

Maximising the Potential of Fodder Beet

Guest speaker: Jim Gibbs, Lincoln University Fodder Beet Specialist, Ruminant Nutritionist and Vet

Venue: Fearn Farm, Tain by kind permission of the Scott family and the team at Fearn

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Key Take Home Messages - growing and utilisation of Fodder Beet

- The KPI should be good dry matter (yield and content) and leaf retention through the winter and not sucrose production/ha (as with sugar beet)
- Agronomy will shift including row spacing (closer to 30cm) and plant numbers (upwards of 130,000/ha)
- Fit for purpose grazing crops will become more available
- The largest limitation is plant number for yield (under 65,000 plants wont yield over 20 tonnes DM)
- Good agronomy pays for itself
- Achieve a good leaf that is retained until utilisation
- Beef and sheep are very differently managed on beet, the driver for cattle is daily live weight gain, the driver for sheep is stocking rate

Key discussion points in the field

Bolters

Bolters largely linked to weather in the spring, from the period from the plant being sown and the 40 days following. Temperatures consistently under 12°C in this period increase the chance of bolters. This bolter period is from a long period of cold rather than short sharp frost / thaw weather. Some cultivars are more prone to bolting than others, partly as unlike sugar beet, there has been much less breeding activity in relation to fodder beet.

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History

Fodder beet has been fed for 500+ years; there were initial thoughts on toxicity for animals through oxalic acid, particularly in the leaves of the crop. For this reason there was a “killing dose” spoken about of feeding animals over 3kg DM/day would cause animal health issues. Some Dutch farmers emigrated to NZ, and were looking for a non-brassica forage which up to that point was the NZ standard when fields not in grass. They took their own fodder beet seed to grow the crop as it wasn't available in NZ at that time. They planted this, but before grazing they cut the leaves and lifted the bulbs to control the cattle's intake, with the thoughts of this toxic oxalic acid. As the crop was grown more it was apparent that a lot of cattle were dying due to something to do with the crop. Jim got involved for research and put in resources to understand what was happening. Often animals were put onto the crop on the 1st June, with deaths starting to be reported on the 7th June. After post mortem examination, the cause of death was identified as rumen acidosis. It became apparent that the animals and the crop hadn't actually been tested for oxalic acid and the volumes found were so small they were unmeasurable, allowing the focus to be made on rumen acidosis and the importance of a structured transition of animals on to the crop.

Transition

Now the work was being focussed on transition, the best solution was found to involve transitioning over approximately a 3 week period. Starting at **1kg DM per animal per day, and not increasing until all cattle are eating the bulbs readily, then moving up 1kg DM every two days until they start to leave it.** Cattle transition is rigid and inflexible. If cattle are put on to beet too quickly, instead of teaching them to eat the beet, you can in fact train them not to eat the beet. If they eat it too quick they will feel a bit ill, through a mild dose of acidosis, they will then associate the beet with feeling unwell.

The cattle need a period of time to learn to eat beet on an annual basis, so if dry cows are grazed every winter, they need a period of time to re-train eating the crop. They will take about a week to learn how to eat the beet compared to grass.

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Top tips for transition:

1. Have a headland of 6-10 metres of grass or green stubble, to allow them to transition at their own time and not have to rely on a ring feeder for additional forage. Resulting in not all animals getting the forage when they want it. Ring feeders are not ideal due to access issues.
2. Allow 1 metre of linear fence per animal – access is as important as allocation
 - a. This way they can all access the beet at the same time and choose their plant and eat it.
 - b. Cattle have a strong preference as to how they eat the beet bulb, they knock the bulb over, eat the middle out, then eat the bottom and leave the crown. They often go and forage or ruminate before coming back to the crown.
3. Assume a 20t DM crop = every m² = 2kg of DM. This is an easy way to measure the crop. If you know the width of the rows its much simpler and reliable to count the number of rows that are made available, rather than relying on various members of staffs “metre” steps which can vary hugely. So an average 50cm row x 1 metre length = 1kg DM (for a 20 tonne DM crop)

Set the yield in 5- 10 tonne lots for example if the crop is 28t DM/ha allocate on a 30t DM basis (if 23 tonne assume a 25 tonne crop), an overestimate of the crop allows for an overestimate of intake, and therefore reduces the risk of over feeding and potentially death of the animal until the transition process is complete.

In the first few days of allocation, allow for 1kg DM per animal, which means the supplement (forage) will be higher e.g. 8kg DM for adult cattle (or 4 kg DM for weaners). The second week the level of beet will be increasing so the level of supplement can decrease e.g. 4kg DM, thereafter the supplement can be as low as 2kg DM for adult cattle, and 1kg DM for weaners.

As the animals transition, they will eat what is easy to forage on. So if grass is available, they will choose the grass first, they will gradually introduce themselves to beet. If the supplement offered is silage at the start, ensure this stays as silage and the animals are after transition not made to eat something else of a different nutritional quantity e.g. straw that they don't like, or they will shy away from it at this important time.

After transition, be careful to limit supplement intake carefully. This approach increases the likelihood that the livestock will maximise their intake on the fodder beet rather than other available forage / fodder.

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Feeding young cattle on beet

Potential to finish on beet at 14-16 months old. This has the added benefit of

- half the methane emissions
- half the water use/kg carcass, which may be attractive to supermarkets.

A positive transition pays dividends in the daily live weight gains of these cattle.

An example would be a 270kg weaner eating 2.2% of their live weight = 6kg. Ration would include 5kg of beet and 1kg of autumn saved grass (after transition). If this ration was 4kg of beet and 2kg of grass, then the live weight would decrease. However older stock (rising 2's) would require 2kg of supplement (grass).

If managed correctly, killing out percentages have shown to be better on beet finished cattle than other systems, with breeds such as the Angus and Herefords achieving 56% KO and continentals achieving 58% KO.

Agronomy

A lot of the agronomy advice is based on sugar beet advice, which is aimed at sucrose production/ha, a key performance indicator for that crop. However, with fodder beet the driver should be production of dry matter and leaf retention throughout the winter. When the leaf is lost throughout the autumn and winter then the protein and phosphorus is imbalanced for the stock grazing. Once the leaf is lost then the protein and phosphorus needs replaced with supplement (forage) which will always have greater fibre and therefore decrease the daily live weight gains achieved from the crop.

Growing more leaf has been a huge driver in NZ and to achieve this they have increased the quantity of nitrogen applied to the crop and the number of split timings that it is applied. The nitrogen is split between sowing, and then over the summer months when the crop is growing vigorously. The later nitrogen applications are having a positive response on leaf retention. This good leaf retention is also showing less leaf disease. A late application of Potassium is also showing good response in NZ.

When leaves are frozen and then thaw out, they often go brown and stringy, this leaf holds its nutrition (protein and minerals) and is often more palatable to the livestock, where they choose to eat this first over green leaf. Early leaf losses are more of an issue, where the tissue senesces and disintegrates, obviously here the nutrition disappears. The aim for the leaf should be keeping good strong leaves into late autumn.

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Row Spacing and Sowing Rate

500mm rows seem to be what is promoted widely, because that is what suits harvesting. Jim has done a vast amount of work in row spacing and has found plant numbers to be a driver for yield. He has found best results with narrow rows, whilst increasing the space between plants. Currently, the best row spacing that can be achieved commercially is 375mm, at 110,000 seeds/ha, but this was based on equipment available to sow at this row spacing. The New Zealand research has shown this increase in plant number from 80-90 000/ha resulted in a 30% yield increase. The research to date suggests that 320mm boxes are optimum (c.130 000/ha), but these are not available commercially yet. In Jim's opinion, these spacings will be universal in grazing beet within five years.

Key discussion points in the church hall

Feeding fodder beet to growing cattle

To maximise intakes and therefor growth rates in growing cattle, you should set up your grazing so that you can see evidence of residues three days behind you. For the current day (Day 0) would be 100% allocation, but you will have left behind 25% of the previous day's beet (1 plant in 4), 10% of the day before that and 5% of the day before that.

| Fodder Beet Face | |
|---------------------------|--------------|
| Current Day Fence (Day 0) | 100% of beet |
| Day prior (Day-1) | 25% of beet |
| Day prior to that (Day-2) | 10% of beet |
| Day prior to that (Day-3) | 5% of beet |

The cattle will move away from the face and mop up the residual beet left from the previous 3 days – **this is the most efficient method of utilisation and one of the most difficult concepts to get farmers to undertake in practice**, as they usually believe a nice clean line immediately behind the fence is a sign of excellent utilisation. Jim has years of direct research and many examples to disprove this (see Saldias and Gibbs 2016).

Variety Choice

The higher the dry matter content, the more of the bulb is in the ground. Aged cattle knock beet over and eat it, but young stock won't, so a high dry matter variety for

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young stock will be high wastage as they can't access the buried part of the bulb so easily, and if they can't eat it from the middle, the intakes drop immediately.

A low dry matter content cultivar usually has less DM yield but it also usually has a higher utilisation than a high dry matter cultivar. In most cases the lower dry matter varieties are associated with greater palatability, which drives intakes. The bigger yield doesn't necessarily lead to making more money if they aren't palatable or the cattle can't knock them over to eat them, because profit comes only from high intakes pushing high liveweight gain.

Also, there is better the utilisation (of even a lower yielding, lower dry matter content variety), and varieties that have lots of retained leaf will also drive intakes and profit.

Some cultivars can be unpalatable to stock, if this is the case then the crop loses its advantage. The animals won't eat the bulb and it will be totally wasted. However, sometimes factors such as weather and other management can play a role in making a cultivar unpalatable, and this isn't always consistent between seasons.

Key attributes to look for in variety selection – do they keep good leaf and do they graze well.

Sheep

Sheep eat beet in a different way from cattle in that they don't knock the beet over, they eat them standing in the ground. If the sheep don't like the bulb, they leave it in the ground, if they do like them, they eat it down to the ground, and cone out the bulb below ground. Sheep are more likely to be selective over palatability of beet over cattle. If they find it unpalatable they will just eat the leaf.

A series of trials were carried out with sheep grazing beet, where their intake was assumed to be 2% of their live weight, they actually ate up to 3.1% of their live weight. With a crop with good leaf retention, there is no need for an additional supplement (forage). If there is no leaf then it is hard to replace, as the supplement will likely be high in fibre and lower in protein which will decrease the intake. The best supplement is grazed grass if it is available, as it will supply protein and minerals well, with minimal fibre to maintain high intakes.

A high water diet such as fodder beet, increases the efficiency of the rumen. The sheep will urinate approximately one quarter of their body weight e.g. 15 litres from a 60kg ewe.

Sheep transition is not as important as cattle transition. They will self-regulate themselves as intake increases, ideally this should be done over a week, with regular switches made between a few hours on and then off the beet. For maintenance feeding e.g. ewes, add supplement feeding. Sheep, like cattle, require space and ideally a large headland to run off the beet. A two day shift is ideal for sheep, to allow for a balance of bulb and leaf.

Leafy crops have a high level of protein, so transition with care if tugging on the beet.

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The main benefit for sheep on a beet system is the ability to raise the stocking rate on the farm by grazing beet early to pull mouths off the pasture in autumn, holding high stocking rates in winter, and keep grass ready for spring.

Minerals

The bulb is low in calcium and phosphorus, the leaf is high in calcium. Every region is different, some are low in phosphorus. The total diet should be in the region 0.24% phosphorus, and in some areas the bulb phosphorus is low (e.g. 0.05%). These areas need good leaf, or supplementation of phosphorus is essential to prevent disorders such as rickets.

A bolus or alternative should be used for copper (not continental sheep) and selenium. If there is a high water passage then the selenium level of the sheep drops. The animals eat a lot of soil on a beet diet, if the soil is high in molybdenum then this can tie up the copper. Iodine deficiencies are not an issue for beet crops, but are for brassicas.

Other discussions

- Some use oats with late sown brassica crops in the headlands
- Planting cereals as a nurse crop has not worked particularly well in NZ
- Some have direct drilled into grass – which has been a false economy. Direct drilling has worked in areas though with difficult soils.
- Fat Hen heavy farms have used a stale seed bed – then sprayed it off and then direct drilled the beet.
- Beet bucket for lifting beet was designed by Jim. This can hold 2 tonne of wet beet and an 110HP tractor can be used.
- When lifting beet, keep the tops on to keep it fresh. In warmer weather it can rot, in cold weather it can store for approx. 1 month.
- In NZ the rotation of beet is very quick as 2 years of beet, then one year of another crop before returning to beet. This may build up disease pressure.
- Dig down plants in the ground and see actually how much % is in the ground.
- Nitrogen fertilisers have increased greatly in NZ. The last application results in about 3% tramline losses, but the balance on the gain outweighs this.

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