SUMMARY OF THE FODDER BEET PROFIT PARTNERSHIP EXPERIENCES

beef+lamb new zealand

BY FARMERS. FOR FARMERS

Resource Book 52

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EXECUTIVE SUMMARY

The Fodder Beet Profit Partnership (FBPP), funded by Beef + Lamb New Zealand (B+LNZ), involved 12 dryland Canterbury foothill farms during the three seasons of 2013-14 to 2015-16.

The founding participants realised there was a lot of "hyper-enthusiasm" about fodder beet. They wanted to benchmark the crop and animal performance to understand what was actually happening on commercial farms, whilst identifying areas for improvement.

The aim of a B+LNZ Profit Partnership project is to lift production and performance 5 per cent annually over the three years.

Other farmers took great interest in the FBPP and the public field days were very well attended.

The area of fodder beet within the FBPP group grew during the project (Table 1), indicating that participant farmers found fodder beet to be a useful tool.

This project involved farmer survey data that has not been statistically analysed. Enough data has been collated to illustrate trends. These can be progressed by researchers.

Subsequent chapters describe the findings of the FBPP relating to R1 cattle on fodder beet. There was not enough data on R2 cattle (too few mobs, too few head) to show meaningful trends, hence R2 data is not presented.

It is important to note that the information in this book summarises on-farm data. The Fodder Beet Profit Partnership (FBPP), funded by Beef + Lamb New Zealand, is not a research project. The results reflect the variety of environments and management systems on participating farms.

Table 1. Summary of fodder beet crop production during the three years of FBPP.

Season	2013-14	2014-15	2015-16
Average sow date	13th Nov	28th Oct	20th Oct
Total beet area within group (ha)	252ha	360ha	375ha
Paddocks sampled	37	29	19
Yield (kgDM/ha)	18,200	17,200	19,200
Expenses ($/ha)	$2,480	$2,450	$2,200
Gross margin ($/ha)	$2,160	$1,930	$2,600
Cost of production (cents/kgDM)	$0.14	$0.14	$0.11

Table 2. Three season summary of R1 cattle 'weighted' average daily gain (ADG) while on fodder beet, during FBPP.

	Three season weighted averages (2013-14, 2014-15, 2015-16)			
	Head	Start LW	Ave days on beet	ADG kg/d
R1 heifers*	4255	217	107	0.54
R1 steers	2436	246	97	0.53
R1 bulls	2681	235	120	0.58
Total head	9372	-	-	-

* includes dairy heifers.

INTRODUCTION AND PROCESS

The FBPP was a B+LNZ Northern South Island Farmer Council directive. Applicant farmers were asked to express their interest and reasons for participating in the programme. The resulting group was facilitated by Anton Nicholls, from Macfarlane Rural Business Ltd in Ashburton.

FBPP farmer goals included:

- Actual data about fodder beet performance on commercial farms
- Growing more high-value winter feed per hectare with better utilisation
- Optimising costs of production
- Reducing the quantity of baled supplementary feed (purchased feed particularly) used
- Increased liveweight gain during winter, leading to earlier kill weights.

Participant farmers agreed with the Profit Partnership concepts of:

- Continuous cycle of improvement
- Measuring/Monitoring/Evaluation/Adoption
- Sharing of data amongst the group
- Transfer of knowledge out to other farmers.

The mechanics of the FBPP involved:

- Four meetings/field visits per year
- Crop tips, emails and various other email discussions
- Collation of crop management diaries into gross margin and cost of production analysis
- Intensive crop drymatter sampling during early winter
- Leaf nutrient testing year one
- Collation of EID data to track Average Daily Gain (ADG) of both mobs and individuals over three years
- Media articles

An offshoot project was realised under the B+LNZ Farmer Initiated Technology Transfer (FITT) framework—"Accurate drymatter yield assessments in fodder beet—Discussion paper for industry". See Appendix.

Public field days (Dec '14—140 attendees, Feb '16—200 attendees) in the first two years followed by booklet production in the third year

Other presentations by FBPP members to other B+LNZ related groups.

BENCHMARKS

Crop production benchmarks

Target crop expenditure

Accurate crop diary information was collated for each of the three years of the project. After year 1 the group had an actual benchmark expenditure of $2,480/ha over the 37 crops that were sampled.

The participants initially thought that crop expenditure/ha figure should be considerably lower. As they carefully constructed their year two budget, they realised they needed to be realistic to themselves, and to other farmers who may still be considering growing fodder beet for the first time. This had to include items that are often under-quoted when discussing crop costs e.g. lime, thistle control, twitch control, properly-costed machinery operations etc. The resulting year two and three group budget figure was $2,350/ha.

Table 3. Average expenditure/ha results collated for each year of the project.

Year	Average expenditure/ha	Paddocks involved
Year 1—2013/14	$2,480	37
Year 2—2014/15	$2,450	29
Year 3—2015/16	$2,200	19

B+LNZ Fodder Beet Profit Partnership year two—cost of production analysis

Group Target Gross Margin 2014-15

Table 4. By Year two, the group had constructed a target Expenditure/ha.

Income per hectare					
Product	**Yield (kgDM)**	**Cost/Unit**	**Income/ha**	**Sub-total**	**Total**
Grazing	18,500	$0.25	$4,625		
Tops grazing					
Lifted bulbs				$4,625	**$4,625**

Expenses per hectare		
Category	**Operation/Product**	**Cost ($)**
Seed	Seed	$363
Establishment	Glyphosate, Insecticide, Application, Cultivation, Precision drill	$479
Herbicide	Herbicides: Pre-em, 2 true leaf, 6 true leaf, 8 true leaf, Applications x4	$654
Pesticide	Insecticides: Pre-em, 2 true leaf, 6 true leaf, 8 true leaf	$67
Fertiliser	Soil test, Lime, Base Fertiliser, Urea + Potassium Chloride x2, cart & spread	$831
Fungicide	Nil (prior to registered products being available)	$0
Irrigation	Nil	$0
Other costs		$0
Total		**$2,394**
	Gross margin per hectare	**$2,231**
	Cost of production per kg of drymatter	**$0.13**
	Cost of production per MJME	**$0.01**
	Expenditure income	**52**

Cost of Production sensitivity					
Dry matter yield: exp	**$2,155**	**$2,274**	**$2,394**	**$2,514**	**$2,633**
14,800 kgDM/ha	$0.15	$0.15	$0.16	$0.17	$0.18
16,650 kgDM/ha	$0.13	$0.14	$0.14	$0.15	$0.16
18,500 kgDM/ha	$0.12	$0.12	$0.13	$0.14	$0.14
20,350 kgDM/ha	$0.11	$0.11	$0.12	$0.12	$0.13
22,200 kgDM/ha	$0.10	$0.10	$0.11	$0.11	$0.12

Drymatter yields

It is important to note that the crops were grown at an average altitude of 305m above sea level (asl) during the three years. These crops certainly didn't have the yield potential of low altitude, coastal, fully irrigated crops!

The crops were intensively sampled as per the methodology detailed in Appendix 2. At least 4.5 hours was spent in each paddock, with at least eight sites sampled per paddock (more where paddocks were larger).

Yields were less than participants were expecting at the project's outset. Yields over the three seasons were fairly consistent, considering that year two was a drought season, while year three had reasonable soil moisture in summer and a kind autumn and winter, where some additional growth was gained.

Table 5. Average drymatter yield results collated for each year of the project.

Year	Average yield	Comment
Year 1—2013/14	18,200 kgDM/ha	Dry summer, wet autumn
Year 2—2014/15	17,200 kgDM/ha	Dry spring/summer
Year 3—2015/16	19,200 kgDM/ha	Dry spring, kind autumn and winter
Average	18,200 kgDM/ha	

Cost of production

The cost of production figure is simply calculated as expenses divided by yield.

There were no reductions in production costs in year two because participants decided they were going to maintain (or in some cases slightly increase) their investment in crop inputs—particularly fertiliser and herbicide.

Year three saw higher yields combined with a reduction in expenditure (due to more optimal drilling dates and timely crop inputs) leading to 21 per cent drop in production costs. This surpassed the FBPP goal of 5% each year of the project.

Articles in the media suggested 8 cents/kgDM was to be expected, but this group (in their environment) calculated that at $2,350 of expenditure they would need to be yielding a massive 30t DM/ha to achieve 8 cents/kgDM!

Table 6. Average drymatter yield results collated for each year of the project.

Year	Average cost of production	Comment
Year 1—2013/14	14 cents/kgDM	Dry summer, wet autumn
Year 2—2014/15	14 cents/kgDM	Dry spring/summer
Year 3—2015/16	11 cents/kgDM	Kind autumn and winter

Animal performance benchmarks

Transition period

A 21-day transition period is crucial to avoid rumen acidosis risk, allowing the rumen to adapt to the high-energy feed. The group followed the fodder beet transition programs designed by Lincoln University. These programmes were a success in that out of 10,000+ cattle (including R2's) in the three years of the project, only six deaths were confirmed as rumen acidosis. More deaths were linked to choking or clostridial diseases.

Too much beet too early may cause sub-clinical acidosis. Vigilance was required during days seven to 14 of transition—this is where problems can occur as the animal wants to increase intakes of beet, but the rumen has not yet adapted.

The FBPP group followed the following successful transition programmes:

R1 cattle:

- Start at 1 kgDM beet per head per day plus the remainder as pasture/grass silage/lucerne baleage, increasing beet by 1 kgDM per head every two days while decreasing the amount of supplement until Day 14, then consolidating that ration until Day 21.
- For R1 cattle additional fibre is required and additional protein is required until the animals are above 300 kgLW.
- After the transition period an R1 might get 70-80% fodder beet, 20-30% grass silage or lucerne hay/silage.
- Once 300 kgLW, protein ration can be stepped back to 20% meadow hay or ryegrass straw.
- R1's were self-regulating to some extent, as they didn't have experience with bulb crops and would consume all the leaf first then just nibble at the bulbs. R2's will gorge, especially if they remember beet from the previous year.

Table 7. **Example only—***transition programme for 220 kgLW* ***R1 beef cattle*.***

Day of transition period	Amount fodder beet (down-the-throat)	Amount of pasture (down-the-throat)	Amount of grass silage (down-the-throat)	Sum-total kilograms drymatter (down-the-throat)	Percentage fodder beet of total diet
1	1.0	2.0	2.5	5.5	18%
2	1.0	2.0	2.5	5.5	18%
3	1.0	2.0	2.5	5.5	18%
4	1.0	2.0	2.5	5.5	18%
5	2.0	1.0	2.5	5.5	36%
6	2.0	1.0	2.5	5.5	36%
7	2.0	1.0	2.5	5.5	36%
8	2.0	1.0	2.5	5.5	36%
9	3.0		2.5	5.5	55%
10	3.0		2.5	5.5	55%
11	3.0		2.5	5.5	55%
12	3.0		2.5	5.5	55%
13	4.0		2.0	6.0	67%
14	4.0		2.0	6.0	67%
15	4.0		2.0	6.0	67%
16	4.0		2.0	6.0	67%
17	4.0		2.0	6.0	67%
18	4.0		2.0	6.0	67%
19	4.5		1.5	6.0	75%
20	4.5		1.5	6.0	75%
21	4.5		1.5	6.0	75%
22 onwards	5.0		1.5	6.5	77%

*

- **Constantly monitor** the animals while they are in the 21 day transition period.
- During transition, check that mobs are eating everything allocated to them each day.
- Do not let a bank of fodder beet residuals accumulate.
- A conservative approach to beet allocation is recommended while you gain experience with this crop.
- R1s generally self-regulating while learning the crop. R2s will gorge if they remember the beet.
- Supplement must be grass or lucerne silage (i.e. protein) until about 300 kgLW, then good meadow hay or ryegrass seed crop straw, but not cereal straw.
- Don't increase the allocation of fodder beet until all animals are on the beet—be patient!

To reiterate: Do not let a bank of fodder beet "residuals" accumulate.

R2 cattle:

- Start at 1 kgDM beet per head per day plus the remainder as pasture/ grass silage/straw, increasing beet by 1 kgDM/hd every two days while decreasing the amount of supplement until Day 14, then consolidating that ration until Day 21.
- For R2 cattle additional fibre is required to complement the beet, but additional protein is not required once over 300 kgLW.
- After the transition period of 14–21 days, an R2 might get 80% fodder beet, 20% straw.
- Never allow beet intake to increase by more than 1 kgDM/hd/day i.e. fence breakouts, this is when animal health problems can occur due to the spike of sugars in the gut.

Table 8. **Example only** *transition programme for 400 kgLW* ***R2 beef cattle*.***

Day of transition period	Amount fodder beet (down-the-throat)	Amount of pasture (down-the-throat)	Amount of grass silage (down-the-throat)	Sum-total kilograms drymatter (down-the-throat)	Percentage fodder beet of total diet
1	1.0	4.0	5.0	10.0	10%
2	1.0	4.0	5.0	10.0	10%
3	2.0	4.0	4.0	10.0	20%
4	2.0	4.0	4.0	10.0	20%
5	3.0	4.0	3.0	10.0	30%
6	3.0	4.0	3.0	10.0	30%
7	4.0	4.0	2.0	10.0	40%
8	4.0	6.0		10.0	40%
9	5.0	5.0		10.0	50%
10	5.0	5.0		10.0	50%
11	6.0	4.0		10.0	60%
12	6.0	4.0		10.0	60%
13	7.0	3.0		10.0	70%
14	7.0	3.0		10.0	70%
15	7.0	3.0		10.0	70%
16	7.0	3.0		10.0	70%
17	7.0	3.0		10.0	70%
18	7.0	3.0		10.0	70%
19	7.0	3.0		10.0	70%
20	7.0	3.0		10.0	70%
21	7.0	3.0		10.0	70%
22 onwards	8.0	2.5		10.5	76%

Average daily gain

During the formation of the project, farmer participants were very keen to compare cattle liveweight gain on fodder beet. Media reported that farmers could expect R1 cattle wintering on fodder beet to grow at 1.0 kgLW per head per day, and R2 cattle to grow at 1.5 kgLW per head per day.

The group used EID technology to monitor individual animals start and finish weights on fodder beet, from which Average Daily Gain (ADG) was calculated. The group also analysed the distribution of ADG within mobs and across animal classes each year. Where EID data was incomplete or seemed to be erroneous, that individual was deleted from this database.

The majority of cattle in the FBPP project were R1 beef cattle, mostly Angus. The R1 heifer class contained some dairy heifers. The cattle were typically grazing fodder beet for around 100–120 days during each of the three years of the project.

Weighted ADG was calculated by sum-totalling a. all the starting liveweights together, b. sum-totalling all the finishing of fodder beet liveweights together, c. sum-totalling the number of days each individual animal was on beet for. Then (a + b) divided by c = Weighted average ADG.

There were not enough measurements to present R2 ADG data (less than 200 head per class each year with only two or less mobs), but indications were that it was not too dissimilar to R1 data.

Table 9. Summary of Rising 1 year old cattle weighted average daily gain (ADG) while on fodder beet, during the three years of FBPP. Includes 510, 1011 and 506 dairy heifers each year respectively.

Class	2013-14				2014-15				2015-16			
	Head	Start LW	Ave days on beet	Weighted ADG kg/d	Head	Start LW	Ave days on beet	Weighted ADG kg/d	Head	Start LW	Ave days on beet	Weighted ADG kg/d
R1 heifers	1448	216	100	0.52	1524	204	98	0.52	1313	232	125	0.58
R1 steers	835	213	122	0.54	1056	266	82	0.54	594	258	88	0.49
R1 bulls	282	232	110	0.39	1019	242	120	0.59	1380	230	122	0.60
Total head R1s	**2565**	-	-	-	**3599**	-	-	-	**3287**	-	-	-

Figures 1, 2 and 3 illustrate a relatively normal distribution for ADG within each population consolidated over the three years of the project. Each class of R1 cattle tended to show 3–5% of the animals growing at 0.2 kgADG or less, while 5-10% of the animals grew at more than 0. 8kgADG. Only 1.0–1.5% of all R1 animals during the three years grew at 1.0 kg ADG or more, during their time grazing fodder beet insitu.

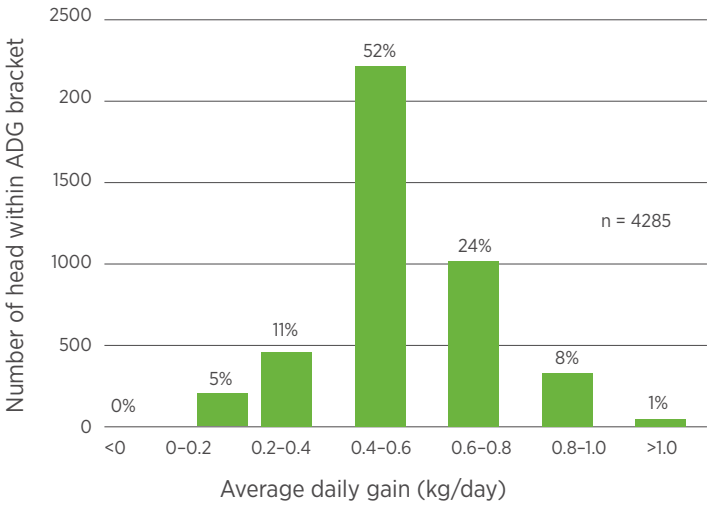

Figure 1. Distribution of weighted average liveweight gain for FBPP R1 heifers "beet only mobs" for the duration (107 days) of in-situ grazing of fodder beet.

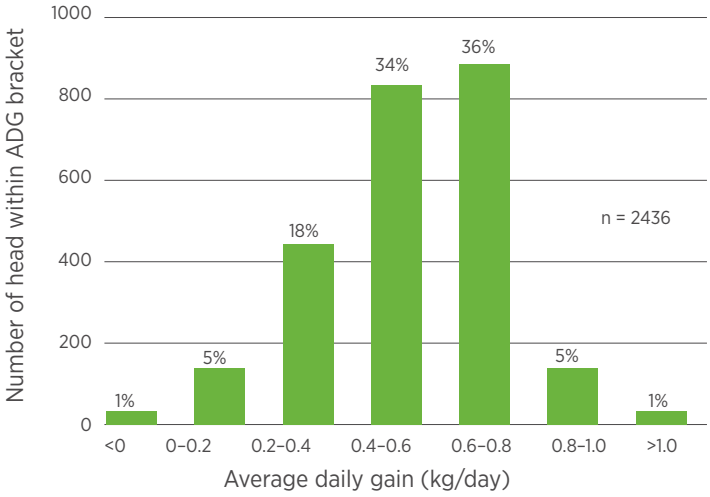

Figure 2. Distribution of weighted average daily liveweight gain for FBPP R1 steers "beet only mobs" for the duration (97 days weighted average) of in-situ grazing of fodder beet.

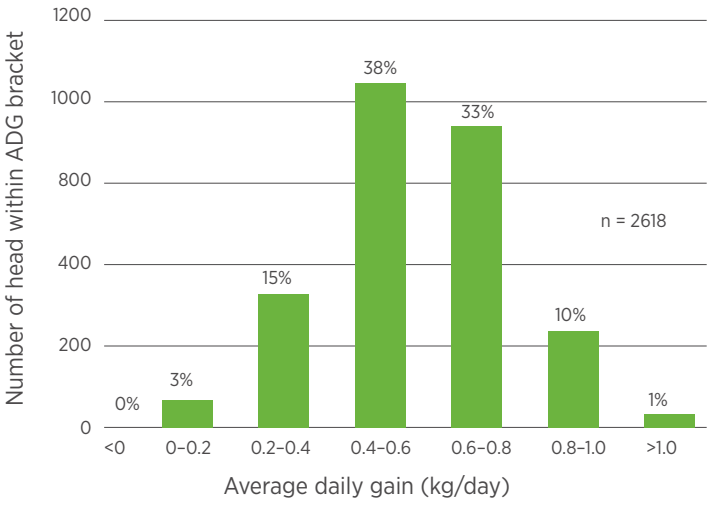

Figure 3. Distribution of weighted average daily liveweight gain for FBPP R1 bulls "beet only mobs" for the duration (120 days ave.) of in-situ grazing of fodder beet

KEY MESSAGES

Crop agronomy findings

Establishment

The majority of the 85 beet crops monitored during the three years of the project were precision planted into cultivated seedbeds. A few crops were direct drilled—with varied success. Where direct drilling was used, it was never in a field trial situation, hence the group never had firm data to suggest that one method was any better than the other. It was never in the groups project plan to compare precision planting with direct drilling—to attain good data, this needs to be done in a monitored field trial.

Wind during establishment

Over the three years of the project, several participants, (as well as other farmers known to the group), had problems with wind harming beet seedlings during early establishment. Seedlings are prone to a sand-blasting effect by soil surface particles, and/or a "helicopter" effect where the seedling twists around ruining the stem.

Approximately $1000/ha has been spent on the crop by the time the seedlings begin bulb growth, so paddock selection is crucial. Consider well-sheltered paddocks and use seed drills that leave a 'windrow' type seedbed surface for initial seedling protection.

Plant population

While low populations led to lower yields, populations that were too high led to greater intra-plant competition therefore small bulbs (that would've been slower for cattle to harvest), and anecdotally lower per hectare yields. While the FBPP tried to measure this, a reasonable trend could not be illustrated. It was felt the optimal yield range was 80,000 to 100,000 fodder beet plants per hectare.

Sow date

In 2014 there was debate about the optimum time to plant fodder beet in Canterbury.

In spring 2014, DLF Seeds conducted fully randomised replicated trials at three sites (low, medium and a higher altitude site on a FBPP members farm at Windwhistle) on the Canterbury Plains, using five different dates (1 September to 17 November). Soil and air temperatures were within 98% of the previous 10-year period. Severe drought reduced differences between treatments at the one dryland site.

The trials showed sowing date had an effect on yield—the earliest dates had statistically higher yields than later dates. There was no effect of sowing date on the number of bolters. Herbicide costs tended to be higher for earlier dates and while some of this extra cost was not needed, the yield benefits (valued at +$1300/ha) far outweighed the costs. Fodder beet can be sown in Canterbury at 6°C soil temp (similar to what British Beet Research Organisation advise their growers). Crops should be planted as soon as soil conditions and seed availability allow (complete seedbed preparation by September).

Fodder beet sowing date

Mean yield of three sites and five dates

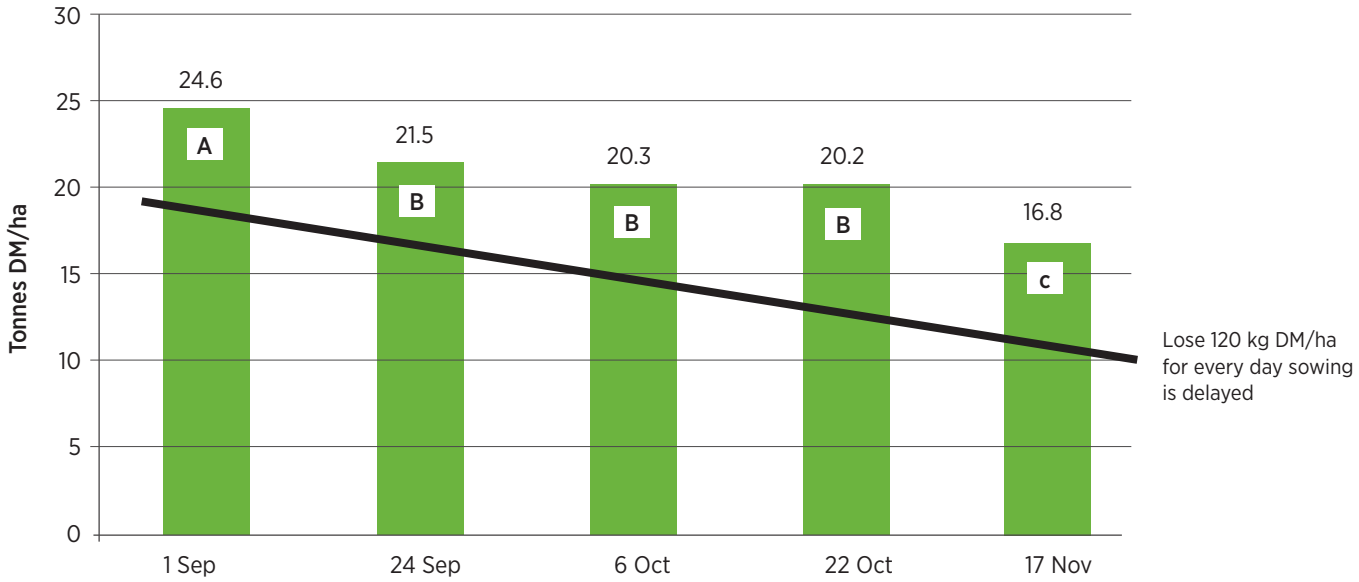

Figure 4: DLF Seeds NZ 2014 sowing date trial at three different sites/altitudes in Canterbury including a FBPP members farm at Windwhistle.

Figure 5. Pseudomonas bacterial blight robs green leaf area very quickly in Canterbury fodder beet during 2014 especially.

Pseudomonas bacterial blight is hosted in:

Brassicas	Onions	Maize	Black nightshade?
Lucerne	Potatoes	Fathen	Hairly nightshade?
Carrots	Beans		Docks?

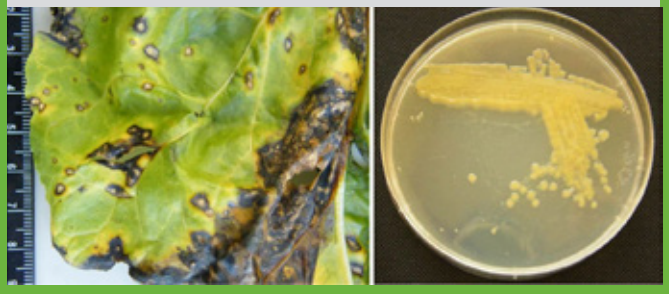

Figure 6. Pathology confirms Pseudomonas bacterial blight, which is a common disease of New Zealand crops and weeds.

Disease

Forage crops use green leaves to intercept sunlight, ultimately converting it to drymatter. Diseased leaves are not effective at intercepting sunlight.

During 2014, the FBPP group became aware of the prevalence of root and foliar disease in New Zealand beet crops.

Many FBPP crops were infected with *Pseudomonas* bacterial blight, a common disease in other crops in Canterbury (and incidently is the disease PSA which affects kiwifruit).

As the area of fodder beet increases and intensifies in New Zealand, disease will have more influence on fodder beet production. The most significant beet disease in the world is *Cercospora*, which has been identified in New Zealand beet crops.

The British Beet Research Organisation is a levy-funded research organisation in the UK. On the back of many trials, they recommend that sugar beet should receive 1–2 fungicides per season. Their sugar beet gets harvested in New Zealand's March equivalent. New Zealand fodder beet crops are mostly grazed in-situ starting typically in May. New Zealand crops need to stay green and productive through March/April/May and growth can even occur in our winter months. There may be a case for increased fungicide use in New Zealand beet crops. Further well-designed field trials are required to answer this question.

In 2014, DLF Seeds New Zealand showed that when offered to livestock, diseased leaves reduced protein offered. Green tops were found to have 28% crude protein and dead tops just 14%.

The FBPP believe it is logical that diseased leaves (versus lush green leaves) are less palatable, have less feed value, and have less utilisation. Further well-designed field trials are required to confirm this.

Figure 7. Sorted leaves showing the progression of disease spread on fodder beet leaves.

Figure 8. Image illustrating the reduced photosynthetic capacity of leaves due to disease, resulting in reduced bulb drymatter.

Greater solar radiation interception increases beet yields

- Sugar beet yields increase when the crop experiences more days of bright sunshine. This has been proven over many years of research at Brooms Barn, Rothamsted Research in the UK.
- This crop science is transferable to New Zealand and is the driver of other crop yields like wheat and maize etc.
- Beet yields are maximised when full crop canopy is achieved before the longest days (e.g. around December 22).
- Weed, pest, disease and/or drought can slow the time taken to achieve full canopy cover.
- Weed, pest, disease and/or drought can decrease the duration of full canopy, reducing the amount of sunlight intercepted, and in turn drymatter production.
- Why drill early? To maximise solar radiation interception during the longest days of the year.

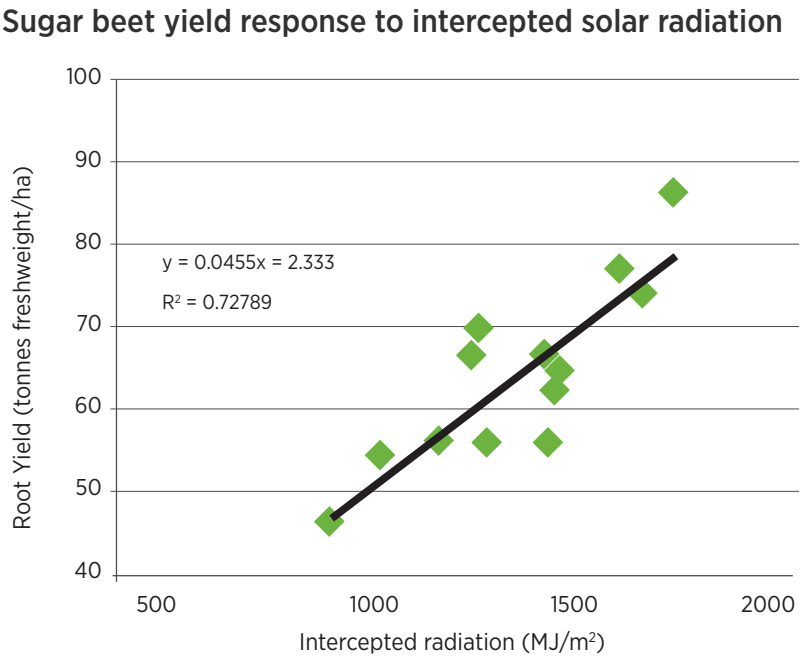

Figure 9. UK sugar beet yield response to intercepted solar radiation. 10 seasons data from Brooms Barn, Rothamsted Research.

Second year beet crops

Some of the FBPP group tried replanting fodder beet in areas where fodder beet was grown the previous year—some got away with it, some won't do it again.

The issues to be aware of when considering growing second year beet crops:

- Disease—root rots like *Rhizoctonia* particularly, are the biggest risk of reduced yield and can't be prevented with agrichemicals. Crop rotation is the only control option. Foliar diseases can also put the second crop at risk as disease innoculom becomes present in the first-year crop and survives into the second year.
- Bolters ("weed-beets")—especially those that grow from bulbs (or parts of) left over from previous year. These bolters can carry disease into the new crop, and if not rouged, will drop more seed adding to the buried seed count. Bolters are non-productive plants that steal light, nutrients and soil moisture from productive grazeable fodder beet plants.
- Two intensive winter greenfeed crops in succession—the second beet crop may not be able to uptake the soil nitrate left over from the first in-situ grazed crop, making the nitrate prone to leaching loss. Further science is needed to investigate this.
- Soil quality—Intensive grazing, especially with heavy animals, during winter conditions, is generally not good for soil quality. Two fodder beet crops in a row heightens the risk of damage to the soil. Track soil quality yourself over time using the Soil Quality Indicators tool at **sindi.landcareresearch.co.nz**

Figure 10. Rhizoctonia root rot is now regularly found in Canterbury beet crops, with anecdotally increased incidence in second year crops.

Figure 11. A bolter can drop 1500 seeds that last 10 years in the soil.

- Herbicide build up?—Some of the FBPP group wondered if less herbicide might be needed in the second year, capitalising on the high herbicide expenditure in the first year. This was not the case. The first-year herbicide applications had lost effect after 12 months and weeds stored as buried seed in the soil quickly established.
- Herbicide resistance—It is known that the same herbicide groups—used repeatedly—lead to resistant weed populations. There is a risk of herbicide resistance occurring when crops grown repeatedly in the same paddock. This would be bad news as there are few herbicide options for fodder beet.

Figure 12. Weed competition with beet

Animal performance findings

Fodder beet feeding transition—Practical farmer experiences
Michael Salvesen, Waikare Ltd, Montalto

We've seen differences between R1 and R2 cattle during beet transition, in that R1's need educating on how to handle bulbs, while R2's remember beet from last year and will gorge. R2's need careful management during transition to avoid rumen acidosis.

Our approach:

R1's

- Breaking into the paddock/crop utilise a small area initially. Allow open-gate access back to pasture (their protein source initially).
- Offer plenty of ryegrass straw, or other fibrous supplement.
- After four days start moving the break line, but only offer a small break.
- Gradually offer less ryegrass straw/supplement.
- We observed that it was day eight—once they were eating all the freshly-offered beet—that it was apparent they had become accustomed to eating bulbs.
- Only offer small breaks until previously offered areas are eaten.
- We found that by day 15, the new breaks should be allocated so that the R1s are fed-to-appetite and all areas are relatively clean of bulbs.
- Once a break area is clean, increase the break size until they are eating approximately 80% of offered feed each day, and cleaning up residual bulbs that were offered in the 2–3 days prior.
- Then move to a fresh paddock, and feed small breaks for a couple of days, then ad lib breaks. The first paddock has been broken-in for other mobs to have plenty of room from the outset of their transition period.
- Once in the new paddock, offer a supplement that includes good protein as well as fibre.

R2's

- Be ***very*** careful! R2's will gorge-feed, as they remember enjoying the beet the previous year.
- Start in the paddock just broken in by the R1's mentioned above, so they have plenty of space.
- Give them plenty of fibrous supplement at the start.
- Give them small breaks from day one. Break size/allocation is *crucial*—be accurate with yield assessments in the transition area.
- Increase the break size slowly, from day four.
- By day 20, the R2's should be ad-lib feeding on the fodder beet, with decreased supplement demand.
- Post-transition, four-day breaks worked for us—they were able to ration themselves, nor did they gobble up all the green leaf on day one.

Figure 13. By day eight of transition, the R1's were accustomed to eating bulbs and were better utilising the daily break. Note—there is less bulb residue to the right of the green line on the freshest break.

Note—The above comments related to the 2014 transition period where we used the beet cultivar Lifta which is a high drymatter cultivar—so you may need to be more careful with softer cultivars like Brigadier.

Some cattle don't perform on fodder beet

Within any mob there are always individuals that won't adapt to fodder beet. It is important to identify these animals early and get them onto another feed type. In the FBPP, EID liveweight measurements were taken just prior (fully fed) to starting fodder beet for the first time. The animals were reweighed 28 days later to monitor how they had performed during transition and the short period thereafter. If individuals weren't gaining weight they were removed from the beet, or at least observed very closely for a shorter period of time.

There are many reasons for the "tail-enders" in a mob. These included sub-clinical acidosis, teeth problems, genetics, clostridial disease, but also cold wet winter conditions, and not feeding to full potential. Also pre-existing disease, social pressures (e.g. small calves being bullied, ridden).

Animal health

For beef cattle, the FBPP found that fodder beet was largely a risk-free feed type, so long as transition was managed carefully (see page 6).

Well-transitioned cattle are less prone to rumen acidosis. Within the FBPP, more deaths were linked to clostridial diseases and choking than acidosis.

Clostridial disease develops in oxygen-free and energy-rich conditions. Under the right conditions, bacteria rapidly multiply and produce toxins. These toxins are released locally and into the blood stream and are extremely potent causing toxaemia/blood poisoning—so dead animals are often the first sign of clostridial disease.

Feeding of high sugar percentage fodder beet (and consequent rapid rumen outflow rate) may lead to excess sugar in the hind gut which in turn can spike the population of clostridial bacteria, leading to problems.

Clostrida are found everywhere and are easily spread in cattle mobs via faeces and via soil ingestion—especially where animals are intensively grazed. Vaccination is an important control measure. 10-in-1 clostridial vaccinations were preferred by the FBPP. Some participants had tried 5-in-1 or 7-in-1 and reverted back to 10-in-1 as they reported less clostridial problems.

Clostridial vaccinations were given three weeks before the cattle started on fodder beet, followed by a booster two weeks later. Some participants also gave a third dose during late winter.

Avoiding increases of more than 1 kgDM of fodder beet consumed, at any time of the season, avoids spikes of sugar in the gut, reducing the risk of clostridial deaths.

Teeth

The FBPP group experienced some front incisor teeth problems (two mobs within three years) with cattle on beet. Retrospectively, early signs were that cattle would eat the green tops of the beet, but not the bulbs. Close inspection revealed that their teeth were severely damaged, out of alignment and gums ulcerated. The two known affected mobs were 14-month-old autumn born bulls. Teeth naturally erupt across a varied age range, so it can't be said that autumn born yearlings are at greater risk- but be aware.

The varied age range of teeth erupting could be a reason why some animals just don't do well on bulb crops.

Other potential reasons leading to teeth problems when feeding bulb crops may include:

- Abrasive soils
- Prolonged feeding e.g. summer bulb crop prior to fodder beet
- Low calcium, run-out, abrasive native pastures reducing teeth strength of young calves before grazing fodder beet
- Low residual grazing.

Incidentally, teeth problems where wounds/ulcerations (and rumen inflammations) can make cattle more prone to clostridial infection.

Feeding practicalities

Hungry animals are more prone to rumen acidosis. Ensure they are well-fed before first introducing to fodder beet.

High-fibre supplement should be fed with beet. Avoid poor-quality supplement, make sure they will consume it!

- Be very strict and very patient during transition. Build/write a plan. See Appendix for a transition programme template.
- Too much beet too early may cause sub-clinical acidosis. Be especially vigilant during days seven to 14 of transition—this is where problems can occur as the animal wants to increase intakes of beet, but the rumen has not yet adapted.
- Animals should always be full before being introduced to fodder beet. FBPP group members would often feed out the supplement in the morning and not offer the fodder beet until lunchtime, 3-4 hours later. Often the daily allocation would be split into two line shifts per day during transition. This reduced wastage, and encouraged more even intake of bulb and leaf.
- Supplement (including fibre) is important during transition for regulating beet intakes.
- For animals new to fodder beet, transitioning may require the beets to be smashed/chopped to get individuals to try them.
- High voltage in the electric fences is especially important during transition!
- Always allocate on a drymatter basis—get accurate yield assessments to allow for accurate allocation. Never allocate by a length of time for cattle.
- Ensure cattle have enough room during transition (without over-allocating beet). This might mean a 10-metre grassed headland is drilled instead of beet. Plan for long break lines/faces. Plan for 1-2 lineal metre per animal (towards 2 for bulls especially).
- Don't let a bank of fodder beet residuals accumulate.
- A conservative approach to feed allocation is recommended while you gain experience with this crop on your property. Patience!

UNFINISHED BUSINESS

The FBPP group thought that there were several areas where further research was required:

- Degree of sub-clinical acidosis that may be happening inside the rumen at fodder beet proportions (of the total ration) higher than 80% i.e. where there are no visual symptoms re the grazing animal observable to the farmer.
- Is there a proportion of animals that don't do well on bulb crops due to the timing of new teeth? Is there any difference between softer and harder cultivars of fodder beet, or should those animals be removed to pasture anyway?
- Field trials using a range of supplementary/protein portions as part of the total feed ration. It would be interesting to gather data to determine how much beet is enough of a percentage in the total feed ration.
- Studies investigating fodder beet feeding proportion and duration effect on carcase quality/grading would be valuable.

CONCLUSIONS

The FBPP group achieved its goal of attaining relevant benchmarks on commercial farms in the Canterbury foothills environment. It achieved improved production and performance targets of 5 per cent plus per annum. The FBPP Group found that fodder beet is certainly a very useful tool, although it's limitations need to be understood, while constantly seeking further improvements.

APPENDIX

APPENDIX 1

Transition template

- **Constantly monitor** the animals while they are in the 21 day transition period.
- During transition, check that mobs are eating everything allocated to them each day.
- Do not let a bank of fodder beet accumulate.
- A conservative approach to beet allocation is recommended while you gain experience with this crop.
- R1s generally self-regulating while learning the crop. R2s will gorge if they remember the beet.
- Must be grass or lucerne silage (i.e. protein) until about 300 kgLW, then good hay, but not straw.
- Don't increase the allocation of fodder beet, until all animals are on the beet—be patient!

Example: Transition programme for _____ kgLW Rising_____ beef cattle

Day of transition period	Amount fodder beet (down-the-throat)	Amount of pasture (down-the-throat)	Amount of grass silage (down-the-throat)	Sum-total kilograms drymatter (down-the-throat)	Percentage fodder beet of total diet

APPENDIX 2

Accurate drymatter yield assessments in fodder beet—discussion paper

Beef + Lamb New Zealand Farmer Initiated Technology Transfer (FITT) programme
Prepared by Anton Nicholls, Macfarlane Rural Business Ltd

Introduction

A Beef+Lamb New Zealand (B+LNZ) Farmer Initiated Technology Transfer (FITT) project must have immediate and relevant application on-farm. The project should aim to improve productivity and profit for farmers. The emphasis must be on **developing practical systems to solve immediate farming problems** or develop opportunities, which means any research component will probably be small.

Accurate drymatter (DM) yield assessments in fodder beet (FB) are ***crucial*** for the following reasons:

- Correct daily feed allocations for wintering cattle, especially during the transition period. Over-allocation significantly heightens the risk of death from rumen acidosis. Permanent sub-clinical damage to the rumen can markedly limit animal performance.
- Over-estimating fodder beet yield (which is common) can lead to over-stocking, leading to expensive supplementary feed purchases, selling stock early at a loss, sacrificing winter grass covers, reduced liveweight gain…all negatives financially.
- To ensure fair and accurate financial transactions occur between farmers when fodder beet grazing is bought and sold e.g. If an actual 22,000 kgDM/ha crop was sold incorrectly at 18,000 kgDM, the seller would've missed out on 4000 kgDM/ha x 8 ha x 28 cents/kgDM equating to $9000!

The project objectives were:

- To produce a standardised **methodology for fodder beet drymatter sampling which is an effective compromise between accuracy, time and cost.** It can be used by industry to assess (and not estimate) DM yield e.g. farmers, seed company reps, agricultural merchant reps, contract feed assessors, farm advisors, agronomists.
- To collaborate with the above industry personnel to understand how individuals are sampling, so we can try to bring the best ideas into a standardised methodology.
- To produce a methodology that is initially a **"straw-man" that can be honed by the industry,** in an effort to (in a future project) produce an industry-standard methodology.
- To produce a methodology that farmers could carry out themselves.
- To ensure that the B+LNZ-funded Innovation Farm and Fodder Beet Profit Partnership (FBPP) have accurate data to allow farmers to make informed decisions and monitor the groups' progress compared to target.

Materials and methodology

Materials

- Fish type carry bin.
- Clipboard, pencil (best in damp conditions), data recording sheet (see example Template 1). Plastic bag over clipboard if rain protection required.
- Weigh scales e.g. digital hanging scales.
- Clear plastic ziplock bags 30cm x 45cm. Two per paddock (one for bulb samples, one for leaf samples).
- Permanent marker pen.
- 2 x 40 kg dry grain/seed sacks (half a dozen as they get damp/muddy during the day).
- Big knife e.g. skinning knife (need leverage to cut bulbs in half length-wise etc, curved top edge of blade good for cleaning bulbs too). One knife per person. Sharp knives are safest!
- One fibreglass cane/electric fencing standard.
- 40m measuring tape.
- Calculator.
- Overalls, gumboots! Waterproof leggings if crop wet.
- Disinfectant for spraying over boots/leggings when moving in between diseased paddocks.
- ARL/Ravensdown or Hills Laboratories feed quality test kit including 30cm x 40cm self-addressed courier bags, sub-sample bags and submission forms.

Example of materials required for a FB drymatter yield assessment.

Methods—The "straw man" methodology

Before entering the paddock: take a blank data sheet (Template 1) and fill in farm(er) name, paddock name, area, date sampled and cultivar. Once in the paddock, row spacings should be recorded. Take two 30cm x 45cm plastic ziplock bags and with permanent marker write on farm(er) name, paddock name, cultivar, date sampled, and either 'leaves' or 'bulbs'.

Measure the weight of an empty sack first. Later, subtract the weight of a dry sack off the average weight on your data sheet. In muddy conditions you may actually need the average of a start weight and finish weight of the sack as moisture and mud make the sack significantly heavier by the end of the paddock.

Walk to the far corner of the paddock to get a feel for the variation throughout the paddock. Don't sample from areas that are not representative of the paddock. Sample from heavy and light areas if they represent an eighth of the paddock. Include misses/gaps in your sample site if that represents the general area. Avoid sample sites where there are large sections of row missing on either side of the row being sampled. The lack of competition gives heavier bulb weights. If working in a team, subjectively justify to each other why you are sampling at that point.

Stop and sample at no less than eight sample sites throughout any paddock. For paddocks over eight hectares, allow for a sample site in every hectare e.g. 13 ha means 13 sample sites. **To allow for variation throughout the paddock you are better to have more sample sites, versus only a few sites of long row length each.**

Time estimate is approximately four hours from start to finish in a paddock for eight sample sites (not including travel time, or processing and courier), depending on plant population. Sub sampling, form filling and courier bagging will probably happen back at the house/office—allow 20–30 minutes for this (8 site paddock = 16 samples).

An accurate drymatter yield is important for the transition area especially. Consider doing four sample sites within the 21 day transition area within any one paddock.

For 40cm row spacings sample between two canes set 5.0 metres apart i.e. 2.0m^2.

For 45cm row spacings, sample between two canes set at 4.44 metres apart i.e. 2.0m^2.

For 50cm row spacings, sample between two canes set at 4.0 metres apart i.e. 2.0m^2.

Take the data sheet and fill in farm(er) name, paddock name, area, cultivar, and once row spacings have been checked record that also.

***Always* check row spacing.** Getting this wrong results in complete inaccuracy (i.e. two different drills could have been used on the same farm). Check by measuring across 20 rows of crop, 20 rows x 40cm rows will measure 8.0m and 20 rows x 45cm rows will measure 9.0m. Twenty rows x 50cm will measure 10m. Any one of those resulting measurements allows for quick reconciliation of a particular row spacing, and immediately indicates if the row spacing is actually different than expected. To repeat: Getting this wrong causes inaccuracies!

Peg the measuring tape to the ground with a cane or electric fence standard. Place at the same point (7cm) from a beet for consistency—you won't know what is at the other end of the 4m length so that takes some skewed bias out of it. At the end of the required length of beet row, mark with the second fence standard. Wind the tape back in so it's out of the way—maybe hang it on the pigtail of the first electric fence standard.

Natural variation amongst beets

Pull beet out of the ground from within the measured row. Shake some of the dirt from the roots, then scrape away the majority of the dirt with the back edge of a knife. Don't worry about cutting smaller fibrous roots. Do try to get as much of the soil out from between roots etc. as reasonable. Once the bulb is clean, cut the tops off just where the green leaves sprout from the top of the bulb. Make sure the bulb stays in the middle of the row—don't let it roll under the next row as it will be difficult to find later. Place all leaves, even the dead ones in a sack, then move onto the next plant. Once finished the row, make sure all the leaves relating to that row have been collected.

Hook the sack onto the hanging weigh scales and hold steady. Speak the weight out loud, and don't do anything else until someone has written the weight on the data sheet! Tip the sack out into one pile (not onto other bulbs) and randomly choose five leaves, from the second layer of the crown for consistency. Place the leaf samples into a 30cm x 45cm plastic ziplock bag labelled with farm(er) name, paddock name, cultivar, date sampled, and "Leaves".

Leaves from the eight sample sites within the paddock will go into the one ziplock bag. Place the sample bag back in the fish bin. Seal the ziplock bag immediately after sampling has finished. More sample sites will mean a larger volume of leaves which will have to be randomly sub-sampled from before fitting into the courier bag. Courier the sealed samples immediately, before the samples lose moisture.

Collect all bulbs, counting them as they go into the sack. Speak the count out loud, and don't do anything else until someone has written the count on the data sheet! Hook the sack onto the hanging weigh scales, spread feet into a solid stance (can be 30 kg in the sack) and hold steady. If measuring a high yielding paddock, someone else needs to help stabilise the scales in a tripod type fashion. If the scales aren't stable, reading an accurate weight is difficult. Speak the weight out loud, and don't do anything else until someone has written the weight on the data sheet! Tip the sack out. Choose an average sized bulb. With a sharp knife (biggish for plenty of leverage) or even a saw, cut a 20mm wide section through the length of the beet on a diagonal from the shoulder to the opposite "heel" of the bulb. Cut that section in half along the middle of the already cut face, keeping the samples as clean as possible. Place the bulb samples into a 30cm x 45cm plastic ziplock bag labelled with farm(er) name, paddock name, cultivar, date sampled, and "Bulbs".

Bulbs from the eight sample sites within the paddock will go into the one ziplock bag. Place the sample bag into the fish bin. Seal the ziplock bag immediately after sampling has finished. More sample sites will mean a larger volume of bulb slices which will have to be randomly sub-sampled from before fitting into the courier bag. Courier the sealed samples immediately, before the samples lose moisture.

Don't leave that sample site until the datasheet is complete. Make sure everything, particularly knives, are in the fish bin before leaving the site.

To reiterate, sample at no less than eight sample sites throughout any paddock. For paddocks over eight hectares, allow for a sample site in every hectare e.g. 13ha means 13 sample sites. A decent number of sample sites captures the variation across a paddock.

Note that the plant population can be determined from the data collection sheet (see Template 1).

Don't forget to subtract the weight of a dry sack off the weights on the data sheet. In muddy conditions, measure the average of a start weight and finish weight of the sack as moisture and mud make the sack significantly heavier by the end of the paddock.

Back at the house/office, carry out sub-sampling, form filling and courier bagging—allow 20 minutes for this (note that 8 site paddock = 16 samples).

Before sub-sampling have the ARL/ Ravensdown or Hills Laboratories feed quality submission forms filled out accurately. On the form request separate drymatter tests for the leaves and for the bulbs. The laboratories will often provide pre-paid and self-addressed courier bags. A paddock worth of eight samples (leaf and bulb) will fit into one courier bag. If more samples sites were taken in the paddock, the leaf and bulb should be sub sampled such enough can fit into the courier bag.

Converting drymatter percentage to per hectare yields

When the drymater percentage results arrive back, those percentages will need to be multiplied by the averaged leaf and bulb fresh weights. The leaves and the bulbs have different drymatter percentages, hence need to be measured and sampled, then analysed separately.

If as in the above methodology, 2.0m2 was measured at each sample site, the average fresh weight (of each leaf sample) needs to be halved back to 1.0m2, then multiplied up by 10,000 (i.e. 10,000m2 in one hectare), to indicate a per hectare basis. Then multiply by the drymatter percentage weight of the leaves, to reveal the drymatter per hectare yield, for the leaves. Repeat for the bulbs. Add the two results together for the sum total yield per hectare.

Discussion

The above "straw man" methodology needs to discussed and honed amongst industry personnel—the ideal is to have the most cost-effective balance between time and accuracy.

Since the transition period is so crucial, it may be best to concentrate on getting an accurate yield in the area that will be utilised over the 21-day transition. Later, the animals may be heading towards ad-lib allocations of fodder beet, so an accurate yield may not be so important at that stage. However if the crop is being sold, an accurate measurement across the paddock will still be of interest to both parties.

Paddock variability is very hard to deal with when carrying out fodder beet yield assessments. In year one of B+LNZ Fodder Beet Profit Partnership, one standard deviation within paddocks (across 45 paddocks) was typically 2.5 tDM on a paddock average of 18.2t DM/ha. That means that for two thirds of the samples in any one paddock, we expected the individual sample yields to lie between 15.7 and 20.7t DM/ha—which represents quite a variation!

Table 1 is an actual paddock during 2015, illustrating a similar story. If an assessor was to arrive only intending to do three sample sites, they could quite easily end up with a yield of 14.5t DM/ ha or a yield of 20.0t DM/ha—two very different answers if one was applying to the paddock as a whole. These two very different answers could cause real problems during the rumen transition period, and/or could lead to an unfair economic transaction if the whole paddock was being sold.

The FBPP decided that for the purposes of their group it was logical to have more sample sites within a paddock to capture the variation across a paddock.

In the future, tools like Forage Scan (GNDVI imaging technology) may be able to help us understand paddock variability, while still ground-truthing with physical cuts. Averages from different zones/areas in the paddock will combine to give a representative weighted average yield for the paddock as a whole. This will help for overall feed budgeting, but also for when feeding different areas of the paddock (that didn't get a physical cut) therefore more accurate allocations.

Leaves weight (kg fresh-weight 4.44m of row)	Bulbs weight (kg fresh-weight 4.44m of row)	Total yield at each sample site (kgDm/ha)
6.05	14.20	17,066
5.45	13.60	16,109
6.95	19.10	22,142
5.79	14.70	17,343
7.45	18.40	21,847
5.30	13.10	15,552
5.60	12.15	14,893
5.00	10.90	13,344
	Mean	**17,287**
	Standard deviation of the sample	**3,164**

Table 1. Yield results from typical paddock of fodder beet, illustrating the amount of variation amongst eight sample sites within a 6.0ha paddock. The standard deviation is 3,164 kgDM/ha inferring that 68% of samples will vary between a range of 14,123 and 20,451 kgDM/ha.

Examples of other different methodologies that industry personnel (in Canterbury alone) are using include variations of:

- Paired rows (side-by-side of 4–5m in row length) with five or so sample sites in a paddock.
- Longer rows of 10m in row length, with four or so sample sites in a paddock.
- A quick-look-see method of a single row (of 2–2.5m in row length) with two or three sample sites in a paddock.
- Single row cuts (of 4–5m in row length) with say five sample sites in a paddock, with the decision to do more depending on the variability in fresh weights from the first five cuts.
- Some people are doing one sample site per hectare, others more, others less.
- Some people are doing 12 cuts per paddock in anticipation of a +/- 2.0 tDM/ha yield range.
- Some people are thinking of committing to only 8ha of a 20ha paddock, and do the smaller area accurately.
- Some people are considering doing accurate plant populations first, then measuring a selection of bulbs, then multiplying the two together. The number of samples may depend on the variation encountered.

A statistician/biometrician will need to have input into the various methods, while understanding the time limitations of physically sampling within one paddock.

Farmers need to accept that if yield assessments are to be carried out accurately, it will take some time to complete the job well. There is value in achieving accuracy. Accuracy will allow for accurate feed budgets, correct feed allocation, correct stocking rates, accurate trading of standing drymatter etc.

The method outlined above gave the FBPP group confidence that the yield assessments were reasonably accurate (and consistent between paddocks) for the purposes of this focused farmer discussion group.

Summary

The "straw man" method described above gave an accurate, time and cost-efficient method of sampling to determine accurate drymatter yield assessments in fodder beet. The effort involved lies somewhere in-between being commercial and scientific; offering farmers a protocol they could use themselves, or at least understand, to attain an accurate result. Industry are invited to provide feedback on this proposed methodology

The significance of herbicide misses

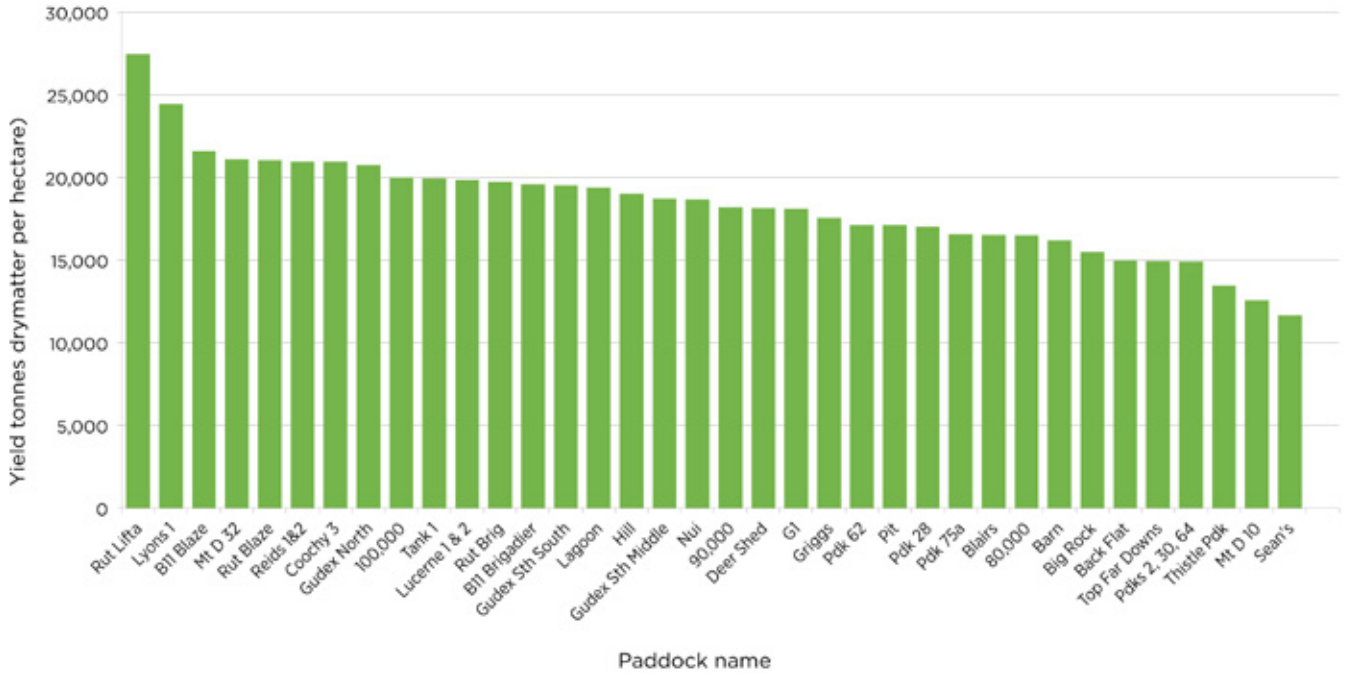

*Figure 1. BLNZ Fodder Beet Profit Partnership—**2014 Yield Summary** (using field sampling methodology detail previous page).*

Please note: this is not a cultivar comparison. The results in Figure 1 highlight the performance of the cultivars in each farm environment and indicates yields achieved with fodder beet in this project. These results should not be used to compare cultivars as there may be differences in climate, soils, soil fertility, rainfall, management, weeds and pests.

Paddock	Cultivar	Yield Est. (kgDM/ha)
B11 Lifta	SF Lifta	27,800
Rut Lifta	SF Lifta	27,491
Lyons 1	DLF Troya	24,460
B11 Blaze	SF Blaze	21,600
Mt D 32	SF Brigadier	21,098
Rut Blaze	SF Blaze	21,059
Reids 1&2	SF Brigadier	20,960
Coochy 3	DLF Troya	20,960
Gudex North	Brigadier	20,752
100,000	SF Brigadier	20,000
Tank 1	SF Brigadier	19,960
Lucerne 1 & 2	DLF Troya	19,862
Rut Brig	SF Brigadier	19,740
B11 Brigadier	SF Brigadier	19,600
Gudex Sth South	Agricom Rivage	19,534
Lagoon	Agricom Rivage	19,397
Hill	DLF Troya	19,032
Gudex Sth Middle	SF Lifta	18,731
Nui	Upbeet	18,687

Paddock	Cultivar	Yield Est. (kgDM/ha)
90,000	SF Brigadier	18,200
Deer Shed	Upbeet	18,144
G1	SF Brigadier	18,106
Griggs	SF Lifta	17,547
Pdk 62	Troya & Kyros	17,132
Pit	Upbeet	17,118
Pdk 28	Troya & Kyros	17,022
Pdk 75a	Rivage	16,583
Blairs	SF Lifta	16,525
80,000	SF Brigadier	16,500
Barn	Upbeet	16,210
Big Rock	Upbeet	15,500
Back Flat	SF Lifta	14,983
Top Far Downs	SF Lifta	14,948
Pdks 2, 30, 64	Agricom Monro	14,920
Thistle Pdk	SF Brigadier	13,456
Mt D 10	SF Brigadier	12,567
Sean's	Upbeet	11,657

APPENDIX 3

Fodder beet yield assessment TEMPLATE

See page 19 for calculations

Name _____ Date _____

Paddock _____ Area _____

Row spacing _____ Livestock class _____

Cultivar _____

40cm = 5.00mm
45cm = 4.44mm
50cm = 4.00mm

First four sites in 0.5 ha transition area.
One per ha thereafter. Minimum of eight sites per paddock.

		GPS (if req.)	Length (m)*	Plant count	Leaves weight (kg)	Bulbs weight (kg)
Transition 0.5 ha	1					
Transition 0.5 ha	2					
Transition 0.5 ha	3					
Transition 0.5 ha	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					

*Double measure

***Sack weights**

Dry clean sack = 200g
Dry dirty sack = 225g
Damp dirty sack = 250g
Saturated dirty sack = 450g

	Plant count	Leaf weight (kg)	Bulb weight (kg)
Average			
Start sack weight*		0.200	0.200
End sack weight*		0.250	0.250
Divide by 2			
Multiply by published drymatter—caution			
Sub-totals kgDM			
Sum total kgDM (total leaf + bulb weights)			

**Guess-timate only*

APPENDIX 4

Fodder beet yield assessment EXAMPLE

See page 19 for calculations

Name _____ Date _____

Paddock _____ Area 5.3 ha

Row spacing 45 cm Livestock class _____

Cultivar _____

First four sites in 0.5 ha transition area.
One per ha thereafter. Minimum of eight sites per paddock.

40cm = 5.00mm
45cm = 4.44mm
50cm = 4.00mm

		GPS (if req.)	Length (m)*	Plant count	Leaves weight (kg)	Bulbs weight (kg)
Transition 0.5 ha	1		4.44	16	4.90	12.00
Transition 0.5 ha	2			11	10.95	17.20
Transition 0.5 ha	3			14	5.50	13.60
Transition 0.5 ha	4			12	7.90	20.10
	5			14	6.00	17.65
	6			14	9.30	18.85
	7			14	6.05	12.65
	8			15	9.60	22.90
	9					
	10					
	11					
	12					

*Double measure

***Sack weights**

Dry clean sack = 200g
Dry dirty sack = 225g
Damp dirty sack = 250g
Saturated dirty sack = 450g

	Plant count	Leaf weight (kg)	Bulb weight (kg)
Average	13.8	7.53	16.86
Start sack weight*		0.200	0.200
End sack weight*		0.250	0.250
Divide by 2	6.9	3.65	8.43
Multiply by published drymatter—caution		11%	16%
Sub-totals kg/DM		4,015	13,495
Sum total kgDM (total leaf + bulb weights)			17,510

**Guess-timate only*

APPENDIX 5

FARMER COMMENTS

FBPP farmer participant practical learnings

About fodder beet

"The ability to either hold, or, really push animals in any situation, i.e. our worst drought ever in 2014–15. However, we were still able to retain all maternal stock and 50% of finishing stock. In 2015–16—even though it was a very dry spring—the beet struck very well with great plant numbers. Good rain in early summer will now give us top yielding crops—as good as any year. Early establishment seems to be essential to get the high yields, all resulting in a high carrying capacity, setting us up for a really good spring."

— Tom Hargreaves, Kakahu

"Animals seem to self-regulate their protein intake. Animals wasting leaf means they are getting excess protein usually too much silage.

More beet and less silage equals better animal growth, cheaper and less labour.

Long faces with beet rows = easier to work out allocation and less competition in big mobs, of bulls especially. Same goes with silage under a wire—also less wastage."

— Tom Macfarlane, Middle Valley/Raincliff

"I feel we've simply learnt how to feed winterfeed better, per se, whether kale or beet. We used to hold them, now we grow them in winter—it's been a step-change!

Whether beet or kale, the crop costs around 12c/kgDM, while baleage and other supplements are nearer 40c/kgDM, so I try to maximise crop intake and minimise supplement. We're using less supplement, but only using excellent quality supplement.

We've refined the crop introduction/transition period since the group began.

We want to use longer than one day breaks, but how long can we go has been a question? We had some on weekly breaks for a while, but have settled on four days.

We've learnt the hard way not to ignore crop disease, which ramped up through autumn and winter.

We learnt that wet paddocks = poor stock performance (and poorer crops too).

Bigger, relaxed breaks = less mud. The stock are not hungry in the morning and therefore no rush for feed, always keep supplement fresh."

— Mike Salvesen, Montalto

"I've learnt the importance of feeding well during transition, increasing fodder beet one day and decreasing supplements on the following day, and not having too long a break during transition."

— Dave Harper, Windwhistle

"To help transition last year we handpicked fodder beet and fed out a little using our three- point linkage feeder as a pre-transition—which we will do again this year."

— Warren Leslie, Albury-Cave

"We believe the cattle do better with a balanced diet of beet and silage—not 90% beet."

— Tony Plunkett, Coleridge

"'Slow and steady wins the race' is true when it comes to cattle transition onto fodder beet. Be patient, take it slow—then you're unlikely to have any problems."

— Cameron Moore, Montalto

"Beet is the crux of an incredibly easy and high performance wintering system when ad lib feeding.

Beet has the ability to withstand a drought, and still produce 15-18 TDM+, when everything else around it struggles.

Soil moisture is required to have early optimal herbicide control of weeds.

Transitioning when conditions dry/warm (i.e. early) helped result in high animal performance over the whole of winter."

— Tim Lissaman

"Take time to do you feed assessments accurately, to correctly allocate breaks, and budget well through to the end of winter.

A kind winter may see 95+% utilisation. A kind winter may see further growth of the beet. Do a mid-winter stock-take of the feed situation and reassess the carrying capacity."

— Dan Harper, Windwhistle / Quartz Hill

"While the R1 steer average daily gain on fodder beet in winter was only average, I suspect they may have actually grown better than normal when on the spring grass after fodder beet?"

— Dene Noonan, Windwhistle

"We are killing R2's earlier than previously—some straight off beet—others earlier than before on the spring grass.

R2's who've experienced beet as R1 do very well as soon as they get on the beet in the second winter."

— Tim and Helen Molloy, Sefton

About sheep on beet

"Four day breaks are best. Give new break when bulbs are still above ground by an inch. They will go back and clean them up. I think this gives the shy feeders a better chance.

They do love supplementary feed: waiting to get off at night, but waiting to run on to the beet in the morning. Are they self-balancing their diet?"

— Barrie Payne, Maungati

APPENDIX 6

FBPP—Weighing event protocol

9 April 2015

Why?—To increase consistency within mobs between events, but also between farms.

The problem?—Individual animals liveweight can vary by 70 kg depending on gut-fill.

Weighing with an empty-ish gut before transition, then a full gut after a 21-day transition, could falsely tell us that the animal has had a positive growth rate, and should stay on the fodder beet. But that animal may never do well on the beet, and would be better transferred to another feed.

Each Fodder Beet Profit Partnership participant needs to supply the following three weighing events (data) at a minimum.

Weighing event protocol:

1. **Before starting onto fodder beet— must have a gut-full of grass.**
   If the individual is full, there is less likely to be doubt/error about the influence of the weight gut-fill. (They should go onto fodder beet the first time full anyway to prevent gorging).
2. **28 days after starting onto fodder beet—say at 2.00pm once a gut-full of supplement and fodder beet.**
   Perhaps 28 days is a good compromise for checking liveweight after transition while allowing another week to confirm positive or negative growth.
3. **Seven days after finishing grazing of beet—full of grass.**
   As cattle are coming off fodder beet and onto grass, the composition of the rumen is changing from low-fibre fast through-put fodder beet, to slower grass. Waiting seven days allows the rumen to switch over, gain a consolidated gut-fill of grass allowing for consistent weight data.

Then ideally:

4. A weight during grazing on spring grass, and
5. A final liveweight before going to slaughter.

For more information on fodder beet, listen to the podcast by Jim Gibbs at **https://beeflambnz.podbean.com**

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