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Grazing cereal crops in a Mallee farming system

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Abstract

In 2010-2011 the Nullawil BWBL group conducted work on rotational grazing through an MLA supported Producer Demonstration Site (B.PDS.1002). The Nullawil BWBL group identified the need to improve the productivity and profitability of the Mallee prime lamb industry. This PDS also identified the need to carry out further work in the area of varietal selection and management of fodder crops to fill in the remainder of the feed gap from the senescence of the current fodder varieties in early September until the availability of the first stubble for grazing in early December.

Key to this was the requirement to better understand the role that grazing cereal grain crops may play in the Mallee system and how this could be adapted to suit their current production methods. The work carried out in this PDS has defined the precision grazing practices and provided the participating Mallee farmers with the skills and techniques to strategically graze sheep in their cereal farming systems to best advantage. During the PDS several issues were identified as deserving of further investigation.

These include:

• The need to identify more suitable species of fodder crops to effectively fill the remainder of the feed gap currently being experienced in the Mallee system from September until the availability of the first stubble for grazing, usually in early December

• The need to develop a value chain system to more effectively market the lambs produced

• The need to better understand the maternal and paternal contributions to growth and carcase quality

• The need to further refine and enhance grazing systems for the Mallee environment.

The Nullawil BWBL group has refined and enhanced the precision management of sheep under rotational grazing with solar powered electric fencing. Utilising both existing and new and emerging varieties of cereal, grain legume and forage crops and examined the use of precision sheep management utilising both Pedigree Matchmaker (PMM) and Walk Over Weighing (WOW).

Executive summary

The Nullawil Producer Demonstration Site was set up to investigate the potential to refine and improve systems and practices developed in the B.PDS.1002 to enhance prime lamb production in Mallee farming systems. The Objectives of the PDS were to;

• To refine and enhance the rotational grazing practices developed in stage one of the PDS (1002) to better manage the nutritional requirements of prime lambs and their dams and increase production (kg/ha) of meat produced from 770kg/ha to 850kg/ha in the rotational grazing system.

• To determine the suitability of other fodder varieties for Mallee grain farming systems to fill the identified feed gap from September until the availability of the first stubble for grazing (December).

• To quantify the financial implications of rotational grazing cereal crops and specialist fodder crops in a Mallee farming system and determine the cost of production of a kilogram of meat per hectare in these systems and compare these costs with previous practices.

• To investigate grazing management practices which decrease the turn off times and increase growth rate from 230g/h/d to 350/g/h/d of lamb produced in Mallee farming systems.

• To investigate the role of walk over weighing (WOW) and pedigree matchmaker (PMM) systems in an extensive environment to identify underperforming animals and their parents.

• To investigate the benefit-cost of the systems and the relative payback period for these systems.

The key works undertaken to achieve these objectives are outlined in the methodology and include;

The Nullawil Grazing Cereal Crops in a Mallee Farming System - 2 PDS commenced in April of 2012 with the sowing of the 5 PDS blocks. At site 1, 40 hectares of Moby barley was sown along with 12 ha of Jivet Ryegrass and 40 ha of a Subzero Brassica and Perun Festulolium (Fescue, Ryegrass hybrid) mix. At site 2, 40 ha of Moby barley were sown.

Below average rainfall (36 mm, BOM; median rainfall=76 mm, BOM) during the establishment phase of the crops was an impediment to the commencement of grazing, with site 1 being grazed too early in the establishment phase before the plants had an opportunity to establish strong roots resulting in 50% of the young plants being pulled out. Grazing and walkover weighing and Pedigree Matchmaker recording commenced on the 18th of May 2012.

The paddocks were divided into four equal sized blocks of 10 ha for the Moby barley on both sites one and two and the Jivet Ryegrass and Subzero Perun mix were each divided into three equal sized blocks.

In 2013 a similar area was sown again on site 2 but a new property was chosen to replace site one. On site one 12 ha of Outback oats was sown along with one block of 12 ha of Moby barley and a second block of 40 ha of Moby barley. On site two 40 ha of Moby barley was sown with along with 40 ha of Subzero Brassica. The commencement of grazing was again impeded by below average rainfall in the establishment phase (38 mm, BOM) but reasonable rain (49mm) fell at the end of June 2013.

The PDS to date has delivered a significant shift in the thinking of the group, with many now looking to adopt rotational grazing utilising new varieties of fodder and electric fencing, and individual animal measurement to manage their livestock in a more efficient manner.

The walkover weighing system along with Pedigree Matchmaker is also creating a great deal of interest. The group is keen to continue with the concept of group marketing of lambs direct to the processor after observing this as part of the PDS but it is essential that meaningful processor feedback on individual lamb carcasses is provided to ensure the success of this concept. The

processors have commented that they would have no difficulty in accepting delivery of lambs produced in the rotational system as they were very even and met the target specifications provided to the group.

In both years of the PDS the ewes and lambs being run on the PDS paddocks were tagged with Radio Frequency Identification Tags (RFID) and body weighed and condition scored (CS) upon entry. Walkover weighing (WOW) and pedigree matchmaker (PMM) was carried out during their stay in the paddock to monitor pedigree and body weight changes.

The inclusion of WOW and PMM in the project demonstrated the value of these technologies to the participants and provided an insight into the use of emerging technologies within the Mallee farming systems. This increased knowledge and understanding of the potential use of innovation in the production of prime lambs to meet market specifications. WOW and PMM were accomplished using water points and lick blocks as attractants to entice the animals through the walkover scales.

Pasture cages were placed in several locations throughout the PDS blocks to monitor the effect of any preferential grazing which might occur. An assessment of remaining FOO (Feed On Offer) was taken when sheep were moved from the paddock. At various stages of plant growth additional pasture cages were positioned in the paddock to monitor the FOO in response to grazing.

This PDS refined the processes developed in B. PDS 1002 in use of solar powered electric fencing to strategically manage prime lamb production in Mallee farming systems where infrastructure such as fencing has been removed to facilitate cropping. It also identified and evaluated species of cereal grain crops with the potential to graze to fill winter feed gaps in the Mallee and thus produce prime lambs to specification in a minimum time by utilising the available dry matter in a more efficient manner. The PDS introduced the producers of the Mallee to the concept of precision sheep management using RFID to monitor and manage prime lamb production.

The Nullawil Rotational Grazing Cereal Crops in a Mallee Farming System 2 PDS assisted to refine the processes developed in B. PDS. 1002 and provided Mallee lamb producers with a viable alternative to current grazing practices which enables the more efficient management of both sheep and fodder to finish lambs to market specifications. The PDS has also introduced producers to the concepts of value chain systems, sheep meat marketing and precision sheep management.

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SEED DISTRIBUTORS 14 -16 Hakkinen Road Wingfield, SA 5013

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BCG Grain&Graze Birchip Cropping Group PO Box 85, Birchip, Victoria, 3483

The Best Wool Best Lamb Network DEPI Victoria

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1 Background

Best Wool Best Lamb (BWBL) is a producer driven network that comprises of 58 producer groups totalling over 1200 group members and over 1185 associate members. BWBL is recognised as a forum which has had great success in achieving on-farm practice change among sheep producers. The Nullawil BWBL group had identified the need to improve the productivity and profitability in the Mallee prime lamb industry. Key to this is the requirement to better understand the role that grazing cereal grain crops could play in the Mallee system and how this could be adapted to suit their current production methods.

The inability of Mallee producers to sow perennial pastures due to the low and variable rainfall is a key limiting factor to the reliable production of quality prime lambs to meet market specifications. The need to develop and better understand the potential and possibilities of grazing cereal crops and newer varieties of forage is vital to the growth and profitability of the prime lamb industry in the Mallee, and indeed all grain growing regions of Australia.

In the Mallee, as with most grain producing areas in Australia, the removal of infrastructure such as fences severely impacts on the precision management of both breeding ewes and the timely finishing of prime lambs.

The Nullawil BWBL group believes that under a rotational grazing regime using electric fences this may be rectified delivering a viable method of precision grazing to the Mallee farming systems.

The Nullawil BWBL group proposed investigating the precision management of sheep under rotational grazing utilising both existing and new and emerging varieties of cereal, grain legume and forage crops.

It should also be noted that input on PDS design and monitoring was provided by DPI agronomy staff involved in Grain and Graze 2 and information from this project may be included in G&G 2 reports.

Animal Ethics approval was sought from the DPI animal ethics committee and approval gained prior to the handling and monitoring of all animals in the PDS.

2 Project objectives

The key objectives of this PDS were;

• To refine and enhance the rotational grazing practices developed in stage one of the PDS to better manage the nutritional requirements of prime lambs and their dams and increase production (kg/ha) of meat produced from 770kg/ha to 850kg/ha in the rotational grazing system.

• To determine the suitability of other fodder varieties for Mallee grain farming systems to fill the identified feed gap from September until the availability of the first stubble for grazing (December).

• To quantify the financial implications of rotational grazing cereal crops and specialist fodder crops in a Mallee farming system and determine the cost of production of a kilogram of meat per hectare in these systems and compare these costs with previous practices.

• To investigate grazing management practices which decrease the turn off times and increase growth rate from 230g/h/d to 350/g/h/d of lamb produced in Mallee farming systems.

• To investigate the role of walk over weighing (WOW) and pedigree matchmaker (PMM) systems in an extensive environment to identify underperforming animals and their parents.

• To investigate the benefit-cost of the systems and the relative payback period for these systems.

3 Methodology

In both 2012 and 2013 two forty hectare paddocks of Moby barley were sown using conventional farming processes. These crops were sown by April 10th. The traditional sowing of the cereal grain varieties was completed by June 1st.

The Moby paddocks were subdivided into four equally sized blocks using solar powered electric fences and rotationally grazed throughout the PDS, fencing was completed be mid June 2012.

Upon the completion of sowing of the traditional cereal varieties, the group then sowed several other varieties for evaluation of their potential to fill the remaining feed gap.

The varieties which were sown include;

On site 1 12 ha of Sub Zero Brassica and Perun (fescue-ryegrass hybrid) mix sown along with 28 ha of Sub Zero Brassica with a small amount of Moby barley to encourage consumption.

On site 2 11 ha of Sub Zero Perun mix along with 11ha of Sub Zero Jivet Ryegrass mix.

The actual areas and varieties sown by the remainder of the group included a total area of 206 ha in the PDS:

• Sub Zero Brassica 12 ha

• Superoo Oats 12ha

• Perun Festulolium (Ryegrass) 12 ha

• Jivet Tetrapliod Ryegrass 20 ha

• Vetch 40 ha

• Moby Barley 110 ha

The sheep involved in the PDS were fitted with Electronic Identification tags (EID) prior to entering the PDS site.

The sheep being run on the PDS paddocks were body weighed upon entry and WOW and PMM was carried out during their stay in the paddock to monitor body weight changes and identify the pedigree of lambs. Lambs were moved from the block as the available fodder reached a height of 75mm, usually around 7-10 days of grazing each block. An assessment of the remaining FOO was taken when sheep were removed from the block.

Other key work included the evaluation of paddock grazing on grain yield and the impact on financial returns this practice may have.

The Nullawil BWBL group also carried out work on 5 other member properties, evaluating new varieties of forage, cereal grain, grain legumes and new varieties of Italian rye mentioned above. This work was carried out in conjunction with the central site and consisted of PDSs of monoculture plantings in small paddocks to simulate paddock grazing.

The group decided to utilise the measurements of Tonnes of Dry Matter production per hectare (DM/ha), carrying capacity in Dry Sheep Equivalents (DSE)/ha and kilograms of meat produced per hectare as the units of measurement to establish a benefit cost for the analysis of the grazing fodder being examined. Grain yield will not be examined as part of this work as the group has already established that the use of fodder specific varieties is preferable for finishing lambs in this environment.

In Summary;

This PDS investigated the potential to employ the use of solar powered electric fencing to strategically manage prime lamb production in Mallee farming systems where infrastructure such as fencing has been removed to facilitate cropping. It also identified and evaluated species of cereal grain and forage crops with the potential to graze and fill winter feed gaps in the Mallee and thus produce prime lambs to specification in a minimum time by utilising the available dry matter in a more efficient manner. The PDS also introduced the producers in the Mallee to the concept of precision sheep management using RFID to monitor and manage prime lamb production.

4 Results and discussion

4.1 Year one

The Nullawil Best Wool Best Lamb group commenced the Rotational Grazing Cereal Crops in a Mallee Farming System 2 PDS on April 21st 2012 when two 40 ha paddocks were sown with Moby barley at 50kg/ha of Moby barley and 45 kg/ha Mon-ammonium Phosphate (MAP) site 1, and site 2, 40 kg/ha and 50 kg/ha of single chute super

The paddocks were subdivided into four equal sized paddocks of 10ha, using solar powered electric fencing consisting of three wires, (two hot and middle earth) and the fence line was sprayed with Roundup® to ensure that no plant growth compromised the fence's effectiveness through earthing out the fence.

The low rainfall during the establishment phase (Table1 Below) of the PDS delayed the development of the root system of the Moby on site 2. The soil type (Grey Heavy Clay) impeded the root development due to the lack of rainfall. The sheep were placed on this block on June 1st without carrying out the mandatory pull test to ensure that plants would not be pulled out through grazing, resulting in about 50% of established barley plants being pulled out. This had a significant effect on the overall plant population and dry matter production from this site.

This was in contrast to site 1 where the lighter sandy loam soils allowed for better root establishment and the pull test was carried out prior to commencement of grazing on June 1st . On site 1 the dry matter production was in line with production achieved in the previous PDS - B.PDS.1002.

The Jivet ryegrass and Subzero on site one were not sown until early May at the completion of the sowing of the traditional cereal grain crops as these cultivars were to be grazed at the end of the productive phase of the Moby barley, however a light grazing was carried out in early August.

4.1.1 Rainfall 2012

During the PDS rainfall was again an issue throughout the establishment phase of the PDS. Although there was good rainfall (70.8 mm) in the beginning of March this rainfall had little impact at sowing on 21st of April (Table1 Below) with only 36mm falling during the crop establishment phase (April – June) and a further 90 mm falling through the balance of the growing season (July - September).

Table 1; Rainfall data for PDS site 2012 source BOM. The lower than average rainfall falling from April to July impacted on plant growth and production

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Rainfall mm
2012	7.2	20.6	70.8	***4.6***	**14.8**	**16.6**	**42.6**	25.0	22.8	21.6	*2.4*	*0.6*	249.6
Mean 1899-2013	22.3	24.2	23.1	23.2	36.5	34.2	35.1	35.4	35.4	35.5	28.4	23.4	358.0

4.1.2 Fodder production 2012

The dry matter (DM) production of the Moby barley was in line with results obtained in the earlier work carried out by this group with the Moby barley on site 1 producing 6.59 tonne of DM/ha. Whilst on site 2 where 50% of the established plants were pulled out through grazing too early the yield was a disappointing 1.27 tonne of DM/ha. This result highlights the need to carefully manage the introduction of sheep onto grazing cereal.

Table 2: Dry matter production Moby Barley 2012.

Site Number	Date	Ungrazed	Grazed Once	Grazed Twice	Grazed Three Times	Yield t/DM//ha
1	18/05/2012	✓				1.39
1	20/06/2012		✓			0.85
1	20/06/2012	✓				2.86
1	31/07/2012		✓			4.44
1	31/07/2012				✓	0.85
1	19/08/2012	✓				6.59
2	18/05/2012		✓			1.09
2	30/07/2012			✓		1.27
2	30/07/2012	✓				0.99

The Feedtest results for the fodder grown on site 1 were a matter of some interest (table 3) with the crude protein of the Jivet ryegrass and the early test on the Moby barley being lower nutritional value than was expected (table 3). Of further interest was the dry matter content of the Jivet Ryegrass and the Perun subzero mix, with these both being low (table 3). The later test on the Moby barley showed a marked increase in the protein content and a decrease in the moisture content, however all of the cultivars provided a reasonably good source of energy for growth with only the Jivet ryegrass having a protein lower than is desirable (16 – 17 %) for young growing lambs towards the end of its growth phase.

It is interesting to note that the decrease in protein occurred post grazing which suggests that the application of N could prove beneficial, but this would require further work to establish if there is a

benefit cost in the application of N. No feed tests were carried out on site 2 as there was insufficient FOO to warrant monitoring other than the DM/ha grown.

Table 3 Nutritional value of fodder 2012 site 1.

Variety	Number of grazing's	Date collected	Moisture %	Dry Matter %	Crude Protein	NDF	DMD %	MJ/kg DM
Moby Barley	0	23/5/2012	71.8	28.2	11.2	41.7	79.8	12.1
Moby Barley	1	29/8/2012	76.2	23.8	9.4	42.1	76.1	11.5
Moby Barley	2	29/8/2012	77.9	22.1	16.8	35.4	85.0	13.0
Moby Barley	3	29/10/2012	66.5	33.5	12.3	48.0	74.3	11.2
%Perun Subzero Mix	0	29/8/2012	86.5	13.5	24.4	18.7	92.4	14.3
Perun Subzero Mix	1	23/10/2012	72.2	27.8	14.6	42.1	75.9	11.4
Jivet Ryegrass	0	29/8/2012	88.9	11.1	26.7	41.5	81.3	12.4
Jivet Ryegrass	1	23/10/2012	67.5	32.5	5.3	39.4	80.2	12.2

Grazing ceased on the Moby barley on October 1 as the barley was shut up to strip for seed for the next season. The remaining lambs were depastured onto the Subzero Brassica to finish them off for sale but interestingly, the feed test carried out on the Moby barley on October 29th (table 3) revealed that the quality and quantity of the feed was more than adequate to complete their growth to sale. As can be seen in Figure 1, the crop still had more than adequate ground cover to support the lambs with 4.67 t/ha of DM available to graze. The Nullawil group decided to strip the paddock to recover seed for the following year which yielded 0.8 t/ha of seed.

Figure 1: Moby Barley October 29th 2012 after grazing was completed for the season 4.67 t/ha of DM remaining to graze but it was decided to strip this to recover seed which yielded 0.8t/ha .

4.1.3 Lamb Growth Rates

Grazing commenced on June 1st 2012 on site 2, but as stated earlier there was no pull test conducted on the site prior to sheep being turned out as was required, resulting in 50% of the plant population to be pulled out by the grazing sheep so it was decided to remove sheep to allow the paddock top recover from the damage.

On site 1 the paddock the pull test was carried out on the Moby barley and passed, so grazing commenced on June 1st 2012 with the introduction of 30 Dry Sheep Equivalents (DSE[1]) per hectare consisting of 400 merino ewes and 450 first X mixed sex lambs. The ewes and lambs were depastured on the site to further educate the lambs to walk through the PMM equipment prior to weaning even though they had been doing so on the farm prior to entering the PDS site.

The 450 lambs on site 1 were weaned from their dams on July 7th and returned to the PDS site for rotational grazing at a stocking rate of 17 DSE. At weaning the average body weight of the lambs was 33.46 kg with a standard deviation (SD) of 5.7kg and a coefficient of variation (CV %) of 17.46%. Assuming a birth weight of 5 kg this equates to an average growth rate through the lactation phase of 326 g/h/d. It was decided to maintain the stocking rate at 17 DSE due to the low rainfall through to the end of July which resulted in reduced pasture growth.

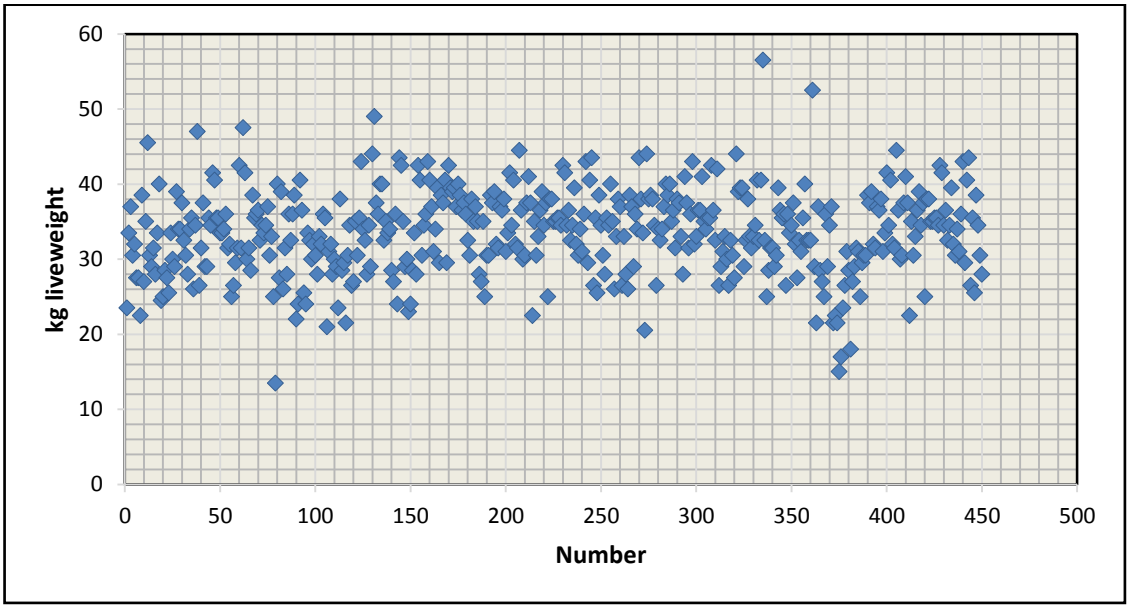

Figure 2: Weaning weight of individual lambs on site 1, 07/072012

The weaned lambs were rotationally grazed through the four paddocks and weighed using WOW and periodically weighed in a weigh crate (static weight) over a period of 53 days until the first draft of lambs was consigned to slaughter. The average growth of the lambs on site 1 over the 53 days until the first draft was 240 g/h/d. However the lambs from the first draft consigned to slaughter on the 29th of August had an average growth rate of 339 g/h/d which was 99 g/h/d better that the mob average, with some individuals growing at around 400 g/h/d. At slaughter, the average dressing percentage from the first draft of lambs from the PDS site was 47.12% with the range being +/- 5%.

[1] http://www.dpi.nsw.gov.au/agriculture/farm-business/budgets/livestock/sheep/background/dse#Table1

As previously mentioned, this PDS also looked at the use of PMM and WOW technology in the Mallee prime lamb system and recorded data on Dam Identity and progressive weights of ewes and lambs on a daily basis. The data recorded for changes in bodyweight for the growing lambs (Figure 3) was comparable to the static weights but the difficulty in data management meant that it was not utilised on all member properties.

The WOW data was not collected on all of the group member properties due to the difficult process of downloading data and filtering the data with the WOW software. It should also be remembered that the WOW data is only a guide to the mob average and does not represent an accurate description of the lamb's body weights but rather an indication of the trends in bodyweight over time.

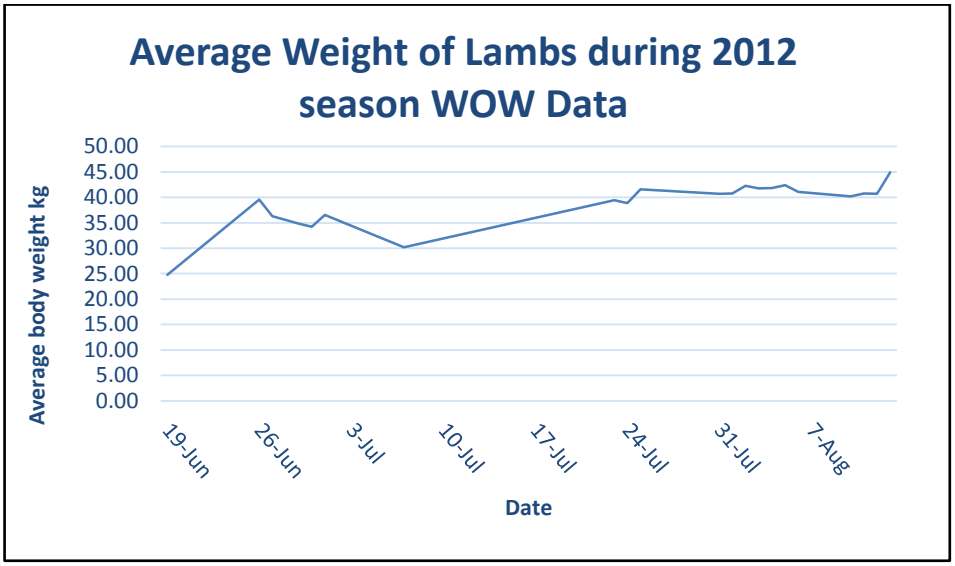

Figure 3: Average weight of lambs during the 2012 season; WOW data

There were a number of overweight lambs consigned to slaughter in the first draft on 29th August as a result of failure to closely monitor the weight gains on all properties. This resulted in penalties being applied to those lambs not meeting the required specifications. The graph below in Figure 4 provides a good representation of the penalties applied to these lambs and reinforces the need to monitor the growth of lambs to avoid these penalties. The overweight lambs were consigned from group members where no WOW data was collected.

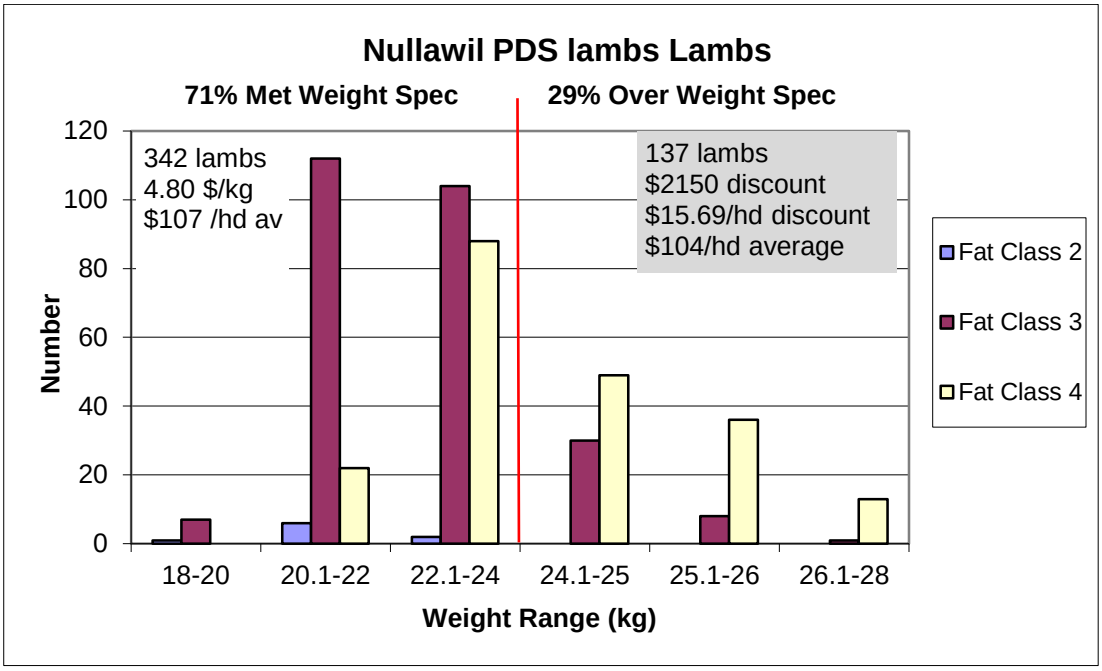

Figure 4: Lamb specifications and penalties applied 29/08/12. The $15.69 discount applied to overweight lambs from group members where no WOW data was available resulted in significant penalties being applied.

The first draft of lambs from the PDS site in 2012 achieved a 30 day shorter time to turn off than the previous turn off time of the first draft of lambs in B.PDS.1002 in 2011. This earlier shipment was an important benefit of improving the growth rate of the lambs in the PDS.

4.1.4 Group Marketing

The Nullawil BWBL group has over the course of the past three years marketed their lambs as a group. This informal group marketing activity has resulted in the group members being able to put together more appealing and marketable lots for processors to buy. It has also resulted in the group purchasing an auto drafter for the group to use as a tool in the marketing of their prime lambs.

To date the group has sent six group consignments for processing. In the first consignment 30% of lambs consigned failed to meet specifications due to the failure of some of the group to monitor lamb growth rates. In the subsequent consignments this was reduced to an average of 6% failing to meet market specifications. The group now only sells lambs in the traditional auction market on vary rare occasions.

4.2 BC analysis year one

The benefit cost (BC) analysis of the trial to date has revealed that for the varieties under investigation the following;

- Moby Barley BC ratio of 6.1:1or $579.50 : $95.00 Gross/ha/sowing cost
- Jivet annual ryegrass BC ratio of 10.3:1 or $987.50 : $95.00 Gross/ha/sowing cost
- Subzero and Perun Festulolium BC ratio of 10.3:1 or $987.50 : $85.00 Gross/ha/sowing cost

It must be said that this analysis was conducted only on the varieties mentioned above and several other varieties sown at the commencement of the PDS including the Superoo Oats (only sown in year two) failed to survive due to the low rainfall during the establishment and growth phases. Both the Jivet Rye grass and the Perun Subzero mix produced a better BC ratio than the Moby barley but these pastures were not available to graze early in the PDS and only became available to graze in early August. This result supports our work to assist in filling the later feed gap from September until the first stubble in Late November to early December.

4.3 Year one conclusions

To date the PDS has demonstrated that the use of electric fencing is a viable alternative to conventional fencing in the Mallee farming system with a significant number of group members either purchasing or investigating the purchase of electric fencing systems after observing lambs in the previous PDS site.

There would appear to be a distinct advantage in the Mallee system to sowing a smaller paddock of high producing fodder to take pressure off the grain producing paddocks. In the system under evaluation the use of early grazing of the cereal grain paddocks then moving on to the higher producing fodder varieties which deliver a higher quality and quantity of dry matter per hectare (DM/ha) and strategically grazing these varieties utilising electric fencing to control sheep would appear to deliver an extended grazing period which allows lambs to be finished without the need to supplement their diet with grain.

The use of PMM and WOW is still under investigation, but early indications are that in the Mallee environment these technologies are still clumsy and require more development in terms of the user interface, as the complex data processing software is difficult for producers to easily use to make management decisions and requires a good to advanced level of computer skill. The collection of regular static weights appears to be the preferred method of monitoring weight gain, with most of the group investing individual animal data monitoring equipment and software.

4.4 Year Two

The Nullawil Best Wool Best Lamb group commenced year two of the Rotational Grazing Cereal Crops in a Mallee Farming System 2 PDS in mid-April 2013 when a 40 ha paddock (site 1) was sown down to Moby barley @ 55 kg/ha with 50kg/ha of MAP fertiliser. A second site (site 2) of 12.5 ha was sown in mid-April at a different location in the Nullawil area with 50kg/ha of Moby barley and 20kg/ha of MAP fertiliser and 12 ha of Outback Oats @ 50 kg/ha with 20 kg/ha of MAP fertiliser.

The difference in fertiliser applications between sites was due to the personal preference of the participating farmer and his knowledge of the paddock requirements; this was reinforced by conducting tissue tests on the plants during the progress of the PDS. The paddock at location 1 was subdivided into four paddocks of 10ha, using electric fencing consisting of three wires (two hot and one earth). This allowed more efficient management of the grazing pressure and allowed for more adequate recovery time.

At the same time a further 30 ha paddock was sown down on site 2 with a clover blend consisting of;

- Clare Sub Clover 2 kg/ha
- Cavalier Sub Clover 2 kg/ha
- Ballansa Clover 1 kg/ha

• Bladder Clover 1kg/ha

Giving a total sowing rate of 6 kg/ha which was fertilised with 20 kg/ha of MAP.

At the completion of the sowing of the conventional cereal grain varieties (June 2nd) a further 25 ha paddock was sown down on site 1 with 3 kg/ha of Subzero Brassica and fertilised with 55 kg/ha of MAP. A full list of varieties and rates sown is provided in the tables below.

4.4.1 Rainfall 2013

Rainfall again proved to be elusive in year two of the PDS, Table 4 provides monthly rainfall figures for both sites. During the growth period from sowing in April through the vegetative phase 2 of the plant in late August there was only 145 mm of rainfall.

Table 4: Monthly rainfall figures for PDS sites (BOM)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Rainfall mm
Monthly Total		11.4	7.6	8.6	29.6	49.2	28.4	29.4	37.4	23	0	25	249.6
Mean 1899-2013	22.3	24.2	23.1	23.2	36.5	34.2	35.1	35.4	35.4	35.5	28.4	23.4	358.0

4.4.2 Fodder Production 2012

Year two of the PDS commenced with the sowing of the PDS sites in mid-April. The season was once again difficult with little rain (16.2 mm, BOM) falling in the period March to April 2013 and a further 29.6 mm falling in May. All trial plots were sown down on approximately 9 mm of rain. The areas and sowing rates are provided in the tables below.

Table 5: Sowing dates and rates Site 1

Date sown	**Area/ha**	**Variety**	**Sowing Rate**	**Fertiliser/ Rate**	**Row Spacing**
18-05-13	40	Moby Barley	55 kg/ha	MAP 50 kg/ha	30 cm
2-06-13	25	Subzero Brassica	3 kg/ha	MAP 55 kg/ha	22 cm

Table 6: sowing dates and rates site 2

Date sown	**Area/ha**	**Variety**	**Sowing Rate**	**Fertiliser/ Rate**	**Row Spacing**
15-05-13	12	Moby Barley	50kg/ha	MAP 20kg/ha	20 cm
16-05-13	12	Outback Oats	40kg/ha	MAP 20kg/ha	20 cm
17-05-13	30	Mixed Clover consisting of Clare 2 sub clover Cavalier medic - Ballansa clover - Bladder clover	**6 kg/ha in mix** 2 kg/ha 2 kg/ha 1 kg/ha 1 kg/ha	MAP 20kg/ha	20 cm
19-05-13	101	Morava Vetch	28 kg/ha		20 cm

Table 7: Sowing dates and rates site 3

Date sown	Area/ha	Variety	Sowing Rate	Fertiliser/ Rate	Row spacing
18-05-13	24	Moby Barley	55kg/ha	MAP 60kg/ha	20 cm
19-05-13	12	Subzero Brassica	3kg/ha	MAP 60kg/ha	20 cm

Follow-up rain in late May and June ensured a reasonable establishment and production of dry matter from the trial sites, however overall lower than average rainfall again impacted on the overall production of fodder from the trial sites. Moby barley once again proved to be a very successful cultivar, again providing good growth rates for the lambs this year. The other cultivar which also proved again to be very useful in filling the late season feed gap was the Subzero Brassica. The Subzero again held on until the mid to late November and provided a good source of fodder to both finish lambs on but also to prepare the ewes for their next joining. The clover mix sown on site 2 germinated and then promptly died due to lack of adequate rainfall again highlighting the benefit of the annual fodder varieties in the harsh Mallee environment.

In this year's PDS it was decided based on plant tissue tests to investigate effect of the application of 60 kg/ha of nitrogen (N) fertiliser on the Moby barley mid-season to assess the impact and benefit this might have. As can be seen in Table 8 below this had a dramatic effect on both production and quality of the fodder produced on site 1. On site 2 however the soil type (Grey Heavy Clay) and the lower rainfall at the establishment phase in April and early May meant that the plant population and density were adversely affected and were then grazed down too low (below 75mm) which meant that recovery and subsequent growth were impeded.

This over grazing highlights the need to carefully monitor grazing length and pressure to ensure adequate regrowth of plant material. It should be noted that even with the over grazing and lower rainfall on site 2 there was still an improvement in DM production of 162 kg/DM/ha (from 1430kg/ha to 1592 kg/ha) and an increase in crude protein from 7.1% to 10.1% in response to the application of 60 kg/ha of N, but little improvement in energy (8.1 to 8.9 MJ/kg/DM) which will be examined later in terms of BC of this application under these circumstances.

Table 8: Dry matter production and nutritional value of fodder produced on sites 1 & 2

Sample Date	Site	Species	Number of Grazings	DM%	DM/kg/Ha	CP %	Energy MJ/kg/DM	NDF	Plus N Y/N
15-Aug-13	1	Moby	0	24.4	3660	10.1	11.3	44.50	N
15-Aug-13	1	Moby	0	21.8	2021	11	11.3	45.00	N
15-Aug-13	1	Moby	1	38.4	2548	13.3	8.4	52.00	N
15-Aug-13	1	Moby	2	30.6	2279	10.3	9.1	54.00	N
15-Aug-13	1	Subzero	0	14.7	2833	25.6	13	24.30	N
15-Aug-13	2	Moby	2	12.9	1753	23.5	11.9	39.60	N
15-Aug-13	2	Moby	2	28.8	1335	9.5	10.5	47.50	N
15-Aug-13	2	Outback Oats	2	25.6	1001	8.2	9.9	47.60	N
18-Sep-13	1	Moby Barley	3	24.7	3458	6.8	10.8	50.80	N
18-Sep-13	1	Moby Barley	0	25.6	4949	7.3	9.8	55.90	N
18-Sep-13	1	Moby Barley	0	23.9	9719	13.3	10.3	52.20	Y
18-Sep-13	1	Moby Barley	2	20.6	6317	12.7	10.7	51.60	Y
18-Sep-13	1	Sub Zero	0	12.3	6430	21.6	13.4	27.50	N
18-Sep-13	1	Sub Zero	2	20.5	1510	14.7	11.7	29.80	N
18-Sep-13	2	Moby Barley	2	23.9	1430	7.1	8.9	55.10	N
18-Sep-13	2	Moby Barley	2	25.2	1592	10.7	8.1	57.40	Y

The application of N to any fodder must be accompanied by the adherence of sound grazing practices and the required minimum one week grazing withhold period to avoid Nitrite/Nitrate poisoning.

Grain yields were established for Hindmarsh barley sown as a comparison to the Moby barley and yields were comparable with previous results (1.8 t/ha) of this PDS and B PDS 1002 .

7 ha of Moby barley was harvested for seed and yielded 1 t/ha which is comparable to previous yields achieved for this variety. Moby barley is a grazing variety and the grain harvest is only to recover seed for next season, however, the value of the seed recovered from this crop is $5,600.00 for the 2013 season.

There were 27 large square bales weighing 550kg cut and baled from 6.8/ha area on trial site 1 yielding 2,183 kg/ha of hay with a current market farm-gate value of $2,500.00.

Unfortunately the clover species trialled failed to germinate or germinated and died due to the low autumn/winter rainfall and therefore were not able to be assessed. Rainfall for the growing season April to September was only186 mm (BOM) which highlights the need to utilise the annual fodder species available and not rely on perennial pasture to maintain or boost production of red meat in the more arid Mallee region.

The Subzero brassica did manage to fill the gap in the feed base this season with the remaining lambs and breeding ewes being depastured on the crop in late October until the first wheat stubble became available for grazing in mid-November. The measurements recorded in Table 8 above highlight the value of this cultivar as a late season variety for consideration to fill the late feed gap.

4.4.3 Lamb Growth Rates

Lambing commenced this year in late March and was concluded by April 20th 2013. The ewes were lambed down on a wheat stubble and supplemented with barley grain and vetch hay. During this period the ewes and lambs were introduced to the PMM and WOW systems. As the ewes were the same mob of ewes used in the previous year's PDS there was no difficulty in training them to walk over the WOW/PMM system. The lambs were educated in several days to walk in and out of the WOW/PMM system with the ewes.

On the 1st of June 2013 the 400 Merino ewes and their 395 1st X Poll Dorset lambs were introduced in to PDS site 1 at a rate of 30 DSE and rotational grazing and PMM/WOW continued on the site until weaning of the lambs on July 8th. The ewes were removed from the PDS site and the lambs remained and continued to be rotationally grazed and assessed using the WOW/PMM system, the remaining lambs equated to 16.78 DSE.

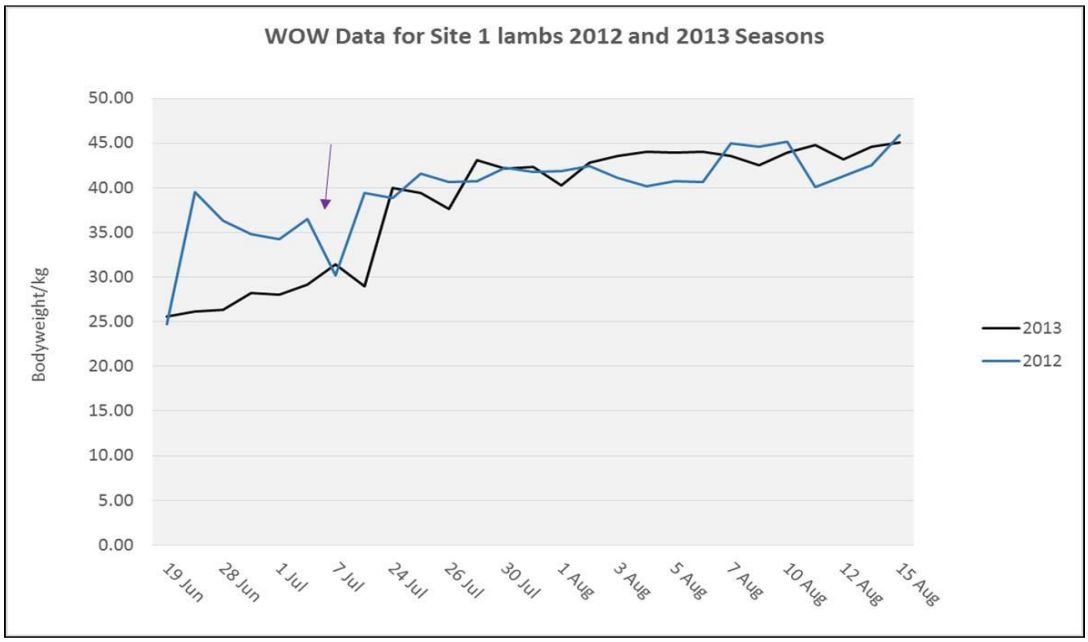

Figure 5 WOW data 2012 - 2013. Growth rates in the lambs climbed steadily in 2012 once being depastured on the Moby but suffered a drop around the time of weaning, then increased steadily until the first draft of sale lambs.

The WOW data (Figure 5 above) was in general agreement with the weights collected in the weigh crate and showed an average weaning weight of the mob of around 28 kg for 2013.

The weaning weight of the lambs on site 1 this year were slightly behind those of the lambs in year 1 of the PDS, however they were still a respectable average of 27.91 kg. Assuming a birth weight of 5 kg this equates to an average growth rate through the lactation phase of 306 g/h/d and a post weaning average growth rate of 251 g/h/d.

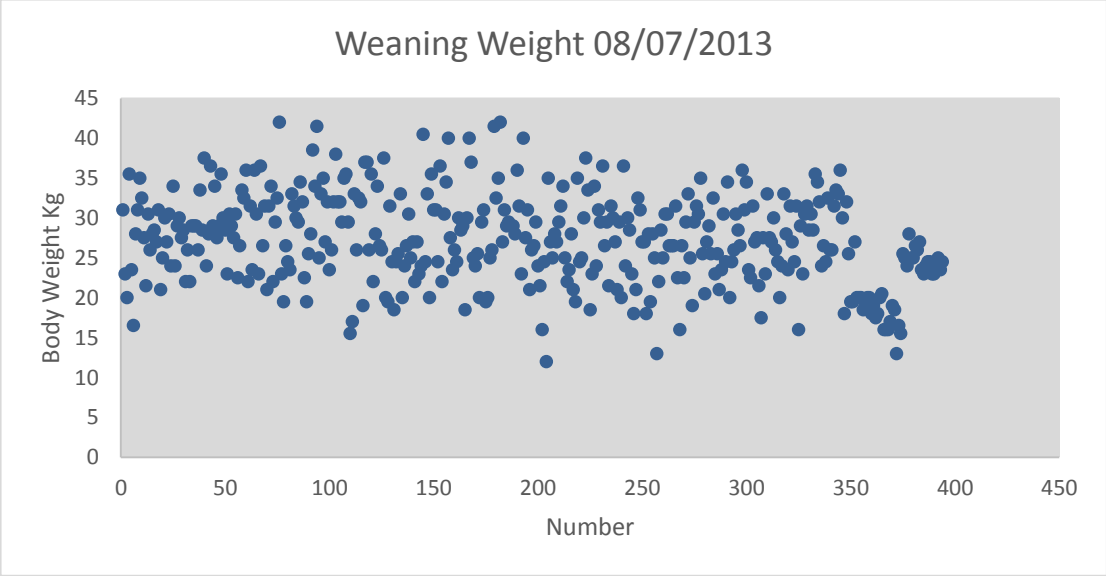

Figure 6; Weaning weight of lambs on site 1, There were again some of the lambs in the group (9) which were already close to sale weight at weaning in 2013.

The first draft of 116 lambs departed for processing from site 1 on August 27th with an average body weight 45.1 kg. These lambs were processed at a works which does not provide individual

carcass feedback and so no individual animal data is available, only kg's of hot standard carcass weight and fat depth, which totalled 2,461.3 kg and averaged 21.2 kg carcass weight. There were 11 lambs discounted 0.20 c/kg for overweight and one lamb discounted by 0.60 c/kg for being under the required carcass weight. The average dressing % for the mob was 47%, which is in line with historical data for all years. However, there were 12 lambs which were discounted by $5.00 for failing to make the grid, but without individual measurements there is no way of assessing what might have been the reason for this.

The importance of weighing lambs prior to consignment has been a strong learning from the PDS for members of the Nullawil BWBL group over the past four years, with all lambs consigned to slaughter hitting the target grid in the final year of the PDS.

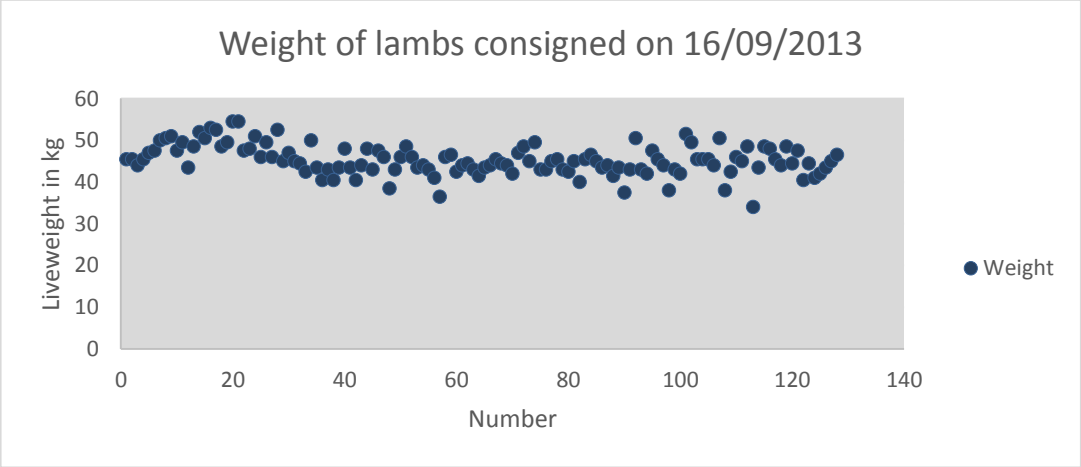

Figure 7: Individual lamb weights consigned to slaughter 16/09/2013

There was one group which did go to a processor who provided individual carcass feedback again this year and again the results reinforce the need to obtain this level of information to make sound management decisions, the results are provided below in Table 7. As can be observed there were several lambs which had very good (50 %+) dressing percentages, but other higher bodyweight lambs which had lower dressing percentages. As this data is linked to an individual lamb with known pedigree through the use of pedigree matchmaker it is a simple matter to investigate further.

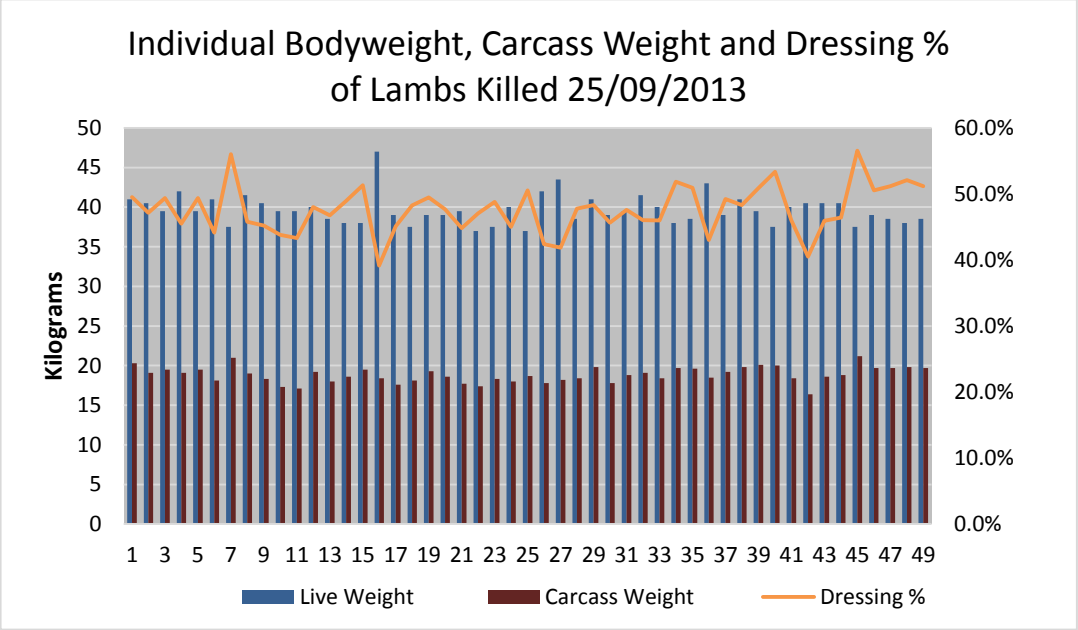

Figure 8: Individual bodyweights, carcass weights and dressing percentages of lambs consigned to slaughter 25/09/2013

The balance of the lambs (129) weighing an average body weight of 33kg remaining on the Nullawil PDS site 1 were moved on to the Sub Zero Brassica in late September and were rotationally grazed on the this fodder until early December when the first of the wheat stubbles became available to graze. During this period the lambs gained at a rate of only 169 g/h/d to be 46.06 kg average body weight on December 5th 2013. These lambs are from the late joined ewes along with a small group of lambs which failed to reach sale weight when the balance were sold and were not assessed as part of the initial group of lambs.

No PMM or WOW data was collected from site 2 as the grazing was only intermittent due to the lack of rainfall and associated poor plant growth. The lambs on site 2 were only growing at 223 g/h/d, but these lambs were not grazed for extended periods on the PDS and were supplemented with grain.

4.4.4 Group Marketing

In all of the consignments of lambs sent away by the Nullawil group there were lambs consigned by multiple vendors. In one consignment there were 400 prime lambs averaging 47.7 kg live weight and dressing out to average 20.68 kg or a dressing % of 43.35%.

The Nullawil BWBL group will continue to consign their lambs to the processor as a group as they believe that this gives them a marketing advantage over the previous practice of selling through saleyards as individuals. They will continue to market small, out of season lots and out of specification lambs through the saleyard system.

4.5 BC Analysis Year two

The benefit cost (BC) analysis of the trial in 2013 has revealed that for the varieties under investigation the following;

- Moby Barley BC ratio of 10.57:1 or $1004.15/ha Gross
- Subzero held for late grazing BC ratio of 2.6:1 or $221.00/ha Gross

It must be said that this analysis was conducted only on the varieties mentioned above and several other varieties sown at the commencement of the PDS including the Superoo Oats failed to survive due to the low rainfall during the establishment and growth phases. Both the Jivet Rye grass and the Perun Subzero mix produced a better BC ratio in 2012 than the Moby barley but these pastures were not available to graze early in the PDS and only became available to graze in mid-August, this was also true for the current 2013 season. This result supports our work to assist in filling the later feed gap from September until the first stubble in late November to early December and the overall benefit must be offset against the need to supplement lambs with grain and hay until the first stubble is available to graze.

As was mentioned previously, in this year of the PDS we decided to examine the effect of applying 60 kg/ha N on the Moby barley in mid-August. The results of this application produced an increase in both Dry matter production but also an increase in crude protein and energy for both grazed and un-grazed Moby barley. The increase in plant production and quality was tested using Grazfeed modelling to establish the extra production value of the plant growth to the lambs in the current PDS at site 1. The BC ratio generated for the application of 60 kg/ha of urea including spreading costs was 2.6:1 which make this application a viable practice for improving the production of lambs in the rotational grazing system provided there is adequate rainfall to generate a response. On site two where there was less rainfall over the site in the months of August –September and Food On Offer (FOO) was low (1,592 kg/DM/ha) there was no benefit found with the application of N fertiliser.

4.6 Year Two Conclusions

To date the PDS has demonstrated that the use of electric fencing is a viable alternative to conventional fencing in the Mallee farming system with 75% of group members either purchasing or investigating the purchase of electric fencing systems after observing lambs in the previous PDS site.

As in year one of the PDS there would appear to a distinct advantage in the Mallee system to sowing a smaller paddock of high producing fodder to take pressure off the grain producing paddocks. In the system under evaluation the use of early grazing of the cereal grain paddocks then moving on to the higher producing fodder varieties which deliver a higher quality and quantity of dry matter per hectare (DM/ha) and strategically grazing these varieties utilising electric fencing to control sheep would appear to deliver an extended grazing period which allows lambs to be finished without the need to supplement their diet with grain.

The use of PMM and WOW is still under investigation; early indications are that in the Mallee environment these technologies require further development in terms of the software to facilitate a greater uptake of this technology. The software is difficult and requires a good to advanced level of computer skills to operate and requires further development in terms of the user interface as the complex data software is difficult for producers to easily use to make management decisions. The collection of regular static weights using the weight crate would appear to be the preferred method of monitoring weight gain although a significant number of the group are investing in individual animal data monitoring equipment and software.

5 Cost benefit overall PDS

The cost benefit analysis reflects the average prices ($4.50, + skin value 2012 & $4.50 + skin value 2013) received for lamb in the past two years. Sowing costs include the cost of fertiliser, fuel and chemicals used in the sowing. Significant factors to be considered in this analysis are that the seasons were particularly difficult for fodder production and were reflected in both DM yield and price received in both years. The lamb figures were calculated on the growth rate and

carcase yield and are exclusive of cost of production, that is, no transport, selling or animal health costs were considered.

Table 6: Cost benefit analysis 2012 – 2013 (Gross Figures)

Year	Variety	Number of Grazing's	Sowing Cost/ha	Cost Benefit Ratio	Gross $ per Ha returned
2012	Moby Forage Barley	Continually in Rotation	$95.00	6.1	$579.50
2012	Jivet annual ryegrass	Continually in Rotation after August	$95.00	10.3	$978.50
2012	Subzero and Perun Festulolium	Continually in Rotation after August	$95.00	10.3	$978.50
2013	Moby Forage Barley	Continually in Rotation	$95.00	10.5	$1004.15
2013	Subzero Brassica	Continually in Rotation after September	$85.00	2.6	$221.00

5.1 Electric fencing

In this PDS, solar powered electric fencing played an integral role in the grazing management system. Historically in the Mallee region the trend was to pull out old existing fences to make larger paddocks for the production of grain. This practice was not conducive to intensive management of lambs to drive increases in production or decreases in turn off times, as grazing pressure could not be effectively controlled.

The system used in this PDS and in the previous B.PDS.1002 was a Speedrite 1000® solar powered energiser provided to the Nullawil BWBL group by Tru-test along with all of the electric fence insulators and electric tape used in all years of the work carried out by the Nullawil Group.

Throughout the PDS the group trialled different construction methods and materials from the basic rough construction using steel posts as strainer and stay assemblies and discovered that the most efficient method of setup was using the prefabricated strainer assemblies and three electric tapes as shown in Figure 8, together with step in insulated droppers for ease of shifting.

Figure 9: End assembly and three electric tape construction electric fence

This construction proved to be most effective in controlling the sheep on the PDS site.

In the first year of the PDS sheep were trained on the electric fence by introducing them to the fence in a set of containment yards. This was achieved by weaning the lambs from the ewes in the containment yard which had electric fence deployed along each side of the fence between the ewes and lambs. The sheep were held in the yards for two days then moved out on to the PDS site. The result was that no sheep went through the fence.

In year two the group decided that they wanted to wean the lambs directly on to the PDS site without training the lambs prior to entry on to the site. This also proved effective with only one or two lambs going through the fence in the first twenty four hours then no lambs crossed the fence once they received a shock.

The recommendations put forward by the fence provider is that animals are trained on the electric system using the method described above, that is introduction and training to the fence system in containment prior to putting sheep out on the fence system in the paddock.

The Nullawil BWBL group found that this was not necessary in every situation. To date 9 of the group have purchased electric fencing equipment with the remainder currently investigating the purchase of equipment for 2014 season. The group members who have purchased and are using electric fences to control grazing pressure on the fodder crops sown down to provide feed throughout the winter feed gap also use the electric fencing to control grazing pressure on their cereal grain crops.

The construction of the electric fencing during both this and the previous PDS have varied throughout the PDS as the group wanted to investigate the many variations available, but it would appear that the configuration and construction most favoured is the three portable tapes with step in insulated posts as seen in Figure 10 below mounted on windup reels for ease of movement.

Figure 10: Three tape electric fence used in year two of the Nullawil PDS, top and bottom hot, middle earth construction using portable step-in insulated posts

5.2 Precision sheep management

The use of electronic Identification tags (EID) has played a significant role in the capture and management of all livestock production data collected in this PDS with all of the sheep being monitored fitted with EID tags. The ability to identify and monitor individual sheep and lamb performance has provided the group with an in-depth insight and understanding of the performance and contribution of the individual animals to the bottom line in this system.

Individual carcass data demonstrated to the group the large variation in carcass yield and composition over all years of the PDS and also the need to better understand the contribution of both maternal and paternal genetics to the overall performance of livestock. Of particular interest to the group was the large variation in carcass yield even when tight weight specifications are adhered to when drafting for consignment. In Figure 7, above, it can be observed some animals presented with above average bodyweights at slaughter but were well below average in carcass weight.

Whilst the group acknowledge the potential of precision management tools to improve overall performance of their prime lamb business they also recognise that at the time of the PDS there is still more development required to make the PMM/WOW more user friendly in terms of data manipulation and management, as the software is somewhat difficult for producers to easily use and in most cases requires assistance from a consultant. The use of static weigh crates and individual data collection is considered to be a valuable tool which the group is happy to use in their management.

The Nullawil BWBL group has invested in a Pratley 3 way auto draft and the purchase of software and other data collection equipment to continue the use of precision sheep management.

Figure 11: Pratley auto draft purchased by the Nullawil BWBL group for use by all members

6 Success in achieving objectives

• To refine and enhance the rotational grazing practices developed in stage one of the PDS to better manage the nutritional requirements of prime lambs and their dams and increase production (kg/ha) of meat produced from 770kg/ha to 850kg/ha in the rotational grazing system.

Success in achieving the objective of increasing the production of red meat from 770 kg/ha to 850 kg/ha was not achieved in the PDS due to the lower than average rainfall achieved over both years of the trial. In the two years of the PDS the average production of red meat was 465 kg/ha of red meat due to the forced reduction in stocking rate from an average 40 DSE in the first PDS to 19 DSE in this PDS due to the lower than average rainfall (Average of 135.5 mm) over both years of the PDS during the plant establishment and growth phases.

• To determine the suitability of other fodder varieties for Mallee grain farming systems to fill the identified feed gap from September until the availability of the first stubble for grazing (December).

The PDS has established that there are several varieties capable of filling the feed gap between September and the availability of the first stubble in December. Some of the varieties include Subzero Brassica and the tetraploid ryegrass Jivet. But both of these varieties along with the Moby barley will respond positively if fertilised with 60 kg/ha of nitrogen post grazing in the presence of adequate rainfall to provide quality feed until the availability of the first stubble to graze in early December.

• **To quantify the financial implications of rotational grazing cereal crops and specialist fodder crops in a Mallee farming system and determine the cost of production of a kilogram of meat per hectare in these systems and compare these costs with previous practices.**

Historically, in the Mallee region lambs were grazed on cereal crops for a very short time (6 weeks) or grazed on a sacrifice traditional cereal crop then finished off on grain. The financial implications of this strategy were that the cost of the sacrifice crop was significant as the grazing availability was limited due to the varietal growth patterns of the cereal grain cultivars which meant finishing lambs on grain. The use of the grazing varieties of cereals in this region were limited if there was the intention to harvest grain from the crop as grazing needed to cease at <GS30 to minimise loss of grain yield. In the previous PDS, B.PDS.1002, it was established that the sowing of cereal grain for lamb finishing was not as financially viable as sowing a fodder specific cereal variety. From the current and previous PDS's the average gross returns per hectare over the four years were;

- Hindmarsh Barley grazed then stripped for grain all years $521. 59/ ha
- Corel Wheat grazed once $465.69/ha
- Moby Barley continually in rotation $1,183.47/ha
- Subzero Brassica (over two years) $599.75

With the traditional strategy of sowing a sacrifice crop the cost of sowing would be the same as sowing a forage crop, however the dry matter production is lower for the traditional crop sown for fodder and continually grazed:

- Hindmarsh barley continually grazed >GS30 1,801kg/ha
- Hindmarsh average DM production un-grazed 3,355 kg/ha
- Moby average DM production un-grazed 6,453 kg/ha

The cost to grow 1kg of meat in the traditional system of grazing on a cereal crop then finishing off on grain was 0.89 c/kg of red meat produced as opposed to the finishing on forage barley which equated to 0.22 c/kg of red meat produced for the same lamb. These costs are for nutritional input only and did not consider fixed costs associated with the farm

Of equal significance is the reduction in turn off time from B.PDS.1002, 161 days to 142 in the current B.PDS.1201 and a significant reduction in turn off times for the traditional system of grazing cereal then finishing off on grain in which lambs were turned off at around 180-185 days.

• **To investigate grazing management practices which decrease the turn off times and increase growth rate from 230g/h/d to 350/g/h/d of lamb produced in Mallee farming systems.**

Whilst the target growth rate was not achieved due to the lower than average rainfall over both years of the PDS the results were still a good improvement in growth rates over lambs in the previous B.PDS.1002 (230g/h/d) with a respectable average growth rate of 276 g/h/d for the Merino X Dorset lambs.

• **To investigate the role of walk over weighing (WOW) and pedigree matchmaker (PM) systems in an extensive environment to identify underperforming animals and their parents.**

The use of the PMM/WOW system in this, and the previous PDS have created a great deal of interest in terms of understanding the individual contribution of lambs to the overall profitability of the Mallee prime lamb system. The potential to provide vital information to producers for breeding and marketing of lambs in the Mallee is considerable, however, there is still a great deal of further development required to make these systems user friendly.

For the average farmer with limited computer skills the systems are difficult to use and extract usable information to make informed decisions without assistance. At the moment there are only two processors with the capability to provide individual carcass feedback to producers to assist with decisions around breeding and selection which means that uptake is slow.

The Nullawil group believe that the use of these systems, without further development is not a viable option; instead the group believe that regular weighing of lambs to monitor growth is sufficient to meet the requirements of the producers until such further development takes place.

• **To investigate the benefit-cost of the systems and the relative payback period for these systems.**

The BC as described above in Table 6 clearly demonstrates that the system of sowing a fodder specific variety of crop then rotationally grazing with prime lambs is a viable and profitable system. The relative payback period for the purchase of the electric fence system is in the order of 1- 2 years depending on the fixed costs of the producer and will vary from enterprise to enterprise.

The use of the electric fence system is difficult to quantify as all of the Nullawil group who have purchased these systems are now using these systems for other purposes than just the rotational grazing systems for which they were purchased which clearly fall outside of the scope of this objective.

The Nullawil BWBL PDS has revealed some interesting results in relation to the current grazing management practices and what can be achieved with the use of rotational grazing and the use of solar powered electric fencing to control grazing pressure. The new cultivars used in the trial, in particular the Moby barley, have made a significant impact in terms of reduced turn off times for lambs produced under the rotational grazing system developed. At the commencement of the PDS traditionally lambs would have been carried over and finished in feedlots, sold as stores or finished lambs in October. Under the system developed through this project the growth rates have averaged 289 g/h/d from birth through to consignment. This was achieved on an average rainfall of 157 mm during the growth phase of the plant over both years. The lower than average rainfall during this PDS significantly reduced the stocking capacity, and hence the ability to produce an increase in the production of red meat in the PDS. There was however the reduction in the turn off time for the first draft of lambs from an average of 161 days in B.PDS.1002 to an average 142 days over both years of this PDS.

Testing of plant tissue in mid to late winter in the PDS revealed a reduction in feed value through lower protein and energy and reduced DM production. This was investigated further in year 2 of the PDS which revealed that with the addition of 60kg/ha of nitrogen to the Moby barley there

was an increase in dry matter production accompanied by a corresponding increase in both protein and energy along with higher digestibility. When the relevant feed test results were submitted to a Grazfeed simulation the results showed an increase in potential growth rates of 77 g/h/d with the addition of the 60kg/ha of nitrogen which delivered a BC ratio of 2.6:1 for the application of Urea in conditions where adequate rainfall was available to produce a response. In situations where the crop is in distress through the lack of rainfall as was the case in year two on site 2 the application of urea delivered a no net benefit for the application.

The results for the Subzero brassica and the Jivet ryegrass indicate that the use of these cultivars to fill the gap from late September to December is recommended. The main consideration is the quality of the FOO provided from these cultivars. The potential to improve the feed value and quantity with the application urea in August is high and worthy of some further investigation as the preliminary results obtained from this PDS indicate that there is a benefit.

Lambs were again individually monitored throughout the course of the PDS and a small group were followed through the processing plant to deliver individual carcass measurements for yield along with individual growth rates for all animals in both years of the PDS. The lambs were individually matched up to their dams using pedigree matchmaker in both years of the project and information on the performance of ewe's progeny over the two years of the project was examined.

Some of the results did have the effect of dispelling some of the groups theories around the potential growth of multiple parity lambs (twins and triplets) as can be observed in the sample of individual data presented in Figure 12 below where the twin siblings performed at the same level as the single lambs of the same genotype in the first draft of lambs for sale 2012. This demonstrates the impact good nutrition has on the ability of lambs to finish early

Also of interest is the large variation (from 45 - 52.7%) in carcass yield observed in the graph below which highlights the benefit of individual carcass data to make informed management decisions. As the Nullawil BWBL group buy in all of the ewes for their breeding program there is little scope to use this information to alter the breeding of their ewes, however there is solid information to use in the selection of the sires they purchase. Also of interest is the fact that the twin lambs identified in the data shown are from a ewe that has consistently produced twin lambs which were amongst the first draft of lambs to be sold each year of the PDS.

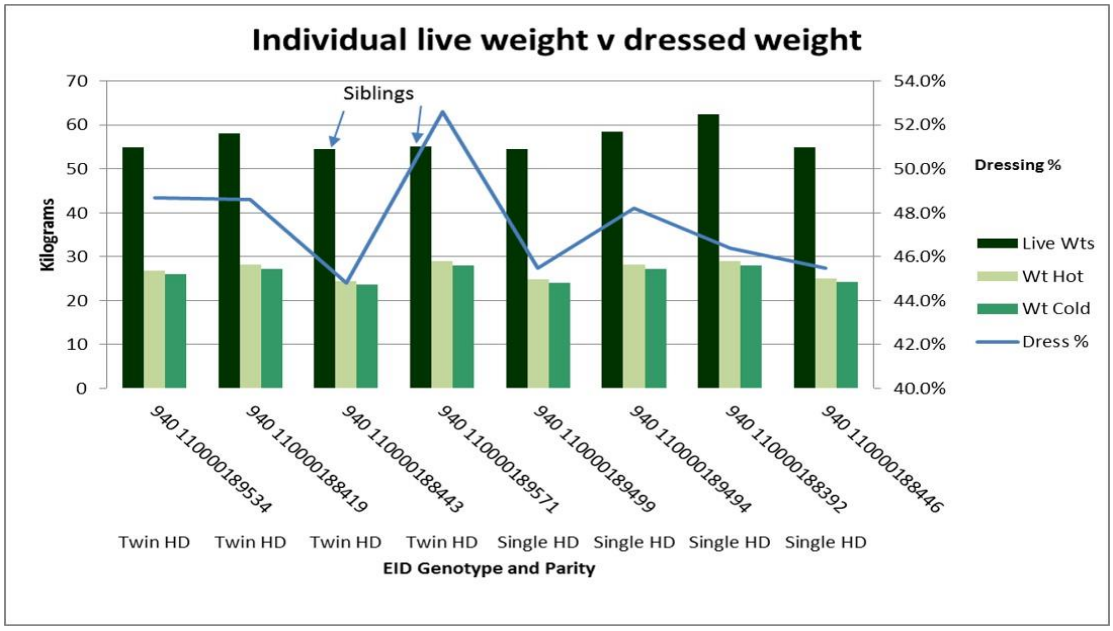

Figure 12; Individual lamb performance, carcass data x genotype x parity

This PDS has demonstrated that there is a financial benefit to be gained with the use of electric fencing to control grazing pressure and specific fodder varieties sown to produce high quality feed to grow and finish prime lambs in the Mallee farming environment. The BC ratios produced in this PDS and the previous work carried out by the Nullawil BWBL group have all delivered an average BC ratio of 7.9:1 in the current PDS and 16.3:1 in the previous PDS. The variations in results can be attributed directly the rainfall during the growth phase of the plants in both trials together with the high price of lamb during B.PDS.1002.

7 Impact on meat and livestock industry – Now and in five years' time

The impact on the meat and livestock industries, in particular the more marginal productions regions such as the Mallee, Riverina areas of Victoria, and New South Wales along with the arid regions of South Australia will be to provide a system that will enable red meat producers to breed and finish product on time and to the specification required with little or no supplementary feeding. The previous practice of sowing sacrifice paddocks to feed ewes and lambs required more area and usually necessitated grain feeding to finish lambs to specification which was labour intensive. The demonstration of successful strategies to utilise new and emerging fodder varieties into these Mallee type grazing systems will provide a reliable source of red meat production from some of the more marginal production areas.

The development of grazing strategies which complement cereal production and add a strong and reliable income stream to producers will help keep the traditional grain growers who have drifted into livestock production during the drought to stay in the livestock production industry for the longer term which will intern boost livestock numbers. The use of solar electric fencing has demonstrated that there is no need to replace expensive fencing pulled out in cropping systems to effectively manage livestock on farm.

8 Conclusions and recommendations

The Nullawil PDS has demonstrated that there is no need to replace expensive fencing and infrastructure to effectively manage intensive grazing in the more extensive regions such as the Mallee. With a small investment in equipment such solar powered electric fencing and the use of technology and planning it is possible to successfully manage intensive rotational grazing in the Mallee farming system.

The PDS has also demonstrated that lamb producers who embrace these systems can lift productivity and profitability by improving their grazing management skills to more effectively utilise the dry matter production of the fodder specific cultivars such as Moby barley and Subzero Brassica, or indeed any of the new and emerging cultivars which have been developed in recent times.

The PDS demonstrated that due to the unreliable rainfall pattern of the more arid zones such as the Mallee region, perennial pastures do not have the persistence or productivity of the annual fodder specific cereals or brassicas in these regions.

This current PDS (B.PDS.1202) and the previous PDS (B.PDS.1002) have also introduced the participants to the concept of precision sheep management utilising RFID. This technology has been embraced by the group with the collective purchase of a Pratley auto draft for use by the group members. The other interesting outcome of the PDS is the adoption of direct group marketing of lambs and the interest in setting up a value chain system to market lambs which

meet market specifications rather than the traditional system of selling all lambs through saleyards.

The recommendations from the Nullawil PDS in the marginal regions are;

• Complete a feed budget to assess the feed requirements of sheep for the period in question.

• Sow an area of grazing cereal (or other fodder variety) prior to the commencement of cereal crop sowing to meet these needs based upon the potential dry matter yield of the material being sown and the requirements of the sheep as established in the feed budget.

• Utilise the conventional cereal crop using solar electric fencing to effectively graze the cereal crop following Grain & Graze methodology in rotation with grazing variety. (about 6 weeks for traditional cereal grain variety). Monitor cereal grain variety closely to avoid grazing past GS30).

• Fence off the grazing block into four equal sized blocks using solar powered electric fencing and rotationally graze through the paddocks allowing for about 7-10 days per grazing depending upon dry matter availability and recovery time.

• Graze the fodder varieties no shorter than 75 mm (or the height of a tennis ball) from the ground to allow enough energy reserves in the plant to recover quickly from grazing in time for the next grazing

• If adequate rainfall occurs during the growth season of the plant, apply 50-60 kg/ha of Nitrogen on removal of the sheep from the paddock in mid-season. Remembering to allow a minimum of 7-10 days withhold prior to the reintroduction of stock onto the paddock to avoid nitrite/nitrate poisoning.

9 Appendices

9.1 Appendix 1

MLA Video link to Nullawil grazing PDS site.

http://www.mla.com.au/Research-and-development/Extension-and-training/Producer-demonstration-sites/PDS-Map/Rotational-grazing-cereal-crops-in-a-mallee-farming-system

9.2 Appendix 2

Comments from group participants

Producer 1

The main results of the PDS for me were what we can achieve by the better management of our fodder crops using electric fencing along with better livestock husbandry we can increase our lambing percentages and decrease our turn off times. The use of EID definitely has a place in this environment as it provides a tool to manage my ewes in conjunction with pregnancy scanning to isolate and manage twin bearing ewes better to get more lambs to survive. But also to identify empty ewes for re-mating or disposal depending on the year, you don't get lambs out of empty ewes!

The decrease in turn off time of my lambs has meant that I have feed available to get my ewes up to re-join for the next season which means that I scan more ewes in lamb. The use of the electric fencing has given me the flexibility to graze my crops I need to, but more important is the fact that I can graze the fodder crops I have sown to maximise the production of them.

I believe that we have effectively filled the feed gap because we have shortened the turn off time of my lambs by 25 -30 days, and up to 95 % of my lambs are gone by early August which means that I have feed available for my ewes to see me through to the first stubble is available to graze and so I can afford to run a few more sheep.

The group marketing has also been a great advantage for my business because I can send my lambs off to the processor and avoid the market fluctuations. A prime example of that is, I sent a consignment of lambs with the group and received $120/head as part of the larger consignment. I sent some lambs which didn't quite make the weight two weeks later into Bendigo when they reached their sale weight and only received $80 /head.

Producer 2

The main results for me was it proved that the system we had developed using electronic tags and rotational grazing worked. We were able to turn off lambs that met market specifications. The Moby and Sub Zero managed to fill the feed gap, but it could have been much better if we had received early rain.

The reduction in lamb turn off time has meant I can have all of my lambs gone in August and then concentrate on getting my ewes ready for the next joining without too much supplementation of grain or hay. This means that my ewes have every opportunity to conceive more lambs because they are in better condition going into joining.

The other success for me has been the group marketing arrangement which we have as a result of the PDS. This has meant that I can send lambs when they are ready rather than waiting until I have enough lambs of a weight to send off to market and putting feed into lambs which are already processing weight.

The use of electric fencing has given me the flexibility to manage my Moby and Sub Zero fodder crops to effectively graze them and maximise the return from them, this would not have been

possible without electric fencing. In our old system we know that sheep will just stay down one end of the paddock and we don't get the full benefit of the crop we have sown the electric has changed the way we manage of grazing pressure.

I have also used the electric fence to strip graze some of my traditional cereal crops, but this is only short term as the Moby Has filled the gap and so there is no need to graze my cereal crops too much.

The main finding for me is that I have the confidence to sow and use the Moby and Sub Zero fodder crops end electric fencing to fill the feed gap and produce a consistent quality lamb that the market wants in a much shorter time frames than I could before the PDS.

The electric fence has given me the flexibility to graze the crops effectively

Producer 3

The biggest benefit for me was identifying something to fill the winter feed gap, this has allowed me to increase my sheep numbers effectively running more sheep on less acres. The electric fencing has enabled me to manage the grazing pressure on my fodder crops to get the maximum benefit off the fodder crop because I can control the grazing pressure.

The Moby barley and Sub Zero have filled the gap well, but I have discovered that I need to treat the fodder crops the same as a grain crop. You need to manage the weeds in them to maximise the moisture utilisation in this dry environment. The electric fence has been great to manage the grazing on my farm. I have used it to graze the Moby as well as the other crops on the farm, and it has been an effective tool for me.

Producer 4

The PDS demonstrated just what you can do with a proper setup and when the operation works well in terms of controlled grazing using electric fences and good fodder varieties. I have been able to turn off my lambs much quicker than I could in the past. I believe that no matter what you use as a fodder variety it has to done right. You need to manage it as you would if it was a grain crop that is you need to prepare the paddock and control the weeds and be prepared to fertilise it to get the best out of it.

The Moby barley appears to be the early to mid-season feed and the Sub Zero loos like the mid to late season feed. The Sub Zero would also give me the opportunity to buy in lambs to finish on the Brassica I have left after all of my own bred lambs have gone in early August and also to get my ewes up for the next joining. I think for our farm we will probably increase the sheep numbers but be able to run them on less country.

The electric fencing also has a role for us in the control of grazing pressure on our fodder crops but we won't use it to graze our traditional cereal crops as we no longer have the need to with the use of the Moby and Subzero. For us the Grain and Graze methods are not an option because the grazing time is so short that it is not worth the effort.

We have also started to weigh our lambs regularly and use this information to forward plan the selling program for our lambs using the weight gains to tell us when our lambs would be ready to market instead of just selling lambs at market for what we can get. We have also changed from 1st X lambs to Poll Dorset lambs because we are now confident we can finish them in most seasons without grain.

Producer 5

The main results that came out of the PDS were we get a lot more value out the paddocks we have sown and by using the electric fence to control the grazing.

The Moby barley has meant that I can wean my lambs close to home and weigh them regularly to monitor their weight gains. I started to wean lambs earlier that I used to and get them away

much sooner than I did in the past. I make the most money on the first draft of lambs, so the more I can get away early the more I make.

The other benefit to come out of the PDS is the group marketing of our lambs. We are able to put together a B Double of lambs from 6-7 different farm which all meet the specifications and we are payed accordingly. None of this would be possible without regular weighing to see how our lambs are growing. We used to just send our lambs to the saleyards when the local agent reckoned they were right to go and we would just have to accept whatever we got. With the group marketing we have the numbers to send larger consignments of lambs for processing direct and hit the grid, we also know how much we will receive before the lambs leave the farm. With group selling I can send lambs when they are ready to go and not when I have enough to go.

By weighing my lambs I know when they are ready to go and can get them away, the extra feed they consume once they have reached their target weight is better going into something else rather than just making a good lamb fatter than it needs to be. I can use this feed to get my ewes ready for joining. In the past I would be happy if I got 75% lambs, but now with this system I would be disappointed if I didn't get 115% lambs because I now have the feed to make it happen.

Electric fencing has turned out to be a real eye opener, I am now using the electric fence to control my grazing in the fodder crops but don't think I will graze my cereal crops because there is not enough time available and I get all the feed I need with the Moby barley and Brassica.

The PDS for me has meant a change in my thinking about the whole management of lambs and the need to understand weight gain and growth of my lambs.