Eyre Peninsula Grain and Graze 2 Research Summary

GB4a/GB4c– Enrich Perennial Forage Shrub Trial

Fifteen species of *Atriplex, Rhagodia, Eremophila* and *Medicago* forage shrubs were established at Minnipa and Piednippie in 2009 to measure their persistence, productivity and palatability to support the establishment of both shrubs and herbaceous perennials for grazing and/or carbon sequestration and soil remediation on low production, constrained soils. Sites were monitored and measured in spring and autumn of 2010, 2011 and 2012. Both sites were grazed for the first time in autumn 2011 and again in 2012; subsequently their recovery was monitored to decide which lines progress to further establishment and evaluation studies. Supported by the national CRC for Future Farm Industries Enrich program it has shown that it is best to have mixed species stands rather than single species. A mix of *A. nummularia, R. preissii, A. semibaccata, E. tomentosa and A. amnicola* has been the most productive, calculated by plant establishment, biomass, persistence and palatability. As a progression, 3 direct seeding trials to investigate low risk/low cost perennial establishment methodology were established from 2011-2013 with the most productive perennial forage shrubs selected from the results of 2 of the trial sites. Production and persistence will be monitored on these sites and grazing in their second year of growth will allow further assessments of grazing preference.

The *Enrich* sites provided excellent information to assist with shrub selection and management, however establishing shrubs from seed appears one of the major hurdles in the further adoption of forage shrubs and more research is required. These sites were used as a 'trial and error' opportunity to understand what the major hurdles for shrub establishment on the EP are. An important conclusion from the demonstration sites was that more work needs to be done on more workable direct seeding practices before promoting it as a cost and production efficient option to growers, especially on time of sowing, site preparation and design and weed management.

GB4b – Annual and Perennial Species Evaluation Trials

Establishment of a trial to evaluate the potential of alternative herbaceous perennials (Sulla, Tedera and Cullen) compared to lucerne commenced in 2009 with 4 sites sown encompassing low to high Eyre Peninsula rainfall zones and alkaline to acidic soil types. After 4 years of evaluation, it has been established that lucerne is well adapted to the better, deeper cropping soils on Eyre Peninsula. However it lacks persistence on the shallow soils as opposed to Tedera, which is well adapted in neutral to acid soil types and Cullen to more alkaline soil types. Sulla was highly productive on the neutral to alkaline soil types and is well adapted to a 2-3 year break in an intensive cropping system, not necessarily as a longer term crop replacement on

retired cropping land. The slow rate and lack of commercial development of the Tedera and Cullen species respectively has meant that there has been little opportunity to promote the species as alternative pastures on their specific niches. As a result of this project, Sulla has been included in crop rotation studies as a phase pasture and is being assessed as an alternative break crop, with weed control and animal production benefits, to annual pastures.

UB6a – Field Crop Grain and Graze (Upper EP)

Several trials were established from 2010 to 2013 to evaluate of a range of dual purpose crops (cereals and broad-leaf) measuring early biomass production, for grazing, biomass production at anthesis, for hay making, and subsequent grain yield from both grazed and ungrazed plots. Four paddocks were sown to barley in 2011, which were split for plus and minus grazing prior growth stage 31. There was measured delayed crop development and reduced lodging as a result of grazing, which also provided a feed source to fill the winter feed gap. There were also significant yield losses in response to late, untimely, continued grazing.

A canola grazing trial established near Cummins on the lower Eyre Peninsula in the same year measured a 60% yield loss in response to untimely and continued grazing. In a barley grazing trial at Wangary in 2011 the grower made the decision to utilise the paddock as a winter feed resource as opposed to an opportunistic grazing resource with grain production as the primary aim. The decision was supported by a delayed sowing date which reduced the early biomass production and the weed infestation which limited the yield in the ungrazed section to 2 t/ha. Grazing until ear emergence reduced yield to an estimated 0.7 t/ha.

In 2012 the same 4 paddocks used for the 2011 trial were sown to canola and medic, which aimed to demonstrate the impact of grazing a grain crop at the optimal stage of growth (6-8 leaf stage for canola) and compare grazed versus ungrazed systems. Due to seasonal conditions, poor early vigour and poor overall growth in the canola, the paddock was not grazed. Biomass was still measured throughout the year and harvest yields were recorded to report on the decision making process of the trial. This decision making process was documented in the EP Farming Systems Summary 2012, in the article “Grain and Graze – who, what, when, where, why, how?” p 126.

In 2013, a broad acre demonstration site was established at Lock with barley, which was sown with the intent to graze for sheep feed with the opportunity to remove stock and cut for hay or harvest grain if the season allowed. Technical advice was provided to the farmer, exclusion cages were placed in the paddock and biomass measurements and feed tests were taken to assist in the decision making process. Results showed 1085 kg/ha higher dry matter in the

exclusion area at harvest and 285 kg/ha more yield than measurements taken from the grazed area in the paddock. This portrays that grazing has not impacted considerably on grain yields or biomass when compared to the substantial feed utilisation throughout the grazing period.

The in-season decision was to leave the northern side for hay or harvest with the southern side grazed down too far for either end use. Conversely, the opportunity to utilise the northern area as a standing feed source to finish lambs on over the summer period was decided to be the best value for the residual crop with 927 kg/ha of barley grain and roughly 5.8 t/ha of dry matter remaining in this area of the paddock.

Although using the cereal as a forage crop has somewhat affected a higher yield result, the feed value over this time needs to be considered as a beneficial outcome as well additional advantages of livestock delaying grass growth and the on-set of weed seed set, offering the opportunity to spray-top later in the season. Furthermore, this end use will provide a valuable and substantial feed source for livestock over the summer and will also prevent other stubbles from being over-grazed, thus benefits of this practice need to be understood from a whole mixed farming system perspective.

UB32 – Impact of Livestock on Soil Health

A trial was established on Minnipa Agricultural Centre in 2008 to test whether soil fertility and health could be improved under a higher input system compared to a lower input and more traditional system. Interposed on the input level comparison was the impact of livestock in a pasture-crop rotation to address the perceptions (often negative) associated with animals and soil health. The 6 year wheat, wheat, pasture (annual medic), wheat, pasture (annual medic), wheat rotation was split for plus and minus grazing in both the high and low input systems to establish the impact of grazing between the 2 treatments. Plant production along with soil nutrition has been documented over the period of the trial. There had been no measured change in soil organic carbon content in response to high and low input systems with or without grazing until 2013 when a higher trend in the 0-20 cm profile was estimated in the 2 grazing treatments (0.15-0.2%), compared to the un-grazed treatments. The study measured increased pasture biomass in 2010 and higher wheat yields in 2011 response to both increased inputs, and grazing. The 2012 pasture phase of the rotation increased pasture biomass production in response to higher plant numbers from the 2010 annual medic establishment, high input treatments. There was increased plant available nitrogen at the 2013 seeding from the 2012 grazing treatments but no increased plant available N in response to higher 2012 biomass production. Grain yield, protein content and screening % following grazing the high input treatment in 2012 was higher than the high input un-grazed treatment, which was higher

than the grazed low input treatment which was higher than the low input un-grazed treatment. Grazing has benefited both production and soil health outcomes.

Economically the high crop and pasture input treatments have produced an extra 1 t/ha of wheat from 4 crops in 6 years, irrespective of being grazed or ungrazed. The value of the extra grazing is reliant on the stocking rate and available growing season pasture area, i.e. there is no benefit unless there is a feed deficit under the current stocking rate requiring hand-feeding in the winter/spring period when annual medic is productive. The cost/ha has been an extra 120 kg of DAP ($80), 80 kg of seed wheat ($20) plus the pasture establishment ($40), giving a 6 year increased gross margin of approximately $110/ha plus any increased livestock returns (assuming a wheat price of $250/t).

Crop Sequencing

To determine the comparative performance of alternative crops and pastures as pest and disease breaks in an intensive cereal phase, a 4-year trial was established in 2011, comparing both a 1 and 2 year phase of alternative break crops followed by 2 or 3 years of wheat. Plots were split where the treatment was considered a multi-purpose option (i.e. grazing/hay/grain). Results in 2011 showed the early grazing potential of canola, a high early feed production of oats and no measured biomass benefit in forage mixture (Vetch/oats) over and above single species. In 2012 due to a slow start to the growing season, the canola/self-regenerating medic treatment did not provide an early grazing opportunity. Oats and self-regenerating medics, coupled with grass and broadleaved weeds, provided the main grazing resource in July/August and Sulla provided the greatest biomass in its second season. 2013 was the first year of the 2 year cereal phase. Grain yield results at this stage are split into 4 groups:

1. Wheat following 2 years of fallow, complete weed control
2. Wheat following 2 years of grass weed control within broadleaf crops and pastures
3. Wheat following wheat in 2012 following break crop in 2011
4. Wheat following wheat in 2012 following wheat (or cereal) in 2012 with limited grass weed control in all years

Extending Best Practice Wool Innovations on Eyre Peninsula

The 3-year project commenced in 2011 using the Merino sheep flock at the Minnipa Agricultural Centre to demonstrate the genetic benchmarking process that leads to the creation of MERINOSELECT Breeding Values by ‘Sheep Genetics’. There is ongoing data collection and management of the Minnipa commercial flock to demonstrate this benchmarking tool to Merino ram breeders and the wider EP sheep industry. Minnipa flock breeding objectives aimed

to increase body weight, fleece weight, reduce breech wrinkle and maintain micron. The project has had measured success with most of these objectives, however with increased data accuracy through better linkage and more measurements we hope to see improvement in all key traits. This technology has the potential to greatly increase production and profitability through long term improvement to genetics. 2012 and 2013 results will be evaluated when DNA information for pedigree analysis is returned.

Demonstration and extension of flock management strategies to improve lamb weaning percentages in low rainfall mixed farming regions

Research into identifying the causes of lamb death conducted in 2012 (EPFS Summary 2012, p 120) was partly inconclusive with 49% of deaths un-diagnosed or not found. The recommendations to ameliorate the factors reducing lamb survival in the 2012 study were used as the basis for this one-year subsequent project in 2013, which employed various flock management strategies to improve weaning percentages and closely measure and monitor flock performance.

Using a 'best practice' management system assisted the Minnipa flock to increase their lamb survival percentage by 10% from year one to year two of the project. Management changes over this time period were minimal, but resulted in significant outcomes. Each individual cause of lamb death from conception to weaning was analysed separately to identify the sequence of events that occurred to both the ewe and lamb during this time. With this information, targeted responses could be implemented immediately and/or into the future.

Research found that lamb survival is one of the most important factors determining success in a self-replacing flock, and that this is driven by ewe performance. The importance of understanding ewe nutrition requirements during pregnancy and throughout lambing was the major catalyst for the Minnipa flock success. Pregnancy scanning was the initial process by which nutritional decisions needed to be made, as the use of this information and subsequent changes in management practices reduced the chance of potential losses considerably. The next step is to identify areas that can be improved to reduce the gap between the potential number of lambs from the number of ewes joined and the actual number of lambs weaned, and this is instigated by understanding lamb survival issues.