final report

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Maximising Pasture Production in a Variable Climate

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Abstract

Grazing businesses rely on pastures to form the basis of their production system. Increased climate variability, resulting in a later autumn break, reduced spring rain and increased summer rainfall creates feed gaps which need to be managed to maintain production in the Barossa region of SA. Through three very different seasonal conditions, three 'major' sites located around the Barossa Valley compared over 100 different pasture varieties and blends for production and quality. In conjunction 13 'minor' sites, developed in 2017 and 2018, demonstrated pasture varieties on local producers' paddocks, allowing large scale monitoring and production measurements. These sites demonstrated that producers could fill the winter feed gap with fodder cereal varieties, such as Moby barley and Dictator II Barley, which increase the stocking rate by 4DSE/Ha helping to maintain late pregnancy and lambing ewes. Maximising opportunities through spring using blends of early, mid and late varieties to capitalise on all rainfall events can increase stocking rates by up to 18 DSE/Ha in spring to increase livestock production. Stocking rates through summer were more conservative, however demonstrated the ability to increase by 5DSE/Ha with the use of Lucerne, which allows producers to reduce summer supplementary feeding. As a result of these demonstration sites, 80% of core producers adopted new pasture varieties and adopted soil and pasture measurement. Information was shared as a result of the demonstration sites through a total of 19 extension activities and 50 communication outputs. This resulted in an 'intend to implement' rate of over 80% for observers changing their pasture varieties and 72% 'intending to implement' soil and pasture measurements. The increased awareness and adoption of producers has provided further incentive for the local rural businesses to continue the major demonstration sites to continue providing information for the producers, seed merchants and local agronomists into the future.

Executive summary

Seasonal variation as a result of climate change, plays a huge role in any agricultural production system and significantly impacts pasture production, quality and persistence. The Barossa area has experienced increased variation in the form of later autumn breaks, reduced spring rain and increased summer rainfall events.

The variation creates feed gaps within a livestock system creating challenges associated with decreases in pasture and livestock production, increased risk and problems maintaining land condition.

By targeting these feed base gaps, with different pasture varieties, producers can respond to create opportunities, reduce risk within the system and maintain ground cover which results in a more profitable and sustainable livestock enterprise.

In summary, this project

- Tested over 100 pasture varieties across 3 major demonstrations sites and 13 minor sites in the Barossa area to identify the pasture varieties which fill seasonal feed gaps to maintain annual stocking rate and increase livestock production.
- Results showed that the best way to help fill seasonal feed gaps to capitalise on different rainfall events and seasonal conditions is to choose a range of pasture varieties.
- Utilising early forage varieties such as Moby Barely, Dictator II Barley and Bison Triticale which are more resilient to cold conditions will fill a winter feed gap. This can provide feed to late pregnancy and lambing ewes helping to maintain lamb growth rates of 300 grams per head per day.
- Vineyards provide an opportunity for winter grazing which will maintain lamb growth rates. The lamb liveweight gain as a result of grazing the vineyard can provide an additional $401/ha to the vineyard system gross income on top of the grape income.
- Utilising a blend of early and late maturing ryegrass varieties - tetila, arnie and vortex - will provide an opportunity for winter and spring feed. In addition, they provide the opportunity to capitalise on late spring rainfall.
- Adding a ryegrass with a forage cereal will improve the pasture quantity by 600kg Dry Matter per hectare and quality by 1 Megajule of metabolizable energy and 1% protein.
- In addition to the winter and spring grazing opportunities, the use of these forage cereals or blends of ryegrasses provide fodder conservation options such as hay, silage or a standing crop, which will fill a summer feed gap helping to maintain stocking rates.
- A summer feed gap can also be filled with summer active lucerne, perennial grasses or summer forage crops. Lucerne provides the greatest increases to annual stocking rate and will provide summer feed even in years of below average annual rainfall.
- Matching rainfall with the pasture variety will ensure perennial pasture varieties and blends will survive and produce through tough years rather than just the average and above average years
- There were 16 core producers directly involved in the project with an additional 706 attending field days
- A total of 19 events which were delivered in the form of pasture walks, webinars, conferences and workshops with an attendance of over 700 ‘observers’.

- 50 communication outputs were delivered across local, state and national networks.
- 12 core producers (80%) are now using alternative species as a result of the PDS and have adopted soil and pasture measurement.
- 13 core producers undertook a pasture refresher course using MLA tools such as the pasture ruler, to enable them to evaluate pasture performance measuring dry matter production, groundcover, pasture composition and feed quality
- The PDS project increased the knowledge and skills in pasture management by an average of 10% for observers and core producers.
- The PDS project increased producers' confidence in choosing pasture varieties by an average of 11% for observers and 22% for core producers.

Not only did the project facilitate increases in farm practices and producer skills and confidence, it also helped to provide a positive learning and networking environment for producers who were experiencing tough conditions. This benefit to the community is unmeasurable as it is critical for the health and wellbeing of the local producer networks.

In addition to the local farmer networks, the project fostered relationships with seed companies and local rural businesses to extend the learning experiences for producers and their own networks. These relationships will continue after the project with two major demonstrations sites continuing to operate providing local relevant pasture information.

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1 Background

Seasonal variation, as a result of climate change, plays a huge role in any agricultural production system and significantly impacts pasture production, quality and persistence. Bureau of Meteorology data demonstrates that Angaston has experienced a reduction in annual average rainfall of 100mm over the past 20 years, from about 500mm to 400mm, and temperatures are predicted to increase by at least 1^{o}C.

Climate change also results in more variable conditions, with the Barossa area experiencing a later autumn break, reduced spring rain and increased summer rainfall events over recent years. This results in more variable feed gaps within a livestock system creating challenges associated with decreases in pasture and livestock production, increased risk within the grazing system and problems maintaining land condition.

The Barossa and Eastern Mount Lofty Ranges also feature sodic soils and a wide variety of topography and climate ranging from 400mm to 600mm rainfall and from deep cracking soil to sandy loam soils, leading to a situation where pasture types traditionally used in South Australia are often unsuited to areas of the Barossa.

To help maximise production to counter these variable conditions, there was a need to establish a feedbase that is optimised for variable rainfall patterns including late breaks, early finishes and out-of-season summer rainfall events which grow in the different conditions experienced across the Barossa.

By targeting these feed base gaps, with different pasture varieties or blends, producers can respond to create opportunities, reduce risk within the system and maintain ground cover which results in a more profitable and sustainable livestock enterprise.

2 Project Objectives

By December 2018, in the Barossa and Eastern Mount Lofty Ranges region of SA:

1. Demonstrate the productive and economic performance of a range of pasture types to improve annual feed production, total grazing days and feed quality in a variable climate on at least 15 sheep and/or cattle properties.
2. Perform a comparative assessment of pasture productivity across four different climates and soil types within the Barossa to understand if the results differ between Barossa sub-regions.
3. Conduct extension activities including pasture walks, field days, a bus tour, webinar series and video to showcase the results and encourage adoption by producers.
4. Upskill at least 60 producers in the use of pasture monitoring techniques.
5. Increase awareness of pasture species options and productivity implications to at least 250 producers within the region

3 Methodology

3.1 Demonstration Sites

The Project developed 17 demonstration sites on properties representing key Barossa climates and soil types to monitor the performance of a range of pasture types in terms of production and quality.

This data was analysed to determine and compare the most effective pasture type / blend for performance in the region.

The demonstration sites were developed as 'Major' and 'Minor' sites.

3.1.1 Major sites

Major sites were set up in three areas representing key Barossa climates and soil types including:

- Koonunga (500mm rainfall, red-brown earth)
- Keyneton (400-500mm, red loam over clay)
- Eden Valley (600mm, sandy loam over clay)

The 0.4-hectare sites were developed in 2016 (year 1) and contained a wide range of different pasture varieties and blends.

The Eden Valley site failed to establish successfully in both 2016 and again in 2017 after being resown so was moved to a new site in Mount Pleasant in 2018. This site was in a high rainfall area (700mm) and a sandy loam over clay soil type.

Site preparation, sowing and weed control were delivered by local rural businesses (Farmer Johns and Coopers Farm Supplies) and seed distribution companies (Heritage Seeds and Pasture Genetics) and the landholders. Sites were sown in accordance with achievable sowing dates in relation to seasonal conditions.

Pasture types were selected in consultation with local agronomists and seeding contractors. They took into consideration the soil type, seasonal conditions and pasture variety characteristics such as maturity, persistence, production and quality.

Varieties included perennial types such as phalaris, cocksfoot and dryland Lucerne and annual types including ryegrass, forage cereals and forage brassicas. They were reviewed on an annual basis and changes made where appropriate.

The Major sites were monitored at least three times per year for:

- Dry Matter production (Kilograms of Dry Matter per hectare)
- Groundcover (% cover/ 0.1m2)
- Pasture composition (% varieties/ 0.1m2)
- Feed quality (feed analysis conducted by Feed Test Laboratory)
- Dry matter production/ 100 mm growing season rainfall
- Annual Stocking Rate

Results were presented for each demonstration site in an Annual Site Report and at the BIGG annual conferences.

3.1.2 Minor sites

Minor sites were developed in 2017 and 2018 facilitating paddock scale demonstration and livestock performance for different pasture varieties and blends.

Thirteen sites were delivered with seven in 2017 and six in 2018. They were developed on paddocks between 2 ha and 20 hectares located across the Barossa region.

Thirteen producers undertook a pasture refresher using MLA tools such as the pasture ruler, to enable them to evaluate pasture performance measuring dry matter production, groundcover, pasture composition and feed quality.

Where available, animal productivity performance measurements including stocking rate, liveweight gain and number of grazing days were taken.

Minor sites were delivered in-kind to the Project by each producer in consultation with the local agronomists.

Minor site participants undertook a pre and post survey to measure the rate of change and adoption.

3.1.3 Seasonal Conditions

The major and minor demonstration sites were located near at least one of the three BIGG weather stations located across representative areas of Keyneton, Flaxmans Valley and Koonunga. These measure real-time rainfall (mm), temperature (oC), plant available water (%) and soil temperature (oC).

The measurements facilitated decision making opportunities to provide pasture management and stocking rate decisions for the demonstration sites. The also provided evidence of the different seasonal conditions faced across the three years of the project.

3.2 Extension Activities

Extension activities provided opportunities to share learning and provide networking for producers. The extension activities were delivered in consultation with the MER Plan, with pre and post event evaluations. Extension activities included:

- Three pasture walks per year at the major and minor sites with local agronomists and seed distributors
- Presentations at the BIGG Conference, in conjunction with the seed companies and local agronomists.
- One workshop per year
- A webinar series was delivered with a total of five webinars over three years. Recordings of the webinars were uploaded to the BIGG Youtube page to ensure producers could continue to receive information after the event.

The events (Appendix 1) were delivered with in-kind support totalling over $36K from local NRM Boards, Sheep Connect SA, AgEx Alliance, local rural businesses and rural consultants. All conference and workshop information were made available on the BIGG website.

3.3 Communication Activities

The project facilitated a range of communication outputs (Appendix 2) which delivered project information internally via the BIGG e-newsletter to BIGG members and stakeholders and externally to the wider community. This was developed in consultation with the MER framework.

Information was shared locally via local newspapers (The Leader and The Herald), state wide via the Stock Journal newspaper and stakeholder newsletters such as Natural Resources AMLR Small Talk and Natural Resources SAMDB The Drift and ABC regional radio; and nationally via the MLA Friday feedback, Southern Association Grasslands Newsletter, social media and the BIGG website.

A Case Study booklet was developed at the conclusion of 2018 detailing the major site finding and the minor site case studies. A video was developed at the conclusion of the project to detail the project findings. This is also included on the BIGG website.

4 Results

4.1 Seasonal Conditions

Seasonal conditions within and between each year of the project were extremely variable (Fig 1.). This provided an opportunity to observe how different pasture varieties fill different feed gaps. The three-year variations were as follows:

- 2016- well above average rainfall- the fourth wettest year on record in the Barossa Valley
- 2017- average rainfall- however included a late break and early finish to spring
- 2018- well below average with only half of the annual average falling through winter and early spring

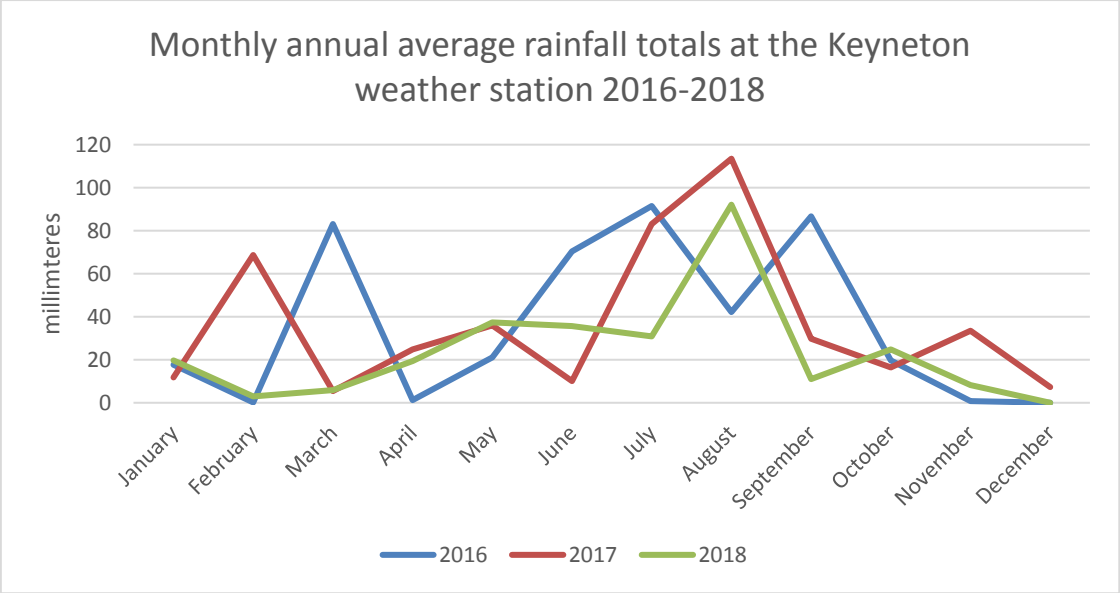

Figure 1: Three years of monthly annual average rainfall at the Keyneton weather station demonstrate the difference in growing season rainfall across the years.

4.2 Major Sites

The three major sites represented key Barossa climates and soil types in Koonunga (500mm rainfall, red-brown earth), Keyneton (400-500mm, red loam over clay) and Eden Valley (600mm, sandy loam over clay). They provided the opportunity to learn how over 100 different pasture species and blends can fill feed gaps to maximise pasture production.

The main production measure taken to compare the results was the change in annual average stocking rate and overall production measured in Kg of Dry Matter per hectare. These demonstrations have not included grazing trials so the production figures are based on the total production through a season, without taking into account the impact of grazing. Grazing demonstrations were included in the minor demonstration sites.

4.2.1 Combination of varieties to fill feed gaps

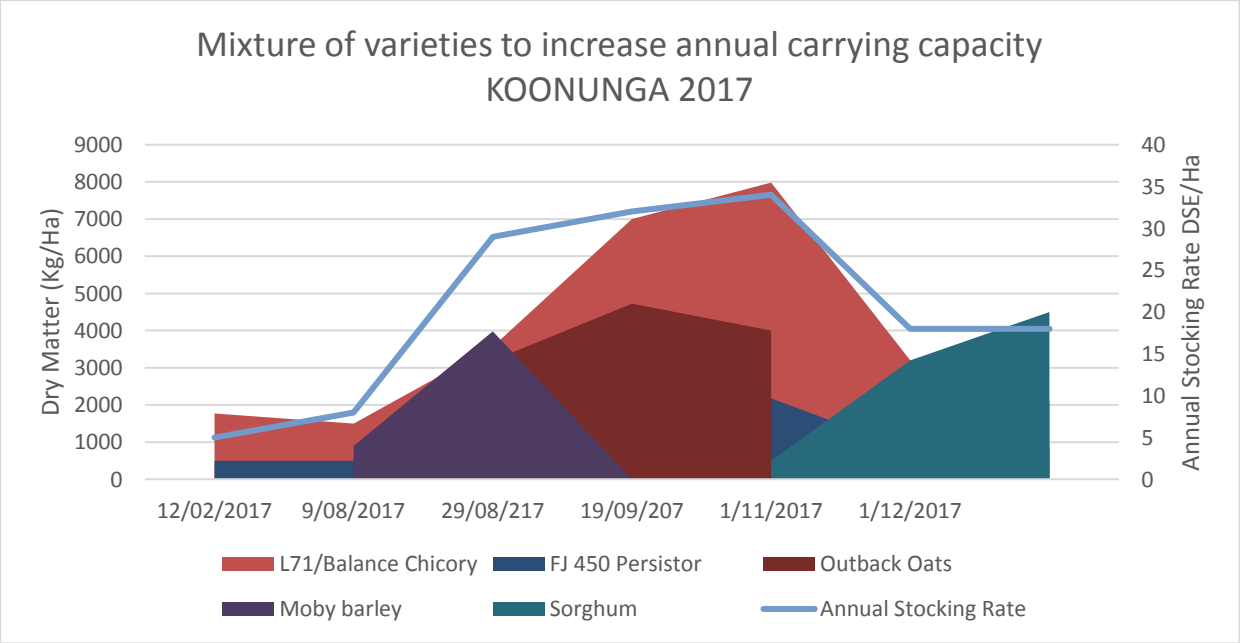

Figure 2: An example of how a mixture of different pasture varieties can maintain the annual stocking rate using dry matter information from Koonunga in 2017. Summer active varieties Lucerne and perennial grass maintain the annual stocking rate at 5 DSE/Ha. Through early August, Moby barley produces over 3000 kg of dry matter which increases the stocking rate to 29. As Moby production declines in mid spring, Outback oats and Lucerne production, increases the spring stocking rate to peak at 34 DSE per hectare where it declines rapidly. The outback oat production declines in early summer however the production of sorghum helps to maintain the annual stocking rate above 20 through the summer.

4.2.2 Filling the winter feed gap

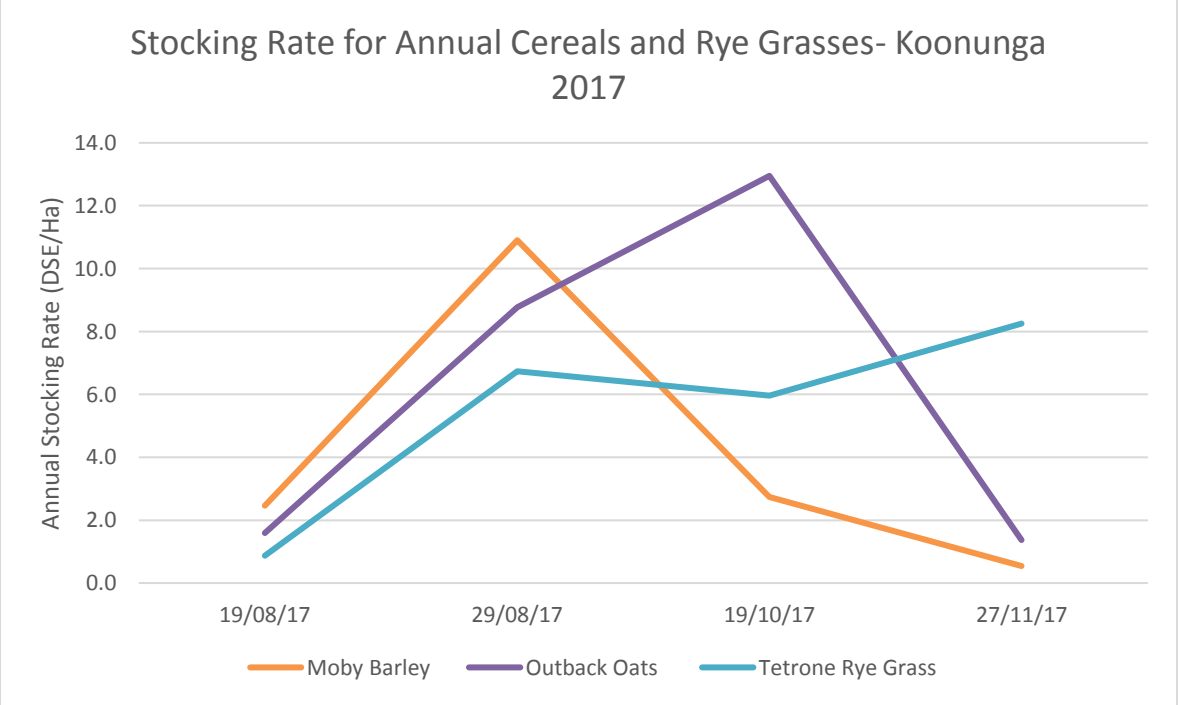

Figure 3: In August 2017 at Koonunga, Moby Barley provided the greatest annual stocking rate at 2.5 DSE per hectare rising to 11 DSE per hectare. In comparison, Outback Oats has the greatest annual stocking rate in October at 13 DSE per hectare which then decreases in November. The Tetrone rye grass provides the lowest stocking rate through August however steadily increases through October to provide a stocking rate of 8.2 DSE per hectare by November.

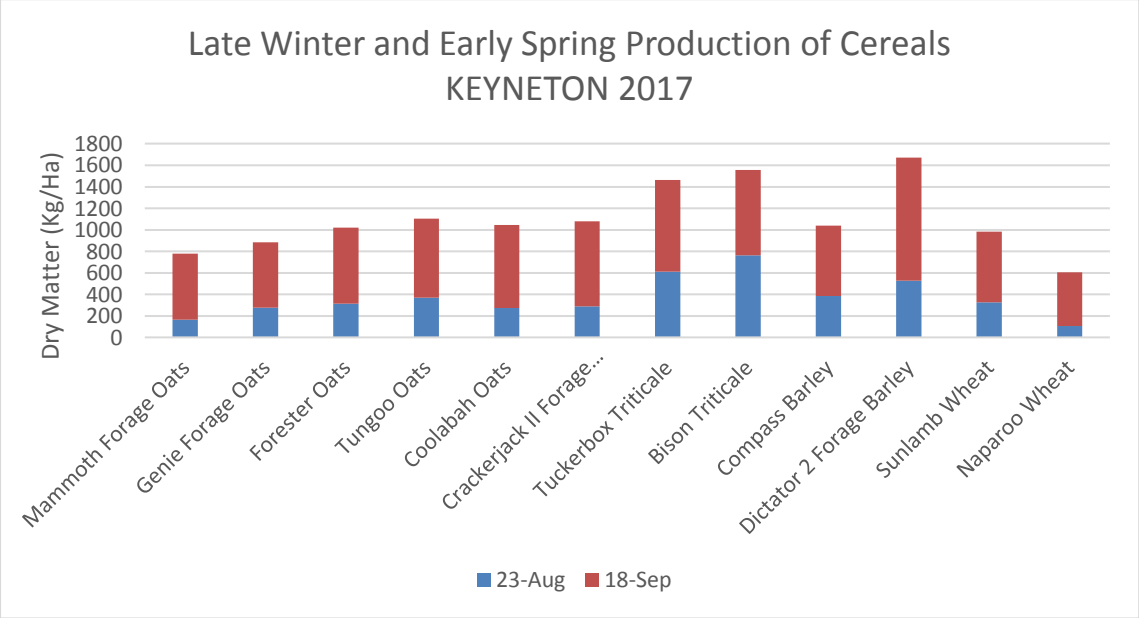

Figure 4: The cereal varieties provided late winter and early spring production, producing an average of over 1000 kg of Dry Matter per hectare at Keyneton in 2017. Dictator 2 Forage Barley produced the greatest amount of dry matter at 1675 kg per hectare followed by Triticales in Bison and Tuckerbox.

4.2.3 Cereal and ryegrass combination

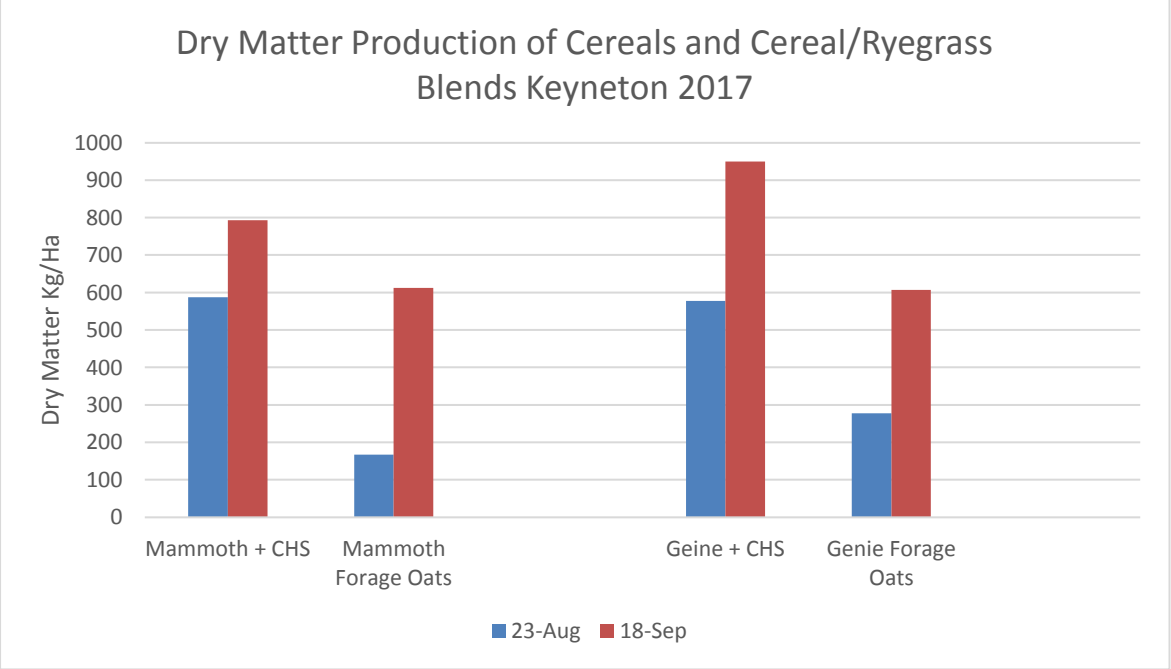

Figure 5: The addition of ryegrass (Coopers Hay and Silage Mix, CHS) increased the dry matter production by over 600 kilograms per hectare in August and September of the forage oat varieties Mammoth and Genie at Keyneton in 2017.

Table 1: Feed Test comparison of Different Forage varieties and blends- Keyneton 2017

Variety	Dry Matter (%)	Protein (%)	Neutral Detergent Fibre	Digestibility (%)	Energy (Mj/Me)
Forage Mammoth Oats	14.8	20.9	42.4	71	10.7
Mammoth Oats + Ryegrass Mix	15.9	21.8	41	73.3	11.5

Feed testing also indicated that as well as added production, ryegrass/ cereal combinations resulted in increased quality in the form of 1 extra MJ of energy, 1% increased protein, 1 % lower Neutral Detergent Fibre which allows livestock to consume greater quantities resulting in increased growth rates.

4.2.4 Extended springs opportunities

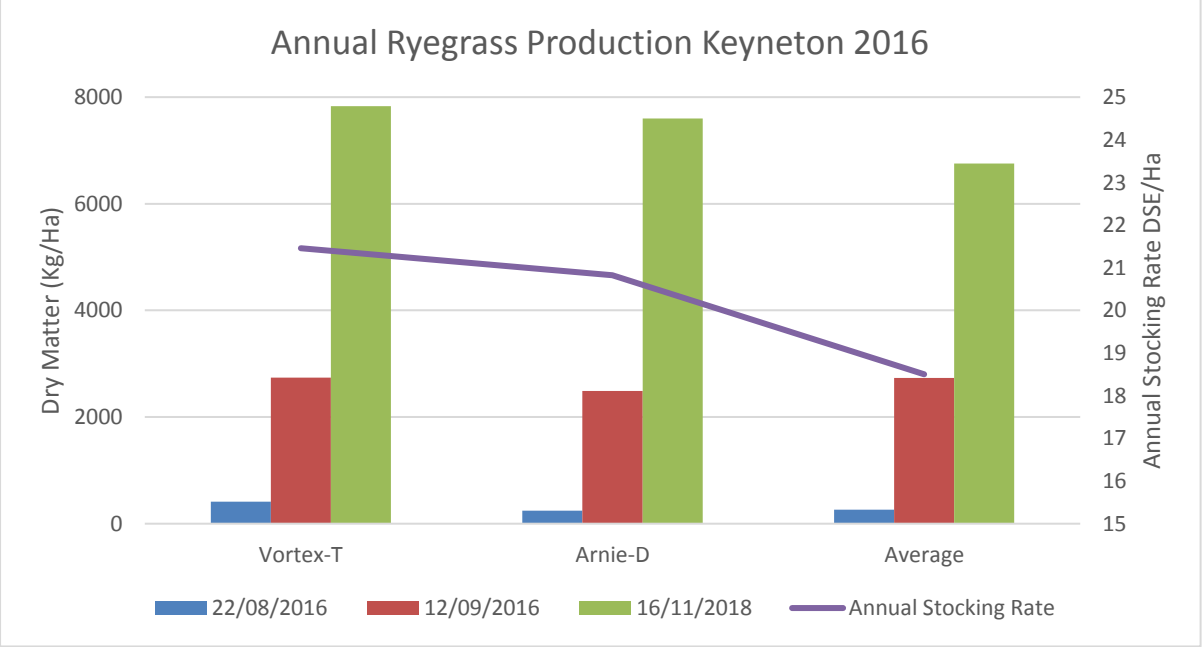

Figure 6: In 2016 at Keyneton, Annual Ryegrass Vortex produced the greatest amount of feed with 200 kg of dry matter above the average in August and a total of 1000 kg of dry matter above the average in November. The additional production provides an increased stocking rate of 3 DSE per hectare. Ryegrass variety Arnie produces the second greatest amount of feed.

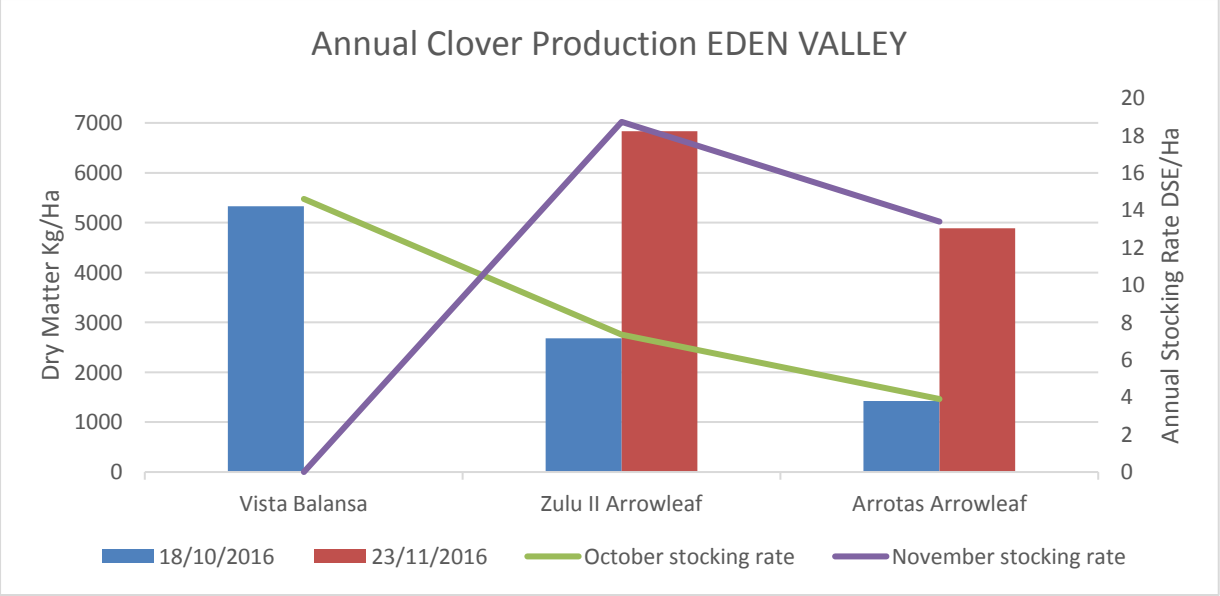

Figure 7: Later maturing, arrow leaf annual clover variety, Zulu II and Arrowtas, in late November, measured 6,800 kg of dry matter per hectare and 4,800 kg dry matter per hectare respectively, compared to the other annual clover varieties. This resulted in an increased November stocking rate of 18 DSE per hectare for Zulu ll and 14 DSE per hectare for Arrotas. However, these varieties did not produce high levels of feed earlier in the season, compared with Balansa clover varieties which provided a stocking rate of 15 DSE per hectare in October.

4.2.5 Filling Summer Feed Gaps

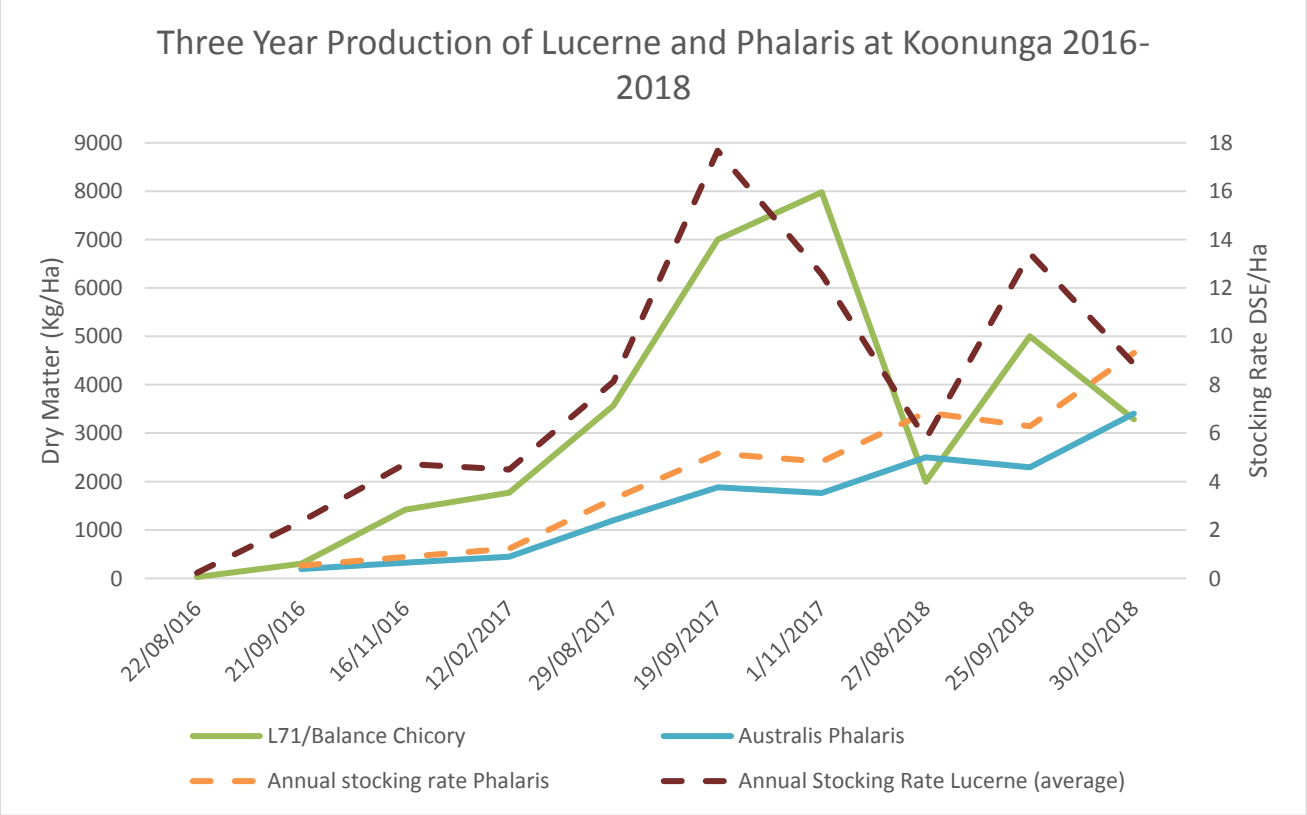

Figure 8: Lucerne varieties and blends at Koonunga produced the greatest amount of dry matter per hectare across three years of monitoring at the Koonunga site. When compared with the greatest performing perennial grass, Australis Phalaris, the lucerne production increased the annual stocking rate by an average of 4, with peaks in spring of increases up to 12 DSE per hectare.

The summer production of lucerne remained above 1000 kg of dry matter resulting in a summer stocking rate above 4 DSE per hectare.

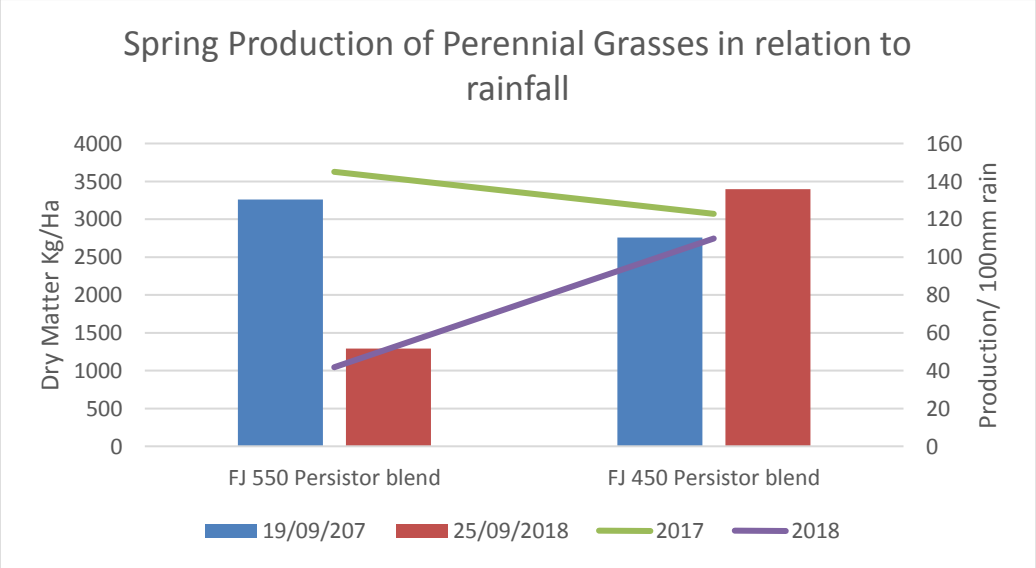

Figure 10: In the average annual rainfall year of 2017 at Koonunga, the Farmer John 550 (millimeters) (FJ 550) Persistor blend produced the greatest amount of dry matter with over 3000 Kg per hectare in spring which resulted in over 140 kilograms of dry matter per 100mm rainfall. However, in the below average rainfall year of 2018, FJ 550 produced the lowest amount of dry matter with just above 1000 kilograms of dry matter and a total of 40 kilograms of dry matter per 100mm rainfall which is 100 kilograms less than that produced in 2017. In comparison, the Farmer John 450 (millimetre) (FJ 450) Persistor blend produced the greatest amount of dry matter in 2018 at 3300 kg of dry matter, which is the same amount as the FJ 550 blend produced in 2017. The total dry matter production per 100mm of rainfall between 2017 and 2018 was marginal with a total of 110 kilograms of dry matter per 100mm rainfall in 2017 and 120 kilograms of dry matter per 100mm rainfall in 2018.

4.2.6 Sowing rate

A comparison of four different seeding rates of Coopers Hay and Silage Mix, which is a mix of early and late maturing ryegrasses, demonstrated the importance of a correct seeding rate.

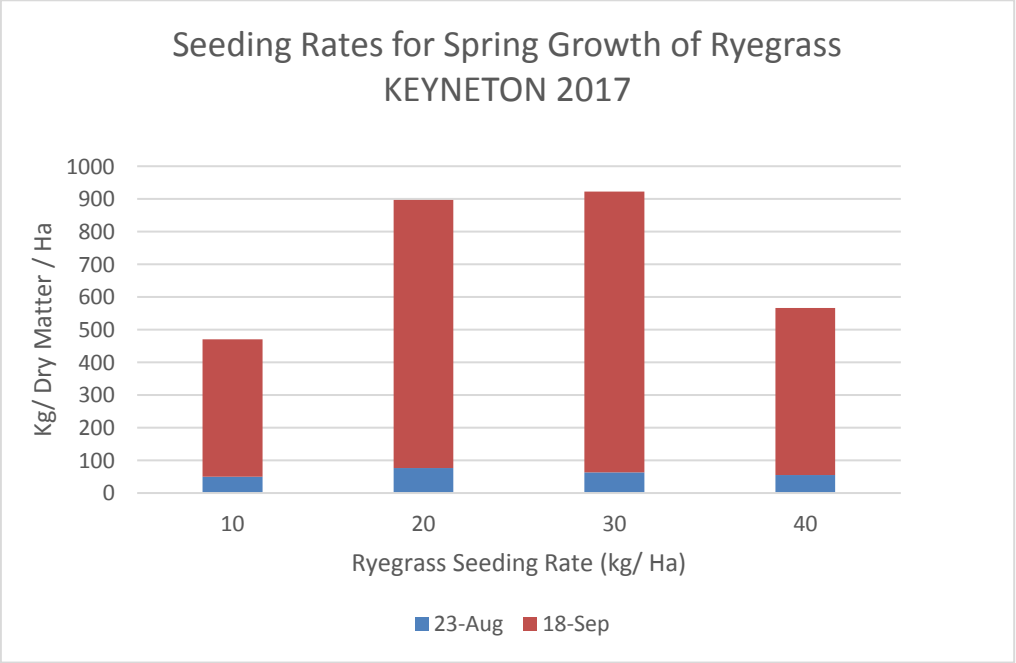

Figure 11: In 2017 at Keyneton, the most spring dry matter was produced in the 30 kg/Ha plots producing 923 kg of dry matter per hectare. The 20kg plot produced only slightly less with 898 kg of Dry Matter per hectare produced. As expected, due to the low number of seeds, seeding at a low rate (10 kg/Ha) reduced the total dry matter production by 400 kg of Dry Matter per hectare. In addition, seeding at a high rate (40kg/Ha) also reduced the dry matter production by 350 kg Dry Matter per hectare.

4.3 Minor Sites

Thirteen minor sites were developed in 2017 and 2018. These sites demonstrated how different producers were filling their seasonal feed gaps using a range of different pasture varieties observed in the major demonstration sites. In addition, where available, they provided the opportunity to measure livestock production which the major sites did not allow.

The full case studies are available on the BIGG website.

Table 2: Minor site producers and increases in pasture and animal production across 2017 and 2018.

Sub-region	Minor Site	Variety	Pasture Use	Pasture production (Kg DM/100mm rainfall)	Animal Production whilst grazing pasture	Production Value ($)
Lyndoch	Site 1	Early Moby Barley	Ewes with lambs at foot	2398	300g/hd/day liveweight (lambs)	$0.81* per head per day $603 per ha
Keyneton	Site 1	Forage Brassica	Merino ewe hoggets	925	Increased 500g liveweight /head and increased 300g/hd fleece weight compared with 'control' once ewes were removed from the pasture	$13.50 * per head increase liveweight $6** per head wool $324 per ha
Keyneton	Site 2	Annual Ryegrasses	Merino ewes	1543	0.3 DSE/ha annual	$18*** GM per ha
Keyneton	Site 3	Native Grass Pastures	Merino ewes-lambing	333	250g/hd/day liveweight (lambs) 115% lamb marking	$0.67* per head per day $44 per hectare
Eden Valley	Site 1	Perennial Grasses and correct grazing	Weaning calves	2000	25 DSE/ha	$1000^ GM per ha
Keyneton	Site 4	Lucerne	Cattle		3.5 (increased stocking rate) DSE/Ha	$140^ GM per ha
Eden Valley	Site 2	Perennial Grasses	Cattle	1500		
Eden Valley	Site 3	Perennial in a vineyard	Merino ewes-lambing		290g/hd/day liveweight (lambs)	$401 increase per hectare
Eudunda	Site 1	Alternative feed opportunities				
Moculta/Keyneton	Site 1	Poly Culture	Merino Rams	1000	455g/hd/day (rams)	$1.20* per head per day $75 per hectare

Eden Valley	Site 4	Annual Ryegrasses and Clover		2700		
Eden Valley	Site 5	Annual Ryegrass and clovers		1016		
Koonunga	Site 1	Lucerne, perennial grasses and chicory	Goats	1300		

- * Lamb valued at 600c/kg cwt
- ** Wool valued at 2000c/kg
- *** Average Gross Margin of $60/DSE sheep enterprise
- ^ Average Gross Margin of $40/DSE cattle enterprise

Table 2 is a comparative table of the different pasture results achieved across the different minor demonstration sites. Pasture production figures are measured in Kg of dry matter per 100 mm of growing season rainfall to compare overall pasture production. Livestock production figures show the response created by the different pasture varieties however due to the different nature of the production systems cannot be compared against each other and are for demonstration purposes only.

4.4 Outputs

Table 3: Total Area and number of livestock for core and observers

	Number of producers surveyed	**Area Managed (ha)**	**Beef Breeders**	**Cattle turn off**	**Total No. Cattle**	**Number ewes**	**Lamb Turnoff**	**Total No. Sheep**	**Total No. Goats**
Core	16	20,250	1445	550	1995	4800	12,950	7,960	200
Observer	163	38,425	1030	1295	2884	23,108	19,374	40,731	163

In total the area under management of core producers was a significant portion of the available Barossa grazing land with a total of 20,250 hectares. The project covered producers managing cattle, sheep and goats. In addition, the total area under management of the observer producers who attended the extension activities was over 38,400 hectares with a large proportion of sheep and cattle.

4.4.1 Extension Activities

Table 4: Total number of extension and adoption events delivered in conjunction with the project

Events	2016	2017	2018	Total number of observers
Pasture Walks	4	2	3	207
Conference	0	1	1	100

Workshop	1	1	1	75
Webinar	0	3	2	324
Total	7	7	5	706

The Project facilitated a total of 19 extension activities (Appendix 1). The total number of observers as a result of these activities was 706 with 40% of the audience being webinar participants and 20% from pasture walks.

Producer surveys were performed at the events, with two performed in 2016, three in 2017 and another two in 2018. This resulted in a total of 167 producers surveyed as observers. Webinars and the other events were surveyed however due to the different style of reporting required by other funding bodies, are not included in this report.

Results from the surveys delivered in response to this project are reported as follows:

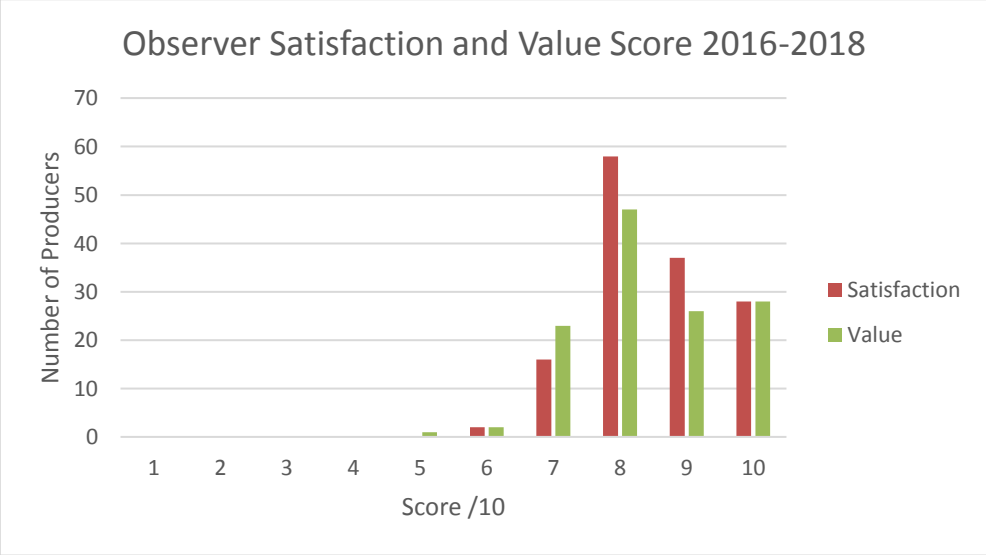

Figure 12: The average satisfaction score was 8.5 across the three years of the project, this was consistent across the years. The average value score was also 8.5.

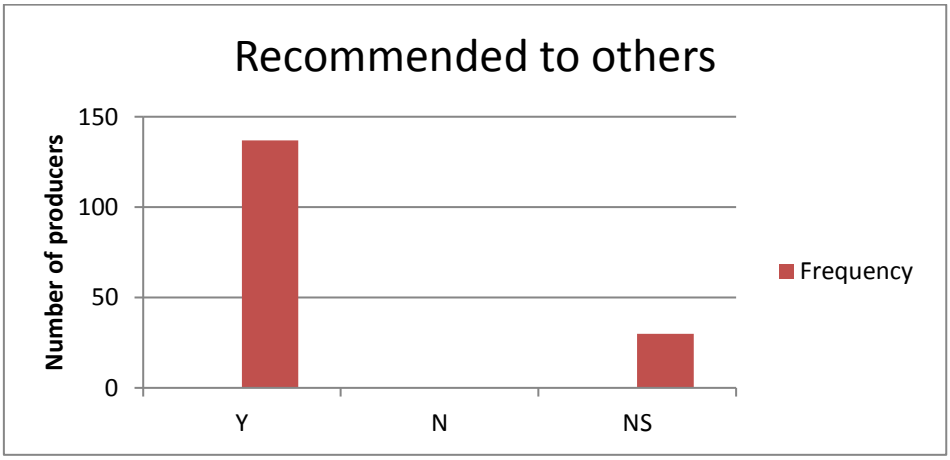

Figure 13: Over three quarters of the producers who attended the events, 137 producers, would recommend the event to others. Thirty producers did not fill out this section of the survey.

4.4.2 Communication Outputs

Communication outputs provided practical information in the form of project updates, case study stories and the provision on technical advice across a wide variety of avenues.

Table 5: Total Communication Outputs and audience reached as a result of the outputs

Audience	Outputs	Producers Reached
Internal (BIGG)	24	300
Local	8	23,000
State	14	102,715
National	7	131,700
TOTAL	50	257,715

The Project reached a total of 257,715 producers on an internal (BIGG members), local, state and national level. Different communication avenues were used including e-newsletters, radio, social media, newspapers and media releases and stakeholder newsletters (MLA, Southern Grasslands Association, Natural Resources AMLR and Natural Resources SAMDB) (Appendix 2).

The 'audience' reach was gathered by 'readership' information for newsletters and newspapers, ABC radio audience and membership numbers for the specific groups (eg. BIGG, Southern Grasslands, NRM board).

4.5 Adoption and Practice Change

The project facilitated an increase in producer's knowledge, skills, confidence and adoption in relation to selecting pastures to increase stocking rate and measuring soil and pastures.

The information was gathered as a result of pre and post survey results for core producers when they entered the project and for observers at extension events.

In addition to these surveys a phone interview was conducted with the two agronomists who worked within the project to gauge adoption on a regional level. These results are reported within the discussion in relation to the particular varieties.

4.5.1 Knowledge Skills and Confidence

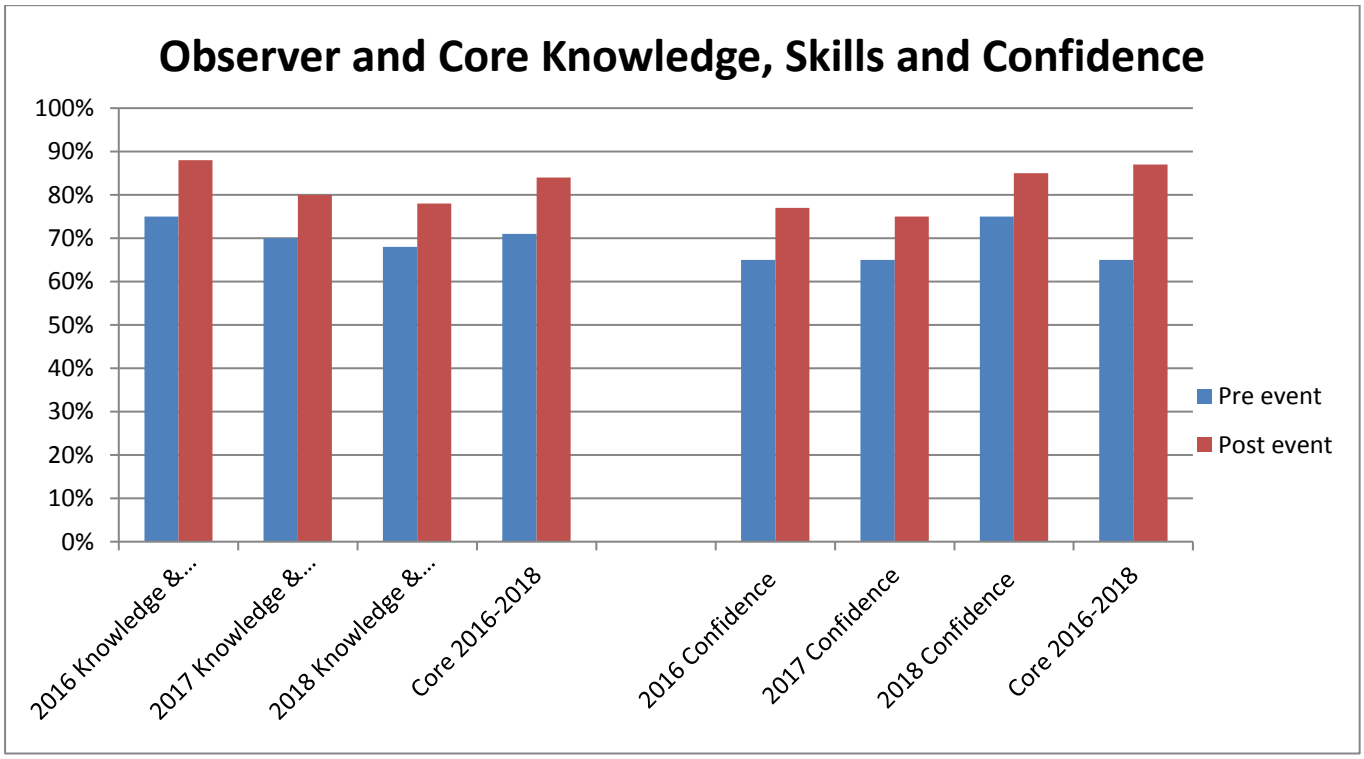

Figure 14: The project facilitated an increase in the knowledge, skills and confidence in observers each years as judged by the pre and post event surveys. The average increase of knowledge and skills for observers was 10% per year and the average increase in confidence was 11% each year. The average increase of knowledge and skills for core was 10% and the increase in confidence was 22%

4.5.2 Adoption Rate

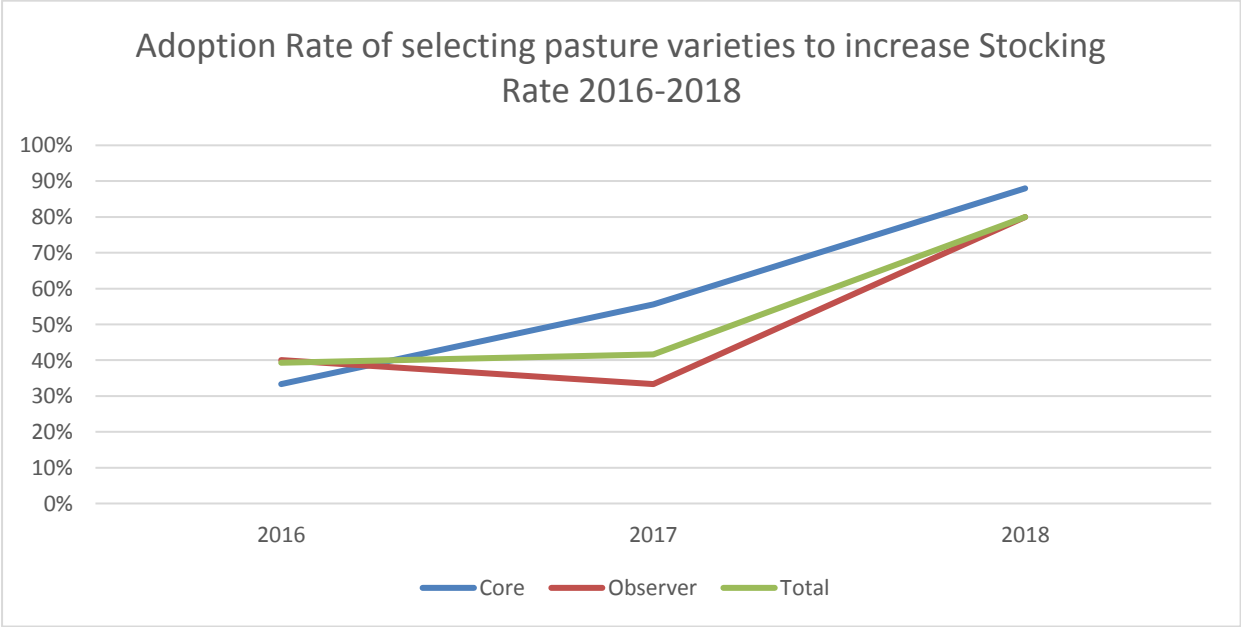

Figure 15: Over 80% of core producers adopted the use of new pasture varieties to increase stocking rates as a result of the project. In addition, the 'intention to adopt' of the observers was 80%. There was a slight decrease, as a result of 6 new core producers being included in the project, in the core adoption rate in 2017, however this was rectified in 2018 in response to the MER.

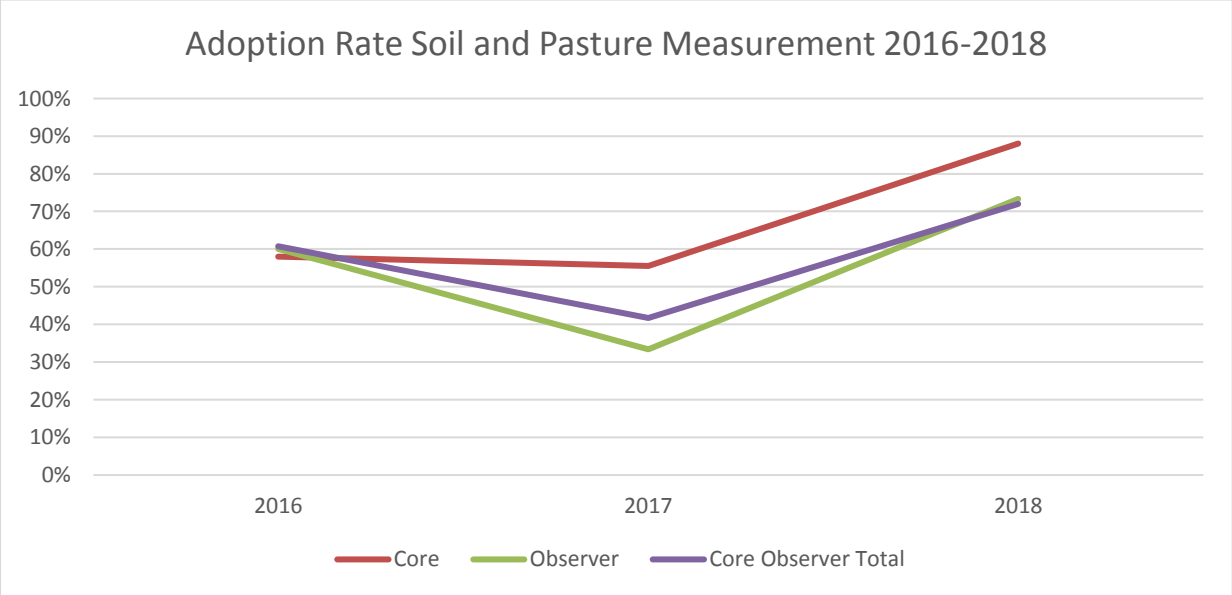

Figure 16: Over the three years of the project, over 80% of core producers adopted soil and pasture measurement and 72% of observers 'intended to adopt' soil and pasture measurement

5 Discussion

5.1 Creating Opportunities and Managing Risk

To maximise pasture production in a variable climate, producers must have a range of pasture species across their property to provide flexibility, creating opportunities when it does rain and spreading the risk if the season is unfavourable. By targeting the pasture variety or species to fill the feed gap created by the seasonal conditions, producers can even out the pasture production curve (Fig 2.) which will maintain or at times increase the stocking rate.

5.1.1 Filling the winter feed gap

The majority of Barossa producers lamb through winter. The winter feed gap, which results from low soil temperature and reduced sunlight hours, can create difficulties for producers in providing adequate nutrition for ewes in late pregnancy and lambing and for maintaining lamb growth rates.

There are opportunities to fill the winter feed gap in the following ways:

- The use of forage cereal varieties which germinate and produce early vigour in cold conditions such as Dictator II barley and Bison tricitale, can produce an average of 600 kg of dry matter per hectare more than the other forage cereal varieties through 70

days of winter (Fig 4.). Due to this early start they continue to produce above average quantity of dry matter per hectare through spring.

- Early maturing forage varieties, such as Moby Barley grow vigorously in winter and have the potential to increase the annual stocking rate by up to 4 DSE when compared with Tetrone Ryegrass (Fig 3.) which has traditionally been used in the Barossa.
- The use Moby Barley allows producers to provide high quality pasture for lambing ewes and maintain lamb growth rates through winter. This was demonstrated Lyndoch - Site 1 (minor site) in 2017 where xbred lambs grew at 300 grams per head per day as result of grazing a Moby Barley pasture. This allowed lambs to be sold three weeks earlier than traditionally.
- In addition to filling the winter feed gap, these forage varieties provide an opportunity to reach greater production levels through fodder conservation options in the form of hay, silage or a standing crop.
- Grazing of vineyards, which are predominant in the Barossa area, through winter periods, when the vines are dormant, can maintain merino lamb growth rates targets of 290 grams per head per day (Table 2). At these growth rates, the winter grazing adds an additional $401 gross income per hectare which is additional to the grape crop which is harvested. Recommended perennial pasture varieties include fescue and perennial ryegrass which are persistent and help to maintain ground cover. The grazing also allows a reduction in chemicals, less soil compaction caused by tractors and beneficial manure added to the vineyard system.

Due to the increasingly late breaks, as seen in 2017 and 2018, and the results from ‘the project’ producers are beginning to adopt the use of these earlier maturing varieties. In 2019, 4 producers are sowing Moby Barley, who have previously not used it before, to fill the winter feed gap and another three are using triticale varieties.

Adoption of grazing in vineyards is increasing throughout the Barossa as producers see the value. Eight attendees to the Koonunga pasture walk, who attended each consecutive year were vignerons who were interested in finding pastures which could be grazed and added value to their vineyards. In addition, three members of the Barossa Lifetime Ewe Group, which evolved as a result of this project were vignerons who were also running sheep. The biggest barrier to adoption is the lack of knowledge and skills involved with a livestock system and lack of infrastructure which could be followed up with a new BIGG project.

5.1.2 Optimising spring rainfall

Pasture growth rates are highest through spring in the Barossa as a result of the available soil moisture and higher soil temperatures. Variable climates have resulted in much ‘shorter’ springs which make it even more imperative to make the most of this growing season to maximise the opportunities it will provide.

To achieve this, the use of different pasture varieties and blends will add flexibility to the system and optimise spring rainfall opportunities in the following ways:

- Forage cereals and ryegrasses grown through spring, can be conserved in the form of hay, silage or a standing crop to fill the summer feed gap. This additional flexibility has been demonstrated to fill a summer feed gap for 97 days (Lyndoch – Site 1) with Moby Barley and 62 days (Keyneton – Site 2) with an annual ryegrass blend. Through the two years of the project, 15 producers have adopted the use of forage cereals including Mulgara Oats, Caspar Oats and Dictator II Barley.
- The addition of ryegrass varieties such as Vortex or Arnie to a forage cereal variety such as Genie Oats at seeding, will increase the annual stocking rate by 2DSE/Ha (Fig. 5). The addition of ryegrass will also increase the quality of the pasture (Table 1) which allows increased production for livestock grazing the pasture. This was one of the main points adopted by the group of 20 NSW producers who attended the BIGG pasture walk in Spring 2017.
- Sowing a blend of different ryegrass varieties such as tetila (mid), arnie (mid-late) and vortex (late) capitalise on late spring rainfall events, or available soil moisture to produce dry matter through October and November. Eden Valley – Site 4 demonstrated the use of these varieties can provide an annual stocking rate of 7 DSE/Ha for grazing and add another 7DSE/Ha if the pasture is turned into silage. The use of a later maturity ryegrass within a pasture mix can also provide the opportunity for grazing once the hay crop has been removed, which can increase the annual stocking rate by 4.6 DSE/Ha, compared with a mid-season tetila ryegrass pasture (Keyneton – Site 2 See Table 2). At least two producers have changed their management system to include these varieties into their system as a result of the project.

- Including late maturing arrow leaf clovers such as Zulu II Arrowleaf has the potential to maximise on late spring rainfall opportunities to increase the annual stocking rate by 18DSE/Ha (Fig. 7). This will extend the number of grazing days by filling the late spring feed gap which occurs after other clover varieties such as Vista Balansa decrease production. Due to these results this variety has now been included in the 'Coopers (Mt Pleasant) annual clover blend'.

- Sowing rates are critical to the establishment of pasture growth rates of annual ryegrass. The Keyneton site (Fig.11) demonstrated that at seeding rates of 20 and 30 kg of ryegrass produced the greatest amount of dry matter per Hectare. In comparison, lower rates of 10, and higher rates of 40 reduced the growth rate and the kg of dry matter produced. This produces cost savings for producers when purchasing seed and is demonstrated by local agronomists to producers when purchasing seed.

5.1.3 Filling the summer feed gap

The summer feed gap is traditionally the most difficult feed gap to fill on account of the lower soil moisture and high temperatures. Opportunities to fill this feed gap help to maintain core breeding stocking rates, improve weaner growth rates and reduce the cost of supplementary feeding.

The use of stored soil moisture to provide conservation of spring surplus feed has already been discussed, however there are further opportunities to help fill this critical summer feed gap:

- In years of high spring rainfall, summer forage crops such as brassicas or sorghum provide an opportunity to utilise stored soil moisture to turn into pasture production to fill a summer feed gap. Keyneton- Site 1 demonstrated the ability to increase the annual stocking rate by 3 DSE/ha through summer using forage brassicas. The use of the high-quality pasture resulted in increased production with ewe hoggets weighing 500 grams liveweight and 200 grams fleece weight above the remainder of the mob who did not graze the pasture. Five producers have tried to adopt the use of brassicas as summer forages, however the 2018 and 2019 summers led to very poor establishment demonstrating the importance of having stored soil moisture prior to sowing.
- The use of summer active lucerne will maintain annual stocking rates, even in years of below average annual rainfall. The Koonunga site demonstrated that lucerne produced the greatest amount of dry matter per hectare per 100mm rainfall across all three years of the demonstration site (Fig. 8). This allows producers to maintain a stocking rate of 4 DSE/Ha (Fig. 9) through summer and up to 12 in spring. This was demonstrated at Keyneton – Site 4 with lucerne variety L56 providing a stocking rate of 3.5DSE/Ha through summer.
- As a result of this information being delivered at the BIGG conference in 2017, Koonunga – Site 1 sowed a lucerne pasture in 2018, and produced 1300kg of dry matter per 100mm of rainfall (Table 2).
- Perennial grasses will also maintain a summer stocking rate up to a stocking rate of 5DSE/Ha (Fig 8.) in average and below average rainfall years. The added flexibility of perennial grasses is the opportunity to cut for hay which can add value to the system and provide summer feed as demonstrated at Eden Valley – Site 2 (SeeTable 2). In addition, they maintained over 90% ground cover which is particularly important in drier years when wind erosion can be significant.
- Grazing management plays a huge role in managing perennial grasses through summer. Strict grazing management following the 'pasture principles' guidelines allowed Eden Valley – Site 1 to maintain an annual stocking rate of 25DSE/Ha (See Table 2) and provided a high-quality summer pasture to wean calves onto. These results encouraged the development of the Barossa-Mid North Pasture Principles Group which ran from 2018-2019.
- Perennial pasture establishment is much riskier due to the extended lifespan of the pasture so ensuring that the pasture matches the rainfall requirements is critical. In areas of low rainfall this is particularly important to ensure that the maximum pasture production is reached in the drier years when there is a lower potential for pasture growth. In the dry conditions of 2018, the Farmer Johns 450mm rainfall perennial blend produced 120 kg of dry matter per 100mm or rainfall. In comparison, the FJ 550mm rainfall perennial blend only produced 40 kg of dry matter per 100mm (Fig. 10).

Due to the poor seasonal conditions of 2017 and 2018, there has been no perennial pasture establishment throughout the Barossa Valley with producers favouring the faster annual feed opportunities provided by forage cereals and ryegrasses.

5.2 Delivery of Objectives

The project delivered on all objective and provided an opportunity to demonstrate the success of the project.

5.2.1 Demonstrate the productive and economic performance of a range of pasture types to improve annual feed production, total grazing days and feed quality in a variable climate on at least 15 sheep and/or cattle properties.

The major and minor sites have provided the opportunity to demonstrate the productive performance of 7 pasture types and over 100 pasture varieties on a total of 16 sheep and/or cattle properties across three very different seasonal conditions.

The productive performance at the major sites was measured throughout the three years in the form of dry matter production which was converted in annual stocking rate changes. Feed quality was also measured throughout the years to compare the varieties.

The highlight of the project was the minor sites which provided the opportunity for producers to learn and measure their own production system, increase their skills and share this information with their peers. These sites measured the productive and economic performance of their pasture varieties (Table 2) demonstrating the good decisions they made and the decisions which they could improve on for the following year.

The three different seasonal conditions created varied feed gaps across the region allowing a great opportunity for the pasture varieties to respond and demonstrate the traits which allow them to fill these feed gaps and maximise pasture production.

Although some economic information was included in the minor sites, a complete economic analysis would add significant value to the production information which were taken from particularly the major and some of the minor sites. This would allow comparisons to be made including the variable costs of pasture establishment, seed costs, weed control measures, fertilisers and machinery costs.

The overall aim of the project was to include these measures, however due to the significant amount of data already gleaned from the project, there was not enough time or funds to achieve this component to the full extent.

5.2.2 Perform a comparative assessment of pasture productivity across four different climates and soil types within the Barossa to understand if the results differ between Barossa sub-regions.

The three major sites represented key Barossa climates and soil types in Koonunga (500mm rainfall, red-brown earth), Keyneton (400-500mm, red loam over clay) and Eden Valley (600mm, sandy loam over clay). They provided the opportunity to learn how different pasture varieties respond within the sub-regions, however due to the scale of the sites, there was not the opportunity to plant comparative species at all sites.

Minor sites were located across the Barossa area. They were chosen in respect to the pasture variety and willingness of the landholder rather than direct location. This resulted in the sub regions of Eden Valley and Keyneton being perhaps over represented compared with Koonunga and Lyndoch (Table 2).

As a result, the location of sites and the difference in pasture varieties at each site, were not varied enough to provide a comparative assessment of pasture productivity however the results did highlight the key role that rainfall plays in pasture productivity. This was significantly helped by linking information with the BIGG soil moisture probes, which validated pasture production through available soil moisture, rainfall and soil temperature measurements.

5.2.3 Conduct extension activities including pasture walks, field days, a bus tour, webinar series and video to showcase the results and encourage adoption by producers.

The project conducted 19 extension activities including 9 pasture walks, 2 conferences, 3 workshops, 5 webinars, a video and a case study booklet to showcase the results (Table 4). These activities were extremely successful with a total of 706 producers attending over the three- year project and just under 100% recommending the event to others.

The extension activities provide a very important avenue for increasing awareness and adoption and were highly valued by producers with an average value score of 8.5 and an average satisfaction score of 8.5 (Fig 12).

By the end of the project, 80% of core producers were adopting new pasture varieties to increase stocking rates (Fig.15) with a further 80% of observers 'intending to implement'. Also, 80% of core producers indicated they were adopting soil and pasture measurement (Fig. 16), with a further 72% or observers 'intending to implement' these practices.

In addition to these results taken from the pre and post surveys, interviews of two local agronomists demonstrated that over 20 producers were sowing new pasture varieties to fill seasonal feed gaps.

The key success factors for these scores were:

- Events provided both a technical aspect with technical presenters but also the opportunity for producers to learn 'from producers' which is a very successful method of knowledge transfer within the farming industries. They were also seasonal, timely and relevant as directed by the advisory committee.
- Targeting short pasture walks to areas to locals could 'pop in' to the event without having to travel far and learn about their local pastures.
- A range and flexibility of events catering to different learning opportunities including large half day conferences, smaller practical half day workshop, inexpensive pasture walks and webinars which can be viewed from home.
- Events provided an interface for seed distributors, agronomists and local rural businesses to interact with producers in a group atmosphere, which provided significant benefits to all in the form of knowledge transfer and in building relationships.
- Provided the opportunity for producers to come together, network and be social, which has huge community welfare benefits, particularly in the past year which has been extremely difficult has been invaluable.
- The project leveraged an additional $36,000 in-kind to help deliver the extension activities from other industry and government funding bodies. This included two Natural Resource Management Boards, rural businesses and local businesses such as the Vet Clinic and Penrice Quarries. This provided the opportunity to deliver the webinar series and to 'value-

add' to the conferences and workshops ensuring producers could get the most value possible from attending the events.
- Where possible, pasture walks visited a range of project sites including sites from other BIGG project to add value to the event and facilitate learning opportunities.
- As a result of the project a group of 15 producers visited a pasture walk in 2017 from the Cranbury Landcare Group in NSW which provided huge networking and sharing opportunities for everyone.

Some of the expected activities such as the bus trip and the field trips did not occur as a result of time constraints and opportunities. However, with so many successful events being delivered, this was of little significance to the overall project outcomes.

5.2.4 Upskill at least 60 producers in the use of pasture monitoring techniques.

The project directly upskilled a total of 40 producers in the use of pasture monitoring techniques. This included core and observer producers.

The 16 core producers monitored their pastures directly using the MLA pasture ruler, ground cover measurements and feed quality testing (FeedTest) throughout the monitoring periods.

Pasture monitoring techniques were demonstrated at the 7 pasture walks. The average increase of knowledge and skills for observers was 10% per year and the average increase in confidence was 11% each year. The average increase of knowledge and skills for core producers was 10% and the increase in confidence was 22% (Figure 14).

The project also helped to encourage the development of three new groups totalling 15 producers who undertook further learning opportunities which increased their knowledge in pasture monitoring techniques in the form of:

- 'Barossa Lifetime Ewe' Group- producers who undertook the Lifetime Ewe Program, 2016
- Barossa- Mid North Lamb Survival Workshop (Lifting Lamb Survival Workshop), 2018
- Pasture Principles Program 2018

In addition, the use of pasture monitoring techniques such as measuring feed quantity and quality was regularly communicated through the communication networks to over 257,000 producers (Table 5) which facilitates awareness of the importance of pasture monitoring.

5.2.5 Increase the awareness of pasture species options and productivity implications to at least 250 producers within the region.

The communication plan developed over 50 outputs across the three years of the project with information which increased producer's awareness of pasture species options and productivity implications.

Of these 50 outputs, 24 were internal to the 300 BIGG membership which is predominantly producers based. Another 8 outputs were delivered locally, within the region, which increased awareness of pasture species options and productivity implications to 23,000 people (Table 5).

The remainder of the outputs were delivered on a state-wide or national level with over 230,000 people reached through a variety of different outputs including written case studies, major site demonstration results, ABC radio interviews and technical articles for industry newsletters.

The use of case studies was extremely successful in helping to demonstrate pasture species options and productivity implications as they provided 'peer' learning for other producers whilst still providing technical information. This mix makes them attractive to media outlets where they can both be reproduced directly or changed slightly with very little additional input.

The in-kind time provided by the minor site producers through the media outlet interview process was significant however due to the large number of core producers, the 'load' could be spread reasonably effectively.

The seasonal variability (Fig. 1) of the three years the project was delivered across also helped to increase producer's awareness of different pasture varieties which may help their systems. In more difficult seasons, producers are looking for information to help them improve their system and to help them become more resilient. This created a demand for information that the project could help to fill. The tough seasonal conditions also helped to demonstrate systems that were still performing well, even with very little rainfall.

6 Conclusions/recommendations

6.1 Conclusion

The project, through the demonstrations at major and minor sites showed that there are a huge range of pasture variety options available to maximise pasture production. Prior to any new pasture program, producers must first identify their feed gaps, by determining their current feed on offer, livestock numbers and classes and relating this to the soil moisture, soil temperature and seasonal forecasts. Once identified, the opportunities to maximise pasture production can be achieved through matching pasture varieties and their growth habits such as maturity, as well as rainfall and soil requirements, seasonality and quality to fill the feed gaps.

It has been demonstrated that these production increases can even be achieved in years of below average rainfall which provides confidence, motivation and hope across the producer network. The opportunity to observe, learn from industry experts and neighbours, and to plan for the seasons through a range of extension activities and communication outputs led to increased adoption and awareness of the practical applications which can be utilised to maximise pasture production across the Barossa Valley and southern Australia.

6.2 Recommendations

6.2.1 Future Research and Development

The project highlighted the importance of having a variety of different pasture varieties, with differing maturities, growth habits, seasonality and rainfall requirements. As such, particularly as a result of the more variable climate, it is critical that research and development on a national level within government organisations and private seed companies continues focusing on the following:

- Earlier maturing forage cereal varieties which establish in cold conditions
- Ryegrasses and legumes which provide high quality feed in cold conditions
- Annual varieties which provide a range of early, mid and late maturity
- Forage cereals which recovery quickly after grazing and produce a high quality hay or silage
- Perennial varieties which establish and thrive in low rainfall environments

To help facilitate this, the project has provided linkages for BIGG with SARDI with the aim to develop a lucerne trial site in the area, when there is a favourable season.

A further research and development project opportunity for BIGG it to determine how blends of pasture varieties can not only increase number of grazing days and livestock production but also improve soil health. The addition of soil health measurements and researching varieties which can improve all three aspects of grazing businesses could significantly improve the resilience of the grazing system.

Within the 'BIGG' scope, the project has highlighted the importance of benchmarking and the need for further opportunities to be developed for producers to capture economic information to perform an economic analysis of their pasture production. The opportunity to develop this will provide further opportunities to not only validate producer's information but also to encourage adoption of pasture renovation and new establishment opportunities.

The obvious extension to this project is to demonstrate and validate how grazing can be used to increase annual dry matter production. Correct grazing and maintaining pastures within a vegetative, rather than reproductive, stage will provide significant gains in pasture production. This can be achieved locally via a 'Pasture Principles' workshop, by establishing grazing 'champions' or further work with funding bodies.

6.2.2 Practical Application of the Project's Insights and Implications for the red meat industry

The three years of the project have demonstrated the hugely variable conditions that grazing businesses are dealing with. The variability creates huge implications for not only the producer having to manage different feed gaps, but also the red meat industry with issues such as available supply and increasing cost of production.

There is the opportunity for large scale practical application of the lessons from this project which will increase production for the red meat industry by demonstrating the key messages from the project as follows:

- It is possible to increase pasture production just by choosing the right variety to fit within the grazing system. Supporting producers to try new pasture varieties or blends to fill their identified feed gaps will increase their production system and allow them to either increase stocking rate or maintain it for longer periods of time. In some cases, simply changing to a different variety of one species, such as adding in a later maturing Vortex ryegrass to an annual ryegrass blend, can increase the annual stocking rate by 3-4 DSE/Ha.

- Even in very dry times, with half of the annual average rainfall, there are pastures such as annual ryegrass blends, perennial grass blends of phalaris and cocksfoot and lucerne varieties (L71) that can maintain annual stocking rates and provide production increases.
- Maximising every little bit of rainfall and turning it into pasture can be achieved by improved pasture selection, correct seeding rate and having a flexible system which can change in response to the season.

The project also demonstrated insights into how producer's value learning opportunities which increase adoption of new ideas as follows:

- Producers value learning from each other and this has an impact on adoption. This must be delivered in a positive message, and with evidenced based measurement to back up the information.
- Providing demonstration sites within producers own 'backyards' with local information, related to their own environment and seasonal conditions. The benefit of being able to drive past the pasture demonstration sites was invaluable, particularly in the dry conditions to be able to see some green pastures sparked interest and provoked conversation.
- Incorporating many different learning opportunities including practical pasture walks and workshops, informative webinars which are accessible to all, case studies backed up by quantitative measurements and general 'good news' stories in the media and newsletter provided the opportunity for the all producers to become aware of the project.
- The interstate opportunities were invaluable to the project particularly with the webinars and pasture walk visit with the group from New South Wales. This provided valuable learning opportunities for both groups, established networks and gave the local producers something to be proud of when sharing their demonstration sites.

These small insights significantly helped with the learning opportunities provided by the project which can be very simply included into red meat industry adoption events.

6.2.3 Development and adoption activities which ensure the red meat industry achieves full value from the projects findings.

The project will continue to provide development and adoption activities into the future to ensure the red meat industry achieves full value from the project.

The two remaining 'major' demonstration sites at Koonunga and Mt Pleasant will continue with both sites developing a plan to include new varieties in 2019. The initial 'start-up' investment and motivation provided by the project to the project partners, Coopers Farm Supplies and Farmer Johns, has led to these sites continuing to provide significant local pasture variety information to landholders. The pasture walks will also continue to be led by the respective companies with support from BIGG.

Information and the findings from the Project continue to flow even after the official completion of the project:

- Project information including webinars, the case study booklet and video are available on the BIGG website and continue to be accessed.

- MLA Feedback Magazine have written 6 articles about the project and the case studies and will be included in print copies throughout the year.
- A case study presentation will be delivered as part of the MLA speaker spot at the GSSA Conference in July 2019.

The project cemented relationships formed between BIGG and the seed companies, Pasture Genetics, Heritage Seeds and the rural businesses Coopers Farm Supplies and Farmer Johns. These relationships have been mutually beneficial for all groups by providing networking and learning opportunities which support the local landholders in their pasture and soil management.

The information from the demonstration sites and the 'producer' interface provided by the project for the seed companies allows information to flow from the 'ground up' to the developers and researchers. This information helps to impact pasture variety selections and plant breeding and will continue as a result of the project. In addition, both agronomists that supported the PDS continue to use the results from the major sites to educate their clients individually when they develop seeding programs.

The PDS project has provided an opportunity for BIGG to work closely with MLA which has been very important for BIGG. The support provided by this project has not only helped the local landholders and industry, as detailed in this report, but has also helped to encourage further in-kind funding from stakeholders to value add to the project in the form of webinars, co-funding events and extension of communication activities. It also helped to place BIGG in a position to grow in terms of networks and opportunities which has allowed it to become an independent incorporated body. This change will allow BIGG to continue to provide support and opportunities for all landholders to help them improve their grazing businesses.

7 Appendix

7.1 Extension Activities

2016				In Kind ($)
Pasture Walk	September*	Keyneton	16	500
	October*	Koonunga	16	250
	October*	Eden Valley	10	500
	November	Ag Bureau Visit Keyneton	35	
Workshop	June	Making the Most of It	21	2000
		TOTAL	98	3,250
2017				
Conference	February*	Perfect Pastures	50	10,000
Pasture Walk	September*	Keyneton	25	500
	September*	Koonunga	17	250
Webinar	March	Perfect Pastures	53	1500
	August	Working with the season	59	1500
	October	Matching Pastures with Production	41	1500
Workshop	June*	Climate Variability	22	2000
		TOTAL	267	17,250
2018				
Conference	February*	Building Resilience	50	12,000
Pasture Walk	June	Pasture Genetics Visit	43	
	September	Mt Pleasant	25	500
	September	Koonunga	20	250
Webinar	June	Grazing Strategies for a dry winter	51	1500
	December	Case Study on Maximising Pastures	120	
Workshop	October*	Working with the Season	32	2000
		Total	341	16,250
		TOTAL 2016, 2017, 2018	706	36,750

* Denotes events that were monitored via a pre and post survey.

7.2 Communication Activities

		Internal	x 300 Members
2016	1	Initial project info	
	2	BIGG Newsletter Update- Initial Monitoring	
	3	BIGG Newsetter- September	
	4	BIGG Newsletter- October	
	5	BIGG Newsletter- November	
2017	6	Presentation at BIGG conference	
	7	- BIGG newsletter- Article May	
	8	- BIGG newsletter- Case Study article June	
	9	- BIGG newsletter- Case Study article July	

	10	- BIGG newsletter- Case Study August	
	11	- BIGG newsletter- Case Study September	
	12	- BIGG newsletter- Case Study October	
	13	- BIGG newsletter- Case Study November	
2018	14	- Presentation at BIGG conference LINK	
	15	- BIGG newsletter- Picking Pastures for 2018 March	
	16	- BIGG newsletter- Shaun's pasture tips April	
	17	- BIGG newsletter- Koonunga Demo Site May	
	18	- BIGG newsletter- Mt Pleasant Demo Site June	
	19	BIGG newsletter- July	
	20	BIGG newsletter- August	
	21	BIGG newsletter- September	
	22	BIGG newsletter- October	
	23	BIGG newsletter- November	
	24	BIGG newsletter- December	
		Local	x 23,000
2016	1	Project Started	
	2	Koonunga Pasture Walk-Leader	
	3	2017 Perfect Pastures Conference- Leader	
	4	EV Pasture Walk Photos - Leader	
2017	5	The Leader Newspaper- October 2017	
	6	The Leader Newspaper- April 2017 (reprint from newsletter article)	
2108	7	BIGG Conference Success- The Leader- Feb 2018	
	8	The Leader Newspaper- February 2018 x 2 articles	
		State	154715
2016	1	One pager info sheet- Stakeholders	15
	2	Website update to store Project info	500
	3	Stock Journal Project started	52,000
	4	Article- SA MDB The Drift	10,000
	5	ABC country hour radio- pasture walk	20,000
2017	6	ABC country radio- presenting 2016 results	
	7	Stock Journal- 2017 Conference	
	8	Yr 1 Case Study results booklet	50
	9	The Drift- SA Murray Darling Basin NRM webinar article	
	10	AMLR Small Talk Pasture varieties article November 2017	20,000
	11	Presentation at the SA Livestock Consultants Conference	100
2018	12	BIGG conference- ABC rural radio Feb 2018	
	13	The Stock Journal- producer case study	
	14	Major Site Results- 50 copies plus website link.	50
		National	131700
2016	1	Southern Grasslands Association Newsletter Article	1000

2017	2	MLA Friday Feedback webinar recording links- x2	60000
	3	MLA Friday Feedback webinar recording links- October	
	4	Facebook Posts- x 20	200
	5	MLA Friday Feedback webinar recording links- June	
2018	6	Case Study Booklet	500
	7	MLA Feedback Magazine	70000