



BRASSICA, BEET AND FORAGE CROPPING GUIDE

2017





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Introduction

Forage crops are a valuable tool for meeting the changing feed and energy requirements of a livestock operation throughout the year. Feed supply and stock performance can be manipulated through the use of different forage species. Agricom recognised the integral role of brassicas, forage cereals and herbs, investing in breeding and research, and is now proud to supply products specifically bred for New Zealand’s farming systems.

Agricom also has links with leading overseas fodder beet plant breeders to ensure Agricom’s fodder beet are some of the most advanced available.

From Small Beginnings

Understanding the breeding process (Figure 1) is useful when considering the purchase of a new product. Agricom products have progressed through each step including extensive off-site evaluation in different environments and farming systems. Farmers can buy Agricom products with confidence, knowing they come from a highly developed breeding programme, and are backed by strong technical support to retailers and farmers alike.

Why Grow Forage Crops?

Forage crops can offer a superior feed supply, both in terms of quantity and quality, in many situations. They provide an excellent source of energy and protein for grazing stock. Use of a forage crop should be considered in any situation where pasture quantity or quality is limiting the potential production of your livestock. The most common situations are as follows:

Finishing young stock in early summer – feed for post-weaning period, where feed demands increase at a time when vegetative pasture growth rates are falling.

Mid-late summer feed for all stock classes – at a time when pastures are of a low quality and low moisture levels are impacting on pasture growth.

Summer “safe” feed – a parasite/pathogen-free grazing environment, to avoid stock health issues related to endophyte effects, worms, facial eczema etc.

Autumn feed – to support an increased stocking rate, required when paddocks are removed for pasture renewal.

Winter feed – maintenance feed for stock when pasture growth is limited, allows stock to be held on small areas, thereby building the amount of valuable, high quality early spring feed. Crops also aid in reducing widespread pasture damage in wet conditions.












Winter stock-finishing – large quantities of quality feed suitable for finishing. For example, cattle and winter lamb contracts.

Break crop for renovation programme of sub-standard pastures – if managed well, forage crops will provide a significant drymatter contribution, minimal time out of production, a useful system for assisting in weed and disease clean up for pre-pasture establishment, and a good opportunity for improving fertility status. Brassicas are particularly useful in avoiding ryegrass seeding over the summer prior to establishment of a grass variety with **AR1** or **AR37** endophyte.

Figure 1. The Plant Breeding Process



Brassica and Fodder Beet User Guide

Cultivar	Sowing Time	Sowing Rate (kg/ha)	Time to First Grazing
Jamon Fodder Beet	 Late September to early November	80,000 seeds/ha (Precision sown)	Anytime after all herbicide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Monro Fodder Beet	 Late September to early November	80,000 seeds/ha (Precision sown)	Anytime after all herbicide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Cerise Fodder Beet	 Late September to early November	80,000 seeds/ha grazing 100,000 seeds/ha lifting (Precision sown)	Anytime after all herbicide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Spitfire Forage Rape	 Mid October to early November	3-4 alone 3 with herbs and clover 1-2 with short term ryegrass	13-14 weeks
	Late January to early March	3-4 alone 2 with short term ryegrass	13 weeks
Winfred Forage Brassica	 Mid October to early November	3-4 alone 2.5-3 with herbs and clovers	10-12 weeks
	February to March	3-4 alone 1-2 with short term ryegrass	10-12 weeks
Hunter Forage Brassica	 Mid October to November	4	6-8 weeks
	February possible	4	8-10 weeks
Sovereign Kale	 Late October	4	14-16 weeks
	Late November to late December	4	18-24 weeks
	Late January to mid February	4	14-18 weeks
Domain Swede	 Late November to early December	0.5 in 60 cm ridges 1 in 20 cm rows 1.5 broadcast	24-30 weeks
Triumph Swede	 Late November to early December	0.5 in 60 cm ridges 1 in 20 cm rows 1.5 broadcast	24-30 weeks
Rival Turnip	 Late October to early November	Range 1.5-3 Varies depending on quality of seedbed preparation	12-14 weeks
New York Turnip	 Late October to early November	Range 1.5-3 Varies depending on quality of seedbed preparation	16 weeks
	January to February	1-2	18-20 weeks

* Variation in DM % can occur under different sowing rate and/or environmental conditions. Northern North Island drymatters have consistently been lower than stated.

Period of Grazing	Number of Grazings	Potential Yield (kg DM/ha)	Notes
After all herbicide withholding periods are met	1	Average = 18,000-22,000 Top = 30,000+	Medium to high drymatter type (16-18%) cultivar, true mono-germ seed, high yield potential. Most suited for grazing*
After all herbicide withholding periods are met	1	Average = 18,000-22,000 Top = 30,000+	Low drymatter type (13-15%) cultivar, true mono-germ seed, high yield potential. Most suited for grazing*
After all herbicide withholding periods are met	1	Average = 18,000-22,000 Top = 30,000+	High drymatter type (18-21%) cultivar, true mono-germ seed, high yield potential. Ideal for grazing, may be lifted*
January to August	1 (Cattle) 1-2 (Sheep)	1st grazing 6,000-9,000 11,000-13,000 depending on number of grazings	Higher yield potential with increased aphid tolerance compared to Winfred . Number of grazings is most affected by management and climatic conditions
Late May to August	1	6,000-9,000	Preferred cultivar due to higher yield potential than Winfred
January to August	3-4	10,000-12,000 depending on number of grazings	Number of grazings is most affected by management and climatic conditions. The addition of herbs, clovers or ryegrass will increase the potential for other grazings once the Winfred has died out or slowed in regrowth
Late May to August	1-2	5,000-8,000 depending on number of grazings	
December to March	3-4	10,000-12,000 depending on number of grazings	Number of grazings is influenced by climatic conditions and grazing management with faster rotations allowing more grazings
April to August	2-3	10,000-12,000 depending on number of grazings	
Lightly in February, then June to September	2	Accumulated = 14,000-15,000	The aim of this system is to graze lightly with lambs throughout February then shut up for winter feed
Late May to September	1	Average = 10,000-14,000 Top = 18,000+	Late flowering makes Sovereign a good choice for late winter grazing
June to September	1	8,000-10,000	Sowing at this time greatly elevates crop quality and potential utilisation rates throughout winter
Late May to September	1	Average = 10,000-14,000 Top = 18,000+	Main-crop swede with very high dry rot tolerance. Should not be sown after other brassicas
Late May to September	1	Average = 12,000-14,000 Top = 18,000+	Very high yielding main-crop swede. Should not be sown after other brassicas
January to March	1	Average = 8,000-12,000 Top = 14,000+	Care should be taken to make sure that Rival makes up no more than 5 kg DM/hd/day or 1/3 of a milking cow's diet
February to March	1	Average = 8,000-12,000 Top = 14,000+	New York is a good choice to be sown for the last paddock of summer turnips to be grazed. Care should be taken to make sure that New York makes up no more than 5 kg DM/hd/day or 1/3 of a cow's diet
Late May to August	1	Average = 6,000-8,000	500 g/ha can be added to annual ryegrass for winter feed however bulb development is often reduced

Fodder Beet

Background

Agricom has been supplying fodder beet to farmers for a number of years, and in that time has conducted research into cultivar performance, crop husbandry and animal feeding techniques.

Pros and Cons Relative to Traditional Winter Forages (Kale, Swedes)

Some farmers have been interested in growing fodder beet, with the main attraction being a higher yield potential than swedes or kale, and reduced insect and disease problems (Table 1). Where land area is restricted, fodder beet should be considered due to the high yield potential. Other farmers may also find that swedes or kale work well for them, and therefore value the lower establishment and supplementary feeding costs, and familiarity with management.

Table 1. Key Features of Fodder Beet and Winter Brassicas

Feature	Fodder Beet	Swedes	Kale
Average yield (kg DM/ha)	18-22,000	10-14,000	10-14,000
Potential yield range (kg DM/ha)	30,000+	18,000+	18,000+
Disease tolerance	Very good	Moderate	Very good
Insect tolerance	Very good	Moderate	Moderate
Cost to establish (\$/ha)*	2,000-3,000	800-1,000	1,000-1,400
Potential animal issues**	Moderate	Low	Low
Supplements required**	Moderate	Moderate	Low

* Best practice estimates. Actual cost may vary due to different situations and weed pressure in different regions of the country.

** Particularly relevant for dairy grazing.

Fodder Beet in Livestock Systems

Fodder beet forage systems provide a flexible, high quality feed option which have the potential to deliver high yields in autumn, winter and early spring with inherently high rates of utilisation by livestock. Many different livestock systems can benefit from the inclusion of fodder beet (see Table 2).

Table 2. Benefits of Fodder Beet Across Different Livestock and Seasons

System	Autumn	Winter	Spring
Dairy	Extended lactation Transition for winter feeding	Winter feed High utilisation crop	Balance high protein pasture Help build spring cover
Beef	Supplement autumn pasture if dry Parasite free feed	Winter maintenance High stocking rate Winter liveweight gain	Balance high protein pasture
Sheep	Flushing feed in a dry autumn	Winter maintenance Winter lamb LWG	Balance high protein pasture
Deer	Pre-weaning feed in a dry autumn	Winter feed	Hold hinds prior to fawning

Successful farm system outcomes from grazing fodder beet rely on appropriate grazing management which minimises the risk of animal health and production issues. Appropriate grazing management includes a well planned and executed transition phase and appropriate choices around supplement use (see Transition section – Table 3, page 9).



Effective establishment of fodder beet requires a good seedbed and regular monitoring.

Fodder Beet

Getting the Best Out of Your Fodder Beet

Pre-sowing

It is important to get a soil test at least six months before sowing fodder beet, as it is very sensitive to low pH levels in the soil, with a pH of at least 6 being required and ideally 6.2. Any soil nutrient correction should be made prior to sowing.

Paddocks should be sprayed with glyphosate and a contact insecticide (e.g. chlorpyrifos) prior to working. Soils should ideally be free-draining and relatively free of weeds. The soils should be worked into a fine tilth before sowing to allow for even sowing depth.

A general fertiliser recommendation is: pre-sowing; Cropzeal 16N at 150-200 kg/ha plus NaCl (salt) at 350 kg/ha. Sulphur, boron and magnesium may be beneficial on some soil types.

It is important when choosing the paddock to ensure that there has been no recent history of chemical use as fodder beet is very sensitive to certain chemicals.

Sowing

A “stale seedbed” technique to remove weed competition is best. This is where a seedbed is prepared at least 4-6 weeks before planting, and germinating weeds are sprayed with a non residual herbicide immediately before planting.

Practical Considerations of Grazing Fodder Beet

Some thought is required to the practicalities of feeding fodder beet. Starting a transition programme requires some planning as it is critical to restrict access to fodder beet. This may be done by “lifting” fodder beet and feeding this out in increasing amounts to stock grazing pasture. Transition programmes utilising fodder beet *in situ* may require a headland to be left without crop at sowing or a headland to be “lifted” prior to feeding to allow animals access to a small amount of the crop. The ability to “drop” a fence adjacent to the crop is also a strategy worthy of consideration.

Large crops may be problematic to feed off due to the high stocking rate required to meet allocation targets. This has practical implications for stock traffic through gateways and tractor movements for supplementary feed. For sheep and deer,

Depending on location, sowing between late September and early November is generally recommended. Earlier sowings risk vernalisation causing bolting, while later sowing reduces yield potential, and germination may be hindered in areas prone to dry summers.

A precision drill is recommended for sowing fodder beet. This will place the seed at the correct depth (2 cm) and space plants accurately ensuring the correct sowing rate.

Post-sowing

Due to slow establishment and the time taken to form a leaf canopy, early and timely weed and insect control is essential; please contact your local seed retailer or chemical representative for more details.



particularly on restricted allocations, break dimensions meeting allocation targets may be too small to feed all animals at once and a system where two different mobs/herds graze the same break at different times (morning and afternoon) may be useful.

For some fodder beet chemicals there are considerable grazing withholding periods. All chemicals, especially fungicides need to have their withholding periods recorded so they can be reviewed if grazing plans are brought forward.

Accurate crop allocation relies on accurate measurements of the crop yield. Fodder beet is inherently difficult to accurately measure without many samples. Yield estimates using five measurement points through the paddock could have an error of +/- 4.5 t DM/ha (Judson, unpublished data). See page 14 for details on the Beet Guru, an app to assist with calculating and interpreting fodder beet yield.

Fodder Beet

Fodder Beet Grazing Management

Diet planning

Prior to feeding a fodder beet crop to livestock, a diet plan needs to be developed detailing both the targeted volume of daily intake and the percentage of this total that fodder beet will make up. This will depend on stock class and the desired level of performance. In some cases the total amount of crop available on farm may also have some impact on these decisions.

High/*ad lib* intake

Where the expectation of gains in liveweight (i.e. steers) or body condition (in dairy cows) is high and the supply of crop is non limiting, high/*ad lib* intakes are often targeted where animals have access to some crop and supplement at all times. With fodder beet, high performance can be achieved while maintaining very high rates of utilisation as quality does not vary significantly through the bulb. Utilisation rates in excess of 90% are observed by the majority of graziers. A careful transition phase is required to minimise the risks (particularly of acidosis) in reaching these high intakes. Performance of animals grazing large volumes of fodder beet is generally high, but there is no good evidence that it is higher than similar animals grazing similar volumes of kale for example¹ and therefore expectations need to be in line with other crops.

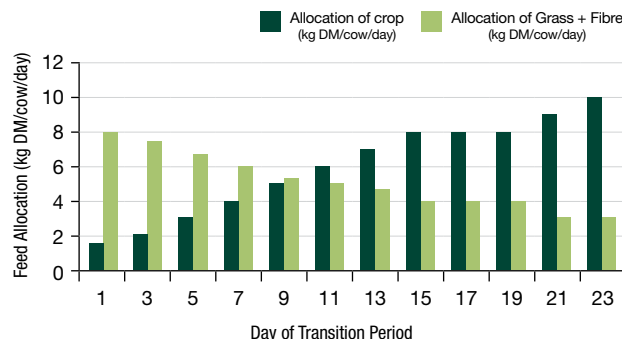
Restricted intake

In some situations, such as maintenance winter feeding or in lactating dairy cows where beet make up only a proportion of the diet, restricted fodder beet diets may be more appropriate. Restrictions in some cases may result in periods of hunger and controlling intake is paramount. Key considerations for restricted feeding are accurate feed allocation, keeping stock full with alternative fibre supplements, the use of double fences or “on-off” grazing to reduce the risk of breakouts. Transition is still critical when restricted feeding is desirable.

Choice of supplement

During the transition phase and once target allocations have been met, supplement plays an important role in the diet. During transition it keeps animals full allowing a gradual increase in the proportion of fodder beet in the diet. Fibre also encourages chewing and the production of saliva which is important in maintaining healthy rumen conditions. The supplement needs to be palatable, close to the crop face and easily accessed.

Figure 2. Example of the Daily Allocation of Crop and Supplement (Grass or Conserved Forage) of MA Cattle Being Transitioned onto a Fodder Beet Crop



Choice of supplement comes down to the supply of protein. Where the fodder beet component of the diet does not meet requirement, the supplement needs to supply the shortfall. Such situations may occur in large fodder beet crops, or damaged crops, when the leaf makes up a small proportion (i.e. 10%) and the total allocation and/or livestock demand for protein is greater, such as the case for young growing animals. In practice, this may mean hay and straw are sufficient for mature animals on a winter diet but good grass balage, conserved lucerne or red clover may be better where LWG is important in young stock.

¹ Edwards *et al.* (2014). Proceedings of the New Zealand Grassland Association.



Fodder Beet

Transition/Animal Health

Acidosis

Acidosis is a reduction in the rumen pH caused by a rapid change of diet to a high quality (starch or sugar), low protein feed source. Fodder beet bulbs have high sugar levels and low fibre levels which can cause acidosis in ruminants if the transition phase isn't managed correctly. The most extreme cases can cause death.

Non-fatal, visual symptoms in cattle are:

- Diarrhoea
- Limited cud chewing (< 50% of cows lying down not chewing their cud)
- Sore hooves – laminitis
- Faeces foamy, contains gas bubbles
- Faeces in the same feeding group varies from firm to diarrhoea
- Increase in fibre particle size (> 0.5 inch) in faeces

Often there are no specific clinical signs of rumen acidosis. Poor performance of stock grazing fodder beet in the initial 14-21 days could be a symptom of acidosis.

Oxalates

Oxalate levels in the leaves of fodder beet may pose a potential, but low risk to cows in a vulnerable metabolic state, as the oxalates bind calcium during digestion making it unavailable to the stock. Symptoms are similar to milk fever, including lethargy and in extreme cases loss of consciousness. Reducing the risk of stock breakouts, which lead to gorging, is vital in reducing the animal health risks.



Long narrow grazing faces allow effective utilisation of fodder beet.

Table 3. Example of a Transition Programme and Final Diets of Fodder Beet for Cows, Sheep and Deer Systems

		MA Cows	R2 Heifers/Steers	R1 Heifers/Steers	Ewes/Hoggets/Hinds	Lambs
Start	Beet	1-2 kg DM per cow allocated behind a wire	1 kg DM per animal allocated behind a wire	0.5-1 kg DM per animal allocated behind a wire	2-3 hours on the crop	2-3 hours on the crop
	Supplement	8-9 kg DM per cow	7-8 kg DM per animal	5 kg DM per animal	Access to pasture > 2000 kg DM/ha	Access to pasture > 2000 kg DM/ha
Transition	Diet	Increase the allocation of crop by 1 kg DM and decrease the supplement allocation by 0.5 kg DM per animal every second day until the final diet is reached for each component. If residuals are accumulating, pause until the allocation is totally consumed.	Increase the allocation of crop by 1 kg DM and decrease the supplement allocation by 0.5 kg DM per animal every second day until the final diet is reached for each component. If residuals are accumulating, pause until the allocation is totally consumed.	Increase the allocation of crop by 0.5 kg DM and decrease supplement allocation by 0.5 kg DM per animal every second or third day until the final diet is reached for each component. If residuals are accumulating, pause until the allocation is totally consumed.	Increase time spent grazing crop by 1-2 hours every second day until the final diet is reached for each component. If residuals are accumulating, pause until the allocation is totally consumed.	Increase time spent grazing crop by 1-2 hours every second day until the final diet is reached for each component. If residuals are accumulating, pause until the allocation is totally consumed.
Final diet (an example)		Beet at 10 kg DM/hd/d Silage at 3 kg DM/hd/d	Beet at 5 kg DM/hd/d Silage at 2 kg DM/hd/d	Beet at 4 kg DM/hd/d Silage at 2 kg DM/hd/d	Beet at 1.1 kg DM/hd/d Silage at 0.5 kg DM/hd/d	Beet at 1 kg DM/hd/d Lucerne hay at 0.5 kg DM/hd/d

This is a guide only. Accurate allocation is important. The timing of feeding each day needs to be consistent. Regular checks are suggested to identify issues early. Always seek further technical advice.

Fodder Beet

Managing for Sustainability

A close relative to sugar beet and silver beet, fodder beet is now widely used in New Zealand as a winter feed source, where it is mainly grazed *in-situ*.

Many people are aware that a small number of bolters are typical in a fodder beet crop, and cultivars that are clean one year may have some bolters the next such is the nature of pollen transfer and weed beet presence in seed production environments. Leaving or ignoring paddocks with bolting plants, no matter how few, is the single biggest risk to the sustainability of fodder beet in New Zealand.

For the last few years the true effect of bolters has been overlooked by many in the sector and their relevancy underestimated. Therefore, its prevalence has risen on many support blocks to significant levels. In some severe cases it will prevent future fodder beet plantings.

Bolters and weed beet building up in our environment is also a major risk to high value red beet and silver beet seed crops within the arable sector. As well, it limits the potential of growing clean, non-contaminated fodder beet seed crops in New Zealand.

If bolting plants are not destroyed before they complete their life cycle, they can produce up to 6000 seeds per plant, with this seed remaining viable over several years. Consequently, once established bolter populations can persist in the seed bank for up to 10 years.



Some growers are ignoring best practice and opting for 'beet on beet' instead of a crop rotation. This practice requires even more active monitoring of bolting beets with immediate removal of these plants from the paddocks. Beet following beet has the additional issue of bolters, generated by left over bulbs or bulb chips from the previous crop. If all or part of these bulbs remain in the ground with a viable root system, these plants (being over 12 months old) will naturally go to seed through their second summer.

When considering next year's spring crops, time must be taken to plan rotations which will support long term fodder beet production. In many cases a 4+ year rotation is advised and if the rotation length is shorter between crops, extra resources must be accounted for in the rouging of bolters. It is also important to be aware of the potential for bolters to emerge in a paddock going into fodder beet that has previously grown beet at any stage in the past – especially in the past 10 years. Above all else it's critical to the future of the crop that all bolting plants are completely removed from paddocks irrespective of anything else.

Quick facts:

- Bolter weed beets are derived from wild beet populations and have a dormancy mechanism for survival.
- Each individual bolter can produce up to 6000 seeds which can stay in the soil for up to 10 years.
- Having a crop rotation with beet following beet is very risky and increases the chances of weed beet build up as well as the introduction of crop limiting diseases and pests.
- If bolting beets are not completely removed from paddocks, (i.e. the bulb and seed head) they can regrow and still produce viable seeds.
- While it's typical to get a few bolters coming through within fodder beet crops, growers need to be aware of the commitment and requirement to completely remove these plants ensuring that future fodder beet can be grown sustainably in the future.

Jamon

- True mono-germ cultivar
- Medium to high drymatter type (16-18%)*
- 50% of bulb above ground
- Very good resistance to bolting
- Above ground colour: orange

Jamon is a very uniform, mono-germ cultivar that has been evaluated in New Zealand for a number of years. It is an orange skinned cultivar with a bulb drymatter percentage of between 16-18%, similar to many current industry products. **Jamon** is French fodder beet breeders Florimond Desprez's most popular product. Combined with our New Zealand experience we believe it complements Agricom's current fodder beet range.



Jamon fodder beet.

* Variation in DM % can occur under different sowing rate and/or environmental conditions. Northern North Island drymatters have consistently been lower than stated.

Suggested Sowing Time	Late September to early November
Suggested Sowing Rate (seeds/ha)	80,000 (Precision sown)
Time to First Grazing	Anytime after all herbicide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Number of Potential Grazings	1
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Bulb DM%	16-18%
Seed Type	True mono-germ
<i>In-situ</i> Grazing	Most suited
Mechanical Harvesting	May be lifted, not ideal



Please refer to pages 8-9 for animal welfare information.

Suggested Sowing Time	Late September to early November
Suggested Sowing Rate (seeds/ha)	80,000 (Precision sown)
Time to First Grazing	Anytime after all herbicide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Number of Potential Grazings	1
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Bulb DM%	13-15%
Seed Type	True mono-germ
In-situ Grazing	Very good option
Mechanical Harvesting	Not suitable

➔ Please refer to pages 8-9 for animal welfare information.

Monro

- True mono-germ cultivar
- Larger bulb type
- Low drymatter type (13-15%)*
- 60% of bulb above ground
- Good resistance to bolting
- Above ground colour: red

Monro is a red coloured beet with a large more rounded bulb shape. It is suitable for in paddock grazing where it is readily accessible to the grazing animal.



Monro fodder beet.

* Variation in DM % can occur under different sowing rate and/or environmental conditions. Northern North Island drymatters have consistently been lower than stated.

Cerise

- Recent breeding release from Florimond Desprez
- True mono-germ cultivar
- High drymatter type (18-21%)*
- Approximately 40-50% of bulb above ground
- Very good resistance to bolting
- Above ground colour: yellow/green

Cerise is a recent breeding release from Florimond Desprez, with a uniform yellow/green tankard shaped bulb.



Cerise fodder beet.

* Variation in DM % can occur under different sowing rate and/or environmental conditions. Northern North Island drymatters have consistently been lower than stated.

Suggested Sowing Time	Late September to early November
Suggested Sowing Rate (seeds/ha)	80,000 grazing 100,000 lifting (Precision sown)
Time to First Grazing	Anytime after all herbicide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Number of Potential Grazings	1
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Bulb DM%	18-21%
Seed Type	True mono-germ
<i>In-situ</i> Grazing	Very good option
Mechanical Harvesting	May be lifted



Please refer to pages 8-9 for animal welfare information.

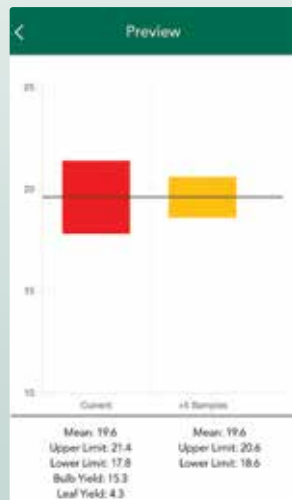


The 'Beet Guru®' App

The Beet Guru is an exciting app that makes understanding yield assessments of fodder beet much simpler.

The accurate measurement of fodder beet yield is technically difficult. This is primarily because as a precision-sown crop, gaps are inevitable and lead to increased yield variation across the paddock.

Gaps may result from poor or zero seed placement, failure of a seed to germinate or failure of a germinating seed to establish due to environmental or insect pressures. Variable yield estimates make accurate forage allocation difficult, which is especially critical during transition feeding.



Beet Guru is a tool which allows individual estimates of yield from paddock assessment to be combined into a mean with 95% confidence intervals calculated. This tool is valuable because it:

- Describes the accuracy with which yield is being stated (i.e. with an estimated 24 tonne average yield, and 95% confidence that the true mean will lie between 20 and 28 tonne). This helps put yield estimated into statistical context.
- Allows you to make decisions in the field on the number of samples to be taken. For example, by increasing the number of samples taken, a more accurate estimate of yield can be determined. You could choose to do a few more samples while still in the paddock to achieve the desired confidence interval.
- Provides a reporting function which can be utilised from the field improving efficiency and speeding up reporting time.
- Provides a live record of the crop you are managing and allows you to benchmark your results against regions and over years. All assessments completed can be downloaded in a spreadsheet.

Why use Beet Guru?

- Simple to use
- No need for pen and paper in the field
- Preview yield with every measurement entered
- Assessment reports sent via email as a PDF
- Assessments stored within the app and used in a spreadsheet
- Available on Apple, Windows and Android
- Free to download

Screens from the Beet Guru app.

agricom.co.nz

Fodder Beet Pests

Fodder beet establishment can be compromised by occasional, localised, and seasonal, pest and disease attack. Their impact can usually be minimised by management. Once established, fodder beet is typically disease-free relative to other crops.

Table 4. Key Pests and Diseases Affecting Fodder Beet Seedlings		
Condition	Impact on Plant	Control
Seedling Insect Pests		
Springtails (<i>Bourletiella spp.</i>)	Attack cotyledons and emerging plants	Seed treatment, chemical, crop rotation and hygiene
Greasy Cutworm (<i>Agrotis ipsilon aneituma</i>)	Plants, especially seedlings ripped off at or just below ground level, young plants wilt	Chemical, crop rotation and hygiene
Grass Grub (<i>Costelytra zealandica</i>)	Adults attack young growing points, larvae attack seedling roots	Seed treatment, chemical
Wheat Bug (<i>Nysius huttoni</i>)	Ring barking of seedlings at ground level leaves plants susceptible to other attacks, damage is similar to that caused by wirestem	Seed treatment, chemical
Weevils (<i>Catopes spp.</i>)	Chew cotyledons or stem at ground level, scalloping of leaf edge	Chemical
Slugs (many species)	Creates severe damage to plants by destroying seedlings	Minimise crop residual or trash before direct-drilling, use slug baits, cultivate paddocks
Seedling Fungal Diseases		
Wirestem (<i>Rhizoctonia</i>)	Often results in complete plant death	Seed treatment, chemical
Plant Pests		
Leaf Miners (many species)	Larvae create tunnels and live within leaf tissue, tissue damage may reduce photosynthetic activity and cause leaf yellowing, premature leaf death, and limit growth at this time. Damage is similar to that caused by Diamondback moth	Chemical
Crop Virus		
Beet Necrotic Yellow Vein Virus	Pale yellow green leaf colour. Causes root malformation which reduces nutrient uptake. Can cause leaf wilting	Crop rotation and hygiene
Beet Western Yellows Virus (BWYV) / Yellow Virus	General stunted growth, purpling of leaves	Crop rotation and hygiene
Crop Fungal Disease		
Rust	Orange spores cover leaf surfaces. Effect on yield is yet to be confirmed	Research ongoing
Powdery Mildew	White powdery substance on leaf surface. Evidence suggests a yield reduction may occur	Research ongoing
Rhizoctonia Root Rot (<i>Rhizoctonia solani</i>)	Caused by soil borne fungi. Leaves wilt and collapse and brown rot develops on the root	Crop rotation, good drainage, maintained soil structure
Wet Rot (<i>Phytophthora spp.</i>)	Foliage wilts and shrivels and a rot of the root develops from the tip upwards	Good drainage, maintained soil structure and avoiding excessive irrigation
Crop Nutrient Deficiencies		
Brown Heart / Heart Rot	Boron deficiency creates the symptoms of the central leaves dying and rotting and can extend to the crown of the root which becomes hollow	Soil testing, Boron fertiliser application
Magnesium Deficiencies	Pale yellowing of leaf. Symptoms of slight magnesium deficiency are similar to that of Beet Western Yellows Virus, although the BWYV is very bright and often tinted orange.	Soil testing and fertiliser application

Adapted from: Charlton & Stewart. (2006). Pasture and Forage Plant for New Zealand, 3rd edition.

Brassica Cultivar Information

Which Multiple-Grazing Forage Brassica Should I Use?

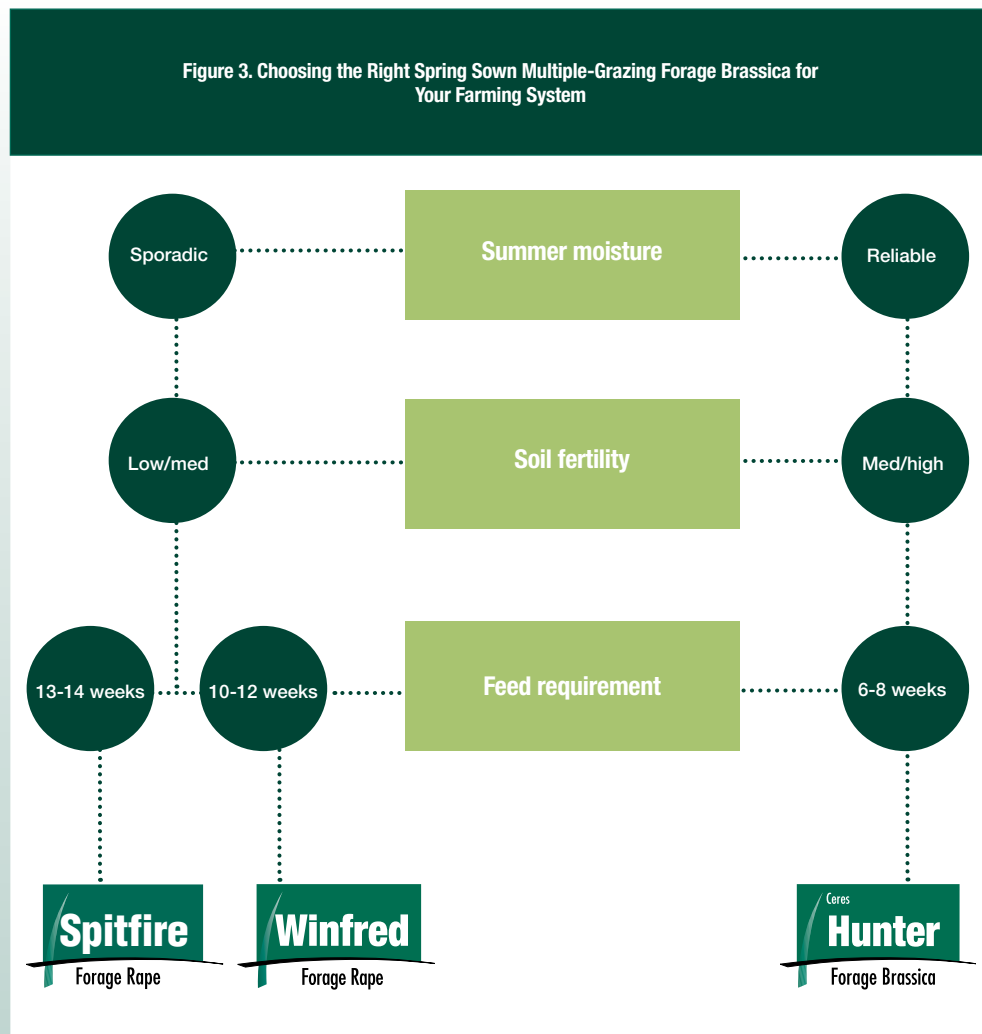
Hunter (*Brassica rapa spp. campestris*) is a hybrid cross between a turnip and a rape, producing one of the fastest maturing brassicas, with a look most like a leafy, non-bulb producing turnip.

Winfred (*Brassica napus*) is a cross between a kale and turnip.

Spitfire (*Brassica napus*) is a cross between a kale and a rape. Both **Winfred** and **Spitfire** are commonly termed forage rapes.

These different genetic make-ups have resulted in very different characteristics.

The following diagram (Figure 3) summarises these characteristics and how they relate to their suitability for different farming systems.



October sown **Spitfire** ready to be grazed by late December to early January.



Late October sown **Hunter** ready for grazing by early December.

➔ Please refer to pages 34-37 for grazing management and animal welfare information.

Herb and Clover Systems with Multiple-Grazing Forage Brassicas

The popularity of the pasture herbs **Tonic** plantain and **Choice** chicory is a result of the real benefits they provide to farm production and animal well-being. Establishing herbs and clovers with a multiple-grazing brassica, e.g. **Winfred**, **Spitfire**, **Hunter**, can improve the regrowth potential of the crop in repeat grazing situations, or can be a useful method of establishing these companion species for future pasture sow-downs (see Figure 7, page 20).

Benefits for drymatter production:

- The red clover and herbs will provide a small but high quality contribution to the diet in the first grazing and increase in quantity in subsequent grazings
- Improves production and persistence in dry periods, with rapid recovery when soil moisture improves
- Provides continued growth under cold conditions
- Increases total crop production
- Provides an established herb base for the direct-drilling of grass and clover species into the run-out brassica crop

Winfred Forage Brassica & Choice Chicory Mix Suited to longer rotations and better chicory growing conditions	
Winfred forage brassica	3 kg/ha
Grasslands Choice chicory	3 kg/ha
Grasslands Relish or Grasslands Sensation red clover	4 kg/ha
Grasslands Tribute white clover	2 kg/ha
Total Mix	12 kg/ha

Forage Brassica and Tonic Plantain Mix Can cope with a wider range of soil conditions and grazing conditions	
Winfred, Spitfire or Hunter forage brassica	3 kg/ha
Ceres Tonic or Ceres AgriTonic plantain	3 kg/ha
Grasslands Tribute white clover	3 kg/ha
Total Mix	9 kg/ha

Suggested Brassica and Herb Pasture Mixes

In a typical pasture renovation when herbs and clovers are established with grass, they may be disadvantaged in terms of establishment rate and the subsequent grazing management of the sward. Adding red clover and/or **Tonic** plantain and **Choice** chicory with a multiple-grazing brassica is a valuable establishment tool, when used in conjunction with subsequent direct-drilling of grass species.

Benefits for the animals:

- Provides variety in the diet, with a greater mineral availability than a brassica crop alone
- May reduce the animal health issues that can arise on a sole brassica diet

Herbs should not be mixed with brassica when that crop is being used to remove weeds from a paddock, because the herbs are sensitive to the brassica herbicides that would be used.



Herbs provide valuable drymatter production throughout the regrowth cycles.

Product Usage

Spitfire is a multi-purpose rape that can be sown in spring for lamb or cattle finishing or summer dairy grazing, or sown in mid summer to early autumn for autumn and winter grazing.

Spitfire has excellent yield, insect tolerance, and a low drymatter percentage (DM%) stem. If using cattle to graze spring sown **Spitfire**, plan for a single graze as the treading of cattle can reduce regrowth ability. With sheep, plan for at least two grazings, as a third summer grazing may not always occur. If more than two summer grazings are required then **Winfred** is the better option, especially with cattle.

Spitfire Forage Systems

Due to the regrowth ability of **Spitfire** and the lower DM% stem, there are numerous options for the addition of companion species, either at the time of sowing **Spitfire** or after grazing, to provide at least 12–18 months grazing. **Tonic** plantain and/or ryegrass (**Asset** without endophyte, **Progrow** or **Ohau**) can be added to increase the quality, yield and longevity of the crop.



A healthy crop of **Spitfire** ready to be grazed.

Grazing Management

Graze **Spitfire** down to a 30 cm stalk, removing all leaf. This residual will optimise utilisation while ensuring plant survival for future drymatter production and crop quality.

Crop utilisation is an important factor when grazing brassicas. **Spitfire**, which has a lower DM% stem, has been observed to have higher potential utilisation, and this has been demonstrated in recent trials.

Figure 4. Utilisation of Rape in Canterbury and Hawke's Bay under Lamb Grazing at Common Allowances

From Judson *et al.* (2013). Proceedings of the NZ Grasslands Association.

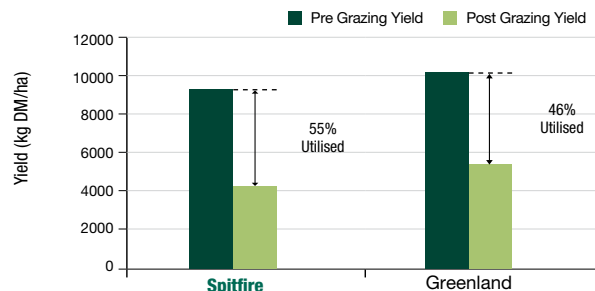
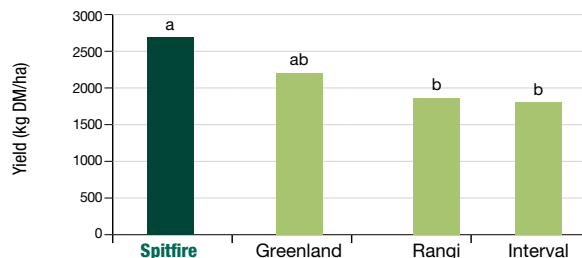


Figure 5. Rape Regrowth Yield from First Grazing in Hawke's Bay Trial

Regrowth 55 Days After 1st Grazing
(Trial Sown: 6th October 2010, 1st Harvest 11th January 2011)



Statistical Significance:

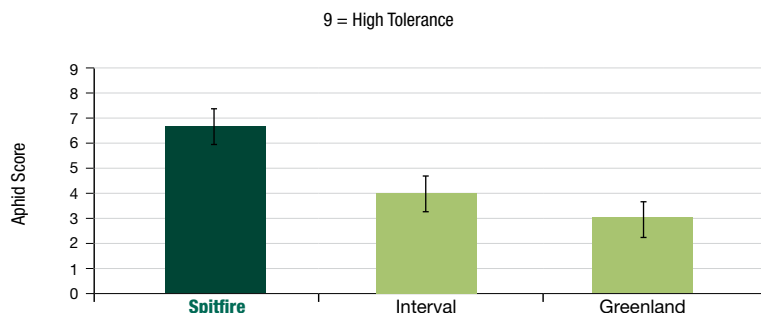
Letters that are different indicate a statistical difference while the same letter indicates no difference.

Trial Results

Spitfire has a high total crop yield potential and excellent leaf yield, which is important for overall crop feed quality. **Spitfire** has a good ability to regrow (Figure 5).

Aphids have the ability to reduce the potential yield of a brassica crop, and can be expensive to control on highly susceptible crops. **Spitfire** is one of the leading rape varieties for aphid tolerance (Figure 6). **Spitfire** can still be affected by aphids, but the risks are reduced, thus increasing plant health and future productivity in aphid prone areas.

Figure 6. Aphid Score at Kimihia Research Centre 2010-2011



Statistical Significance:

Those cultivars whose error bars do not overlap are significantly different from each other at the 95% confidence level. Those cultivars whose error bars do overlap are not significantly different from each other.



Spitfire (left) showing strong plant health and quality compared with another rape (right) under the same management.

Suggested Sowing Time	Mid October to early November	Late January to early March
Suggested Sowing Rate (kg/ha)	3-4 alone, 3 with Relish, Sensation, AgriTonic, Tonic or Choice . 1-2 with short term ryegrass	3-4 alone, 2 with short term ryegrass
Time to First Grazing	13-14 weeks	13 weeks
Number of Potential Grazings	1-2	1
Potential Yield (t DM/ha)	1st grazing 6-9 11-13 total*	6-9 depending on sowing date

*Depending on number of grazings

- High yielding, intermediate-height rape
- Low stem DM% and a plant maturity of 13-14 weeks
- Suitable for summer, autumn and early winter feeding
- Excellent aphid tolerance

➔ Please refer to pages 34-37 for grazing management and animal welfare information.

Winfred

Forage Rape

Product Usage

Winfred is a very versatile brassica, as it is suited to a wide range of soil fertility and environmental conditions, and is either spring and/or late summer sown.

It is well suited to dryland conditions where it has a very good record of on-farm performance. **Winfred** has proven to have excellent grazing tolerance, making it very reliable for multi-grazing.

Winfred is particularly good for lamb finishing in summer-dry regions and has good application in deer, beef and other dry-stock operations.

Winfred Forage Systems

Due to early grazing and multiple opportunities to graze regrowth, **Winfred** can be sown with **Tonic** plantain, **Choice** chicory and red and white clover (e.g. **Relish/Sensation** and **Tribute**) providing a spring sown crop that may last at least 12 to 18 months (Figure 7 and page 17).



Pre grazing mass at which the trial on page 21 was conducted. Results mentioned may vary in taller crops.



Target post grazing residual for **Winfred** to maximise liveweight gain per hectare (see page 21).

Figure 7. Winfred Forage Systems

Option	Spring	Summer	Autumn	Winter	Spring	Summer
1	Winfred Only		Other Rotation			
2	Winfred Only		Direct-drilled Grass			Grass
3	Winfred + Ryegrass					Grass
4	Winfred + Tonic					Tonic
5	Winfred + Choice + Relish/Sensation				Choice + Relish/Sensation	
6	Winfred + Choice + Relish/Sensation		Direct-drilled Grass if Herbs are thin		Herbs, Clovers and Grass	
7			Winfred only		Other Rotations	
8			Winfred + Ryegrass			Grass

Note: Fading colours indicate change in plant composition from brassica to other species.



Winfred forage rape.

Maximising Returns from Winfred

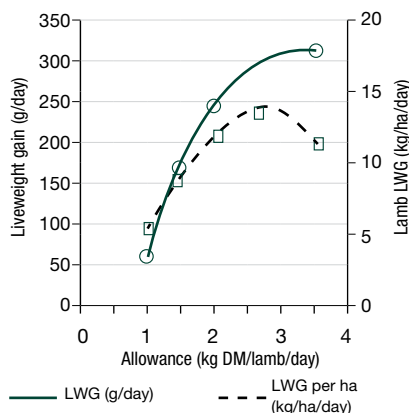
Trials by Agricom have focused on identifying the appropriate grazing management of **Winfred** to maximise animal productivity. The effect of daily allowance on liveweight gain per head and per hectare on mid-height crops in a rotationally grazed system was established (Figure 8).

At low allowances, liveweight gain per hectare was not maximised because despite high stocking rates (92 lambs/ha), lambs grew slowly. Slow growth (50 g/day) was a consequence of restricted intake.

At generous allowances (3.5 kg DM/lamb/day), per hectare production was not maximised because despite lambs growing rapidly (320 g/day), stocking rates were low (38 lambs/ha).

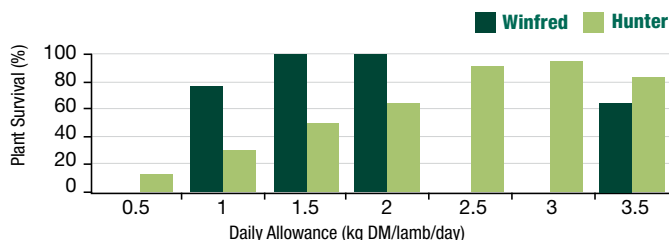
At allowances of around 2.5 kg DM/lamb/day, liveweight gain per hectare is maximised (14 kg LWG/ha/day).

Figure 8. Effect of Daily Allowance of Winfred on Liveweight Gain of Lambs



Further Agricom research has found that moving lambs twice weekly, or weekly, is more productive than longer grazing durations.

Figure 9. The Effect of Daily Allowance (kg DM/lamb/day) on Plant Survival (Hunter Measured at 7 Allowances, Winfred only Measured at 4 Allowances)



Increasing grazing intensity, (i.e. low daily allowance), and consequently leaving a lower post-grazing residual, had a minor effect on the survival of **Winfred** plants, but a much larger effect on **Hunter** plants (Figure 9). Heavy grazing removed up to 70% of **Hunter** plants but only 20% of **Winfred** plants. Plant survival is an important component of regrowth yield.

Suggested Sowing Time	Mid October to early November	February to March
Suggested Sowing Rate (kg/ha)	3-4 alone 2.5-3 with herbs and clovers	3-4 alone 1-2 with short term ryegrass
Time to First Grazing	10-12 weeks	10-12 weeks
Number of Potential Grazings	3-4	1-2
Potential Yield (t DM/ha)	10-12*	5-8*

*Depending on number of grazings

- Early-maturing, 10-12 weeks
- Regrowth potential for 3-4 grazings
- Fast recovery from grazing with excellent subsequent yields
- Ideal for mixing with herbs and clover

Maximising productivity per hectare comes from optimising grazing parameters. To achieve maximum liveweight gain per hectare, lamb producers grazing mid-height crops (75 cm) should look for stock to eat essentially all leaf laminae, all petiole, and half the height of the stem.

➔ Please refer to pages 34-37 for grazing management and animal welfare information.

Product Usage

Hunter is a quick growing, leafy turnip, with minimal bulb development and is best suited to multiple-grazings. **Hunter** was selected for vigorous regrowth, resulting in a variety with fast recovery from grazing and excellent ability to yield in the second, third and sometimes fourth regrowth cycles.

Plants are susceptible to drought and aphids, and are best suited to heavier soil conditions with periodic summer moisture and/or irrigation.

Hunter is an ideal crop for lamb finishing and suitable for most stock classes.

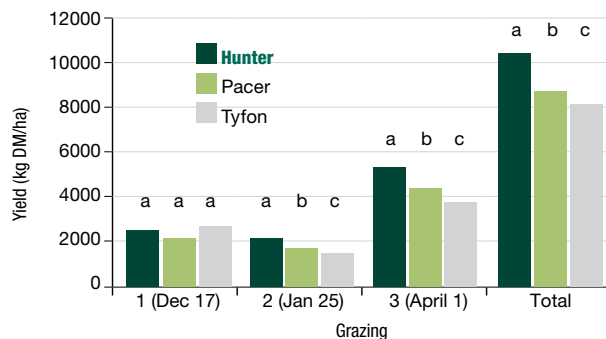


Hunter can be ready for grazing 6-8 weeks after planting.

Performance

**Figure 10. Hybrid Brassica Drymatter Production Trial
Lincoln, Canterbury**

Sown 25/10/07, Average Rainfall 660 mm Supplementary
Irrigation of Approximately 80 mm



Statistical Significance:

Letters that are different indicate a statistical difference while the same letter indicates no difference.

Quick Guide to Hunter Grazing Management



Residual too low – eating too much of crop

- High stocking rates, but animals growing slowly
- Low LWG/ha - 1.7 kg LWG/ha/day
- Eating 80% of forage on offer



Residual to maximise liveweight gain per hectare

- Optimal stocking rates and animals growing quickly
- Maximum LWG/ha - 12.4 kg LWG/ha/day
- Eating 65% of forage on offer



Residual too high – not eating enough of crop

- Low stocking rates and animals growing quickly
- Moderate LWG/ha - 7.2 kg LWG/ha/day
- Eating 35% of forage on offer

Maximising Returns From Hunter

Leafy turnips like **Hunter** have become a widely used feed source for finishing lambs. It is common to set-stock lambs on the crop and draft them off as they reach target weights. A trial by Agricom suggests it is unlikely this grazing management makes the most efficient use of the **Hunter** crop.

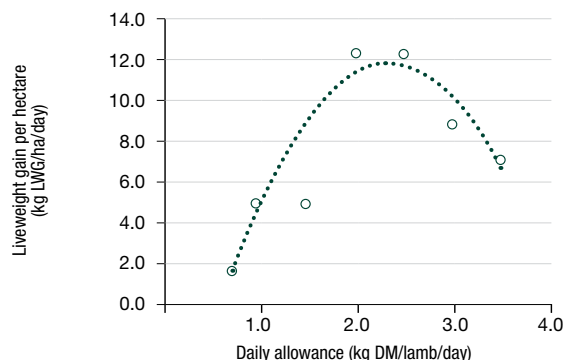
The trial investigated the effect of daily allowance on the production of liveweight per hectare in a rotationally grazed **Hunter** finishing system, with the view of determining optimum grazing parameters.

At allowances of 1 kg DM/lamb/day or less, where grazing residual was low, the crop produced little regrowth, lamb growth rates were poor (25-75 g/day) and production per hectare was not maximised (2-5 kg LWG/ha/day).

At generous allowances (3.5 kg DM/lamb/day) where grazing residual was high (3000 kg DM/ha) and where lamb growth rates were high (300 g/day), per hectare production was still not maximised (7 kg LWG/ha/day) because of low stocking rates.

The key message from this work was that per hectare productivity was maximised (12 kg LWG/ha/day) at an allowance of 2.0-2.5 kg DM/lamb/day where lambs ate 65% of the crop and grew at nearly 300 g/day. Grazing residual, also has a dramatic effect on the survival of **Hunter** plants (Figure 9, page 21).

Figure 11. Effect of Allowance on Production Per hectare



Suggested Sowing Time	Mid October to November	February possible
Suggested Sowing Rate (kg/ha)	4	4
Time to First Grazing	6-8 weeks	8-10 weeks
Number of Potential Grazings	3-4	2-3
Potential Yield (t DM/ha)	10-12*	10-12*

*Depending on number of grazings

- Early-maturing from spring sowing, 6-8 weeks with minimal ripening requirement
- Excellent quality forage for finishing animals through the summer months
- Fast recovery from grazing with excellent subsequent yields
- Strong plant survival from multiple-grazings



Please refer to pages 34-37 for grazing management and animal welfare information.

Product Usage

Sovereign is a very popular kale that combines excellent quality with a good yield potential. **Sovereign** has a very high top end yield potential, although average yields are around 12-14 t DM/ha, depending on management and environment.

The majority of **Sovereign** sowings occur from late November through to mid December. These sowing dates maximise winter feed yield potential for dairy cows, heifers, sheep and beef. Earlier sowings can be used, and these are often lightly grazed by lambs through February, before being used for winter feed by other stock classes.

Sovereign can be successfully sown from late January to mid February for mid-to-late winter feed. These later sowing dates provide a lower yield potential, more similar to rape, but a very high quality feed with excellent utilisation potential for heifers, hoggets, deer and even lambs.

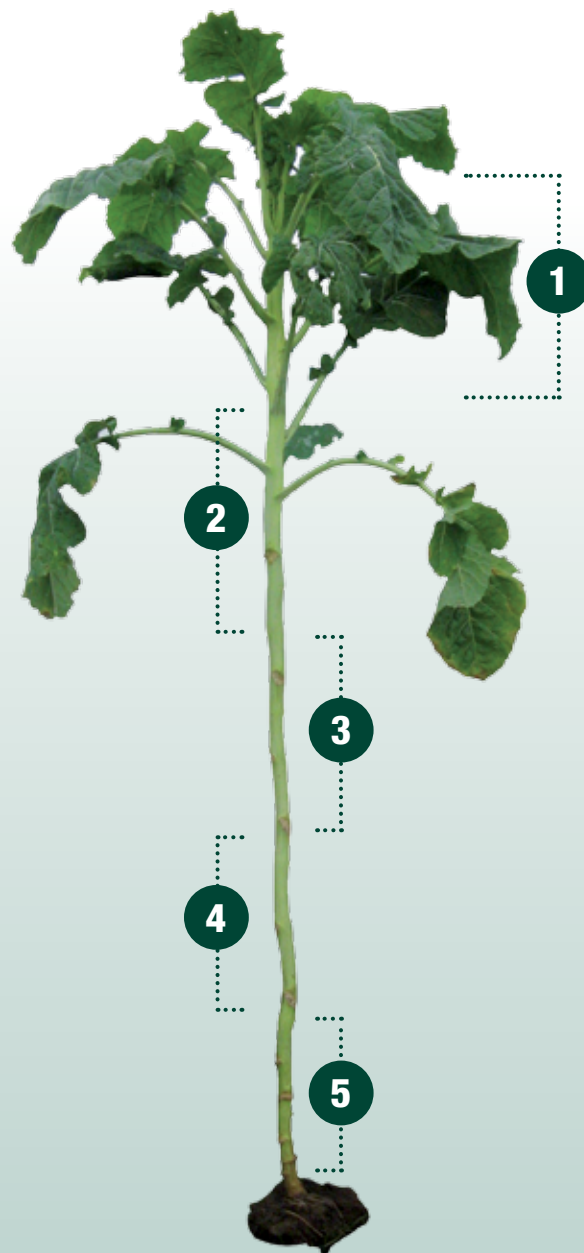
Table 5. Composition (% of total DM) and Crude Protein Content (CP%) and its Impact on Diet Protein Content for Different Kale Types

PLANT PART	Giant Types			Sovereign		
	% of Total DM	CP % DM	Diet* Crude Protein %	% of Total DM	CP % DM	Diet* Crude Protein %
1 LEAF	24	17.7	17.7	44	16.7	16.7
2 UPPER STEM	17	9.5	14.3	11	10.0	15.4
3 UPPER MID	19	6.2	11.7	14	7.3	13.7
4 LOWER MID	20	5.7	10.2	15	5.9	12.3
5 LOWER	20	4.5	9.0	16	5.6	11.2

*Diet CP% refers to the average CP% of the diet as more kale components are eaten.

Where grazing management results in the whole kale plant being consumed, crude protein intake may be marginal particularly if straw or other low-protein supplements are used. For dry cows a crude protein level of 12-14% is required (DairyNZ Farm Fact 1-13).

At an 84% utilisation a **Sovereign** diet would supply 12.3% crude protein but at 80% utilisation giant types would only supply 10.2% crude protein. In this situation a supplement with a higher amount of protein is likely to be needed.



Understanding Your Kale Plant – Grazing Implications

Crop Yield

Crop yield is heavily influenced by a number of factors including soil fertility and environmental conditions through the growing season.

Kale Plant Composition

There is considerable variation between kale cultivars in the relative proportion of leaf and stem, and the various qualities of these plant components. In general, **Sovereign** has a higher percentage of leaf than giant types. This difference in composition is consistent, but the actual proportions are influenced by environmental conditions.

The leaves of kale plants are high quality regardless of the type of kale.

The quality of the stem of kale decreases from the top to the bottom (Table 6).

Sovereign generally has a higher quality throughout the stem than giant types. From the middle of the kale stem to ground level, quality reduces quickly to low levels at the bottom of the plant.

Table 6. Composition (% of total DM) and Metabolisable Energy Content (MJ ME/kg DM) and its Impact on Diet ME Content for Different Kale Types

	Sovereign			Giant Types		
PLANT PART	% of Total DM	Energy (MJ ME/kg DM)	Diet ME* (MJ ME/kg DM)	% of Total DM	Energy (MJ ME/kg DM)	Diet ME* (MJ ME/kg DM)
❶ LEAF	44	12.9	12.9	24	12.7	12.7
❷ UPPER STEM	11	12.4	12.8	17	11.6	12.2
❸ UPPER MID	14	11.6	12.6	19	9.7	11.4
❹ LOWER MID	15	9.4	12.0	20	9.8	11.0
❺ LOWER	16	8.6	11.5	20	6.6	10.1

*Diet ME refers to the average quality of the diet as more kale components are eaten.

Implications of Utilisation for Diet Quality

When aiming to improve body condition of cows grazing kale it is important to understand the influence of utilisation on total diet quality. When 84% is utilised the overall diet quality for **Sovereign** (12 MJ ME/kg DM) is higher than giant types (11 MJ ME/kg DM).

To achieve the same diet quality relative to **Sovereign** at 84% utilisation, giant types could only be utilised to 50% and much more of the stem would have to be left ungrazed.

Suggested Sowing Time	Late October	Late November to late December	Late January to Mid February
Suggested Sowing Rate (kg/ha)	4	4	4
Time to First Grazing	14-16 weeks	18-24 weeks	14-18 weeks
Number of Potential Grazings	2	1	1
Potential Yield (t DM/ha)	Accumulated = 14-15*	Average = 10-14 Top = 18+	8-10

*Depending on number of grazings

- Medium-tall kale with excellent yield potential
- Late flowering variety that maintains leafy crops into early September
- Good leaf-to-stem ratio for its yield potential
- Thinner stemmed variety, particularly when compared to giant kales



Please refer to pages 34-37 for grazing management and animal welfare information.

Suggested Sowing Time	Late November to early December
Suggested Sowing Rate (kg/ha)	0.5 in 60 cm ridges 1.0 in 20 cm rows 1.5 broadcast
Time to First Grazing	24-30 weeks
Number of Potential Grazings	1 (It may be possible to graze the tops in February-March)
Potential Yield (t DM/ha)	Average = 10-14 Top = 18+

- Excellent dry rot tolerance
- Early maturity, yellow-fleshed first crop swede
- Palatable swede, ideal for all classes of stock
- Very good table swede

➔ Please refer to pages 34-37 for grazing management and animal welfare information.

Product Usage

Domain is a dry rot tolerant, yellow-fleshed swede. **Domain** is an early maturity traditional swede and is very similar in growth habit to Doon Major and **Dominion**.

Traditional types of swedes such as **Domain** are not particularly leafy in nature and often produce and maintain lower leaf yields than the more modern higher yielding swedes available today. They also are characterised by lower bulb drymatter percentages – this is often related to softer bulb types. **Domain** is suitable for sheep, dairy, beef and deer and this type of swede is ideal for younger stock classes.

Domain has shown very high tolerance to dry rot, however it has no improved clubroot tolerance and is not recommended as a second crop swede and should not be sown after any other brassica.

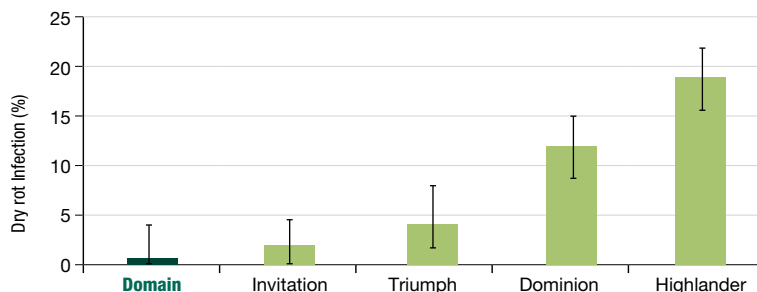
Domain is an early maturing soft swede which is often preferentially grazed in May and early June. As **Domain** is a palatable swede, the practice of grazing the leaf with lambs and hogget's in autumn requires careful monitoring as the chipping of bulbs can occur very early in the grazing. Bulb chipping can lead to diseases infecting the damaged bulb prior to the main grazing period.



Domain is very palatable.

Figure 12. Percent Infection of Dry Rot in Swede Cultivars

Combined averages from three trials in Gore Plant and Food Research (2009, 2010 & 2011) where all swedes presented were present in all three trials and dry rot occurred



Statistical Significance:

Those cultivars whose error bars do not overlap are significantly different from each other at the 95% confidence level. Those cultivars whose error bars do overlap are not significantly different from each other.

Product Usage

Triumph is a very high yielding yellow-fleshed swede with good dry rot and mildew tolerance. This new generation swede has a uniform bronze/purple skinned bulb and very good leaf holding characteristics.

Triumph is defined by its very high yield potential for a swede and is one of the highest yielding swedes to come through our breeding programme. **Triumph** has an intermediate bulb drymatter percentage, higher than **Domain**.

Triumph has shown high tolerance to dry rot, however it has no significant improvement in clubroot tolerance and is not recommend as a second crop swede and should not be sown after any other brassica.

Triumph is highly suitable to all farm systems that require high yielding swede crops. It is suitable for ewes, deer and is particularly suitable for dairy support.

Like all brassicas, **Triumph** requires good establishment management, climatic conditions and fertiliser use to fully express its yield potential.

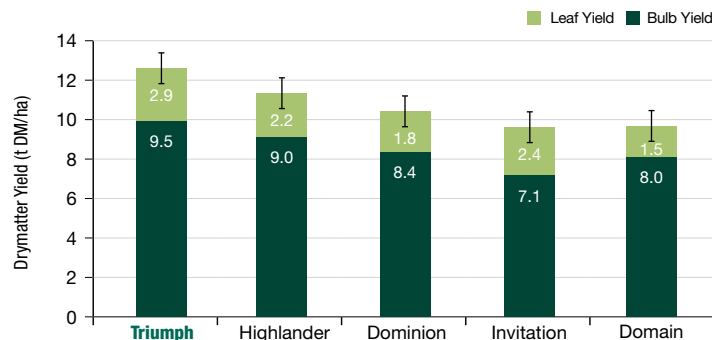


Triumph is very high yielding.

Suggested Sowing Time	Late November to early December
Suggested Sowing Rate (kg/ha)	0.5 in 60 cm ridges 1.0 in 20 cm rows 1.5 broadcast
Time to First Grazing	24-30 weeks
Number of Potential Grazings	1 (It may be possible to graze the tops in February-March)
Potential Yield (t DM/ha)	Average = 12-14 Top = 18+

Figure 13. Drymatter Production of Swede Cultivars

Combined averages from six trials at Gore Plant and Food Research (2009, 2010, & 2011), Chertsey (2010), and Methven (2011, 2012) of cultivars present in all six trials



Statistical Significance:

Those cultivars whose error bars do not overlap are significantly different from each other at the 95% confidence level. Those cultivars whose error bars do overlap are not significantly different from each other.

- Very high yielding, yellow-fleshed, main-crop swede
- Leafy swede with good leaf retention in winter
- High dry rot tolerance
- Suitable for all stock classes



Please refer to pages 34-37 for grazing management and animal welfare information.



	Rival	New York	New York
Suggested Sowing Time	Late October to early November	Late October to early November	January to February
Suggested Sowing Rate (kg/ha)	Varies depending on quality of paddock preparation-range 1.5-3	Varies depending on quality of paddock preparation-range 1.5-3	1-2
Time to First Grazing	12-14 weeks	16 weeks	18-20 weeks
Number of Potential Grazings	1	1	1
Potential Yield (t DM/ha)	Average = 8-12 Top = 14+	Average = 8-12 Top = 14+	Average = 6-8

Rival

- Early-maturing diploid summer turnip approximately 12-14 weeks
- Excellent leaf production and leaf holding
- Tankard bulb with high proportion above ground

New York

- Medium-maturity turnip at approximately 16 weeks
- Excellent yield potential with an improved leaf-to-bulb ratio
- Bred for improved turnip mosaic virus tolerance
- Full-leaved variety (not segmented)

➔ Please refer to pages 34-37 for grazing management and animal welfare information.

Rival

Rival is ideally used as part of a pasture renovation programme on dairy farms that have a period of dry weather, or a loss of pasture quality, through January and February.

Growing a **Rival** crop provides a standing volume of high energy and protein feed, which helps maintain milk production under periods of environmental stress. **Rival** is a high-performing cultivar, with a higher leaf proportion than some other turnip varieties, ensuring high quality at grazing.

New York

New York is a modern version of a traditional late autumn and early winter feed turnip. It has also performed very well as a spring sown medium to late-maturity summer turnip, and fits very well in conjunction with **Rival**, where the early grazed **Rival** makes up two thirds of the area and **New York** provides the last third of the area to be grazed.

When used as a winter feed crop, bulb development as in all late summer sown turnips is heavily influenced by how early the crop is sown and how much space each plant has to develop significant bulbs. **New York** is often mixed with Italian or annual ryegrass, where the increased competition often limits final bulb size. In these circumstances the extra leaf production becomes invaluable at that time of the year.

New York has performed strongly as a later-holding summer turnip.

Summer turnips should never make up more than 5 kg DM/day, or one third of a milking cow's diet.



Rival turnip is white-fleshed with a tankard bulb shape.



New York turnip is white-fleshed with an oval bulb.

Brassica Seed Treatment

The first four to six weeks after sowing is a critical stage in the life of a new plant as seedlings emerge and develop their plant structures. Sowing treated seed is a simple and cost effective means of helping to ensure a brassica crop establishes successfully, so that it has the opportunity to reach its genetic potential in terms of yield and quality.

The Ultrastrike and Superstrike brassica seed treatments are insecticide and fungicide based products that provide broad spectrum protection against economically damaging insect pests and fungal diseases during the plant establishment period. The seed treatments are highly targeted and apply only very small quantities of chemical active ingredients to the soil, reducing the impact on the environment and the need to handle chemicals on farm.

Ultrastrike and Superstrike Brassica Product Profiles

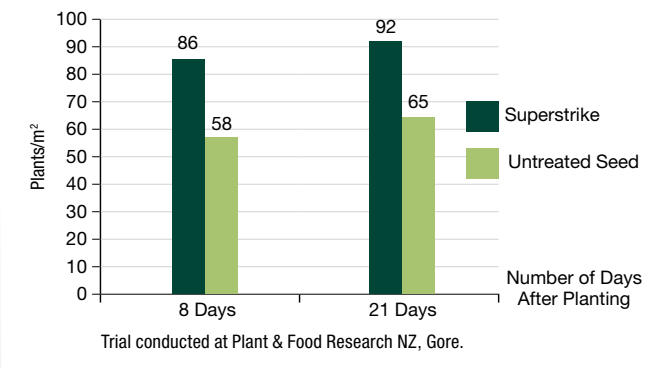
	Ultrastrike brassica	Superstrike brassica
Insect Protection	Springtail Aphids Argentine Stem Weevil Wheat Bug (<i>Nysius</i>)*	Springtail
Disease Protection	<i>Fusarium</i> <i>Pythium</i> <i>Rhizoctonia solani</i>	<i>Fusarium</i> <i>Pythium</i> <i>Rhizoctonia solani</i>
Nutrients	Molybdenum	Molybdenum
Sowing Rate	Same as for untreated seed	Same as for untreated seed
Recommended Use	Winter crops Autumn sown crops Direct-drilled crops	Summer crops Winter crops, in areas where springtail is the main insect threat during establishment

*In situations conducive to high *Nysius* pressure, where a brassica crop is sown next to a lucerne paddock or is established under hot, dry conditions, a foliar insecticide application may be necessary 2-3 weeks after sowing to enhance protection.

Visit www.seedtreatment.co.nz for more information on Ultrastrike and Superstrike seed treatments.

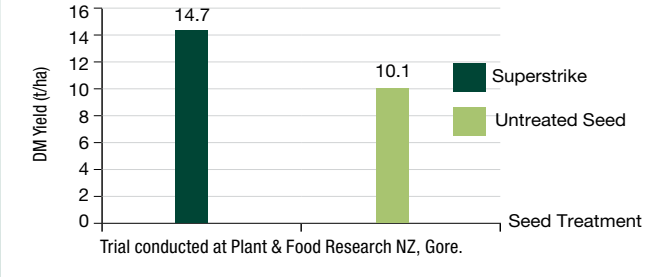
Plant Establishment

Figure 14. Establishment of Superstrike Treated and Untreated Kale Seed Under Springtail Pressure



Crop Yield

Figure 15. Drymatter Production of Superstrike Treated and Untreated Kale Seed, 207 Days After Sowing



Establishment of Ultrastrike treated brassica seed under springtail and aphid pressure.

Brassica Crop Husbandry

Successful Brassica Establishment

Planning

Planning is the key to success. Your planning checklist should include the following:

Paddock selection

Questions to ask when selecting paddocks;

- Which paddocks have poor performing pastures? Have undesirable species? Low legume content?
- Has fertility status been limiting pasture production? Will this need addressing to ensure a good brassica crop and a successful renovation phase?
- Is the paddock selected in close proximity to a run-off paddock, supplementary feed source and water supply?
- How easily will the paddock be subdivided?
- Is the right farm equipment available for successful subdivision or paddock water supply requirements etc?
- What is the proposed crop sequence for this paddock?
- Do any other issues need addressing prior to a permanent sow-down, e.g. elimination of volunteer ryegrass before **AR37/AR1** endophyte ryegrass establishment?

Pre-sowing preparation

- Successful weed control starts with careful identification of species, growth stage and vigour. This will determine herbicide selection. Seek advice from a technical representative for specific recommendations
- Early workings should aim to stimulate weed germination (ideally 2 months pre-sowing)
- Aim for a moist, fine, firm seedbed, allowing the small brassica seed to be planted at an even 1 cm depth

Planting

Conventional cultivation

Conventional cultivation is generally the most reliable way of eliminating weeds and establishing brassicas. Best practice is the broadcasting of fertiliser prior to planting. For a minimal pass operation, pull hoses out of coulters and drop fertiliser in a surface band, with incorporation by light harrowing and rolling.

Direct-drilling

Direct-drilling is suitable if spray control of weeds is successful and fertiliser applications are considered carefully. For detailed information on no-tillage and direct-drilling refer to “Successful No – Tillage in Crop and Pasture Establishment”, Ritchie *et al.* (2000).

Nitrogen (N) applications are a key component of successful establishment from direct-drilling. Under no-tillage regimes, crop residues are broken down by microbial activity (not burning, oxidation or mineralisation as in tillage systems) that temporarily locks up nitrogen. Therefore N will not be available at the time of the brassica establishment, and hence this delay in N availability needs to be compensated for at sowing time.

Ridging

Ridging effectively provides a raised seedbed for establishment away from excess moisture. It is best suited to use in wetter climates.

Broadcasting

Broadcasting, (the scattering of seed onto a worked seedbed), can be successful, but a higher sowing rate and subsequent light harrowing and rolling is recommended.

Fertiliser guidelines for brassicas

Refer to individual species for specific sowing information. Best practice establishment techniques should include the use of a commercial seed treatment for seedling protection (page 29).

Typically, less productive pastures are sown out into brassicas, often meaning they are established into less than optimum conditions. Brassicas tend to differ from other crops in certain aspects of their fertiliser requirements. Brassica yields are sensitive to nitrogen and phosphorus status. In addition, boron deficiency may impact on plant health, especially in the bulb brassicas. The seed is particularly prone to germination injury if soluble fertiliser or boron is placed too near the seed. Inappropriate levels of certain nutrients can induce animal disorders e.g. the sulphur compound S-Methyl Cysteine Sulphoxide (SMCO).

Table 7. Optimum Soil Fertility Status (MAF Quick Test)

Soil test	Ranges (for near maximum production)
Olsen P	20-30
Sulphate-S	3-8
Soil test K	5+
Soil test Mg	8+
pH	5.9-6.2

Table 8. General Fertiliser Application*

Nutrient	Short Term Crop (6,000-10,000) kg DM/ha	Long Term Crop (10,000-18,000) kg DM/ha
	Application (kg/ha)	
Nitrogen**	50-100	100-250
Phosphate	40-60	50-80

*When optimum soil fertility is present, the following fertiliser needs to be applied to support good crop growth.

**Split dressing of 25-50 kg N/ha at sowing and 25-50 kg N/ha 4-6 weeks after sowing.

For paddock specific fertiliser recommendations contact your local fertiliser representative.



Kale is very responsive to nitrogen. The above photo shows the effect of a fertiliser spill on growth.

Phosphorus (P)

Early purpling, stunted and erect leaves are an indicator of P deficiency (this can also be induced by cool weather, so herbage testing is the best form of identification).

In many cases farmers do not see brassica crops reach their full potential because P levels are limiting growth. Ideally P status should be 20+. Low inputs (20-30 kg P/ha) are only suitable for high fertility soils or where crop yield is not important. Most crops will benefit from rates of 40-50 kg P/ha, and swedes at a higher rate of 60-70 kg P/ha. DAP is a good way to provide P to brassicas. The opportunity for lifting of P status should also be considered at this time.

Sulphur (S)

Sulphur deficiency is characterised by stunted, pale or yellowed growth (particularly the young growth) and leaf curling and distortion. It is not necessary to use sulphur on brassicas unless S levels are low (2-3 mg/kg).

Boron (B)

The condition “brown heart” in bulb brassicas is the most common symptom of boron deficiency. Other brassicas may show swelling, hollowing, browning and rotting of stems.

Brassica crops have a greater requirement for B than grasses. Boron deficiencies are more likely to occur on light textured soils with less organic matter to retain soil B from leaching. Do not put boron down the spout with the seed (see Table 9B, page 33) on brown heart.

Nitrogen (N)

Paleness (yellow and/or reddening and old leaf dieback) usually indicates N deficiency. The amount of N required for successful crop growth is dependent upon the paddock history. When establishing a brassica into a runout pasture, the crop will require starter N and several side dressings of urea. This is especially true in direct-drilling situations. Applications of 90-100 kg/ha of urea per dressing are sufficient. Nitrogen can be applied directly after grazing for the multiple-grazing summer brassicas, although vigilance to any stock health issues is recommended at the next grazing. Starter N only may be enough in areas where N levels are good. Excessive N will increase the risk of nitrate problems with grazing stock, and increase leaf growth at the expense of bulb growth in bulb crops.

Soil pH

Brassicas can tolerate a range of pH levels, but prefer levels above 5.7. Liming will reduce clubroot infection and increase soil molybdenum availability. Lime works best when incorporated into soil.

Brassica Pests and Disease Guide

Brassica establishment can be compromised by occasional, localised, and seasonal, pest and disease attack. Their impact can usually be minimised by management. Once established, brassicas are normally relatively disease-free compared with other crops.

Table 9A. Key Pests and Diseases Affecting Brassica Seedlings		
Condition	Impact on Plant	Control
Seedling Insect Pests		
Springtails (<i>Bourletiella spp.</i>)	Attack cotyledons and emerging plants, smooth edge damage, damaging until the 4th leaf stage	Ultrastrike or Superstrike seed treatment, chemical, crop rotation and hygiene
Greasy Cutworm (<i>Agrotis ipsilon aneituma</i>)	Plants, especially seedlings ripped off at or just below ground level, young plants wilt	Chemical, crop rotation and hygiene
Grass Grub (<i>Costelytra zealandica</i>)	Adults attack young growing points, larvae attack seedling roots	Chemical
Wheat Bug (<i>Nysius huttoni</i>)	Ring barking of seedlings at ground level leaves plants susceptible to other attacks, damage is similar to that caused by wirestem	Ultrastrike + chemical
Weevils (<i>Catopes spp.</i>)	Chew cotyledons or stem at ground level, scalloping of leaf edge	Chemical
Slugs (many species)	Creates severe damage to brassica plants by destroying seedlings	Minimise crop residual or trash before direct-drilling, use slug baits, cultivate paddocks
Seedling Fungal Diseases		
Wirestem/Strangles (<i>Rhizoctonia solani</i>)	Brown lesions at ground level, narrowing of root and stem base, often caused by strangles, damage similar to that caused by wheat bug. Wirestem/Strangles-damage to sap flow from abrasion at ground level by wind etc. Affected tissue susceptible to fungal attack (wirestem)	Ultrastrike or Superstrike seed treatment, chemical
Damping off/(<i>Fusarium</i> and <i>Pythium</i>)	Affects seedlings in the first few weeks after sowing. Infected seedlings either fail to emerge or recently emerged plants can collapse, with plants revealing shrivelling and discolouration at the shoot base	Ultrastrike or Superstrike seed treatment



Aphids.



Springtail.



Nysius.

Table 9B. Key Pests and Diseases in Established Brassica Crops

Condition	Impact on Plant	Control
Plant Pests		
Aphids (many species)	Sap suckers that weaken plants, reduce yields, carry viral diseases, mainly attack summer crops	Tolerant cultivars to certain aphid species, Ultrastrike seed treatment, chemical
Diamondback Moth (<i>Plutella xylostella</i>)	Young larvae burrow in and feed on internal leaf tissue, older larvae feed on lower leaf surfaces, larvae damage is often holes, some quite large, similar to white butterfly caterpillar	Chemical
White Butterfly (<i>Pieris rapae</i>)	Leaf feeding leaves skeletonised leaf with leaf ribs remaining	Chemical
Leaf Miners (many species)	Larvae create tunnels and live within leaf tissue, tissue damage may reduce photosynthetic activity and cause leaf yellowing, premature leaf death, and limit growth at this time. Damage is similar to that caused by Diamondback moth	Chemical
Crop Viruses		
Turnip Mosaic	Stunted growth, mottling and crinkled leaves, yellowing, leaf death, poor bulb development	Control of vector aphids
Beet Western Yellows	General stunted growth, purpling of leaves	Control of vector aphids
Cauliflower Mosaic	Poor vigour, can attack all brassica species	Control of vector aphids
Crop Fungal Diseases		
Clubroot (<i>Plasmodiophora spp.</i>)	Causes irregular swelling of root, leaf wilting, stunted growth and plant death	Crop rotation (6 years in high risk areas), hygiene, reduce double cropping
Dry Rot (<i>Leptosphaeria maculans</i>)	Affects swedes mainly, small sunken brown-grey circular spots on leaf or bulb neck, plant death	Crop rotation and hygiene, more tolerant cultivars, reduce double cropping
Ring Spot (<i>Mycosphaerella brassicicola</i>)	Small dark spots on older leaves in cool wet conditions	Crop rotation
Leaf Spot (<i>Alternaria spp.</i>)	Small dark lesions and dark sooty mould on leaves, may lower yields	Chemical
Black Rot (<i>Xanthomonas campestris</i>)	Attack on vascular system in warm humid conditions, yellowing of leaf margins, wilting, leaf loss	Crop rotation
Rust	Orange spores cover leaf surfaces. Effect on yield is yet to be confirmed	Research on-going
Powdery Mildew	White powdery substance on leaf surface. Evidence suggests a yield reduction may occur	Research on-going
Crop Nutrient Deficiencies		
Brown Heart	Boron deficiency, affects bulb crops	Soil testing, Boron fertiliser application

Adapted from: Charlton & Stewart. (2006). Pasture and Forage Plant for New Zealand, 3rd edition.
 Please refer to pages 34-37 for detailed brassica grazing management and animal welfare information.

Brassica Grazing Management and Animal Welfare

Best Practice Grazing

The successful grazing of livestock on brassicas requires farmers to be aware of a number of factors that may impact on the productivity and health of animals. To successfully achieve the desired outcome (e.g. body condition score gain, liveweight gain or maintenance feeding) from grazing brassica crops, farmers should be aware of a number of factors which may impact on the productivity and health of animals.

Allocation

In many cases, where animal performance does not meet the expectation of farmers, reduced feed intake through poor allocation of feed is a common cause. Fast growing animals require high intakes and where feed is restricted high intakes are not possible. Restricted intake may occur as a result of the daily break in a strip grazing situation being too small for the number of animals or animals spending too long in a paddock in a rotationally grazed situation. Stocking rate being too high in a set stocked system can also restrict intake. Correct allocation is critical for highly productive systems.

Feed Quality

Quality parameters of feed influences stock performance. For young growing animals adequate intakes of energy, protein, macro and trace elements are important for healthy and productive livestock. Specific requirements will depend on liveweight, pregnancy status and desired performance level (e.g. growth rate). Table 10 gives typical values for energy, protein and DM% of a range of feeds to help determine specific requirements.



Table 10. Typical Nutritive Values for a Range of Feeds

Feed Type	Drymatter Content* (%)	Metabolisable Energy (MJ ME/kg DM)	Crude Protein (% DM)
Swedes			
- Top	15	12.5-13.0	15
- Bulb	10	12.5-13.0	12
Kale	15	11.5-12.5	15-20
Turnips			
- Top	13	13.0-13.5	19
- Bulb	9	12.5-13.0	13
Rape	17	12.0	16
Ryegrass/White Clover			
- Winter leafy	14	11.2	26
- Winter Autumn	17	10	20
- Summer-dry	28	8	10
Oats			
- Winter grazing	16	11-12	18
- At time of harvest for green chop cereal silage	18	11	13
Triticale			
- Winter grazing	15	11-12	20
- At time of harvest for whole crop cereal silage	38 ¹	10-10.5	8-10
Fodder Beet			
- Top	10-13	9.7	15
- Bulb**	12-20	11.9	6 (9-11****)

Adapted from: Drew and Fennessy, (1980) and the Lincoln University Farm Technical Manual, and Plant & Food Research Ltd data.

¹Figure adjusted to better reflect ideal harvest timing.

* Drymatter content will vary depending on crop maturity, weather, and cultivar.

** NIAB Association, The Agronomist Handbook 2010/11.

*** In NZ we are getting crude protein (CP) in fodder beet bulbs of between 9 and 11%.

Crop Utilisation

Break feeding (strip grazing) is the best practice for manipulating utilisation rates, diet quality, crop life, and crop regrowth potential. Generally, as crop utilisation increases, animal intake per head decreases.

Transitioning onto a Crop

Transitioning is allowing time for the rumen microbial populations to reach a new equilibrium capable of dealing with a new feed. Theoretically this process takes 21 days to be fully complete but practically the transition is well enough advanced to minimise issues by 10-14 days. The process usually entails a gradual increase in the proportion of the crop in an animal's diet. This can be achieved by a) the time they are left on the crop each day, or b) the daily crop allocation.

The following guidelines help to limit the effect of diet change through the transition period:

- Introduce animals slowly to a crop, from an initial 2-3 hours to full allocation by 10-14 days. This allows rumen microbes to adjust and may reduce the "grazing check" effect
- Do not introduce hungry animals to the crop. Gorging may occasionally lead to bloat or nitrate poisoning problems

- Offer an alternative source of feed, pasture, hay or silage, during introductory stage and throughout grazing of crop
- Stock performance will be improved if transitions from grass to brassica and back to grass are minimised as much as possible, e.g. use appropriate stocking rates so animals stay on brassicas for the desired time

Why is Fibre Important?

Brassica crops typically are highly digestible, have high ME and protein content but are often low in fibre. Fibre (NDF and ADF) is required for efficient rumen function.

Fibre:

- Helps maintain rumen pH by encouraging saliva production through chewing
- May dilute any possible anti-nutritional plant chemicals and therefore reduce their effect on livestock
- Extends the number of grazing days on the crop, as it supplements animal intake
- Must be palatable so stock can consume it
- May be detrimental to animal performance if there is excessive use of low quality fibre

Note: Ensure stock have ready access to a good supply of drinking water.

Animal Health and Welfare Considerations

Rape Scald

Rape scald is a reaction by livestock to photodynamic plant chemicals in brassicas. Symptoms include reddening and swelling of the skin, commonly on the ears and face and possibly udders of sheep and cattle. Affected livestock generally attempt to seek shade, rub affected areas, and may appear generally distressed. This condition is most commonly seen in lambs grazing immature or second growth rape or other forage brassicas. The risk of rape scald can be minimised by delaying first grazing until crops have ripened (purplish/blue tinge on leaf margin), avoiding excessive nitrogen and sulphur fertilisers, and being vigilant to early signs. Animals with scald should be removed from crop and offered shade. Some cultivars have minimal ripening requirements and are suited to situations when feed is required quickly and/or where ripening may be delayed by climatic conditions.

However, under certain environmental conditions photosensitivity has been known to occur beyond the normal period of ripening.

Photosensitivity From Turnips

Photosensitivity is also possible with dairy cows grazing summer turnips and with other stock classes on summer turnips and leafy

turnips. The cause of this condition is not well understood; for dairy cows the risk factors include: consuming large volumes of turnips (greater than 30% of diet) and feeding on crops under environmental stress. Animals with photosensitivity should be removed from crop and offered shade.

In lambs grazing summer turnips (including **Hunter**) this condition is rare and unpredictable but may be associated with adverse and overcast weather conditions.

This may be of particular concern to stud stock owners, where photosensitivity may cause cosmetic issues to sale animals.

Nitrates

When protein manufacture cannot keep up with nitrogen uptake in plants, the excess accumulates as nitrates, which when consumed are converted to nitrites in the rumen and can cause toxicity problems to grazing animals. This may occur in most pasture species when nitrate levels (as KNO₃) reach 5% of the drymatter. When animals ingest high levels of nitrates, nitrites build up in the bloodstream. Here they bind with the oxygen-carrying compound, haemoglobin, to form a compound that no longer is able to carry oxygen. Simply, the animal suffers oxygen deprivation.

The most common symptom of nitrate toxicity is sudden death, but prior to death, excessive salivation, rapid gasping breath, rapid pulse (>150 beats/min), pale blue or brown colouration of membranes, tremors, and muscle weakness may occur. Pregnant animals surviving may abort.

Nitrates can build up in any situation where environmental conditions promote plant growth but limit photosynthetic activity. These include sudden temperature changes, dry periods followed by rain, frost, shading, overcast days, insect damage, some herbicides, some nutrient deficient soils, excessive nitrogen fertiliser use, soils with deficiencies in sulphur, phosphorus, molybdenum, or high acidity levels. Nitrate toxicity can occur on a range of grasses, brassicas, forage cereals and weeds. Young plants and plant material close to the ground are more likely to have high nitrate levels.

Awareness and Management of Nitrate Problems

- Recognise environmental conditions that cause nitrate build up
- Get suspect crops analysed before grazing
- Introduce stock gradually to allow rumen adjustment
- Do not put hungry animals onto suspect crops
- Avoid overstocking of suspect crops as high grazing pressure will increase the amount of high-nitrate plant parts eaten
- When strip grazing, watch utilisation levels or graze for short periods
- Dilute high nitrate feed with a low nitrate feed source, e.g. hay, pasture, silage
- Make high nitrate forages into silage. Fermentation generally reduces nitrate levels
- Manage nitrogen applications carefully to match plant requirements, and therefore avoid excess uptake and nitrate build up
- Do not allow animals access to nitrogen fertilisers, fertiliser storage areas, fertiliser spills, or grazing on recently fertilised paddocks
- Take care when using nitrogen fertiliser around waterways, to avoid nitrate build up in drinking water
- Ensure that soil nutrient levels are in the optimum range for your farming system, as some nutrient deficiencies lead to nitrate build up
- Healthy animals are less likely to be affected than animals in poor health
- Remember that nitrate levels in animals are a combination of the nitrate consumed in their feed and their drinking water

Treatment of Nitrate Toxicity

- Remove stock to low risk pasture
- Seek emergency veterinary assistance

SMCOs, Kale Anaemia, Red Water

As the name suggests this disorder is most commonly found when animals graze kale, however it can occur in all brassicas. It is most likely to occur in brassicas that have bolted or are flowering in spring. It may also become a problem if crops are grown in soils high in sulphur, or after sulphur fertilisers have been used.

Brassicas contain a non-protein amino acid called S-methyl cysteine sulfoxide (SMCO). During rumination SMCO is converted into a compound that can potentially damage the red blood cell membrane, allowing leakage of haemoglobin from the cell and ending up in the urine (hence the term red water).



Moderate levels of SMCO may cause loss of appetite, ill thrift, mild anaemia and digestive upsets. High levels can cause severe anaemia and red coloured urine (red water). After an attack of poisoning, death can occur suddenly.

Follow best practice guidelines for feeding brassica crops, e.g. slow introduction, access to an alternative feed source etc. Be vigilant if you are grazing a crop that has started flowering and suspect there may be a problem. Soil testing prior to sowing will indicate the levels of key nutrients, including sulphur, and assist in applying the right fertiliser for good crop growth. Ideally, limit the applications of sulphur and nitrogen.

If kale anaemia is suspected, remove animals from the crop and keep under close watch until health is regained.

Goitre

In some situations iodine deficiency can occur when livestock are fed on brassica crops. This is because brassicas are naturally low in iodine and contain plant chemicals which are goitrogenic and inhibit iodine uptake. Iodine is important for growth and cell differentiation of tissues through its inclusion in thyroid hormones. Consequently, iodine deficiency has its greatest effect on the developing foetus and therefore may play an important role where pregnant livestock graze brassicas for extended periods in the final stages of pregnancy. The most marked sign of iodine deficiency is enlarged thyroid glands (goitre), but weak newborn lambs, low birth weights and a high rate of perinatal mortality, may be subclinical signs along with poor wool growth and lower fertility in older stock. Be aware of the iodine status of pregnant livestock grazing a brassica crop and consider an iodine supplement.

Trace Elements

There is some evidence that animals grazing solely brassica crops do not receive sufficient trace elements and begin to deplete their liver stores. A trace element supplementation programme should be considered if animals are offered a sole diet of brassica for an extended period, or animals have a low trace element status prior to crop introduction. This may require soil, herbage and blood analysis and consultation with your veterinarian to establish current trace element status and the appropriate supplementation programme.

Mixing herbs and clovers with brassica crops is a strategy that may assist with increasing trace element availability to stock (refer pages 38-45).



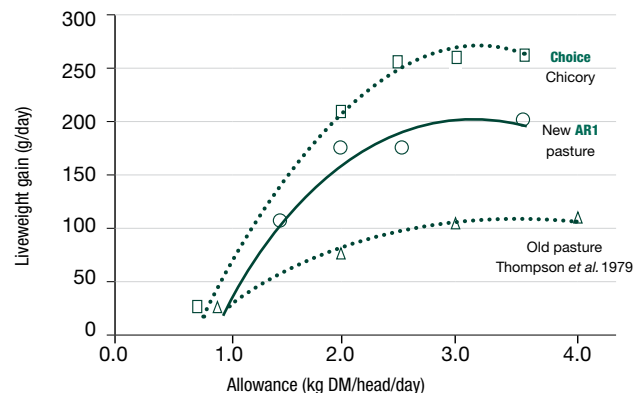
Choice was bred in New Zealand by AgResearch Grasslands, the breeders of the original forage chicory, Grasslands Puna.

Choice was bred from true perennial chicory parents under grazing evaluations and selected for high drymatter production, improved cool season growth and recovery after grazing.

Choice has performed very well in industry trials, showing high drymatter production and good grazing ability.

Choice chicory is a perennial herb with a deep tap root, high forage quality, and high warm season pasture growth. It has been thoroughly proven on farms, and in research, to substantially improve production both per animal and per hectare in sheep, deer and dairy cows.

Figure 16. Liveweight Gain of Lambs Offered Various Allowances of Chicory (Choice) and New and Old Pasture

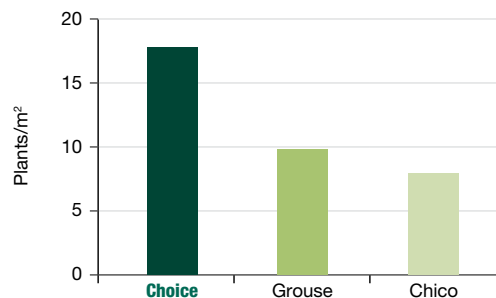


Choice for Sheep and Beef Systems

Standout Points from Current Choice Research and Experience in Sheep and Cattle

- Choice** is a uniform, high quality summer forage with ME's ranging between 11.5-13.0 MJ ME/kg DM
- Average lamb liveweight gains of around 250 grams/head/day are achievable with ranges from 220 to 400 grams/head/day
- High dressing out percentages in lambs and cattle
- Faecal egg counts are reduced in lambs grazing chicory compared with perennial ryegrass
- Chicory carries lower spore counts for facial eczema, and potentially supports lower concentrations of zearalenone.
- Carrying capacities have ranged from 40-70 lambs/ha with an average of 40 on dryland and 55 with irrigation or summer rainfall
- Chicory is a good source of minerals particularly (Zn, Cu, Mg, P, Ca, K)

Figure 17. Plant Density of Chicory Cultivars Measured In 2003 After 2001 Planting-Plants/m² 3 Years After Planting, Kimihia Research Centre, Canterbury



Farmers have recorded higher dressing out percentages in lambs finished on chicory.

Choice for Dairy Systems



Standout Points from Current Choice Research and Experience in Dairy Systems

- 1. Spring sown summer crops of **Choice** with or without clover average around 11 t DM/ha ranging from 8 to 15 t DM/ha in 6-7 months
- 2. As a summer crop, **Choice** is a very high quality feed source with ME's of 11.5 to 13.0 MJ ME/kg DM and crude proteins of 22% to 27% at a time when unirrigated ryegrass can contain both low ME and low crude protein
- 3. When pasture quality is poor (below 10 ME) feeding **Choice** at 20-40% of the diet can increase milksolids production by 17%¹
- 4. Chicory is a responsive species to high fertility and is well suited to effluent paddocks where the deep tap root and high summer growth rates make it ideal for utilising surplus nutrients
- 5. Chicory is an ideal break crop, reducing insect pest build up and providing an opportunity to control difficult weed grasses such as yellow bristle grass

¹Lee & Minneé. (2012). DairyNZ Technical Series, August 2012. Chicory and plantain – your questions answered.



Perenniality
Perennial
Cool Season Growth
High (for chicory)
Growth Habit
Erect
1000 Seed Weight (grams)
1.2
Suggested Sowing Rate (kg/ha)
1-3 mixed stand 6-8 pure stand

- High forage quality
- Improves animal performance (sheep, deer, dairy)
- Higher carcass yields in lambs
- Increases ovulation rate in ewes (up to 22%)
- High summer growth
- Perennial with moderate persistence (3-4 years)
- Good drought tolerance, deep tap root (1.5 m)
- Elevated mineral content (Zn, Cu, Mg, Mn, P, Ca, K)
- Anthelmintic affect in sheep and red deer
- Reduced facial eczema spore levels

Tonic plantain is a broad-leaved, coarse rooted herb that can adapt to a range of soils, rainfall zones and other climatic conditions. **Tonic** is unique as it is an upright cultivar with seasonal drymatter (DM) production strengths in summer, autumn and winter.

Tonic has elevated concentration of minerals such as copper (Cu), sulphur (S), phosphorus (P), sodium (Na), and calcium (Ca) relative to ryegrass. **Tonic** also has consistently increased liver concentrations of Cu, selenium (Se) and cobalt (Co) in both lambs and deer despite a similar plant content of Se or Co compared to ryegrass.

Not all plantains are the same. Animal performance on older cultivars is poor compared to **Tonic**. This is most likely to be a function of their poor winter growth and higher propensity to produce seed head relative to **Tonic**.



Tonic right shows cool-season activity compared to Hercules plantain. Photo taken in May.

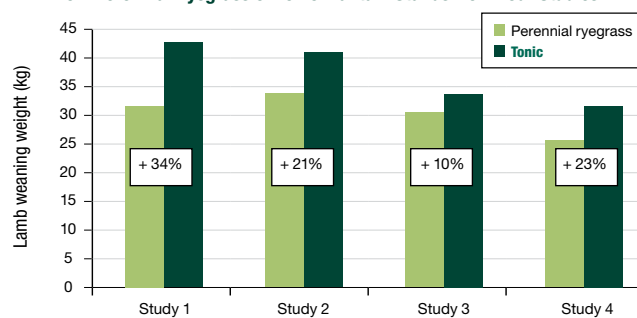
Tonic for Sheep and Beef Systems

Some of the Standout Points from Current Tonic Plantain Research in Sheep and Beef

1. High dressing out percentage in cattle and sheep
2. Ideal grass alternative (substitute) for creating and maintaining high legume content pastures
3. Drymatter production through autumn, winter and early spring similar to perennial ryegrass
4. Fast recovery from hot dry summer conditions
5. Reduced dag production in sheep
6. High mineral supply of copper and selenium

Tonic has a deep, coarse, root system, which gives it a degree of drought tolerance and the ability to respond quickly after summer-dry conditions. Including **Tonic** in a pasture mix will also improve summer pasture quality due to **Tonic's** high quality leaf production and mineral content. Pure stands of **Tonic** can be used during lambing to increase lamb and ewe weights at weaning. The key to this use is the unique trait of high winter and early spring growth compared to other plantains.

Figure 18. Weaning Weight Differences of Lambs Born, Grazed and Weaned from Perennial Ryegrass or Tonic Plantain Stands from Four Studies



Study 1 Judson. (2008). (109 day lactation)

Study 2 Judson *et al.* (2009). (95 day lactation)

Study 3 Judson *et al.* (2009). (87 day lactation)

Study 4 Judson. (2010). Unpublished hogget lambing (hogget 90 day lactation)

Some of the Standout Points from Current Tonic Plantain Research in Dairy Systems¹

1. **Tonic** plantain can produce over 19 tonnes of drymatter per hectare per year in the Waikato
2. When the metabolisable energy (ME) of ryegrass was moderate (10.5 ME) milk yield was similar from cows fed ryegrass alone or ryegrass supplemented with **Tonic** plantain
3. When the ME of ryegrass was poor (9.6 ME) supplementing ryegrass with **Tonic** plantain increased cow drymatter intake (DM) by 6% and milksolids (MS) yield by 19%
4. Feeding **Tonic** plantain at up to 40% of diet did not affect rumen pH, and had no apparent ill effects on rumen health
5. The urinary N content was 28% lower in cows supplemented 40% **Tonic** plantain which could have important implications for the environment

Table 11. DM Intake, Milk Yield and Milksolids Yield of Cows Fed Indoors with Low and Moderate ME Ryegrass Supplemented with 20% and 40% Plantain.					
	100% Ryegrass	20% Plantain 80% Ryegrass	40% Plantain 60% Ryegrass	Significance	
				Supplementing Plantain	Amount of Plantain
Ryegrass ME = 10.5 (MJ/kg DM)					
DMI (kg DM/cow/day)	15.7	14.8	14.5	*	NS
Milk yield (kg cow/day)	12.2	12.3	12.5	NS	NS
Milksolids yield (kg cow/day)	1.01	1.00	1.00	NS	NS
Ryegrass ME = 9.6 (MJ/kg DM)					
DMI (kg DM/cow/day)	13.5	14.7	14.0	*	NS
Milk yield (kg cow/day)	9.9	11.5	11.7	***	NS
Milksolids yield (kg cow/day)	0.83	1.02	0.96	**	NS
Statistical Significance:					
* , ** and *** show statistical significance at the 0.05, 0.01 and 0.001 probability level.					
NS shows non-significant probability levels.					
'Adapted from: Minnee and Lee. (2012). Proceedings of the workshop "Plantain for Northland Pastures".					

Tonic can be sown as a pure crop for use over the summer period when ryegrass quality is reduced. Sowing **Tonic** at 8-10 kg/ha will give high quality feed over the summer and autumn and provide a persistent summer crop option for at least two years and possibly more. It can also be sown with white clover.



Perenniality
Perennial
Cool Season Growth
Very high Similar to perennial ryegrass
Growth Habit
Erect
1000 Seed Weight (grams)
2.0
Suggested Sowing Rate (kg/ha)
1-3 mixed sward 2-3 in brassica mix 8-14 pure stand

- Suitable as a 2-3 year crop option
- Valuable winter and early spring growth making it highly suitable for ewe lactation
- Has a positive impact on milk production when grass quality drops in summer
- An ideal source of minerals for animal health and performance

Perenniality
Perennial
Cool Season Growth
Very high Similar to perennial ryegrass
Growth Habit
Erect
1000 Seed Weight (grams)
2.0
Suggested Sowing Rate (kg/ha)
1-3 mixed sward 2-3 in brassica mix 8-14 pure stand

- Similar seasonal drymatter production to Tonic
- Upright growth habit
- Higher tiller density than **Tonic**
- Suitable addition to grass pasture mixes and high legume density pastures

AgriTonic Plantain

AgriTonic is a forage plantain from the breeding programme that created **Tonic**; it maintains many of the seasonal growth features of **Tonic** while having an increased leaf number. During autumn establishment **AgriTonic** can have a greater density of leaves which may be not as large as **Tonic's**.

AgriTonic has been bred from plants surviving our intense breeding process and we believe this has conferred some additional tolerance to grazing and other farm management stresses.

AgriTonic provides the ideal option for including in a general pasture mix at 1-3 kg/ha where grazing pressure is often unnoticed and intense. In high density legume mixes **AgriTonic** also provides well tillered plants that should complement this style of grazing system.



Example (left) of plants that were selected to create **AgriTonic**, showing the density compared to other material in the breeding program.

Sensation Red Clover

Sensation red clover was selected as an upright growing cultivar with good persistence under close grazing. It is an early flowering variety, giving better production in late winter and spring without losing the summer production advantage that red clovers offer over white clovers.

Sensation has only moderate levels of formononetin (a plant oestrogen), allowing it to be used in all pasture mixes to enhance animal performance. Red clover can also be set-stocked in spring, so is suitable for lambing ewes.



Perenniality
Perennial
Cool Season Growth
Medium-high for red clovers
Oestrogen
Low
Leaf Size
Medium
1000 Seed Weight (grams)
2.5
Ploidy
Diploid
Suggested Sowing Rate (kg/ha)
4-6 grass or brassica mix 12 pure stand

- High yielding cultivar
- Upright growth habit
- Strong early season growth
- Reduced levels of formononetin (oestrogen)

Perenniality

Perennial

Cool Season Growth

Medium-high for red clovers

Oestrogen

Low

Leaf Size

Medium

1000 Seed Weight (grams)

2.5

Ploidy

Diploid

Suggested Sowing Rate (kg/ha)4-6 grass or brassica mix
12 pure stand

- A major improvement in persistence within grazing systems
- High yield potential over time
- Semi-prostrate growth habit
- Low levels of formononetin (oestrogen)

Relish Red Clover

Relish red clover is a major advancement in red clover breeding and a wonderful replacement for the well proven New Zealand cultivars Grasslands **Colenso** and **Sensation**.

Relish is ideally suited to pasture mixes where its growth habit should help to maintain red clover content over time. It must be remembered that sowing rate often has the biggest impact on red clover persistence as it is a much larger seed than white clover. Low sowing rates will lead to low plant populations from the very start of the pasture.

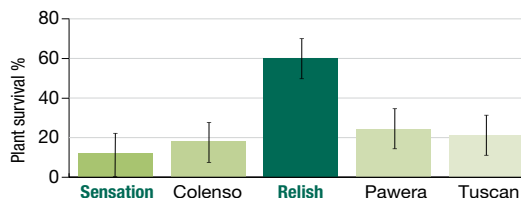
Relish is a primary option for a red clover forage crop with proven persistence and production. **Relish** has shown to be highly productive with enough early spring growth for it to be used as a lambing forage (as early as September).

Proven in Persistence Trials

In a replicated rotationally grazed plot trial to test growth and persistence¹, eighteen red clover cultivars were mixed with ryegrass and compared. **Relish** showed significantly greater growth and persistence over all other varieties. After three and a half years under grazing, 60% of the 'Grasslands **Relish**' plants were alive, more than any other entry, and significantly ($P < 0.05$) more than any commercial cultivars in the trial.

This is a significant breakthrough in red clover genetics for New Zealand based grazing systems and highlights why **Relish** is a major change in red clover reliability. For persistence, nothing else evaluated from within New Zealand or from around the world came close to **Relish** for persistence under grazing.

Figure 19. Plant Survival (%)
Percentage of Red Clover Plants Surviving after Three and a Half Years Under Cattle Grazing in the Manawatu



¹ Ford, J.L., & Barret, B.A. (2011). Improving red clover persistence under grazing. Proceedings of the New Zealand Grassland Association.

Red Clover for Finishing Lambs

Table 12. Comparison of Three Forage Options for Growing Lambs			
Forage Treatments	Forage Brassica	Red Clover	Ryegrass/ White Clover
DM production (t/ha) (November to March)	6.5-8.0	6.5-8.0	4.5-5.0
Stocking rate (lambs/ha)	45-55	45-55	30-35
Liveweight gain (g/day)	200-300	200-300	50-150
Liveweight gain/ha (kg/ha/day)	9-17	9-17	1.5-5.3

Red clover is successfully used as a component of a pasture mix to improve pasture production and quality during the summer. However, recent interest in red clover sown as a pure stand has shown the potential as an alternative to a summer brassica crop for finishing lambs, with the additional benefits of persisting for two years, improving soil nitrogen, and the option of conserving excess feed as hay or silage if required.

In a series of Agricom experiments, groups of lambs (n=10-55) were rotationally grazed on a mix of **Colenso** and **Sensation** red clover, perennial ryegrass/white clover pasture, or spring-sown leafy turnip, over 2 years. Grazing commenced each year in early December and concluded in early March. Treatments were irrigated to ensure feed supply, and nitrogen was applied to the brassica crop after the first grazing. Table 12 shows the general effect of each forage system on key productive parameters.

This evaluation suggested that, in the appropriate environment, there is no disadvantage in using red clover compared with a forage brassica in either the number of lambs potentially finished per hectare, or the speed of growth. In addition, red clover systems supported more grazing days because the crop lasted for 2 years, required no nitrogen input, and in fact improved soil nitrogen, and could have been conserved as hay or silage if required.

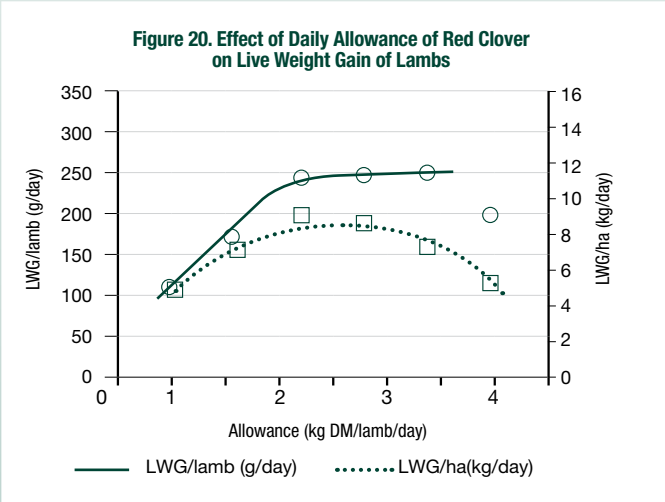
Brassica crops are still important in a renovation programme where longer crop rotations are less appropriate, or where quick feed is required from a spring sowing. In these situations red clover is less appropriate. However, red clover is an option where a longer term finishing crop is desirable.

Maximising Animal Productivity

Maximising animal productivity from red clover stands is a balance between high stocking rates and fast growing animals (Figure 20).

When young lambs were offered varying allowances of red clover, liveweight gain reached a maximum at an allowance of 2 kg DM/lamb/day. Further increases in allowance did not increase liveweight gain, probably because they had achieved maximum intake at this allowance. Where very generous allowances were offered (3.5 kg DM/lamb/day), growth rates were lower (Figure 20). This was probably a consequence of the poorer quality forage on offer in this treatment, because reproductive stems were allowed to accumulate under lax grazing.

Generous allowances did not optimise production per hectare either. Liveweight gain per hectare was low at high allowances because of the combined effect of slow individual liveweight gains and low stocking rates. At low allowances, liveweight gain per hectare was also low despite high stocking rates, with liveweight gain of individual animals reduced because of the restricted intake. Liveweight gain per hectare was maximised at an allowance of 2-2.5 kg DM/lamb/day, as lambs grew fast and stocking rate was optimised.



Spring Forage Cereals

Spring sown forage cereals are a good way of producing high yields in a short space of time. This large yield is a cost effective way of producing feed that has either a good balance of protein and energy or more carbohydrate and starch depending on the cultivar used and the time of harvest.

GREEN CHOP CEREAL SILAGE (GCCS)

GCCS produces a feed that has a good balance of protein and energy, similar to high quality pasture silage. GCCS is used as a pasture replacement supplement when pasture levels are low. GCCS is harvested late spring/early summer before seed heads are present to get maximum quality and yield.

Coronet and Milton Forage Oats

Oats are used for quick production of GCCS, usually after a winter crop. Both **Coronet** and **Milton** oats can be planted from late winter onwards for high quality GCCS before planting another crop or pasture early summer. **Coronet** is leafier and has the ability to provide very high quality feed later in the season due to a later maturity date. **Milton** oats are faster to mature, providing higher levels of feed during the early mid winter.

Management of GCCS is simple with a nitrogen based fertiliser (150-250 kg/ha DAP) being used at sowing, with the potential of another application of nitrogen (35 kg N/ha) being applied 6 weeks after sowing depending on background soil nitrogen.

WHOLE CROP CEREAL SILAGE (WCCS)

WCCS produces a feed that has high carbohydrate and starch levels, with adequate fibre for a balanced feed. WCCS can be used as a feed supplement to balance animal intake when feeding brassicas or high quality pasture.



Crackerjack Triticale

Crackerjack is the preferred triticale cultivar to be grown for WCCS due to its high yield potential. **Crackerjack** can be planted in either winter or early spring.

Monty Barley

Monty barley can be sown later in the spring (Sept-Oct) and harvested earlier in the summer in areas that are prone to summer dry. **Monty** barley will produce very high quality WCCS.

Monty is a silage barley with high yield and quality that will perform in a wide range of environments. Trials show yields equal to or better than other cultivars in the Manawatu, Southland and Canterbury.



Monty showing reduced awns providing palatability and animal health benefits.

WCCS CROP MANAGEMENT

Time of sowing is crucial for yield. Crops planted too late rush through their growth stages and have less time to accumulate yield. Plant crops as early as possible, **Crackerjack** triticale can be planted as early as mid winter, and **Monty** barley in early September.

Paddock preparation can affect yield. Cultivated ground should be moderately fine and even to achieve a consistent drilling depth of 3-4 cm. Broadcasting cereal seed is not recommended.

Fertiliser has a critical influence on yield potential. All spring cereals should be planted with a nitrogen-based fertiliser (e.g. 150-250 kg/ha DAP). Triticale crops normally have 66% of their total nitrogen requirements applied at the end of tillering (Growth Stage 31), with further nitrogen applied at flag leaf emergence (Growth Stage 39) for high yielding crops. Barley develops faster, so 60% is applied at sowing and 40% at the end of tillering (Growth Stage 31).

The total amount of nitrogen required depends on existing soil nitrogen levels, and the target yield (e.g. irrigated or low rainfall). Irrigated crops on heavily cropped land can require 250 kg N/ha to achieve 16 t DM/ha, but a dryland crop on fertile soil may only need 80 kg N/ha for a 10 t DM/ha yield.

Fertile soils will supply enough potassium, phosphate and sulphur, but soil tests often show that potassium fertiliser is required (at planting).

Weeds should be controlled before canopy closure (Growth Stage 21-29) because they will reduce silage yield and can affect palatability. Many broadleaf herbicides are suitable. Check with your retailer or chemical company.

Plant growth regulators can improve silage quality of triticale crops by increasing the ratio of grain to stem/leaf. These need to be applied at an early stage (Growth Stage 31), discuss this with your retailer or chemical company.

Fungicides can protect the yield and quality of silage. Fungicides are commonly applied with herbicides or plant growth regulators to prevent disease. Full rates are usually then applied at full flag leaf emergence (Growth Stage 39) to keep leaves green during grain fill, and to comply with withholding periods. Triazole and strobilurin chemicals are commonly mixed to achieve both ‘knock-down’ and residual control. Discuss with a retailer or chemical company representative.

Harvesting of WCCS is not difficult, but requires planning and monitoring to ensure correct timing. The grain needs to develop until it is larger than the seed you planted, and will have changed colour from light-green to yellow/light-brown (see photo below). When you squeeze the grain between your finger nail and finger, it should crease easily but no liquid or white ‘slop’ should ooze out of the grain. This is called the ‘cheesy dough’ stage, because the contents of the grain resemble colby cheddar cheese. The drymatter of the crop should then be 36-40%.

Silage should be chopped finely, consolidated, and inoculant is recommended. If the crop is to be baled, cut the crop slightly earlier (34-37%), and use extra layers of plastic. It is not recommended that triticale harvested at the WCCS stage be baled.

Harvesting of WCCS requires good planning to ensure the crop is harvested with maximum yield and quality.



Correct cheesy-dough stage

Table 13A. Barley – Basic Management Recipe for Monty Planted in Spring for Silage

Typical Timing	Action	Details (examples)
September	Spray out old pasture	Glyphosate @ 3-6 l/ha + surfactant
September/October	Sow Monty barley and fertiliser	140 kg/ha seed + N, P, K fert providing 75-100 kg N/ha
4-6 weeks post-sowing (Growth Stage 31)	Assess weeds and spray if required	e.g. MCPA at 3 l/ha
4-6 weeks post-sowing (Growth Stage 31)	Tank mix fungicide with above herbicide	Product mix to provide curative plus protectant properties
4-6 weeks post-sowing (Growth Stage 31)	Final nitrogen application	50-75 kg N/ha

Table 13B. Triticale – Basic Management Recipe for Crackerjack Planted in Spring for Silage

Typical Timing	Action	Details (examples)
July-September	Spray out old pasture or winter crop residue	Glyphosate @ 3-6 l/ha + surfactant
Sow early in spring (July-September)	Drill Crackerjack triticale and fertiliser	175-185 kg seed + 250 kg D.A.P
5-8 weeks post-sowing (Growth Stage 31)	Assess weed pressure. Apply first fungicide	3 l/ha MCPA. Tank mix fungicide with herbicide
5-8 weeks post-sowing (Growth Stage 31)	Main nitrogen application. Consider plant growth regulator	75-100 kg N/ha (depending on soil fertility) 1.25 l/ha Cycocel + 200 ml/ha Moddus
Flag leaf/booting stage (Growth Stage 39)	Fungicide application. Final nitrogen	Protectant + curative fungicide 50-70 kg N/ha

Intended Use

Whole crop cereal silage

Resistance to stripe rust

Moderate

Planting TimeSouthland late winter or until early spring
North Island/Canterbury mid winter to spring**Sowing Rate (kg/ha)**170-180 kg
Based on a 52 g 1000 seed weight

- Improved resistance to stripe rust
- High silage yields
- High energy and carbohydrate levels
- Cool season growth
- Good tolerance to lodging

Product Usage

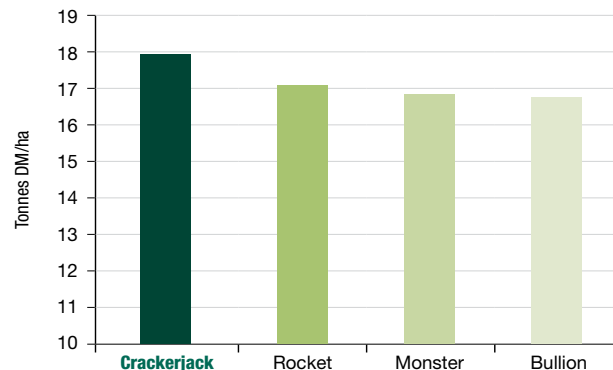
Crackerjack is a high yielding triticale for whole crop cereal silage production that can be planted in late winter or spring. Trials have shown potential production up to 18 t DM/ha for whole crop cereal silage, superior to other crop species, such as wheat and barley.

Crackerjack is not a difficult crop to grow and has a wide harvest window (compared with barley). When harvested at the recommended stage (approximately 130 days from August sowings in Canterbury), silage has a good energy level and is sought after by dairy farmers.

The varieties **DoubleTake** and **Prophet** are also used for silage production, but are generally planted in autumn for winter grazing and spring silage.



**Figure 21. Yields of Spring Triticale Cultivars,
Multi-Site Mean of all NZ Trials**

**Sowing**

Crackerjack can be sown from mid winter to spring (July-September) in the North Island and Canterbury, or late winter to early spring (August-October) in Southland. The recommended sowing rate is 170-180 kg/ha to achieve 250-300 plants/m², but this will vary with seed size and sowing date (increase populations from 250 to 300 plants/m² for later sowings). Weed and aphid management is similar to cereals grown for grain.

Product Usage

Monty is a medium-maturity spring barley. It has consistently achieved high grain and silage yields over many trials. Silage quality is very good due to the high grain content. Trials indicate that **Monty** is capable of producing 14-15 tonnes DM/ha silage crops in Canterbury with irrigation and good management.

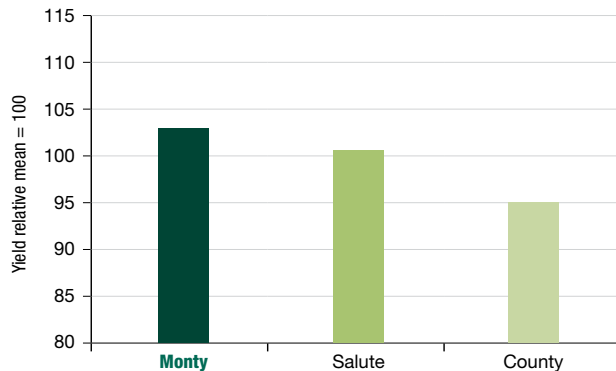
Straw strength is also a feature of this variety. Conventional barley has hard spiky awns that remain quite sharp in the stack. **Monty** is unique in this respect having reduced awns which minimise the damage conventional awns can do to soft, sensitive mouths, reducing animal stress and maintaining animal performance.

Monty has good resistance to all diseases, except scald. Scald is a disease spread by rain splash and is usually worst in wet springs or early sowings. Scald can be easily controlled with fungicides.

Trial Data

Although yields will be influenced by a number of factors such as fertility levels, timing of sowing and ongoing inputs, crop yields of 8-14 tonnes DM/ha could be expected.

Figure 22. Spring Barley Cultivar Silage Evaluation Trials, Plant & Food Research Ltd



Intended Use
Whole crop cereal silage
Disease Resistance
Good
Planting Time
September-October
Sowing Rate (kg/ha)
140 kg Based on a 40 g 1000 seed weight

- Hooded barley reducing the impact of awns during feeding
- High yield whole crop barley
- Excellent straw strength
- Good disease tolerance

Intended Use
Single winter grazing, or green chop cereal silage
Resistance to rust
Very good
Planting Time
Early autumn or late winter to early spring (for silage)
Sowing Rate (kg/ha)
100-120

- Very good rust tolerance
- Late maturing
- Frost/cold tolerant
- High leaf-to-stem ratio
- Very high yielding for grazing or green chop cereal silage

Intended Use
Green chop cereal silage or single winter grazing
Resistance to rust
Very good
Planting Time
Autumn or early spring
Sowing Rate (kg/ha)
100-120

- Very high yields
- Improved disease resistance
- Rapid establishment



Product Usage

Coronet is one of the newer yielding forage cereals that can either be early autumn or late winter to early spring sown. **Coronet** has a fine stem and high leaf content, combined with very good disease and cold/frost tolerance, to make it the preferred crop where very high quality feed is wanted.

Coronet is the ideal option for winter feed when sowing in dry autumn conditions, as it can be sown deeper and later than ryegrass. Trials have shown **Coronet** to yield 6-8 tonnes DM/ha over this period. When sowing in autumn, the earlier **Coronet** is sown the larger the grazing yield will be.

If twitch/couch is a problem weed in pastures, autumn is the ideal time to spray this weed with glyphosate, with **Coronet** being drilled for winter feed, then the paddock re-sown to grass, or another break crop in early spring.

Coronet can germinate in relatively cold soils (5°C) compared with ryegrass, so is an ideal crop to plant in late winter to early spring after winter crops have been grazed, enabling high quality green chop cereal silage to be harvested before planting another crop or pasture in late spring. Trials indicate that yields of 6-8 tonnes DM/ha can be achieved in this short timeframe. The ideal time to cut **Coronet** for maximum quality and yield is at the boot stage (see Figure 23, page 51).



Milton is a very high yielding oat with improved disease resistance and has the ability to hold quality until grazing/cutting, and is ideally suited for planting in autumn to provide a single grazing in early to mid winter. **Milton** is also ideal for green chop cereal silage, either planted in late autumn after maize, or in early spring following winter brassica crops.



Milton Forage Oats.

When to Harvest Cereal Silage

When making silage from oat crops, harvesting should only be done at the booting stage, as this species is not ideal for whole crop cereal silage. Harvesting before this stage will reduce yields.

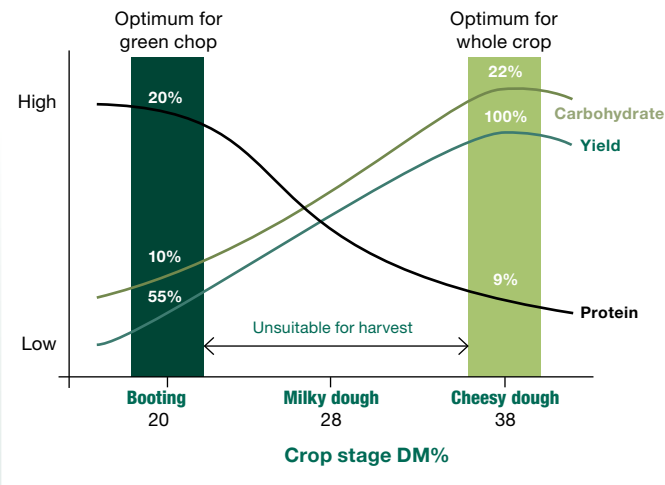
Barley is recommended to be harvested at the whole crop stage, with either oats or triticale providing better leaf yield if crops are cut at the green chop stage.

Triticale can be harvested at either the whole crop or green chop stage. The whole crop stage maximises yield and carbohydrate content of the silage (Figure 23), while the green chop stage maximises protein content at the expense of yield and carbohydrate. Harvesting between these stages is not advised as it fails to produce optimum yield or quality.

Whole crop silage is high in carbohydrate (in the form of starch) and fibre, with moderate protein, making it ideal to supplement animal diets when they are grazing brassica crops, or pastures with high water and protein content.

Green chop cereal silage has a good balance of protein and energy (similar to good pasture silage), so can be used as a substitute for a lack of available pasture.

Figure 23. Optimum Time of Harvest for Cereal Silage and Impact on Yield and Quality



Which Forage Cereal Type to Use?

Table 14. Forage Cereal Type Based on Planting Time and Intended Use						
Planting Time	Autumn Planting				Late Winter, Early Spring	Mid Spring
Intended Use	Single Late Winter Graze for High LWG	Single Winter Graze For High DM Production	Spring Green Chop Cereal Silage	1-2 Winter Grazings, and/or Whole Crop Cereal Silage	Single Cut Whole Crop Cereal Silage	Single Cut Whole Crop Cereal Silage
Coronet oats					For green chop cereal silage only	
Milton oats					For green chop cereal silage only	
DoubleTake triticale						
Prophet triticale						
Crackerjack triticale						
Monty barley						

Best Use

Can also be used

Not recommended



Laura Keenan
Upper North Island
Sales Manager
027 541 2232

Hamish Johnstone
Central North Island
Sales Manager
027 706 6309

Will Waddell
Western North Island
Sales Manager
027 807 8920

Rupert Thomson
Eastern North Island
Sales Manager
027 705 0664

Ben Trotter
Central Otago
Sales Manager
027 591 8712

Mark Kearney
Northern South Island
Sales Manager
027 229 5776

Gareth Kean
Southern South Island
Sales Manager
027 226 2777

Lyndon Anderson
Central South Island
Sales Manager
027 595 3340

Mark Brown
NZ Sales and Marketing Manager
027 220 4110

Allister Moorhead
Product Development Manager
027 433 7739

Sarah McKenzie
Extension Manager
027 704 6684

Sam Robinson
Fodder Beet Technical Specialist
027 886 0499

Dylan Moratti
Upper North Island
Extension Agronomist
027 550 4085

Blake Gunn
Lower North Island
Extension Agronomist
027 406 0474

Fraser Harrison
Upper South Island
Extension Agronomist
027 404 5513

Stephanie Wright
Southern South Island
Extension Agronomist
027 404 5520

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