EverGraze into Practice - Case study south western Victoria

Background

EverGraze is a national project that is developing new grazing and livestock systems to increase profitability and improve environmental outcomes on grazing properties in southern Australia. Initially, detailed grazing experiments (Proof Sites) were undertaken followed up with whole paddock evaluations on farms (Supporting Sites). In 2011, a series of case studies evaluated the whole-of-farm impact of adoption of new EverGraze grazing technologies.

The main outcomes of the EverGraze research were the principles of using the right pasture species, in the right place in the landscape, managed to maximise production and persistence, and then grazed by high performing livestock. In western Victoria, this means considering a wider range of perennials than just phalaris and perennial ryegrass (lucerne, tall fescue, cocksfoot), placed in either well drained or wetter parts of the landscape as required by the species with fertiliser and grazing management to suit the species. Superior genetic merit livestock are then managed so that high requirements (lactation) match with peak pasture supply. High quality pastures are best used by either growing stock or ewes/cows with high reproductive performance.

The western Victorian case study used a property south of Hamilton to test how the results from the Hamilton Proof Site could be used on a farm to increase profits and improve environmental outcomes. An eight person team of producers, agronomists, economists and animal scientists had a close look at the current soils, pastures, management and livestock and in consultation with the owners, suggested alternative pastures, animal and management options. These alternatives were modelled using the GrassGro computer program to estimate the impact on production and profits. A sophisticated water flow model was used to determine effects of the changes on recharge, runoff and erosion. This report provides details of the current farming operations, changes suggested and why these were proposed and predicted effects on production, profit and environmental outcomes.

Case study farm details

Doug and Cate Savin farm 30 km south of Hamilton in south-western Victoria, where the 720 mm rainfall occurs mainly from April to December. However, being only 50 km from the coast, the summers are mild and storms provide opportunities for summer pasture growth. August calving Angus cows making up 60% of grazing pressure with calves born in August-September kept for sale at 18 months meaning a high requirement for pasture over summer and autumn. Crossbred ewes lambing in July are bought in, lamb at 2 years of age and make up about 40% of the grazing pressure. Most lambs are sold in December with 20-30% held over and sold in April-May.

With a 400 ha farm it's important that they get high production per hectare. They currently run about 20 DSE/ha, close to the average of benchmarked farms in the area. However, they recognize that to keep pace with rising costs they need to look at ways to increase overall profitability. Supplementary feeding costs are high ($165/ha) compared to the district average ($98/ha) due to a shortage of quality pasture in late summer and autumn and they are looking to see if this expense can be reduced. Lamb weaning rate is currently 115% about the same as for other prime lamb farms in the region but lower than that achieved on the best farms.

Current pastures are mainly Victorian perennial ryegrass and fertiliser history is about 18 kg/ha P and 14 kg/ha K applied annually. Some paddocks have recently been sown to summer active ryegrass and tall fescue and lucerne have been considered. The farm is relatively flat but soils and topography vary with drier sandy soils on hilltops and lower lying wet flat. There are two environmental concerns that the Savin's would like to overcome. Waterlogged areas become pugged leading to pasture damage and reduced production.. Higher parts of the farm with light sandy soils are prone to wind erosion if bared out over summer and there is potential to grow lucerne or kikuyu.

Other important considerations for the Savin's are the impact on risk (variability in income) stress levels, family involvement and lifestyle.

Key results

The modelling suggests that there is potential for;

- Stocking rates to increase by 36% and Gross Margins by about $300/ha (over 50%) by changing soil fertility, stocking rates, pasture species and livestock systems. To obtain the higher gross margin would mean a greater emphasis on sheep and less on beef cattle.
- For the cattle herd, it is possible to nearly double Gross Margins (increase by $250/ha) by increasing soil fertility, running higher stocking rates and using 25% lucerne. For cattle, using lucerne significantly halved feeding costs compared to the ryegrass pastures ($82/ha vs $165/ha).
- Spending on increasing soil fertility and stocking rate generates a 70% return on investment.
- Twenty five % of farm sown to lucerne increases profitability of cattle but not of lamb enterprises. The later winter lambing and early summer sale of lambs means that there is low demand for high quality summer feed from the sheep enterprise.
- The addition of lucerne pastures reduced gross margin variability, in a failed spring, lucerne was able to effectively use summer rainfall and reduced the need for purchased feed.
- Lucerne reduces risk in adverse seasons in all livestock enterprises, lower variability in Gross Margins compared to perennial ryegrass pastures
- If 25% of the farm is sown to lucerne pastures, recharge is reduced by 16 mm/year (15%) and runoff by 0.2mm/year.
- A self-replacing composite ewe flock increased gross margins by 17% compared to XB ewes and reduced disease and price risks.

Case study process

Background data on farm productivity, profitability, environmental issues and the owner's aspirations was assembled and provided to the review team. Half a day was spent visiting the farm, inspecting facilities and pastures and talking with the owners about their priorities and how they managed the farm. Using existing benchmark production data, recent soil test information, views and aspirations of the owners, the review team undertook a Strengths, Weaknesses, Opportunities and Threats analysis (Table 1). A list of farm weaknesses and solutions to important issues was developed (Table 2).

Table 1 Strengths of "Corinda Vale"

- Good match between feed supply and demand for sheep and cattle
- Good genetics and management of the beef cattle herd
- High standard pastures dominated by sown perennials, strong P fertiliser history
- Stocking rates up with average for benchmarked farms in the region
- Reticulated water supply and good backup systems
- Good fencing, small paddocks
- Good family involvement, shared goals, positive attitude, keen to consider alternatives

Table 2 Current weaknesses and potential solutions for Case Study Farm

Weakness	Cause	Solution
Pasture production and stocking rate less than full potential given the rainfall and soil type, could be 28-30 DSE/ha.	Low potassium levels (Skene K 65-150 mg/kg, recommend 150-300)	Change fertiliser program for the property to balance nutrient requirements
Overall sheep productivity lower than potential	Sheep take lesser role on farm, purchased ewes, 8 week joining, weaning 115%, oldest lambs 18 weeks at weaning, scanned not used to identify dry ewes.	Tighter management of ewes, *ie* shorter joining, scan ewes, wean light ewes to boost condition score
High supplementary feed costs in the cattle enterprise ($165/ha/yr compared to $98/ha/yr district average)	High requirement for summer/autumn feed in the spring calving cattle enterprise, and lack of summer feed from current pastures	Use species that extend the growing season and provide out of season feed for cattle.
Sheep genetics could be improved	Purchasing replacement ewes is simple but high exposure risk (price, disease) Also, inability to select superior genetics.	Explore the option of a self replacing (Composite) ewe system
Water-logging in low-lying areas, erosion of lighter soils	Farm topography and insufficient water use, poor persistence of ryegrass on sandy soils	Increase water use of pastures, match species to soil type

Based on the strengths and weaknesses, several steps to lift overall production and profitability on the farm while improving environmental outcomes were suggested.

Increased fertiliser and higher stocking rate

Recent soil tests suggest that low potassium levels are limiting pasture production, clover content, especially spring production. Phosphorus and Sulphur levels are relatively high and the team suggested that the future fertiliser policy should use more K and less P and S. While the actual rates and products required need to be determined with input from an experienced agronomist, the team felt that this change could lead to a significant increase in pasture quality and production.

Increased fertiliser, higher stocking rates + 25% lucerne

For the next increase, the review team suggested looking at more diverse pastures to use wetter and drier parts of the farm. Lucerne sown with a complimentary perennial grass should be well suited to the sandy slopes and provide quality summer feed for young stock. Results from the Hamilton Proof Site shows while that using lucerne has no effect on average gross margin, it has a big benefit in failed springs where all ryegrass farms have to purchase large amounts of supplements. Lucerne will also help use excess water on the farm, provide a low risk pasture (no ryegrass staggers) and fire break on the farm.

Summer active tall fescue would suit the wetter flats and stand up better to grazing in winter, kikuyu is already present on the most exposed sandy hill tops and summer active perennial ryegrass (Banquet) should suit the relatively high rainfall mild summer climate of the farm. However, it is not possible to run these species in the GrassGro model so while they are realistic options for the case study farm, the effects of these species were not included in the modelling results.

The review team considered that the cattle was operating close to best management practice so did not suggest any change to calving time or genetics. The main options were to compare the production and gross margins achieved with the high fertility pastures with and without lucerne.

For the sheep enterprise, the review team suggested comparing the current XB ewe system with a self replacing Composite ewe flock. It was considered that Composite ewes would have higher fertility, allow greater genetic gain and reduce risk of introducing diseases. The comparisons were:
XB ewes; Current system with XB ewes bought in, lambing first at 2 years of age, and weaning 115% across the whole flock.
Composite ewes; Self-replacing ewe flock, lambing first at 12 months and weaning 130% across the whole flock. A direct comparison was also made between XB ewes and Composite ewes both at 115% weaning

All new animal options were compared with a baseline comparison of the current pastures with the current sheep and cattle systems. The CATPlus model (Catchment Assessment Tool) was used to look at the effect of the changes on water flow both on the farm and within the catchment.

Results

The results from the GrassGro modelling are shown in Table 3.

Table 3 Alternative pasture and sheep systems – Production and Economics

Scenario	Pasture growth (kg /ha)	Stocking rate (DSE/ha)	Supp feed ($/ha)	Meat (kg/ha)	Wean (%)	Mean Gross Margin ($/ha)	Gross Margin (10th, 90th Percentile)
Current farming system	10,000	20.5	$68	455	115	$560	**$377, $728**
Increased fertiliser & higher stocking rate: XB ewes	13,300	28.0	$40	635	119	$872	**$677, $1044**
Increased fertiliser, higher stocking rates + 25% lucerne: XB ewes	13,000	28.0	$44	632	121	$858	**$721, $1003**
Increased fertiliser & higher stocking rate: Composite ewes	13,000	28.0	$57	520	115	$902	**$451 $1219**
Increased fertiliser & higher stocking rate: Composite ewes	13,300	29.6	$77	598	130	$1016	**$491, $1386**
Increased fertiliser, higher stocking rates + 25% lucerne: Composite ewes	13,000	29.2	$67	591	131	$1007	**$672, $1493**

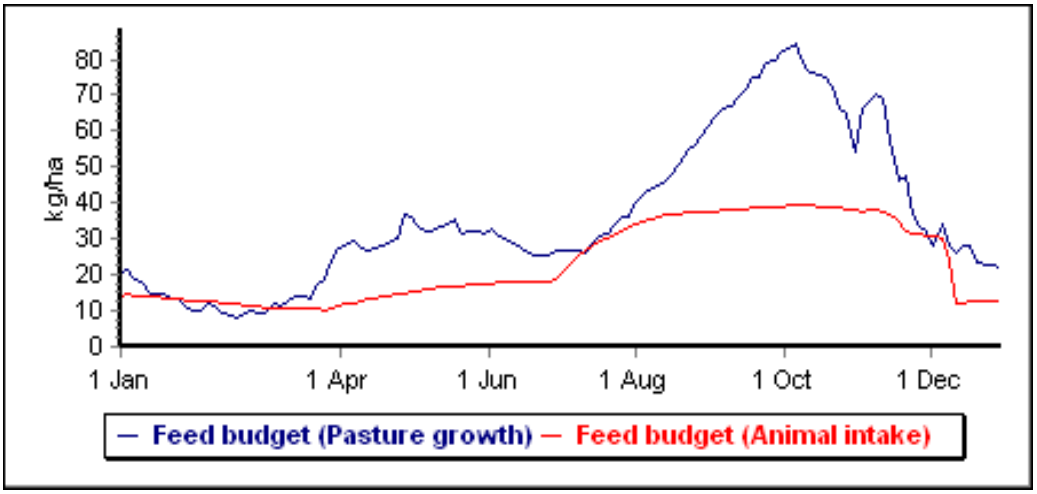
For the sheep systems, increasing soil fertility (assuming this was key limitation based on limited soil tests) allowed stocking rates to increase by 37% to about 28 DSE/ha, close to the potential carrying capacity in the region based on results from previous research. Gross Margin under this new scenario was 55% or $300/ha higher than for the current sheep system.

Sowing 25% of the farm to lucerne had no effect on the average Gross Margin compared to using all ryegrass sub clover pastures. Figure 1 shows that for July lambing ewes, ryegrass pastures with peak production in September-November, provides a neat match between feed demand and supply. However, the variability of the gross margin where part of the farm was sown to lucerne was lower than for all ryegrass pastures. The main benefit of lucerne was in failed springs when late rainfall provides significant additional pasture compared to ryegrass pastures. This is a similar result to that found at the Hamilton Proof Site where in 2006-07 drought, the feeding cost for systems including 33% lucerne was much higher compared to that for 100% ryegrass systems

Moving to Composite ewes increased gross margin to over $1000/ha due to reduced costs of replacement ewes, joining ewe lambs and a higher weaning percentage from the Composite compared to the XB ewes. Even if the same weaning % was used for both flocks (115%) Composite ewes had a higher gross margin due to lower replacement costs.

Alternative scenarios with earlier or later lambing and earlier or later sale of lambs were also tested. None of these scenarios with or without lucerne increased Gross Margins compared to the current system.

Figure 1. Perennial ryegrass pastures with higher fertiliser, 11 XB ewes/ha



The results from GrassGro modelling of the different cattle and pasture systems are shown in Table 4. In contrast to the sheep systems, using lucerne on part of the farm increased the profitability of the cattle systems as it provided quality herbage in summer and early autumn and so reduced the need for supplementary feeding (Table 4, Figures 2 and 3). Overall, gross margin of the cattle enterprise was lower than for prime lambs, due to lower meat income per ha (less total kg produced and lower price $/kg) , higher supplementary feed costs ($/ha), and in the GrassGro simulations, a slightly lower stocking rate could be maintained than with the ewe flock.

As for sheep, using lucerne reduced variability of income in the cattle enterprises compared to all ryegrass pastures.

Table 4. Alternative pasture and cattle systems – Production and Economics

Scenario	Pasture growth (kg/ha)	Stocking rate (DSE/ha)	Supp feed ($/ha)	Meat (kg/ha)	Weaning (%)	Gross Margin ($/ha)	Gross Margin (10th, 90th Percentile)
Current farming system	10,000	20.0	$165	397	96	$272	**$145, $430**
Increased fertiliser, higher stocking rate	13,300	25.5	$128	510	96	$453	**$290, $610**
Increased fertiliser, higher stocking rate + 25% lucerne	13,000	25.5	$82	527	96	$523	**$361, $632**

Figure 2. Perennial ryegrass, higher fertiliser, 1.6 cows/ha

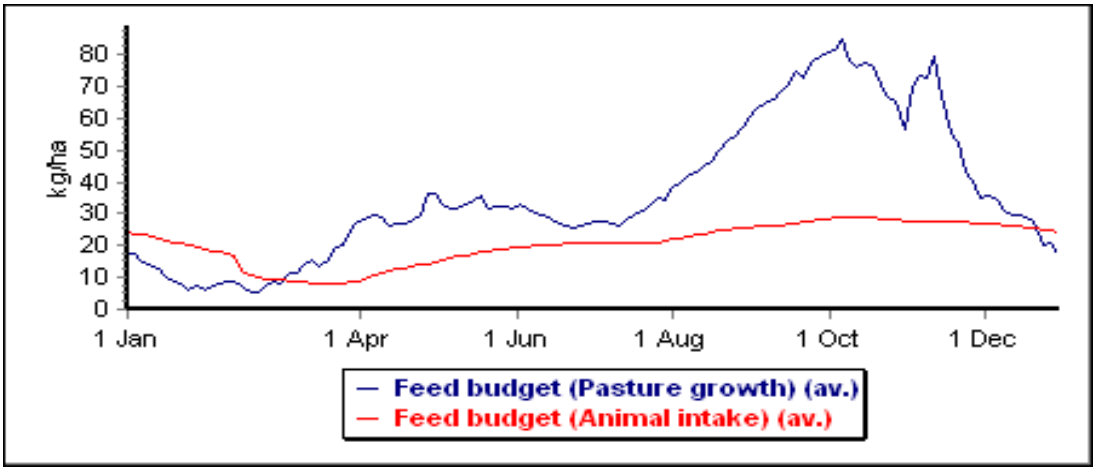
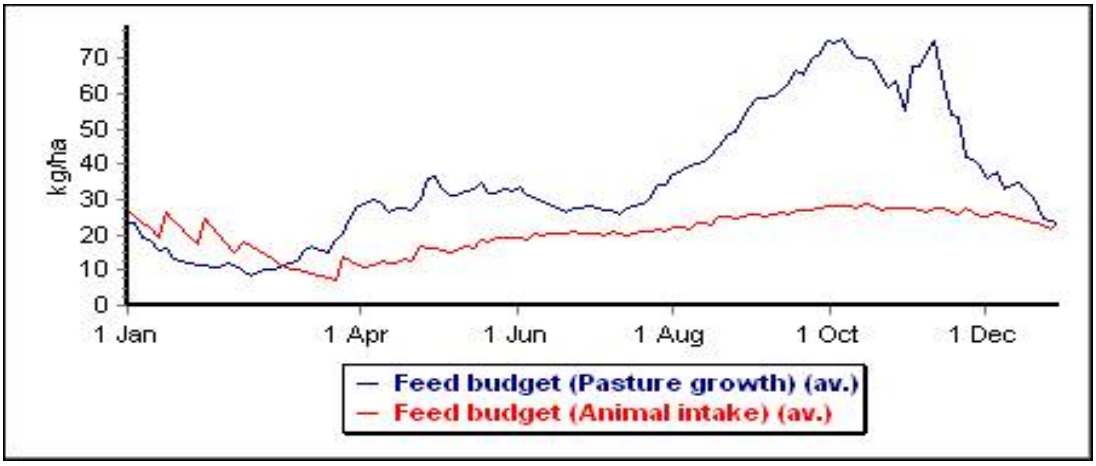


Figure 3. Perennial ryegrass, higher fertiliser + 25% lucerne, 1.6 cows/ha



Deciding on the most profitable investment

Production values and gross margins only tell part of the story on which option is the most profitable. Changing livestock, pasture type or fertiliser applications requires expenditure upfront and returns follow some years later. Therefore, the different options have been analysed over a 10 year period, looking at 3 measures of success;

- *Net Present Value;* This is the value in todays $$ of the cumulative cash flows (enterprise income minus enterprise costs and all additional capital costs) generated from the investment option over 10 years. An interest rate of 5% is charged on $$ invested to get the new system up and running. For simplicity, overhead costs and owner operator labour were not included in this analysis. It is assumed any extra livestock could be run utilizing existing labour.
- *Extra return/year;* This is the additional $$ that will be returned on the whole farm once the new system is fully operational.
- *Return on Additional Capital;* This measurement considers the return that the additional expenditure will generate. ROAC is lower for the lucerne systems due to higher costs of establishment.

All of the alternative scenarios were more profitable than the current systems (Table 5). Increased fertiliser and stocking rate provided the largest boost in NPV and extra return per year.

Table 5. Alternative pasture and livestock options – Whole farm profitability

Scenario	Net Present Value	Extra return/year (steady state)	Return On Additional Capital (steady state)
Current livestock and soils fertility, ryegrass pastures, 60:40 cattle sheep,	$1.26 million	-	-
Increased fertiliser, higher stocking rate, ryegrass pastures, 60:40 cattle sheep	$1.88 million	$98,000	75%
Increased fertiliser, higher stocking rate + 25% lucerne, 60:40 cattle sheep	$1.90 million	$106,900	70%
Increased fertiliser, higher stocking rate, ryegrass pastures, 100% cattle	$1.44 million	$27,600	30%
Increased fertiliser. higher stocking rate + 25% lucerne, 100% cattle	$1.52 million	$46,000	41%

Social, lifestyle and risk impacts

The review team also considered the impact of the proposed changes on non monetary factors. These are summarized below.

- *Higher fertility and stocking rates;* small increase in stress on operators and need for more capital, no change to other social or lifestyle issues. Low risk if adequate soil tests and expert advice is available.
- *Higher fertility, stocking rate and 25% lucerne;* more labour, stress, need for capital and risk (failure). However, improved lifestyle (less feeding and problems over summer) and lower risk in tough seasons.
- *Higher fertility, stocking rate and 25% lucerne, more sheep less cattle;* increased labour, higher stress (more sheep), lifestyle (owners prefer to work with cattle, more work over summer)
- *Higher fertility, stocking rate and 25% lucerne, all cattle;* less labour and stress, improved lifestyle, reduced risk in tough years.

- *Composite ewes;* reduced risk from disease introduction to the farm, less stress and risk from high purchase price.

Environmental impacts

It's important to consider the impact of changes in pastures, stocking intensity and animal systems on recharge, runoff and potential erosion risk. The new pasture and animal systems were compared with a Catchment Assessment Tool (CATPlus) that uses soil and pasture details and historical climate records to estimate surface runoff, erosion and recharge below the root zone,

Runoff and erosion from the farm were low in all scenarios (Table 5) due to the permeable soil and relatively flat topography on the farm. Significant runoff (>1 mm/year) only occurred in 6 years out of 40 with the highest being 9 mm/year in 1983.

Increasing soil fertility had no impact on recharge. However, when 25% of the farm was sown to lucerne, recharge fell from 123 mm/year to 105 mm/year. Increased water use occurred because the lucerne pasture had higher green leaf area in summer and so more soil water was transpired. The overall impact was similar to that seen at the Hamilton Proof Site where recharge under lucerne pastures was much lower than for perennial ryegrass pastures

Table 5 Alternative pasture and animal systems – Environmental factors

Scenario	Recharge per year	Runoff per year	Erosion per year
Current farming system	124 mm	0.7 mm	0.001 mm
Increased fertiliser and stocking rate	123 mm	0.6 mm	0.001 mm
Increased fertiliser and stocking rate + 25% lucerne	105 mm	0.5 mm	0.001 mm

As an interesting comparison, the effect of planting either 25% or 100 % trees on the farm was also tested. These plantings resulted in recharge dropping to 93 mm/year and 5 mm/year respectively.

When the changes in pasture type and fertility were applied across the Eumeralla catchment, similar differences in recharge to those observed on Corinda Vale were predicted. *ie* reduction in recharge of 14% from incorporation of 25% lucerne, and little effect on runoff and erosion.

Conclusions

Overcoming nutrient deficiencies

The greatest increase in productivity and profitability occurred when nutrient deficiencies were corrected, increasing pasture production by about 3000kg/ha and allowing higher stocking rates (*c* 28 DSE/ha) to be maintained across the farm. The higher pasture production had a greater impact on the profitability of the prime lamb enterprise because the feed demand was well matched with feed supply and allowed a greater increase in overall stocking rate than for the cattle enterprise where progeny stayed on the farm for 18 months. Correcting soil nutrient deficiencies is low risk as there is good information available on likely responses and critical soil levels.

Using lucerne

Further refinement of the pasture system included 25% of the farm sown to lucerne. Including lucerne on the farm had no effect on the mean gross margin/ha of the prime lamb system as there was limited need for high quality pasture in summer as most lambs were sold in December. However, 25% lucerne reduced the variability of the gross margin/ha for the prime lamb flock. In years with a dry spring, the lucerne pasture was able to respond to summer rain and reduced the need for supplements.

For cattle, using 25% lucerne increased Gross margins by ?? % as the higher quality feed could be effectively used by the growing young stock reducing supplementary feed requirements. Using lucerne will reduce risk in poor springs but there is increased risk during the establishment phase.

Composite vs XB ewes

Composite ewes were more profitable than XB ewes. This was due to a combination of factors including joining at 7 months of age, had higher overall weaning percentages and cheaper replacements. Even when Composite and XB ewes were assumed to have the same weaning percentage, the Composite ewes were more profitable due to lower replacement costs. For Composite ewes, there was no difference between the gross margin with or without lucerne. While the lucerne could be used for the replacement ewes, presumably this benefit was relatively small compared to the total flock requirements. Moving to self-replacing Composite ewes reduces risk from disease introduction, variable genetics and purchase price. However, it increases complexity of the sheep operation compared to purchase of replacement ewes.

Sheep vs cattle

Cattle were less profitable than prime lamb systems in all scenarios. A similar increase in gross margin was observed if the cattle were grazed at higher stocking rates on more fertile pastures as was observed in the prime lamb flock. In contrast to the lamb systems, the cattle enterprise was able to capitalize on the lucerne pastures with a 16% higher gross margin/ha than for the high fertility ryegrass pasture system. The different response between the sheep and cattle flock to lucerne was due to greater demand for high quality forage in summer and reduced cost for supplements in the cattle lucerne systems. Maintaining both sheep and cattle reduces exposure to price risk from a change in commodity prices.

Environmental impacts

The addition of 25% lucerne resulted in about a 15% decline in recharge and a small decline in runoff. Given that only 25% of the farm was sown to lucerne, these reductions in recharge and runoff should lead to positive benefits in water-logging, nitrate leaching, soil acidity and soil health which are all driven by water movement. Reduced runoff may have a small impact on water flow into dams and streams but the modelling indicated large variability between years and it is likely to have little if any measurable impacts. In contrast, if 25% of the farm was planted to trees, recharge was almost completely eliminated with likely large impacts on future ground water levels.

Return on investment.

When the suggested changes were aggregated into today's $, the use of higher fertility pasture systems with a 60:40 cattle sheep mix lead to a $640K higher NPV compared to current practice. However, if an all cattle operation was used, the NPV was only $180K higher than current practice. The adoption of higher soil fertility and higher stocking rates increased return/year by around $100K

with a 70% return on investment. Using an all cattle system with high fertility ryegrass pastures lead to an extra return of $27K/year and 30% return on investment. A combination of ryegrass and lucerne pastures with an all cattle operation gave a significantly higher return per year ($46K) and return on investment (41%) compared to the ryegrass only system.

Owner's intentions

Following this exercise, the owners intend to work on the following priorities;

- *Soil fertility and stocking rate;* The owners intend to overcome soil fertility limitations thorough more soil testing and changing fertiliser applications with advice from appropriate people. They agree that this should allow them to increase to at least 25 DSE/ha
- *Sheep vs cattle;* The Savin's will maintain the current sheep:cattle ratio. They are considering Composite ewes and understand benefits in disease status, selection of superior genetics and lower capital costs but are concerned that it may add complexity to the sheep operation.
- *Supplementary feeding;* They will look for more cost effective feedstuffs, purchased on ME values.
- *Alternative pasture species;* The first priority is to increase soil fertility and then stocking rates. Once this has been achieved, they will consider using alternative species such as lucerne (or tall fescue). They feel that trying to establish other species while simultaneously changing fertility and stocking rate adds too much complexity to their systems.

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