce. It is worth nothing in a good year if you didn't need to supplementary feed. **Breakeven DM production would need to be about 1.1 t DM/ha**	This is based on 70% utilisation where 588 kg DM/ha available at 13.5 MJ ME/kg DM which is equivalent to 7938 MJ ME/ha. The cost to supply this with feed barley at $218/t fed (90% DM) and an ME of 12 is 2 cents/MJ of ME. (7938 MJ ME/ha x $0.02) = $159/ha
Estimated extra DSE grazing days in August from 588 kg DM/ha (this is 70% utilisation of 0.84 DM t/ha)	490 DSE grazing days/ha	490 DSE grazing days/ha at a stocking rate of 14 DSE/ha would allow stock to graze for 30 days before feed would run out or a phalaris paddock to be rested at this time.	Allow 1.2 kg DM/hd/day, with stock wasting 30% of feed (588 kg DM/ha ÷1.2)
Extra DM/ha in response to Nitrogen grown in September	Extra 1.6 to 1.7 t DM/ha at both sowing rates	Nitrogen cost about $40/ha	

The higher seed rate cost an extra $169/ha to grow an extra 840 kg DM/ha in August and even in a year when feed demand was high this cost would probably not have been recouped based on supplementary feeding alone.
However, there may have been other additional benefits that may have allowed costs to be recouped, for example additional animal production at this time (e.g. weight gains) that have not been able to be accounted for.
Actual grazing occurred in July at 12.7 DSE/ha (DSE rating of 1.8, given 6.9 ewes/ha were grazed) and feed at this time is generally always highly sought after for filling feed gaps and to allow phalaris pastures to be rested.

Conclusion

The double rate of Italian ryegrass did lift winter production as expected but not enough to cover the additional seed costs. The demonstration shows the good responses to nitrogen and applying nitrogen in early to mid-winter would assist in also lifting winter production. This site which was in the process of building nutrients, may not have reached critical nutrient levels to allow the full yield production of Italian ryegrass.

2018

SITE 1; Mokepilly South

Location: "Martang South/Mokepilly South," Lake Fyans **Site Hosts:** Lachie and Minnie Green

Tetila annual Italian ryegrass (diploid) sown at the "conventional" rate of 16 kg/ha and compared with the "double" rate of 32 kg/ha. Different fertiliser rates were also compared as was the use of nitrogen in early spring.
The ryegrass establishment is part of a medium term plan to increase the paddock's fertility and production.

The paddock was sown on May 20th with 100 kg/ha DAP fertiliser (Nitrogen 18kg/ha, Phosphorus 20kg/ha, Sulphur 1.6kg/ha) and also a double fertiliser rate was applied to a sowing strip. The paddock establishment was considered late due to the late autumn break and lack of soil moisture on Martang South. Grazing commenced in August.

Table 6. Average monthly stocking rate at "Martang South" and grazing times

Month	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Av. Year
DSE/ha					10.4	16.6	2.8	2.4		**6.3**

Liquid N was applied to the paddock in early August. Pasture cages were placed in the paddock to allow the collection of pasture cuts for dry matter measurement. Nitrogen in the form of urea was applied to some of the cages in each treatment in early September.

Dry Matter Production

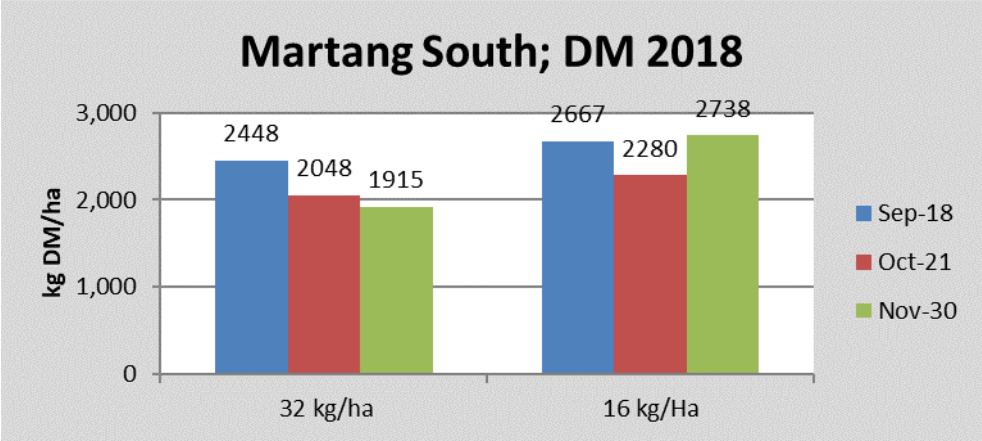

Fig. 8; Dry Matter production

The average dry matter production recorded was actually lower in the high seed rate demonstration. This was an unexpected result possibly affected by the late autumn break and the subsequent late sowing time, reduced winter rainfall, poor September rainfall (12% of the average) and below average October rainfall (60% of average).

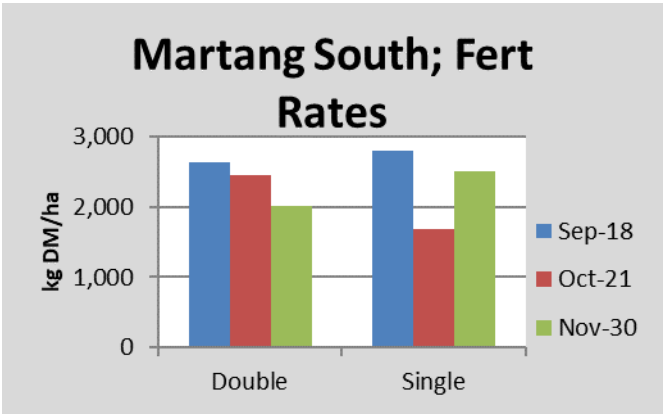

Fig. 9; Fertiliser responses

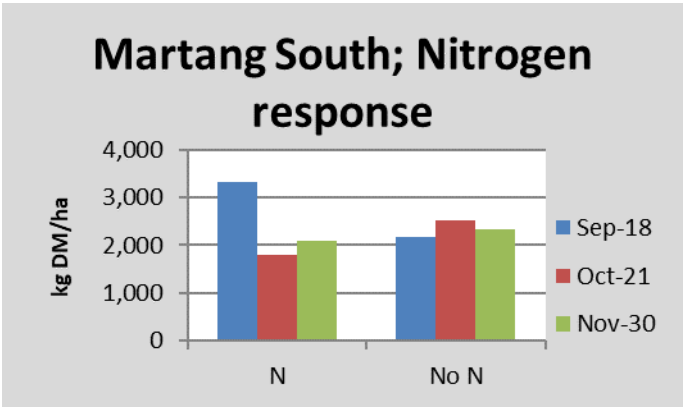

Fig. 10; Nitrogen responses

The double rate of fertiliser (Fig. 10) only produced an extra 127 kg DM/ha and the added nitrogen only produced an extra 174 kg DM/ha. This probably reflects the overall vigour of the ryegrass stand.

Income/Benefits

As the site was rotationally grazed, and both treatments were within the same paddock, potential benefits have been estimated rather than a gross margin produced.

Table 7. Estimated benefits of high input versus standard input.

Benefits	High input vs Standard input	Comments	Assumption
Extra Dry matter production	An increase of 542 kg DM/ha grown in winter to early spring from the higher seeding rate when Nitrogen was applied worth an extra $148/ha at a cost of $107/ha (extra seed + urea), but a reduction of 219 kg DM/ha from higher seeding rates in winter where N wasn't applied.	When Nitrogen was applied there was greater growth from the higher seeding rate. No additional feed grown from the higher seeding rate in late winter/early spring when nitrogen was not applied which indicated nitrogen was limiting its response. Overall a reduction of 1.27 t/ha of feed from the high seeding rate.	70% utilisation where 379 kg DM/ha available at 13.0 MJ ME/kg DM which is equivalent to 4927 MJ ME/ha. The cost to supply this with feed barley at $330/t fed (90% DM) and an ME of 12 is 3 cents/MJ of ME. (4927 MJ ME/ha x $0.03) = $148/ha
Shift in timing of feed grown with the use of nitrogen as shown by pasture cages	An extra 1.2 t DM/ha grown in Aug/Mid Sep from nitrogen (Fig 10) but only an extra 173 kg DM/ha grown from Sep to Nov compared to nil nitrogen.	The Aug Nitrogen application grew more feed in late winter/early spring which could be used to lift pasture production quickly to benefit lambing ewes. The N response was mainly confined to late winter/early spring which probably coincides with moisture availability.	
Fertiliser rate	No obvious benefit in late winter/early spring probably due to cold temperatures but spring (mid Sep to late Oct) produced an extra 773 kg DM/ha when pasture was actively growing.	The extra growth in mid spring from the higher fertiliser rate may have depleted moisture in the dry spring, so that there was no growth response in late spring.	

Residual value	No expected difference	In year 2, 20-30% plants might be expected to survive if the plant was able to form viable seed and the seed re-establishes. However due to the dry spring and demand on feed production, this was unlikely to have occurred.	

The higher seed rate cost an extra $45/ha but grew no extra feed in August/early September when no nitrogen was applied. However, pasture responded to the nitrogen treatments at this time indicating that it was one factor restricting growth. The double rate of fertiliser showed the biggest response in mid spring to late October which coincided with better rainfall. The late sowing may have resulted in the plants unable to take advantage of the extra fertility during the winter period.

Conclusion

It should be noted the results are unreplicated and are inconsistent with results from other demonstrations. The results from 2018 at Martang South should therefore be treated with caution. The site was affected by a late autumn break and below average early spring rains which constrained pasture production. The higher sowing rate needed nitrogen fertiliser to produce additional winter dry matter.

The Martang South site was the most severely affected by the seasonal conditions and suggest that producers need to be flexible in their approach to species selection. Changing from ryegrass to a grazing cereal in response to the late autumn may have resulted in a higher rate of dry matter production.

SITE 2; Paradoo

Location; Cobbitty/Paradoo Prime; Pigeon Ponds **Site Hosts:** Tim & Georgie Leeming

Pigeon Ponds had a more favourable season in 2018 than the other four short lived ryegrass sites with an earlier autumn break and regular late autumn/early winter rains. Conditions got reasonably wet in winter before below average spring rainfall reduced potential dry matter yield. Two paddocks were selected for high production annual forage pastures, one paddock had Tetila ryegrass established and the other was sown with Moby Barley, which was included in the grazing cereals demonstration. A long term Australian/sub clover pasture was selected as a control paddock.

Dry Matter Production

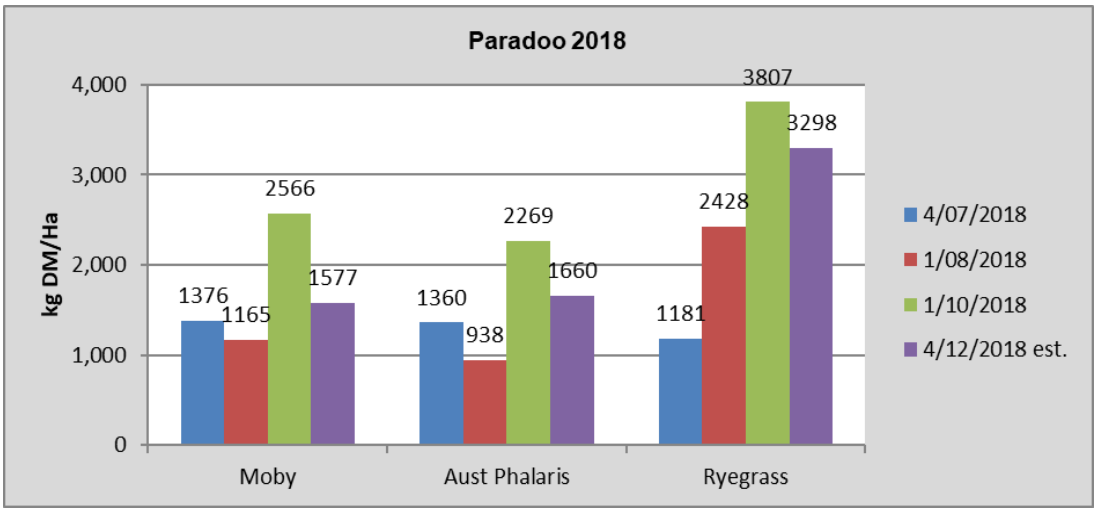

Fig. 11; Dry Matter production comparison, Paradoo

The Tetila stand maintained a high level of ryegrass throughout the growing season and it made up 80% of the pasture composition at the start of October. The phalaris pasture had around 35% sub clover, 35% phalaris and 30% annual grasses and broadleaf weeds. December dry matter was estimated only.

Feed quality

Feed Tests were conducted at Paradoo on August 22nd and the results are shown in table 8. The ryegrass showed a higher energy value than both the phalaris and the grazing cereal.

Table 8. Feed quality August 2018

PARADOO	Moby Barley	Tetila Ryegrass	Phalaris
Crude Protein (% of DM)	20.1	25.6	25.5
Neutral Detergent Fibre (NDF) (% of DM)	44.3	40.1	40.7
Digestibility (DMD) (% of DM)	62.7	75.3	69.5
Est. Energy (MJ/kg DM)	9.2	11.3	10.3

Financial analysis

Costs of establishment

The cost of establishment at Paradoo gives an indication of the annual ryegrass sites. The paddock was dry sown and so no herbicide costs were incurred. Details of other sites can be found in appendices 3 – 5.

Table 9. Establishment costs at Paradoo

Activity	Item	Rate	Input Unit	Price	Price Unit	Cost/ha
Seed	Tetila short term ryegrass	27	kg/ha	$1.90	**$/kg**	**$51.30**
	Moby barley	80	kg/ha	$350.00	**$/t**	**$28.00**
Fertiliser	MAP	80	kg/ha	$650.00	**$/t**	**$52.00**
Operations	Sowing	1	application	$44.00	**$/ha**	**$44.00**
						$175.30

Table 10. Additional costs of Tetila ryegrass versus Australian phalaris

Activity management costs	Additional costs	Comment
Establishment costs	Tetila at $147/ha vs $0 costs for phalaris.	Tetila was also $23.30/ha more expensive in comparison of Moby barley due to the seed cost.
Costs of urea applied to plots	Tetila at $112/ha vs $0 costs for phalaris	Urea delivered $490/ha, Spreading $12/ha, Tetila had 2 applications of urea.
Extra nutrient removal	Tetila would require higher fertiliser rates in 2019. Estimated to be an additional 15 kg P/ha.	An increase in Tetila feed grown would have resulted in more nutrient removal. Removal approx. 3kgP/kg t of DM.

Income/Benefits

Table 11. Estimated benefits Tetila versus phalaris at "Paradoo"

Benefits	Tetila vs Barley vs phalaris	Comments	Assumptions
Extra Dry Matter, grown from establishment to Dec 4th measured via pasture cages & cuts	Tetila grew an extra 4.5 DM t/ha than phalaris	The extra feed was grown from July until Dec. The extra feed is worth $1068/ha It cost an extra $260/ha more than the already established phalaris for establishment and nitrogen applications. The extra Nitrogen applied May 29th doesn't seem to have generated a pasture response up until July but may have been utilised to provide a response from July to Aug. An additional N application in Aug 27th has helped grow extra feed over spring.	Assumed 70% utilisation and additional feed valued using market replacement of Barley grain worth $330/t (90% DM) or 0.03 $/MJ ME. Extra 3.15 t DM/ha utilised equivalent to 35,595 MJ/ME.
Higher energy quality during winter.	Tetila 1.0 MJME/kg DM higher than phalaris	Worth approximately an extra 15 g/day in sheep weight gain.	6 MJME is approximately 100g/day weight gain in sheep
Regeneration of Tetila in 2019		Tetila, although an annual regenerated in 2019 by allowing it to set seed. This reduces the need for re- sowing.	

Conclusion

The results at Paradoo, show the advantage of using a high production annual ryegrass in the system. Its production when compared to the winter dormant Australian phalaris showed a 72% increase in dry matter production. The difference in winter growth was around 90% showing the value of adding the annual ryegrass into a highly productive lambing system.

SITE 3; Quamby

Location: Quamby; Dobie **Site Hosts:** de Fegely Partnership

Hybrid long rotation ryegrass (cv. Barberia) has the growth of annual but can persist for 4 to 5 years. A second year of the Hybrid ryegrass pasture was measured for dry matter production and feed quality during 2018 and compared to an adjacent phalaris cv. Holdfast GT /sub clover pasture as a control paddock.

Dry Matter Production

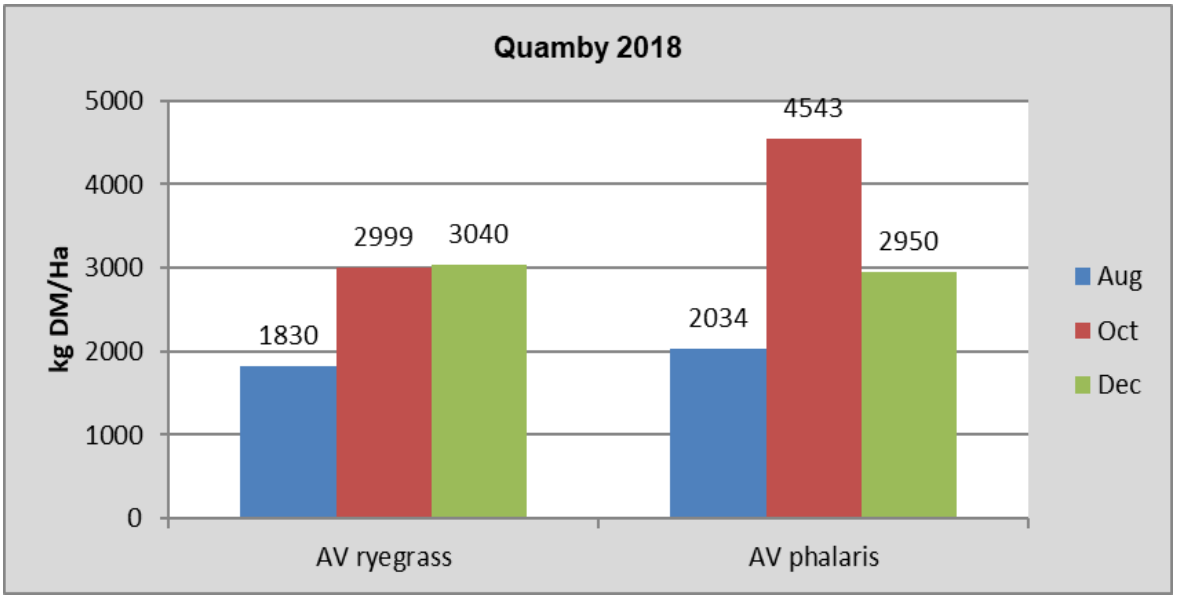

Fig. 12; Dry matter production at Quamby 2018

Feed quality and composition

The phalaris pasture had much higher sub clover content at 40% in spring compared to the ryegrass pasture with approximately 15%. Feed tests were conducted at Quamby on August 28th. There was little difference in the energy value between the pastures. The higher sub clover content might have driven up the quality results of phalaris.

Table 12. Feed quality results at Quamby.

QUAMBY	Barberia Ryegrass pasture	Holdfast GT Phalaris pasture
Crude Protein (% of DM)	30.5	27.1
Neutral Detergent Fibre (NDF) (% of DM)	31.6	34.7
Digestibility (DMD) (% of DM)	85.8	84.6
Est. Energy (MJ/kg DM)	13.1	12.9

Conclusion

Whilst in 2018 the phalaris grew more dry matter than the ryegrass pasture, it provides additional benefits to the farming system. High performing phalaris/sub clover pastures are the basis for the lamb production system on Quamby, but their system would be unworkable without annuals in the mix. The grazing of annual forage residue in the Quamby system over summer helps reduce grazing pressure of the phalaris pastures resulting in more robust perennial pastures which make up the majority of the farm's pasture type. The Barberia long rotation ryegrass fits into this farming system and made a positive contribution to the entire farm output.

2019

SITE 1; Paradoo

Cobbitty/Paradoo Prime; Pigeon Ponds **Site Hosts:** Tim & Georgie Leeming

A paddock was sown to annual ryegrass cv Prine at two seed rates and compared to an adjacent Holdfast GT phalaris pasture as a control.

Dry Matter Production

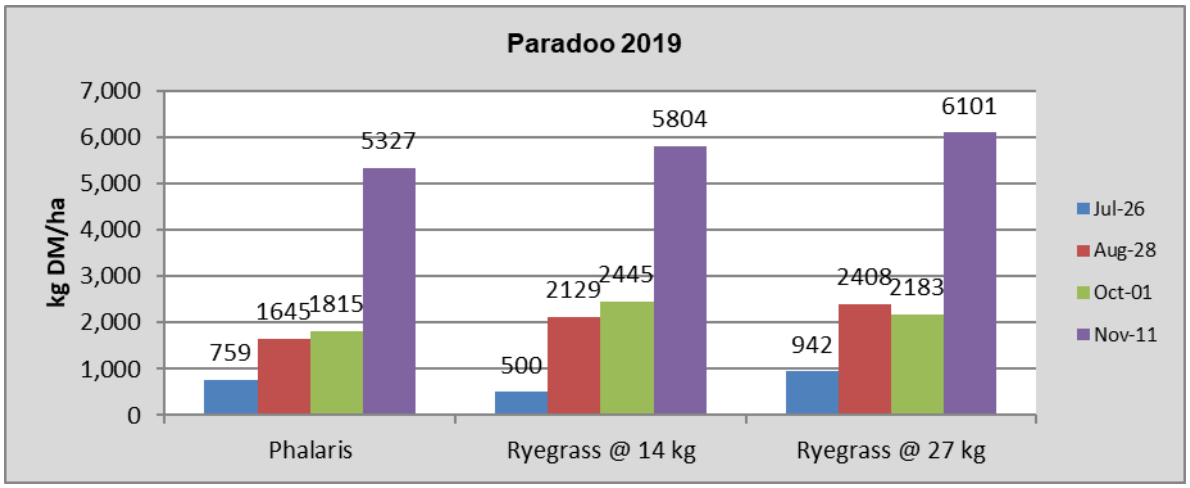

Fig. 13; Dry Matter Production, Paradoo 2019

The higher rate of ryegrass seed showed that the "double" rate of ryegrass grew an extra 756 kg DM/ha when compared to the "standard" rate and an extra 2,089 kg DM/Ha when compared to the phalaris.

Fig. 14; End users taking an interest in the dry matter measurements at Paradoo.

Feed Quality and composition

A feed test was conducted on the ryegrass on October 1st.

Table 13. Feed quality results for ryegrass

Paradoo	Ryegrass
Crude Protein (% of DM)	21.8
Neutral Detergent Fibre (NDF) (% of DM)	31.2
Digestibility (DMD) (% of DM)	85.9
Est. Energy (MJ/kg DM)	13.2

Ewes and lambs were rotationally grazed through winter and early spring in both pastures. Young trade cattle were fattened on the ryegrass during spring. No grazing figures were available, so an estimated gross margin (GM) was calculated based on the total feed grown for the year as recorded in pasture cages (see Fig. 15). The estimated gross margins show that the highest gross margin was in the order of double rate ryegrass, control ryegrass and then phalaris, based on the higher stocking rates they could support. The double rate ryegrass earned potentially an extra $29/ha.

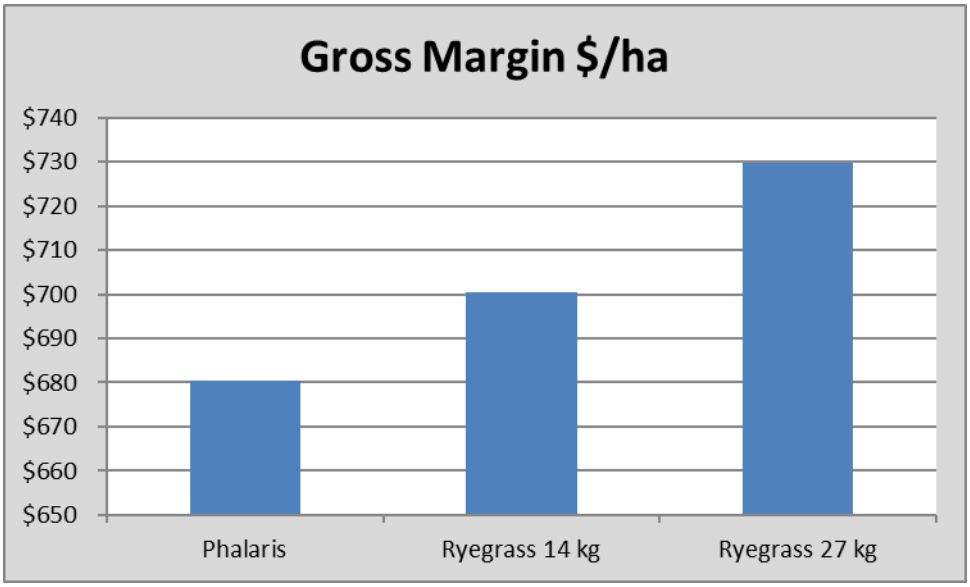

Fig. 15; Estimated gross margin, Paradoo 2019

Table 14 shows the additional benefits of double rate ryegrass over the control rate and phalaris if the extra feed grown had to be purchased. Not all the additional feed grown may be utilised (70% assumed) over spring, but it would likely to be utilised during winter.

Table 14. Estimated benefits of double rate hybrid ryegrass compared to control rate and phalaris using a reduction in supplementary feeding costs to evaluate benefits at "Paradoo"

Benefit type	Calculated benefits and value of extra feed grown	Comments	Assumptions
Total extra dry matter produced over the growing season	Hybrid ryegrass double rate grew 756 kg DM/ha more than the control rate ryegrass, valued at $206/ha. Double rate rye grew an extra 2.1 t/ha more than the phalaris valued at $573/ha. Control rate ryegrass grew 1.3t/ha more than phalaris valued at $355/ha.	The value of the extra feed grown & utilised exceeds the establishment costs.	Assumed 70% utilisation and additional feed valued using market replacement of Barley grain worth $334/t (90% DM) or 0.03 $/MJ ME.
Extra winter dry matter	Double rate rye grew an extra 721 kg DM/ha more than the control ryegrass valued at $197/ha. The additional winter growth of double rate hybrid ryegrass was 946kg DM/ha more than the phalaris valued at $258/ha. Control rate ryegrass grew 225 kg DM /ha more than phalaris valued at $61/ha.	The winter feed is likely needed and utilised as it is generally in short supply. The extra seed costs of double rate ryegrass was $40/ha more than the control rate, which has potentially been paid back by the additional feed grown.	
Survival and regeneration potential of ryegrass in 2020.	Annual ryegrass was allowed to set seed in 2019 to increase its likelihood of survival for two to three years.	Regeneration means the establishment costs could be spread over two or even three years.	

In the good season of 2019, the additional feed grown from the double rate over the winter made this an attractive proposition. The additional winter production could potentially reduce supplementary feeding over winter and has potentially allowed increases in stocking rate or would drive higher liveweight gains.

Tim Leeming was impressed with the amount of dry matter a tetraploid ryegrass can produce. Tim intends to direct drill and bulk up 250 ha of country with annual ryegrass mainly into paddocks that don't have any or much phalaris. The winter production of the annual ryegrass was just as good or better than phalaris and Tim said that sowing down all of the farm to phalaris is expensive.

Good November rains had let the paddocks get away and set seed. Tim locked up the paddock at seeding and hopes to get survival of ryegrass in the second year. He only resumed grazing in January and had put in stock to smash the seed to the deck and hopefully not eat it. Tim will monitor how successful this strategy is. Whilst most farmers in medium to high rainfall zone, use annual or hybrid ryegrass to cut hay or put weaners on which removes the seed, he believes being able to allow it to set seed will enable him to get two to three years of high winter production out of them. Tim wants to learn the skills to improve its survival capacity. This will make the potentially high risk option a more attractive strategy.

Lockup of pastures to allow seeding is likely to provide high quantities of seed that can potentially regenerate in the following year. Whilst it may provide a reasonable pasture in the second year, it could have lower production. The seed which is sitting on the surface will be subject to insect predation and once it germinates, its first root will be exposed on the surface where it can dry out before being able to grow into soil.

There are benefits with being able to dry sow ryegrass as there is no need for knockdown or to wait for the autumn break to occur which can sometimes be quite late. However, dry sowing is best suited to paddocks that do not have annual weed issues or their seed set is addressed in the year prior to sowing. Any herbicide interventions that have to be carried out after establishment will suppress pasture growth. The double rate has shown it increases the initial dry matter production so that it may potentially keep pace with fast germinating annual grasses.

Conclusion

Rainfall at the site provided sufficient moisture throughout the growing season and didn't cause any waterlogging. The higher rate of ryegrass seed showed that the "double" rate of ryegrass grew more dry matter over winter and that the extra potential income has paid for its costs, based on having to buy in feed and through potential increases in stocking rate. If the ryegrass survives over summer or regenerates from seed and provides good winter production for two to three years, then the strategy will be less risky and more profitable. The Paradoo site also showed the success of dry sowing ryegrass.

SITE 2; Aramis

Location: "Aramis" Gatum **Site Host:** Mark Jarvis

The paddock at "Aramis" Gatum was sown with two rates of an annual/hybrid ryegrass mix (cvs Prine/Barberia). The pasture received a urea application in late winter. The paddock measured the higher rate of seed against the "normal or standard" sowing rate for most farms. The paddock chosen was a very fertile site which had been rehabilitated after being converted into a raised bed cropping system some years ago. The pasture was sown before the autumn break and germinated quickly after the May rains and grew unchecked through a reasonably mild winter at Gatum.

Dry Matter Production

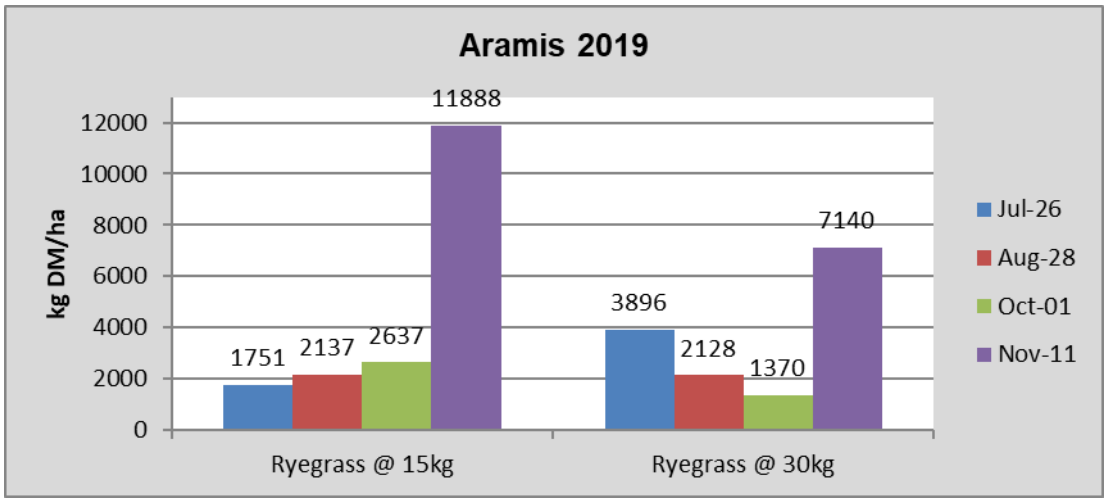

Fig. 16; Dry Matter production, Aramis 2019

The higher seed rate showed a higher growth rate at the July measurement but the "standard" rate was similar at the next two assessments. The final cuts showed a large differential favouring the "standard" rate. It has been suggested that the "standard" rate allowed for more aggressive tillering in the plants as they had more space to grow in spring.

Fig. 17; Ryegrass at Aramis 30th August, 2019

The pasture had around 30% sub clover in spring and feed tests were taken on October 1st from the ryegrass/clover pasture as well as taken from the ryegrass component only. The feed tests show the high quality feed value in both samples.

Table 15. Feed quality results for ryegrass, Aramis 1/10/19

Aramis	Ryegrass/clover	Ryegrass only
Crude Protein (% of DM)	18.6	19.2
Neutral Detergent Fibre (NDF) (% of DM)	40.3	40.3
Digestibility (DMD) (% of DM)	79.8	82.5
Est. Energy (MJ/kg DM)	12.1	12.6

Financial analysis

Income/Benefits
No grazing figures were available and so a gross margin has been estimated based on the potential stocking rate calculated from pasture cuts. The estimated gross margin was $393/ha higher in the control ryegrass due to the potential higher stocking rate it could carry than the 30kg/ha ryegrass rate.

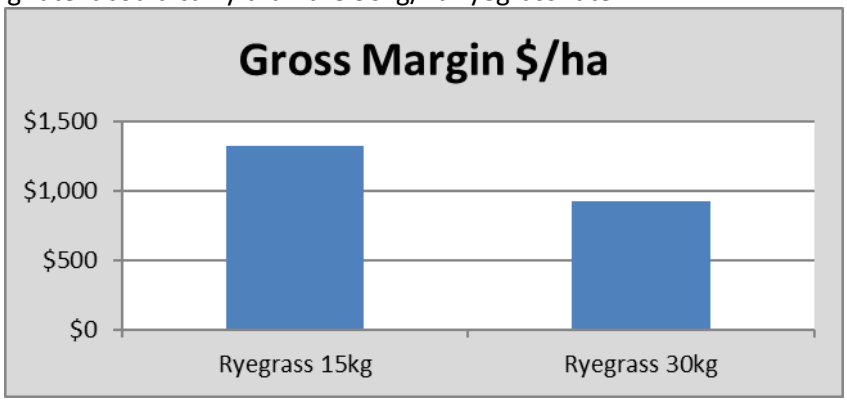

Fig. 18; Gross margin $/ha hybrid ryegrass

The double rate of ryegrass did what it was expected to do, which was to lift early dry matter production in winter. Information from previous trials showed that the control usually catches up, which it did here.

However, what was unexpected was the difference in annual production between the two sowing rates which was due to the higher spring production (6 t DM/ha) of the control hybrid ryegrass. The reason why is not easily explained, as if competition for resources (space, light, water, nutrients) was limiting production in the double rate, then this eventually should have occurred in the control and growth reduced.

The double rate ryegrass mix compared to the 15 kg/Ha, has , based, on its extra winter growth potentially exceeded costs of establishment and management when valued based on replacement costs of barley grain supplements.

Conclusion
The production of the ryegrass at both seed rates was exceptional. Despite a short period of wet conditions, the ryegrass grew unchecked and showed that it is a valuable addition to pasture systems where rainfall is fairly predictable.

SITE 3; Mokepilly South

Location: "Martang South/Mokepilly South" Lake Fyans **Site Hosts:** Lachie and Minnie Green

The demonstration site was selected in early autumn but the pasture establishment was delayed until May 10th due to circumstances beyond the host famer's control. Firstly Lachie's old seeder was sold and its replacement arrival was delayed, this was followed by a major tractor breakdown. After this, Lachie's father, Alan, had emergency heart surgery which reduced the labour availability; he has made a full recovery. It was decided that despite the delay to sowing that the demonstration should go ahead as the situation reflected "real life" in farming enterprises.

Extra nitrogen applications were applied to try to compensate from delayed pasture establishment. Italian annual ryegrass cv Betta Tetila (diploid ryegrass) was sown at "standard" rate of 16 kg/ha and compared with the "double" rate of 32 kg/ha. Urea was applied on July 18th, 7th August, 3rd September and 27th September to provide unlimited nitrogen under the treated cages.

Dry matter Production

The dry matter average differences are shown in Table 16 and graphed in Fig. 19. It should be noted that the measurements were taken from a small number of cages.

Table 16. Average dry matter differences compared to the single seed rate with no N.

Management factor	Kg DM/ha
Single seed rate	0
Double seed rate	+425
+ N (all)	+685
+ N Single seed rate (16 kg/ha)	+310
+ N Double seed rate (32 kg/ha)	+1,060

The results showed that the double seed rate with nitrogen applied grew just over one tonne of dry matter more when compared to the "standard" rate of ryegrass with no nitrogen applied.

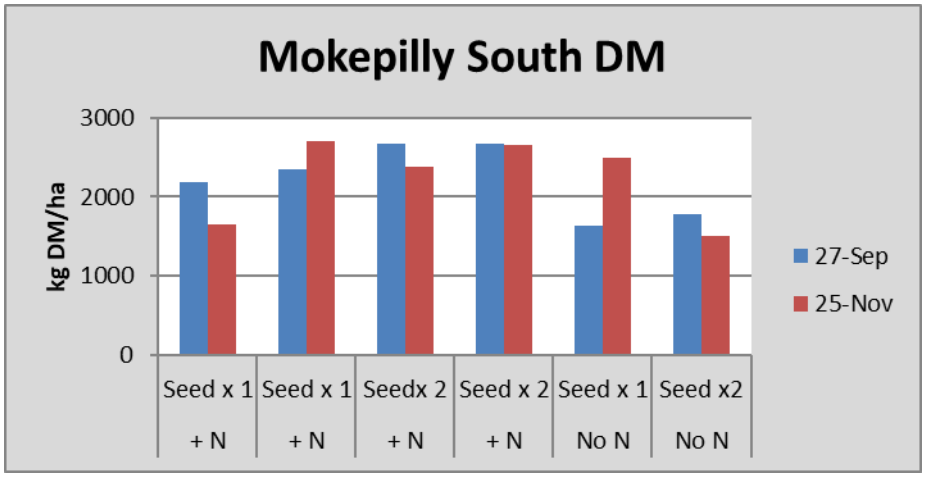

Fig. 19; Dry matter production at Mokepilly South

Financial analysis

Income/Benefits

The site was rotationally grazed and both treatments were within the same paddock and so production benefits have been estimated from pasture cuts. A gross margin has been estimated based on the potential stocking rate calculated from pasture cuts where nitrogen was had been applied.

The estimated GM was $21/ha higher in the double rate of ryegrass due to the potential higher stocking rate it could carry.

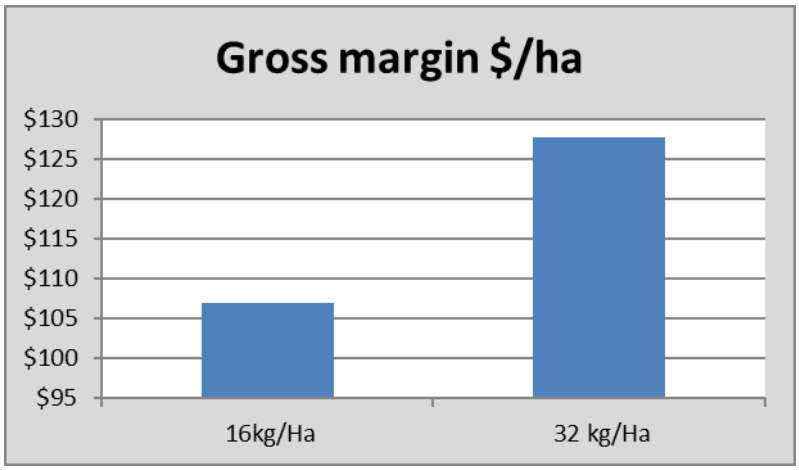

Fig. 20; Gross margin $/ha annual ryegrass control + N at Mokepilly South

The later sowing of May 10th and reduced rainfall in spring would have affected total dry matter production at Mokepilly South. September, October and November rainfall was poor (half of the long term average).

Conclusion

The late establishment of the ryegrass due to factors beyond the control of the host farmer provided a good opportunity to show the penalities, both in dry matter production and loss of flexbilty in utilising the pasture that are the outcome of late sowing. The responses to nitrogen indicate that its use is justified. The demonstration shows that even with poor spring rainfall, the benefits over winter can at least pay for the additional seed costs and nitrogen fertiliser.

4.1.2 Grazing Cereals

2017

SITE 1; Jallukar Park

Location: Jallukar Park; Rhymney **Site Hosts:** Brady Family

SITE 2; South Glengowan

Location: South Glengowan; Joel Joel **Site Hosts:** K, J & C Hall

The opportunity to include the South Glengowan site came about in early winter and it was not possible to set up an ungrazed control site at that stage. The two grazing oats sites are in a similar environment, so the annual pasture site was used as a control for both demonstrations. The results are reported together in this section. The producers were focused on grazing with opportunistic grain production.

Dry Matter Production

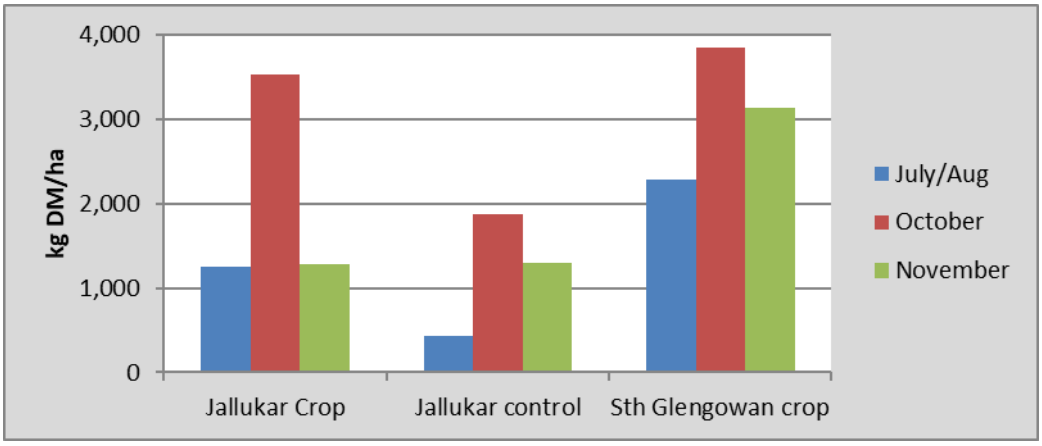

Fig 21; Dry Matter production at the Jallukar Park and South Glengowan sites.

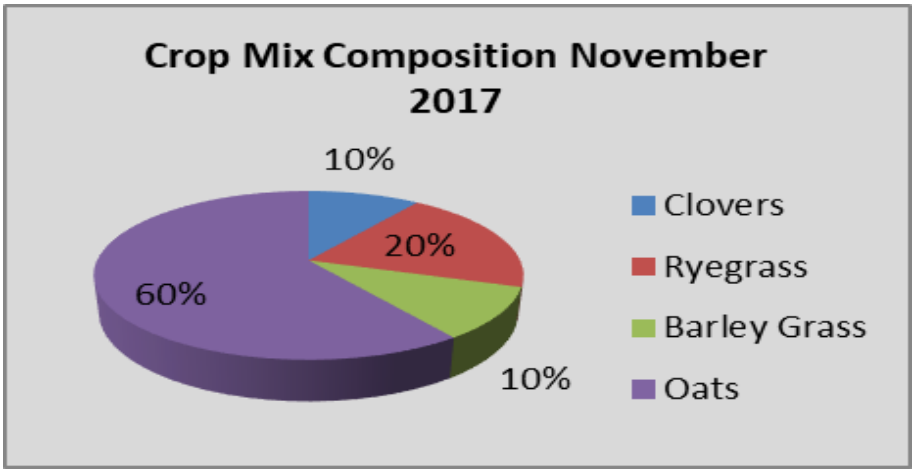

Fig. 22; Crop mix composition; Jallukar Park

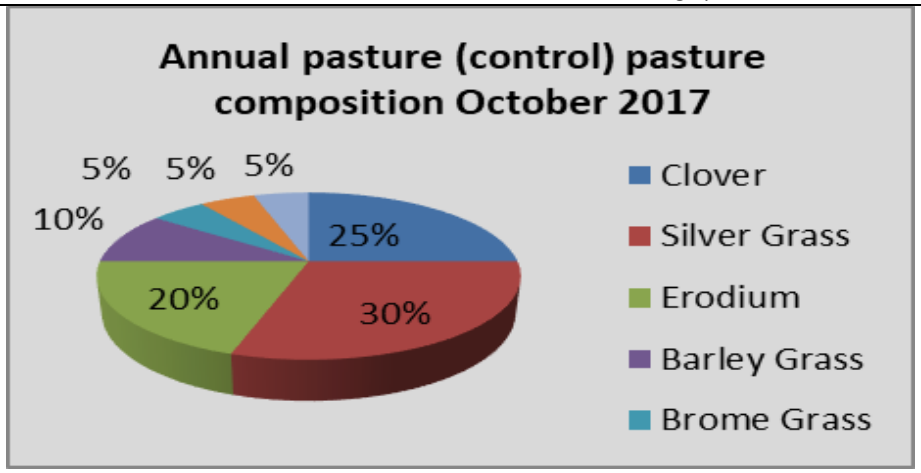

Fig. 23; Annual pasture composition; Jallukar Park

The oats at South Glengowan made up greater than 90% of the dry matter.

Fig. 24; oats at South Glengowan ready for baling

Income/Benefits; Jallukar Park

It was difficult to determine income from the treatments as only the one mob of stock were used and rotationally grazed between both paddocks. Potential benefits have been estimated rather than a gross margin produced.

Table 17. Estimated benefits oats versus control at Jallukar Park

Benefits	Oats vs Control	Comments	Calculation
Extra Dry Matter, grown in July to October as measured by cuts	2.5 DM t/ha	Worth the equivalent of $385/ha based on replacement value with barley. This value would only be realised in a poor year when you needed to supplementary feed. Worth nothing in a good year if you didn't need to supplementary feed. It cost an extra $220/ha to produce. Breakeven DM production was calculated to be 1.2 t DM/ha	This is based on 70% utilisation where 1750 kg DM/ha available at approx. 11 MJ ME/kg DM which is equivalent to 19,250 MJ ME/ha. The cost to supply this with feed barley at $218/t fed (90% DM) and an ME value of 12 is 2 cents/MJ of ME. (19250 MJ ME/ha x 0.02 cents/kg) = $385/ha.

Extra Dry Matter, grown in July to October as measured by cuts	2.5 DM t/ha	An extra 1500 kg of available DM/ha would have allowed an extra 4 ewes/ha to be run over the grazing period. However the increase in available DM was utilised by ewes with twins during July, Aug reducing the need to purchase stock and continue to carry them.	
Total extra grazing days from June to Dec by stock	42 days	Extra grazing days comes from extra DM production.	
Extra grazed days by ewes with lambs over winter	37 days	Extra days enables producer to rest phalaris to increase its leaf area and growth by 10-20%.	80 days on oats versus 37 on annual.
Extra Grazed days by Ewe weaners in Nov to Dec	20 days	If spring fails, you still have oats you can utilise without the issue of having to rest phalaris or risk grazing phalaris which impacts on its ability to produce dormant buds.	35 days on oats versus 15 days on annual
Extra animal production of young ewes Nov to Dec	50g/hd	No weight gain on annual pasture. More available feed allowed a higher intake and weight gains to occur.	Estimated by host farmer.
Peace of mind		Owner sleeps at night, knowing they still have some feed if spring fails	
Flexibility		Provides diversity to farm which already has most paddocks sown to phalaris.	

Financial analysis; South Glengowan

Costs of establishment

The cost of establishment at South Glengowan gives an indication of the grazing cereal sites. Details of other sites can be found in appendices 3 - 5.

Table 18. Establishment costs at South Glengowan**.**

Item	Description	Rate	Input Unit	Price	Price Unit	Cost/ha
Seed	Winteroo Oats	140	kg/ha	$ 200.00	$/t	$ 28.00
Fertiliser	Granulock, Zn & Cu	80	kg/ha	$ 700.00	$/t	$ 56.00
Knockdown herbicide	Glyphosate 450	2	L/ha	$ 13.40	$/L	$ 26.80
	MCPA	1	L/ha	$ 8.95	$/L	$ 8.95
	Fastac	100	ml/ha	$ 11.65	$/L	$ 1.17
Operations	Cultivation	1		$ 40.00	$/ha	$ 40.00

	Sowing (contract)	1	application	$ 50.00	$/ha	$ 50.00
	Spraying	2	applications	$ 12.00	$/ha	$ 24.00
Total costs						**$ 234.92**

A knockdown spray in September 2016 was used to control barley grass and the owner felt this contributed to the successful result of the oats dry matter production.

Income/Benefits

Lambs gained 315 grams/day. They entered paddock weighing 19 kg on June 7th and weighed 50.5 kg on September 15th. Seventy lambs were sold at a price of $146/head and the remainder were kept for breeding purposes.

The oats paddock was used for grazing for 100 days which allowed the adjacent paddock which had been sown to phalaris to be rested whilst it established. During the 100 days grazing, there would have also been wool growth, estimated to be 1 kg/hd on 193 ewes. After stock were removed, spring rains enabled extra growth and so there was opportunistic hay production on 16 ha with 100 tonnes of oaten hay produced into 153 square bales each weighing 650 kg and grain harvesting on 26 ha. There was likely also split oats and stubble that would have enabled additional grazing opportunities in December.

Gross Margin

A gross margin has been calculated for the paddock based on some of the realised income from harvesting and hay production and an estimated livestock income based on the stocking rate of 4.6 DSE/ha at a gross margin of $42/DSE. The gross margin comes from the Livestock Monitor Program (2017/2018) for South West Victoria prime lamb production but it doesn't include pasture costs as these are accounted for in the variable costs for oats establishment.

Table 19. Estimated gross margin of oats demonstration paddock at South Glengowan.

Income					
	Yield	**Input Unit**	**Price**	**Price Unit**	**Income ($/ha)**
Grain yield (26 ha)	3.46	t/ha	$170.00	$/t	$588.20
Hay (16 ha)	6.25	t/ha	$163.00	$/t	$1,018.75
Grazing income	4.6	DSE/ha	$42.00	DSE	$193.20
Gross Income					**$1,800.15**
Variable Costs					
	Rate	**Input Unit**	**Price**	**Price Unit**	**Cost/ha**
Oats establishment					$234.92
Harvesting			$55.00	$/ha	$55.00
Hay bailing	9.6	bales/ha	$20.00	bale	$191.25
Hay Mowing/Windrowing	16	ha	$65.00	ha	$65.00
Fuel & Oil	1		$10.34		$10.34
Total variable costs					**$556.51**
Gross margin					**$1,243.64**

- Grain price: Value of feed oats costed in 2017 if farmer had to purchase (source: PIRSA, 2017). Producer kept oats and so no transport costs or selling costs.
- Bales: Oaten hay valued on a 5 year average selling price, if they had to purchase (Source: PIRSA, 2017). Hay retained by producer, so no selling or transport costs.
- Grazing income is from Livestock Monitor Program (2017/2018) for South West Victoria prime lamb production average gross margin per DSE but it doesn't include pasture costs of $5.18/ha as these are accounted for in the variable costs for oats establishment.

Conclusion

This demonstration highlighted that although oats can be a valuable feed source in a poor year by reducing supplementary feeding costs, in a good year, although extra feed may not be needed, it does recoup establishment costs by providing opportunistic hay and grain production.

2018

SITE 1; South Glengowan

Location: South Glengowan; Joel Joel **Site Hosts:** K, J & C Hall

Oats cv Winteroo were sown in May at a sowing rate of 140 kg/ha which was cross sown at 70 kg/ha in each direction, 80 kg/ha of DAP fertiliser was added at establishment. The paddock is the same one used at South Glengowan in the 2017 & 2019 demonstration.

A rundown annual grass pasture in the adjacent paddock was used as a control for this demonstration site. The annual pasture was rotationally grazed in line with the usual farm management; its pasture composition is shown in Fig. 25. The annual pasture was stocked at equivalent of about 7.0 DSE/ha. The oats were grazed during winter before stock were removed to allow growth for hay production. The grazed oats equated to an annual rate of 3.86 DSE/ha.

Dry Matter Production

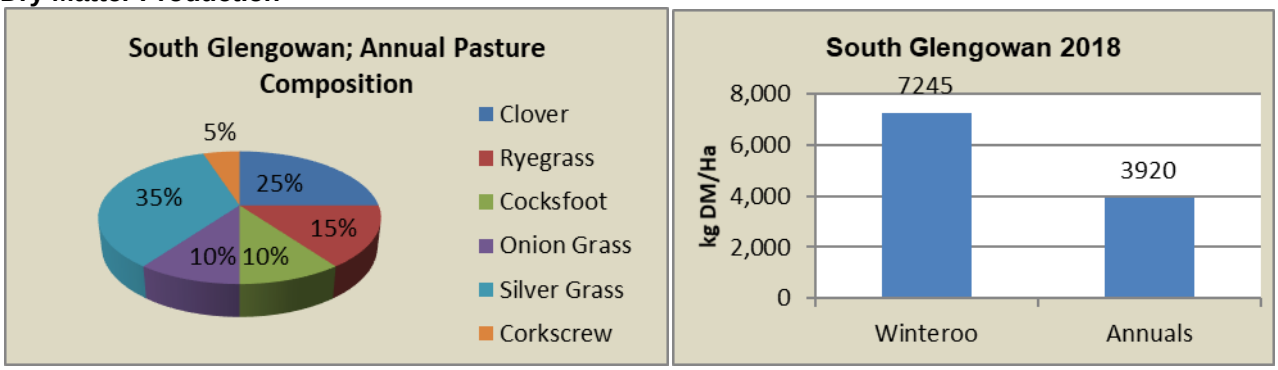

Fig. 25 & Fig. 26; Annual pasture composition and dry matter production, South Glengowan 2018

October rain allowed enough recovery for the oats to be cut for hay following grazing.

Income/Benefits

There was minimal supplementary feeding on the oats paddock. Stock only spent about 6 months of the year on the annual pasture and this supplementary feeding was valued at $10/DSE.

The Gross Margin for oats was much higher than that of the annual pasture, mainly coming from income generation of oaten hay in 2018 which had high value due to demand in the dry season and the additional forage growth.

Table 20. Estimated gross margin of oats and annual pasture at South Glengowan

	Oats			Annual Pasture		
	Average Income per DSE	**Medium Income per DSE**	**High Income per DSE**	**Average Income per DSE**	**Medium Income per DSE**	**High Income per DSE**
Income/DSE	$42	$60	$80	$42	$60	$80
Grazing Income $/ha	$164	$234	$312	$294	$420	$560
Hay Income $/ha	$1,571	$1,571	$1,571			
Gross income $/ha	$1,735	$1,805	$1,883	$294	$420	$560
Total Variable costs	$456	$456	$456	$70	$70	$70
Gross margin $/ha	**$1,279**	**$1,349**	**$1,427**	**$224**	**$350**	**$490**

Conclusion

The results show the financial gains that can be obtained in a sheep/cereal enterprise with the addition of grazing cereals. Combining grazing with hay or grain production can result in very favourable gross margins adding to the farm's bottom line as well as filling feed gaps for lambing ewes at vital times.

SITE 2; Overdale

Location: Overdale; Concongella **Site Hosts:** Holden Family

Moby Barley has been successful as a grazing cereal in drier areas of the Wimmera and the project advisory group decided to include it in the project at Overdale. A Winteroo oat crop was used as a control; oats has proven to be a reliable performer in the Southern Wimmera.

It should be noted that the barley site was a sandy loam whilst the oats paddock was grown on a gravel loam soil. The cereals were sown in autumn; nitrogen in the form of urea was applied in early August to a section of each demonstration.

Dry Matter Production

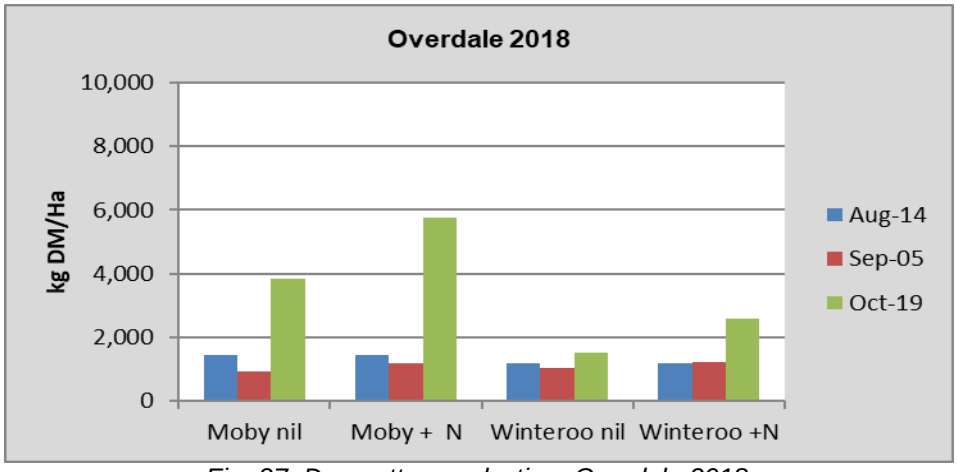

Fig. 27; Dry matter production, Overdale 2018

Feed Quality

The barley had a higher estimated energy content when tested on August 17th (13.6 MJ/kg DM) compared to the oats (13.0 MJ/kg DM).

Production

The barley was locked up for grain production after grazing whilst the oats was grazed until growth ceased; this gave the oats a higher carrying capacity of 4.2 DSE/ha compared to 3.6 in the barley. The barley paddock had a proportion of dropped grain after harvest, some of which geminated after December rains. This allowed a valuable additional grazing period of 20 days for stock in January/February in 2019 which added an extra 0.5 DSE/ha to the barley carrying capacity.

Fig. 28; Oats 18th July 2018

Fig. 29; Barley 15th August 2018

The barley was harvested for grain and during this process, straw was direct baled and later utilised on farm in containment areas.

Table 21. Moby harvest results

	Grain tonnes/ha	Grain value/ha at $200/tonne	Straw tonnes/ha	Straw value/ha at $100/tonne
Moby barley	2.0	$600	0.6	$120

The barley straw feed test had an energy content of 7.3 ME and 3.6% protein.

Financial Analysis

Income/Benefits

The gross margins showed a return for the barley of approximately $606/ha but the oats paddock was likely to make a slight profit where the income per DSE was valued at $42. Table 22 shows the difference with GM where the livestock income is $42, $60 and $80 per DSE. The grazing income was similar in both paddocks but the additional growth of barley allowed the production of grain and hay. Barley also allowed additional grazing in summer 2019 which was valued at $60/ha due to high costs of grain at that time.

Table 22. Estimated gross margin of oats and barley with variable grazing incomes at Overdale

	Oats			Barley		
	Average Income per DSE	Medium Income per DSE	High Income per DSE	Average Income per DSE	Medium Income per DSE	High Income per DSE
Income/DSE	$42	$60	$80	$42	$60	$80
Grazing Income $/ha	$174	$249	$332	$151	$216	$288
Grain				$660	$660	$660
Straw				$72	$72	$72
Gross income $/ha	$174	$249	$332	$883	$948	$1,020
Total Variable costs	$161	$161	$161	$278	$278	$278
Gross margin $/ha	**$13**	**$88**	**$171**	**$606**	**$670**	**$742**

There was no supplementary feeding in either paddock during 2018. Supplementary feeding was needed to help graze down the barley stubble in 2019. The benefit for both crops was the spelling of phalaris in spring to support its persistence and for farm management. Not all paddocks can be sown to phalaris because it exposes risks to phalaris staggers or reduces the ability to take advantage of opportunities such as sowing a summer crop when moisture is available.

Host farmer Mal Nicholson made the point that the below average rainfall in 2018 in the Stawell area allowed the grazing cereals to be grazed at the right time in the growth cycle. A wetter winter may have compromised grazing times by trying to avoid any soil compaction and pugging issues. Also dividing the barley paddock (28 ha) in two (12 ha and 16 ha) with a hot wire tape low to the ground meant better utilisation, so livestock didn't walk all over it and trash it.

The old Suffolk ewes in lamb loved the barley stubble, ate it down to the boards, so that you could have potentially sown directly into it and had no trash issues. There had been grain amongst the stubble that was lost due to wind damage. Supplementary feed was needed on the barley to utilise the stubble. In comparison, the oat stubble was still standing; stock didn't like it as much. The barley straw was used in 2019 to start off containment areas that were being set up as the season was tight.

Table 23. Other estimated benefits barley versus oats at "Overdale"

Benefits	Barley versus Oats	Comments	Assumptions
Extra Dry Matter, grown from establishment to October 19th measured via pasture cages & cuts	Barley grew an extra 2.4 DM t/ha without Nitrogen and 3.4 DM t/ha with Nitrogen compared to oats.	The extra feed was mainly grown in late mid Spring (Sep 5 to Oct 19). It cost an extra $34/ha to produce but this was for extra fertiliser. Nitrogen applied in August had the biggest impact on growth during mid spring.	
Grazing in summer 2019 from barley re-shooting.	182 DSE grazing days/ha from Jan 17 to Feb 6.	Gazing worth additional $100/ha	Lupins used as a market replacement for barley as it has similar protein levels (30%) in summer and was worth $550/t DM in January 2019 (PIRSA, 2019)
Higher energy quality of barley during winter.	Barley 0.6 MJ of ME/kg of DM higher than oats	Worth approximately an extra 10 g/day in sheep weight gain	6 MJME = 100g/day weight gain

Conclusion

The near perfect conditions for grazing cereals in the Stawell region in 2018 showed the potential for Moby Barley establishment as a tool in filling the winter feed gap. The high winter growth provides large amounts of dry matter for grazing ewes with lambs at foot.

SITE 3; Paradoo

Location: Cobbitty/Paradoo Prime; Pigeon Ponds **Site Hosts:** Tim & Georgie Leeming

Pigeon Ponds had a more favourable season than the other four sites with an earlier autumn break and regular late autumn/early winter rains. Conditions got reasonably wet in winter before below average spring rainfall reduced potential dry matter yield. Moby Barley, 80 kg/ha was sown on April 18th with 80 kg/ha MAP. Urea was applied once at 120 kg/ha.

The barley didn't handle the wet, cold conditions in winter and there were large areas of plant loss; at the start of October, barley made up 60% of the pasture composition. The range of the counts was 20% to 80% depending on the location of the assessment in the paddock. Not surprisingly, the lower, wetter areas had the lower counts.

Large mobs were rotated around the paddocks, so no individual paddock details are available. The barley was eaten down but without eating the growing point (Tim checked with a razor blade) and so it was spelled and allowed to run to head and for the production of hay. The barley was cut for hay yielding 1 tonne/ha at 8 MJ/kg DM.

Dry Matter Production

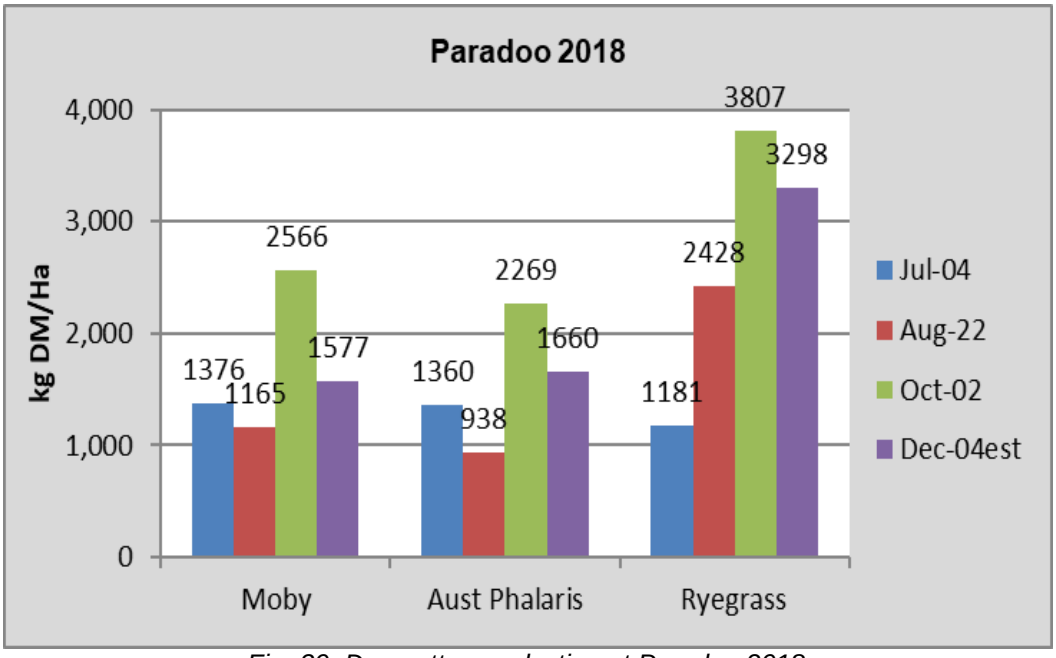

Fig. 30; Dry matter production at Paradoo 2018

The DM production of the Moby is shown in comparison the ryegrass and Australian phalaris pastures used in the Tetila Italian ryegrass demonstration.

Feed Quality

The energy for the barley at Paradoo (9.2 MJ/kg DM) was much lower than the result at Overdale which was 13.6 MJ/kg DM, probably reflective of it being only 60% of the pasture composition.

Financial Results

The Moby barley at Paradoo returned a gross margin of $586.50/ha when grazing and hay returns were calculated.

Conclusion

The Moby Barley did not appear suited to the cold, wet winter and did not produce the amount of dry matter that can be expected when using it in warmer, drier regions.

2019

SITE 2; South Glengowan

Location: South Glengowan; Joel Joel **Site Hosts:** K, J & C Hall

Background:
How much dry matter does an oats/ryegrass mix produce and does it pay? The producers were focused on grazing with opportunistic hay production.

Oats cv Bannister 100 kg/ha was sown dry in late April with 15 kg/ha of Italian ryegrass. Single superphosphate 100 kg/ha of was broadcast prior to sowing & 100 kg/ha of MAP fertiliser was added at establishment. The paddock received 80 kg/ha of urea in mid August. A rundown phalaris/ annual grass pasture in nearby paddock was used as a control for this demonstration site. The pasture was rotationally grazed in line with the usual farm management; its pasture composition is shown in 32.

Dry Matter Production

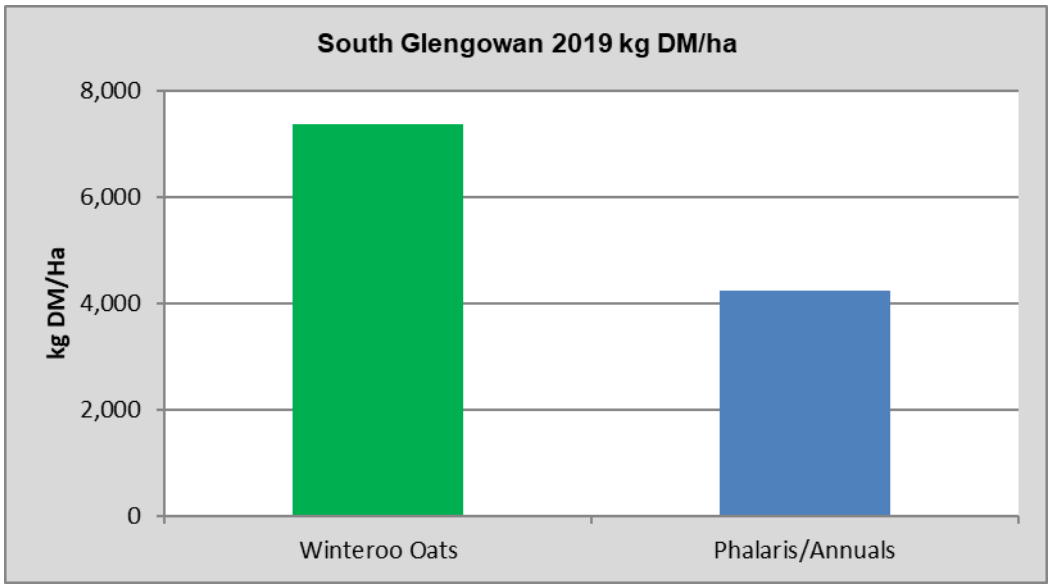

Fig. 31; Dry matter production, South Glengowan 2019

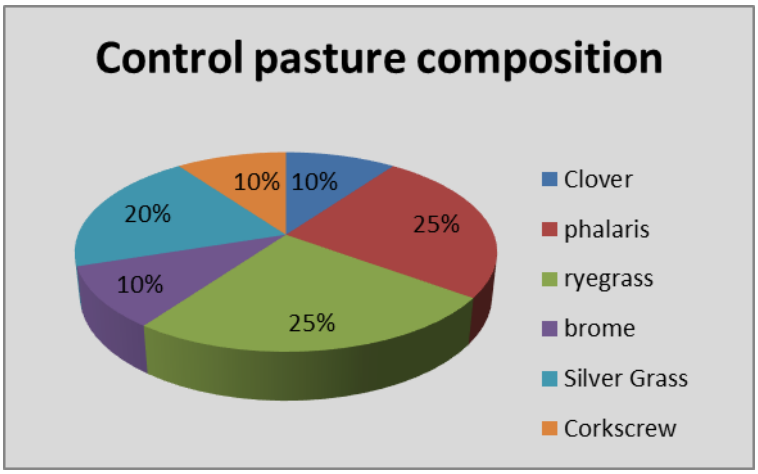

Fig. 32; Control paddock pasture composition

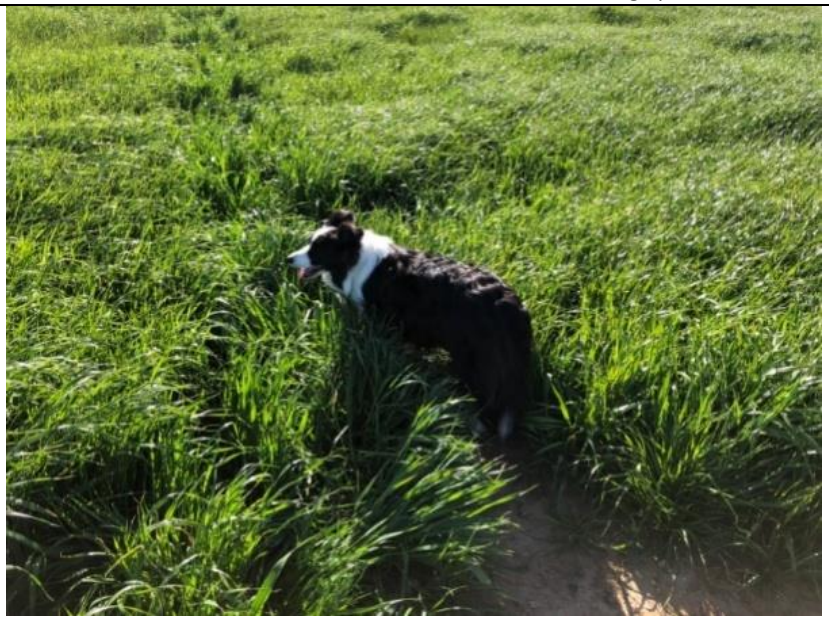

Fig. 33; oat/Italian ryegrass 30/9/19

Fig. 34; oat/ryegrass pasture after hay production

Feed quality

Feed Tests were conducted on the oat/Italian ryegrass pasture at South Glengowan on June 14th and October 22th; the results are shown in table 24. Energy content was high in June at 12.8 MJ ME/kg DM but dropped off in October to 10.4 MJ.

Table 24. Feed quality results for oats/ryegrass June & October

SOUTH GLENGOWAN	June	October
Crude Protein (% of DM)	29.3	9.8
Neutral Detergent Fibre (NDF) (% of DM)	40.0	51.9
Digestibility (DMD) (% of DM)	83.6	70.0
Est. Energy (MJ/kg DM)	12.8	10.4

Sheep production

The paddock ran 320 ewes, most with twin lambs for 109 days during late autumn and winter. Average lambing percentage was 185%. One third of the lambs were weaned and sold during this period and averaged $200 per head. The regrowth after that removal allowed for a second grazing period for six weeks starting on December 1st with 275 lambs with average liveweights of 49.5kg. Liveweight gain was 3kg/hd/wk which resulted in an extra $68.25 per head gain in value (at $8.64/kg dressed weight). The grazing equated to an average 8.6 DSE/ha for 2019, the DSE/ha figure was high for the paddock over 2019 due to the lactating ewes with a high number of twin lambs.

Financial analysis

Table 25. Costs at South Glengowan for oats/Italian ryegrass in 2019

Activity	Item	Rate	Input Unit	Price	Price Unit	Cost/ha
Seed	Bannister Oats	100	kg/ha	$350.00	$/t	$35.00
	Italian Ryegrass	15	kg/ha	$2.90	$/kg	$43.50
Fertiliser	Single Super	100	kg/ha	$327.00	$/t	$32.70
	Urea	80	kg/ha	$550.00	$/t	$44.00
Knockdown	Glyphosate 450	1.5	L/ha	$6.30	$/L	$9.45
	Fastac	100	ml/ha	$11.65	$/L	$1.17
Operations	Spreading	2	application	$8.50	$/ha	$17.00
	Cross sown	1	application	$50.00	$/ha	$50.00
	Spraying	1	application	$8.50	$/ha	$8.50
Total costs						**$241.32**

Income/Benefits

The hay is kept on farm to be used, so there are no selling costs associated with it.

Table 26. Estimated gross margin of oats/ryegrass demonstration paddock with grazing and hay in yield at South Glengowan

Income	Rate	Input Unit	Price	Price Unit	Income ($/ha)
Hay	5.70	t/ha	$300.00	t	$1,710.00
Grazing Income	8.6	DSE/ha	$42.00	DSE	$361.20
Gross Income					**$2,071.20**
Variable Costs	**Rate**	**Input Unit**	**Price**	**Price Unit**	**Cost/ha**
Oats/Ryegrass est.			seeTable 24		$241.32
Bailing	8.8	bales/ha	$20.00	bale	$175.09
Mowing/Windrowing	1	pass	$65.00	ha	$65.00
Fuel & Oil	1		$10.34	ha	$10.34
Total variable costs					**$491.75**
Gross margin ($/ha)					**$1,579.45**

The estimated gross margin for the control pasture paddock was $219.63.

Table 27. Other estimated benefits at South Glengowan

Benefits	Oats/ryegrass mix versus phalaris/ryegrass	Assumptions
Total extra dry matter produced over the growing season by oats/ryegrass compared to control phalaris/ryegrass pasture	Oats/Italian ryegrass produced an additional 3.1 t DM/ha more than the phalaris. The extra feed grown by the oats/rye mix with nitrogen was worth $759/ha at a cost of $241/ha.	Assumed 70% utilisation of the extra feed grown (2170 kg DM/ha at 12 MJ = 25284 MJ ME. Additional feed valued using market replacement of barley grain worth $334/t or 3 cents/MJ of ME.
Extra autumn winter dry matter production of oats/ryegrass	The paddock supported approximately 1 DSE/ha more over the winter than the phalaris pasture running at 7 DSE/ha.	A DSE in a prime lamb production system is worth approximately $35/ha.

The inclusion of Italian ryegrass into the oats mix would improve the quality of the feed and most likely stock adjustment onto the feed would be quicker so that faster weight gains could occur. The Italian ryegrass could also produce more tillers in response to November rainfall providing additional grazing opportunities. It also however doubles the seed costs. The hay was to be used on farm and provides an insurance policy for any feed shortages in 2020.

Conclusion
The oats/ryegrass mix was expensive to sow, but its ability to feed high numbers of stock and then be locked up for opportunistic hay production makes it a valuable contribution to the farm system.

Demo Site 4. Overdale

Location: "Overdale," Concongella **Site Hosts:** Holden family

Two paddocks were used in the demonstration and due to factors beyond the host farmer's control, including waterlogged areas; establishment was delayed until mid June.
One paddock was sown to barley cv Moby and had a small area of oats cv Echidna sown as a control. The second paddock which has a light, gravelly soil which had barley cv Moby sown at 40 kg/ha with rape cv Greenland added to one section while self-sown annual ryegrass was in another area of the paddock. Grazing cereals at a nearby member farm, Mount Glen, were sown as part of another project; these were observed but no dry matter cuts were taken from the site.

Dry Matter Results
The delayed sowing of the barley severely affected its dry matter production reinforcing the message that annual forage pastures need to be sown prior to or just after the autumn break.

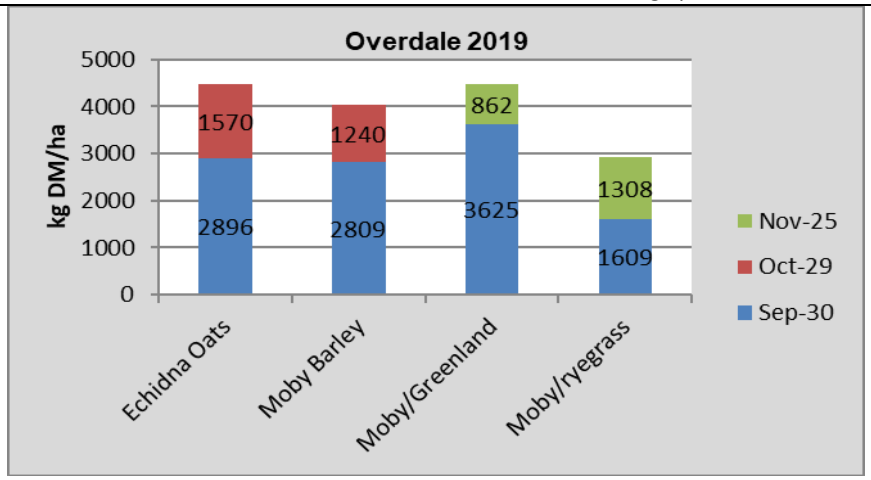

Fig. 35; Dry Matter results at Overdale

Financial analysis

The late sowing affected the amount of dry matter grown and this is shown in the gross margin results which were all negative**.**

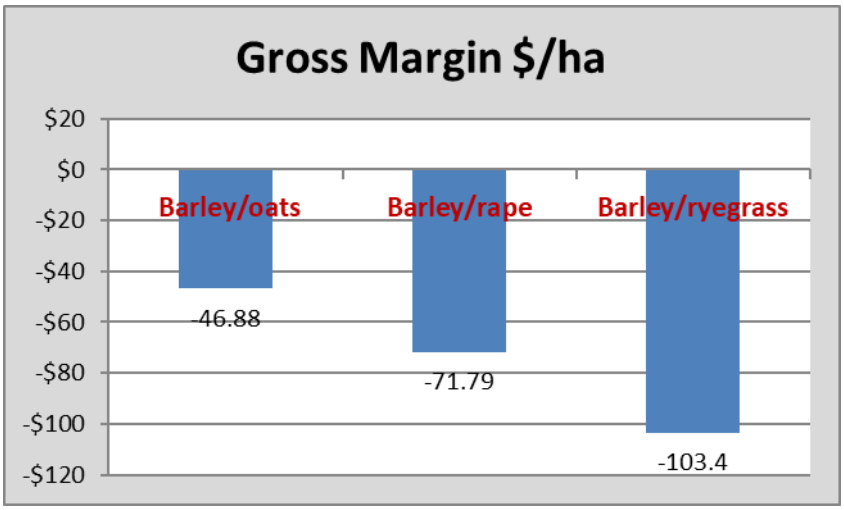

Fig. 36; Gross margin results, Overdale 2019

Conclusion

Although the gross margins were negative, they probably didn't capture all the benefits that the producer got from the annual crops. The quantity of feed grown from the cereals was lower in comparison to other demonstrations because of the late June sowing and waterlogging that occurred. The demonstration highlights the importance of growing and utilising high amounts of feed to recoup the sowing and nitrogen costs of annual crops.

Demo Site 5. Grazing Wheats

Location: "Challicum View" Ballyrogan **Site Hosts:** Maconachie family

Background

PPS were able to add a private demonstration site conducted by PPS members the Maconachie family at Ballyrogan. Grazing wheats were demonstrated in a side by side site with a further paddock analysed for the demonstration. The grazing wheat demonstrations were conducted on the basalt soil flats at "Challicum View".

Trial Inputs and Design

Bennett white wheat and Revenue red wheat were planted in the same paddock (Trough) and grazed by 400 first cross ewes with 1.5 lambs at foot for 28 days during winter. The paddock was then managed for grain production. Another paddock (2nd Ryegrass) was sown to Revenue red wheat and grazed by 250 first cross ewes with 1.5 lambs for 40 days; it was then managed for grain production as well.

Fig. 37; White wheat & Red wheat.

Fig. 38; PPS members inspecting grazing wheats during end of year farm tour.

Results and financial analysis

Ash Maconachie is an agronomist at Gorst Rural, Lake Bolac in addition to his input into the management at "Challicum View". Ash provided the following results table.

Table 28. grazing wheats results

GROSS MARGIN CALCULATION				INCOME			COSTS						GROSS MARGIN
Paddock	Crop Variety	Area (ha)	Yield t/ha	Price Grain	Grazing Value	Total Income	Seed	Fert	Chem	Operations	Other Costs	Total Cost	Profit
				($/ha)	($/ha)	($/ha)	($/ha)	($/ha)	($/ha)	($/ha)	($/ha)	($/ha)	($/ha)
Trough	Wheat - DS Bennett	12	6.17	1912	114.29	2,026	85	198	80	157	0	520	1,506
Trough	Wheat - SQP Revenue	61.5	5.07	1547	114.29	1,661	25	198	81	157	0	461	1,200
2nd Ryegrass	Wheat - SQP Revenue	38.5	5.51	1663	207.2	1,870	25	204	80	157	0	466	1,404

Conclusion

The results show that grazing wheat can provide useful stock feed during winter with little or no grain yield penalty. The addition of the higher value white wheat variety into the system provided a higher gross margin than both the red wheat sites. The use of white grazing wheat has been limited to basalt soils in the PPS member region to date; PPS members plan to use it in areas of lower rainfall and shallower soils in 2021 to ascertain its suitability in tougher conditions.

4.1.3 Clover

Demo Site 1; Jallukar Park

Location: Jallukar Park at Rhymney **Site Hosts:** Brady Family

Background

The use of Arrowleaf clover sown alone or with other clovers has become a feature of management systems in the lighter soils of the Ararat/Stawell regions and PPS included a pasture in the 2019 demonstration.

Trial Inputs and Design

The pasture was an old stand with a mix of Sub, Balansa and Arrowleaf clovers, unfortunately the Arrowleaf was not as dominant as in previous years which reduced the dry matter production to around 4,500 kg DM/ha. A self-sown paddock of oats on the same farm was used as a comparison site.

Feed test results were taken to assess the value of the high quality feed when used in lamb weaning management.

Dry Matter Production

The dry matter production for both site are shown in Fig. 39.

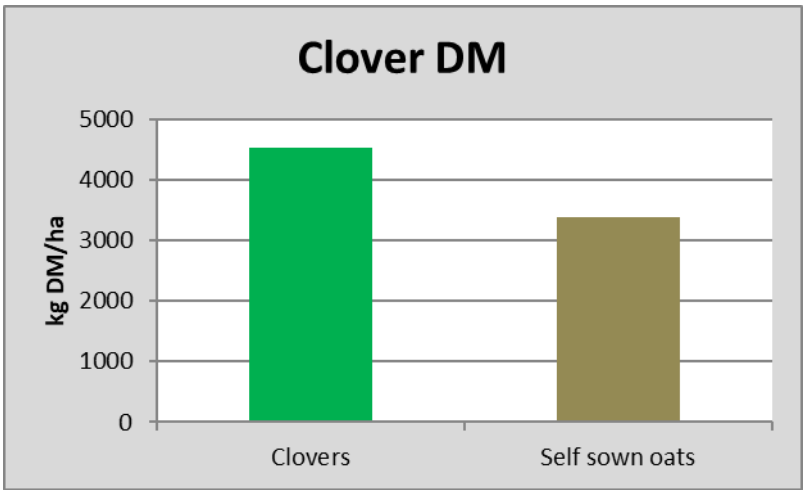

Fig. 39; Clover dry matter results

Both sites had dry matter production below the rest of the farm, the self sown oats paddock is being prepared for a perennial pasture establishment in 2020. The dry October experienced in the region limited spring clover production.

Feed quality

A feed test result taken in spring showed that the pasture was of high quality and would easily meet the requirements of weaned lambs.

Table 29. Feed quality results for clover pasture 1st October

JALLUKAR PARK CLOVER	October Results
Crude Protein (% of DM)	30.7
Neutral Detergent Fibre (NDF) (% of DM)	27.3
Digestibility (DMD) (% of DM)	84.0
Est. Energy (MJ/kg DM)	12.8

Fig 40; Jallukar Park clover October 1st 2019

Conclusion

Although the clover pasture did not yield as much as expected it provided valuable feed for young sheep during winter and early spring. Grazfeed calculated on this pasture that weaner ewes at 30 kg could grow at 289 g/day and their feed intake would be at 100% and not limited by quality. In comparison, Grazfeed estimated that weaner ewes on the oats pasture with no clover and a likely digestibility of 70% in October would gain 159 g/day. On clover, the weaner stock eating 1.5 kg DM/ha with a wastage of 30% and leaving behind 800 kg, could give 2,056 grazing days/ha. Whilst the oats could potentially support 1,433 DSE grazing days or about 3.9 DSE/ha less than the clover pasture.

5 Discussion

5.1.1 Effect of using annuals in a perennial system

PPS members have been integrating high production annual forages into their pasture systems progressively since 2007 but the consecutive dry years of 2014 and 2015 brought about a large change in management and the value of having high production annuals in the pasture system became apparent. The establishment of short lived ryegrass and grazing cereals increased on many farms and became part of the total management system. This is reflected in the annual PPS pasture establishment survey where the large increase in the percentage of ryegrass sown can be seen from 2016 to 2019. There was also a large increase in the area of grazing cereals established annually but, unfortunately, PPS did not include them in the pasture survey until 2018. Fig. 41 shows the increase in ryegrass establishment.

Fig. 41; Phalaris pasture set up for lambing at Overdale; Concongella

Figure 41 shows an example of a perennial pasture which was able to be saved for a lambing paddock as the farm had grazing cereals added to the pasture system to provide winter feed.

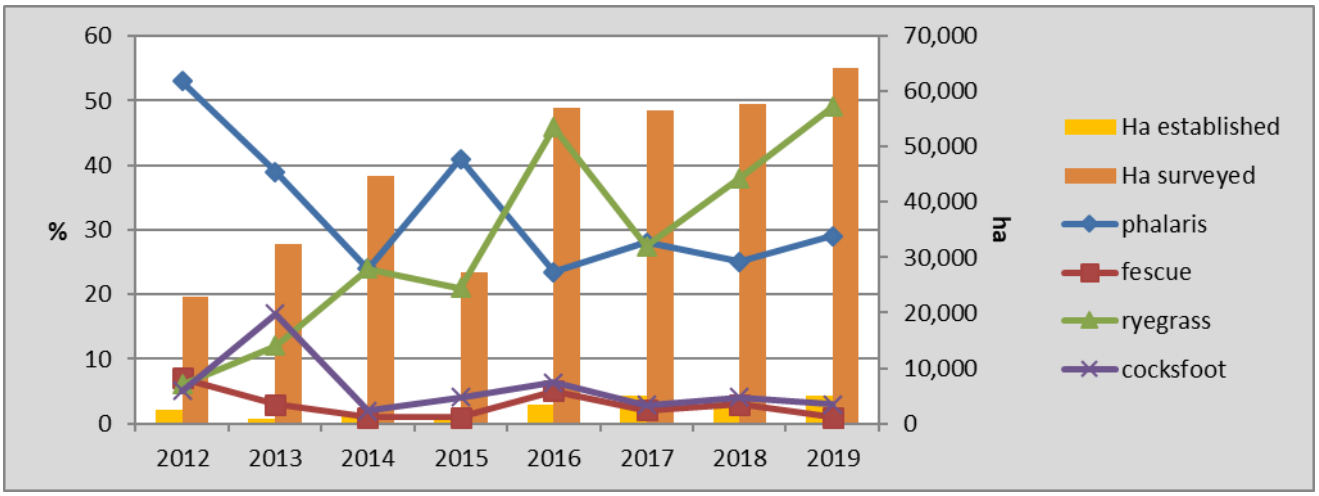

Fig. 42; Hectares in survey & percentage of grass varieties sown from 2012 to 2019.
Ref PPS Annual Pasture Establishment Survey

Case Study; Quamby: Dobie
Charlie & Rich de Fegely aim to have 20% of the farm devoted to quick growing annual or short term pastures for their system to turn off 8,000 lambs annually. Pure legume stands and grazing barley are also part of the mix, although annual grasses have mostly taken the place of grazing cereals in their system. Having 100% of the farm in phalaris would expose them to risk, with nowhere to put stock in the case of a phalaris staggers issue. Some paddocks with phalaris would be grazed at sensitive times instead of being spelled, which would threaten their persistence. It would also reduce their opportunity to take advantage of out of season rainfall events.

The short term pastures consist of grazing barley and annual or bi-annual ryegrass, these are combined with Arrowleaf and Antas clover pastures to allow a weaned lamb rotation at high stocking rates which aims to have weight gains of 100 grams/day. The 14 day rotation has mob sizes of up to 75 DSE/ha on the individual paddocks and 11.5 DSE/ha on the whole area in the rotation. The pastures need to be quick growing throughout spring to have enough quality feed ahead of the rotating mob of lambs to ensure maximum production.

While the short term grasses and pure clover stands are maximising weaned lamb production, the phalaris based pastures are in recovery phase after lambing and lactation with managed grazing ensuring their long term persistence, which are a feature of the Quamby system. They are also producing sufficient dry matter to carry ewes over summer and autumn before lucerne pastures are used to flush the ewes before joining.

5.1.2 Annual/short lived ryegrass

Ryegrass has a problematic history in the Upper Wimmera and Upper Hopkins catchment region of Victoria. Perennial ryegrass cultivars do not persist well if there are a series of hot, dry summers and the endemic annual cultivar, Wimmera, is prolific but does not survive under continued grazing; it is also a problem weed in cropping situations.

Newer cultivars of annual and biannual ryegrass are proving to be very productive and suitable for short term, high production pastures and are now part of the grazing system on many PPS member farms.
The shorter the pasture life the bigger the annual gains have to be in that year to account for the establishment costs. This makes the strategy of sowing annuals or short rotation ryegrasses relatively risky. Being able to reduce establishment costs, without comprising feed production helps increase likely returns. The producers undertaking the demonstrations have done this by trying to buy cheaper seed, either via purchasing farmer traded seed or cheaper priced older cultivars. In the good 2019 rainfall environment, being able to sow high rates of cheaper seed, early in the autumn seems to be a successful strategy in lifting winter production. However, note that not all the demonstrations were successful which reflects the potential high risk of sowing annuals or short term rotation ryegrasses.

Risks of not growing enough feed can be reduced by sowing in autumn provided weeds have been controlled in the previous year, the use of nitrogen to promote additional growth and the pasture not being constrained by nutrients or acidity.

Many farms are now sowing annual ryegrass prior to the autumn break into paddocks which have had weed control measures implemented in the year prior. The 2019, PPS pasture survey asked members for the area dry sown and it amounted to 48% of the total surveyed area (5,013 ha) which had pasture or grazing cereals established.

Case study; Paradoo; Pigeon Ponds
Ryegrass has performed exceptionally at Paradoo and has played a major role in successful grazing rotation during the intensive lambing regime carried out by Tim and Georgie Leeming.

Paddocks with gullies are used for three periods of lambing with breaks in between to allow for pasture recovery. This means that a large feed wedge is required for maximum production when the ewes and lambs come out of the lambing paddocks. The ryegrass pastures make a large contribution to the lambing system management.
In 2018, Tim grazed the Tetila ryegrass until November with ewes and lambs and had thought it had finished, but late rain rebooted it and Tim allowed it to set seed. From mid to end of January, once seed had dropped on the ground, he ate off the dry grass and this allowed the sub clover to come through in 2019.

Tim has always favoured perennial ryegrass but with sowing annual ryegrass at a high rate and with it capable of producing 12 t DM/ha, and managing it so that sowing only need occur every 2 or 3 years, the numbers stack up and it becomes an economic option. As a result of this, Tim is sowing more annual ryegrass. In 2019, he used an annual (Prine) which he hopes will have better seedling recruitment capability.

Fig. 43; yearling cattle on Tetila ryegrass at Paradoo, October 2019

5.1.3 Annual Ryegrass; seed rate comparison

PPS added a ryegrass seed rate comparison to the demonstration; Some PPS members have been using higher than recommended rates of seed when establishing annual ryegrass pastures. Higher rates of fertiliser were used with the higher rates of seed in some of the demonstrations.

A research paper (Harmer, Sewell & Salmon 2012) found that higher ryegrass sowing rates increased yield in 2003, 2009 and 2010 trials at Ballarat. PPS aimed to demonstrate the effect of higher inputs in the drier areas that covered the project area. It should be noted that the PPS project was a demonstration only and that dry matter measurements were taken from a small number of pasture cages.

The higher seed rates (27 – 32 kg/ha) were demonstrated against the more commonly used rates (14 – 16 kg/ha) at Mokepilly South (2017 – 2019), Paradoo (2019) and Aramis (2019).

Harmer, Sewell & Salmon found that the higher seed rates increased early season growth but the growth rate converged later on, presumably due to complimentary tillering at the lower seed rates. PPS noted the same effect in three out of the four sites in the demonstration.

The winter dry matter (DM) results are shown in Fig. 16 and show large gains at Aramis in 2019, where the season was ideal for almost unrestricted ryegrass growth. Interestingly the DM result was reversed during late winter and spring when the lower seed rate measurements outperformed the higher rate and ended up producing a higher DM overall; see Fig. 16.

The Paradoo site also had favourable conditions but did not match the exceptional result at Aramis.
Mokepilly South has only been under the host farmers' management for a few years and has an acidic sandy loam soil type with low fertility. The pasture program is part of the overall farm improvement with extra inputs addressing soil nutrient constraints.

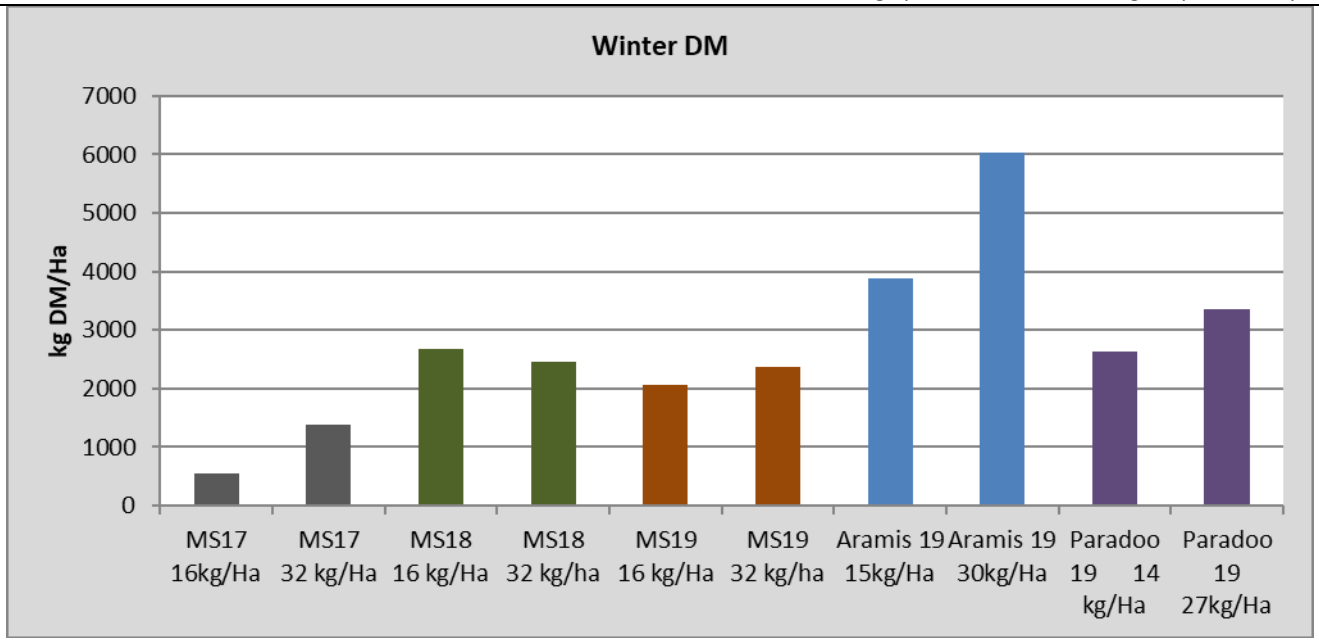

Fig. 44; Winter dry matter comparison for 2017 – 2019

The dry matter differential for the double rate against the recommended seed rate for the whole growing season at each site is shown in Fig. 45.

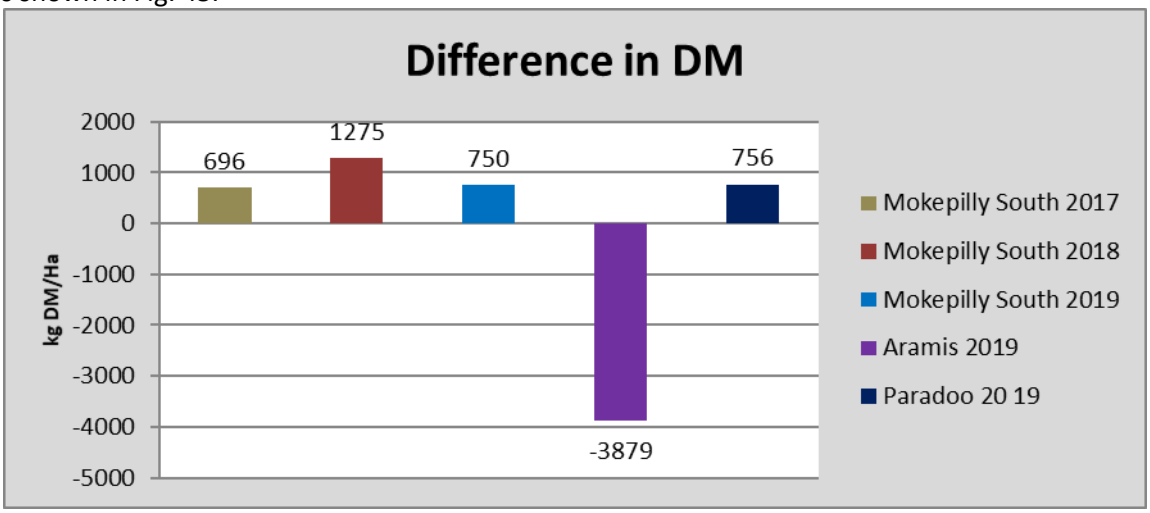

Fig. 45; Dry matter increase/decrease for high seed rates at Paradoo, Aramis and Mokepilly South.

The 2018 analysis estimated that the breakeven DM production for the high seed rate in the demonstration would need to be about 1.0 t DM/ha. Only one of the sites in the demonstration achieved this. The results from the research trials (Harmer, Sewell & Salmon) and the PPS demonstration suggest that the best results from using higher seed and input rates are achieved in high fertility soils. Soil constraints need to be addressed before there is likely to be a reliable response to the higher inputs.

Aramis site host, Mark Jarvis, remarked, “I think that we are better off making sure that we get weed control, fertiliser and management right rate rather than increasing seed rates.”

5.1.4 Grazing Cereals

The adoption of grazing cereals in the pasture system has been increasing partly due to cultivars such as Moby barley which produce large amounts of “early” feed. This allows producers to maximise the autumn growth of perennial pastures through deferred grazing by utilising containment areas and quick growing cereals. This allows the perennials to be prepared for lambing pastures to provide optimum nutrition for lambing ewes.

Another factor in the adoption of grazing cereals is a change of emphasis from getting the best grain yields possible when grazing cereals to getting maximum sheep production. This reflects the current market conditions with high sheep meat prices. Many PPS members now use their grazing cereals as sheep or cattle feed crops rather than grain crops and regard grain or hay production as a bonus rather than a priority.

The PPS pasture establishment survey showed that grazing cereals made up 2.34% (2018) and 3.1% (2019) of the total farm area of PPS members who responded. The demonstration showed that Moby Barley appears to be a variety well suited to the conditions in the Southern Wimmera but did not perform well in the wetter, colder region in the south west (Paradoo site).

The gross margins for grazing cereals showed the positive financial results that can be gained by combining grazing and hay and or grain production in successful crops. They also show reduced profit or even losses when late establishment, wet conditions or drought affect crop growth. Graph 46 shows the comparative gross margin results for the grazing cereal sites.

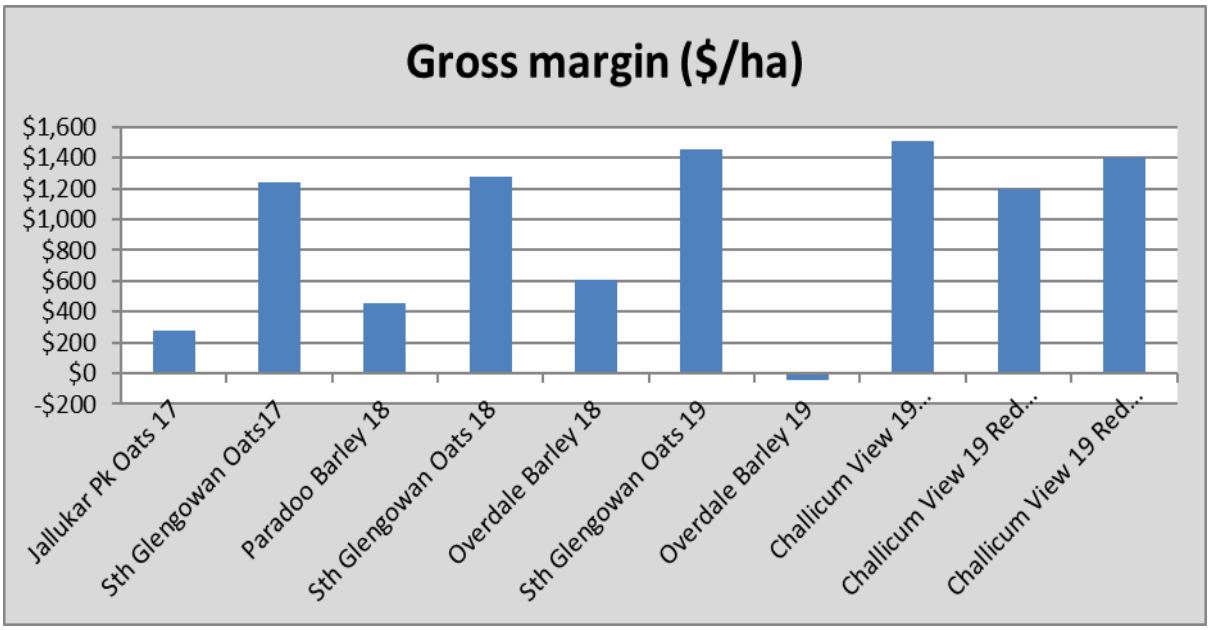

Fig. 46; Gross margins for grazing cereal sites

The demonstration also highlighted that there are many non-tangible benefits of having high producing annual forages in the system and that winter production is not the only benefit. For example Moby barley and other cereals have more chemical annual grass control options than grazing oats; this may be important if the annual forage crop is used as part of the preparation for future pasture establishment.

The good rainfall year of 2017 enabled good early dry matter production of the grazing oats demonstration. In a good year, the extra feed may not be needed but it provides opportunity to rest phalaris paddocks or sow down other paddocks. In a year with a late break, the oats will provide a valuable source of feed reducing supplementary feeding costs. Importantly it will also provide a source of feed (albeit reduced) in a failed spring that can be utilised without the concerns of impacting on its persistence which exist in a permanent pasture.

Figure 47 shows the selection of grazing cereals sown in 2019 by PPS members who participated in the annual pasture survey, with most sowing either barley or oats.

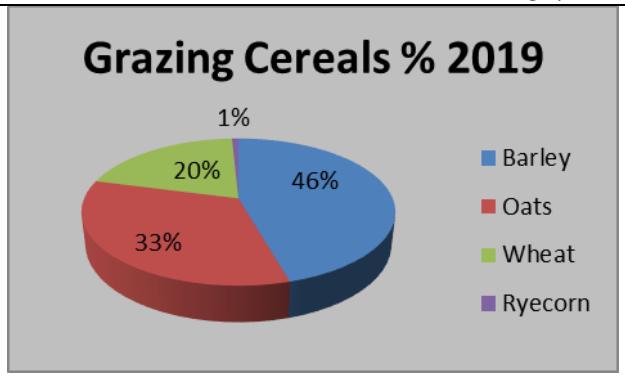

Fig. 47; Grazing cereal selection 2019

Case study; Paradoo; Pigeon Ponds

The barley was not successful in 2018 and Tim Leeming expressed his disappointment with it in his conditions; this was the first time he had grown it. As he explained at a farmer group visit "I saw it going really well at Goroke; I forgot that this isn't Goroke; we get too wet and cold for it to be suited here." Barley is also sensitive to low pH conditions; this may have been a factor in this result.
Tim thought if the upcoming season looked dire, then he might go for Moby barley as the drier conditions would suit. With a crop like barley you can use herbicide manipulation, take out all the weeds and take it to grain. Tim has most of the farm in Holdfast GT but he doesn't want all the farm in it. He wants some flexibility to make use of rainfall. For example if he gets three inches of summer rainfall, he might sow sorghum or brassicas in a couple of paddocks for summer feed.

The result at Paradoo reinforced the message of getting the right plant in the right place from the EverGraze project, with regards to the suitability of Moby barley in paddocks prone to waterlogging. The Paradoo site also showed the importance of good planning and being ready to sow as soon as the autumn rains come or dry sow prior to the autumn break.

Fig. 48; The PPS project manager made his mark in the Moby barley paddock at Paradoo; showing the wet conditions that did not suit the variety.

Case Study; South Glengowan, Joel Joel

Oats were sown for three years in a paddock at South Glengowan at Joel Joel, 23 km east of Stawell which has an annual rainfall of 470 mm. The area consistently suffers from "bob tail" springs when below average rainfall limits spring plant growth; these conditions occurred during the demonstration. Despite this, the oats provided sufficient growth after grazing to allow for hay to be produced and in 2017, part of the paddock to be harvested for grain.
The 2018 & 2019 results showed a gross margin of greater than $1,100/ha. The use of a rundown pasture paddock as a control each year showed the financial gains that can be made by the use of grazing cereals in the pasture/crop systems that are in place in the region.

The final year of the demonstration had a biannual ryegrass added which will provide feed as the paddock returns to a pasture phase in 2021.

5.1.5 Clover

Clover

The use of Arrowleaf clover as a standalone variety has increased in the region in recent years. This is shown in the graph below from the PPS annual pasture survey (recording of Arrowleaf separately commenced in 2016).

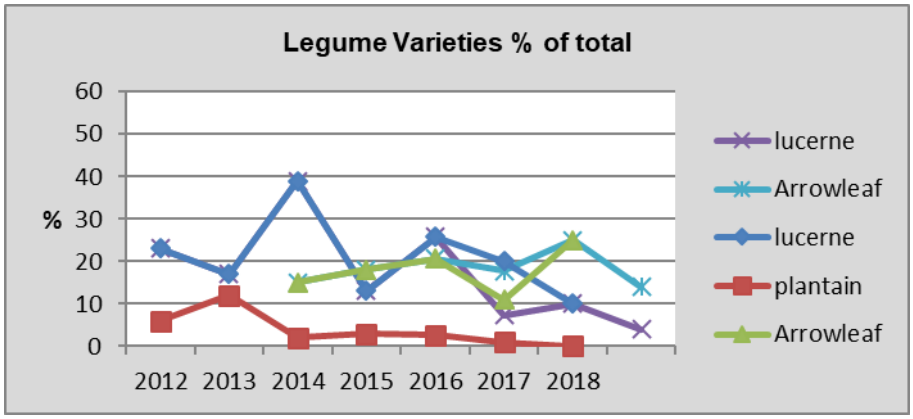

Fig. 49; PPS Annual pasture survey - legume variety selection

Although it was not part of the project, the use of Arrowleaf clover has been successfully demonstrated on PPS member farms. It has been widely adopted by PPS members and now forms an important part of the pasture systems on many farms. Arrowleaf growth pictures from 2017 are shown in Figs. 50 and 51.

Fig. 50; Arrowleaf Clover; Tirranna, Mt Cole Creek

Fig. 51; Arrowleaf clover; Jallukar Park, Rhymney

Conclusions

Given the high weight gains achievable on pure clover paddocks, they are a useful fodder option in the farming system but they do require extra attention to care. At least 70% groundcover needs to be maintained over summer to prevent erosion but enough litter must be removed to enable hard seeds to be broken down for successful autumn regeneration.

An additional benefit of the clover pasture would be that it could provide 56 kg nitrogen/ha based on an older clover stand fixing 12.5 kg N per tonne of dry matter. A clover alone paddock poses some environmental considerations as the species sown were all annuals and likely to leave the paddock bare over summer.

5.1.6 Seasons; timing of autumn break

Dry sowing

Anecdotally, the sowing of high production annuals prior to the autumn break has been increasing since the dry years of 2014/15. PPS included a question on dry sowing in the 2019 Annual Pasture Survey and the results showed that 48% of the 5,013 ha of new pastures established were dry sown. The dry sown pastures were, in most cases, annual ryegrass of grazing cereals but a couple of phalaris pastures were also successfully established. The two key factors in successful dry sowing obtained from feedback from PPS were good weed control in the spring prior to sowing and confidence in receiving adequate rainfall after April 25th, which is the average autumn break timing in the region.

Forage choice

Forage choice can be influenced by the timing and effectiveness of the autumn break where dry sowing has not been carried out.

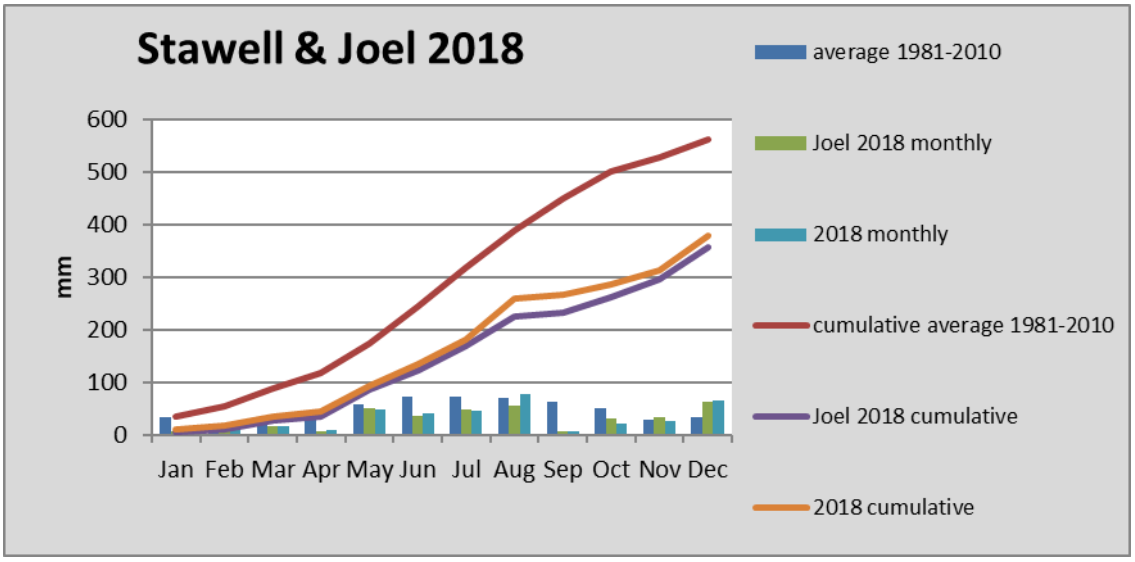

Fig. 52; Stawell & Joel Joel rainfall 2018

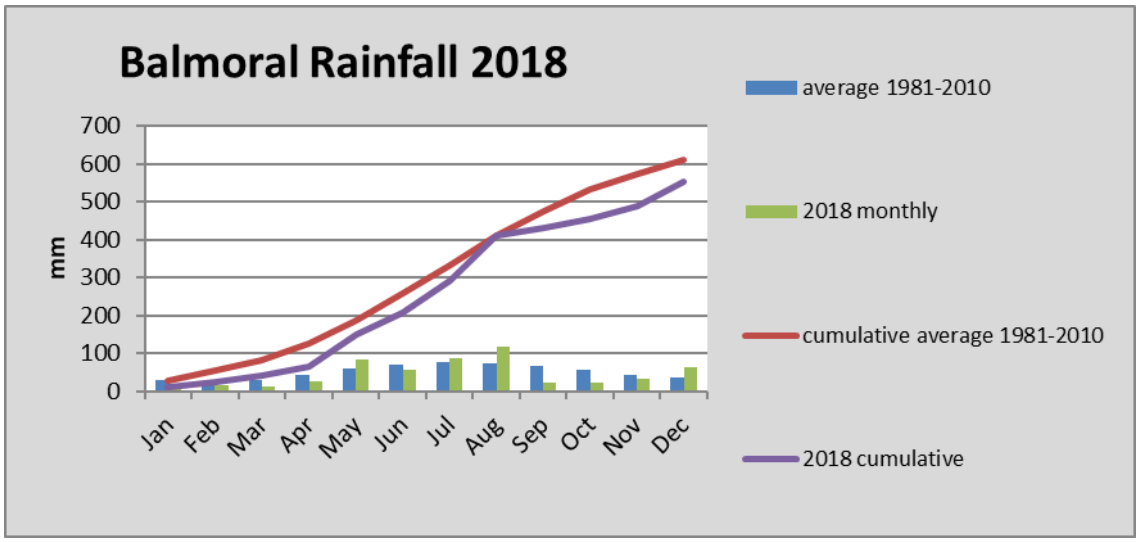

Fig. 53; Balmoral rainfall 2018

Figs. 52 and 53 are good examples of the variable autumn rainfall events in the region. The Stawell area did not get adequate rainfall until May 2018 to commence growth and did not get close to the cumulative average during the year. Balmoral, close to Pigeon Ponds & approximately 100 km to the west of Stawell, had an April autumn break and was close to average rainfall until spring.

The autumn conditions can be taken in consideration if dry sowing has not taken place and PPS members have discussed changing from an annual ryegrass establishment to a grazing cereal to produce a quicker bulk of feed if the autumn break is late.

Conversely, the Moby barley result at Pigeon Ponds suggested that in years of an early break and potential wet conditions ryegrass may be a better choice than grazing cereals due to better waterlogging tolerance.

6 Conclusions/recommendations

6.1.1 Project Objectives

Aim: To demonstrate the production, financial and grazing management benefits of including high production annual forage pastures in perennial grazing systems in low rainfall regions of Victoria.

Project objectives: By March 2020, the PPS will demonstrate the value of optimal high production annual forage in perennial grazing systems on 12 member farms and demonstrate the impact that the improved pasture production has on lamb production systems.
As a result of this project (assuming a positive outcome):

- 60 members will have or will be planning to implement a high production annual forage system on their properties and will have the skills and knowledge to do so.
- 200 people will have increased knowledge and awareness of the benefits/drawbacks of a high production annual forage pasture in this region and will have increased their skills on how to establish a high production annual forage system.

PPS believes that it has met the objectives of the project. The 2019 Annual Pasture Survey showed that 36 out of the 47 respondents established high production annuals in their grazing systems. This number can be extrapolated across the total PPS membership (>100 farm businesses) to satisfy project objective one.
PPS has met project objective number two through attendance at the PPS Annual Conference, PPS events with paddock inspections and information provided to members in annual results reports on the project.

6.1.2 Pre and post demonstration survey

PPS members were asked to rate their current knowledge of the costs and benefits of using short term forages to fill feed gaps early in the project in 2017. The survey was repeated at the end of the project in February 2020.
A rating of 0 indicated no knowledge and a rating of 10 was used to indicate that the respondent had all the knowledge required. A scale of 0 – 10 was used for the respondent to indicate where they rated their level of knowledge. The pre project average response was 6 with a range of 2 – 9, the post project response increased to an average of 7 with a range of 3 – 10.

Participants were also asked to rate their confidence in using short term annuals using a similar 0 – 10 scale with 0 being poor confidence and 10 being excellent. The pre project average response was 7 with a high of 10 and a low of 2, the post project response increased to an average of 8 with a range of 3 – 10.
The responses are shown in Fig. 54.

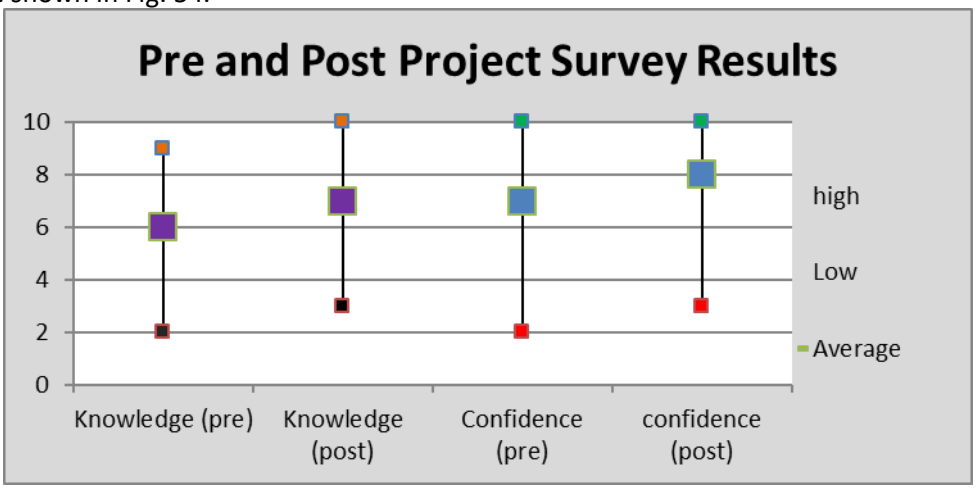

Fig. 54; Knowledge and confidence responses.

Participants also responded to a question on the percentage of their farm which is sown to annuals annually, range of responses to the question is shown in Fig. 55.

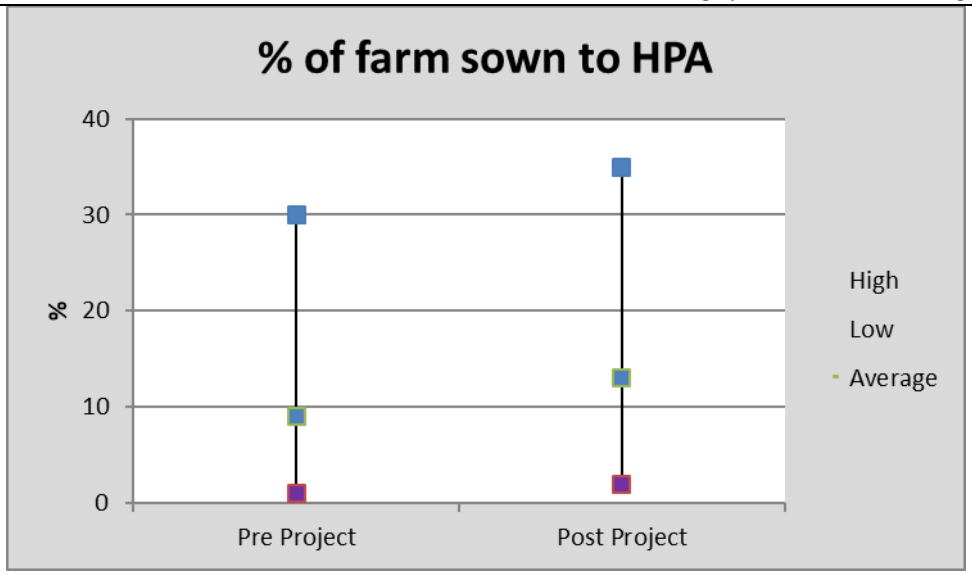

Fig. 55; Percentage of farm sown annually to high performance annuals or short lived forages.

The pre and post survey also recorded the varieties of high production annuals being established and these are shown in Fig. 56. While some changes were noted, these are likely to be seasonal rather than long term change.

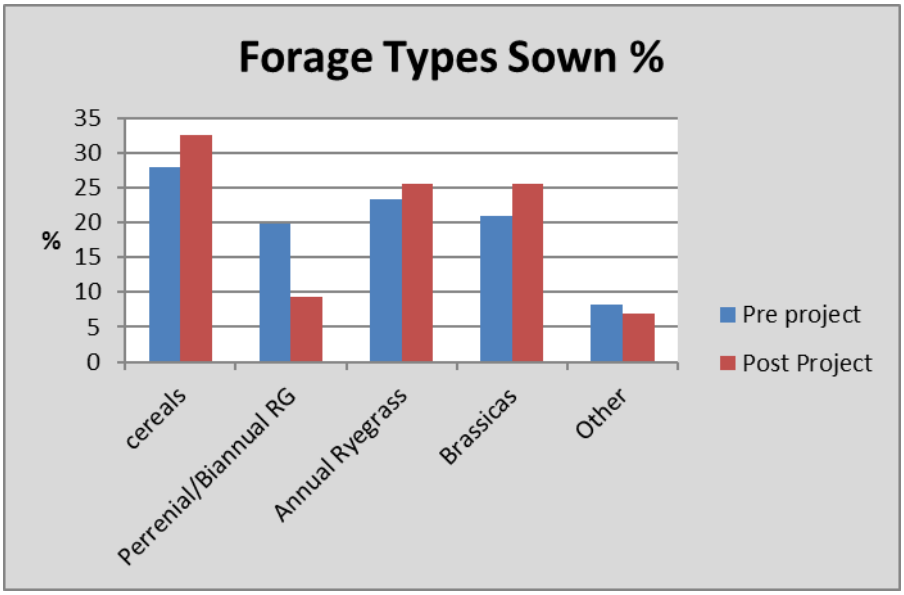

Fig. 56; Forage types established pre & post project.

The pre and post survey asked members about their normal forage establishment program and the responses showed an increase in the frequency of the use of short term pastures and also the application of additional nutrients to ensure maximum productivity.

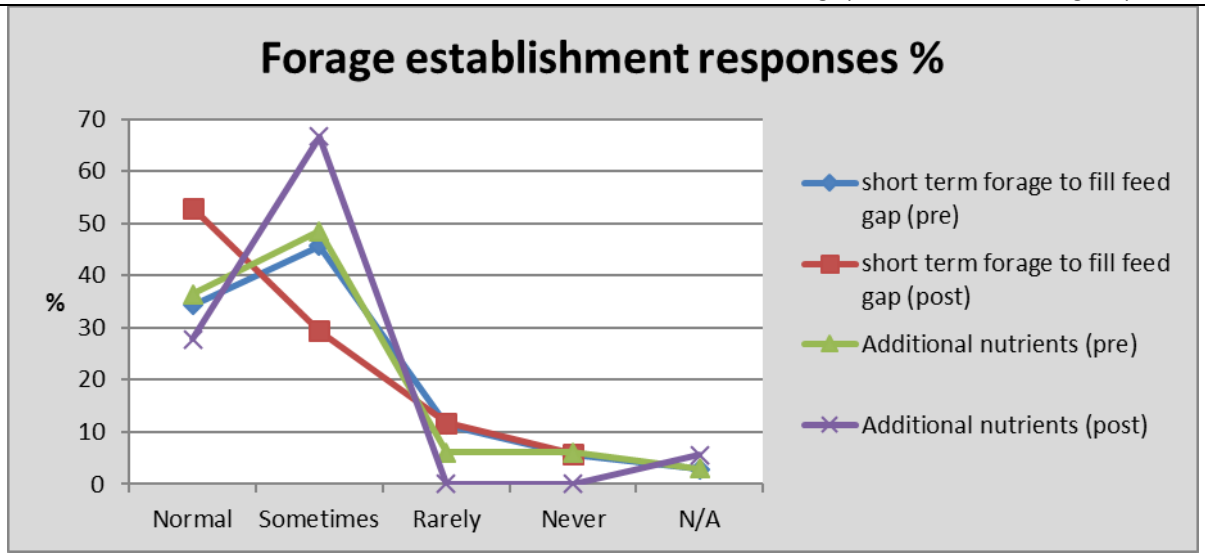

Fig. 57; Pre & post responses to questions on the use of forage pastures and nutrient application.

The survey also asked about the use of high seed rates in annual ryegrass pastures and the pre survey showed that 59% of farms used the practice as normal or sometimes. This dropped to 41% in the post survey, possibility reflecting the variable results obtained to the practice during the project.

6.1.3 Practice Change

Since 2012, PPS has been surveying members on their annual pasture establishment; this has shown changes on farm during this time. The results reflect the change in pasture systems with the recognition that the addition of high production annuals are an integral part of managing farms with the majority of the farm area sown to perennial species.

The graphs below show the increase in annual grasses and cereals since the dry years of 2014/15 after which there was an increase in quick growing feed varieties which provided fast growth after the autumn break and allowed better management of perennial varieties. Grazing cereals were not included in the survey until 2018 but anecdotally there has been a large increase since the dry years of 2014/15.

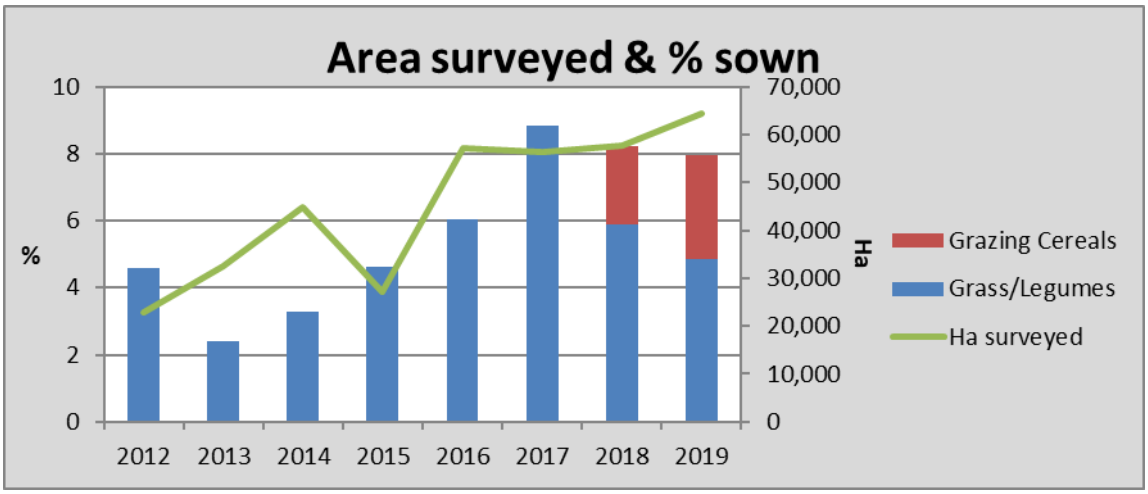

Fig. 58; PPS member pasture survey showing hectares of cereals and short lived pastures established.

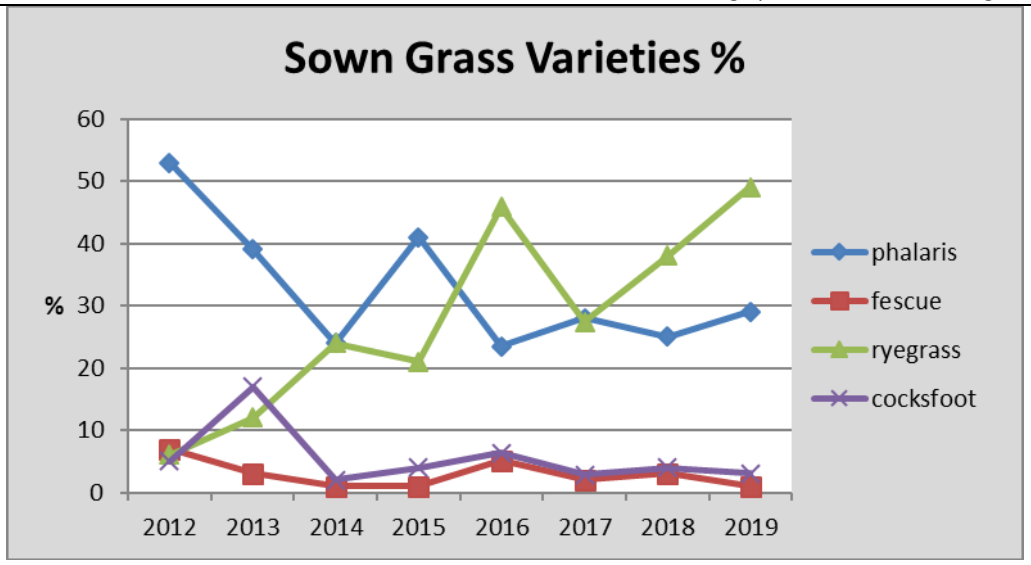

Fig. 59; Percentage of grass varieties established in PPS survey

The grass establishment results show an increase in short term (annual & biannual) ryegrass and a decline in the percentage of phalaris establishment. The need to fill short term feed gaps explains the ryegrass increase while the decline in phalaris can be attributed to the success of PPS members management of these pastures by increasing their persistence and therefore requiring less resowing.

6.1.4 Annual and Short Lived Pastures Conclusions and Recommendations

General

- Having annual forages in the grazing system provides extra dry matter in mid to late winter above that of annual or rundown pastures.

- Annual forages are generally unable to fill a feed deficit during early winter with the exception of early autumn breaks because the forage needs time to establish. However a biannual or short rotation ryegrass or spring sown cereal/brassica , if managed for persistence, could fill an early winter gap. This was not explored in this project but is a concept worth further investigation.

- Annual forages also provide valuable backup spring feed in the event of a failed spring and allows producers to rest perennial pastures to increase growth and improve persistence.

- The PPS demonstration suggest that the best results from using higher seed and input rates are achieved in high fertility soils. Soil constraints need to be addressed before there is likely to be a reliable response to the higher inputs.

- Annuals with lower costs of production per tonne of dry matter produced are more likely to be profitable provided the essential ingredients of weed control and fertility are provided.

- Cereals allow grazing and opportunistic grain or hay production in good years which can produce high gross margin (GM) results. Lower or even negative GM can result from grazing only but the GM does not take into account other benefits on farm such as saving perennial pastures for lambing ewes.

- Grazing cereals showed gross margins in excess of $1,000/ha where early establishment, good growing conditions and a grain or hay harvest after grazing was possible.

Forage selection

- The 2018 ryegrass and grazing cereal results at Paradoo reinforced the message of getting the right plant in the right place from the EverGraze project.
- When grazing cereals, prioritising livestock grazing over grain and/or hay production in years of high stock prices may be financially beneficial in mixed farm enterprises.
- Specialist grazing Barley appears to be a variety well suited to the conditions in the Southern Wimmera.
- Specialist grazing wheats appear well suited to the basalt soils of the Upper Hopkins catchment.
- Grazing white wheat provides an opportunity for winter stock feed as well as a grain harvest of higher value than red wheats.
- Grazing white wheats need further demonstration on drier, shallower soil types to assess their suitability in a wider part of the region.
- Specialist grazing cereals have more chemical annual grass control options than grazing oats; this may be important if the annual forage crop is used as part of the preparation for future pasture establishment.
- Specialist grazing barley is sensitive to aluminium toxicity, therefore a soil pH greater than 4.8 ($CaCl_2$) is recommended for barley.
- More research is required by the grazing industry on animal production gains on different varieties of high production annual forage pastures.

Forage Management

- Year three results reinforce the importance of good planning and being ready to sow as soon as the autumn rains come or dry sow in the case of grazing cereals and annual ryegrass.
- The rate of dry sowing is increasing and the 2019 PPS Annual Pasture survey showed that 48% of the 5,013 ha of pasture and grazing cereal establishment were sown before the autumn break.
- The two key factors in successful dry sowing obtained from feedback from PPS are good weed control in the spring prior to sowing and confidence in receiving adequate rainfall after April 25th, which is the average autumn break timing in the region.
- The sowing date comparisons would suggest that to get a benefit from higher seed rates in the drier region of the Southern Wimmera pasture establishment needs to occur early in the autumn.
- Producers need to be flexible in their approach to species selection. Changing from ryegrass to a grazing cereal in response to a late autumn break may result in earlier useable winter feed and a higher rate of dry matter production.
- Splitting paddocks using hot wires allows better grazing utilisation.

7 Bibliography

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8 Acknowledgements

Host farms

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- Quamby; Dobie
- South Glengowan; Joel Joel

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