Final report

PDS: Better Bega Beef

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Abstract

Three on-farm paired paddock trials in the Bega Valley demonstrated highly profitable increases in productivity associated with improved pasture production and pasture quality.

District soil data indicated that there are major soil deficiencies on farms in the Valley. Previous work across southern Australia has shown that major increases in productivity and profitability result from correcting these deficiencies.

Fertilizer requirements were determined from a combination of soil and plant tissue tests. Capital applications of fertilizer were applied over two years to remove these limitations. Fertilizer was applied to an existing pasture sward to one of the paired paddocks at each of two grazing sites. By the end of the trials, one site had recorded an increase of 6DSE/ha as a result of the fertilizer applications and the other site had recorded a 13DSE/ha increase.

Another site examined the impact of additional potassium on hay and silage production. Extra potassium resulted in an average 19% increase in yield. Further investigations identified boron deficiency, the correction of which resulted in a 300% increase in hay/silage yields.

The results of the project confirm the results obtained from other areas in southern Australia. It has established local benchmarks and provided strategies for capturing pasture productivity.

Executive summary

Background

Stocking rate is a major determinant of profitability and pasture production is the major determinant of stocking rate.

District soil data indicated that there are major soil deficiencies on farms in the Bega Valley. Previous work across southern Australia has shown that major increases in productivity and profitability result from correcting these deficiencies.

Dairy farmers as well as sheep and beef farmers were targeted for this PDS. The PDS evaluated responses to fertilizer to provide benchmarks for productivity in the Bega Valley. Farming systems and environmental conditions vary between regions. While the principles of fertilizer application are well recognised practical evaluations under local farming systems are essential to identify and modify practices to capture the benefit of improved nutrition.

Objectives

- Investigate the potential productivity of pastures in the Bega Valley through the correction of soil nutritional deficiencies – achieved.
- Work with the participating farmers to adapt their farming systems to the increase in pasture production – achieved.
- Evaluate the economics of correcting soil nutritional constraints – achieved.
- Demonstrate the results to the wider farming community – partially achieved.

Methodology

Three paired paddock comparisons evaluating the impact of correcting soil deficiencies were conducted in the Bega Valley. At each site comprehensive soil and plant tissue tests were taken and a fertilizer program developed to correct the deficiencies identified. Both paddocks at each site were initially managed under the normal farm practice for the farm. On one paddock (Productivity paddock) sufficient fertilizer was applied to correct the deficiencies over a two-year period while the standard farm practice was maintained on the Control paddock. These fertilizer applications are termed “capital applications”. The responses to the fertilizer in terms of changes in stocking rate, pasture composition, supplementary feed levels and pasture production were monitored and measured over a three-year period.

The participating farmers met regularly, assessed the pastures and stock, and were involved in decisions to manage the increased pasture growth.

Results/key findings

Large increases in productivity were obtained from addressing identified nutritional issues on three properties. At one site which was running sheep, the stocking rate increased from 5 DSE/ha to 18 DSE/ha. Wethers were initially run in this trial, but the improved nutrition resulted in dramatic changes in pasture composition and feed quality such that the pastures are now carrying breeding stock. At an average gross margin of $35/DSE, this represents a profit of $455/ha.

Another site was stocked with breeding cows. In the first year, the cost of supplementary feed was $165 on the Control paddock, while no feed was required on the Productivity paddock. At the

conclusion of the project, there was a 6DSE/ha difference between the two paddocks – an advantage of $210/ha to the Productivity paddock.

When the increase in carrying capacity was assessed in terms of the cost of the capital fertilizer, the increase in carrying capacity at the first site was achieved at a cost of $35/DSE and at the second site at a cost of $67/DSE.

The third site was a hay/silage operation. A number of nutritional deficiencies were identified and addressed. Additional potassium resulted in an average 19% increase in fodder production, while boron application resulted in an estimated 300% increase in dry matter production.

The results were regularly communicated to the wider farming community through newsletters and social media outlets. Two field days were held which were attended by local farmers, Agriculture Department staff and local agronomists.

It was planned to involve neighbouring farmers in regular site inspections. However, there was poor uptake in this activity and the imposition Covid restrictions meant that this component was not fulfilled.

Benefits to industry

The project demonstrated major increases in productivity through the correction of nutrient deficiencies on existing pastures and on sown fodder crops. The practical demonstrations of the potential productivity provide benchmarks for the Valley and a basis for the extension of this information to the wider community.

Future research and recommendations

The results of these trials confirmed the results achieved previously through the Grassland's Productivity Program (GPP) and the Paired Paddock Program (PPP) funded through AWI from the mid-1990s to mid-2000s.

There is a poor understanding and implementation of best practice fertilizer practices in much of the medium to high rainfall zones. Major lifts in farm productivity and profitability are being forgone as a result.

A program focussing on the identification of nutrient deficiencies on-farm and the active engagement by farmers adopt the resulting recommendations and to adapt to their farming system would deliver large benefits to the red meat industry.

The results also highlighted the opportunity to develop integrated management of difficult to control weeds such as African Lovegrass and Fireweed through the use of fertilizer, higher stocking rates and selective use of herbicides.

PDS key data summary table

Project Aim:
Demonstrate the impact of growing more pasture (through the removal of nutritional limitations and other identified limitations) and efficiently utilising the feed produced by running more cattle or achieving higher growth rates in young stock (indicative targets of 20% increase in DSE/Ha).

Measure and compare the economic performance of two paired paddock treatments in each location with respect to changes in production per hectare, either as an increase in stocking rate (targeting 20% increase in DSE / ha), increased animal performance per head (weight gain) or reduced supplementary feed costs

	Comments		Unit
Production efficiency benefit (impact) Site 1 (Alcock) Site 2 (Weston/Culley) Site 3 (O'Brien)	1. Capital cost per DSE increase SR/ha Inc GM/ha 2. Capital cost per DSE increase SR/ha increase GM/ha 3. $/ha (K) tDM/ha (B)	$69 6 $240 $35 13 $455 $303 300%	/DSE DSE/ha /ha /DSE DSE/ha /ha /ha %
Reduction in expenditure Reduction in labour i.e. DSE/FTE, LSU/FTE, AE/FTE; Reduction in other expenditure	Less supplementary feed at one site (Site 2)	-$165	/ha
Increase in income	Average	$500	/ha/year
Additional costs (to achieve benefits)	Approx	$200	/ha/year
Net $ benefit (impact)		**$300**	**/ha**
Number of core participants engaged in project	Included partners and sharefarmer	5	
Number of observer participants engaged in project	Workshop and field day attendees	41	
Core group no. ha		1090	
Observer group no. ha		0	
Core group no. sheep		500	hd sheep
Observer group no. sheep			hd sheep
Core group no. cattle		667	hd cattle
Observer group no. cattle			hd cattle
% change in knowledge, skill & confidence – core		100%	
% change in knowledge, skill & confidence – observer	Not undertaken		
% practice change adoption – core	Results adopted on all core farms	100%	
% practice change adoption – observers	Not undertaken		.
% of total ha managed that the benefit applies to		100%	
Key impact data			
Gross Margin / Ha	**Site 1 $240** **Site 2 $455** **Site 3 $387***		

Capital Fertilizer Cost/DSE	**Site 1 $69** **Site 2 $35**

* Potassium response only

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1. Background

Lack of knowledge of both best practice beef production and available markets for dairy or dairy-cross beef products impact on the overall viability and sustainability of these businesses. A dairy business that is successfully diversified across both dairy and beef industries is good for the business itself and good for the dairy and beef industries. At present, it is estimated that the carrying capacity of unfertilised native or mixed pastures in the Bega Valley is approximately 3 DSE per hectare. Moderately fertilised mixed pasture might carry 5 – 8 DSE per hectare. The project is expected to demonstrate that the carrying capacity of dryland pastures can be significantly improved.

2. Objectives

Over a three-year period, commencing in September 2018, to carry out three "Paired Paddock Programs" (each with two sites) to:

1. Demonstrate the impact of growing more pasture (through the removal of nutritional limitations and other identified limitations) and efficiently utilising the feed producedby running more cattle or achieving higher growth rates in young stock (indicative targets of 20% increase in DSE/ha).
Comment: This objective was exceeded

2. Measure and compare the economic performance of two paired paddock treatments in each location with respect to changes in production per hectare, either as an increase in stocking rate (targeting 20% increase in DSE / ha), increased animal performance per head (weight gain) or reduced supplementary feed costs.
Comment: This objective was met with targets exceeded

3. Increase the skills and practices of core and observer producers in stock and pasture assessment and feed budgeting (measured by workshop attendance and surveying improved knowledge and skills and increased adoption).
Comment: Due to the late start to the program which coincided with Covid restrictions it was not possible to engage a consistent group of observer participants. No formal assessment of core producers was undertaken at the end of the project. It was deemed unnecessary as all the final participants had moved or were intending to adopt the findings of the project.

4. Communicate the findings of the paired paddock comparisons to the wider farming community (75 members of the Far South Coast Dairy Development Group (FSCDDG); approximately 300 members of the Far South Coast Farmers Network (FSCFN) and more broadly in the region through LLS and Landcare networks as appropriate).

Comment: Regular updates of the program were circulated through the FSCDDG Facebook page and the FSCFN newsletter. LLS personal were heavily involved in the establishment of the sites and local agronomists (4) attended the site meetings and field days.

5. The core producers will continue to use the results of the comparisons as a result of the PDS (measured by follow-up survey of adoption of BMP).
Comment: Follow-up survey was deemed to unnecessary as the participating farmers had either extended the lessons from the trials to extensive sections of their farms or were

intending to do so. One producer was investigating using high rates of fertilizer in conjunction with selective herbicide use and increased stocking rates as a means of managing African Lovegrass.

6. 25% of the members of the DDG (75 producers) indicate they will adopt results from the PDS
Comment: This objective was not met. Despite widespread advertising and direct approaches to selective dairy farmers there was minimal interaction with dairy farmers. There was no attendance at any of the farm walks and only one dairy farmer attended one of the field days.

3. Demonstration Site Design

3.1 Methodology

Soil test data surveys for the Bega area indicated that there were major deficiencies in phosphorus (70% deficient), sulphur (70% deficient) and potassium (30% deficient).

The program was based on the methodology used for the Grassland's Productivity Program/Triple P which assessed, under practical farming situations, the potential productivity of pastures in the medium to high rainfall areas of south eastern Australia if soil nutritional limitations were removed. GPP/PPP achieved an average 35% increase in stocking rate across over 1100 paired paddock comparisons, with an average increase in gross margin of 30-40%.

Given the existing soil data it was anticipated that significant improvements in productivity could be achieved by addressing nutritional limitations.

The program required the selection of two comparable paddocks on a farm. One would be run under the farmer's normal farming practices (Control paddock) and the other which would have fertilizer applied over a two year period to remove nutritional limitations (Productivity paddock). Under grazing comparisons, stock were to be stocked initially at the same stocking rate on both paddocks. Stock numbers were increased incrementally on the Productivity paddock as feed levels increased above the Control paddock or if stock condition on the Productivity paddock was better than on the Control paddock.

It was a requirement that stock be set stocked for as much as practical for the duration of the project to ensure that any changes in stocking rate were sustainable. The set stocking requirement was a barrier for a number of potential participants.

The project was seriously impacted firstly by the extended drought suffered by the district until 2020, then by the south coast bushfires and finally the Covid 19 lock downs.

Recruitment of participants into the program was difficult due in part to financial constraints associated with the drought.

Six sites were identified for the project following the drought. Four were grazing sites and two were sites for hay/silage production. Each paddock on each site was soil sampled for major nutrients and acidity levels and clover tissue samples were taken to assess the trace element status of the pastures.

While six sites were initially selected, three actual demonstration sites were operationalised.

The soil test results from the sites which completed the project are shown in Table 1, Table 2 and Table 3

The results are colour coded for interpretation. Red indicates a limitation to production and

green, no limitation to production. Orange indicates a marginal result. Phosphorus application rates were calculated to lift the starting soil test level and the phosphorus buffering Index to a non limiting value.

3.1.1 Alcock, Mogilla

Comparison: Speckle Park cows and calves.

Table 1 Soil test results Alcock site

Treatment	Paddock	pH (CaCl2)	EC	P (Olsen)	PBI	Potassium	kgP/ha/yr	kgK/ha	S reqd
			dS/m	mg/kg		mg/kg			
Control	Front	4.9	0.04	6	67	120			y
Productivity	Double Gate	5	0.07	9	50	180	25	0	y

Fertilizer was applied at the rate of 250kg/ha/year for two years. Molybdenum and copper were applied in the first year at a total cost of $418/ha.

3.1.2 Weston/Culley, Myrtle Mount

Comparison: Initially stocked with wethers on both paddocks.

Table 2 Soil test results, Weston/Culley site

	Paddock	pH (CaCl2)	EC	P (Olsen)	PBI	Potassium	kgP/ha	kgK/ha	S reqd
			dS/m	mg/kg		mg/kg			
Control	West pdks	4.8	0.06	7	83	160	35	0	y
Productivity	Airstrip	4.9	0.07	7	78	360	35	0	y

Superphosphate was applied at the rate of 320kg/ha/year for two years. Molybdenum was applied in the first year at a total cost of $453 .

3.1.3 O'Brien, Moran's Crossing

Comparison: Hay and silage production.

Table 3 Soil test results, O'Brien site

	Paddock	pH (CaCl2)	EC	P (Olsen)	PBI	Potassium	kgP/ha	kgK/ha	S reqd
			dS/m	mg/kg		mg/kg			
Control	Windmill W	4.7	0.06	15	77	50	0	100	y
Productivity	Windmill E	4.7	0.06	15	77	50	0	100	y

This site had been extensively harvested for silage/hay for a number of years. The standard fertilizers applied have been DAP and urea. This resulted in adequate phosphorus, but low sulphur and very low potassium – target level 120mg K/kg. The basal treatment was changed to single superphosphate to cover the sulphur deficiency. The comparison at this site focussed on the application of additional potassium following harvests. Molybdenum and copper were

also applied in the first year.

Boron was applied to the site following identification of a deficiency through plant analysis.

3.1.4 Grazing site – Verona

This site was abandoned in 2021. Stock were frequently moved between paddocks and the Control paddock was oversown during the course of the project making it impossible to draw meaningful conclusions from the comparison at this site.

3.1.5 Hay/silage site, Toothdale

This site only started in 2021 due to the effects of the prolonged drought on the business. When the paddocks were sown to an oaten silage crop it was found that there were major differences between the performance of the paddocks that were not related to the treatments and were not evident in the soil tests or initial observations. Consequently, this site was abandoned.

3.1.6 Grazing Site – Angledale

Abandoned after owner decided to use effluent and was not able to commit to set stocking.

At the grazing sites, existing pastures were used. No resowing of pastures was undertaken. At the harvested site, ryegrass crops were sown annually.

3.2 Economic analysis

At the grazing sites, records were kept of the changes in stocking rate and the class of stock run on the paddocks. Records of supplementary feed was also recorded when it was fed. Changes in stocking rates were used to undertake gross margin analyses of the paddocks at two grazing sites. The use of capital fertilizer can also be viewed as a means of "buying" carrying capacity. The cost of buying a DSE through fertilizer application was compared to the cost of buying a DSE of carrying capacity through land purchase.

At the hay/silage site, the marginal return from applying extra potassium was calculated from the value of the extra rolls harvested.

3.3 Extension and communication

The project was to have two focal groups with three closely monitored paired paddock sites in each. Each of these groups was to have a group of neighbouring farmers who would be encouraged and supported in running comparisons on their properties.

The following communication activities were undertaken

- Annual Field Days
- Meeting reports to South Coast Dairy Development Group and Far South Coast Farmers Network
- Individual results of the trials for each paired paddock comparison
- A fact sheet produced based on case studies

Other activities undertaken were the involvement of local agronomists and a number of interviews with the local ABC radio station.

The program lost impetus due to the impact of Covid restrictions which meant that on-farm meetings involving non-core producers could not be held for a critical period in the program.

3.4. Monitoring and evaluation

The monitoring and evaluation processes are shown below

- One paddock on each of six farms managed normally and the other paddock fertilized to remove nutritional limitations.
- Cooperating farmers and interested producers to meet on each of the sites three times a year to assess the response to increased soil fertility and adjust stocking rate to maintain similar stock condition on both paddocks.
- Data on area and stock involved
- Funding – cash and in-kind
- Demonstration site data - feed availability, feed quality, stock condition, and stock weights monitored to provide basis for changing stocking rates/measuring difference in per animal performance.
- Field days held, demographics collected, and M&E conducted
- Communication products
- Reports in SCDDG newsletters and social media
- Case studies
- Producer guides / fact sheets
- Change in knowledge/attitudes/skills of core and observer participants before and after project/activity particularly in relation to pasture and stock assessment as a means of making informed decisions regarding feed budgeting
- Experience of producers involved in the PDS
- Producer (core & observer) practice (relevant to the topic/project) before and after project

4. Results

4.1 Demonstration site results

Pasture production increased with the application of fertilizer on the grazing sites. While there were significant responses in the first year at both sites, the sites took two years for major changes in pasture composition to become evident. The fertilized paddocks increased clover content markedly and after the second year the annual ryegrass was becoming evident. There were major weed issues at the Alcock site (Fireweed) and African Lovegrass at the Weston/Culley site. The increased pasture vigour was identified as a vital tool in managing both these weeds.

Large increases in stocking rates were achieved at both the grazing sites (see below). At the Weston/Culley site, the stock type on the Productivity Paddock was changed from wethers to lambing ewes due to the improvement in pasture quantity and quality.

The hay/silage site produced profitable increases in yields from additional potassium and spectacular results from the correction of boron deficiency.

4.2 Economic analysis

The economic analyses of the grazing sites has been done in two ways. Firstly, the costs and returns based on including the capital cost of the fertilizer as a recurrent cost for the two years of application. Note, that once soil fertility levels have been lifted through the capital fertilizer applications, subsequent fertilizer is applied as a maintenance dressing and the cost included in the gross margin of the enterprise.

The inclusion of the capital cost of fertilizer as an annual (recurrent cost) is important from a cash flow perspective in justifying the upfront cost of the fertilizer, but in reality the fertilizer is designed to lift long term carrying capacity. Consequently, another way of assessing the benefit of the program is to divide the total capital fertilizer cost by the increase in carrying capacity. This gives a capital cost per extra DSE carried which can be compared to the cost of purchasing extra carrying capacity through land purchase.

Increasing stock numbers through land purchase is estimated to cost $800-$1000/DSE.

4.2.1 Alcock

This site received two capital applications which averaged $213/ha/year.

The first year of the trial was at the end of the drought. The Control paddock in this year was stocked at 6.8DSE/ha and the Productivity paddock at 8.5DSE/ha. The stock on the Control paddock were fed hay while no hay was fed on the Productivity paddock. The cost of hay fed on the Control paddock was $165/ha. As well as this saving in fodder costs, the return from the extra stock, based on average gross margins of $35/ha would have added another $60/ha benefit to the Productivity paddock. These amounts combined covered the annual cost of the fertilizer.

Since then and with the better seasons, the Productivity paddock carried 20 DSE/ha through the winter last year while the Control paddock carried 14 DSE/ha – a difference of 6 DSE/ha. Based on the above gross margin, this is an additional $210/ha. Again this increase in gross margin covered the cost of the fertilizer.

If the application of fertilizer as a capital dressing is seen as a means of “buying” carrying capacity, then an increase of 6 DSE/ha has cost $418/ha in fertilizer or $70/DSE.

4.2.2 Weston/Culley

Initially both paddocks were stocked at a rate of 6.5 wethers/ha. The project highlighted the hidden potential of the existing pastures. The use of fertilizer alone has dramatically changed the composition of the pasture – without the need to resow.

As the pastures responded stock numbers were increased and the change in pasture quality meant it was now suitable for breeding ewes which were introduced to the paddock in 2021.

Cattle had to be introduced to help control the extra feed during 2022. The Control paddock was stocked at 5 DSE/ha for the last twelve months while the Productivity paddock averaged 18DSE/ha.

Again using an average gross margin of $35/DSE the Productivity paddock would have returned $455/ha more than the Control paddock in 2021/22. If the cost of the capital fertilizer is assessed in

terms of increased carrying capacity, a DSE of carrying capacity has been "bought" for about $35/DSE.

4.2.3 O'Brien

Comprehensive soil tests were taken which showed very low potassium, low sulphur and low copper. (Table 3)The soil test also indicated that boron was marginal. The hay and silage operation creates a large drain on potash levels in the soil. As a result, it was decided to focus on the impact of extra potash on herbage yield. Extra potash was applied following each cut based on the potassium content of the hay/silage taken from the paddock. The phosphorus fertilizer was switched to single super to cover the sulphur deficiency and copper was also applied.

The yields resulting from the extra potash are shown in Table 4.

Table 4. Hay and Silage yields from the application of additional potassium fertilizer

	Control	**Additional potash**		
Silage	**Rolls/ha**	**Rolls/ha**	**Diff**	**% increase**
Nov-20	17.6	21.7	4.2	24%
Aug-21	5.6	6.0	0.4	7%
Oct-21	8.1	9.7	1.6	20%
Hay				
Jan-21	10.5	11.7	1.2	12%
Total	**28.1**	**33.4**	**6.1**	**19%**

The costs and returns relating to the application of extra potash are shown in Table 5.

Table 5. Economic returns from application of additional potassium fertilizer

	Value/roll	**Value/ha**	**Cost/ha**	**Benefit/ha**
Silage	$ 100 /roll	$ 416	$112.50	+$303.50
Hay	$ 100 /roll	$ 121	$37.50	+$63.50

In the second year of the project, plant tissue samples were taken to check on the trace element status of the paddock. Boron which was marginal in the soil test was shown to be very deficient in the tissue sample. As a result a test strip of foliar applied boron was put out resulting in an estimated 300% increase in hay yield at a cost of approximately $6/ha for the boron fertilizer.

Table 6. Summary of economic results – grazing site

	Alcock	**Weston/Culley**
Fertilizer cost, Year 3	$178	$215
Increased stocking rate (Yr 3)	6	13
Increased returns/ha @$35/DSE	$210	$455
Benefit/ha	$32	$240
Total capital fertilizer cost	418	453
Capital fertilizer cost /DSE	$70	35

Note that capital fertilizer was applied for two years after which applications would be expected revert to maintenance applications the cost of which is covered in the calculation of the gross margin figures

Table 7. Summary of economic results – silage/hay site

	O'Brien
	2021
Additional costs /ha	$150
Additional benefits /ha	$537
Net benefit (cost) /ha	$387

Note, the returns for the estimated threefold increase in production from the boron application has not been calculated.

4.3 Extension and communication

In September 2019 a meeting was held with approximately 20 producers as well as local commercial agronomists, LLS officers and Landcare officers to promote the program.

The establishment of the sites was delayed as a result of the continuing drought and was impacted by the lingering financial impact of the drought experienced in the area.

The ability to hold site inspections was severely hampered by Covid restrictions. A training day on pasture assessment planned for early 2021 was replaced with a Zoom meeting of participants in March 2020. Video clips explaining how to assess pasture were emailed to participants along with recording sheets. This was method was unsuccessful due to connectivity problems and confidence of participants and consistency of assessment methods between individuals. A local consultant was engaged to assess the individual sites which were presented at a subsequent Zoom meeting.

Following the lifting of Covid 19 restrictions on travel and meetings, an on-site meeting was held on 14 June 2021. .

Further site meetings were held during 2021 and 2022. Records of these meetings were circulated to participants following the meetings and are included in the appendices.

Two field days were held – one in November 2021 and in 2022. These field days were advertised through the farmer networks, through advertisements and press releases in the local paper and through radio interviews on the ABC. These were attended by 20 and 16 people respectively. As well as attendance by participants and district farmers, the meetings were attended in total by four commercial agronomists, LLS staff and a local Dairy Australia extension officer.

Reports of the Field days were circulated to other interested farmers following the days. Interviews recorded at the field day in 2021 were broadcast on the local ABC rural program

4.4 Monitoring and evaluation

No surveys of non-core participants were undertaken. There were limited opportunities to involve this cohort during the Covid shut down period. Following the lifting of restrictions there was

minimal attendance by non-core farmers despite circulation of dates of inspections through the SCDDG newsletter and the Farmers' network.

Pre-surveys of current core participants indicated a poor understanding of soil and plant nutrition. The survey of skills highlighted that participants generally were lacking in feed budgeting skills and predicting the performance of animals in different pasture situations. The inability to meet regularly meant that many of the skill training components were not undertaken and it was deemed inappropriate to test the participants on these aspects.

In preparing the Case Studies for this report, a key learning by all participants was the need to gain a complete understanding of nutritional requirements of pastures and adopt the practice of applying capital fertilizer to rapidly

However, if the final outcome of an extension program is adoption, the following can be reported for the participants.

4.4.1 Alcock

The owners of this site had started to embark on a more extensive fertilizer program as a result of the program, but during late 2022 decided to retire from farming.

4.4.2 Weston/Culley

As a result of the program, capital fertilizer has now been applied to a further 32ha with plans to extend the practice to the remaining paddocks on the farm.

4.4.3 O'Brien

The farmer at this site has markedly changed fertilizer practices on his hay/silage paddocks. Additional potassium applications have continued following the demonstration of the yield increases obtained. As well a granular boron product has now been applied to all paddocks.

5. Conclusion

The results of this project confirm the results obtained from the Grassland Productivity and Paired Paddock programs conducted in the 1990s and 2000s.

Stocking rate is the major driver of profitability of grazing industries. This PDS on-farm evaluation demonstrated that there are major nutritional limitations in existing pastures in the Bega District and that the correction of these deficiencies can markedly increase production and profitability.

The science behind fertilizer application is well established but the strategy to capture the benefits are not well understood. The participants in this project now have a basis for the continued inclusion of the practices demonstrated in this project.

5.1 Key Findings

- There is large potential in most pastures that is being hidden by inadequate nutrition.
- Getting soil fertility right will lift production dramatically and provide better resilience in poor seasons.
- Soil tests as well as plant tissue tests should be used to identify nutritional deficiencies
- When building up soil fertility, capital applications of fertilizer on targeted small areas is a better use of resources rather than small amounts over large areas.
- Even at high fertilizer prices there can be economic returns in the short term.
- Once critical soil levels have been reached, applications can be reduced to maintenance levels.
- Capital fertilizer can be viewed as a means of buying carrying capacity – almost always cheaper than buying more land.

5.2 Benefits to industry

The demonstration of the benefits of a capital fertilizer program provides a benchmark for the Bega District. The results if implemented widely, would result in major increases in sustainable stocking rates and increased profitability.

6. Appendices

6.1 Press Releases

6.1.1 Press Release January 2021

TRIALS GETTING RESULTS

Research tells us that the key to productivity and pasture resilience is good soil nutrition. However the cost of implementing a program to improve soil fertility is a barrier to many producers because of concern that the action may not be profitable.

A project funded by MLA with assistance from Incitec Pivot, has been organized through the Far South Coast Dairy Development Group. The project is assessing the impact of good soil nutrition on pasture production, stocking rates and profitability. In the program, one paddock on each farm is run under the normal farm practice, while another receives capital fertilizer applications to correct soil nutritional deficiencies. Stock numbers are adjusted on the improved paddock if the pasture growth and animal performance on the improved paddock are better than on the normal practice paddock.

Despite a slow start to the program due to seasonal conditions, four on-farm, paired paddock comparisons are starting to show big increases in productivity.

The stocking rate on a site running wethers has doubled from 5 wethers/ha to 10 wethers/ha. There are two cattle breeding sites. At one site, the stocking rate on the improved paddock is 1 cow and calf/ha while the stocking rate on the control paddock is 0.75 cow and calf/ha. Despite the lower stocking rate on the control paddock, these animals were fed about $350 hay/head during winter/early spring, while the improved paddock received no supplementary feed.

The other cattle site has only recently been stocked. Pasture assessments indicated 25% extra growth on the improved paddock and the paddock has been stocked at 25% above the stocking rate on the control.

The outstanding result has been from a silage operation at Moran's Crossing. Soil tests indicated low sulphur, copper and very low potassium – as a result of depletion through silage cutting. The initial intention at this site was to look at the impact of capital dressings of potash to overcome the low soil test values.

At the harvest in September 2020, 4.1 rolls/ha were taken from the normal potash section and 5.5 rolls from the section with the extra potash - around 25% yield increase in yield

The soil tests at this site showed a marginal boron level, however issue tests indicated a severe deficiency. To test if this was an issue boron was sprayed onto all the paddock except a small strip, in early October.

6.1.2 Press Release May 2021

SOIL FERTILITY FIELD DAY

The results of trials looking at the impact of good soil nutrition on pasture production, stocking rates and profitability will be presented at a field day at Helen Weston's property at Myrtle Mount on Thursday 3rd June.

The trials are evaluating the economics of investing in fertilizer to correct nutritional deficiencies through Pasture resilience depends on good soil nutrition. However the cost of implementing a program to improve soil fertility is a barrier to many producers because of concern that the action may not be profitable.

A project funded by MLA with assistance from Incitec Pivot, has been organized through the Far South Coast Dairy Development Group. In the program, one paddock on each farm is being run under normal farm practice, while another has received capital fertilizer applications to correct soil nutritional deficiencies over a two year period. Stock numbers are adjusted on the improved paddock if the pasture growth and animal performance on the improved paddock are better than on the normal practice paddock. On other sites the impact on silage production is being measured.

After a slow start due to drought and fires the trials are starting to show some impressive results.

The field day will start at 10:30 and finish at 1:00. Follow the signs from Candelo.

6.1.3 Press Release November 2021

SOIL FERTILITY FIELD DAY

The results of trials looking at the impact of good soil nutrition on pasture production, stocking rates and profitability will be presented at a field day at Helen Weston's property at Myrtle Mount on Monday 29th November.

The trials are evaluating the economics of investing in fertilizer to correct nutritional deficiencies through correcting nutrient deficiencies. Pasture resilience and productivity relies on good soil nutrition. However the cost of implementing a program to improve soil fertility is a barrier to many producers because of concerns that the action may not be profitable.

A project funded by MLA with assistance from Incitec Pivot, has been organized through the Far South Coast Dairy Development Group. In the program, one paddock on each farm is being run under normal farm practice, while another has received capital fertilizer applications to correct soil nutritional deficiencies over a two year period. Stock numbers are being adjusted on the improved paddock if the pasture growth and animal performance on the improved paddock are better than on the normal practice paddock. On other sites the impact on silage production is being measured.

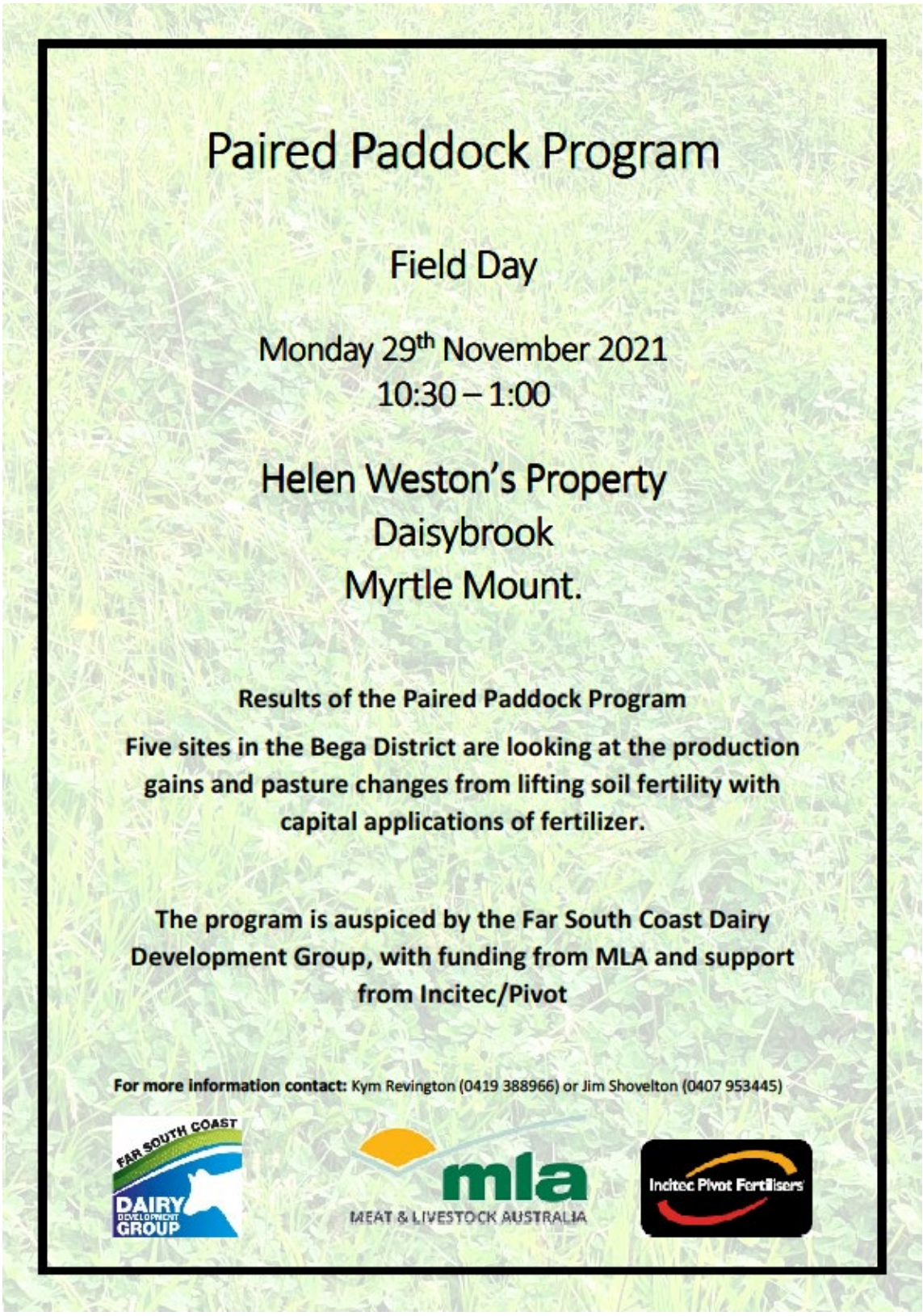
After a slow start due to drought and fires the trials are showing some impressive results with large increases in production and major improvements in pasture composition.

The field day will start at 10:30 and finish at 1:00. Follow the signs from Candelo

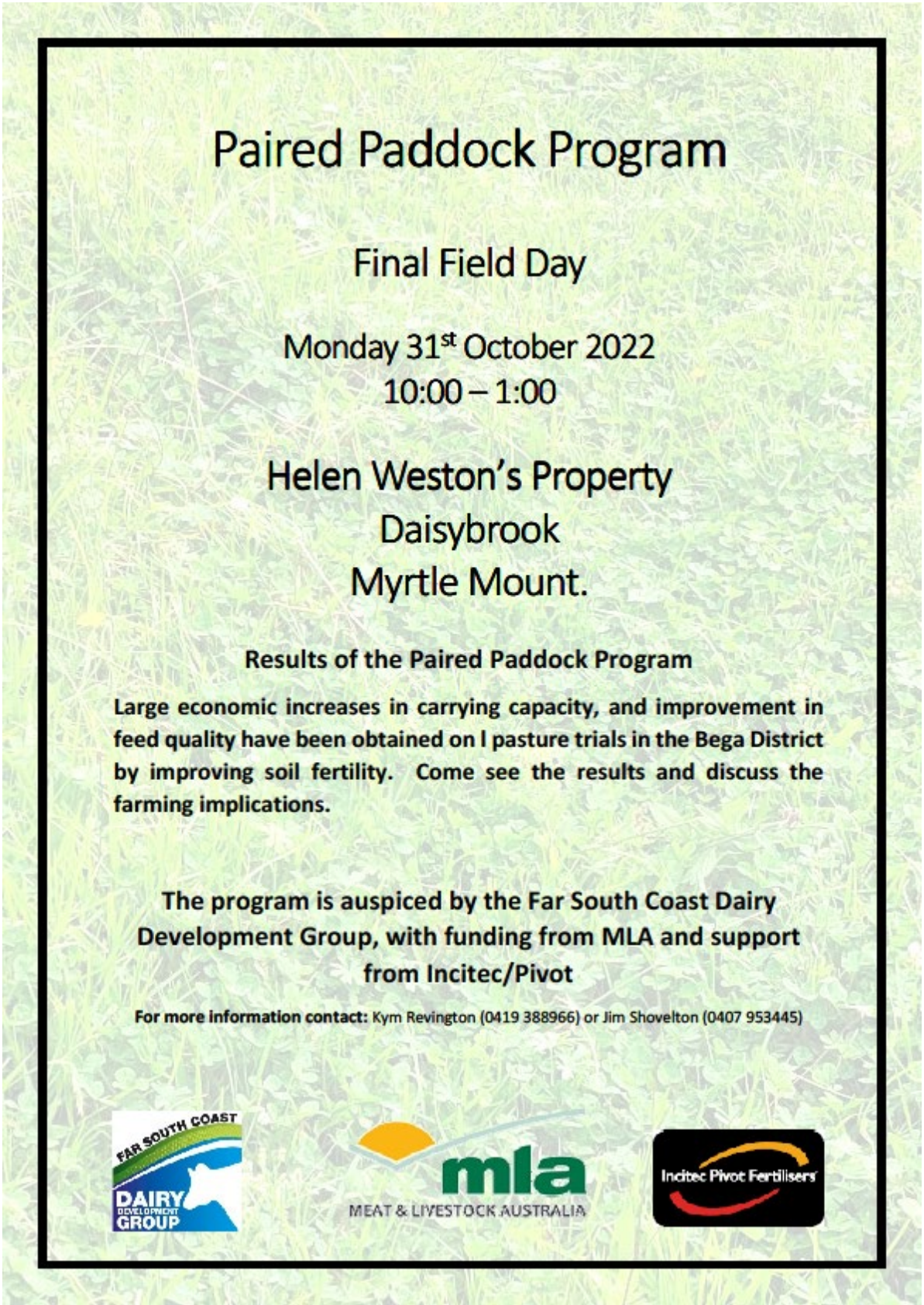
For further details contact Kym Revington on (0419 388966) or Jim Shovelton (0407 953445)

6.2 Field Day Fliers

6.2.1 November 2022

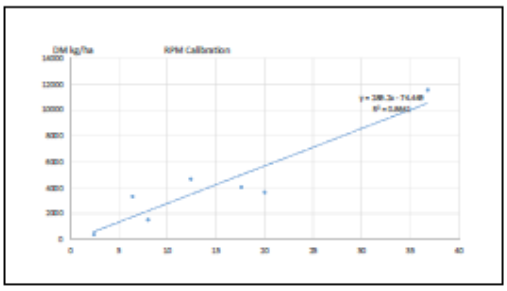


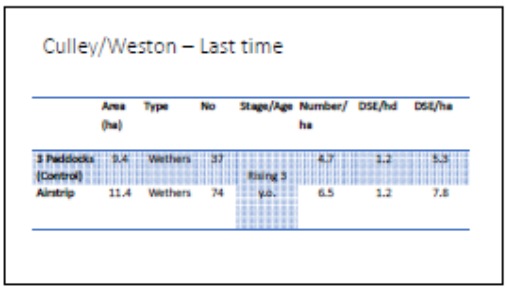
6.2.2 October 2022

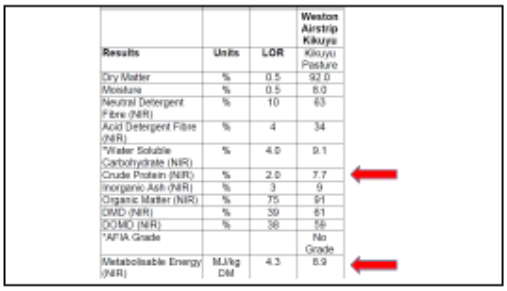


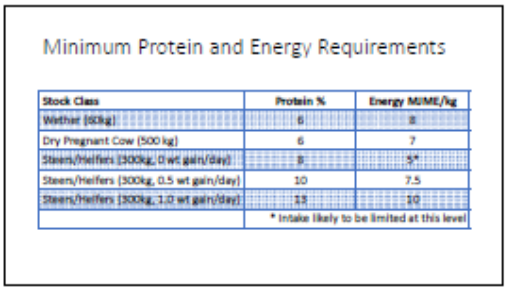
6.3 Power Point Presentations

6.3.1 August 2020









Weston/Culley - Airstrip

Weston/Culley - Airstrip

Weston/Culley - 3 Paddocks - Control

Farmer	Paddocks	Type	Avg RPM hgt (cm)	DM kg/ha
Weston	Airstrip	Fert	9	2240
	3 paddocks	Control	6.2	1720

- **Airstrip paddock (Fert)**
- Top third to half of paddock is grazed more heavily than bottom (sheep camp at top of paddock)
- Pasture composition is kikuyu & lovegrass in the bottom part of the paddock, while the top part of paddock has less grasses and more herbaceous plants
- White clover & sub-clover (?) starting to emerge in good numbers throughout paddock

- **3 Paddocks (Control)**
- Middle paddock has more feed in it than the top and bottom paddocks
- A good number of clover plants are visible, but much smaller leaves than airstrip paddock

- Issues
  - How to bring pasture in Airstrip paddock under control?
  - Thistle control?

Alcock

Last time

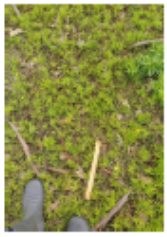
	Area (ha)	Type	No	No/ha	DSE/hd	DSE/ha
Front (Control)	8.8	Cows	6	0.68	10	6.8
Double Gate	9.4	Cows	8	0.85	10	8.5

The cattle in the Control paddock have been given access to a recently sown oat crop due to the low feed availability in that paddock. Cattle are holding, but the Control paddock were OS 2.5 and 4.0 in the Double Gate paddock. Both to be fed Control paddock cattle to receive more.

Alcock – Double Gates

- Scott & Virginia Alcock
- **Double Gate Paddock (Fert)**
- Pasture height = 1.5cm = 550 kgDM/ha
- Pasture measurements with ruler and measurements sheet (not RPM)
- Kikuyu pasture was greener than Weston's with first tentative signs of spring growth following recent rainfall
- Fireweed could be become a problem, with many seedlings growing above the kikuyu pasture
- Fireweed was recorded at 16% of pasture measurements
- Clover is evident, but remains patchy across the paddock

Front Paddock - Control



- **Front Paddock (Control)**
- Open pasture with 13% bare ground recorded
- Avg pasture height = 1.1cm = 300kgDM/ha
- Fireweed more common throughout paddock with lots of small seedling carpeting some areas
- Currently destocked & silage/hay had been fed
- Few clovers were evident across the paddock

- Issues
  - Fireweed control
  - Stocking policy

O'Brien

- **Objective**
  - Understand the role of potash in grass production by comparing a replacement policy with one that includes replacement plus capital applications of potash to correct deficiencies.

Tissue Tests

- 3.5% potassium = 75 kg Muriate of potash per ton of dry matter
- 2.5% potassium = 50 kg Muriate of potash per ton of dry matter

K Soil tests

	9 June 2019		19 March 2020	
	Colwell K	Calculated K	Colwell K	Calculated K
East	50	48	71	80
West			78	72

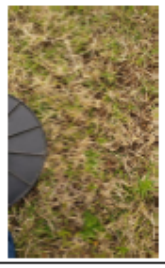
Issues

- Follow Potassium
- Boron?

Dummett

- **South Paddock (Fert)**
- RPM measurements recorded due to quantity of frosted off dead kikuyu
- Avg RPM height 5.8cm = 1600 kgDM/ha
- Currently destocked
- Some clovers present but quite patchy at this stage
- Fireweed present in smallish amounts (patches)

Dummett - Ridge Paddock



Dummett

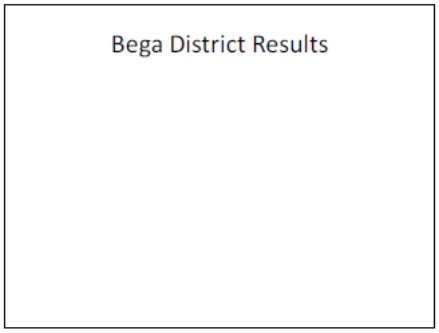
- **North/Road/Tree Paddock (Control)**
- RPM measurements recorded due to quantity of frosted off dead kikuyu
- Patches of fireweed seedling emerging
- Currently stocked
- Kikuyu pasture has a reasonable quantity of dead stolons – with leafy material underneath starting to grow

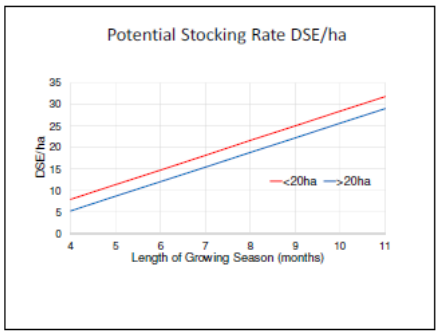
Dummett

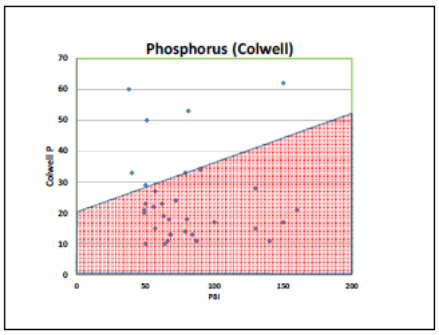
Dummett

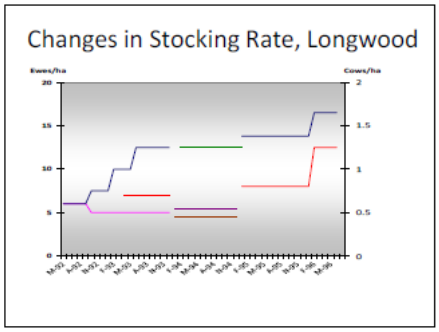
Farmer	Paddocks	Type	Avg RPM hgt (cm)	DM kg/ha
Dummett	South	Fert	5.8	1602
	Road	Control	5.2	1428

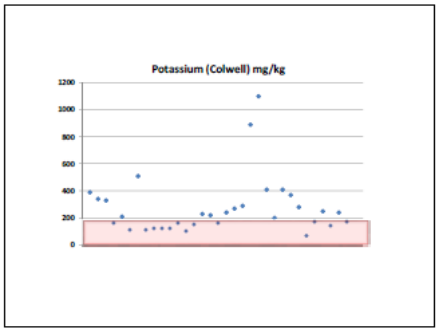
6.3.2 June 2021 Field Day

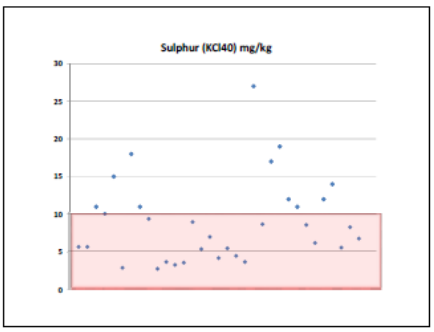












Scott and Virginia Alcock

Stock	Year	Fertilizer	
		Control	Treatment
Cows and calves	2019	Nil	290kg/ha super + moly and copper ($240/ha)
	2020	125 kg super	290kg/ha super ($178/ha)

Site Locations

Control

Scott and Virginia Alcock

Paddock	pH (CaCl)	Phosphorus (Colwell)	Potassium (Colwell)	Sulphur
Control	4.9	13	130	4.9
Treatment	5.0	18	180	6.4
Critical Level	5.0	30	140	8

Control

Weston/Culley

Paddock	pH (CaCl)	Phosphorus (Colwell)	Potassium (Colwell)	Sulphur
Control	4.8	12	160	5.4
Treatment	4.9	14	360	5.3
Critical Level	4.8	30	140	8

Weston/Culley

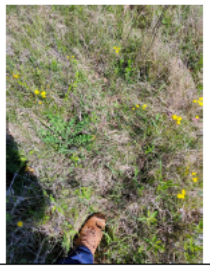
Pasture Composition June 2020

	Control	Treatment
Kikuyu	26	23
Annual Grass	0	2
Native Grass	25	24
Clovers	19	12
ALG	4	6
Broadleaf Weeds	26	32

Weston/Culley

Stock	Year	Fertilizer	
		Control	Treatment
Wethers	2019	Nil	350kg/ha super + moly ($238/ha)
	2020	Nil	350kg/ha super ($215/ha)

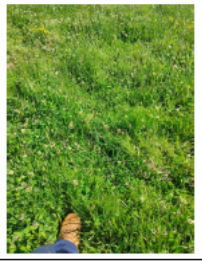
Control



Weston/Culley

	2020		2021	
	Start	December	September	October
Control	4.7 wethers/ha	4.7 wethers/ha	4.7 wethers/ha	4.7 wethers/ha
Treatment	6.5 wethers/ha	11 wethers/ha	5.5 ewes and lambs/ha	11 ewes and lambs/ha

Treatment Paddock



Control

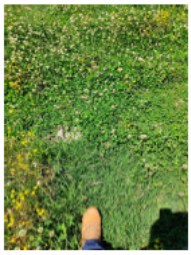
Treatment Paddock

Treatment Paddock

Scott and Virginia Alcock

	2020		2021	
	Breeding cows/ha	Hay fed ($/ha)	Breeding cows/ha	Hay fed ($/ha)
Control	0.7	$325	0.7	Nil
Treatment	0.85	Nil	1.7	Nil

Treatment Paddock



Jeff and Louise O'Brien

	Result	Critical Level
pH (CaCl)	4.7	4.8
Phosphorus (Colwell)	29	30
Potassium (Colwell	50	140
Sulphur	5.6	8

Jeff and Louise O'Brien

	Control	Additional K		
Silage	Rolls/ha	Rolls/ha	Diff	% increase
Nov-20	17.6	21.7	4.2	24%
Aug-21	5.6	6.0	0.4	7%
Oct-21	8.1	9.7	1.6	20%
Hay				
Jan-21	10.5	11.7	1.2	12%
Total	28.1	33.4	6.1	19%

Jeff and Louise O'Brien

B harvest 19.3 rolls/ha. Previous harvest 5.1 rolls/ha

Jeff and Louise O'Brien

			Value	Cost
Silage value/roll	@	$ 100 /roll	$ 416.00	$112.50
Hay value/roll	@	$ 100 /roll	$ 121.13	$37.50

Plant Tissue Results

Minor and Trace Elements

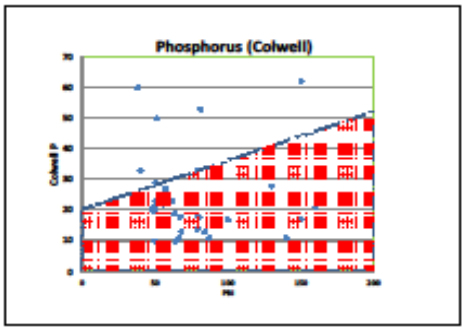
Analyte	Unit	Range	Weston	Alcock	O'Brien		Dummett
			Airstrip	Double Gate	Windmill East	Windmill West	South
Nitrogen	%		4.50	3.00	1.3	1.3	3.00
Calcium	%	0.8-2.5	1.6	1.30	0.37	0.42	2.40
Magnesium	%	0.15-0.5	0.41	0.31	0.23	0.25	0.52
Sodium	%	0-0.5	0.34	0.25	0.07	0.3	0.30
Chloride	%	< 1.7	0.66	0.64	1.1	1.5	0.57
Copper	mg/kg	5-30	9.5	7.6	3.7	2.7	6.5
Zinc	mg/kg	15-50	38	29.0	16	20	31.0
Manganese	mg/kg	25-300	210	110.0	270	270	250.0
Boron	mg/kg	25-100	22	24.0	5.4	5.5	23.0
Molybdenum	mg/kg	0.5-1	1	4.80	not done	not done	<0.05

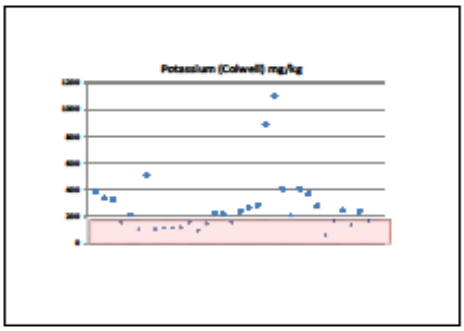
O'Brien Plant Tissue Results

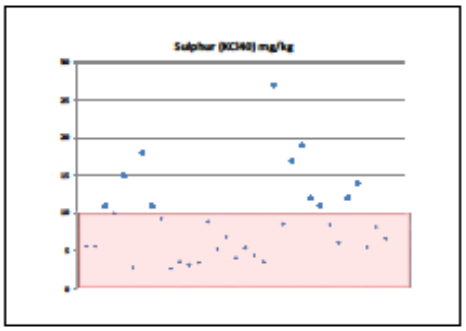
Analyte	Unit	Range	Windmill East	Windmill West
Nitrogen	%		1.3	1.3
Calcium	%	0.8-2.5	0.37	0.42
Magnesium	%	0.15-0.5	0.23	0.25
Sodium	%	0-0.5	0.07	0.3
Chloride	%	< 1.7	1.1	1.5
Copper	mg/kg	5-30	3.7	2.7
Zinc	mg/kg	15-50	16	20
Manganese	mg/kg	25-300	270	270
Boron	mg/kg	25-100	5.4	5.5

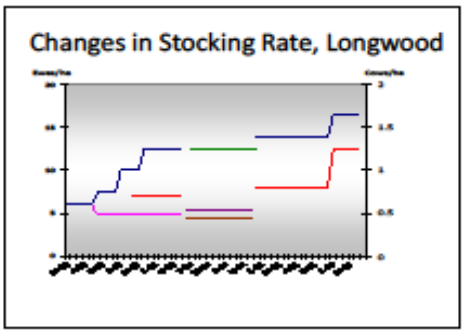
6.3.3 November 2022 Field Day

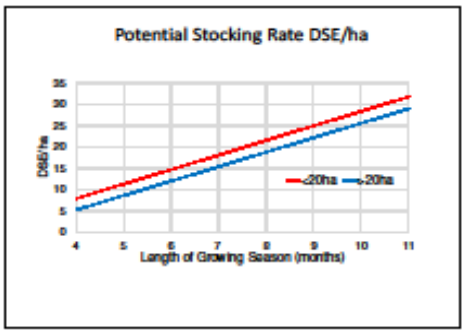
5/12/2022











Bega District Paired Paddock Program

Site Locations

Scott and Virginia Alcock

Paddock	pH (CaCl)	Phosphorus (Colwell)	Potassium (Colwell)	Sulphur
Control	4.9	13	130	4.9
Productivity paddock	5.0	18	180	6.4
Critical Level	5.0	30	140	8

Scott and Virginia Alcock

Stock	Year	Fertilizer	
		Control	Treatment
Cows and calves	2019	Nil	290kg/ha super + moly and copper ($240/ha)
	2020	125 kg super	290kg/ha super ($178/ha)

Control

Control

Productivity Paddock 2021

Productivity Paddock 2022

Scott and Virginia Alcock

	2020		
	Breeding cows/ha	Hay fed ($/ha)	Fertilizer cost/ha
Control	0.7	$325	-
Productivity paddock	0.85	Nil	$240

Scott and Virginia Alcock

	2022	
	Breeding cows/ha	DSE/ha
Control	0.88	14
Productivity paddock	1.25	20

Scott and Virginia Alcock

	2022	
	Breeding cows/ha	DSE/ha
Control	0.88	14
Productivity paddock	1.25	20

Difference of 6 DSE/ha. At $40/DSE =$240 extra

Scott and Virginia Alcock

	2022	
	Breeding cows/ha	DSE/ha
Control	0.88	14
Productivity paddock	1.25	20

Difference of 6 DSE/ha. At $40/DSE =$240 extra

6DSE/ha increase in carrying capacity for $420/ha = $70/DSE

Scott and Virginia Alcock

Paddock	pH (CaCl)	Phosphorus (Colwell)	Potassium (Colwell)	Sulphur
Productivity Paddock 2019	5.0	18	180	6.4
Productivity Paddock 2022	5.0	30	260	12
Critical Level	4.8	30	140	8

Jeff and Louise O'Brien

	Result	Critical Level
pH (CaCl)	4.7	4.8
Phosphorus (Colwell)	29	30
Potassium	50	140
Sulphur	5.6	8

Jeff and Louise O'Brien

	Control	Additional K		
Silage	Rolls/ha	Rolls/ha	Diff	% increase
Nov-20	17.6	21.7	4.2	24%
Aug-21	5.6	6.0	0.4	7%
Oct-21	8.1	9.7	1.6	20%
Hay				
Jan-21	10.5	11.7	1.2	12%
Total	28.1	33.4	6.1	19%

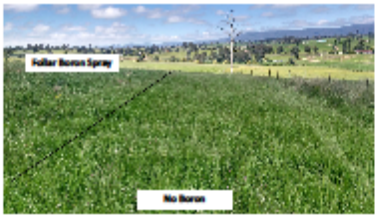
Jeff and Louise O'Brien

			Value	Cost
Silage value/roll	@	$ 100 /roll	$ 416.00	$112.50
Hay value/roll	@	$ 100 /roll	$ 121.13	$37.50

O'Brien Plant Tissue Results

Analyte	Unit	Range	Windmill East	Windmill West
Nitrogen	%		1.3	1.3
Calcium	%	0.6-2.5	0.37	0.42
Magnesium	%	0.15-0.5	0.23	0.25
Sodium	%	0-0.5	0.07	0.3
Chloride	%	< 1.7	1.1	1.5
Copper	mg/kg	5-20	3.7	3.7
Zinc	mg/kg	15-50	16	20
Manganese	mg/kg	25-300	270	270
Boron	mg/kg	25-100	5.4	6.5

Jeff and Louise O'Brien



Harvest 19.3 rolls/ha. Previous harvest 5.1 rolls/ha

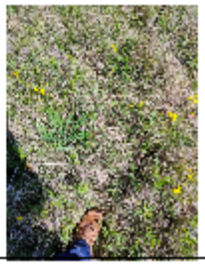
Weston/Culley

Paddock	pH (CaCl)	Phosphorus (Colwell)	Potassium (Colwell)	Sulphur
Control	4.8	12	160	5.4
Productivity	4.9	14	360	5.3
Critical Level	4.8	30	140	8

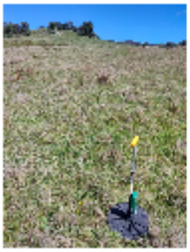
Weston/Culley

Stock	Year	Fertilizer	
		Control	Productivity paddock
Wethers	2019	Nil	350kg/ha super + moly ($238/ha)
	2020	Nil	350kg/ha super ($215/ha)

Control



Control



Productivity Paddock 2022

Weston/Culley

	2022	
	Stock	DSE/ha
Control	Wethers	5
Productivity paddock	Ewes + Cattle	18

Weston/Culley

	2022	
	Stock	DSE/ha
Control	Wethers	5
Productivity paddock	Ewes + Cattle	18

Difference of 13 DSE/ha. At $40/DSE =$520 extra/ha

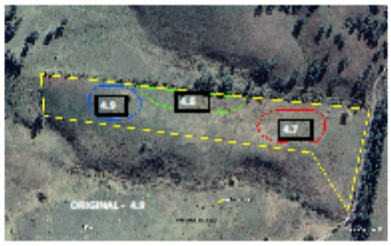
Weston/Culley

	2022	
	Stock	DSE/ha
Control	Wethers	5
Productivity paddock	Ewes + Cattle	18

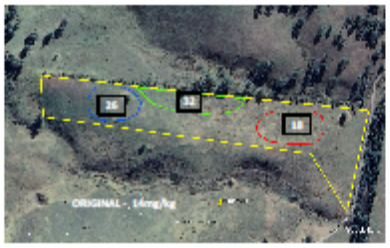
Difference of 13 DSE/ha. At $40/DSE =$520 extra/ha

13 DSE/ha increase in carrying capacity for $440/ha = $34/DSE

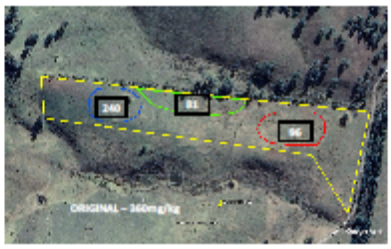
Soil Samples 2022 –pH($CaCl_2$)



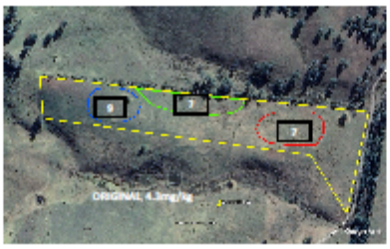
Soil Samples 2022 –Colwell Phos.



Soil Samples 2022 –Potassium



Soil Samples 2022 –Sulphur



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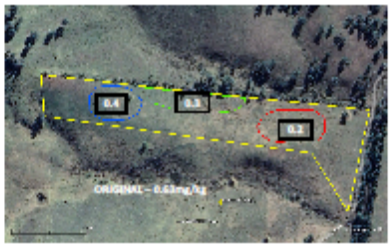
Soil Samples 2022 –Boron



6.4 Reports

6.4.1 December 2019

Paired Paddock Program

Site Inspections 2nd and 3rd December 2019

The Bega area is still in a severe drought and with the exception of Jeff and Louise O'Brien's site, treatments have not yet been applied. Currently we have four sites in the program and are looking to get back up to six when the season hopefully turns around.

The soil test results were previously circulated and I have included them again below. The aim of the project is to fix up the nutritional limitations to plant growth during the course of the project and the fertilizer recommendations are based on this premise. It is important to remember that a deficiency that is not corrected will mean that the response to other fertilizers will be limited. Note that in all comparisons except O'Brien's, no fertilizer will be applied to the Control paddock.

Acidity: While all soils were acidic, none were at the level where they would be significantly affecting the growth of the pasture species present.

Phosphorus: All soils were very low in available phosphorus. The target level for phosphorus measured by the Olsen method is 15mg/kg. There is no extra advantage in going above this level. In the soil test tables, I have calculated the amount of phosphorus required to lift the soils to 15 mg/kg. This is done using the Phosphorus Buffering Index (PBI) which predicts how a soil will respond to added phosphorus. The higher the PBI, the more phosphorus is required.

Sulphur: Sulphur levels are also low. The target level is 8-10 mg/kg. The low figures indicate that a phosphorus/sulphur fertilizer is need – in this case single super is appropriate.

Potassium: Critical potassium levels vary with soil type and for the soils in the project the level is around 140-160 mg/kg.

Trace Elements: The major trace element likely to be missing is molybdenum. Moly is essential for the nitrogen fixation in the nodules on the roots of clovers. Soil tests are not sufficiently accurate for determining the need for molybdenum so we have to rely on history or plant tissue tests. As none of the sites has had a recent history of molybdenum application, moly has been included in the recommendations for the first year only. Molybdenum interferes with the uptake of copper by the animal and, as a precaution, copper has been included in the mixture where the copper level is low or marginal.

There were no other major nutritional issues identified.

Helen Weston/Ian Cully (Myrtle Mount)

This site will run wethers. Wethers are not very responsive on a per head basis to increases in feed availability so that, while the base stocking rate can be increased to meet feed levels at the lowest point of feed availability, excess feed at other times of the year will be taken up with heifers/steers.

The Control sheep will be run over three paddocks with a total area of 5.6 ha while the Productivity Paddock is 11.4ha. This Productivity paddock is a long narrow paddock with a scattered infestation of African Lovegrass. There is a significant fertility trend from the bottom of the paddock to the top resulting in higher grazing pressure on the upper part of the paddock. Of interest will be if the change in fertility results in more even grazing.

Young wether weaners currently on the property were condition scored – average was around three with little variation. Ian was contemplating selling the wethers due to the likely cost of continued feeding.

	Paddock	pH (Water)	pH (CaCl2)	EC	P (Olsen)	PBI	Calc.K	Copper	Sulphur	Total P reqd	kgP/ha	kgK/ha	S reqd	Mo	Mo Cu
				dS/m	mg/kg		mg/kg	mg/kg	mg/kg						
Control	West pdks	5.7	4.8	0.06	7	83	160	0.37	5.4	70	35	0	y	y	
Productivity	Airstrip	5.8	4.9	0.07	7	78	360	0.7	5.3	70	35	0	y	y	

Scott and Virginia Alcock (Mogilla)

This comparison will run Speckle Park cows and calves. Speckle Park cattle have been bred for high marbling attributes. Both paddocks have been stocked with cows with 4 month old calves. Estimated carrying capacity was around 6 DSE/ha. The Productivity Paddock has more of a southerly aspect than the Control Paddock.

	Paddock	pH (Water)	pH (CaCl2)	EC	P (Olsen)	PBI	Calc.K	Copper	Sulphur	Total P reqd	kgP/ha	kgK/ha	S reqd	Mo	Mo Cu
				dS/m	mg/kg		mg/kg	mg/kg	mg/kg						
Control	Front 1	5.8	4.9	0.04	6	67	120	0.23	4.9	78	36	25	y		y
Productivity	Double Gate 1	5.8	5	0.07	9	50	180	0.46	6.4	51	25	0	y		y

Phil and Kerry Dummett (Verona)

The property stocking rate is about 11 DSE/ha. The paddocks are relatively small. Breeding cattle will be run with the option of putting heifers on if there is not enough response to justify increasing breeding cow numbers on the Productivity paddock.

	Paddock	pH (Water)	pH (CaCl2)	EC	P (Olsen)	PBI	Calc.K	Copper	Sulphur	Total P reqd	kgP/ha	kgK/ha	S reqd	Mo	Mo Cu
				dS/m	mg/kg		mg/kg	mg/kg	mg/kg						
Control	South 1	5.8	4.9	0.06	8	130	150	0.72	6.3	63	30	0	y		
Productivity	North 1	5.6	4.7	0.06	8	82	150	0.4	6.4	61	30	0	y		

Jeff and Louise O'Brien (Moran's Crossing)

This site will look at the response in silage production to the removal of nutritional deficiencies. The site is irrigated and has been sown to ryegrass. Silage samples were taken in August and analysed. They showed dry matter contents of 55% and 49%. Average digestibility was 60%, average metabolisable energy was 9.5 and protein content was 13%.

	Paddock	pH (Water)	pH (CaCl2)	EC	P (Olsen)	PBI	Calc.K	Copper	Sulphur	Total P reqd	kgP/ha	kgK/ha	S reqd	Mo	Mo Cu
				dS/m	mg/kg		mg/kg	mg/kg	mg/kg						
Control	River 1	5.6	4.7	0.06	14	90	70	0.23	5.7	9	10	50	y		y
Productivity	Windmill	5.4	4.7	0.06	15	77	50	0.18	5.6	0	0	100	y		y

The site is very deficient in potassium which will be a result of the removal of potassium in silage/hay over an extended period. One tonne of dry matter removes about 50kg potash (25kg potassium). Copper and sulphur were very low as well

A herbage sample was taken to double check the copper and sulphur status. The results confirmed low copper and sulphur levels. Danny is looking at the cheapest option for getting additional sulphur onto the paddocks and also options for spraying on copper to address that deficiency. Boron was also low, but this may or may not be a problem as boron's initial effect is on seed yield and not herbage production. However, very low levels can affect herbage yields and we will look at boron in more detail next year.

Originally, two paddocks were going to be in the trial, but it was decided that because the potassium levels were so low that we should concentrate on the Windmill paddock and use the resources to lift the potassium level to an adequate level in that paddock. 100 kg/ha potash (half the recommended amount of potash) was put on half the Windmill paddock. The remainder will be applied prior to the next growing period. Irrigation has ceased due to lack of water, but prior to that the last silage cut there appears to have been about a 40% increase in dry matter production on the half that received the extra potash. Silage samples have been taken to get accurate dry matter levels and an indication of how much potassium has been removed in the silage. Soil samples will also be taken to see what shift there has been in the soil potassium level. Unlike phosphorus where we have good guidelines how soils will respond to added phosphorus, we have little data for potassium. If we can get some guidelines from this site it will help in making better recommendations in the future.

Jim Shovelton
Senior Consultant
Meridian Agriculture

13 Dec.2019

6.4.2 Meeting Report April 2020

Paired Paddock Program

Pasture Assessments, Zoom Meeting April 2020

Had we been able to meet on site we would have been able to go through the process of assessing pasture on site. There are a few tricks to it which would not have been easily explained through the video link. As a result Kym went round all three grazing sites and measured them at the end of April, so we have a consistent assessment of all the sites as a starting point.

Fertilizer has now been applied to all sites

Jeff and Louise O'Brien

Following the results from last year, the design has been modified. Both areas will be topdressed with phosphorus, sulphur and copper. The main treatment will involve different rates of potash. Rather than a large area with low potash, the control section will now be a small area and the section topdressed with the high rate of potash will be the larger section of the paddock. The aim is to see how potassium level change over time and if we can relate those changes to application rates and nutrient removal. Soil samples have been taken from both areas to check potassium levels and Kym will take herbage samples from the two treatments just prior to silage to look at the export of potassium in the herbage.

Phil Ryan

Both paddocks will be sown to a ryegrass mix. Due to lack of water the paddocks may be cut for silage rather than grazed.

Helen Weston/Ian Cully (Myrtle Mount)

Stocking Rate

	Area (ha)	Type	Number	Stage/Age	Number/ha	DSE/hd#	DSE/ha
3 paddocks (Control)	**9.4**	**Wethers**	**37**	**Rising 3 yo**	**3.9**	**1.2**	**4.7**
Airstrip	**11.4**	**Wethers**	**74**		**6.5**	**1.2**	**7.8**

 # Table 1

The wethers were condition score 3 when stocked and weighed 67kg. They will be shorn in early June and condition scored again at that time.

Pasture composition

	Introd. Perennial Grass	Fireweed	Native Grass	Clovers	ALG	Broadleaf Weeds	Dead Pasture	Bare Ground
3 paddocks (Control)	**26**	**0**	**25**	**19**	**4**	**26**	**0**	**0**
Airstrip	**23**	**2**	**24**	**12**	**6**	**32**	**0**	**0**

There is little difference at this stage between the composition of the two paddocks, however Kym noticed that the clover was more vigorous on the Airstrip paddock.

Green Feed on Offer

	Ave Pasture (cm)	Pasture density	Est Feed on Offer#	Feed Quality##
3 paddocks(Control)	8.8	Mod Dense	2000kg/ha	Mod (65%-70% digestible)
Airstrip	9.0	Dense	2500kg/ha	High (75% digestible)

Table 2

Table 3

Despite the higher stocking rate on the Airstrip paddock, an extra 500 kg DM was present compared to the Control paddock. In discussions with Ian, he was happy to leave the Control stocking rate where it is, but to use the excess 500 kg/ha on the Airstrip paddock over the next three months. Ie there are 500 kg available for 90 days or about 5 kg/day. If we allow 1 kg/ha per DSE then there is enough feed for an extra 3.5 wethers per hectare or approx. 40 per paddock. These will be introduced but marked differently so that we can follow the performance of the original animals. Water is becoming a potential issue

Scott and Virginia Alcock (Mogilla)

	Area (ha)	Type	Number	Stage/Age	Number/ha	DSE/hd#	DSE/ha
Front (Control)	8.8	Cows and calves	6		0.68	18	12.2
Double Gate	9.4	Cows and calves	8		0.85	18	15

 # Table 1

Calves weighed are to be sold around end of May. The bulls in each paddock were removed at end of April. Cattle are holding but the Control paddock is getting tight and the cows will be given access to a recently sown oat crop. Grazing days will be recorded.

	Introd. Perennial Grass	Fireweed	Native Grass	Clovers	ALG	Broadleaf Weeds	Dead Pasture	Bare Ground
Front (Control)	49	11	23	2	0	5	1	9
Double Gate	60	12	17	7	0	3	0	2

Feed on Offer (

	Ave Pasture (cm)	Pasture density	Est Feed on Offer#	Feed Quality##
Front (Control)	1.9	Dense	700	Mod- High
Double Gate	3.6	Dense	1200	Mod- High

Table 2

Table 3

Phil and Kerry Dummett (Verona)

	Area (ha)	Type	Number	Stage/Age	Number/ha	DSE/hd#	DSE/ha
Tony's Rd (Control)							
Ridge							

 # Table 1

Neither paddock has been stocked for the trial as yet

	Introd. Perennial Grass	Fireweed	Native Grass	Clovers	ALG	Broadleaf Weeds	Dead Pasture	Bare Ground
Tony's Rd (Control)	64	7	25	1	0	0	0	3
Ridge	56	4	33	1	0	2	1	5

The top 60% of the Ridge paddock was burnt in the fires and Phil said that the growth on the paddock has been patchy over all the paddock. Tis paddock was topped a couple of weeks ago and Tony's Road paddock has just been topped.

Feed on Offer

	Ave Pasture (cm)	Pasture density	Est Feed on Offer#	Feed Quality##
Tony's Rd (Control)	9.3	Dense	2600	Mod - High
Ridge	4.25	Dense	1300	High

Table 2

Table 3

6.4.3 Meeting Report August 2020

Bega Paired Paddock Program

Decisions from Zoom meeting 28/08/2020

Weston/Culley

Excess feed on the bottom 40% of the Airstrip paddock needs to be eaten. Mob stock this section (using an electric fence) with 190 wethers. Rough estimate – should require about 25 days to reduce the bulk – but monitor. When mob removed, increase the original stock numbers by another 12 head. Use this opportunity to spray the thistles in the top section. Control to remain the same, but concentrate the stock on the middle paddock to bring the bulk down.

Alcock

Stock on the Control paddock have been given access to additional paddocks. Fireweed has taken over the Control paddock and it was decided that the paddock should be abandoned as the trial is compromising the management of the area. The cattle on the fertilized paddock have lost a little condition, but will not calve until November. Fireweed is also an issue on this paddock and it will be slashed and mulched to keep it under control. Stock numbers to remain the same.

O'Brien

Fertilizer recommendations for the next growing period will be worked out after the tissue samples and soil tests from the treatments come back and silage yields are available. Indications are that nitrogen levels are at the low end and there should be additional responses possible. The very low boron levels in both the soil and herbage should be checked with a foliar spray of boron. If this shows a response then a granular additive should be added to the fertilizer.

Dummett

Stock are still being rotated around the farm due to the lack of feed and the resowing of pastures. Phil will record stock numbers and days until the paddocks can be set stocked – possibly at the end of September.

Next Catch up

The next catch up will be at the end of October

Jim Shovelton

6.4.4 Meeting Report December 2020

Bega Paired Paddock Program

Meeting Dec 2 & 3, 2020

Tues: Hayden, Danny, Tash, Ian, Scott, and Virginia.

Wed: Jeff, James, Ian, Phil, Hayden, Danny, Tash.

Weston/Culley

After the last meeting, the bottom half of the Productivity paddock was crash-grazed by 170 wethers for 20 days to remove the bulk of feed.

Ian has decided to reduce the stock on the Control paddock to 5 DSE/ha as he believes that this is a more sustainable long term stocking rate. 22 wethers were added to the Productivity paddock and is now stocked with 98 wethers at approx. 10/ha.

Stock from both sides were in CS 4-5 but the stock from the Productivity paddock stock were probably a little fatter.

I feel that the pasture response on the Productivity paddock is disappointing – the growth on the stock camp resulting from the crash grazing is far superior to the rest of the paddock and is an indication of the potential of the paddock.

Fertilizer has been applied to other parts of the farm (not the control paddocks).

Alcock

Stock numbers have remained the same – 8 cows and calves on the productivity paddock and 6 cows and calves on the control. Stock are calving at the moment. Stock condition on the productivity paddock is variable 2.5 – 3.5 CS and there is a big age spread (7-15 years). The cattle on the Control paddock are younger Angus cows and have a higher CS.

Stock on the Productivity paddock have not been fed. The stock on the Control paddock were moved off due to lack of feed for a couple of weeks and were fed a bale of silage per week for about 17 weeks. This equates to about 3 bales per head. Assuming each bale at $130/t, the feed cost was $325/head for the Control animals.

There is a large amount of fireweed on the Productivity paddock. It has been mulched to a low level twice to control it, which has impacted on the feed availability in this paddock. There is a very good base of kikuyu and reasonable clover but the fixed nitrogen has not yet transferred into the kikuyu as it is still N deficient.

The Control paddock received 125 kg/ha super this year, but the pasture is still poor.

O'Brien

There has been a massive response to the foliar application of boron. The harvest in September produced 70 silage rolls. The harvest in November, after the boron application, produced 263 rolls.

The original treatments were replacement potash and replacement potash plus extra potash to lift the soil potassium level.

At the November cut:

Normal potash (West side) – 137 rolls/7.8ha = 17.6 rolls/ha

Extra 50kg potash (East side) – 126 rolls/5.8ha = 21.7 rolls/ha.

21.7-17.6 = 4.1 rolls/ha difference. i.e. 4.1/17.6 = 23% increase.

Paddock has just been resprayed with boron with a section still left untreated. The boron response was still visible. Herbage is still boron deficient on both and nitrogen very low in both also. Will move to a granular application of boron at next topdressing.

Dummett

Pasture meter readings indicated that there was about a 25% increase in feed on the Productivity paddock. The Control paddock will be stocked 11 DSE/ha (1 pregnant heifer per hectare) and the Productivity paddock will be stocked at 12.5 DSE/ha.

Herbage Tests

Below are the herbage analyses from the sites taken in November/December.

Analyte	Unit	Range	Weston	Alcock	O'Brien		Dummett
			Airstrip	Double Gate	Windmill East	Windmill West	South
Total Nitrogen	%	Clover	4.50	3.00	1.3	1.3	3.00
Nitrate Nitrogen	mg/kg		<50	89	<50	<50	<50
Ammonium	mg/kg		210	240	87	90	210
Phosphorus	%	0.25-0.5	0.33	0.29	0.26	0.28	0.17
Potassium	%	1.2-2.5	2.2	2.40	2.3	2.8	0.97
Sulphur	%	0.25-0.4	0.28	0.22	0.20	0.18	0.21
Calcium	%	0.8-2.5	1.6	1.30	0.37	0.42	2.40
Magnesium	%	0.15-0.5	0.41	0.31	0.23	0.25	0.52
Sodium	%	0-0.5	0.34	0.25	0.07	0.3	0.30
Chloride	%	< 1.7	0.66	0.64	1.1	1.5	0.57
Copper	mg/kg	5-30	9.5	7.6	3.7	2.7	6.5
Zinc	mg/kg	15-50	38	29.0	16	20	31.0
Manganese	mg/kg	25-300	210	110.0	270	270	250.0
Iron	mg/kg	50-65	98	140.0	43	29	52.0
Boron	mg/kg	25-100	22	24.0	5.4	5.5	23.0
Molybdenum	mg/kg	0.5-1	1	4.60	not done	not done	<0.05

Note that the standards are for clover, but that Jeff O'Brien's samples are ryegrass. Most of the standards are similar to clover but the ryegrass calcium standards are lower and the levels are adequate. The profiles for Weston's and Alcock's are good with the exception of the marginal boron levels

Jeff's nitrogen, copper and boron levels are still low. Sulphur is marginal to low so the paddock should continue to get sulphur. The other analysis of interest is the low sodium level for the East section. Lactating animals normally require around 0.18-0.20% sodium. The low level may not be an issue if the cattle are getting additional sodium from other sources.

Phil's phosphorus and potassium results are a bit surprising. The soil test did not indicate a potassium deficiency and the site received 300+kg/ha super. Molybdenum was not applied as Phil indicated that the paddock had received molybdenum in the past. I don't know how long moly lasts in Bega soils so this result suggests that the moly status should be checked with a tissue test 5 years after application. No tissue tests were taken to assist with the recommendations as there was no growth.

We should trial strips of boron this year on all sites except Jeff's to see if the marginal levels are impacting on growth.

Jim Shovelton

5 Jan 2021

6.5 Field Day Notes

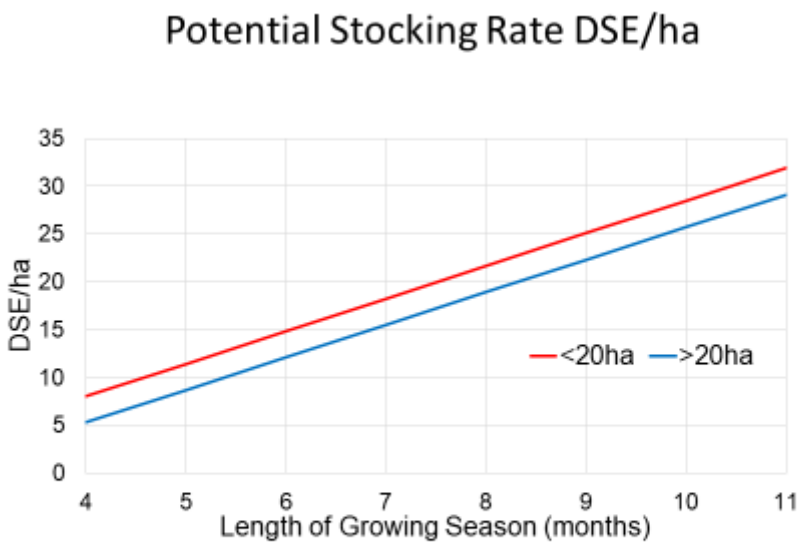
6.5.1 Field Day notes 2021

Field Day Notes
November 2021

Background

The project sought to look at the economic benefit from removing soil fertility limitations on the performance of existing pastures.

This project is based on the method used for the Grassland's Productivity Program/Triple P which established, under practical farming situations, the potential productivity of pastures in the medium to high rainfall areas of south eastern Australia. The Grassland's Productivity Program/Triple P achieved an average 35% increase in stocking rate across over 1000 paired paddock comparison, with an average increase in gross margin of 30-40%, correcting soil fertility issues on existing pastures. It demonstrated that potential carrying capacity was set by the length of the growing season as shown below.



The Bega Comparisons

The program was initially intended to start in 2019, however the drought and then the bushfires meant that the project didn't effectively start until 2020 once good rains fell

Five sites were selected. Of these three have given quantifiable results.

One paddock on each farm was run under the normal farm practice while another received a fertilizer program developed to correct soil nutritional deficiencies. Over a three year period the responses to the fertilizer will be measured in terms of changes in pasture composition, stocking rate and per animal performance to evaluate the economic and other benefits from improving soil health. The comparisons are due to finish in spring 2022.

Site Locations

Weston/Culley

Soil Test Results

Paddock	pH (CaCl)	Phosphorus (Colwell)	Potassium (Colwell)	Sulphur
Control	4.8	12	160	5.4
Treatment	4.9	14	360	5.3
Critical Level	4.8	30	140	8

Deficient in phosphorus and sulphur. pH and potassium are not limiting for the species present.

Fertilizer applied

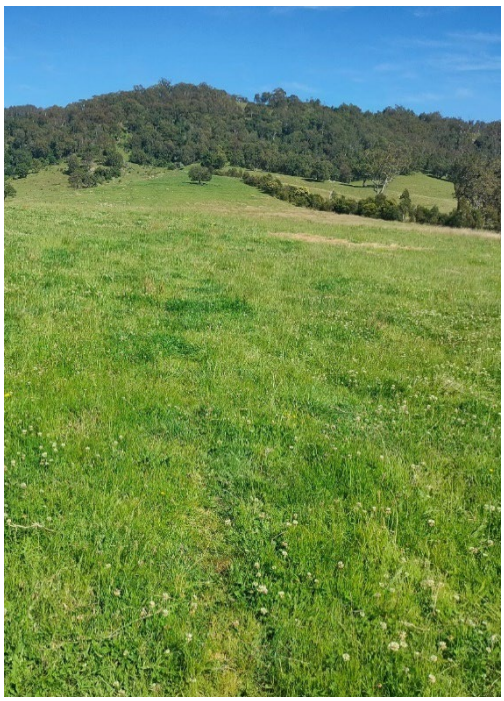
Stock	Year	Fertilizer	
		Control	Treatment
Wethers	2019	Nil	350kg/ha super + moly ($238/ha)
	2020	Nil	350kg/ha super ($215/ha)

Molybdenum included in first year as it had not been applied before.

Pasture Composition, November 2021

	Control	Treatment
Kikuyu	26	23
Annual Grass	0	2
Native Grass	25	24
Clovers	19	12
ALG	4	6
Broadleaf Weeds	26	32

Control



Treatment

Stocking rate changes

	2020		2021	
	Start	December	September	October
Control	4.7 wethers/ha	4.7 wethers/ha	4.7 wethers/ha	4.7 wethers/ha
Treatment	6.5 wethers/ha	11 wethers/ha	5.5 ewes and lambs/ha	11 ewes and lambs/ha

Stocking rate changes have yet to settle down on the Treatment paddock, but the application of fertilizer has significantly increased carrying capacity and turned a “wether” paddock into one that is capable of running breeding ewes.

Scott and Virginia Alcock

Soil Test Results

Paddock	pH (CaCl)	Phosphorus (Colwell)	Potassium (Colwell)	Sulphur
Control	4.9	13	130	4.9
Treatment	5.0	18	180	6.4
Critical Level	**5.0**	**30**	**140**	**8**

Phosphorus and sulphur were deficient in both paddocks and potassium deficient in the Control paddock. The pH levels are satisfactory for the species present.

Fertilizer Applied

Stock	Year	Fertilizer	
		Control	Treatment
Cows and calves	2019	Nil	290kg/ha super + moly and copper ($240/ha)
	2020	125 kg super	290kg/ha super ($178/ha)

Copper was applied with molybdenum as tissue tests showed marginal copper.

Control

Treatment

Stocking rate changes

	2020		2021	
	Breeding cows/ha	Hay fed ($/ha)	Breeding cows/ha	Hay fed ($/ha)
Control	0.7	$325	0.7	Nil
Treatment	0.85	Nil	1.7	Nil

In the first year, the cost of supplementary feeding on the Control paddock was greater than the cost of the fertilizer despite the Treatment paddock having a higher stocking rate. In 2021 the stock numbers increased significantly on the Treatment paddock and have covered the fertilizer cost.

Jeff and Louise O'Brien

This site was an irrigated silage/hay paddock for dairy production.

Soil Test Results

	Result	Critical Level
pH (CaCl)	4.7	4.8
Phosphorus (Colwell)	29	30
Potassium (Colwell	50	140
Sulphur	5.6	8

Phosphorus was marginal but sulphur and potassium were very deficient. The low sulphur level was a result of using DAP/MAP rather than single super and the low potassium level is a result of extended hay/silage harvesting. The pH was not a level that would affect the growth of the ryegrass pasture.

The initial objective was to look at the impact of applying additional potash of harvest yields.

Production Responses

	Control	Additional K		
Silage	Rolls/ha	Rolls/ha	Diff	% increase
Nov-20	17.6	21.7	4.2	24%
Aug-21	5.6	6.0	0.4	7%
Oct-21	8.1	9.7	1.6	20%
Hay				
Jan-21	10.5	11.7	1.2	12%
Total	28.1	33.4	6.1	19%

The additional potash resulted in an average 20% yield increase. The table below shows the return from the extra potash compared to the cost of the additional potash.

			Value	Cost
Silage value/roll	@	$ 100 /roll	$ 416.00	$112.50
Hay value/roll	@	$ 100 /roll	$ 121.13	$37.50

Plant Tissue Results

Plant tissue tests were taken to check on the trace element status of the pasture. Copper was identified as a deficiency and copper was applied to the whole paddock. Of interest was the deficient boron level. This was in contrast to the soil test which showed a marginal level.

Analyte	Unit	Range	Windmill East	Windmill West
Nitrogen	%		1.3	1.3
Calcium	%	0.8-2.5	0.37	0.42
Magnesium	%	0.15-0.5	0.23	0.25
Sodium	%	0-0.5	0.07	0.3
Chloride	%	< 1.7	1.1	1.5
Copper	mg/kg	5-30	3.7	2.7
Zinc	mg/kg	15-50	16	20
Manganese	mg/kg	25-300	270	270
Boron	mg/kg	25-100	5.4	5.5

Boron was applied as a foliar spray (cost about $6/ha) to all the paddock except a section along the western boundary.

B harvest 19.3 rolls/ha. Previous harvest 5.1 rolls/ha

The pasture to the right of the line received no boron. Notice the lack of seed heads in the no boron section. The response to boron was estimated to be 2 -3 times of the area which didn't receive boron. The strips were not harvested separately, but the harvest after the application of boron yielded 19 silage rolls/ha across the paddock, whereas the yield for the previous harvest was 5.1 rolls/ha. There would have been some increase in the second cut due to warmer weather but would not account for much of the large difference in yields between the two harvests.

Conclusion and Next Steps

The results to date show that identifying soil deficiencies and correcting them quickly can result in huge responses in pasture growth, pasture quality and animal performance. In all the three sites reported, the responses to the fertilizer application have been profitable.

The soil tests are effective in identifying deficiencies of the major elements but can give misleading results for trace elements. It is important that all deficiencies are corrected and the both soil and tissue tests used to develop a comprehensive fertilizer program

The project will continue during 2022. A number of site inspections and a further field day will be held to finalise the results of the trial. If you are interested in being kept informed of the results of the trails please feel free to contact me on 0407953445 or jshovelton@meridian-ag.com.au \.

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6.5.2 Field Day notes November 2022

Field Day Notes November 2022

Project looked at unlocking the potential of pastures. Evidence from other areas in southern Australia indicates that low fertility is hindering the ability of many pastures to grow to their potential.

Existing pastures were used at two sites and at the other, annually sown ryegrass pastures were used. The program looked at applying sufficient fertilizer to correct missing nutrients over a two year period on one paddock (Productivity paddock) while another paddock was managed under the current farm fertilizer practice (Control paddock). Stock numbers were adjusted during the years as changes in pasture availability occurred. On the ryegrass pasture, yields of hay or silage were recorded for each of the treatments.

Scott and Virginia Alcock

Scott and Virginia run a Speckle Park stud and commercial herd on a family property at Mogilla.

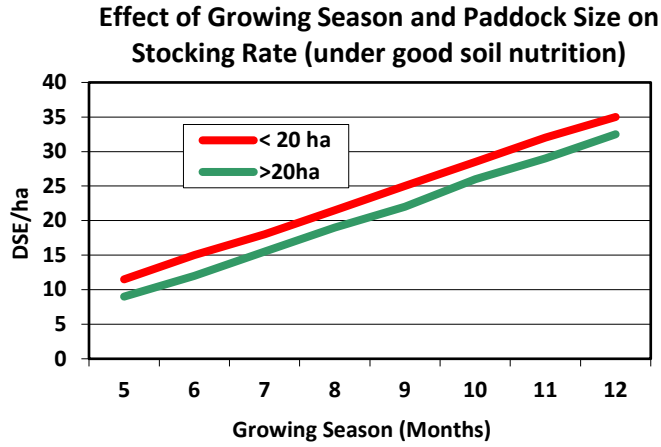
Scott and Virginia Alcock

The Alcocks had been applying low rates of superphosphate on their property and were keen to see if there were doing the right “thing”. They jumped at the opportunity to be involved with the project as they saw it as a means of understanding the potential of their farm and to get some confidence about managing increased rates of fertilizer. Scott had been thinking that there had to be more potential for the farm and saw the project as getting in on the ground floor to evaluate the approach on their farm.

The paddocks were set-stocked with breeding cattle. Set stocking was the most difficult aspect of the program but was done to ensure that there was confidence that changes in stocking rates were sustainable.

Capital Fertilizer vs Maintenance Rates

There are well established soil nutrient levels which are essential for good pasture growth. Grazing stock continually drags nutrients out of the system, so that if soils levels are low, small amounts of fertilizer often do not replace those which are being used by the animals. We know from the Grassland's Productivity Program (GPP) that if we get soil conditions right, carrying capacity is ultimately determined by the length of the growing season.



A key finding of the GPP was that fertilizing selected paddocks with sufficient nutrients over a couple of years to remove deficiencies (Capital Dressings) was a much more efficient means of lifting productivity than spreading the same amount at low rates over a larger area. Once target levels are reached applications can be reduced to levels to maintain soil levels (Maintenance Dressings).

Because Capital Dressings can be viewed as a means of "buying carrying capacity" one measure of the economics of Capital Dressings is to compare the fertilizer cost per increase in DSE with the cost/DSE through purchasing land or from sowing down pastures to new cultivars.

Soil tests indicated phosphorus and sulphur deficiencies on the Productivity Paddock which were addressed with two capital applications of fertilizer of 300kg/ha super phosphate. Molybdenum was included in the first year as the paddock had not had molybdenum in recent years. The cost for each of these applications was approximately $200/ha.

The first year of the trial was at the end of the drought. The Control Paddock was stocked at 6.8DSE/ha and the Productivity Paddock at 8.5DSE/ha. The stock on the Control Paddock were fed bales/ha while no hay was fed on the Productivity paddock. The cost of hay fed on the Control paddock was $165/ha. As well as this saving in fodder, the return from the extra stock, based on average gross margins would have added another $60/ha benefit to the Productivity paddock.

Since then and with the better seasons, the Productivity Paddock has carried 20 DSE/ha through the winter last year while the Control Paddock has carried 14 DSE/ha – a difference of 6DSE/ha. Not only has the stocking rate increased, but the pasture quality is vastly superior on the Productivity Paddock.

Pasture quality on Alcock's Productivity Paddock

If the application of fertilizer as a capital dressing is seen as a means of "buying" carrying capacity then an increase of 6 DSE/ha has cost $400/ha in fertilizer or $67/DSE.

According to Virginia, the key learning from the project has been the benefit of soil testing to identify what's missing in the soil. For Scott, the strategy of applying capital rates of fertilizer to improve soil fertility in targeted paddocks rather than small amounts of fertilizer across a large number of paddocks has been the main message.

Jeff and Louise O'Brien

Jeff and Louise operate a 190 head dairy herd at Moran's Crossing. As part of their expansion in the past, they purchased a nearby block for silage and hay production.

Jeff O'Brien

Jeff was encouraged to join the project by the Local Land Services Officer. A key motivation for Jeff was to get a better understanding of soil tests and to see if extra production could be achieved for his "cut and carry" operation.

Comprehensive soil tests were taken which shows low potassium, low sulphur and low copper. The soil test also indicated that boron was marginal. The hay and silage operation creates a large drain on potash levels in the soil. As a result it was decided to focus on the impact of extra potash on herbage yield. Extra potash was applied following each cut based on the potassium content of the hay/silage taken from the paddock. The phosphorus fertilizer was switched to single super to cover the sulphur deficiency and copper was also applied.

The yields resulting from the extra potash are shown below.

	Control	Additional potash		
Silage	**Rolls/ha**	**Rolls/ha**	**Diff**	**% increase**
Nov-20	**17.6**	**21.7**	**4.2**	**24%**
Aug-21	**5.6**	**6.0**	**0.4**	**7%**
Oct-21	**8.1**	**9.7**	**1.6**	**20%**
Hay				
Jan-21	**10.5**	**11.7**	**1.2**	**12%**
Total	**28.1**	**33.4**	**6.1**	**19%**

			Value	Cost	Benefit
Silage value/roll	@	$ 100 /roll	$ 416	$112.50	+$303.50
Hay value/roll	@	$ 100 /roll	$ 121	$37.50	+$63.50

In the second year of the project clover samples were taken to check on the trace element status of the paddock. Boron which was marginal in the soil test was shown to be very deficient in the tissue sample. As a result a test strip of foliar applied boron (see below) was put out resulting in an estimated 300% increase in yield.

Plant response from foliar application of boron (LHS)

Jeff has used the lessons learnt from the trials to extend the fertilizer program across all the paddocks harvested. Boron has been applied as a granules to all paddocks to give extended impact rather than annual foliar applications and potash applications have increased to cover potassium export in hay and silage. Silage yields of 15t/ha have been achieved which has been vital in allowing Jeff to build up fodder reserves – not only for with in season use but also for drought reserves as well. He now believes that he can sustainably feed his stock over an extended period.

In Jeff's words, soil and tissue samples have been critical in identifying what the paddocks and as a result the returns from the application of boron has been a no-brainer.

Helen Weston and Ian Culley

Ian Cully share farms on Helen Weston's property at Myrtle Mount in the Bega Valley.

Helen has had a long term interest in looking at new practices and approaches that would improve her property. It was through her involvement in Landcare activities that she was encouraged to participate in the project. Her property was running wethers with occasional cattle grazing.

Unimproved pastures were used for this comparison. Soil tests indicated that phosphorus and sulphur were limiting, as with the Alcock site. Superphosphate at 220kg/ha was applied each year for two years at a total cost of $440/ha. Molybdenum was also included in the application in the first year.

Ian Culley in the Productivity paddock

Both paddocks were stocked initially at a rate of 6.5 wethers/ha. The project highlighted the potential of the existing pastures. The use of fertilizer alone has dramatically changed the composition of the pasture – without the need to resow.

As the pastures responded, stock numbers were increased and the change in pasture quality meant the paddock was now suitable for breeding ewes. Breeding ewes were introduced to the paddock in 2021.

Pasture quality on the Productivity paddock

Cattle had to be introduced to help control the extra feed during the past year. The Control paddock has been stocked at 5 DSE/ha for the last twelve months while the Productivity paddock has averaged 18DSE/ha.

Again using conservative gross margins of $40/DSE, the Productivity paddock would have returned $520/ha more than the Control paddock in 2021/22. If the cost of the Capital fertilizer is assessed in terms of increased carrying capacity, a DSE of carrying capacity has been “bought” for about $35/DSE.

A key message from the project has been that it is essential to get a complete picture of soil fertility through both soil and tissue tests. As a result of the project Capital fertilizer will be applied to all the pastures on the property over the next few years.

Take home messages

1. There is large potential in most pastures that is being hidden by inadequate nutrition.
2. Getting soil fertility right will lift production dramatically and provide better resilience in poor seasons.
3. Soil tests as well as plant tissue tests should be used to identify nutritional deficiencies
4. When building up soil fertility, capital applications of fertilizer on targeted small areas is a better use of resources rather than small amounts over large areas.
5. Even at high fertilizer prices there can be economic returns in the short term.
6. Once critical soil levels have been reached, applications can be reduced to maintenance levels.
7. Capital fertilizer can be viewed as a means of buying carrying capacity – almost always cheaper than buying more land.

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