final report

Project code: B.PRS.0613

Prepared by: Stuart Kemp

Glenelg Prograze Group

Date published: July 2009

ISBN: 9781741918564

PUBLISHED BY
Meat & Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Non -Toxic Perennial Grass Pastures for Sheep

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

Without the support and assistance of the following organizations this project would not have happened.

Premier Sponsor: Stephen Pasture Seeds
Major Sponsor: PastureWise Pty Ltd, Leeming Family
Other Sponsors: Meat and Livestock Australia, Feedtest, Landmark, Elders, Vickory Brothers, Hamilton Farm Supplies, Kevin Walsh fencing Contracting

Summary – Key Points:

- Compared to Victorian perennial ryegrass with toxic endophyte, the Deep Rooted Perennial (DRP) pasture had:
    - Higher average stocking rates
    - Heavier Ewes
    - Higher lamb marking rates
    - Higher Net Income
    - Fewer worms
- Samson ryegrass also had an advantage over Victorian BUT it has not persisted as well.
- The Victorian perennial ryegrass treatment has a much lower legume content than the other treatments
- The Victorian perennial ryegrass treatment was less palatable over summer than other treatments and produced toxins that were ingested by the ewes.
- At the end of the project the only pasture that continued to persist well and produce the best production results was the Deep Rooted Perennials comprising Flecha tall fescue and Holdfast phalaris.

Contents

Project Details and Summary Charts

Aim

To increase understanding of the agronomic, livestock and economic impact of toxic perennial ryegrass pastures and the ability of safe alternative pastures to potentially improve animal production and farm profitability

Method

Project Design and Layout:

Table 1: Species sown and initial stocking rates for each treatment.

Treatment	**Camel**	**Samson**	**Victorian**	**Deep Rooted Perennials**	
Area	4 Ha	4 Ha	4 Ha	2 Ha	2 Ha
Grass	25kg/Ha Camel	25kg/Ha Samson	25kg/Ha Victorian	20kg/Ha Flecha MaxP	6kg/Ha Holdfast
Endophyte	Nil	AR1[#]	Wild Type	MaxP	Nil
Legume	4kg/Ha Coolamon 4kg/Ha Riverina	4kg/Ha Coolamon 4kg/Ha Riverina	4kg/Ha Coolamon 4kg/Ha Riverina	4kg/Ha Coolamon 4kg/Ha Riverina	4kg/Ha Coolamon 4kg/Ha Riverina
Stock	36 Coopworth ewes 6 Merino ewes	36 Coopworth ewes 6 Merino ewes	36 Coopworth ewes 6 Merino ewes	36 Coopworth ewes 6 Merino ewes	
Stock/Ha	10.5 ewes/Ha	10.5 ewes/Ha	10.5 ewes/Ha	10.5 ewes/Ha	

#Note: While it was intended that Samson AR1 be used to provide a novel endophyte option, testing during the summer of 2007/08 revealed that it did not contain the AR1 novel endophyte. The grass has performed as would have been expected for Samson but a combination of tiller tests and SSR analysis indicates that it contains a high level of standard or WT endophyte.

Site Preparation

A 16Ha paddock was split up into 4 equal paddocks containing approximately the same number of trees and with watering points installed in each paddock. The paddock was cleaned up in spring 2005 using the spraygraze technique and then prior to sowing in autumn 2006 Glyphosate was used to achieve a clean paddock with no weeds. The site was sown as per Table 1. Prior to sowing Lime was applied at 2.0t/Ha. Soil tests showed that no capital fertilizer was required prior to sowing. The pasture was sown with 100kg/Ha of MAP. Due to the dry conditions of 2006 it was decided to let the pasture properly establish and grazing during the year was confined to strategically stocking it with either sheep or cattle for short periods of time

and then removing all stock to ensure good plant survival. Each treatment survived through the first summer and recovered well in Autumn 2007. This set the project up well for a start in June 2007.

Animal Selection

All ewes were pregnancy scanned and weighed prior to assignment to treatments. All Coopworth ewes used in the trial were assessed as bearing twins and most of the Merino ewes were assessed as bearing single lambs. The few Merino ewes carrying twins were evenly distributed across the four treatments. Upon weighing all stock they were arranged by type (Merino vs Coopworth) and by weight and then placed into 5 strata from which animals were then selected for each treatment. At the end of this process each treatment had the same number of twin bearing Merino ewes, single bearing Merino ewes and twin bearing Coopworth ewes. The average weight of the ewes in each treatment ranged from 55.9kg to 56.0kg, this was a variation of less than 200g.

Stock Management

Stock were managed by the owner and farm manager (Tim Leeming) in the same way as the rest of the sheep on the property. The only exception from this was the imposition of a set stocking policy for most of the year so that each group was only exposed to the one source of feed. During summer when the feed ran low in each of the treatments the sheep were mobbed together and hand fed in a small confined area to ensure that their condition score remained over 3.0 prior to mating and then did not slip to less than 2.7 on average during late summer and up until re-introduction into their particular treatments in autumn. This strategy is normal practice on this farm. These sheep were not mixed with other sheep from the farm and were maintained as a separate unit during the course of the project. All standard animal husbandry practices such as drenching, vaccinations, shearing, crutching etc were conducted at the same time as for the rest of the stock on the farm and were in line with standard practice.

Paddock Mangement

Post sowing the treatments received the same fertilizer treatment in autumn of each year of 200kg of Superphosphate. Any thistles were spot sprayed or chipped out as required and no other herbicides or insecticides were applied.

Stock Measurements

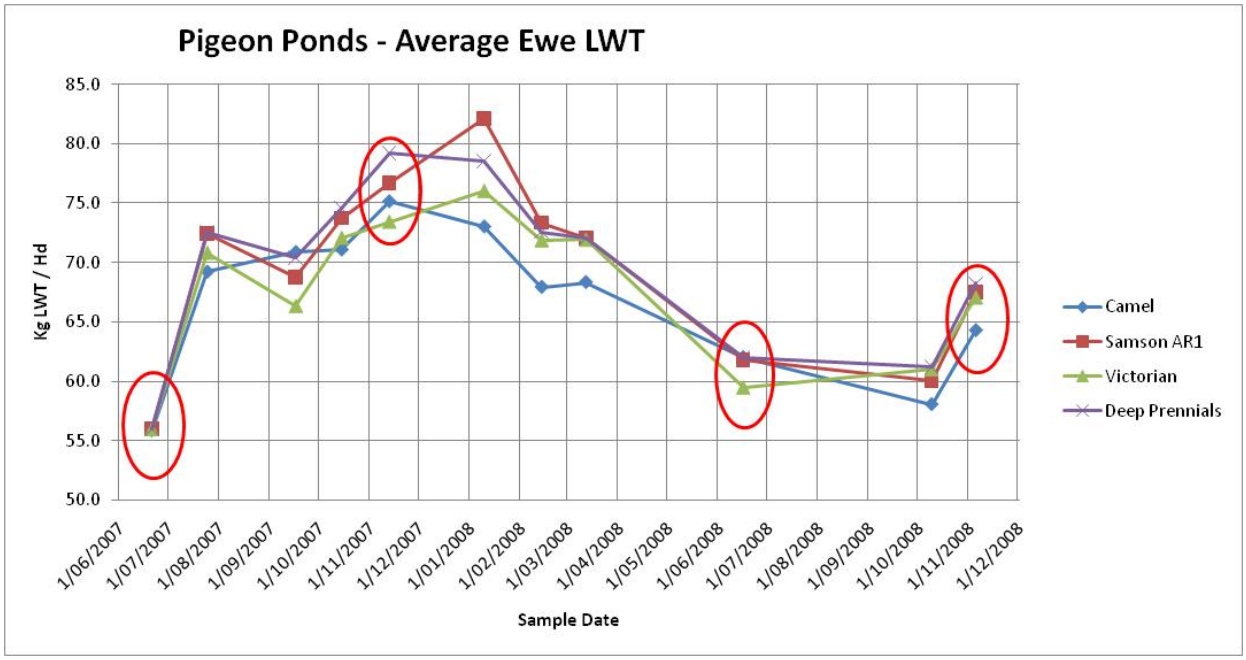
Stock were weighed regularly. From June 2007 to February 2008 this was approximately monthly. August was usually missed due to the sheep lambing at the time. The discovery that one of the pasture types was not what was intended (ie did not contain the novel endophyte AR1) led to a review of the measurement program and instead measurements were strategically conducted prior to lambing and then post lambing. At each measurement each sheep was weighed and periodically condition scored, particularly around summer.

Pasture Measurements

From June 2007 to February 2008 the pastures were monitored at the same time as the ewes were weighed. Pastures samples were also taken at this time and delivered to Feedtest for analysis. Measurements recorded include pasture cover, feed quality (ME, Protein, NDF) and alkaloid content (primarily the Victorian WT option).

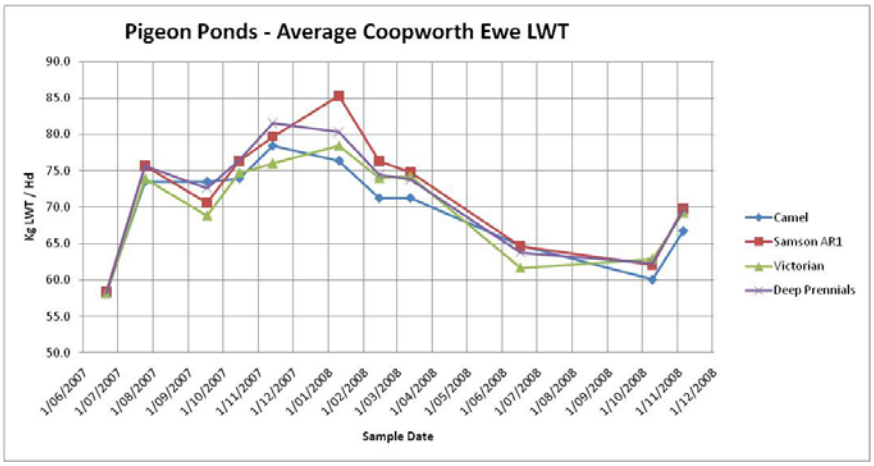
Results

June 2007 – June 2008 Ewe Live weight

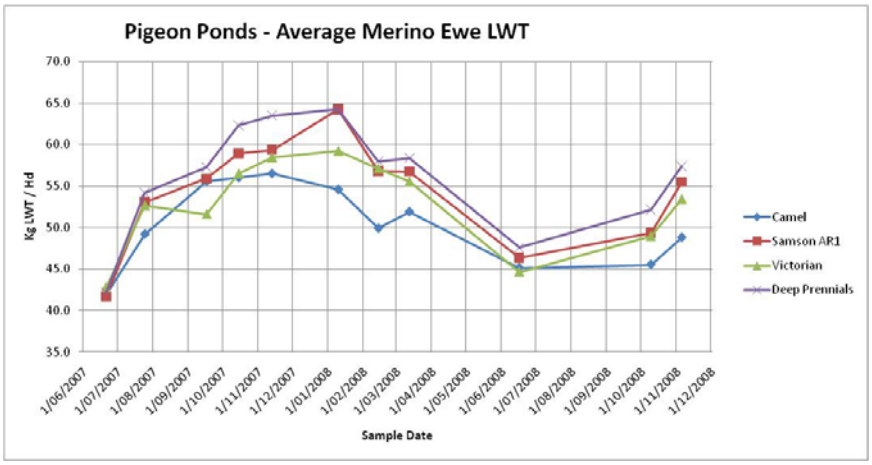


The ewes averaged approximately 5kg LWT heavier in 2008 vs 2007 however conditions in 2008 were such that by November of that year they were approximately 10kg per head lighter than the previous year. This is a substantial difference when considering the supplementary feed requirement over the summer months of 2008/09. In terms of the different treatments the order of sheep on the camel treatment tending to be the lightest and the sheep in the DRP treatment tending to be the heaviest was consistent at these time points and also generally throughout the trial.

Over the first 12 months of the project, the DRP's and Samson pastures allowed the ewes to reach heavier weights than the Camel and Victorian pastures going into summer, potentially setting them up for better conception rates and the subsequent lambing percentages that was observed in 2008.

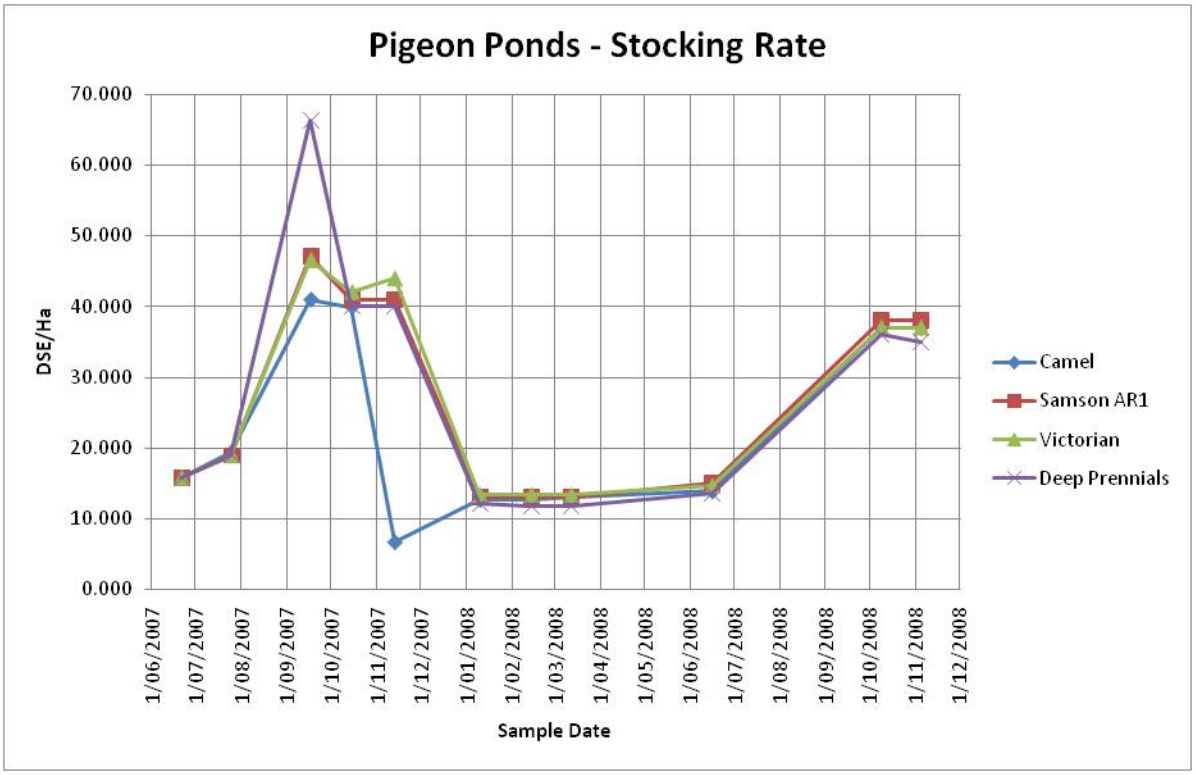


The Coopworth ewes dominate the sheep numbers in the project and the trends in this table are the same as for the trends overall.



Interestingly the Merino ewes in the DRP treatment were consistently the heaviest of all the merino ewes and this trend was more distinct than for the Coopworth ewes. The spread of weights at the conclusion of the project in November 2008 was greater for the Merino ewes than for the Coopworth ewes.

June 2007 – November 2008 Stocking Rate



The pattern across the two winter/spring periods involved was very similar however the dry conditions across 2008 meant that there was no opportunity for additional grazing of the treatments (eg with cattle) hence the more stable figures. It should be noted that while a straight line has been drawn from the June 2008 data to the October 2008 data set, it is expected that the same or similar figures for June 2008 would have applied to July 2008. Measurements were not recorded in July due to the earlier than expected beginning of lambing in the Camel block. It is also expected that even though no measurements were recorded in September 2008, it would have been similar to the figures for October 2008. The overall stocking rate pattern was similar in both years.

The table below outlines the average stocking rate from June 2007 through to June 2008

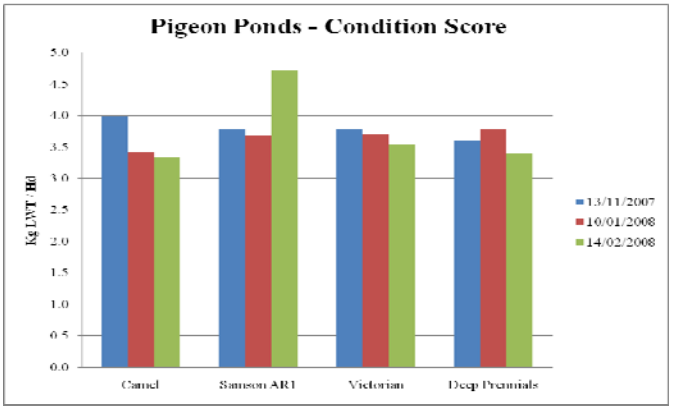
Treatment	DSE/Ha
Camel	19.5
Samson AR1	23.6
Victorian	23.8
DRP's	25.6

DRP = Deep Rooted Perennials

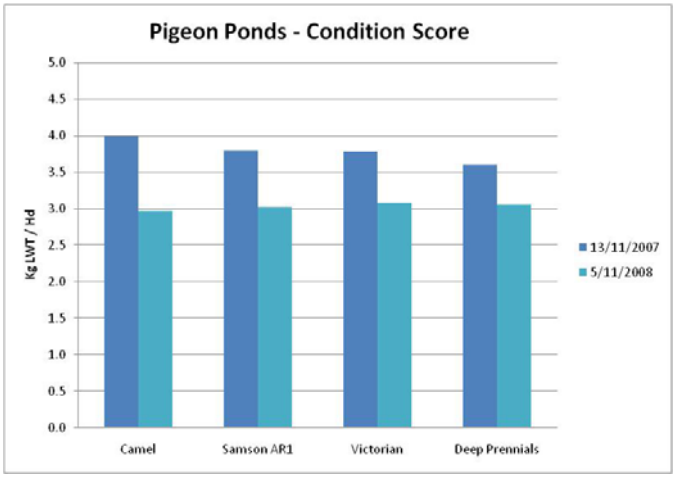
This table clearly demonstrates that over a 12 month period it is possible to achieve quite high average stocking rates, particularly with deep rooted perennial pastures. The sustainability of this approach needs to be considered carefully and in this case subsequent observations of the

pasture clearly indicate that in this environment, perennial ryegrass cannot survive such intense grazing pressure while the tall fescue and phalaris pastures may.

Conditions Scores



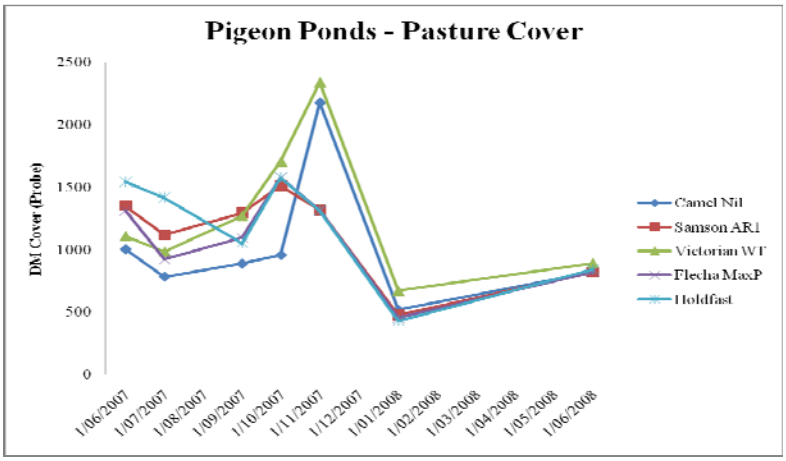
Overall condition scores were excellent for these livestock in the summer of 2007/08.



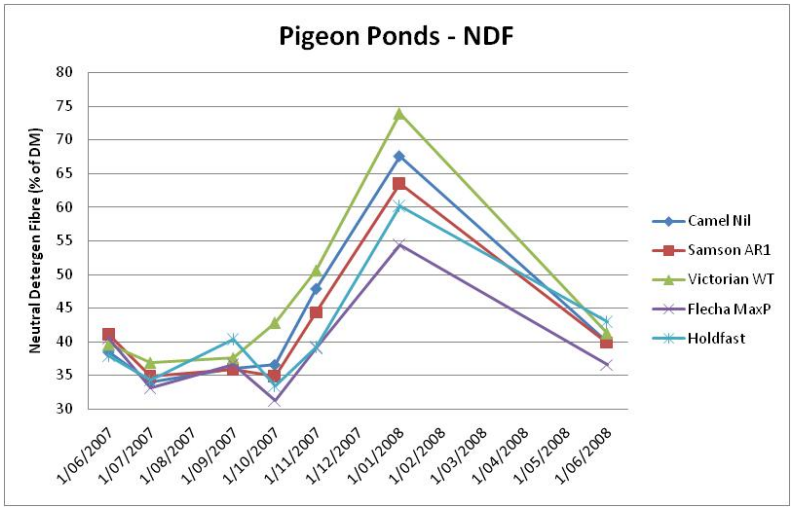
Due to the tough conditions in 2008 the reduced pasture growth appeared to limit the ability of the ewes to put on weight and the chart above clearly demonstrates that the ewes, while still in good condition, were not as well off at weaning in 2008 as they were in 2007. This reduced condition will have implications for subsequent supplementary feed over the summer of 2008/9 as well as potentially impact on the conception rates of the ewes at joining with lower lambing rates a possible result.

June 2007 – June 2008 Pasture Cover, Feed Quality and Alkaloid Levels

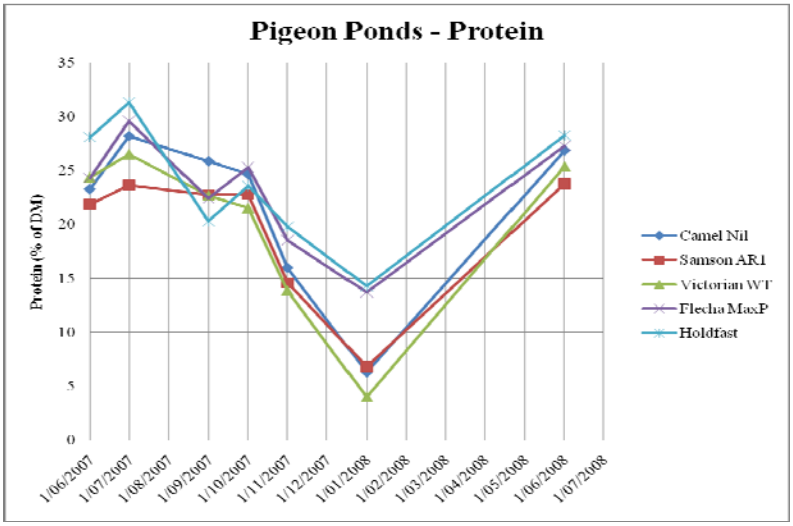
These charts specifically cover just the first 12 months of the project. Due to the Samson AR1 treatment being found not to contain the AR1 endophyte it was decided to reduce monitoring intensity in the later half of 2008 and finish the project at the end of the year.



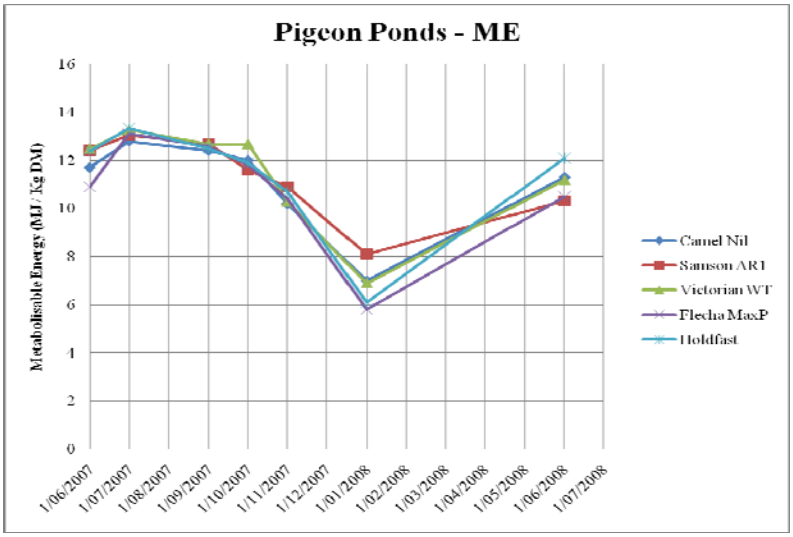
Under a high stocking rate and set stocking policy it was difficult to get pasture covers up to and around 1500kg DM/Ha however during 2007 the ewes continued to do well. Late in 2007 when the lambs were weaned the pastures were able to get away from the ewes and build up a little however not sufficiently to allow maintenance of the ewes over the summer. Interestingly, the Victorian and Camel treatments in particular were able to build up some standing dry dead matter late in 2008. At the time it was observed to be primarily reproductive stem and not surprisingly this corresponded with increases in the NDF levels reported below. The ewes in all treatments were able to get on top of this feed by mid summer and were in need of supplementary feeding.



Higher fiber levels are more consistently recorded in the Victorian treatment than any other and this is not surprising given that some of the newer cultivars in the other treatments have been selected for improved feed quality and lower fiber levels.

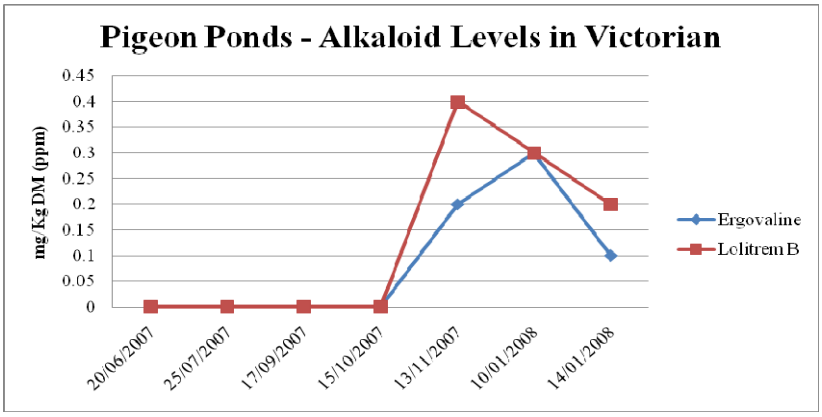


Apart from across the summer period, it is clear that all of the treatments contained more than enough protein to satisfy ewe and lamb requirements. It should be noted however that the deep rooted perennials Flecha tall fescue and Holdfast phalaris maintained much higher protein levels in the January measurement than all of the perennial ryegrass treatments. This may have significant consequences when formulating supplementary feed rations. This result implies that if there is any standing feed available of these cultivars then the feeding regime should focus more on the supply of energy which is often cheaper than including costly protein supplements in the ration. The chart depicting Metabolisable Energy (ME) levels in the different treatments below strengthens this suggestion by showing that the same two cultivars (Flecha and Holdfast) had lower ME values than the ryegrasses.



ME levels in the different pasture types are very good for much of the spring and early summer however they fall to quite low levels across the summer. It is worth noting that there are three groupings over the summer period with the Samson treatment being approximately 1 MJ ME/Kg DM better than the Camel and Victorian ryegrasses and 2 MJ ME/Kg DM better than the Flecha and Holdfast. This too would have implications for supplementary feed regimes.
Overall, it is worth noting that pastures aint pastures and that even within a single species there can be significant variation from one cultivar to another in terms feed quality. This means that it is crucially important to know what is in the paddock and to strategically sample these pastures/feeds and determine the actual feed quality prior to formulating potentially expensive supplementary feeding rations for the summer period.

Alkaloids in Pastures



Low pasture covers made it hard for perennial ryegrass to survive and promoted sub clover growth. Feed quality was generally very good as seen above. Toxic alkaloids (Ergovaline and Lolitrem B) did rise late in spring but the dry weather over summer meant that grass growth and alkaloid production stopped. Overall these levels are below the point where clinical symptoms would be expected. However there may well have been subclinical symptoms that either have not been picked up or, perhaps, are being expressed in ewe liveweight and lamb marking figures (see 2008 data). This project cannot statistically prove this however the table below showing the results of some urine analysis indicates quite clearly that the ewes on the Victorian treatment were excreting (and by inference, ingesting) significantly more toxin than other “toxin free” treatments.

Urine Analysis – Ergot alkaloids

	Mean Lysergol ergot alkaloids (ng/mg creatine)	Std Deviation	P Value	Significance
Deep Rooted Perennials	12.65	8.23	P = 0.0003	Yes – sig<0.001
Victorian (WT)	38.72	8.47		

Overall these levels were still quite low. This is in line with the test results for the pasture reported earlier.

2008 Worm Burden Tests (21/7/08)

Treatment	EPG
Camel	50/0
Samson AR1	70/0
Victorian	20/0
DRP's	0/0

DRP = Deep Rooted Perennials
Advice from Vet: No drench necessary.

This result was surprising given the low pasture covers and high stocking rates for this project.

Production from June 2007 to June 2008

INCOME	**Camel**	**Samson**	**Victorian**	**Deep Perennials**
Lambs	68	71	65	66
Lambing %	162%	169%	155%	157%
Av. Weaning Wt (kg)	31.6	33.5	34	34.4
Kg Lamb LWT per block	2148.8	2378.5	2210	2270.4
$/Kg Lamb	$1.50	$1.50	$1.50	$1.50
$/Ha	$805.80	$891.94	$828.75	$851.40
$/skin	$7.50	$7.50	$7.50	$7.50
$/Ha skins	$127.50	$133.13	$121.88	$123.75
Total Lamb Value	**$933 /Ha**	**$1,025 /Ha**	**$951 /Ha**	**$975 /Ha**
Compared to Victorian	-$18	+$74		+$24
Extra Grazing Days (cattle)		106	106	479
Weight gain kg/day		1	1	1
TTL LWT gain (kg)		106	106	479
$/Kg LWT		$1.00	$1.00	$1.00
Value of Grazing $/Ha		**$26.50**	**$26.50**	**$119.75**
Wool Income				
(Av 4kg/hd x $2.50/kg) $/Ha	$92.50	$95	$95	$92.50
Ewe weight change				
Number at end	37	38	38	37
Av. Weight at start	55.9	56	56	56
Av. Weight at End	62.0	61.9	59.5	62.0
Av. LWT gain/hd	6.1	5.9	3.5	6.0
$/Kg (nominal)	$0.70	$0.70	$0.70	$0.70
Value of weight gain $/Ha	**$39**	**$39**	**$23**	**$39**
GROSS INCOME ($/HA)	**$1,064**	**$1,185**	**$1,095**	**$1,225**
COSTS				
Stock Days off/on pasture	876			
$/day/hd	$0.05			
Total $/ha	$10.95			
Fertilizer Cost ($60/Ha)	$60	$60	$60	$60
Shearing ($3.50/hd x 40 hd)	$35	$35	$35	$35
Crutching ($1.10/hd x 40hd)	$11	$11	$11	$11
Animal Health ($0.60/Hd x 40)	$6	$6	$6	$6
Supplementary Feed ($18/hd x 40hd)	$180	$180	$180	$180
TOTAL $/Ha	**$292**	**$292**	**$292**	**$292**

Deaths/Culls	5	4	4	5
Value of Loss ($30/Hd)	$150	$120	$120	$150
Value of Loss / Ha	**$37.50**	**$30**	**$30**	**$37.50**
TOTAL COSTS ($/Ha)	**$340**	**$322**	**$322**	**$329**
NET INCOME ($/Ha)	**$724**	**$863**	**$773**	**$896**
Margin over Victorian WT	-$49	+$90		+$123

I know which one I would want! The DRP pasture option represents an 16% increase in net income (excluding establishment costs etc) over the Victorian perennial ryegrass option.

Production from June 2008 to November 2008

2008 Lambs

INCOME	**Camel**	**Samson**	**Victorian**	**Deep Perennials**
Lambs	57	59	57	61
Lambing %	154%	155%	150%	165%
Av. Weaning Wt (kg)	29.3	29.9	31.7	31.2
Kg Lamb LWT per block	1670.1	1764.1	1806.9	1903.2
$/Kg Lamb	$1.90	$1.90	$1.90	$1.90
$/Ha	$793	$838	$858	$904
$/skin	$6.00	$6.00	$6.00	$6.00
$/Ha skins	$106.85	$110.65	$106.85	$114.35
Total Lamb Value	**$817 /Ha**	**$860 /Ha**	**$875 /Ha**	**$922 /Ha**
Compared to Victorian	-$58	-$15		+$45
Wool Income				
(4kg/hd x $2.50/kg) $/Ha	$92.50	$95	$92.50	$90
Ewe weight change				
Number at end	37	38	37	36
Av. Weight at start	62.0	61.9	59.5	62.0
Av. Weight at End	64.3	67.6	67.1	68.3
Av. LWT gain/hd	2.3	5.7	7.6	6.3
$/Kg (nominal)	$0.70	$0.70	$0.70	$0.70
Value of weight gain $/Ha	**$15**	**$38**	**$49**	**$40**
GROSS INCOME ($/HA)	**$924**	**$993**	**$1016**	**$1036**
Deaths/Culls			1	2
Value of Loss ($30/Hd)			$30	$60
Value of Loss / Ha			**$8**	**$15**
INCOME ($/Ha)	**$924**	**$993**	**$1008**	**$1021**
Margin over Victorian WT	-$84	-$15		+$13

NB: The ram got to the ewes in the camel treatment one week earlier than the other treatments and so lambs in the camel treatment were on average approximately 1 week older at weaning. An adjustment of 1.6kg has been made to these lambs, being the average additional growth over the final week.

Although the project concluded at the end of 2008, if it is assumed that the animals were carried through the summer and to June and that ewe weights in June were as per the November weighing, we can add the following costs and come up with a final Net Income.

	$/Ha	$/Ha	$/Ha	$/Ha
Fertilizer Cost ($70/Ha)	$70	$70	$70	$70
Shearing ($3.50/hd)	$32	$33	$32	$32
Crutching ($1.10/hd)	$10	$10	$10	$10
Animal Health ($0.60/Hd)	$6	$6	$6	$6
Supplementary Feed ($18/hd)	$166	$171	$166	$162
TOTAL COSTS $/Ha	**$284**	**$290**	**$284**	**$280**
NET INCOME ($/Ha)	**$640**	**$703**	**$724**	**$741**
Margin over Victorian WT	**-$84**	**-$21**		**+$17**

The DRP treatment continued to outperform all other treatments.

Discussion on PIRD Objectives

Objectives

A. 10% improvement in lamb growth rates through using improved non toxic pastures. Although the Samson AR1 turned out to be Samson WT, there was limited difference observed in the growth rates of the lambs across the treatments. The Camel treatment in year 1 was a little lower than the other treatments but this had more to do with the level of feed that was produced in this paddock than any possible toxicity issue. However, in year 1, excluding the Camel treatment, there was a 2.5 – 7.5 improvement in total kg lamb weight produced in the improved (DRP and Samson) treatments over the Victorian WT. In year 2 just the DRP treatment had an advantage (5.4%) over the Victorian WT treatment. These results are still quite impressive when it is considered that both years were drier than normal or drought years and this would have depressed the potential pasture growth from all treatments.

B. ½ unit improvement in ewe condition score & 10% greater ewe liveweight through using improved perennial pastures. In the first year the Samson treatment exhibited excellent late season growth compared to all other treatments due to some November/December rain. This resulted in the ewes body weight and condition score improving considerably over the other treatments. To a large extent much of this body weight was lost over the summer months however the February condition scores for the Samson treatment were 1 unit greater than all other treatments. However the continuing tough conditions and

possibly other factors (such as the Samson containing WT endophyyte (toxic) rather than the expected AR1 (safe) endophyte) resulted in only a 3.5% advantage in lamb numbers at the end of the 2008 year. On the other hand, while the DRP treatment did not show the same advantages of the Samson over the 2007/08 summer, it did have a 10% better marking result compared to the Victorian WT treatment and finished up with a 7.5% greater number of lambs. The lack of replications and the relatively small numbers involved mean that this will not be statistically shown however it is an encouraging trend that should not be ingnored.

Changes as a result of this project

Overall the continuing dry conditions have hampered significant change on farm however all farmers that have observed this project first hand are impressed with the DRP treatment in particular and are encouraged to adopt these pasture types further on their own farms when the conditions are more favorable for establishing pastures. Farmers better understand some of the issues relating to toxic perennial ryegrass pastures through the regular discussions on the issue and they understand that there are more productive and persistent options than Victorian perennial ryegrass.

Environmental benefits

This project along with numerous other sources has promoted the benefits of long term persistent perennial pastures for both livestock production and for maintenance of topsoil.

Open Days and Field days

Over time the group monitoring this project changed from Prograze course participants to Lamb Cheque course participants. As a group they inspected this project 3 – 4 times a year and received regular feedback from Tim Leeming (who conducted both courses). In addition to these farmers one of the sponsors, Stephen Pasture Seeds, held 3 major field days at the site and invited guest speakers to attend the day and discuss the various pastures at the site. Two of the field days attracted approximately 20-30 farmers from the region while the third attracted 45-50 farmers.

Possible areas of Improvement of Project

There were two main issues that impacted the project. Firstly, the prevailing drought/dry conditions with below average rainfall resulted in tougher conditions over the summers and reduced plant persistence (for the ryegrasses only). This also reduced the potential pasture production. In this context, the results of the project are even more impressive. The second issue surrounds the Samson AR1 treatment. While in the first two years the performance of the cultivar was what would have been expected of Samson, the testing of the endophyte clearly showed that it contained the toxic (WT) form of endophyte and not the safe AR1 strain that was intended. How this came about remains a mystery however it does raise the question of how often does this happen in the industry? It was only through the endophyte testing regime in this

project that the error was discovered and it is generally rare for farmers to undertake this sort of testing as a normal practice. This issue alone would warrant further research.