Final report

E.PDS.1803 – Filling the Feed gap with fodder beet

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Abstract

The autumn/winter feed gap remains a real challenge for beef producers in the North East and Upper Murray regions of Victoria. Many group members of the Mudgegonga and Upper Murray BetterBeef groups had seen fodder beet being used to fill a similar feed gap while on farm tours to Tasmania. To assess the suitability of fodder beet for use on local farms, a series of demonstration crops were planted on three farms. Crop performance was monitored from germination through to grazing, with plant weight and numbers used to estimate crop biomass (t DM/ha). Total DM production was then used to calculate cost of production. All three sites had low plant establishment rates (averaging 48,000 - well below the anticipated 85,000 plants per ha). Low plant densities coupled with low plant weights at two sites resulted in unprofitably low DM/ha – *both sites were characterised by high amounts of summer weeds*. One site performed better with greater plant weights driving higher yields. High establishment costs *($3,165/ha)* made two of the three crops unprofitable. A 12.2 t DM/ha fodder beet crop was required to break even with a 6 t DM/ha millet crop. Under the tested conditions, it is unlikely that fodder beet will play a meaningful role in filling the autumn/winter feed gap in the North East/Upper Murray regions of Victoria.

Executive summary

Background

This demonstration investigated the use of fodder beet to fill the autumn/winter feed gap in North East Victoria. While on a tour of Tasmania, producer group members had seen fodder beet successfully integrated into a farming system and were intrigued by the possibilities, but felt that an assessment of benefits and risks needed to be undertaken. While the demonstration was used as a chance to increase skills and knowledge of fodder beet establishment and management, it was also seen as a key opportunity to evaluate the performance of the crop in the local environment prior to possibly adopting this high up front cost strategy to filling the autumn/winter feed gap.

Objectives

Objective 1 – Equip producer group members with the knowledge and skills required to establish and manage a fodder beet crop.

Producer knowledge around fodder beet increased from 3.6/10 to 6.5/10, average skill levels also increased from 4.6/10 to 6.9/10.

Objective 2 – Benchmark the production of kilograms of beef per hectare from fodder beets.

For two of the three demonstration sites, establishment of fodder beet would have resulted in a decrease in beef production. Crop yields were compromised by low establishment counts and poor crop performance.

Objective 3 - Promote the findings of the demonstration to the group and a wider audience to encourage adoption.

Whilst skills and knowledge increased as a result of the demonstration, producer attitudes towards fodder beet decreased from 4.5/10 to 2.8/10, no doubt a direct result of seeing the high costs to establish the crop and then the disappointing results of low plant establishment and poor DM production. While some producers may have intended to adopt fodder beet prior to the demonstration, at the conclusion of the demonstration no producers had adopted fodder beet.

Methodology

Demonstration crops were established on three farms (at Murmungee and Shepparton in year 1, and at Towong in year 2). Crop performance was assessed via the collection of establishment counts and monitoring of plant weights at key time points through to grazing. Plant numbers were multiplied by average plant weights to calculate total DM production. A partial budget comparing fodder beet to millet has included a sensitivity analysis to account for variable crop yields.

Results/key findings

Plant establishment was poor at all three sites, averaging 44,888 plants/ha (compared to a target of 85,000 plants/ha). Dry Matter production in the first season crops was highly variable and ranged from 2.42 t DM/ha through to 27.4 t DM/ha. In the second season, crop yields were poorer and ranged from 0.4 t DM/ha to 2.4 t DM/ha depending on weed control strategies. Crop establishment costs averaged \$3,165/ha (\$475 seed; \$1,385 chemical; \$1,305 fertiliser) excluding tractor hours and labour – with a 10 t DM/ha crop costing \$317/tonne DM. Based on variable input costs a 12.4 t DM/ha fodder beet crop had the same cost of production as a 6 t DM/ha millet crop. COVID-19 travel restrictions impacted on the ability of group members to visit demonstration sites in the first

season, however a paddock walk was undertaken at one site prior to grazing. A pre-grazing summary had been provided to group members electronically, including crop photos. A group inspection of the second season crop was not undertaken as it had been grazed earlier than expected due to disappointing plant numbers and DM production. Producer knowledge, attitudes, skills and aspirations have been assessed through the use of pre and post demonstration surveys. While there had been a favourable shift in producer skills and knowledge, the shift in attitude was aligned to an increased awareness of the risks associated with fodder beet – which has ultimately ended up with no adoption of the crop as a means of managing the autumn/winter feed gap.

Benefits to industry

Our results indicate that the potential for fodder beet to fill the autumn/winter feed gap in the North East and upper Murray areas of Victoria is likely to be limited. Poor plant establishment and competition from weeds significantly reduced crop yields. These low yields combined with high up front establishment costs has resulted in a commercially unviable cost of production for two of three sites. While the potential benefit of fodder beet remains attractive (high value feed that can be held over until required in autumn/winter) the high establishment costs and risks of low DM yields due to low germination and/or competition from weeds are too great to allow for high levels of adoption.

Future research and recommendations

The potential of a high yielding high quality fodder crop that can capitalise on late spring/summer rains and sit in the paddock until required to fill the autumn/winter feed gap remains an attractive proposition. The risks associated with low yields through a combination of high establishment costs, poor plant establishment and low yields are all significant. Further research into alternative chemicals that are more widely available and cheaper than the tested options would be beneficial. Alternative sowing methodologies that result in greater germination rates and higher plant densities in a commercial setting would also be of value – some producers had expressed an interest in looking at broadcasting and harrowing fodder beet seed into a worked seedbed.

PDS key data summary table

Project Aim:
To assess the potential benefits and risks associated with the use of fodder beet to fill the autumn/winter feed gap on North East Victorian beef farms.

	Comments		Unit
Production efficiency benefit (impact) Animal production efficiency - kg LWT/ha; kg LWT/DSE, AE or LSU Pasture productivity – kg DM/ha Stocking rate – DSE, AE or LSU/ha Reproductive efficiency – marking %, weaning % Mortality rate (%)	*Average DM production decreased from 6.48 t DM/ha to 2.5 t DM/ha, equating to a reduction in stocking rate from 24 to 9.3 dse/ha*	-3.98 -14.7	t DM/ha dse/ha
Reduction in expenditure Reduction in labour i.e. DSE/FTE, LSU/FTE, AE/FTE; Reduction in other expenditure	There were no reductions in labour	0	
Increase in income		$0.00	/ha
Additional costs (to achieve benefits)		$3165.00	/ha
Net $ benefit (impact)		**$0.00**	**/ha**
Number of core participants engaged in project		6	
Number of observer participants engaged in project		30	
Core group no. ha		2,200	
Observer group no. ha		12,000	
Core group no. sheep		1,500	hd sheep
Observer group no. sheep		2,000	hd sheep
Core group no. cattle		2,000	hd cattle
Observer group no. cattle		6,500	hd cattle
% change in knowledge – core and observer participants	*Producer knowledge of fodder beet benefits increased from 4 to 6.5/10*	62.5%	
% change in aspirations – core and observer participants	*Producer aspirations for fodder beet declined from 5.2 to 3.5/10*	-32.6%	
% practice change adoption – core	*There was no adoption of fodder beet by any group members*	0%	
% practice change adoption – observers	*There was no adoption of fodder beet by any group members*	0%	
% of total ha managed that the benefit applies to	*Fodder beet was not sown on any managed land*	0%	

Key impact data

Net $ benefit /ha (total ha managed)	**-$75.00/ha**
Gross Margin / Ha	**-$867.00/ha**
Cost of production ($ / t DM)	**$317/t DM at a 10 t DM crop yield**

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1. Background

Profitability of pasture based beef systems can be limited by the age of animals at sale. Animals that have had reduced growth rates (due to restricted feed supply) will be older at the same carcass weights than those that have had unrestricted growth rates. Older cattle are less productive and profitable for beef operations as effective stocking rate is decreased, and the carcass quality is both reduced and more variable. Additionally, there can be further inefficiencies for replacement heifers that are too light (weight and fat) at their first joining.

Correcting pasture based feed deficits with cereal grains has been one approach, but it is often uneconomic and unsustainable in southern Australia. Furthermore, there are growing international markets for grass fed beef that excludes grain fed animals. The pasture systems of Victoria are well positioned to increase in this space. Many producers rate the autumn/winter feed gap as the biggest feed restriction within their current enterprises.

There are several strategic pasture/crop options to filling the late autumn early winter feed deficit. In the mixed farming areas of south east Australia, producers are seeking to utilise early sown grazing cereal crops – which have the added benefit of early grazing followed by a harvestable grain crop.

Many members of the Upper Murray and the Mudgegonga BetterBeef groups had visited a prominent farmer in Tasmania that had been successfully using fodder beet as part of their annual farming calendar.

Fodder beet grazing systems provide another approach for filling seasonal feed gaps, providing large yields of high energy feed to 'bank' for times of feed deficit to finish beef on forage. The crop has large yields (20-40 t DM/ ha) of high energy feed (12 MJ/ kg DM) that lasts for long periods (one year) with little change. The crop is extremely water efficient, and the large yields mean small areas are required because the stocking rates are high (20-30 steers/ ha for 150 days), so targeted irrigation can be cost effective.

These systems have been demonstrated in New Zealand for ten years to provide high autumn and winter feed intakes and strong liveweight gains (1-2 kg/ day) for extended periods (150 days). The crop is a practical approach to finishing beef on forages and while largely untested at this stage, is thought to be suitable for the northern Victoria (especially the Upper Murray based on both rainfall and feed demand).

While the fodder beet option has the potential for large yields of high quality forage, it is an expensive crop to establish and maintain through to harvest (both in terms of seed, sowing and herbicide/pesticides). The high input costs are reliant on high yields to achieve a favourable economic outcome. While the overall production of grazing cereals is less than that of fodder beet, the establishment costs are considerably lower (less than 50% of fodder beet). Finding the breakeven levels of production for either system is an important factor for producers deciding which option is the most suitable to fill the late autumn/early winter feed gap, whilst maintaining acceptable levels of animal production.

Having seen the use of fodder beet on farms in Tasmania, two local beef groups from northern Victoria were keen to investigate the performance of fodder beet in their own environment, ultimately establishing if fodder beet had a role in filling the autumn/winter feed gap on their farms.

This demonstration used a partnership between Agriculture Victoria and commercial agronomists to implement and test a 'new' production system for three demonstration farms.

2. Objectives

The primary aim of the demonstration was to increase the per hectare production of beef using high yielding, high quality fodder beet crops. The specific objectives were to:

Objective 1 – Equip producer group members with the knowledge and skills required to establish and manage a fodder beet crop.

Producer knowledge around fodder beet increased from 3.6/10 to 6.5/10, average skill levels also increased from 4.6/10 to 6.9/10.

Objective 2 – Benchmark the production of kilograms of beef per hectare from fodder beets.

Liveweights pre and post grazing were not collected at any demonstration site. For two of the three demonstration sites, the establishment of fodder beet would have resulted in a decrease in beef production due to low DM yields. Crop yields were compromised by low establishment counts and poor crop performance. The cost effectiveness of fodder beet has been compared to an alternate summer crop, millet. To break even with a 6 t DM/ha millet crop in terms of energy produced per $ invested, would require a 12.4 t DM/ha fodder beet crop.

Objective 3 - Promote the findings of the demonstration to the group and a wider audience to encourage adoption.

Whilst skills and knowledge increased as a result of the demonstration, producer attitudes towards fodder beet decreased from 4.5/10 to 2.8/10, no doubt a direct result of seeing the high costs to establish the crop and then the 'disappointing' results of low plant establishment and poor DM production. While some producers may have intended to adopt fodder beet prior to the demonstration, at the conclusion of the demonstration no producers had adopted fodder beet.

3. Demonstration Site Design

3.1 Methodology

Demonstration fodder beet crops were established at three sites over two growing seasons. A theoretical agronomic plan for establishment and management of the fodder beet crop was developed by local agronomists from Pasture Genetics. This plan, used as the foundation for the management program, was the basis of all costings and is included as Appendix 1 (included for interest only – and not as a recommendation for other farms).

Fertiliser and lime rates were dependent on soil test results. Specific chemical rates were dependent on timing, soil type and what weeds or pests were present. The timing of herbicide applications was critical and relied on having chemical on hand well in advance of use, as most were not freely available.

Paddocks were power harrowed to a fine seed bed and sown at 1 box/ha (100,000 seeds/ha).
All sites were planted with a four-row precision seeder (loaned courtesy of SeedForce Shepparton)(Figure 1). Collection of the seeder from Seedforce in year one corresponded with a COVID-19 lockdown in Victoria which meant seeding in season 1 at Murmungee was delayed by approximately two weeks.

Figure 1. Four row trial plot seeder loaded courtesy of SeedForce Shepparton.

Plant establishment was estimated from an average of the number of plants along five 20m drill rows, multiplied by 1000 (to account for 50cm row spacings). When required, plant counts were replicated approximately three weeks after the initial counts to ensure germination was complete. Average bulb weights were collected at key points throughout the growing season to estimate dry matter production of the fodder beet – through to the point of grazing when final herbage mass estimates were calculated.

Herbage mass (t DM/ha) was estimated by multiplying plant counts by the average plant weights. Plant weights were estimated by digging a representative sample of bulbs (approximately twenty plants) and weighing fresh and dry. Plants were weighed as 'bulbs' and 'tops' with the bulb divided into above and below ground fractions. Bulb portions were cut into smaller components to facilitate drying (Figure 2). Samples were oven dried at 90 degrees Celsius for 48 hours, with bulb portions given a second drying period. Total crop yields (tonnes/hectare) were estimated by multiplying average bulb weights by estimated plant numbers.

Figure 2. Fodder beet 'tops' cut from 'bulb'; Above and below ground bulb portions separated; Bulbs cut up prior to oven drying.

Whilst the initial project plan was to collaborate with a New Zealand fodder beet expert, with links to chemical companies, this did not eventuate. Regrettably, after much back and forth in early development of the project application the New Zealand 'expert' went offline and was never heard from again (despite repeated contact attempts/emails etc).

1.1.1 2020 demonstration sites

Sites were proposed at Murmungee and the Upper Murray in year 1, however this was not possible, primarily due to Black Saturday bushfire affected farms and farmers.

As a result, we continued with the site at Murmungee (3 ha) and were able to collaborate with a producer at Shepparton (15 ha) that had just sown fodder beet. Both sites planned to graze (as opposed to mechanically harvest) their fodder beet crops to fill a late autumn/early winter feed gap and had access to summer irrigation. The Murmungee site was grazed with cows while Shepparton grazed the fodder beet with finishing stock (steers and heifers). The Shepparton site was not managed by a current group member, but they were helpful and willing to let us monitor their crop performance. The site had very high levels of soil fertility and irrigated on a fortnightly basis.

As way of a 'mini demonstration' the Murmungee site incorporated two different fodder beet varieties: Bangor (Pasture Genetics) versus Brigadier (SeedForce) – with a view to assessing the suitability of one variety versus the other. Of the sown paddock, one bay (1/3 available area) was sown to the selected Pasture Genetic variety with the remaining two bays sown to the SeedForce variety. Aside from the different fodder beet variety, all bays were managed identically in terms of weed management and irrigation.

1.1.2 2021 demonstration sites

In the second spring (August/September 2021) a demonstration was established with a producer in the Upper Murray at Towong (3ha) secured with kind support from Graham Martin, AgMate Corryong. A dryland site was deliberately selected as being the toughest test for the fodder beet crop, but with the most application for the district. The originally proposed Upper Murray site could not be used because of changed plans from those farmers – specifically to continue using shorter term, early sown grazing cereals as a source of later autumn/early winter feed.

The Towong site included a mini demonstration that investigated 'conventional' versus 'innovative' preemergent weed control in fodder beet crops. The rational for looking at alternate preemergent weed control was driven by two factors, 1) the difficulty in sourcing traditionally recommended herbicides and 2) the high cost of establishment of traditionally managed fodder beet crops. Based on available chemical approximately ¼ of the available area was sown with 'conventional' management and ¾ with 'innovative' management.

3.2 Economic analysis

Costs of establishment (seed, chemical and fertiliser) and observed crop yields were used as the basis of an economic analysis. Cost of production has been calculated for a range of crop yields to give a break even cost of production with purchasing grain. A partial budget was used to compare the economics of fodder beet versus millet, as well as a sensitivity analysis that compares performance at variable yields for both the fodder beet and the millet.

3.3 Extension and communication

Planned communication and extension activities included the following:

- Planning meeting to review/outline the demonstration and discuss project activities and any modifications for methodology

- 1 social media posts/ year (on AgVic Facebook and/or Twitter)
- 1 summary update of seasonal performance for email distribution to wider producer group.
- 1 group field day (limited to group members due to COVID-19 protocols) to undertake pregrazing fodder beet assessments. Producers were unable to visit the Shepparton site due to COVID-19 travel restrictions, however group updates included data and photos from the Shepparton site.
- Producer update summarising 2nd year findings for email distribution to wider group.
- Debrief meeting with local agronomist and host producer in Upper Murray.
- Face to face communication activities (farm visits) had been impacted by COVID-19 restrictions.

3.4 Monitoring and evaluation

Monitoring and evaluation included:

- Surveys to benchmark KASA (knowledge, attitude, skills and aspirations) undertaken by the group prior to commencing the demonstration and at its completion.
- Annual review of the demonstration to discuss how the project is performing, results and required changes to methodology.
- Estimates of costs and benefits of the practice demonstrated.

4. Results

4.1 Demonstration site results

4.1.1 Year 1 sites – Murmungee and Shepparton

All agronomic advice was sourced locally form team members at Pasture Genetics and SeedForce, with follow up support from local Agronomists at LandMark Baranduda (now NorMac Rural, Yenda Producers) and AgMate Corryong.

Establishment counts
Fodder beet crops were sown at Murmungee on 21/10/2020 and in the week prior to this at Shepparton. Establishment counts were undertaken on 11/11/2020.

Plant establishment counts at Murmungee,
Bay 1 - 54,000 plants/ha – Seedforce, Brigadier
Bay 2 – 45,333 plants/ha – Seedforce, Brigadier
Bay 3 – 46,667 plants/ha – Pasture Genetics, Bangor

We don't believe that these numbers show any meaningful difference in germination rates between the two varieties.

Estimated plant establishment at Shepparton, 45,000 plants/ha. Establishment counts at Shepparton were highly variable and estimated plant count were developed based on comparison to the Murmungee site.

The fodder beet was planted at a rate of 1 box (100,000 seeds)/ha – giving establishment percentages of 49% and 45% at Murmungee and Shepparton respectively.

Both sites planted into well worked seedbeds, with a fine tilth. Why the germination rates were less than the desired 85%+ is a matter of speculation. It has been suggested that rainfall events post sowing caused a 'crust' to form over the germinating seed – which may have hindered emergence. Alternatively, the rainfall event may have resulted in extra soil 'washing' into the drill row and burying the seed deeper than the ideal, impacting emergence. Both sites used the same precision planter, so it is possible that there was an issue with set up of the sowing equipment. There was no issue with seeder calibration, and the correct volume of seed was used for the sown area.

Herbage mass

The low plant numbers in addition to small plant size led to lower than anticipated herbage mass. Herbage mass was assessed at both sites on the 22/2/2021 and again at Shepparton on March 15. The Murmungee site was not assessed on the March 15 due to low initial herbage mass, with little anticipated change. Both sites were again assessed for a final time on April 14.

On the 22/2/2021 the Murmungee site had only 563kg dry matter (DM) and 2378kg fresh weight of beet/ha. Of that, 69% consisted of 'tops' and 31% was 'bulbs'. In line with literature the bulbs had higher dry matter (31% DM) than the tops (20% DM). Even if we assumed a hypothetical plant population of 85,000 plants/ha as a desirable target, at these bulb weights there would only be 3.7t/ha fresh – or 0.9t DM/ha. At these levels of DM production, given the 124 days the paddock had been locked up between sowing and this final harvest, it was expected that nearly any other summer crop (millet, sorghum etc) would have out produced the fodder beet.

The 'tops' contributed 27% of total herbage, while 73% was stored in bulbs – almost the complete reverse of Murmungee and a sign of a more mature/advanced crop at Shepparton. At an extrapolated plant number of 85,000 plants/ha (which would be the plant numbers from a desired 85% germination) it would have been a theoretical yield of 16t DM/ha. While this does point to the possible yield, it remains theoretical as at increased plant numbers the average plant size would likely be reduced.

By the March 15 inspection, the Shepparton site had accumulated 23t DM/ha, 128 days after being sown (15/3/2021) – an indication of what can be achieved by a high input fodder beet system. Bulbs sampled on 15/3/2021 were divided into above ground and below ground portions – with an estimated 34% of bulb being below the ground. Some different beet varieties have different bulb shapes, and it's anticipated that the high portion of bulb above ground would lead to easier utilisation of the crop by animals that have not previously consumed fodder beet.

Final bulb weights were collected prior to grazing on 14/4/2021 (Table 1) – 165 days after sowing. When individual bulb weights (Table 1) were extrapolated out to t DM/ha crop yields, the Shepparton site had an estimated 27.4 t DM/ha at grazing (14/4/2021) and the Murmungee site 2.4 t DM/ha (Table 3)(Figure 3).

Table 1. Average final fodder beet component weights (g) per plant, for Murmungee and Shepparton demonstration sites

	Murmungee				Shepparton			
	Bulb below ground	Bulb above ground	Leaf	Total	Bulb below ground	Bulb above ground	Leaf	Total
Fresh wt (g)	77	72	82	231	2426	712	944	4082
Dry wt (g)	36.2 (total bulb)		13.5	49.7	468 (total bulb)		141	609

The bulb of the Brigadier Fodder beets grown at Shepperton were 14.9% DM, slightly higher than the anticipated 13% DM.

Table 2. Final fodder beet crop yields (t/ha) based on average plant numbers and weights at grazing for Murmungee and Shepparton sites.

	Murmungee – 19/4/2021			Shepparton – 14/4/2021		
	Avg plant wt (g)	Plants/ha	Total yield t/ha	Avg plant wt (g)	Plants/ha	Total yield t/ha
Fresh wt	148	48700	7.2	4082	45000	184
Dry wt	49.7	48700	2.42	609	45000	27.4

Two different fodder beet varieties were sown at the Murmungee site (Table 3) – however, due to the overall poor performance of the crop and high weed burdens there was little merit in comparing the performance of one variety versus the other. The Dry Matter percentages of leaf and bulb components were similar for the two varieties. Pasture Genetics percentage DM for leaf and bulb was 17% DM and 24.4% DM respectively, while the SeedForce DM's were 15% leaf and 23.8% bulb.

Table 3. Average final plant component weights (g) and estimated yield (t DM/ha) between varieties at Murmungee.

	Fresh weights					Dry weights			
	Bulb below ground	Bulb above ground	Total Bulb	Leaf	Total	Dry bulb	Dry Leaf	Total Dry wt	Total yield at 48,600 plants/ha
Pasture Genetics Bangor	97.3	129.3	226.6	101.7	328.3	55.3	17.7	73	3.5
Seed Force Brigadier	47.5	24	71.5	62	133.5	17	9.3	26.3	1.7

Figure 3. The contrasting performance of fodder beet plants of similar age from Murmungee and Shepparton sites for collection of final plant weights.

The Pasture Genetics variety yielded 3.5 t DM/ha at 'harvest' compared to 1.7 t DM/ha from the SeedForce variety (Table 2). The pasture Genetics variety also had a higher percentage of DM stored as bulb as opposed to leaf, presumably related to the development of the crops. On a dry matter basis, the fodder produced by the Pasture Genetics crop consisted of 24% leaf and 75% bulb, while the SeedForce crop was 35% leaf and 65% bulb. This is in line with observations from the

Shepparton site where increased crop yields coincided with the percentage of DM stored in the bulb also increasing.

Fodder beet samples from Murmungee were deemed too small and underdeveloped to warrant testing of nutritive characteristics. Samples were taken from the Shepparton site, sorted into bulb and leaf fractions and sent via express post to Feedtest in Werribee. Regrettably, as was the case with many parcel deliveries at the time during COVID lockdowns the samples were delayed in transport and arrived at FeedTest in a state unsuitable for analysis. As an indication of expected nutritive characteristics of fodder beet a meta-analysis of all fodder beet results from the FeedTest laboratory from last two years is included as Table 4.

Table 4. Nutritive characteristics of fodder beet from samples submitted to FeedTest between June 2020 and May 2022.

	Samples		Dry Matter (DM)	Moisture	Crude protein (CP)	Dry Matter Digestibility (DMD)	Metabolisable Energy (ME)
Bulb	18	Mean	14.1	85.3	7.3	92.4	14.3
		Low	8.4	81.1	2.9	84.4	12.9
		High	18.9	91.6	14.8	99.1	15.4
Leaf	17	Mean	9.9	90.1	22.2	67.4	10.1
		Low	6.5	87.4	16.1	59.9	8.7
		High	12.6	93.5	28.5	74.7	11.2

Weed control

Summer grass weeds were a huge problem at the Murmungee site (Figure 4). Coupled with the 'kind' summer, the site only received one irrigation. Further irrigations were cancelled on the back of low beet numbers and high weed burdens – the thought being that irrigating the paddock would only exasperate the weed numbers and size.

Initial grass weed control advice was sought through a local agronomist – as a result the crop was sprayed with 'Verdict' (used in the week prior to irrigating), and then a second follow up weed control with 'Targa'. The Verdict helped with weed control but was slow acting and took a couple of weeks for control to be evident. The Targa appeared to be less successful, which was not surprising given the added maturity of the grass weeds.

Visually the site looked weed dominant. While the beet numbers remained constant between observations (with no loss of plant numbers), individual beets remained small, with minimal bulb development – and just didn't grow. There is no doubt that low germination rates of the beet hindered crop performance, and at no point did the beet reach 'canopy closure' which encouraged further germination and growth of summer weeds.

Figure 4. Weed burdens at Murmungee close to grazing

The high numbers of weed plants outcompeted the fodder beet plants, which while survived, did not developed as hoped. It was the belief of the local agronomist that sowing the crop two weeks later than originally scheduled contributed to the weed burden of the paddock/crop.

In contrast, the Shepparton site was a different proposition, being cleaner of weeds and having been irrigated on a weekly basis – undoubtedly major factors in the yield differences between the two sites.

Grazing

There were no animal health issues reported at either the Murmungee or Shepparton sites when grazing the fodder beet crops. Steers at the high yielding Shepparton site were given a gradual introduction to the crop over a two week period, where access to the crop was restricted on a time basis.

Figure 5. Beet at point of grazing from Shepparton site, with a below ground portion from a theorised similar sized bulb after grazing.

Post grazing the crop was inspected, with a view to collecting residuals to calculate an estimated utilisation rate/percentage. Essentially no remaining fodder beets could be collected, with utilisation accordingly estimated in excess of 95% (Figure 6). The high percentage of bulbs above ground (77% of bulb being above and 23% being below ground – excluding the 'tops' of the plant) resulted in cattle knocking bulbs out of the ground and consuming the entire plant (Figure 5). As the beet plants matured, they have an increasing portion of the plant above ground – becoming like a 'loose tooth' leading to high utilisation rates (for the sown varieties at least). No attempt was made to collect crop utilisation post grazing at Murmungee due to the poor crop performance and yields.

Figure 6. Fodder beet residuals post grazing at Shepparton

Neither the Shepperton nor Murmungee farmers who had trialled fodder beet in 2021 planted fodder beet in the following year/season.

4.1.2 Year 2 site - Towong

Agronomic support was received through SeedForce with additional local advice sought through AgMate Corryong.

Establishment counts
The Upper Murray site at Towong was sown on 3/11/2021 after a wetter than average spring delayed access to paddocks for spraying and sowing.

Establishment counts at the Upper Murray site were initially completed on 15/12/2021 and rechecked on 11/1/2021. Observations showed the crop to be more uniform than the first year sites, though plant numbers were still much lower than hoped – with an average of 41,000 plants per ha. After visiting this site, it would seem plant numbers in the first year sites had been overestimated – possibly an unconscious bias towards counting plant numbers in 'better' rows. At a visual inspection, this site was superior to the 2020/21 crop at Murmungee – highlighting the importance of how plant number assessments are made in unfamiliar crops.

Given this third trial site also had lower than hoped plant numbers, it is possible that there was a point of failure common to all sites. It is possible that the reduced plant numbers were related to the machinery used, with the same seeder used at all sites.

Sowing depth appeared to be critical to germination. At the Upper Murray site, there was a situation where a seed box 'leaked' seed across the paddock as equipment was moved to the start of the paddock. This accidental 'test strip' where seed was dropped on top of the soil with no press wheels or further contact resulted in nearly 100% germination (albeit with a MUCH higher seeding rate). While care must be taken interpreting anything from such an accident, it does suggest that the seed was viable and had the potential for high germination rates. Unfortunately, the wider demonstration was unable to replicate the same levels of germination at a paddock scale, despite having careful operators and specialist precision seeding equipment.

Weed control

Two pre-emergent weed control strategies were assessed at the Towong site. The need for a second chemical control option was driven by the lack of availability of traditionally recommended chemicals. The second option had been investigated in recent Australian fodder beet research (undertaken at Shepparton, Victoria) and reduced the establishment costs of fodder beet crops.

There was no impact of the different preemergent weed control on crop establishment, with similar germination rates recorded across the two treatments (40,667 plants/ha in conventional strip and 41,333 plants/ha in innovative management strip). Visually there were differences in weed numbers during early crop assessments, with Figure 7 showing crop and weed development 42 days after sowing.

Figure 7. Weed burdens and crop development 42 days post sowing in fodder beet

Weed burdens and crop development 42 days post sowing in fodder beet with conventional (left side) and innovative (middle image) pre-emergent weed control (Fig. 7). The image on the right shows the conventional crop management with innovative management visible to top right.

However, subsequent plant performance was impacted. A further round of mid growing season crop inspections was undertaken on 11/1/2022, 69 days post sowing. Fodder beet plants that had ‘conventional’ pre-emergent weed control averaged 340mm tall and 13 leaves, while plants from the ‘innovative’ management averaged only 160mm tall and 4 leaves (Fig. 8).

Figure 8. Mid growing season fodder beet plant size from conventional (left image) and innovative (right image) pre-emergent weed management.

The reduced plant performance appeared to have been driven by increased competition from weeds, with visibly more weeds from the 'innovative' weed management program. Due to the very small size of the plants at this stage, no bulb weights were collected – with plant height and leaf numbers used as a means to highlight differences in crop performance.

The differences in fodder beet production due to 'conventional' or 'innovative' preemergent weed control continued through to the grazing-off of the crop (Fig. 9).

Figure 9. Plant sizes close to grazing from innovative (left side of image) conventional (right side of image) pre-emergent weed management. Note lack of 'leaf' having had cows through paddock.

Grazing

Cattle were introduced to the crop approximately 120 days after sowing (3/3/2022) when final bulb weights and fractions were collected (Table 5). As per previous protocols, bulb weights were separated from the leafy tops, however the weight of tops had been compromised from cows having had access to the crop. Plant weights from the conventional management were considerably heavier than those from 'innovative' management. Unfortunately, both treatment groups still had disappointing and unprofitable total fodder beet yields (costings below). As a result of these low yields a decision was made to cut the paddock losses and graze off the crop earlier than originally anticipated.

Herbage Mass

The impact of increased weed competition in the 'innovative' management severely limited the development of the fodder beet plants compared to those under conventional management. At harvest, plants from the conventional management averaged 68.5 g DM/plant compared to only 9.4 g DM/plant for the innovative management plants (Table 5). At the measured plant numbers, these average plant weights equated to 2.8 and 0.4 t DM/ha for the conventional and innovative management regiments respectively (Table 6).

Table 5. Average dry land fodder beet component weights (g) under conventional and innovative management

	Conventional				Innovative			
	Bulb below ground	Bulb above ground	Leaf	Total	Bulb below ground	Bulb above ground	Leaf	Total
Fresh wt g	261.0	114.5	27	402.5	17.6	6.4	5.4	29.5
Dry wt g	41.4	19.8	7.2	68.5	5.5	2.0	1.9	9.4

The 'conventional' management regimen had 30% higher chemical costs per hectare than the 'innovative' management ($1,385/ha versus $1,061/ha). This equated to a 15% increase in total costs per hectare between the innovative ($2,196) and conventional ($2,520) management programs. These costs were lower than the originally anticipated $3,165/ha, as given the outlook for low crop yields (based on low plant numbers and high percentages of weeds) a decision was made to not have follow up fertiliser and Urea applications.

A crop yield of 2.8 t DM/ha for the conventional management at a total costs $2,520/ha equated to $900/tonne of grown feed. A crop yield of 0.4t DM/ha at a total cost of $2,196/ha for the innovative management has cost $5,490/tonne of grown feed. Both of these results are unprofitable at best.

Table 6. Total dryland fodder beet crop yields (t/ha) based on average plant weights and numbers at Towong.

	Conventional			Innovative		
	Avg plant wt (g)	Plants/ha	Total yield t/ha	Avg plant wt (g)	Plants/ha	Total yield t/ha
Fresh wt	402.5	40667	16.4	29.5	41333	1.2
Dry wt	68.5	40667	2.8	9.4	41333	0.4

While the profitability of the innovative system was decimated by a combination of 1) low plant numbers and 2) small bulb weights, the traditional system does give some insight into the potential bulb weights from a dry land fodder beet crop in the upper Murray. If average bulb weights from a conventional management system are extrapolated out based on theoretically improved plant establishment rates of 80% germination it suggests a possible crop yield of 5.5 t DM/ha (Table 7).

While there are limitations to this approach – in that we are unlikely to achieve the same bulb weights at greater bulb densities, it does provide a guide to possible crop performance.

Table 7. Predicted yields (t/ha) for dryland fodder beet production in the Upper Murray at theoretically improved plant densities.

	Plants/ha				
Bulb size	40000	60000	70000	80000	95000
402.5 (fresh)	16.1	24.2	28.2	32.2	38.2
68.5 (DM)	2.7	4.1	4.8	5.5	6.5

At the benchmarked total costs of $2,520/ha for 'conventional' fodder beet management, a 6t DM/ha crop would cost $420/tonne of feed. This is close to parity with $365/t grain given the significant travel costs involved in bringing grain into the upper Murray (300kms @ $4.20/loaded km/24 tonnes = $55/tonne transport).

Despite these high costs, the farmer at the Towong site has expressed interest in sowing fodder beet again. The DM yields being deemed encouraging enough to try again if establishment and weed control could be improved. There is interest to investigate a lower cost method of establishment, specifically to look at broadcasting seed with subsequent harrowing to establish seed to soil contact.

5.1 Economic analysis

The agronomy program has been costed (Table 8) and costs per unit of feed have been calculated for a range of DM yields (Table 9). Dry Matter yields have been selected to cover the range of yields measured across the demonstration sites (and account for theoretical higher germination rates that may be achieved in other circumstances).

Table 8. Theoretical fodder beet program for seed, chemical and fertiliser with associated costings.

Application	**Seed**	**Chemical**				**Fertiliser**			
		Tramat	Pyramin	Betanal	Chlorpyrifos	DAP	MOP	Urea	
Starter fertiliser						300 kg/ha	100 kg/ha		
Sowing	1 box/ha								
Pre-emergent		2 l/ha	2.5 kg/ha		1.2 l/ha				
1st post emergent		2 l/ha		5 l/ha	1.2 l/ha				
2nd post emergent				5 l/ha	1.2 l/ha				
1st fertiliser application							100 kg/ha	150 kg/ha	
2nd fertiliser application							100 kg/ha	150 kg/ha	
final fertiliser								150 kg/ha	
Total units/ha	**1**	**4**	**2.5**	**10**	**3.6**	**300**	**300**	**450**	
Cost per unit 'box/drum/tonne'	$475	$405	$439	$404	$187	$1,800	$1,200	$900	

Pack size	100,000 seeds	5	5	5	20	1000	1000	1000	
Price/unit	-	81	87.8	80.8	9.35	1.8	1.2	0.9	
Price/ha applied	$475	$324	$220	$808	$34	$540	$360	$405	
Total cost/ha	**$475**	**$1,385**				**$1,305**			**$3,165**

Fodder beet is an expensive crop to establish – with a 'standard' establishment program costing in the order of $3,165/ha (Table 8). Of these costs, chemical was the greatest single component (43.8%) followed by additional fertiliser inputs (41.2%) and seed (15%). These costs make no allowance for additional costs of using a contractor, or the accumulated tractor hours to either sow or spray the crop. In part we have excluded these costs as sowing an alternative summer crop would incur similar costs – however, if comparing cost of home grown fodder beet to bought in grain then they could be included. Given the high establishment costs, it is critical that the subsequent crop is high yielding to offset the up front investments. Further to this, there is little room to 'cut corners' and reduce costs as any attempt to do so is likely to have significant ramifications to crop yields. We have seen that ineffective weed control is a major limitation to crop performance.

The estimated crop yields from the three demonstration sites ranged from less than 0.5 tonnes DM/ha through to 27.5 t DM/ha. Given the high establishment costs of seed, fertiliser and chemical, the subsequent fodder beet crop needs to be relatively high yielding to be more cost effective than buying in energy in a different format (such as grain) to fill a period of energy deficit. At a 2.5t DM/ha crop yield each tonne of fodder beet has cost the producer $1,266 to produce, whereas the cost per tonne of a 15t crop is $211/tonne and a higher yielding 25t crop is $127/tonne (Table 9).

Table 9. Cost per tonne of grown fodder beet at variable crop yields.

	Fodder beet yield t DM/ha										
Est cost/ha	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5
$3,165	$1,266	$633	$422	$317	$253	$211	$181	$158	$141	$127	$115

A crop yield of 9 t DM/ha of fodder beet (at an establishment cost of $3,165/ha) results in a $350/tonne cost of production. Whilst this cannot be compared to a tonne of hay or silage DM (due to the high energy cost of the bulb and leaf fractions of a fodder beet crop) – a tonne of fodder beet is comparable to a tonne of grain on an energy basis. In other words – to achieve a comparable cost of production to purchasing energy from grain at $350/tonne would require a 9 t DM/ha fodder beet crop. This includes the additional risk of having considerable upfront costs and having a paddock that will be 'out of action' between sowing and grazing – likely to be in the order of 170 days.

A common summer crop option producers can employ to fill the autumn/winter feed gap is the use of millet, a lower cost and lower yielding alternative. Based on the respective costs of establishment and the lower energy content of millet (assumed at 10.5 MJ ME/kg DM) versus that of fodder beet (assumed at 11.5 MJ ME/kg DM) and sensitivity analysis of the two crops identifies a break even point whereby a 6 t DM/ha millet crop costing the same per tonne of feed produced as a 12.4 t DM/ha fodder beet crop (Table 10). To that end, any fodder beet yields below 12.4 t DM/ha and a producer would have been better off having sown millet.

Table 10. Sensitivity analysis

		Millet yield (t DM/ha)		
		4	6	10
Fodder beet yield t DM/ha	5	-$2,269	-$2,919	-$4,218
	10	-$304	-$953	-$2,252
	12.4	$650	$0	-$1,299
	20	$3,628	$2,979	$1,679

Whilst the economic assessment is important, the decision to sow a crop or not will also be based on a producer's attitudes to risk management and other factors such as ability to store or handle grain.

Given the paddock size, fertility and growing season of the Upper Murray demonstration site – the average annual stocking rate based on the method of Saul and Kearney (2016) is estimated at 24 dse/ha, or an average t Dm/ha production of 6.48 (based on a dse being 7.4 MJ ME and an average MJ ME/kg DM for pasture of 10). If we assume a 2.5 t DM/ha fodder beet crop yield – we have reduced the carrying capacity of that hectare to 9.3 dse/ha. Based on a long term average of $5/dse net profit from beef production (https://www.mla.com.au/contentassets/5adfb56a72394ded92c72cff2a9b03f1/b.com.0351.a_final_report.pdf) net profit has decreased from $120/ha to $46/ha as a result of sowing fodder beet – due to a reduced carrying capacity, as a result of reduced DM production. A loss of $73.50/ha net profit due to reduced production.

At a gross margin of $59/dse for high rainfall beef enterprises (GRDC resources publication, 2022) the decrease in stocking rate associated with the reduced DM production of a 2.5 t DM/ha fodder beet crop (compared to an estimated pasture yields of 6.48 t DM/ha) was a $1,416/ha gross margin versus a $549/ha gross margin, a loss of $867/ha due to sowing fodder beet.

5.2 Extension and communication

Project activities in the first year were impacted on by the dry spring of 2019, followed by the 2019/2020 bushfires. With other stressors to contend with, no demonstration crops were established in the first spring. While demonstration crops were established in the second year, group activities were then impacted by COVID-19 restrictions which came into effect prior to sowing of the first crops. It was not possible to have face to face group meetings, nor a larger open field day prior to grazing. Prior to grazing of the Murmungee site, it was possible to have a smaller group paddock gathering. However, group members were unable to attend the better performing Shepparton site. The Shepparton site was attended in isolation by Nick Linden for data collection. A summary (including photos) from both sites was distributed to all group members at the conclusion of the first growing season.

The poor germination and performance of the fodder beet crop at Towong in the final year has also negatively impacted on extension activities. Whilst it was initially planned to hold a paddock walk and crop inspection prior to grazing, this did not occur. Unfortunately, the paddock was essentially a write off, and cows had been grazed through the paddock prior to producers being able to attend the site. Even if the cows had not been put through the paddock by the farmer, the reality was that it would have been hard to attract time-poor producers to a group activity at a failed crop site, with little to see or analyse. A disappointing end to what was a disappointing failed crop.

Table 11. Extension and communication activities

	Date	Activity	Producer attendances	Service providers
Website	Nov 2019	Factsheet on AgVic demo webpage		
Group session	Jun 2019	Initial group briefings with Mudgegonga based group members	10	1
Group session	Jul 2019	Initial group meetings with Upper Murray based group members (with Pasture Genetics representative)	7	1
Group field work	Nov 2019	Collection of trial seeder and sowing of Murmungee site	3	2
Group update	Jan 2020	Summary results distributed to group - Year 1 results	34	1
Paddock walk	Apr 2021	Paddock walk/site inspection at Murmungee. CV19 travel restriction made it impossible to access Shepparton site	8	1
Media	Apr 2021	Fodder beet article Beef Sheep Newsflash article	Circulated to 3,500 subscribers	
Media	May 2021	SALRC Newsflash		
Social media	June 2021	Social Media - Facebook post and Tweet – Use of fodder beet		
Group field work	Oct 2021	Collection of seeder and sowing of Towong site (attended by local agronomist)	3	2
Debrief	Jun 2022	Debrief with host farmer and local agronomist	2	1
Media	Sept 2022	Beef Sheep Newsflash article	Circulated to 3,500 subscribers	
Factsheet	Sept 2022	Final summary distributed to all group members	35	2

The utilisation of different local 'district' agronomists in both years of the demonstration has been a useful means of increasing the skills of local service providers in dealing with fodder beet. Neither of the local agronomists used throughout the demonstration had first hand knowledge of fodder beet agronomy prior to the demonstration – hence a useful training and development activity for the consulting service providers.

5.3 Monitoring and evaluation

At the Murmungee paddock walk, group members agreed that while the demonstration results appear disappointing (in that there were low germination rates with low DM production) in this regard a 'negative result' was still a favourable outcome with good learnings. Whilst not the results that had been hoped for, these findings have resulted in new knowledge, skills and aspirations around the use of fodder beet. The greatest impact of the demonstration has been the non-adoption of fodder beet.

5.3.1 Knowledge, Attitude, Skills, Attitude, Adoption

A pre and post evaluation survey on the demonstration was completed with members of the Mudgegonga and Upper Murray Better Beef Groups. This evaluation measured changes in knowledge, attitude, skills, aspirations (motivation) and adoption (KASAA) for two key objectives shown below (Figures: 10-13). The surveys involved producers rating their current level of knowledge, skills, aspirations from 1-10 against each of the demonstration objectives.

Figure 10: Knowledge pre, post and change

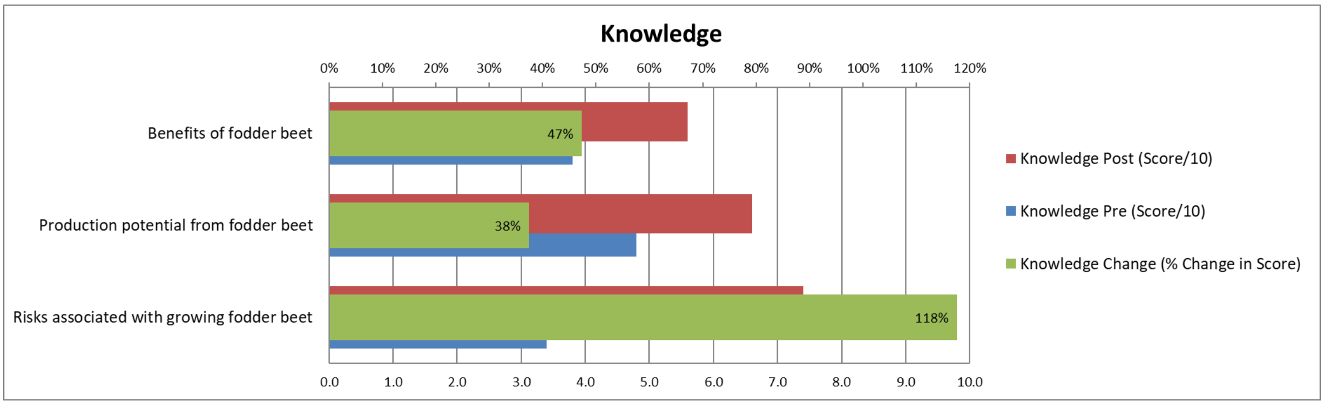


Figure 11: Attitude pre and post. Change is not shown as was negative

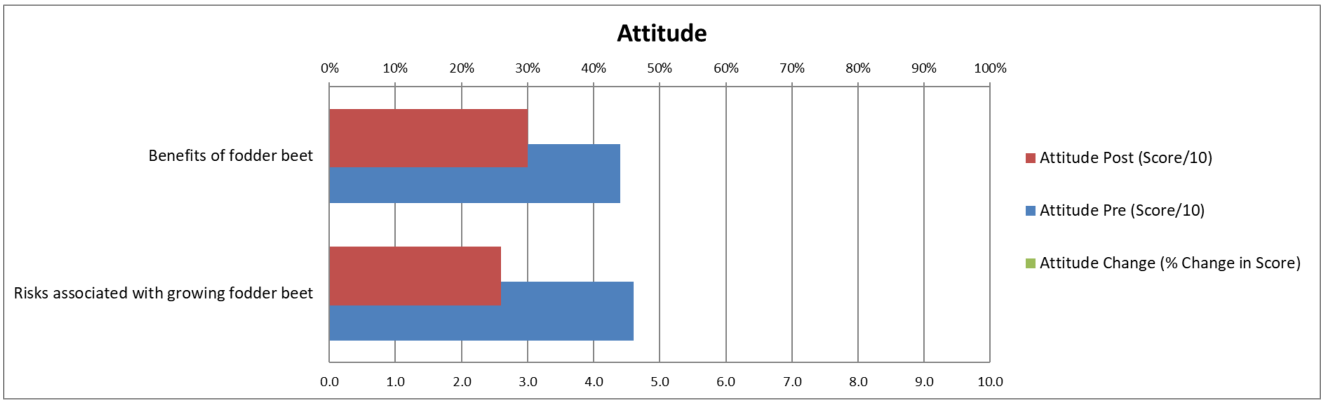


Figure 12: Skills pre, post and change

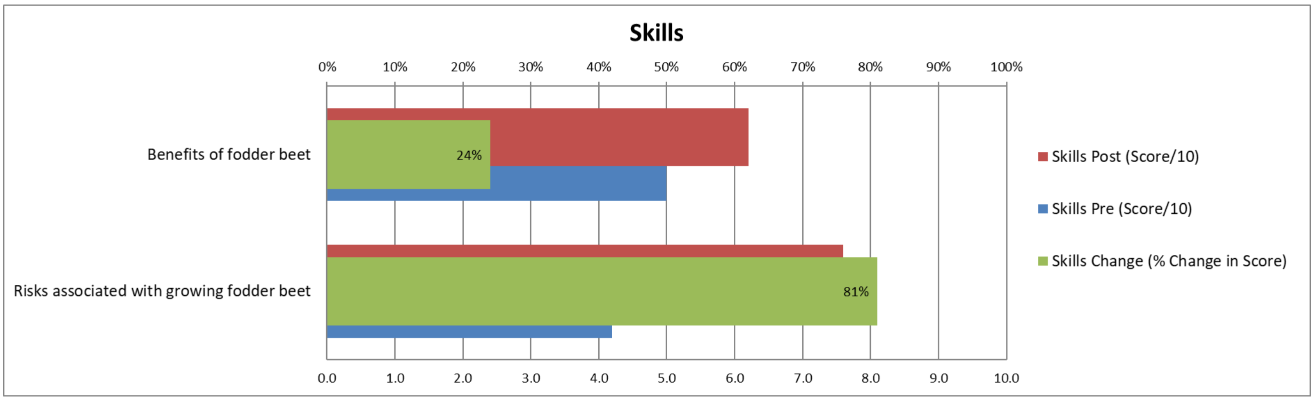
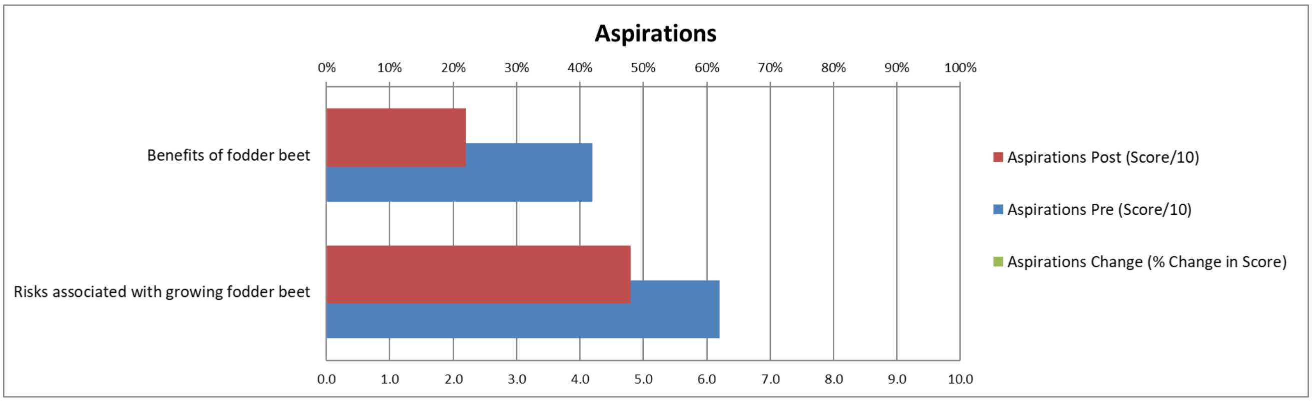


Figure 13: Aspirations pre and post. Change is not shown as was negative.



Knowledge

Producers indicated their knowledge had increased across all parameters, ranging from a 38% to 118% change in knowledge. Overall, the group had indicated a low initial knowledge of all parameters, which increased from 4.0/10 to 6.5/10. The greatest increase in knowledge was associated with the risks of growing fodder beet.

Comments from producers include:

- *"It's just too risky"*
- *"When we worked the paddock so well, what we created was a perfect 'weed' bed, not just a seed bed."*

Attitude

Average rating for attitude across all parameters DECREASED from 4.5/10 to 2.8/10. The attitude towards both benefits and risks associated with fodder beet decreased due to participation in the demonstration. It is likely that producers who had previously seen fodder beet in different environments (such as Tasmania) now had a poorer attitude towards it having seen the low germination rates and poor crop performance that we had encountered.

Skills

Producers indicated their skills had increased across both parameters by 24-81%. Average skill level across the parameters increased from 4.6/10 to 6.9/10, with the biggest changes being in the ability to assess the risks associated with fodder beet.

Comments from producers include:

- *"It's too hard to grow beet"*

Aspirations

Producers indicated that their aspirations towards fodder beet had declined. Motivation pre demonstration across all parameters was moderate, averaging 5.2/10 and decreased to 3.5/10.
For some group members having seen fodder beet in a different environment informed them of the potential – experience with the crop in their local environment then tempered their excitement and actually resulted in them no longer planning to make changes/adopt the crop at home.

Adoption

There was no adoption of fodder beet throughout the demonstration. 100% of members surveyed indicated that they had not sown fodder beet either before or post the demonstration. Only one of the three host farms indicated any willingness to try sowing fodder beet again.
Comments from producers include:

- *"There are other lower cost/lower risk options."*

What new skills have been learnt?

- Group members have improved skills required to assess both the benefits and risks associated with growing a fodder beet crop.
- Members also learnt that what happens on a producers farm in Tasmania, who is experienced with fodder beet is a world away from what can transpire in their own environment. Replicating a management program does not equate to a replicated result.
- Members were better prepared to establish and manage a fodder beet crop post the demonstration, with 75% of surveyed members reporting an increase in confidence in doing so.

Additional comments from producers:

- *"A perceived 'poor' result from a demonstration is no less a worthy outcome."*
- *"Although the trial doesn't appear to have been successful, it has been a valuable insight into the difficulties of establishment."*

6. Conclusion

The demonstration looked at whether fodder beet could play a useful role in filling the autumn/winter feed gap in north east Victoria.

Our results in terms of germination percentages and t DM of feed grown were well below anticipated levels and can be viewed as disappointing. However, the demonstration has provided a real world example of the performance of fodder beet in the local region and has highlighted both the high costs of establishing fodder beet and the risks associated with summer fodder crops. In particular the impacts of weeds on subsequent crop performance was strongly noted.

While none of the group members adopted the use of fodder beet to fill the autumn/winter feed gap on their farms, all have increased their knowledge – and have large changes in their attitudes towards fodder beet. This increased awareness of the risks associated with fodder beet has better positioned them to assess the role that fodder beet may, or may not play within their specific enterprises.

6.1 Key Findings

- While fodder beet has a massive 'potential' for the production of high quality feed in some environments, replicating an agronomy program and implementing it within a new environment comes with great risk and no guarantee of success.
- High seed and chemical costs as well as the need for specialist sowing equipment result in expensive establishment costs for fodder beet (establishment costs of up to $3,165/ha, excluding tractor hours) – a fodder beet crop yield of 12.2 t DM/ha is required to break even with a 6 t DM/ha millet crop. A fodder beet crop yield of 10 t DM/ha equates to a $316/tonne cost of production.

6.2 Benefits to industry

The potential of fodder beet remains – where it was demonstrated with high irrigation inputs and with a relatively weed free crop we were able to achieve a high yielding (27.4 t DM/ha at grazing) low cost ($114/t DM) high quality feed. Feed that could be used to fill a critical feed shortage.

However, the reality is these results could not be replicated across two other commercial farms that had experience with summer cropping programs, in paddocks that had previously been sprayed out to control summer weeds. In these cases they had high establishment costs, but got none of the benefits – and the fodder beet yields of 2.4, 0.4 and 2.8 t DM/ha would have likely been outperformed by any other summer crop option. The reality is that sowing fodder beet in these paddocks has reduced overall farm production. The overall farm cost of locking up a paddock for 170 days from sowing, to only accumulate a couple of tonnes of DM is impossible to justify.

Whether or not there are additional chemical options for weed management in fodder beet registered for use in other countries such as New Zealand that are appropriate for use in Australia may be a factor in future adoption. Furthermore, maybe the role of fodder beet is more appropriate after multiple years of summer weed control. Either way, the high establishment costs of fodder beet makes it a risky proposition, with no guarantee of high yields.

7. References

Saul, GR and Kearney, GA (2016) Potential carrying capacity of grazed pastures in southern Australia *https://www.evergraze.com.au/wp-content/uploads/2016/07/potential_productivity_wool_tech-_sheep_breed_50_492_98-.pdf*

8. Acknowledgements

This demonstration encountered a number of difficulties, from seasonal constraints to COVID19 restrictions – as a group, we are deeply indebted to the support of all of the host farmers, local agronomists as well as the group co-ordinator Chris Mirams for their support in seeing the demonstration through to completion.

9. Appendix

Example fodder beet agronomy program

Fodder Beet Agronomy Program

ASAP

- Soil test the paddock.
- Remove as much trash from paddock as possible with heavy grazing.
- Disc paddock to remove weeds and break up trash. An initial cultivation here is optional to encourage weed germination and make spraying easier.
- If the paddock has had a recent heavy lime application, additional lime may not be required.
- Fallow paddock

Mid to late September

- Spray paddock with a knock down herbicide e.g. **glyphosate 540 at 2L/ha**.
- Broadcast starter fertiliser: **300 kg/ha DAP + 100 kg/ha MOP + 2.5kg/ha Bo**
- Power harrow and roll the paddock to create a fine, firm, level seedbed.
- When soil temp is at least 10 degrees C, sow fodder beet using a precision planter.
    - Normal row spacings are up to 50cm, with plants approx. 20cm apart, 2cm deep.
    - I would recommend **Bangor at 90,000 seeds/ha** but the rate is variety dependant.
    - Sow into moist soil rather than 'watering up'
    - Leave a strip at the start of the paddock that is not sown to allow enough space to introduce stock. A long wide front on the paddock is ideal to allow stock enough room to graze. Fodder beet is a high yielding crop so initially the allocated strip will only be narrow.
- Immediately after sowing apply pre-emergent herbicide & insecticide: **2 L/ha Tramat + 2.5 kg/ha Pyramin (rate dependant on timing and soil type) + 1.2 L/ha chlorpyrifos**.
    - Apply in 110-220L water/ha.

Fodder Beet 2-4 Leaf Stage

Approx. 1-month post-sowing.

- Apply first post-emergence herbicide: **2L/ha Tramat + 5L Betanal (possible to reduce this rate) + 1.2L/ha chlorpyrifos if required**
    - Do not apply in hot weather (above 30°C)
    - Apply at least 6 hours before rain or irrigation
    - Water rate 250-300 L/ha
    - Make sure there is no residual chemical in the sprayer prior to spraying fodder beet.
    - Do not enter treated areas for 9 days after application.
- Monitor for insects. Spray if required (not in hot weather).

12 Days Later

- Assess the need for a second broadleaf herbicide or insecticide. **Betanal + chlorpyrifos**

14 Days Later

- Assess the need for a final herbicide. **Lontrel** is an option for thistle control.

7 days prior to canopy closure

- Apply fertiliser: **100 kg/ha MOP + 150 kg/ha urea**

8 weeks later (late Jan)

- Apply second dose of fertiliser: **100 kg/ha MOP + 150 kg/ha urea**

8 weeks later (late March)

- Apply **150 kg/ha urea**

Late-May

- Measure crop yield and begin planning the grazing transition.

Please note: the above recommendation is a guide only. Fertiliser rates will be dependant on soil test results. Lime has not been recommended based on historical applications, though pH(water) needs to be at least 6. Chemical rates are dependant on timing, soil type and what weeds or pests are present. The timing of herbicide applications is critical so it should be ordered in advance as most companies are not likely to always have them in stock.

The crop needs to be monitored at least once per week to check for insects, weeds or signs of nutrient deficiencies.