Producer Demonstration Site

Maximising Pasture Production in a Variable Climate

Demonstration Site Report 2016

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Climate change is creating challenges for grazing business resulting in more variable seasons and pasture growth. The Barossa Improved Grazing Group (BIGG), Coopers of Mt Pleasant and Farmer Johns are working with producers over three years to develop a more reliable feedbase responsive to the changing climate through the Meat & Livestock Australia (MLA) Producer Demonstration Site (PDS) Project.

The aim of the three-year project is to:

- Increase annual pasture dry matter production and total grazing days on 15 properties across four sub-regions in the Barossa and Eastern Mount Lofty Ranges by establishing a feedbase that is optimised for variable rainfall patterns including late breaks, early finishes and out-of-season summer rainfall events

The demonstration sites provide information for the 'major' site component of the MLA PDS Project, with an aim to provide options for producers to consider when developing their own 2017/2018 pasture program.

Background:

In the first year of the three-year project, three of the four major demonstration sites were set up. Sites were located in paddocks representative of the local areas, close to BIGG's soil moisture monitoring probes, with good access and main road frontage, and low residual clover levels (Figure 1). They were developed in direct collaboration with producers, local agronomists and seed merchants, Coopers of Mt Pleasant/ Heritage (Keyneton/ Eden Valley) and Farmer Johns/ Pasture Genetics (Koonunga).

The sites were managed according to best practice land and soil management with soil testing, fertiliser and weed control performed prior and during the growing season. Sites were also fenced off to prevent grazing.

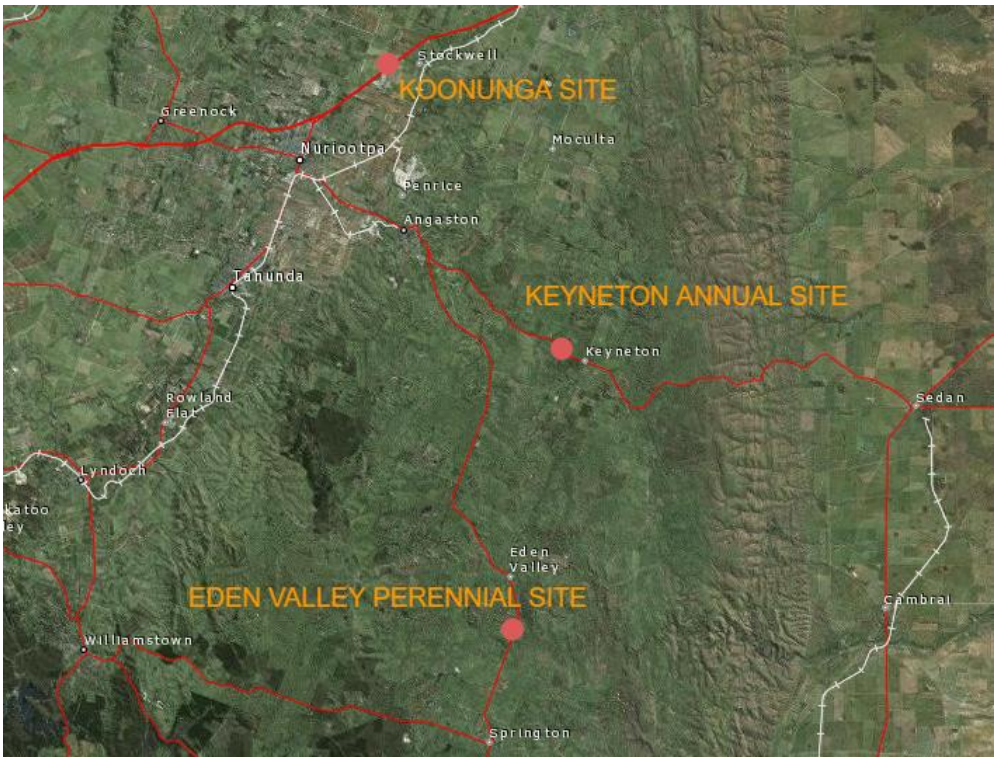

Figure 1: Map of the three 2016 Producer Demonstration sites located in the Barossa Valley

Thankyou must be extended to the producers who have provided their land, time and knowledge towards the outcomes of this Project helping to deliver improved pastures and grazing systems across the local area.

Seasonal Condition 2016:

The 2016 growing season has been the best in the last five years across the district. According to the Bureau Meteorology Annual Climate Summary for South Australia (Thursday 5 January 2017):

- Total rain for South Australia was 63% above average, the fourth-wettest calendar year on record, and the wettest year since 2010, the majority of this fell in the winter, spring and summer.
- Mid-March saw a thunderstorm which dumped 83mm of rain over two days, however, the following April and May were below average rainfall.
- Temperatures varied markedly during 2016, with a warm first half of the year that included the State's fifth-warmest autumn on record, then a near-average winter but a cool spring that included the ninth-coolest September days on record, despite cooler nights during spring, the State's mean minimum for 2016 was equal seventh warmest at 0.73 °C above average.
- South Australia's mean temperature for 2016 was 0.58 °C above average, but after exceptionally warm years, it was the coolest year overall since 2012.

In summary, the 2016 growing season delivered a late break in June, with above average rainfall which resulted in cold, wet conditions through winter where there was very little pasture growth. However, the wet and mild conditions continuing through spring and summer have delivered above average pasture growing conditions.

Key Messages from Year 1 of project:

- Early sowing is imperative before a cold wet winter
- Annual brassicas or turnip varieties can be utilised within a pasture mix for quick, early winter feed opportunity, particularly in colder conditions when other varieties may not be growing.
- Selecting varieties for later maturity will provide increased feed in an above average spring growing season
- The balance of cereal, legume and brassica is a delicate one. Consider complimentary species that balance out the bell curve of feed availability including varieties which produce early feed, later feed and opportunities for silage or hay to provide feed through summer months.
- Perennial species, particularly Lucerne, provide feed throughout the summer months when there is plant available moisture.
- For livestock production, it is important to consider the dry matter and energy percentage of feeds, not just the production potential.

Keyneton Annual Demonstration Site

The Keyneton site is located on a sandy loam soil with a low pH (4.3 in CaCl2) and phosphorus (14ppm Cowell) (Appendix 1). The paddock has been in an annual hay rotation with ryegrass and cereal for the past 3 years and has very little residual clover. Keyneton average annual rainfall is 500mm.

Varieties were chosen on a basis of grazing potential, feed quality potential, and the potential for further opportunity such as hay or silage. Comparisons against newer and the older more traditional varieties used in the local areas were also included.

Varieties have been divided into their individual sections to allow comparisons within and between varieties, rather than being randomly allocated. These include:

- Cereals (oats, triticale, wheat and barley)- 22 varieties
- Ryegrasses (annual ryegrass, Italian ryegrass)- 9 varieties
- Clovers (sub clover and annual clover) – 4 varieties
- Vetch – 4 varieties
- Peas – 2 varieties
- Cereal and ryegrass mix (oats, triticale and barley)- 3 mixes

As a result of the late break which occurred towards the end of May, the site was only sown on 9 June 2016. Plots were 1m x 10m sown using a cone seeder supplied by Heritage Seeds. Prior to sowing, the seeds were weighed to ensure the correct seeding rate (Kg/Ha).

Two weeks after sowing, the site was inspected and found most cereal seeds had been devoured by birds. Therefore, the cereal component of the site was resown on 19 July 2016. The site was subsequently netted to prevent bird access, however this did not completely stop the bird activity and it is estimated that the birds removed 5 percent of the seeds after the second sowing.

Prior to sowing, the site received two complete knockdown herbicide treatment and biosolids were applied in May.

Fertiliser Super Potash + Traces @ 200kg/ha + Urea @ 100kg/ha were applied on 30 September 2016.

The Keyneton site was covered with bird netting to prevent predation of the cereals as a result of the late sowing time.

Measurements were taken on 12 September and 8 November 2016. All plots were measured using 0.1m² quadrant taking three random measurements (plant number, Kilograms or Dry Matter per Hectare (Kg/DM/Ha)) across the plot with the results averaged (except the cereals as documented below). Dry matter was estimated at 15% to determine the dry matter content of the pasture for the September measurement. November dry matters were measured with Feed tests taken on 8 November 2016 when the cereals were just about to go into head.

As a result of the late sowing, measurements were varied because establishment of plants took much longer than anticipated. In addition, the bird damage, and subsequent resowing resulted in a lack of confidence in the results from the cereals. To try and correct this the variance in plant numbers against one of the traditional varieties within each species was measured.

Cereal production measurements (Kg/DM/ha) were taken in the most productive three spots (observed by eye) and then averaged to try and discount the impact of the birds.

Keyneton Seasonal Conditions:

The soil moisture, measured at the Keyneton soil probe, located approximately 1km north east of the site, demonstrates plant available water in the soil profile across the 2016 growing season. Figure 2 indicates that there was low plant available water through the autumn period, however from June through to the end of October, the soil profile has basically been saturated allowing full plant available water for the annual species.

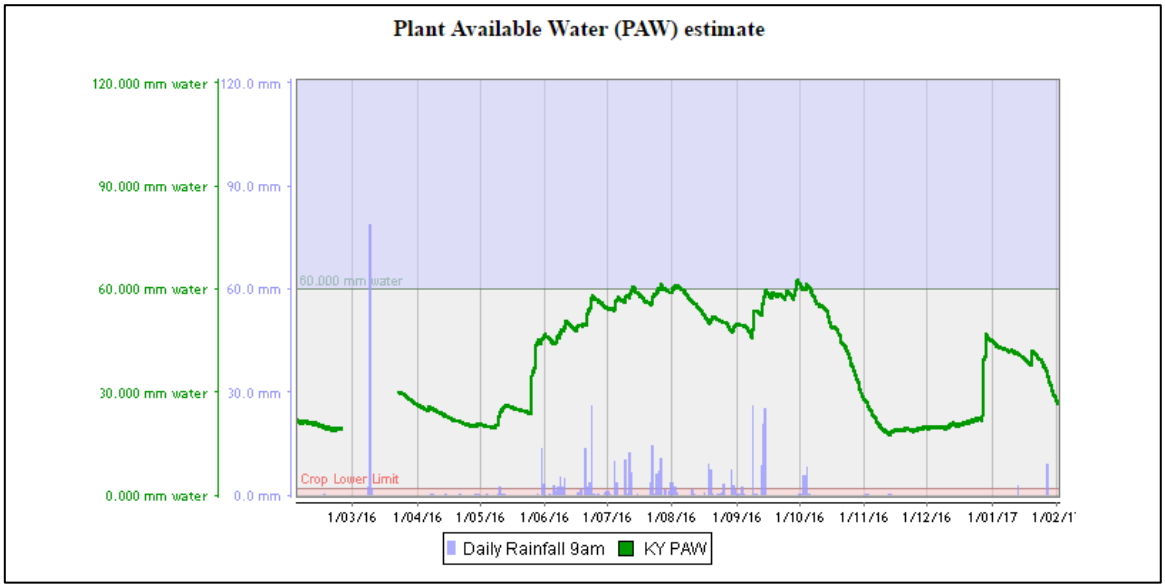

Figure 2: 2016 Plant Available Water (PAW) estimate taken at the Keyneton Soil Moisture Probe Site

Keyneton Results:

Cereals

Considering the late sowing, cold and wet conditions and the predation, the majority of the cereals performed well, which is a result of the excellent spring conditions. Overall, triticale produced the most dry matter per hectare later in the season averaging 12 000 Kg of dry matter per hectare (Figure 3). The oats also performed well averaging just over 8000 kg of dry matter per hectare. In comparison, the average dry matter production of the wheat and barley was less than half of the oats and triticale, which can be explained by the waterlogging and cold conditions and indicates that they may not be suitable to be sown late .

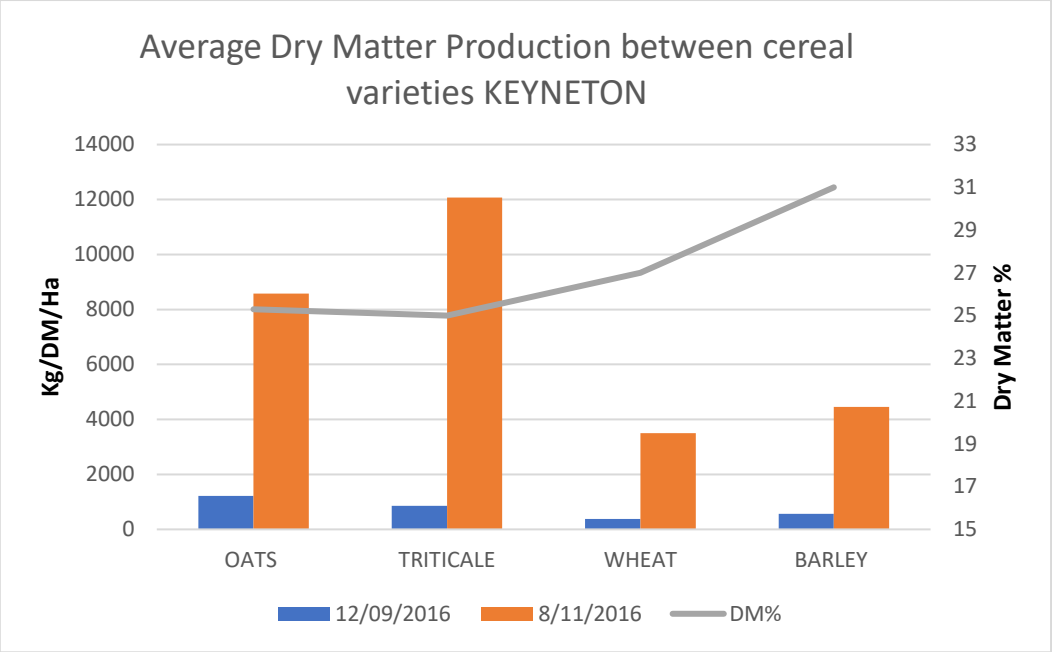

Figure 3: Dry matter production at Keyneton throughout the 2016 growing season

In terms of early production of cereals, oat varieties provided just over 1000kg dry matter/Ha compared to 850 kg dry matter of the averages of triticale (Figure 4). In particular, the oat variety Mammoth performed well producing double the dry matter above the average of all of the cereals combined in September.

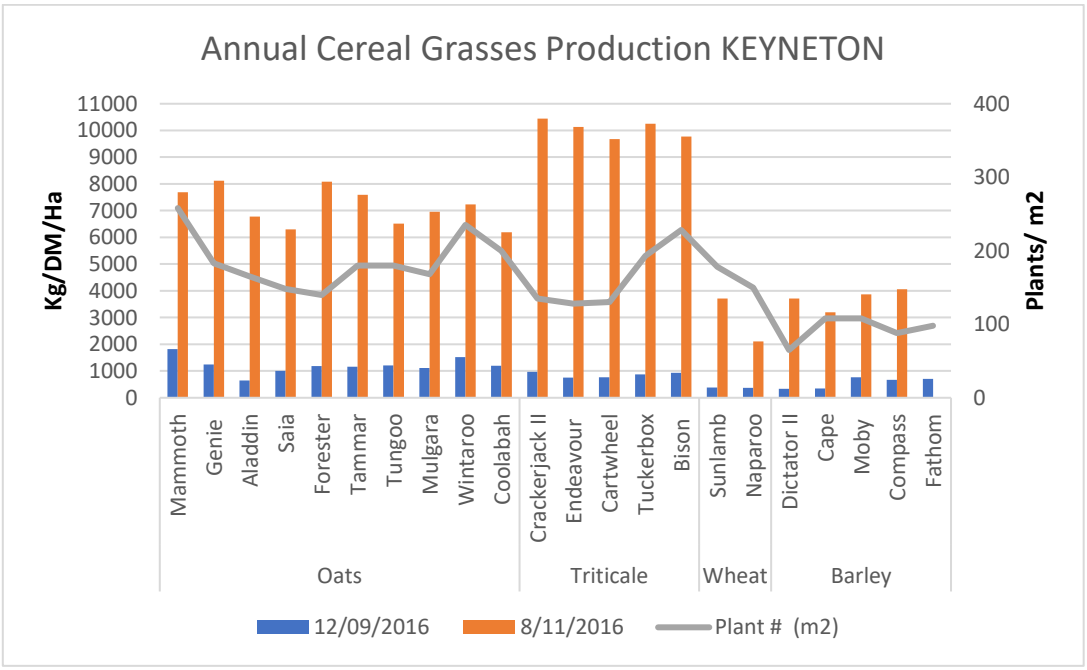

Figure 4: Cereal grass production of individual varieties through the growing season at Keyneton

Interestingly, barley varieties Cape and Moby had the same number of plants per m^2, however Moby produced 1000kg of dry matter/Ha more in September (Figure 4). This is important when considering the cost of production.

Feed testing to determine pasture quality allowed a comparison between forage type oats and export hay/grain specific varieties. Figure 5 shows that forage oats provide an extra 1.7 Megajoules of metabolisable energy (ME), are 10 percent more digestible and have 5 percent lower dry matter (Figure 5). These figures (although not the protein) are comparable with the clover, vetch and peas. Feed testing also indicated that including ryegrass within a cereal mix improved the feed quality in all areas of protein, energy and dry matter providing further opportunities for livestock management.

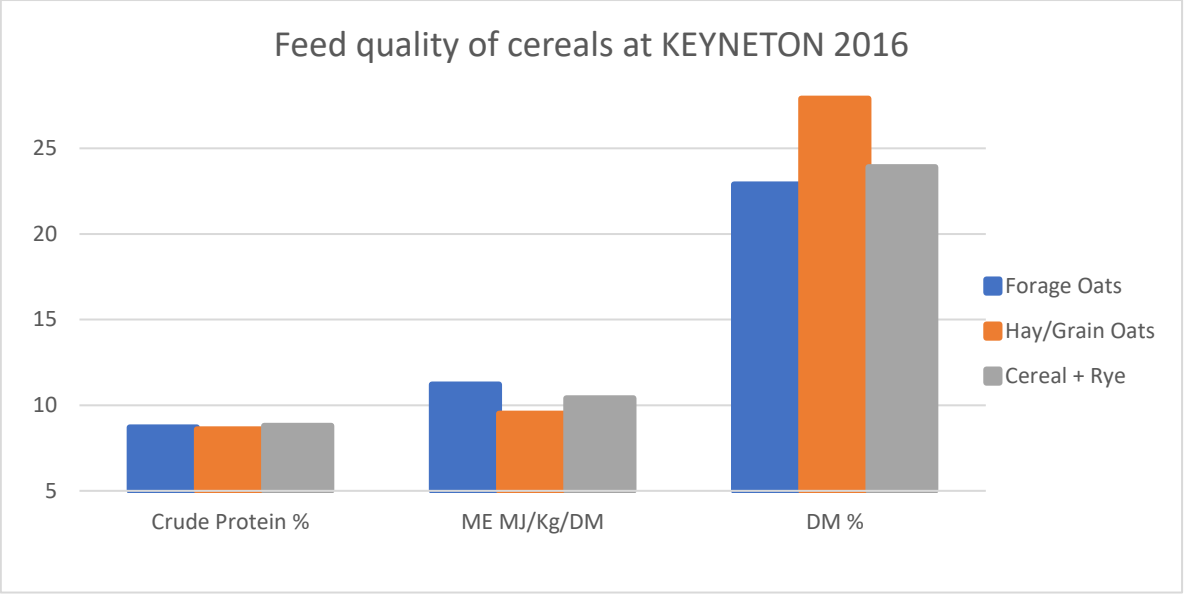

Figure 5: Feed quality of cereals at Keyneton taken 8 November 2016, (bulk sample of three plots).

Annual Ryegrasses

The annual ryegrasses produced the earliest feed compared to all other annual varieties. Dry matter cuts could be taken in late august with all plots averaging 260 Kg dry matter per hectare. In comparison, all other varieties could not be measured as they were not yet established. Considering this they also produced the most dry matter across the year ending up with an average just below 7000kg dry matter per hectare.

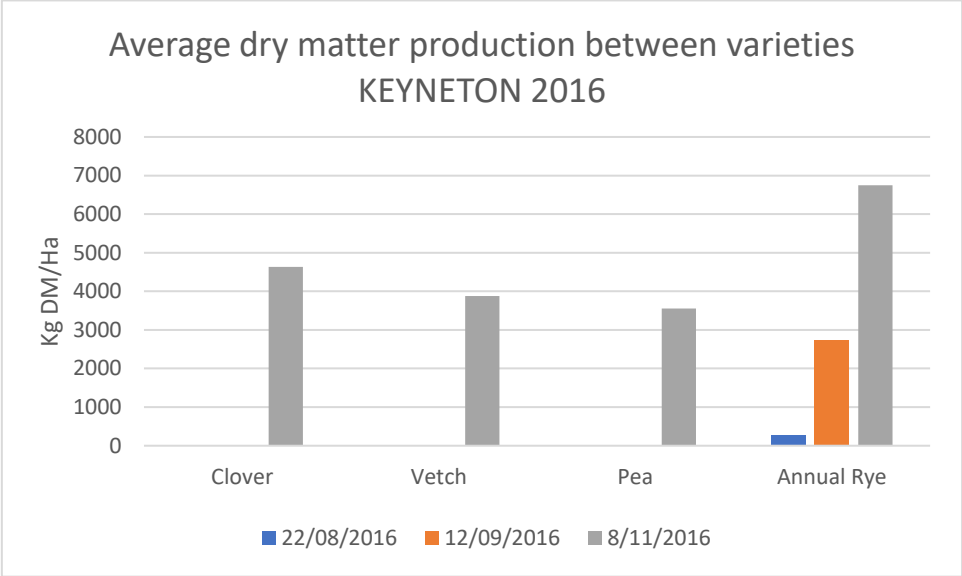

Figure 6: Seasonal production of annual varieties at Keyneton in 2016.

Annual ryegrass (bottom) had early spring production compared to the clover varieties (top) on 9 September 2016

Of the ryegrasses, Vortex produced the greatest early and late feed, followed by HS 222 and Arnie (Figure 7). Vortex produces a larger leaf area compared with other ryegrass varieties, and is a slightly later maturing variety allowing it to produce feed through the late spring if the soil moisture is available. An inspection in January 2017 also indicated an emergence of new plants within the vortex plot indicating its ability to reseed quickly in response to summer rainfall.

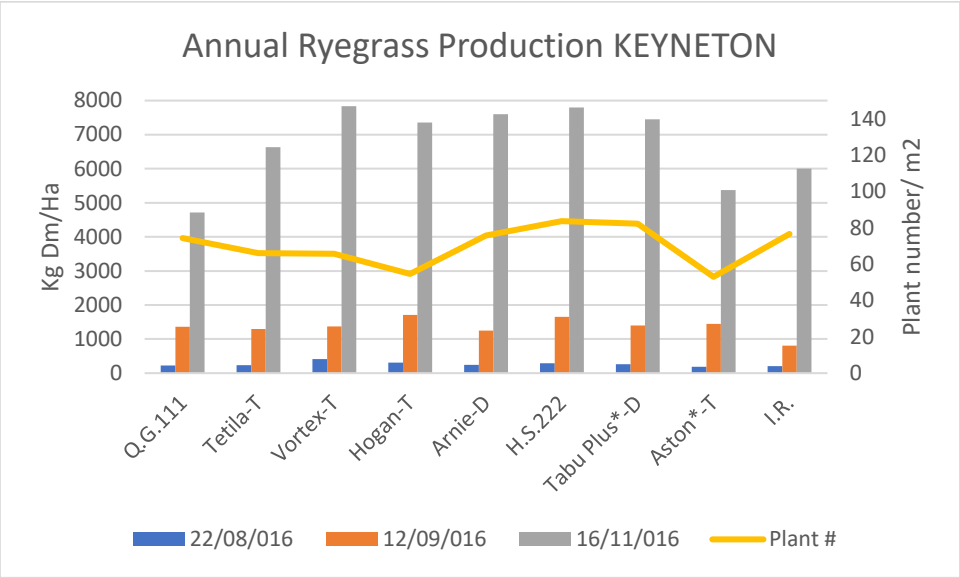

Figure 7: Annual ryegrass production for the seasonal growing period at Keyneton in 2016.

Clovers/ Vetch/Peas

Production of these nitrogen fixing varieties was severely compromised by the late sowing, which prolonged establishment. Considering this, all varieties produced over 3000 Kg of dry matter in November, because of the mild and wet spring conditions. RM4, a vetch variety performed particularly well with over 5000 Kg of dry matter per hectare (Figure 8), because of its late maturity providing late growth in the spring season.

Annual balansa and persian clover varieties have small seeds so provided an alternative to the larger seeds of vetch and subclovers, which take longer to germinate in a later sowing situation. The annual clovers produced the highest kilograms of dry matter per hectare with 4800kg, compared with the sub clover varieties.

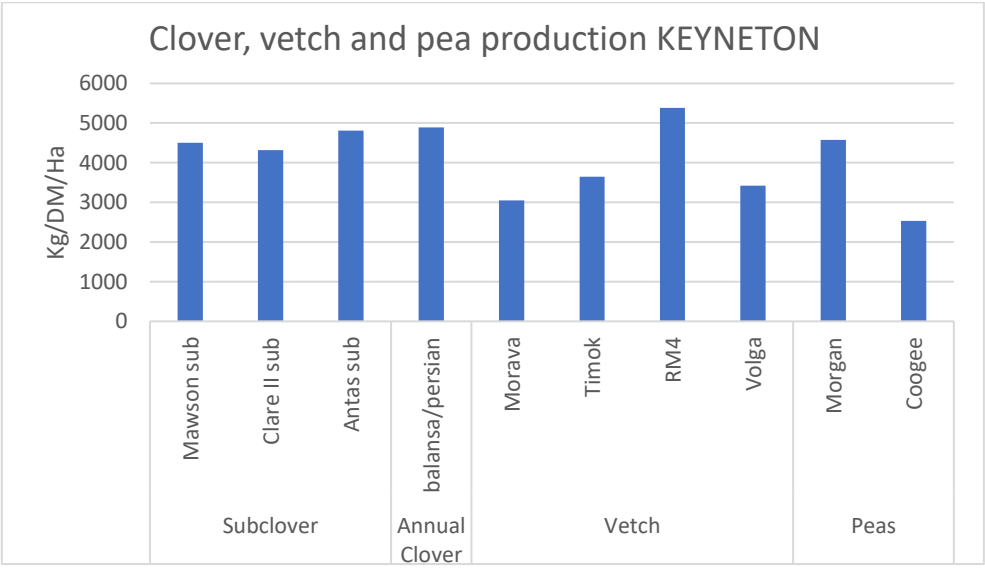

Figure 8: Dry matter production per hectare of clover, vetch and pea production on 8/11/16 at Keyneton

Eden Valley Perennial Demonstration Site:

The Eden Valley site soil test indicated good pH (5.1 in CaCl2), however low phosphorus (18ppm Cowell), low organic matter (1.4%) and very low cation exchange capacity (2.96 meq/100g) (Appendix 1). This paddock has been in an annual hay rotation with cereals. Eden Valley average annual rainfall is 750mm.

Perennial varieties were chosen on a basis of grazing potential, feed quality potential, and the ability to establish in 600mm rainfall. Comparisons against newer and the older more traditional varieties used in the local areas were also included.

Plots were randomised within individual varieties and replicated three times. Plots measured 1m x 5m. Varieties included:

- Perennial herbs (plantain, chicory)- 4 varieties
- Lucerne- 6 varieties
- Perennial grasses (fescue, phalaris, cocksfoot, ryegrass)- 18 varieties
- Subclover- 16 varieties
- Annual clover (arrowleaf, persian, balansa)- 8 varieties
- White clover- 2 varieties

The site was sown 9 June 2016. Prior to sowing, seeds were weighed to ensure the correct seeding rate (Kg/Ha) and the site received two complete knockdown herbicide treatments. Fertiliser Super Potash + Traces @ 200kg/ha + Urea @ 100kg/ha were applied on 30 September 2016.

A large amount of toadrush was observed at the site in November which significantly impacted the late spring production of the perennial grasses in particular, which were still establishing.

Perennial grasses were monitored on 23 August 2016. All remaining plots were measured for plant numbers and dry matter production on 18/19 October, in addition the annual clover varieties were measured 23 November. All plots were measured using 0.1m² quadrant taking three random measurements across the plot with results averaged. Dry matter percentage of 15% was used to determine the dry matter content of pastures.

The Eden Valley site was sown in early June using a cone seeder which was towed behind a quad bike.

Eden Valley seasonal conditions:

The soil moisture, measured at the Flaxman's Valley soil probe, located approximately 10km north of the site, demonstrates plant available water in the soil profile across the 2016 growing season (Figure 9). As with the Keyneton site, there was low plant available water through the autumn period, however from June through to the end of October, the soil profile has basically been saturated allowing full plant available water. For the perennial varieties, it is important to note the high level of plant available water continuing through summer.

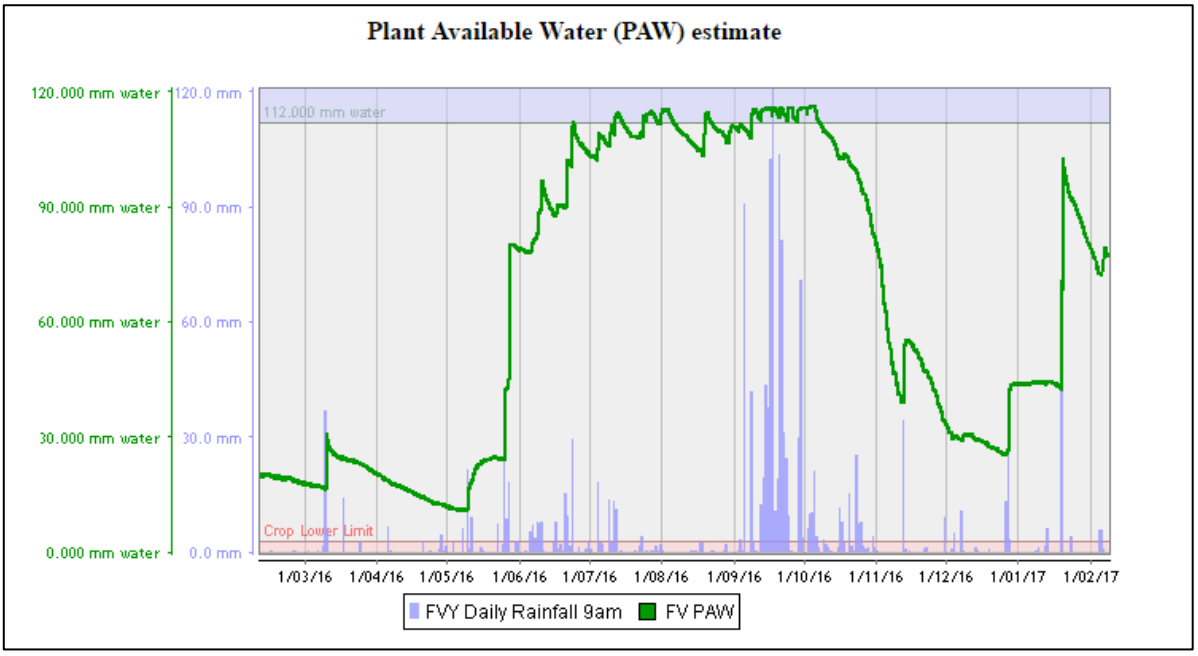

Figure 9: Annual Plant Available water for 2016/17 at the Flaxman's Valley Soil Moisture Monitoring Site

Eden Valley Results

Clovers

The later sowing conditions impacted the production potential of the subclovers which produced an average of 1000kg dry matter per hectare (Figure 10). In comparison, the annual clovers, which have a smaller seed, facilitating germination, produced an average of 3000kg dry matter per hectare. Mawson produced the greatest kg of dry matter measuring 3000kg, with an average plant number indicating efficient production per plant which should be taken into account when determining cost of production. The regeneration potential of the sub clovers will be taken into account in 2017 when regeneration plant counts will be taken to determine production over the three-year period of the project.

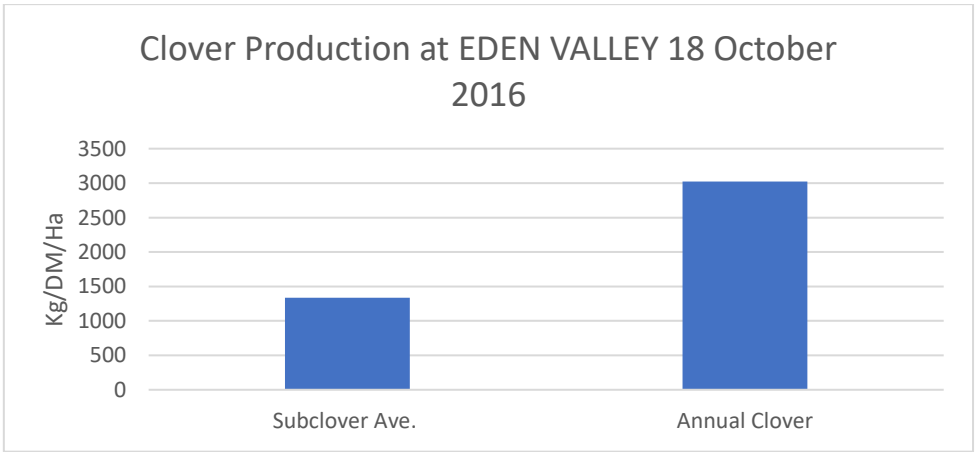

Figure 10: Clover production in October 2016 at Eden Valley.

Above average spring rain and mild conditions highlighted the ability of the later maturing varieties to continue providing feed through the spring and into summer. 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 which has already set seed and died (Figure 11). However, these varieties did not produce high levels of feed earlier in the season, compared with balansa clover varieties highlighting the importance of selecting varieties to fit individual livestock production systems.

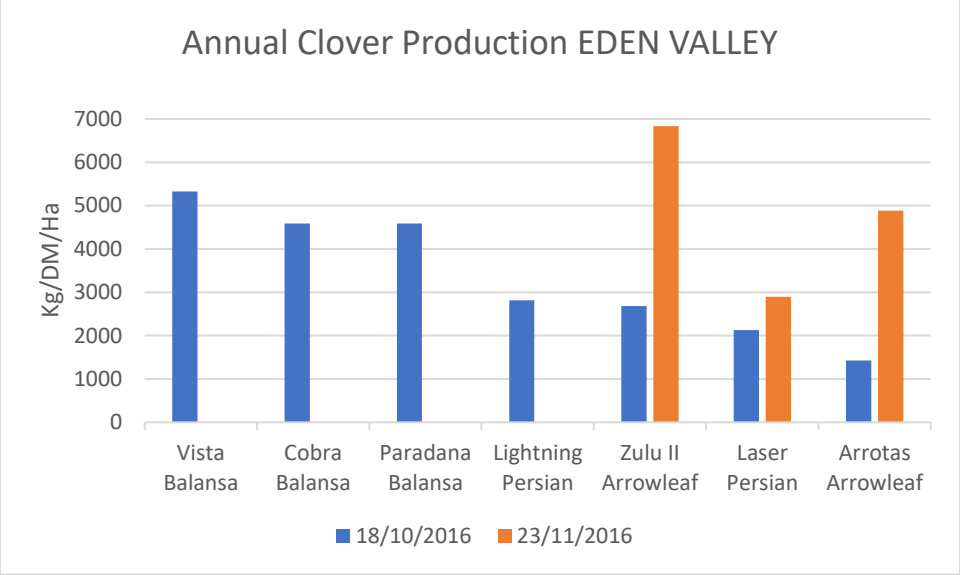

Figure 11: Annual clover production in the growing season at Eden Valley 2016.

The later maturing variety Arrowtas clover continued production through spring in response to high plant available water

Perennial Grasses and Perennial Herbs

Perennial grasses and herbs were significantly impacted by the late sowing, and the competition from the toadrush, demonstrating the importance of sowing these into warmer soils prior to waterlogging. These varieties will be re-sown in 2017 to allow comparison in 2017/18.

Koonunga Demonstration Site:

The Koonunga site is in red-brown sandy loam soil with adequate pH (6.4 Cacl2) and marginal Phosphorus (35ppm Cowell) (Appendix 1). This paddock has been in an annual hay crop rotation with oats. Koonunga average annual rainfall is 450mm.

A selection of annual and perennial varieties were chosen to allow comparisons and demonstrations of feed quantity and quality. Mixes of different varieties were also included to demonstrate the potential for extended feed availability from winter through to summer.

The varieties and pasture mixes included:

- Annual varieties (oats, brassica and radish)- 4 varieties
- Lucerne- two varieties plus three mixes (barley, brassica and oats)
- Clover/medic- 5 varieties
- Perennial grasses (phalaris, cocksfoot, fescue)- 4 varieties

The site was sown on 2 June 2016. Prior to sowing, seeds were weighed to ensure the correct seeding rate (Kg/Ha) and the site received two complete knockdown herbicide treatments. Fertiliser was applied after sowing.

The site exhibited a fair amount of background oats from the previous year's crop.

Measurements took place on 22 August, 21 September and 16 November. In addition, a grazing simulation using three lawn mown strips across each plot occurred on 21 September. This was achieved by mowing the site to a height of 5cm.

All plots were measured using 0.1m² quadrant taking three random measurements across the plot with results averaged. Dry matter percentage of 15% was estimated to determine dry matter content of the pastures until feed test results provided exact dry matter quantity in November.

The Koonunga demonstration site contained a variety of perennials, annual and blends.

Koonunga seasonal conditions

The Koonunga soil probe is located approximately 10km north west from the demonstration site. The plant available water observed at the site indicates there was very little plant available water in the soil until the late break occurred in early June (Figure 12). This was followed by an extended growing season through winter until late spring when this began dropping quickly. However, the summer rainfall has provided some plant available water which is important to observe perennial pasture potential.

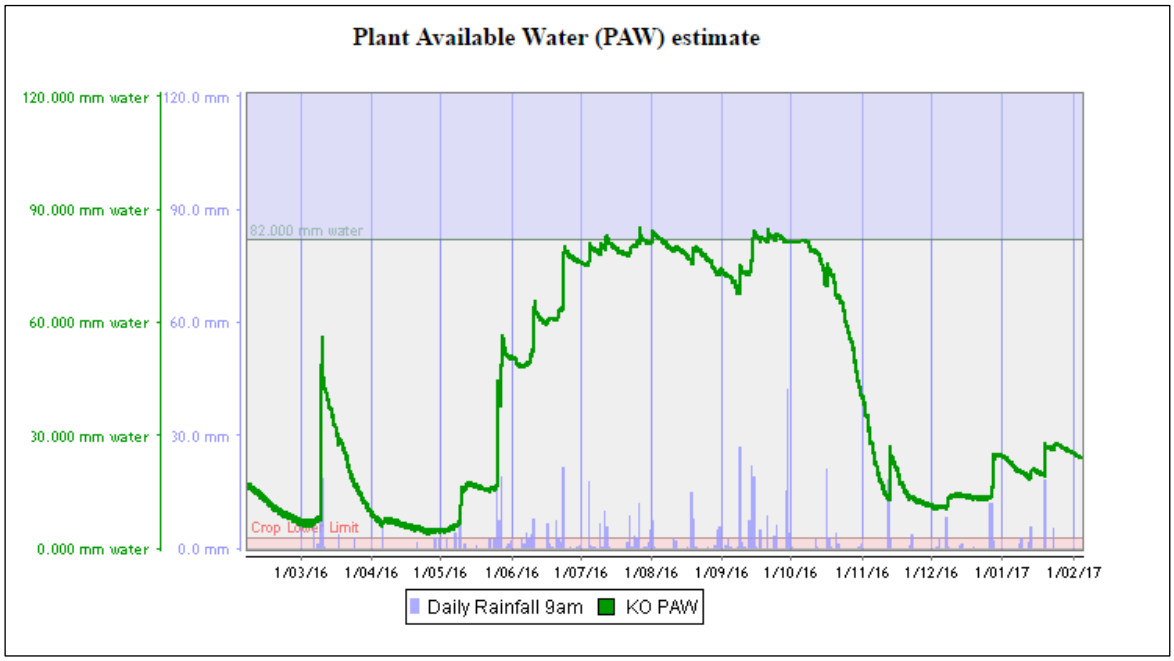

Figure 12: Annual plant available water from the Koonunga Soil Moisture Probe 2016.

Koonunga RESULTS:

Annuals:

The cold wet conditions highlighted the opportunity for including annual brassicas and radish (in grazing systems) in pastures. Pure stands of radish can cause metabolic problems, and can result in toxicity, however due to the early winter growth rate should be considered in a pasture mix, particularly in wet cold conditions when other varieties may not be growing. This site demonstrated early production of over 500 Kg of dry matter per hectare five weeks after sowing and an average of 3000 kg of dry matter per hectare in September (Figure 13).

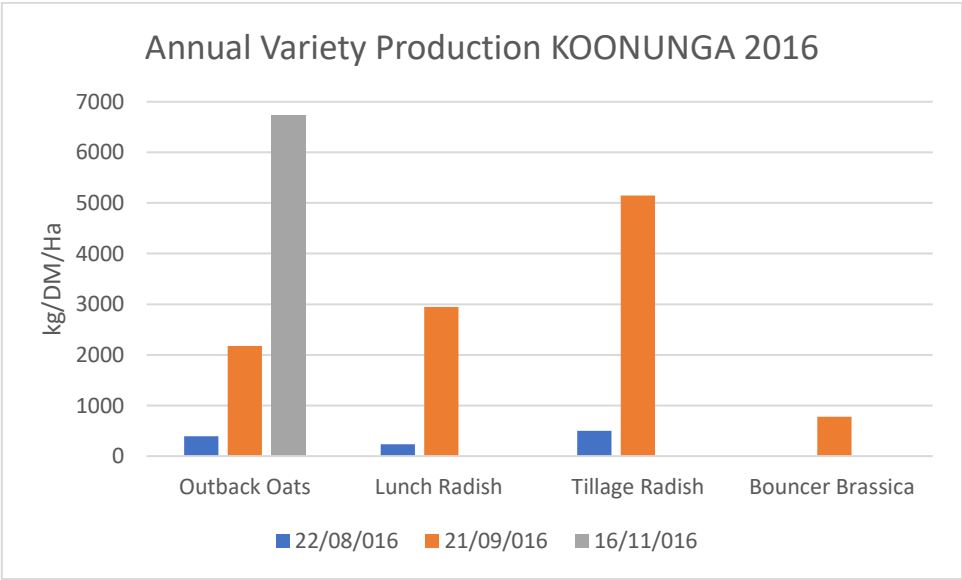

Figure 13: Annual growing season production at Koonunga 2016

In comparison, outback oats, provided comparable early feed, slightly less feed in September, however only reached maturity in late November when the brassica and radish varieties had set seed and died (Figure 13). In addition, oats can be stored in the form of hay or silage, providing value adding opportunities compared with the brassicas and radishes which can only be fed in the paddock.

Opportunities for providing early winter feed with outback oats (left) tetrone ryegrass (centre) and tillage radish (right), at Koonunga 22 August 2016.

Lucerne/ lucerne mixes

Combining compatible species with perennial varieties provides the ability to extend the growing season, providing more feed availability.

In autumn, Lucerne 71, when combined with Moby barley, produced 1800 Kg DM/Ha more than the straight Lucerne 71 as a result of the early production achieved from the barley. Once the barley has matured, the perennial Lucerne will be available for summer feed production, extending the grazing days of this pasture mix (Figure 14). This must be balanced with the overall potential of the variety which has decreased by 600 kg of dry matter in February compared with the straight Lucerne indicating the importance of determining the time of year feed is required.

Feed quality of these varieties has been tested however results were not available at time of printing. They will be included in the 2017 report.

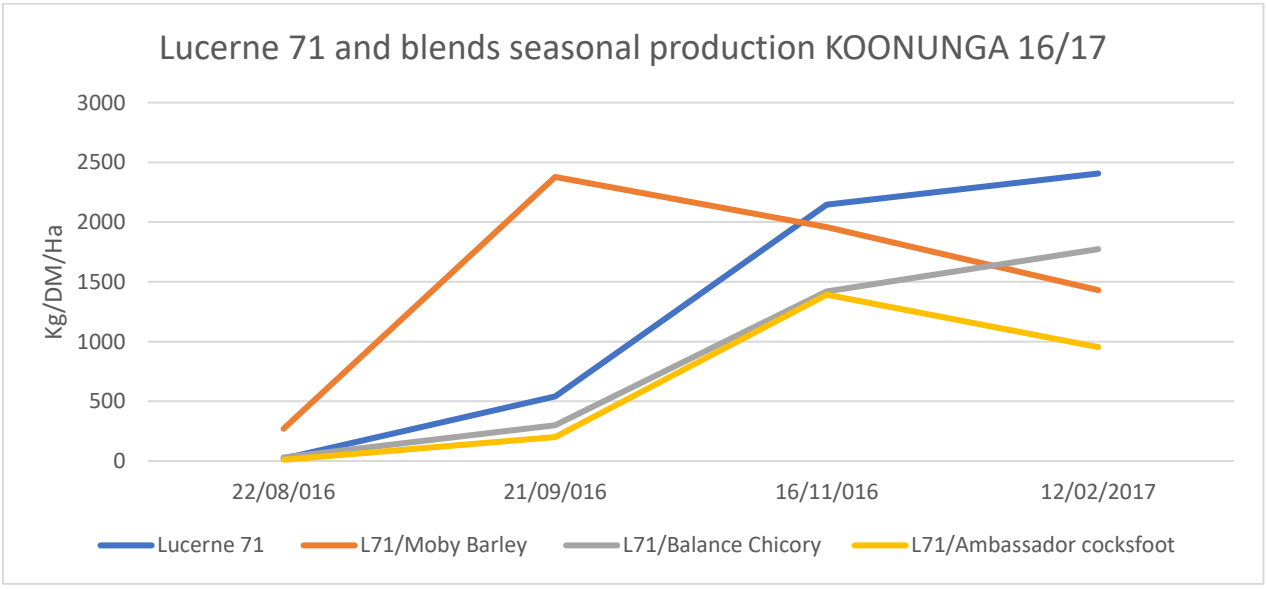

Figure 14: Lucerne 71 and Lucerne mixes seasonal production at Koonunga 2016

Clovers/ Medics

The importance of combining early and late varieties, particularly in a wet season when the later varieties will continue to provide feed, will extend feed availability and number of grazing days. Cavalier medic, an early variety produced the greatest early feed, however because of the early maturity, it did not continue to produce feed through late spring (Figure 15). In comparison, annual arrowleaf clover, Zulumax, provided significant late feed.

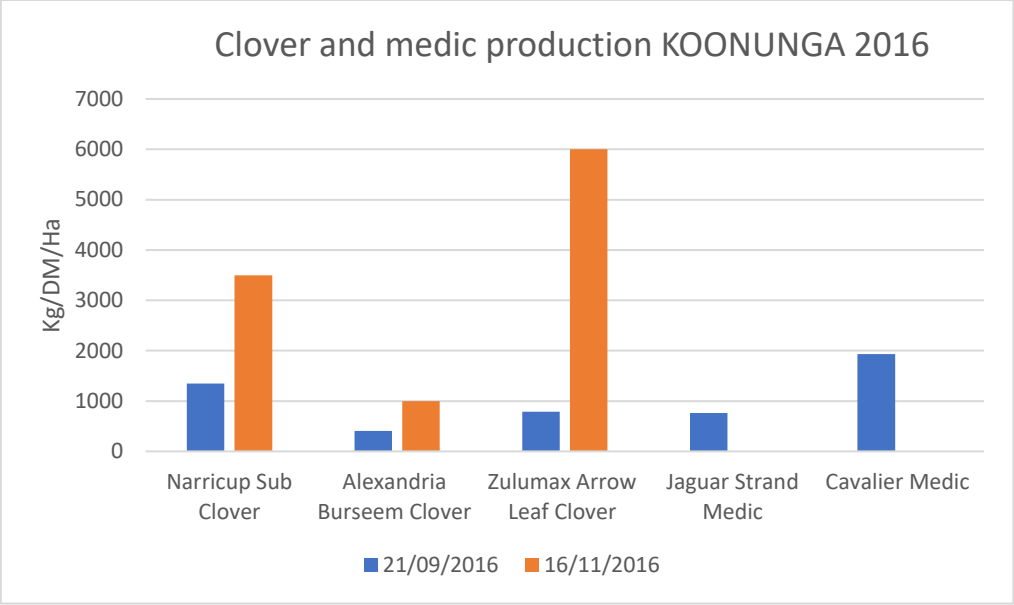

Figure 54: Clover and medic production in 2016 at the Koonunga site.

Perennials

Perennial grass varieties were very slow to establish because of the cold, wet conditions and could not be measured in September. November results indicates some production through November and then continued production through the summer months as a result of the plant available water when other annual varieties are not producing (Figure 16). These varieties provide good ground cover opportunities through the summer months helping to keep the soil in place. Their production and persistence will continue to be monitored to determine overall production over the three year period.

The addition of Lucerne 71 to the Ambassador Cocksfoot increased production by 300kg of dry matter per hectare indicating the potential for increased grazing opportunities.

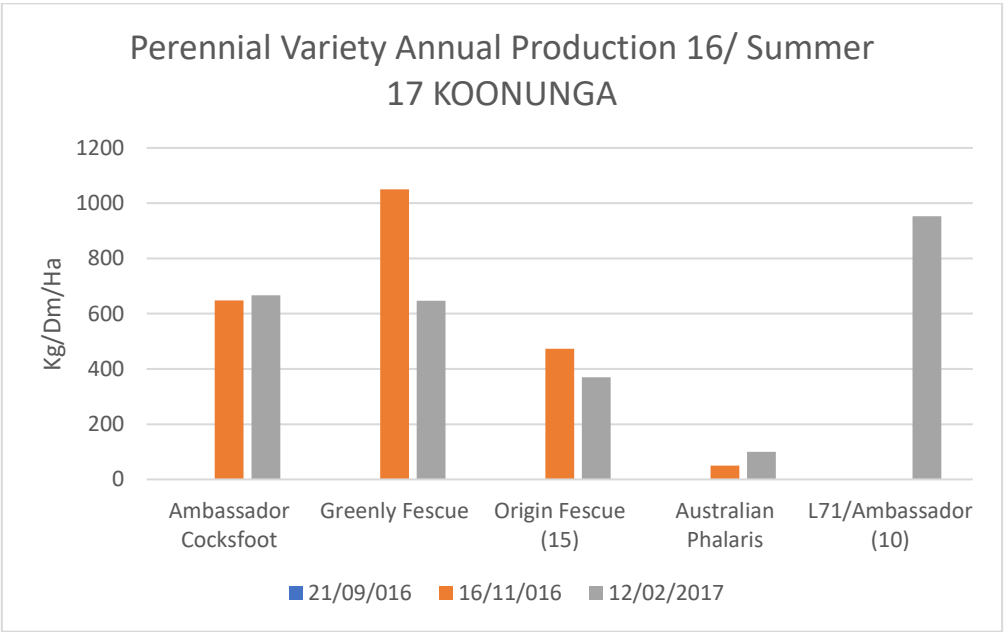

Figure 16: Annual production of perennial varieties at Koonunga

Varieties to provide year round feed

A combination of different pasture varieties across a grazing system is important to provide grazing opportunities and extend annual grazing days. The 2016 results at Koonunga (Figure 17) demonstrated the potential opportunities for having early, quick feed in the form of radish or brassicas, followed by later maturing clovers to make the most of the plant available moisture through the spring. In addition, with summer rainfall Lucerne provides opportunities for grazing through the summer. The use of cereals, demonstrated by the outback oats also provided grazing opportunities through spring, with the potential to store it in the form of silage or hay which could be fed out through the summer months when supplementary feeding may be required.

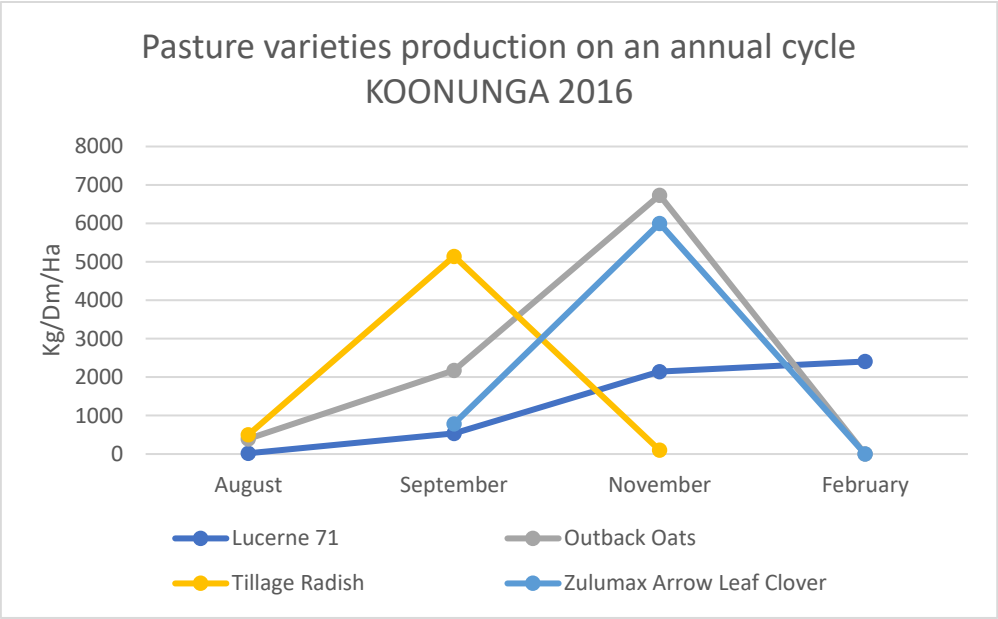

Figure 17: A combination of different varieties can provide extended opportunities for feed availability through the year.

Recommendations for 2017:

- Early sowing to see the potential of the perennial and sub clover varieties
- Paddock scale and grazing/livestock demonstrations to determine live weight gains, persistence and regeneration potential after grazing
- Opportunities for sowing in spring (depending on the season) to provide summer feed opportunities
- Plant regeneration of annual varieties and subclovers from the 2016 demonstration sites measured in m^2
- Measure persistence of the perennial grasses and Lucerne
- Simulated grazing demonstrations to measure grazing impact of the different varieties
- Spring sowing of some annual varieties to demonstrate opportunities for summer fodder crops

Conclusions

In order to provide a year-round feed supply, a mix of pasture varieties should be considered with complimentary species that balance out feed availability. In a wet, above average season, utilising brassicas or annual ryegrasses to provide winter feed opportunities, cereal varieties to provide spring production and silage/hay opportunities, followed by later clover varieties which continue to provide feed through spring can add value to the pasture renovation program and help to provide extended feed opportunities. In addition, summer varieties, such as Lucerne, which utilise summer rainfall opportunities will significantly increase annual grazing days when other varieties are not producing and provide some ground cover to prevent erosion.

Disclaimer

Care is taken to ensure the accuracy of the information contained in this report. However, it is not a comprehensive guide to managing your land or pastures. These sites are for demonstration purposes and are intended to provide information and provoke thought. All sites have been managed to try and provide the most accurate information however no legal liability is accepted for the information, errors or omissions contained in this booklet.

APPENDIX 1: SOIL TEST INFORMATION

Phosyn Analytical, 1/60 Junction Road,
Andrews, Queensland 4220, Australia
Tel: +61 7 5568 8700
Fax: +61 7 5522 0720
Email: phosynanalytical@phosyn.com.au

Analysis Results (SOIL)

Customer BIGG - MLA PROJECT
BAROSSA

Distributor COOPERS FARM SUPPLIES
MT PLEASANT
SA
5235

Sample Ref KEYNETON EVANS 0-10cm

Date Received 27/05/2016 (Date Sampled: 25/05/2016)

Sample No B087664 (UG) / SBK1125

Crop PASTURE

Analysis	Result	Guideline	Interpretation
pH [1:5 H2O]	4.8	5.8 - 8.0	Low
pH [1:5 CaCl2]	4.3	5.2 - 7.4	Low
Organic Matter (%)	5.2	3.0 - 8.0	Normal
CEC (meq/100g)	4.90	12.00 - 40.00	Very Low
EC [1:5 H2O] (dS/m)	0.10	0.90 - 3.00	Very Low
NO3-N (ppm)	30.0	15.0 - 70.0	Normal
Phosphorus [Olsen] (ppm)	13	20 - 70	Slightly Low
Phosphorus [Colwell] (ppm)	14	43 - 150	Low
Potassium[Am. Acet.] (meq/100g)	0.29	0.50 - 1.20	Low
Calcium[Am. Acet.] (meq/100g)	3.70	6.00 - 15.00	Slightly Low
Magnesium[Am. Acet.] (meq/100g)	0.69	1.00 - 4.50	Slightly Low
Sulphur [MCP] (ppm)	11	7 - 20	Normal
Boron[CaCl2] (ppm)	0.2	1.0 - 5.0	Low
Copper [DTPA] (ppm)	0.7	2.5 - 20.0	Low
Iron [DTPA] (ppm)	197	5 - 120	High
Manganese [DTPA] (ppm)	21.3	5.0 - 60.0	Normal
Zinc [DTPA] (ppm)	1.5	5.0 - 15.0	Very Low
Sodium[Am. Acet.] (meq/100g)	0.2	0.3 - 3.0	Low
Aluminium[KCl] (meq/100g)	0.06	1.00 - 2.50	Very Low
Chloride (ppm)	22	200 - 1100	Very Low
Ca base saturation (%)	75.5	50.0 - 75.0	High
K base saturation (%)	6.0	2.0 - 5.0	High
Mg base saturation (%)	14.2	5.0 - 15.0	Normal
Na base saturation (%)	3.2	1.0 - 2.0	High
Al base saturation (%)	1.20		

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Analysis Results (SOIL)

Customer BIGG - MLA PROJECT
BAROSSA

Distributor COOPERS FARM SUPPLIES
MT PLEASANT
SA
5235

Sample Ref EDEN VALLEY NOACK 0-10cm

Date Received 15/04/2016 (Date Sampled: 14/04/2016)

Sample No B087662 / SBJ3268

Crop PASTURE

Analysis	Result	Guideline	Interpretation
pH [1:5 H2O]*	6.0	5.8 - 8.0	Normal
pH [1:5 CaCl2]*	5.1	5.2 - 7.4	Slightly Low
Organic Matter (%)	1.4	3.0 - 8.0	Low
CEC (meq/100g)	2.96	12.00 - 40.00	Very Low
EC [1:5 H2O]* (dS/m)	0.03	0.90 - 3.00	Very Low
NO3-N (ppm)	8.0	15.0 - 70.0	Slightly Low
Phosphorus [Colwell]* (ppm)	18	43 - 150	Low
Potassium[Am. Acet.]* (meq/100g)	0.12	0.50 - 1.20	Low
Calcium[Am. Acet.]* (meq/100g)	2.43	6.00 - 15.00	Low
Magnesium[Am. Acet.]* (meq/100g)	0.34	1.00 - 4.50	Low
Sulphur [MCP]* (ppm)	4	7 - 20	Slightly Low
Boron[CaCl2] (ppm)	0.1	1.0 - 5.0	Very Low
Copper [DTPA]* (ppm)	0.8	2.5 - 20.0	Low
Iron [DTPA]* (ppm)	44	5 - 120	Normal
Manganese [DTPA] (ppm)	3.2	5.0 - 60.0	Slightly Low
Zinc [DTPA]* (ppm)	3.8	5.0 - 15.0	Slightly Low
Sodium[Am. Acet.]* (meq/100g)	< 0.1	0.3 - 3.0	Very Low
Aluminium[KCl] (meq/100g)	0.03	1.00 - 2.50	Very Low
Chloride (ppm)	12	200 - 1100	Very Low
Ca base saturation (%)	82.2	50.0 - 75.0	High
K base saturation (%)	4.0	2.0 - 5.0	Normal
Mg base saturation (%)	11.4	5.0 - 15.0	Normal
Na base saturation (%)	1.6	1.0 - 2.0	Normal
Al base saturation (%)	0.90		
Ca:Mg Ratio	7.2	2.5 - 3.0	High

Nutrient Advantage®

Nutrient Advantage Advice® Recommendation Report

Angaston Ag Bureau

SA

Report Print Date: 05/05/2016
Agent/Dealer:
Advisor/Contact: Farmer Johns
Phone: 08 8562 1311
Purchase Order No: 39351

Grower Name: Angaston Ag Bureau
Sample No: 021349796
Paddock Name: Glen Beckers
Sample Name:
Sample Depth (cm) 0 **To** 10

Nearest Town: ANGASTON
Test Code: E22
Sample Type: Soil
Sampling Date: 20/04/2016

Analyte / Assay	Unit	Value	Very Low / Marginal / Optimum / High / Excess	Optimal
Soil Colour		Brown		
Soil Texture		Sandy Loam		
pH (1:5 Water)		7.0	Neutral	5.8-7.0
pH (1:5 CaCl2)		6.4		
Electrical Conductivity (1:5 Water)	dS/m	0.08		<0.15
Electrical Conductivity (Saturated Extract)	dS/m	0.8		<1.9
Chloride	mg/kg	<10		
Organic Carbon (OC)	%	0.7		0.9-1.45
Nitrate Nitrogen (NO3)	mg/kg	21		
Ammonium Nitrogen	mg/kg	2		
Phosphorus (Olsen)	mg/kg	17		20-30
Phosphorus (Colwell)	mg/kg	35		
Phosphorus Buffer Index (PBI-Col)		19	Very very Low	
Potassium (Colwell)	mg/kg	330		150-250
Sulphate Sulphur (KCl40)	mg/kg	4		10-25
Cation Exchange Capacity	cmol(+)/kg	4.8		
Calcium (Amm-acet.)	cmol(+)/kg	3.7		
Magnesium (Amm-acet.)	cmol(+)/kg	0.4		
Sodium (Amm-acet.)	cmol(+)/kg	0.10		
Potassium (Amm-acet.)	cmol(+)/kg	0.61		0.4-0.5meq
Aluminium (KCl)	cmol(+)/kg	<0.1		
Aluminium (KCl)	mg/kg	<9.0		
Aluminium Saturation	%	<1.0		<5 %
Calcium % of cations	%	77.0		60-85 %

Analyses conducted by **Nutrient Advantage Laboratory Services**

For a copy of Laboratory Methods of Analysis please go to www.nutrientadvantage.com.au

NATA Accreditation No: 11958

Certificate of Analysis is available upon request.

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