AGRICOM.CO.NZ

Beet, Brassica and Forage

CROPPING GUIDE.

AGRICOM
Pastures for Profit®

AGRONOMIC LEADERSHIP FROM OUR R&D TO YOUR FARM.

FOREWORD

The importance of the role of forage crops has been well understood for a long time, but interest in the fit and application of many of these species has lifted markedly in the last few years. Much of this interest stems from wanting to better understand the cost effectiveness of a well-grown forage crop, but increasingly questions are also being asked about environmental functionality along with specific animal performance outcomes. With rising costs of imported feeds plus a degree of uncertainty within supply chains, there has never been a better time to explore the cost benefits of quality home grown forage crops.

For many farmers, the filling of a summer or winter feed deficit is the primary goal when considering forage cropping. Increasingly, we are seeing more specialised trading and/or finishing systems, where specific traits or shoulder season opportunities mean a deviation from mainstream forage options might need consideration. Agricom's portfolio of products is well suited to support such conversations and this is now a major focus in our R&D direction and aspirations. New Zealand farmers can buy Agricom products with confidence knowing they come from a highly developed breeding programme, backed by strong technical support and a proven track record.

WHAT TO LOOK OUT FOR THIS SEASON AT AGRICOM?

We strongly recommend keeping an eye out for **Manta** Italian ryegrass; it has proven to be a real beast and can be integrated into a variety of mixed cropping systems such as rape and grass or oats and grass. Additionally, an up and coming product to consider is **Crowa** forage oats which boasts impressive strengths for catch cropping and disease resistance. This oat variety is a great addition to an already robust forage cereal portfolio.

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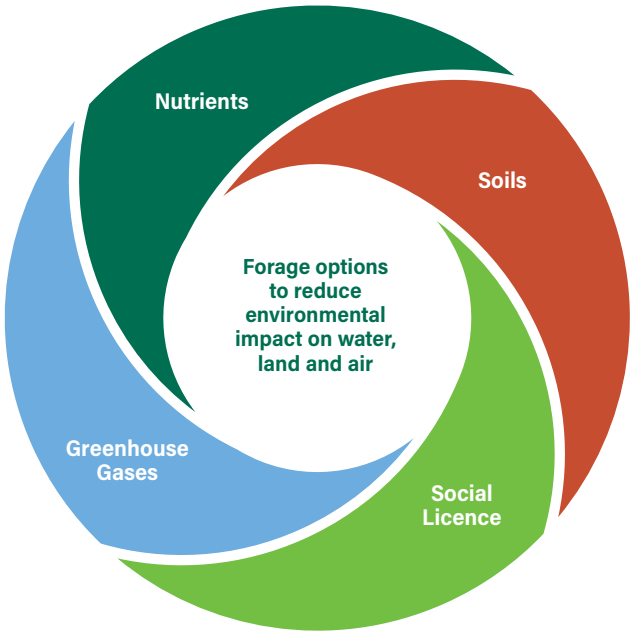
Forage Options to Reduce Environmental Impact

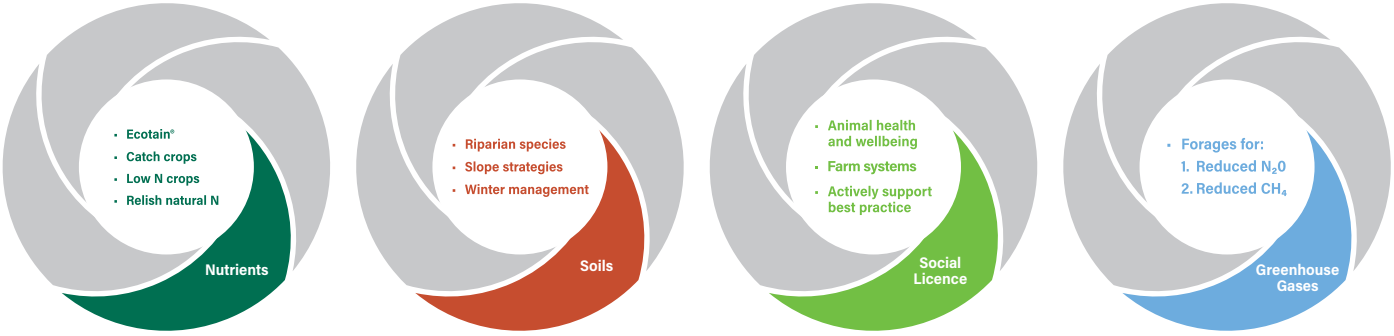
THE AGRICOM ENVIRONMENTAL LENS FRAMEWORK

Efficient and sustainable pastoral agriculture remains the cornerstone of New Zealand's agricultural industry. However, there is an increasing demand from customers to produce food in a sustainable way and where animal welfare is considered. Meeting the expectations of consumers in these aspects is becoming increasingly important.

Nitrate leaching limits, sediment control, welfare of animals during the winter, carbon sequestration and greenhouse gas mitigation are now all aspects of producing food, running in parallel with production and profitability.

Agricom provides a full portfolio of products, information and systems fit for a broad range of New Zealand's farming requirements. These products and forage systems have been designed to achieve high levels of production across a range of environments. Agricom's Environmental Lens Framework provides real tools, products and systems to help reduce the impact of nutrients, soils and greenhouse gases on water, land and air. 'Functional Forages' is an important part of the Agricom Environmental Lens as it represents Agricom's suite of products and systems, which can be considered as contributing tools from an environmentally sustainable view.





WHAT CAN BE DONE TO REDUCE MY IMPACT ON THE ENVIRONMENT THROUGH NUTRIENT LOSSES OR SURPLUSES?

Farm management factors such as pasture type, imported feed use and nitrogen fertiliser can help to reduce nitrogen (N) and phosphate (P) leaching. **Ecotain®** environmental plantain, catch crops such as **Milton, Coronet** and **Crowa** oats**,** low N crops such as **Jamon** and **Brunium** fodder beet and **Relish** red clover natural N systems are all options that may reduce the impact of nutrient losses and surpluses.

WHAT CAN BE DONE TO REDUCE MY IMPACT ON THE ENVIRONMENT THROUGH SOIL MANAGEMENT?

Soils are an incredibly important part of farming. To farm sustainably into the future, we need to manage and maintain soil health to prevent soil related issues such as erosion, excess nutrients, contamination and loss of carbon. Examples of forages to assist in slope strategies or heavily pugged areas are dense winter active grasses like **Three^{60}** perennial ryegrass, or **Manta** Italian ryegrass. Winter grazing management and riparian species such as **Savvy** cocksfoot and **Hummer** or **Haven** tall fescue can also positively influence soil health to reduce the impact on land and water.

WHAT CAN BE DONE TO REDUCE MY IMPACT ON THE ENVIRONMENT THROUGH GREENHOUSE GASES?

The two main greenhouse gases emitted by New Zealand pastoral systems are methane and nitrous oxide. The amount of methane produced is typically related to the amount of drymatter consumed. Therefore, using high quality feeds will reduce the volume of emissions per unit of product as animals need to eat less to achieve the same performance. However, there are some forages which result in less methane per kg of drymatter eaten such as forage rape.

In terms of nitrous oxide, reducing the amount of protein in feed such as fodder beet is likely to reduce nitrous oxide. However, **Ecotain** has reduced both nitrogen excretion and emissions in some studies.

For more details on how different forages and different forage systems may assist in achieving both your productivity goals but also the growing expectation of consumers, talk to your local Agricom representative about Agricom's Environmental Lens.

› Please refer to page 45 for more on winter crop grazing management and environmental considerations.

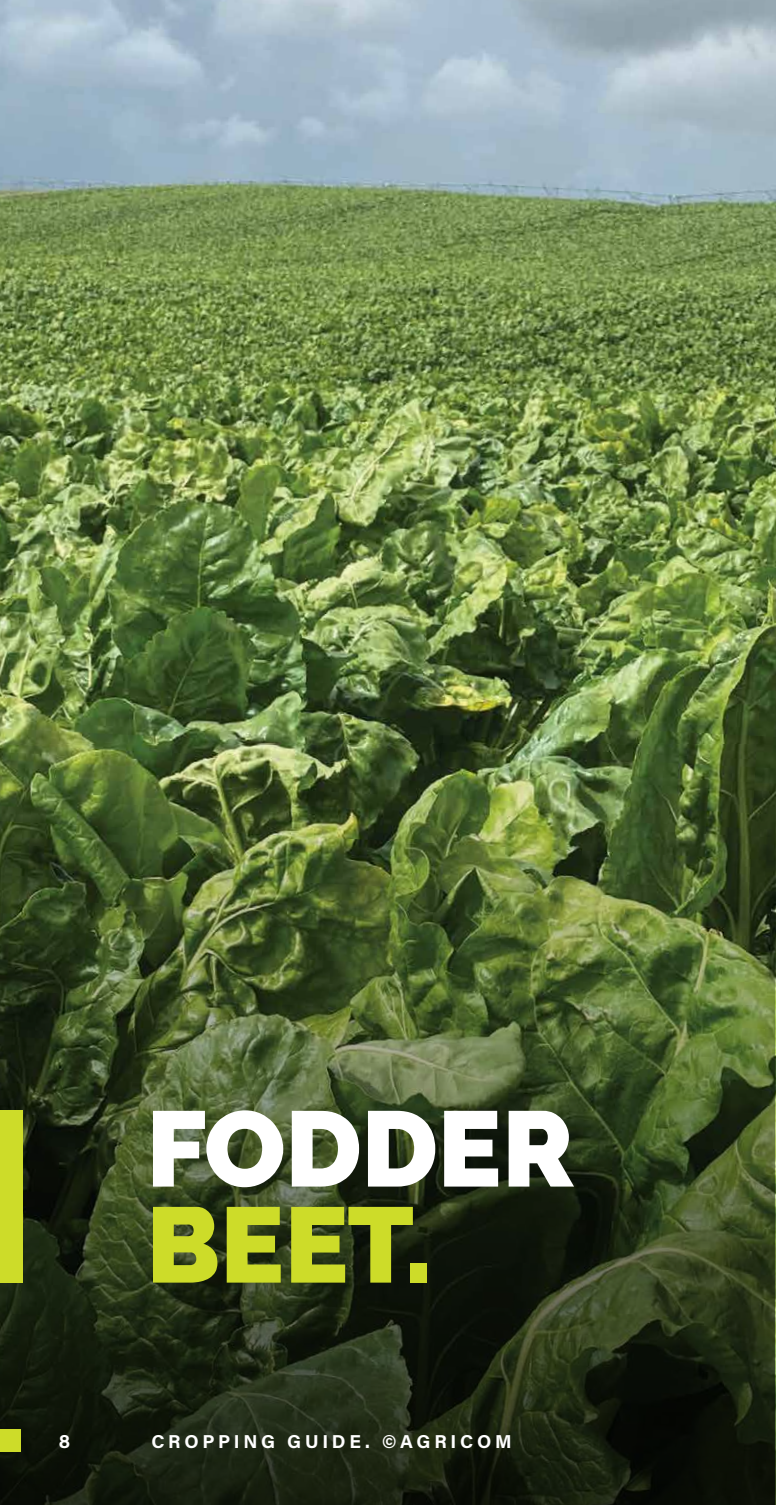
Fodder Beet and Brassica User Guide

Page No.	Cultivar	Sowing Time	Sowing Rate (kg/ha)	Time to First Grazing
14-20	**Fodder Beet**	Late September to early November*	80,000-90,000 seeds/ha grazing 100,000 seeds/ha lifting	Typically 24-28 weeks to reach yield potential**
30	**MAINSTAR** Forage Rape	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
32	**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
26	**SOVGOLD** 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
29	**TRIUMPH** Swede pelleted	Late November to early December	0.5 in 60 cm ridges 1 in 20 cm rows 1.5 broadcast 90,000 seeds/ha pelleted	24-30 weeks
28	**DOMAIN** Swede pelleted	Late November to early December	0.5 in 60 cm ridges 1 in 20 cm rows 1.5 broadcast 90,000 seeds/ha pelleted	24-30 weeks
34	**HUNTER** Forage Brassica	Mid October to November	4	6-8 weeks**
		February possible	4	8-10 weeks
35	**RIVAL** Turnip	Late October to early November	Range 1.5-3 Varies depending on quality of seedbed preparation	12-14 weeks**
35	**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

*For **Brunium** suggested sowing time is October to early November.
** Or after all herbicide, fungicide and insecticide grazing withholding periods are met.

Period of Grazing	Number of Grazings	Potential Yield (kg DM/ha)	Notes
March to September*	1	Average = 18,000-22,000 Top = 30,000+	Drymatter content (%#): **Feldherr** 12-15%, **Jamon** and **Bangor** 16-18%, **Delicante** and **Brunium** 16-20%, **Enermax** 19-21%, **Tadorne** and **Surf** 20-26%. **Brunium** is tolerant to *Rhizoctonia*. **Feldherr** is ideal for all stock classes and is particularly suitable for young stock.
January to August	3	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 **Mainstar** has died out or slowed in regrowth
Late May to August	1-2	5,000-8,000 depending on number of grazings	
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. 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 **Mainstar**
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 **SovGold** 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 = 12,000-14,000 Top = 18,000+	Very high yielding main-crop swede. Should not be sown after other brassicas
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
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	
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

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



FODDER BEET.

VARIETIES

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. Agricom has partnered with world leading fodder beet breeding companies, Florimond Desprez and DLF Beet Seed, to access new genetics for improved yield and quality. Table 1 shows the primary varieties Agricom markets in New Zealand.

TABLE 1: FODDER BEET VARIETY BULB DM %

Low	Medium	High	Sugar Beet
Feldherr 12-15%			
	Jamon 16-18%		
	Bangor 16-18%		
	Brunium 16-20%		
	Delicante 16-20%		
		Enermax 19-21%	
			Surf 20-26%
			Tadorne 20-26%

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

PROS AND CONS RELATIVE TO TRADITIONAL WINTER FORAGES (KALE & SWEDES)

Many 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 2, page 9). 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.

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

TABLE 2. 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.

Successful farm system outcomes from grazing fodder beet rely on appropriate grazing management which minimises the risk of animal health and production issues.

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 3).

Appropriate grazing management includes a well planned and executed transition phase and appropriate choices around supplement use (see Transition section – Table 4, page 12).

TABLE 3. 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 liveweight gain	Balance high protein pasture
Deer	Pre-weaning feed in a dry autumn	Winter feed	Hold hinds prior to fawning

Getting the Best Out of 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.

Soils should ideally be free-draining and relatively free of weeds and insect pests. The soils should be worked into a fine and firm 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.

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.

SOWING

Depending on location, sowing between late September and early November is generally recommended. Earlier sowings risk vernalisation causing bolting, 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.

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, 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 22 for details on the Beet Guru®, an app to assist with calculating and interpreting fodder beet yield.

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.

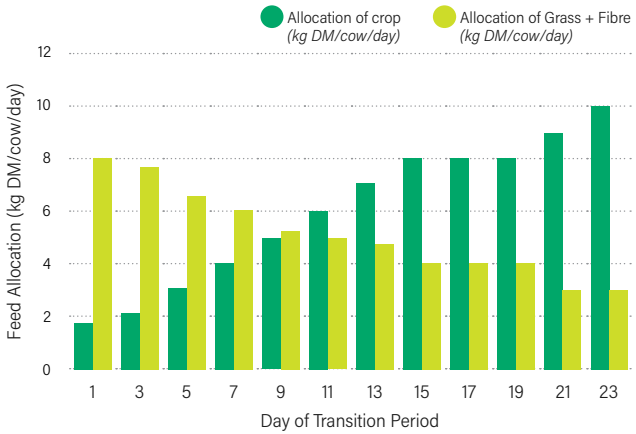
HIGH/*AD LIB* INTAKE

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 example* 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 makes 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.

Figure 1. 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

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.

Choice of supplement comes down to the supply of protein. Where the fodder beet component of the diet does not meet protein 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 liveweight gain is important in young stock.

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

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.

Visual symptoms in cattle are:

- Diarrhoea
- Limited cud chewing (< 50% of cows lying down not chewing their cud)
- Sore hooves – laminitis
- Foamy faeces, 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.

TABLE 4. 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	Beet at 5 kg DM/hd/d	Beet at 4 kg DM/hd/d	Beet at 1.1 kg DM/hd/d	Beet at 1 kg DM/hd/d
		Silage at 3 kg DM/hd/d	Silage at 2 kg DM/hd/d	Silage at 2 kg DM/hd/d	Silage at 0.5 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.

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. Additionally, 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 6,000 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 leftover bulbs or bulb chips from the previous crop. If all or part of these bulbs remains 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 cropping programmes for the coming year, 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 roguing 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 6,000 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 fodder beet can be grown sustainably in the future

Jamon
Fodder Beet

Bulb DM%	16-18%*
Suggested Sowing Time	Late September to early November
Suggested Sowing Rate (seeds/ha)	80,000-90,000 grazing
Time to First Grazing	Anytime after all herbicide, fungicide and insecticide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Seed Type	True monogerm
***In-situ* Grazing**	Most suited
Mechanical Harvesting	May be lifted, not ideal

Please refer to pages 9-13 for grazing management and animal health information.

VERSATILE, HIGH YIELDING BEET.

Jamon is a very uniform, monogerm 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.

- True monogerm cultivar
- Medium drymatter type (16-18%)*
- 50% of bulb above ground
- Proven to perform across all stock classes and environments in New Zealand
- Above ground bulb colour: orange

"Excellent high yielding all-rounder, with great leaf retention and quality."

Fraser Harrison - Forage Systems Specialist

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

Feldherr
Fodder Beet

Bulb DM%	12-15%*
Suggested Sowing Time	Late September to early November
Suggested Sowing Rate (seeds/ha)	80,000-90,000 grazing
Time to First Grazing	Anytime after all herbicide, fungicide and insecticide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Seed Type	True monogerm
***In-situ* Grazing**	Most suited
Mechanical Harvesting	Not suitable

Please refer to pages 9-13 for grazing management and animal health information.

HIGH YIELDING LOW DRYMATTER STYLE.

Feldherr is a high-yielding, monogerm hybrid fodder beet with a light orange bulb colour. It has a low bulb drymatter percentage (12-15%)*, which some farmers prefer for grazing. **Feldherr** can produce large bulbs and high yields for its type and is suitable for all classes of stock; particularly young stock, older animals and deer.

Feldherr has a high proportion (60-80%) of the bulb out of the ground.

- True monogerm cultivar
- Low drymatter type (12-15%)*
- 60-80% of the bulb above ground
- Larger bulb type
- Suited to grazing with all stock classes
- Above ground bulb colour: orange

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

NEW

Delicante

Fodder Beet

Bulb DM %	16-20%*
Suggested Sowing Time	Late September to early November
Suggested Sowing Rate (seeds/ha)	80,000-90,000 grazing 100,000 lifting
Time to First Grazing	Anytime after all herbicide, fungicide and insecticide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Seed Type	True monogerm
***In-situ* Grazing**	Very good option
Mechanical Harvesting	May be lifted, not ideal

Please refer to pages 9-13 for grazing management and animal health information.

STRONG MEDIUM-HIGH DRYMATTER TYPE, SOLID PERFORMER.

Delicante is a high-yielding, monogerm hybrid fodder beet with a green to white bulb colour. It has a medium to high bulb drymatter percentage (16-20%)* which contributes to its high yielding potential.

Delicante is most similar in aspects to **Enermax** from bulb colour however **Delicante's** bulb is more pronounced out of the ground and has better leaf characteristics and disease tolerance.

Delicante can produce large tankard bulbs and high yields for its type. It is suitable for all classes of stock; particularly adult stock classes.

- True monogerm cultivar
- Medium – high drymatter type (16 – 20%)*
- Approximately 50% of bulb above ground
- Tankard bulb type
- Suited to grazing with all stock classes
- Above ground bulb colour: white-green

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

Enermax Fodder Beet

Bulb DM%	19-21%*
Suggested Sowing Time	Late September to late October
Suggested Sowing Rate (seeds/ha)	80,000-90,000 grazing 100,000 lifting
Time to First Grazing	Anytime after all herbicide, fungicide and insecticide grazing withholding periods are met. Typically 28 weeks to reach yield potential
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Seed Type	True monogerm
***In-situ* Grazing**	Possible but not preferable
Mechanical Harvesting	Most suited

Please refer to pages 9-13 for grazing management and animal health information.

LIFTING AND GRAZING OPTION.

Enermax was bred specifically for farmers wanting to lift, store and feed fodder beet to animals. It produces bulbs with a consistent size and height. The yield potential is high and the high bulb drymatter percentage (19-21%)* is an advantage for lifting.

Enermax is a modern monogerm hybrid variety with high-quality seed for consistent establishment.

- True monogerm
- High drymatter type (19-21%)*
- 40-50% of the bulb above ground
- A great choice for lifting
- Uniform bulb size and height
- Bulb colour: white/green

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

Brunium
Fodder Beet

Bulb DM%	16-20%*
Suggested Sowing Time	October to early November
Suggested Sowing Rate (seeds/ha)	80,000-90,000 grazing 100,000 lifting
Time to First Grazing	Anytime after all herbicide, fungicide and insecticide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Seed Type	True monogerm
***In-situ* Grazing**	Very good option
Mechanical Harvesting	Good for lifting

Please refer to pages 9-13 for grazing management and animal health information.

VERY GOOD RESISTANCE TO *RHIZOCTONIA.*

Brunium is an ideal cultivar where a history of *Rhizoctonia* has been experienced on farm. It is highly suitable for both grazing and lifting.

- True monogerm cultivar
- Medium-high drymatter type (16-20%)*
- Oval bulb shape, approximately 40-50% of bulb above ground
- Recommended not to be sown in September particularly in the South Island
- Very good resistance to *Rhizoctonia*
- Above ground bulb colour: red

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

Bangor
Fodder Beet

Bulb DM %	16-18%*
Suggested Sowing Time	Late September to early November
Suggested Sowing Rate (seeds/ha)	80,000-90,000 grazing 100,000 lifting
Time to First Grazing	Anytime after all herbicide, fungicide and insecticide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Seed Type	True monogerm
***In-situ* Grazing**	Most suited
Mechanical Harvesting	May be lifted

Please refer to pages 9-13 for grazing management and animal health information.

UNIFORM PERFORMER.

Bangor is a modern monogerm hybrid variety that is ideal for grazing. **Bangor** is a uniform fodder beet with a medium bulb drymatter percentage with a high yield potential.

- True monogerm cultivar
- Medium drymatter type (16-18%)*
- Approximately 50% of the bulb above ground
- Above ground bulb colour: yellow

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

Tadorne
Sugar Beet

NEW

Surf
Sugar Beet

VERY HIGH YIELDING SUGAR BEET.

Bulb DM %	20-26%*
Suggested Sowing Time	Late September to early November
Suggested Sowing Rate (seeds/ha)	100,000-120,000 lifting
Time to First Grazing	Anytime after all herbicide, fungicide and insecticide grazing withholding periods are met. Typically 24-28 weeks to reach yield potential
Potential Yield (t DM/ha)	Average = 18-22 Top = 30+
Seed Type	True monogerm
***In-situ* Grazing**	Not suitable
Mechanical Harvesting	Good for lifting

Tadorne and **Surf** are sugar beets from Florimond Desprez. They have a very low soil tare and they are only suitable to be mechanically harvested and not grazed *in-situ.*

Tadorne and **Surf** have an upright leaf habit with white bulbs of a very high drymatter percentage.

Tadorne has had outstanding yield results in New Zealand conditions for the last six years.

- Both are true monogerm cultivars
- Very high drymatter types (20-26%)*
- 20-30% of bulb above ground
- Tolerant to *Rhizomania*
- Above ground bulb colour: white

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

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 5. KEY PESTS AND DISEASES AFFECTING FODDER BEET

Condition	Impact on Plant	Control
Seedling Insect Pests		
Springtails *(Bourletiella spp.)*	Attack cotyledons and emerging plants	Seed treatment, chemical, crop rotation and hygiene
Greasy Cutworm *(Agrotis ipsilon aneituma)*	Plants, especially seedlings ripped off at or just below ground level, young plants wilt	Chemical, crop rotation and hygiene
Grass Grub *(Costelytra zealandica)*	Adults attack young growing points, larvae attack seedling roots	Seed treatment, chemical
Wheat Bug *(Nysius huttoni)*	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 *(Catopes spp.)*	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 bait, cultivate paddocks
Seedling Fungal Diseases		
Wirestem *(Rhizoctonia)*	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 *(Rhizoctonia solani)*	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 *(Phytophthora spp.)*	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.

The Beet Guru® App

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

We all know that the accurate measurement of fodder beet yield is challenging. That is why we have developed a tool that makes interpretation of assessments simple for farmers and retailers. Aptly called the "Beet Guru", the tool is an app that is extremely easy to use on your handheld device.

All you need to do is enter the fresh weights of the bulb and leaves from each sample into the app, and it calculates a mean, upper and lower range of drymatter yield that's statistically valid. The Beet Guru also has a reporting function which is especially useful for retail users. All the grower and paddock details are stored within each assessment so a report can be produced at the end of the process. Simple and efficient, and it's free!

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 PDF
- Assessments stored within the app and used in a spreadsheet
- Available on Apple, Windows and Android
- Free to download

For more information visit **beetguru.co.nz**
Phone **0800 183 358** or Email **info@beetguru.co.nz**

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FORAGE BRASSICA.

Introduction

Forage brassica crops can often provide a superior feed supply, both in terms of quantity and quality. They provide an excellent source of energy and protein for grazing stock. Use of a forage brassica 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

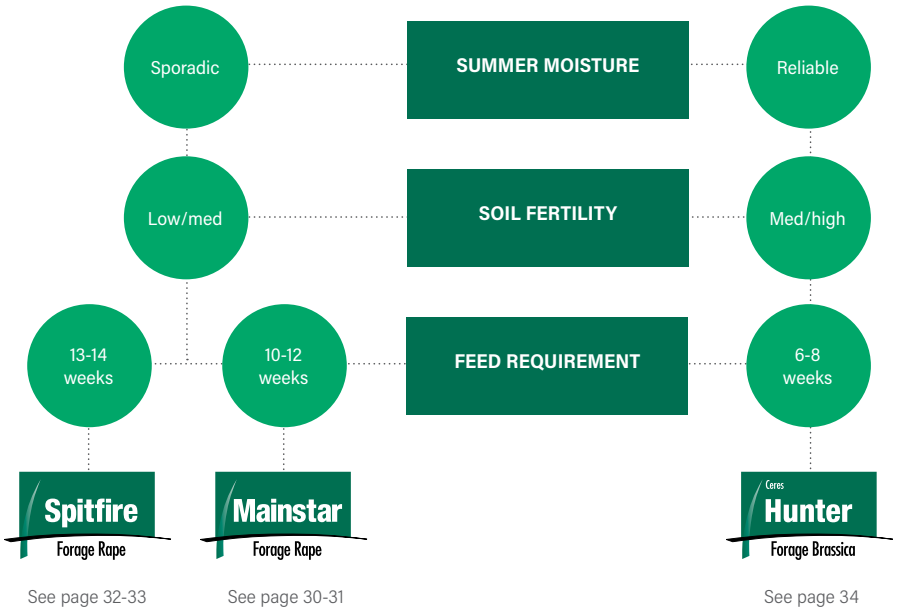
FIGURE 2. THE PLANT BREEDING PROCESS

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. **Spitfire** *(Brassica napus)* is a cross between a kale and a rape. **Mainstar** *(Brassica napus)* is a cross between a kale and rape. Both **Mainstar** 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.

Figure 3. Choosing the Right Spring Sown Multiple-Grazing Forage Brassica for Your Farming System



See page 32-33

See page 30-31

See page 34

SUMMER BRASSICAS PODCAST

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

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

SovGold Kale

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 (sheep only for first grazing of leaf only)	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
- Late flowering variety that maintains leaf into mid September
- Very high total leaf yield
- High total yield for intermediate kale

Please refer to pages 43-51 for grazing management and animal welfare information.

PRODUCT USAGE

SovGold is a modern New Zealand bred kale that combines excellent quality with a high yield potential. **SovGold** has a very high top end yield potential, although average yields are around 10-14 t DM/ha, depending on management and environment. **SovGold** is well suited to all cattle grazing systems and sheep systems that sow late to control crop height for utilisation by sheep.

Some of the key points that set SovGold apart are:

- **SovGold** produces a very high leaf yield which converts to a high leaf-to-stem ratio
- **SovGold** has been bred with stem quality in mind
- **SovGold** is a later flowering kale

The majority of **SovGold** 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.

SovGold 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 6. AVERAGE YIELD (KG DM/HA) AND STEM TO LEAF BREAKDOWN OF SOVEREIGN VS SOVGOLD

	Number of Trials	Total Yield (t/ha)	Leaf Yield (t/ha)
Sovereign	27	13.7	4.9
SovGold	24	14.7	5.3

TABLE 7. CRUDE PROTEIN (CP%*) AND METABOLISABLE ENERGY CONTENT (MJ ME/KG DM) FOR DIFFERENT PARTS OF THE KALE PLANT FROM SOVGOLD AND SOVEREIGN FROM SIX SPLIT PADDOCKS OVER TWO SEASONS (2017/18 & 2018/19)

	Sovereign			SovGold		
Plant Parts (Image right)	% of Total DM	CP% DM	Energy (MJ ME/kg DM)	% of Total DM	CP% DM	Energy (MJ ME/kg DM)
1. **Leaf**	41	18.8	13.8	44	16.6	13.6
2. **Upper Stem**	10	12.2	13.7	10	12.6	13.5
3. **Upper Mid**	16	8.3	13.1	15	8.7	11.9
4. **Lower Mid**	16	6.9	11.9	5	7.3	11
5. **Lower**	17	6.7	9.8	16	6.7	9

NIRS carried out by Hill Laboratories.
* Diet CP% refers to the average CP% of the diet as more kale components are eaten.

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

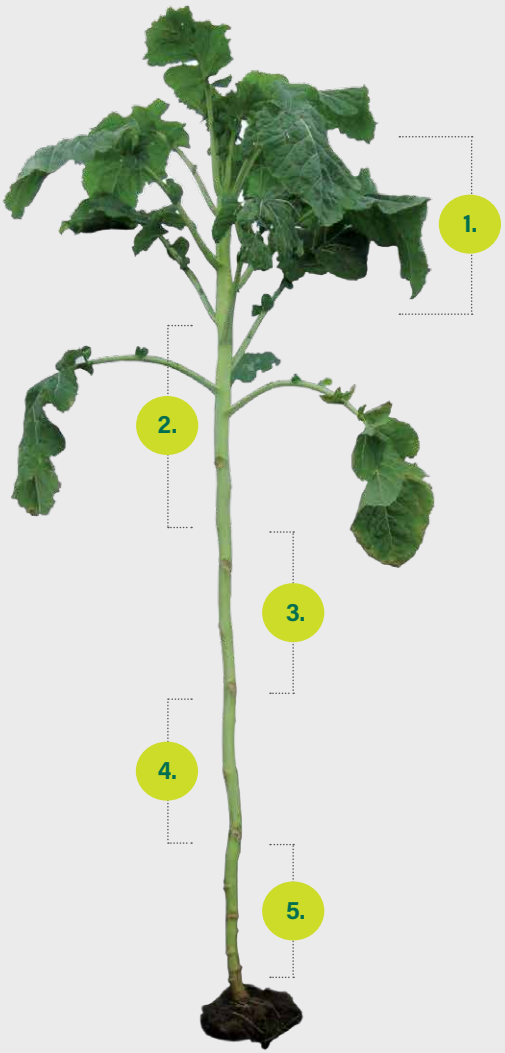
There is considerable variation between kale cultivars in the relative proportion of leaf and stem, and the various qualities of these plant components. In general, **SovGold** has a higher percentage of leaf than giant types. This difference in composition is consistent, but the actual proportions are 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 7). In general from the middle of the kale stem down to ground level, quality reduces quickly to low levels at the bottom of the plant. **SovGold** has a higher quality throughout the stem than giant types.

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. 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).

YOU'VE GOT KALE PODCAST



Domain Swede

EXCELLENT DRY ROT TOLERANCE.

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 90,000 seeds/ha pelleted
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

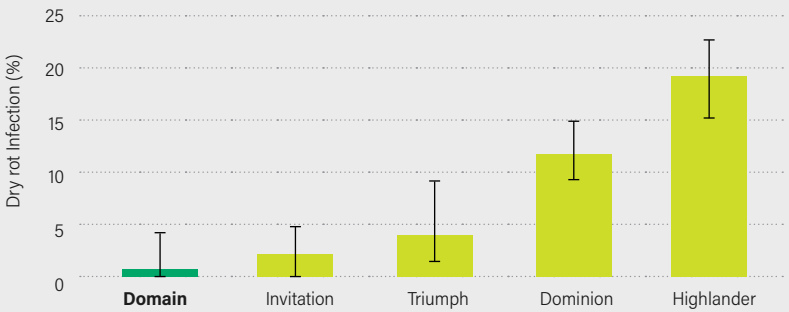
Please refer to pages 43-51 for grazing management and animal welfare information.

PRODUCT USAGE

Domain is a dry rot tolerant, yellow-fleshed swede. **Domain** is an early maturing soft swede which is often preferentially grazed in May and early June. It 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. As **Domain** is a palatable swede, the practice of grazing the leaf with lambs and hoggets 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.

Figure 4. 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.

Triumph Swede

VERY HIGH YIELD POTENTIAL.

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 90,000 seeds/ha pelleted
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+

- 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
- Pelleted seed available for precision sowing

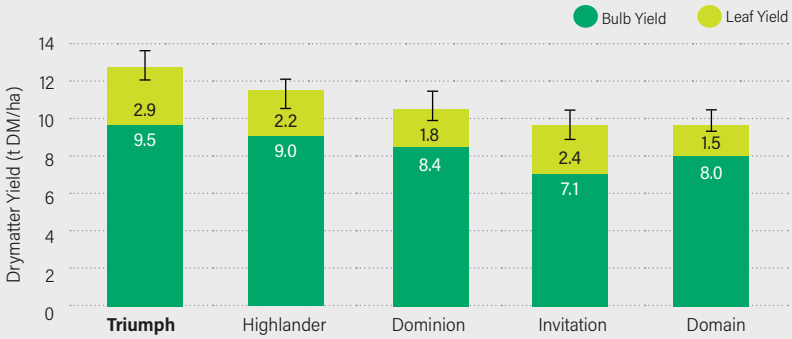
Please refer to pages 43-51 for grazing management and animal welfare information.

PRODUCT USAGE

Triumph is a very high yielding yellow-fleshed swede with high dry rot 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.

Figure 5. 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.

Mainstar Forage Rape

EXCELLENT REGROWTH POTENTIAL.

Suggested Sowing Time	Mid October to early November	February to March
Suggested Sowing Rate (kg/ha)	3-4 alone, 2.5-3 with **Relish, Sensation, AgriTonic, Ecotain®** or **Choice.** 1-2 with short term ryegrass	3-4 alone 1-2 with short term ryegrass
Time to First Grazing	10-12 weeks	10-12 weeks
Number of Potential Grazings	3 Mixes may extend number of grazings	1-2 Mixes may extend number of grazings
Potential Yield (t DM/ha)	10-12*	5-8 depending on sowing rate

* Depending on number of grazings

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

› Please refer to pages 43-51 for grazing management and animal welfare information.

PRODUCT USAGE

Mainstar is a modern early maturity rape. Traditionally rape has been used as a summer lamb-finishing crop and ewe-flushing feed. **Mainstar** has excellent regrowth potential and good frost tolerance extending grazing times from early summer to late winter. **Mainstar** has extremely good aphid tolerance. While its use won't completely remove the need to spray for aphids, it will greatly reduce the need in many situations. **Mainstar** is a very versatile brassica, being suitable for a wide range of soil fertility and environmental conditions, stock classes and sowing times.

Due to **Mainstar's** potential to have an earlier first graze than most other rapes, it has the ability to be grazed up to three times through summer and early autumn, at which time it is regularly shut up and carried into winter as a winter feed.

Figure 6. Mainstar Forage System

Note: Colour change indicates change in plant composition from brassica to other species.

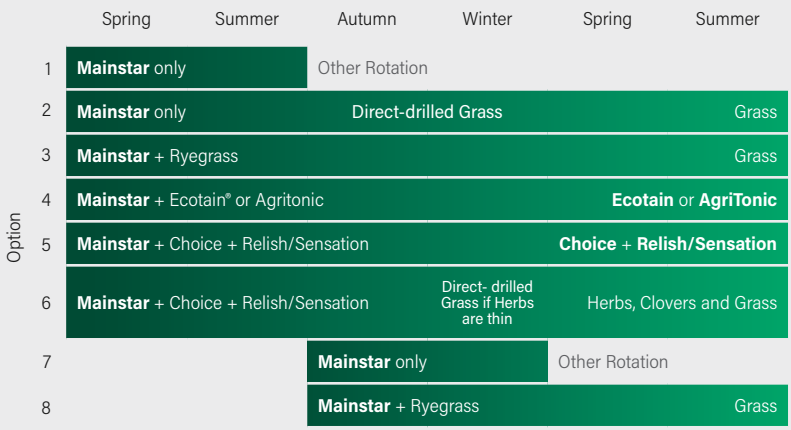


Figure 7: Lincoln Spring Sown Rape, Trial Sown 29th October 2019

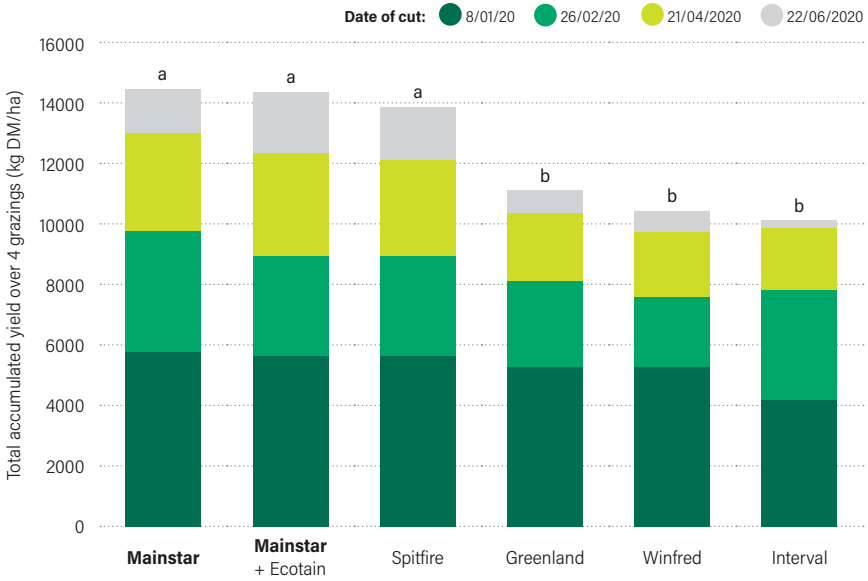


Figure 7: These six replicate trials were carried out over the 2019/20 season at Lincoln in Canterbury. We had very good establishment and very good growth leading up to the first grazing however after this we had an extensive summer dry spell until the end of March. As shown by the data, both Mainstar and Spitfire forage rapes have performed exceptionally well with the addition of Ecotain to Mainstar showing its merits in the third and fourth grazing. It is very clear that the regrowth potential of Mainstar is exceptional and it is a standout in its category.

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

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.

Preferential grazing and high utilisation of **Mainstar** (right) vs **Winfred** (left).

Spitfire

Forage Rape

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, Ecotain®** 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 Mixes extend number of grazings	1 Mixes extend number of grazings
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 drymatter percentage and a plant maturity of 13-14 weeks
- Suitable for summer, autumn and early winter feeding
- Excellent aphid tolerance

Please refer to pages 43-51 for grazing management and animal welfare information.

EXCELLENT YIELD AND INSECT TOLERANCE.

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 **Mainstar** 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. **Ecotain®** environmental plantain and/or ryegrass (**Manta** italian ryegrass, **Mohaka** tetraploid hybrid ryegrass or **Ohau** tetraploid long-rotation ryegrass) can be added to increase the quality, yield and longevity of the crop.

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.

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

Figure 8. 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.

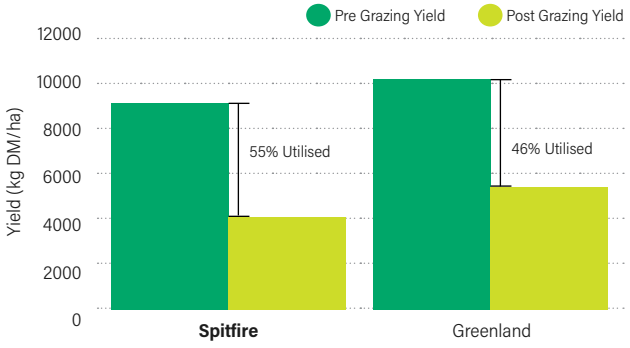
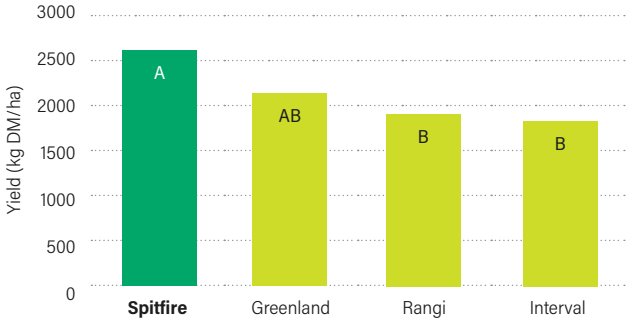


Figure 9. Rape Regrowth Yield from First Grazing in Hawke's Bay Trial

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

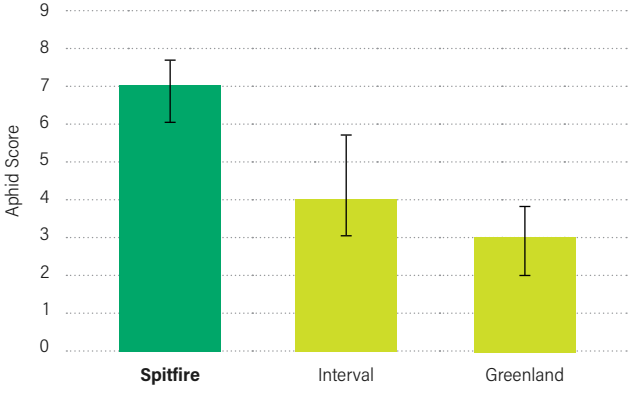


Statistical Significance: Letters that are different indicate a statistical difference while the same letter indicates no difference.

TRIAL RESULTS

Spitfire has a high total crop yield potential and excellent leaf yield, which is important for overall crop feed quality. **Spitfire** has very good utilisation and ability to regrow (Figures 8 and 9). 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 10). **Spitfire** can still be affected by aphids, but the risks are reduced, thus increasing plant health and future productivity in aphid prone areas.

Figure 10. Aphid Score at Kimihia Research Centre 2010-2011 (9 - High Tolerance)



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.

Ceres

Hunter

Forage Brassica

QUALITY FORAGE FOR FINISHING ANIMALS.

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 43-51 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.

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

Ceres **Rival** Turnip

Ceres **New York** Turnip

	Rival	New York	New York
Suggested Sowing Time	Late Oct to early Nov	Late Oct to early Nov	Jan to Feb
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 at approximately 12-14 weeks
- Excellent leaf production and leaf holding ability
- 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 43-51 for grazing management and animal welfare information.

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

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

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

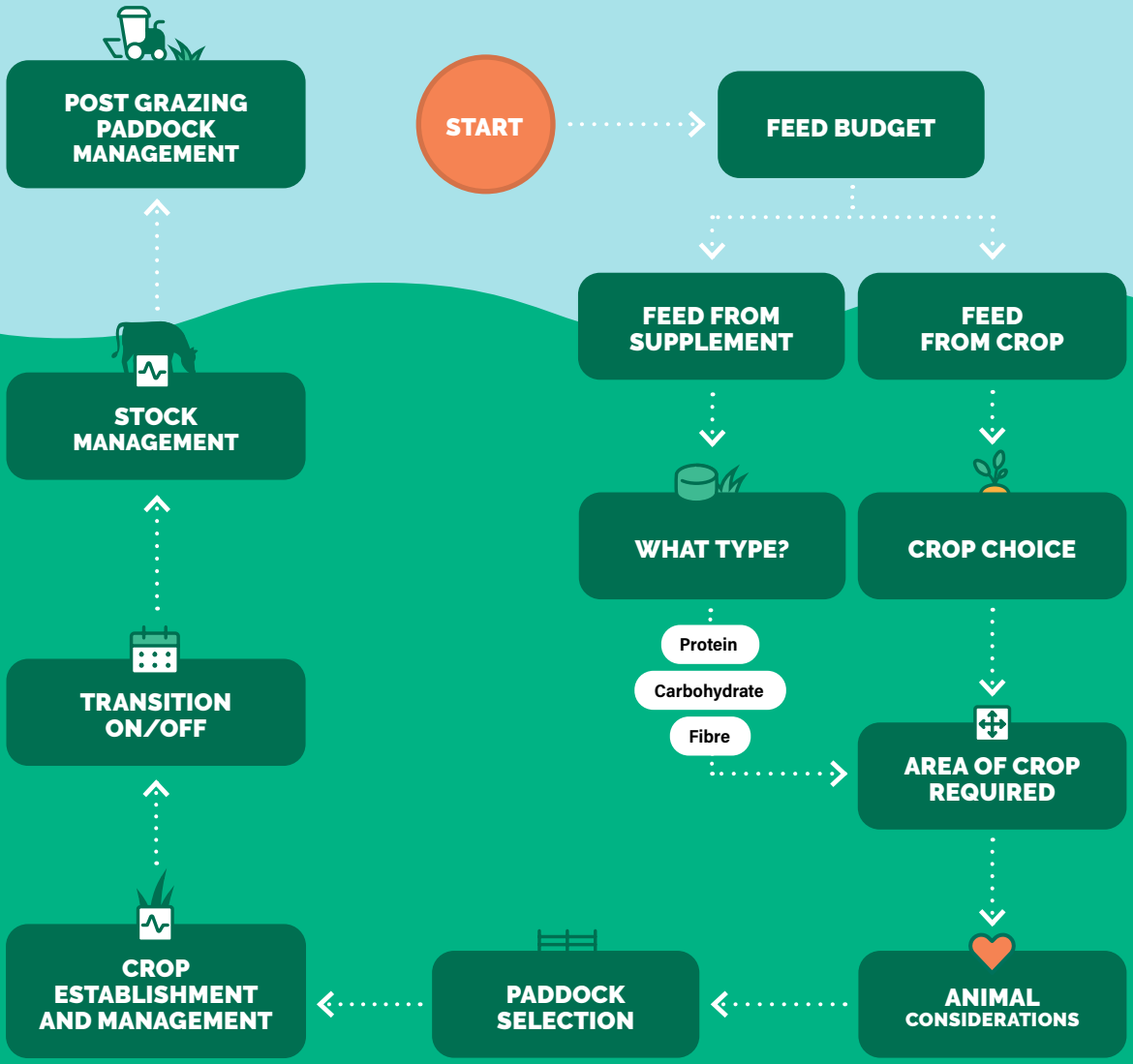
New York is a modern version of a traditional late autumn and early winter feed turnip. It has also performed very well as a spring sown medium to late-maturity summer turnip, and fits very well in conjunction with **Rival**, where the early grazed **Rival** makes up two thirds of the area and **New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

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.

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.

WINTER FEED PLANNING

This diagram identifies the recommended steps when setting up for an intensive winter grazing crop and ensuring this is in line with the required regulations. The following pages will look at these factors in more detail.



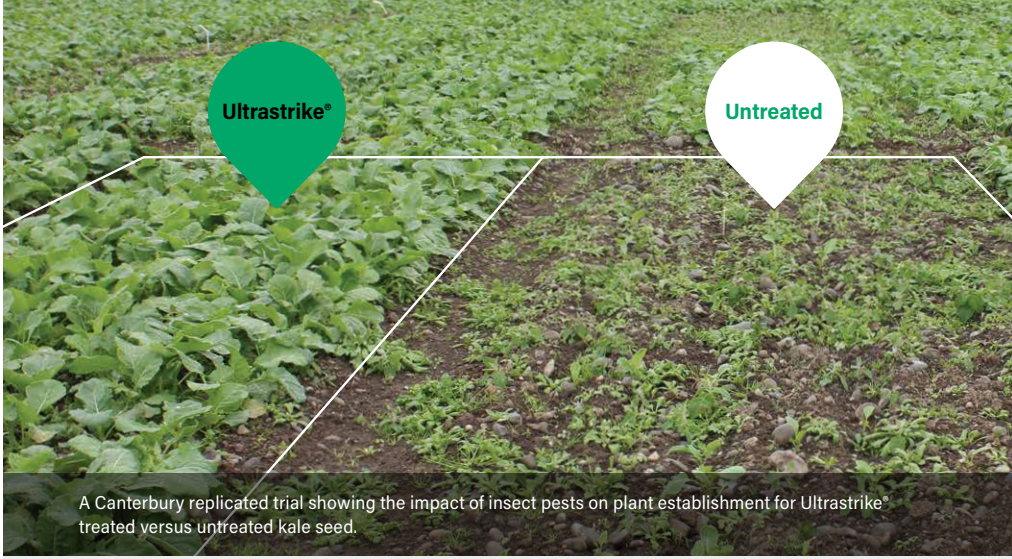
Ultrastrike® brassica™

Superstrike® brassica™

	Ultrastrike	Superstrike
Insect Protection	Springtail Aphids Argentine Stem Weevil Wheat Bug (*Nysius*)*	Springtail
Disease Protection	*Fusarium* *Pythium* *Rhizoctonia solani*	*Fusarium* *Pythium* *Rhizoctonia solani*
Nutrients	Molybdenum	Molybdenum
Sowing Rate	Same as for untreated seed	Same as for untreated seed
Recommended Use	Winter and summer crops	Turnip and rape crops only

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



A Canterbury replicated trial showing the impact of insect pests on plant establishment for Ultrastrike® treated versus untreated kale seed.

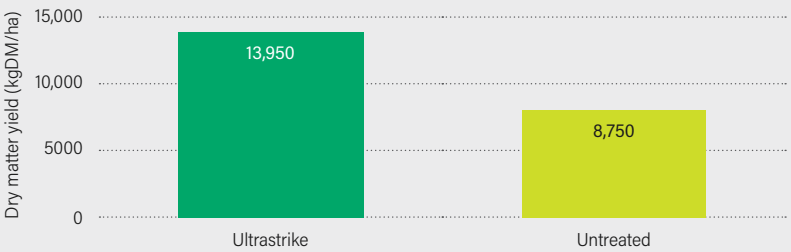
BRASSICA SEED TREATMENT

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.

Figure 11. Crop Yield of Ultrastrike Treated Kale and Untreated Kale Seed

Trial conducted by PGG Wrightson Seeds



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 two months pre-sowing)
- Aim for a moist, fine, firm seedbed, allowing the small brassica seed to be planted at an even 1 cm depth
- Creation of a fine, firm seedbed is highly recommended for any precision sown seeds such as swedes and fodder beet

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.

> Creation of a fine, firm seedbed is highly recommended for any precision sown seeds such as swedes and fodder beet. Consider pelleted swedes for crop uniformity and ease of measurement.

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 for 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

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).

> 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 37).

TABLE 8. 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	5.7-6.2

TABLE 9. 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	100-190
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.

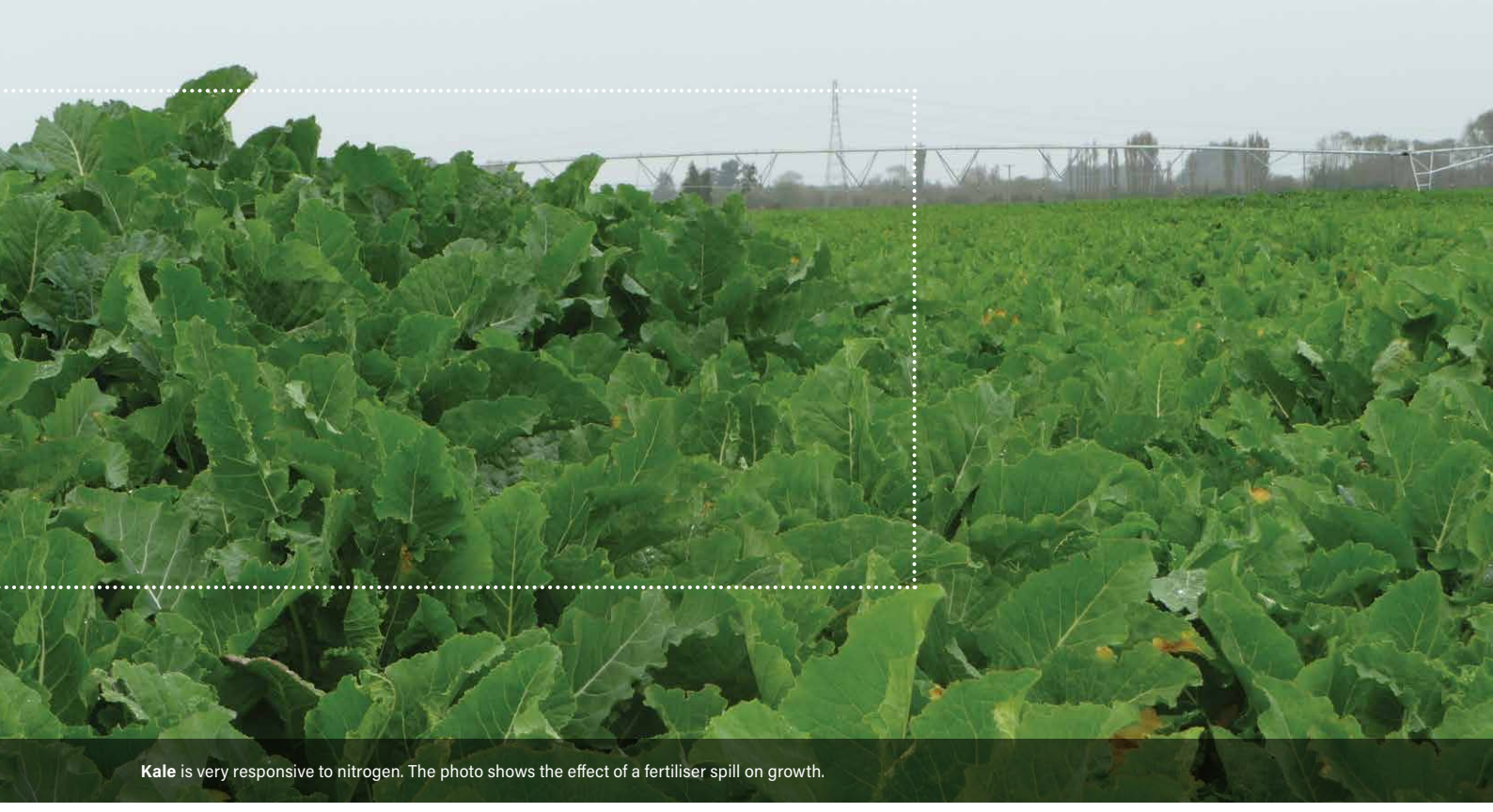
Phosphorus (P)

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).



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

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 10B, page 42) 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.


Aphids


Springtail


Nysius

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 10A. KEY PESTS AND DISEASES AFFECTING BRASSICA SEEDLINGS

Condition	Impact on Plant	Control
Seedling Insect Pests		
Springtails *(Bourletiella spp.)*	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 *(Agrotis ipsilon aneituma)*	Plants, especially seedlings ripped off at or just below ground level, young plants wilt	Chemical, crop rotation and hygiene
Grass Grub *(Costelytra zealandica)*	Adults attack young growing points, larvae attack seedling roots	Chemical
Wheat Bug *(Nysius huttoni)*	Ring barking of seedlings at ground level leaves plants susceptible to other attacks, damage is similar to that caused by wirestem	Ultrastrike + chemical
Weevils *(Catopes spp.)*	Chew cotyledons or stem at ground level, scalloping of leaf edge	Chemical, Ultrastrike for Argentine Stem Weevil
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 *(Rhizoctonia solani)*	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 (*Fusarium* and *Pythium*)	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

TABLE 10B. 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 *(Plutella xylostella)*	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 *(Pieris rapae)*	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 *(Plasmodiophora spp.)*	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 *(Leptosphaeria maculans)*	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 *(Mycosphaerella brassicicola)*	Small dark spots on older leaves in cool wet conditions	Crop rotation
Leaf Spot *(Alternaria spp.)*	Small dark lesions and dark sooty mould on leaves, may lower yields	Chemical
Black Rot *(Xanthomonas campestris)*	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.

Brassica Grazing Management

BEST PRACTICE GRAZING

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. See page 34 'Quick Guide to **Hunter** Grazing Management'.

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 11, page 44 gives typical values for energy, protein and drymatter percentage of a range of feeds to help determine specific requirements.

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.

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

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 the grazing of the 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 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

TABLE 11. 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. [1] Figure 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%.

Winter Crop Grazing Management and Environmental Considerations

ENVIRONMENTAL CONSIDERATIONS FOR FEEDING WINTER FEED CROPS

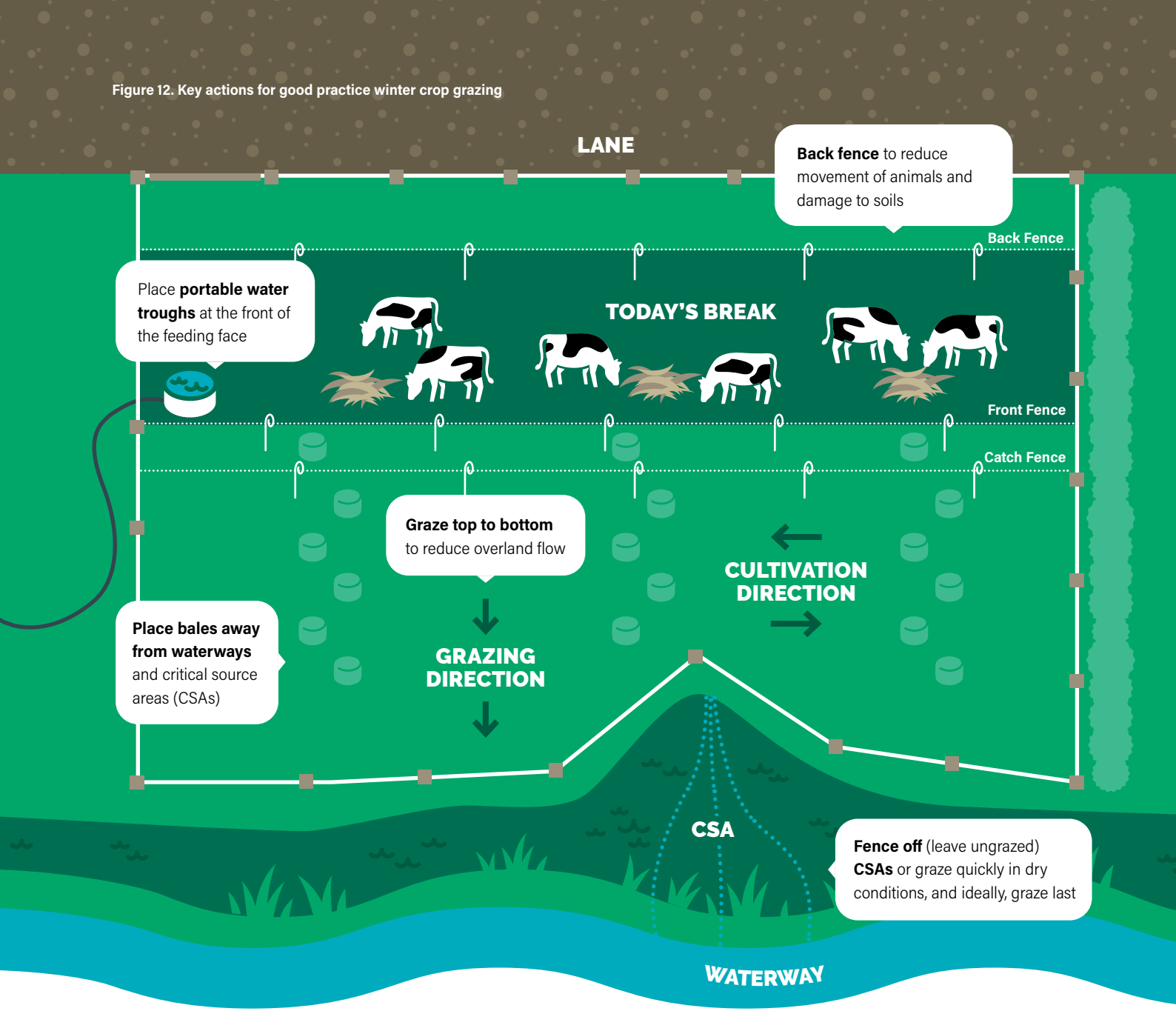
Winter grazing of crops is a key source of sediment, nutrient and pathogen loss into waterways from farms. Reducing losses from winter crops can go a long way to reducing total farm losses. With a few simple steps, you can make a real difference now. Soil is our greatest asset, so holding onto more of it makes good economic sense. Damage to soil from poor grazing management of winter crops will impact on the future productivity of that paddock.
Too much soil and nutrients in waterways impacts on their ecology and can kill freshwater species.

What can you do?

1. **Exclude stock from waterways.** Create an ungrazed buffer zone of crop between the livestock and the waterway. 3-5 metres is a good starting point but this should increase with slope and instability of soil.
2. **Leave an ungrazed buffer zone around either side of Critical Source Areas (CSAs).** These are parts of the paddock that can channel overland flow directly to waterways, like gullies, swales, very wet areas, spring heads, waterway crossings, stock camps and vehicle access routes.
3. **Graze paddocks strategically.** On a sloping paddock, fence across the slope and start grazing at the top of the paddock, so the standing crop acts as a filter. Or, if there is a waterway present, start grazing at the opposite end of the paddock.
4. **Make breaks "long and narrow"** - research shows that the crop will be utilised more efficiently by cattle.
5. **Back fence.** Regularly backfence stock off grazed breaks to help minimise pugging damage and to reduce runoff risk.
6. **Water and supplement placement.** Place troughs and supplementary feed in a dry central part of the paddock well away from any waterways or CSAs.
7. **Provide adequate feed, shelter and clean fresh drinking water.** Doing this will also limit stock movement and help reduce damage to crop and soil.
8. **Plant a catch crop.** Where soil conditions and farm management allow, consider planting a fast growing crop in spring such as greenfed oats or **Ecotain®** environmental plantain. It can make a dramatic difference to reducing nitrogen losses - see page 58-59 for more.

For more information visit **beeflambnz.com/wintergrazing** and **dairynz.co.nz/wintering**

Figure 12. Key actions for good practice winter crop grazing



Adapted from DairyNZ

Environmental Considerations for Feeding Winter Feed Crops

Essential Freshwater is part of a new national direction to protect and improve our rivers, streams, lakes and wetlands.

THE ESSENTIAL FRESHWATER PACKAGE AIMS TO:

1. Stop further degradation of our freshwater
2. Start making immediate improvements so water quality improves within five years
3. Reverse past damage to bring our waterways and ecosystems to a healthy state within a generation

There are some specifics in the new policy around intensification of land use and winter grazing, which will affect farmers growing winter crops.

Intensive winter grazing is defined as the grazing of an "annual forage crop" with cattle.

An annual forage crop is defined as being grazed from the 1st of May to the 30th of September each year and includes swedes (or equivalent), kales, fodder beets etc.

For more information on implementation guidance on Essential Freshwater policies and regulations refer to environment.govt.nz/acts-and-regulations/freshwater-implementation-guidance/agriculture-and-horticulture/intensive-winter-grazing.

THE ESSENTIAL FRESHWATER PACKAGE INCLUDES SEVERAL PIECES OF LAW INCLUDING:

1. New National Environmental Standards for Freshwater (also known as NES)
2. New Stock Exclusion Regulations
3. Amendments to the Resource Management (measurement and reporting of water takes) Regulations (2010)
4. Replacement of the existing NPS-FM 2017 and amendments to the RMA for faster freshwater planning processes and enable mandatory and enforceable Freshwater Farm Plans and the creation of regulation for reporting nitrogen fertiliser sales

A CONSENT FOR WINTER GRAZING WILL STILL BE REQUIRED IF:

1. The area being used for winter grazing is greater than the highest annual amount used in the five-year period from the 1st of July 2014 to the 30th of June 2019
2. You have not had intensive winter grazing on your land in the reference period 2014-2019

The restrictions on increases in the land area used for intensive winter grazing will be removed by the 31st of December 2024 and will not apply if the Regional Council have amended the regional plan to meet the new NPS-FM.

INTENSIVE WINTER GRAZING RESTRICTIONS:

Areas used for winter grazing must comply with a certified Freshwater Farm Plan. If no plan exists, farmers must comply with the following conditions:

1. Paddock has a mean slope of < or equal to 10 degrees
2. All livestock are kept at least 5 m from rivers, lakes, wetlands and drains at all times
3. Winter grazing can occur on no more than 50 ha or 10% of the property (whichever is greater)
4. A resource consent is required if you can't meet these conditions as a farmer

SYNTHETIC NITROGEN FERTILISER USE ON WINTER CROPS:

From the 1st of July 2022 dairy farmers, followed by other livestock farmers need to report their nitrogen fertiliser use. Greater application rates of nitrogen can be applied to your winter forage crops, however, you will need to ensure your total farm average does not exceed 190 kg N/ha/year.

For more extensive information on wintering dairy cattle refer to **dairynz.co.nz/feed/crops/wintering**

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 one third of diet) and feeding on crops under environmental stress.

- Crops should be accurately measured and allocation for dairy cows should be no more than one third of diet
- Animals with photosensitivity should be removed from crop and offered shade as soon as possible

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 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.

TREATMENT OF NITRATE TOXICITY

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

KEY TIPS

- 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. Ensiling does not decrease nitrate levels but may be a way of managing high nitrate pastures by reducing the proportion in the diet
- 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

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 sulphoxide (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.

- When changing stock class in early spring to clean up remaining brassica crops, follow best practice for feeding crops
- Slow introduction (ensure transition feeding)
- Access to alternative feed source

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, clovers and grasses with brassica crops is a strategy that may assist with increasing trace element availability to stock (refer pages 52-65).

HERBS, LEGUMES & GRASSES.

Relish red clover

Choice chicory

Herb and legume crops are often used as a source of quality summer feed where they offer both consistently high energy and protein to grazing stock. Recently the role of plantain and red clover as spring lactation feeds has highlighted how widely these products can be incorporated into different farming systems.

Herbs offer particularly high levels of critical micro-nutrients which are complementary to an existing animal health supplementary programme.

The most common situations are:

- Sheep lactation stands of **AgriTonic** plantain/**Ecotain®** environmental plantain or **Relish** red clover established to lamb-specific stock classes
  - Last lambing twin bearing ewes
  - Twin bearing hoggets
  - Scanned triplet mobs
- **AgriTonic/Ecotain®** clover pasture and **Relish** red clover stands for summer and autumn finishing
- **Choice** chicory for specific summer lamb finishing over two to three years
- **Choice** chicory or **Ecotain®** environmental plantain for summer cropping on dairy platforms
- Summer "safe" feed – a parasite/pathogen-free grazing environment, to avoid stock health issues related to endophyte effects, worms, facial eczema etc.
- 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. Herb and legume stands are particularly useful in avoiding ryegrass seeding over the summer prior to establishment of a grass variety with novel endophytes such as **AR1** or **AR37**

Herbs & Legumes

	Ecotain® and AgriTonic *(Plantago lanceolata)*	**Choice Chicory** *(Cichorium intybus)*	**Relish Red Clover** *(Trifolium pratense)*
Suitability/Use	Lambing to weaning feed. Lamb and cattle finishing with legumes Dairy: Ideal for maintaining summer milk production. Mixed in dairy pasture Mixed with regrowth brassica	Dairy: Ideal for maintaining summer milk production Finishing for sheep, deer and all classes of cattle Mixed in pastures	Lamb finishing Lambing to weaning feed. Silage production Mixed in pastures
Fixes nitrogen	No	No	Yes
Drought tolerance	Moderate: Fibrous, coarse root system. Good survival, quick response to moisture	Good: Deep tap root	Moderate-good: Tap rooted plant
Length of crop – productive years	2-4 years. Natural reseeding may increase persistence	6 months in wet dairy soils. 2-3 years, depending on soil type and total rainfall	Generally 2-3 years with grass weed control
Yield from spring sowing to May (t DM/ha)	8-14 t	8-15 t	8-14 t
Full year potential (t DM/ha)	14-19 t	12-17 t	12-17 t
Seasonal growth	All year	September-May	September-May
Summer	Mid-high	Mid-high	Very high
Autumn	Very high	Very high	High
Winter	High	Mid-low	Mid-low
Spring	High	High	Very high
Herbage quality	Dependent on stem content	Dependent on stem content	Dependent on stem content
Metabolisable energy (ME)	11.0-12.0 MJ ME/kg DM	11.5-13.0 MJ ME/kg DM	11.5-13.0 MJ ME/kg DM
Crude protein (%)	16-28% DM	16-27% DM	20-28% DM
Insects & diseases	Plantain moth, Porina, grass grub	Can be susceptible to the rot disease *Sclerotinia* in cool, moist environments	Tolerance to clover root weevil* Slugs
Animal health	Elevated elements copper (Cu) & selenium (Se). Reduced dag production in sheep. Can induce hypocalcaemia in pregnant ewes if changed onto ryegrass pastures	Good source of mineral (Zn, Cu, Mg, P, Ca, K). Faecal egg counts are reduced in lambs compared to ryegrass. Lower spore levels for facial eczema and zearalenone	Medium to low formononetin (oestrogen). Bloat in cattle
Grazing suitability	Set stock late winter/spring for lambing. Tolerates frequent rotations, grazing at 15-20 day rounds	Best suited to rotational grazing	Set stock early spring. Then rotational grazing as soon as possible
Suggested sowing rate (kg/ha)	12 Pure stand (or plus white clover) 2-3: Brassica mix 1-3: Pasture mix	8-10: Pure stand 1-3: Pasture mix	12: Pure stand. 4-6: Grass or brassica mix. Red clover does not spread like white clover, or reseed easily under modern grazing systems

* Gerard, P.J., Crush, J.R., Hackell, D.L. (2005). Interaction between *Sitona lepidus* and red clover lines selected for formononetin content. Annals of Applied Biology 147: 173-181.

Coolamon Subclover *(Trifolium subterran*	**Resal Persian Clover** *(Trifolium resupinatum)*	**Brace; Attribute; Nomad White Clovers** *(Trifolium repens)*	**Viper Balansa Clover** *(Trifolium balansae)*
Suited to free draining dryland environments, particularly under sheep grazing	Annual regenerating clover. Autumn sown for high spring yield. Can be strategically spring sown (e.g. red clover stand, brassicas and whole crop cereal silage)	Cultivar choice depends on stock class. Suited to moderate-high fertility soils, but less productive and persistent in dry situations	Autumn sown for high spring yield (e.g. into established **Ecotain®** environmental plantain or **AgriTonic** stands). Can be strategically spring sown (e.g. red clover stand, brassicas and whole crop cereal silage)
Yes	Yes	Yes	Yes
Good: Plants die in summer and new plants generate from hard seed	Requires resowing every year	Moderate-low	Good: Plants die in summer and new plants generate from hard seed
6-8 months then reseeds and plants die. Will regenerate from hard seed over time	6-8 months then dies	Perennial clovers that survive through high stolon densities and reseeding	6-8 months then reseeds and plants die. Will regenerate from hard seed over time
Results pending	Results pending	Results pending	Results pending
Results pending	8-18 t	4-12 t	7-14 t
April-November	April-November	September-May	April-November
NONE - establishing	NONE - establishing	High	NONE - establishing
High if sown early	High if sown early	Mid	High if sown early
High (warmer climates) Med (colder climates)	High (warmer climates) Med (colder climates)	Mid-Low	High (warmer climates) Med (colder climates)
Very high (peak Oct/Nov)	Very high	High	Very high (peak Oct/Nov)
High winter and spring	Generally high	High spring and summer	Generally high Depending on stem content
High	High	11.5-13.0 MJ ME/kg DM	High
–	High	High	High
–	–	Clover root weevil, Clover flea	–
Low levels of formononetin. Risk of bloat in cattle	No oestrogens. Risk of bloat in cattle	Risk of bloat in cattle	Low levels of formononetin. Risk of bloat in cattle
Set-stock early, then plants need to be spelled or lightly stocked later in spring if seed set is required for future persistence	Grazing rotations similar to other herb and red clover stands unless being shut up for silage production	Suitable for set stocking or rotational grazing dependent on cultivar choice	Plants need to be spelled or lightly stocked later in spring if seed set is required for future persistence
Minimum: 6 Standard: 8-12	6-10: Pure stand 3-6: Pasture mix with annual ryegrass or cereals	**Attribute** & **Nomad**: 2-5 in mix. **Brace**: 3-5. Often 2 different leaf sizes are mixed together to provide greater tolerance of differing management	4-6: Mixed sward

Grasslands®
Choice
Chicory

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 8-10 pure stand

- A long-lived chicory with strong persistence
- Certified chicory variety
- Superior disease tolerance
- Improved drymatter production
- Ideal for short term 'finishing' or dairy pastures

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 metabolisable energy (ME) 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)

CHOICE FOR DAIRY SYSTEMS

Standout Points from Current Choice Research and Experience in Dairy Systems

- 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
- 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
- When pasture quality is poor (below 10 ME) feeding **Choice** at 20-40% of the diet can increase milksolids production by 17%*
- Chicory is a responsive species to high fertility and is well suited to effluent paddocks where the deep taproot and high summer growth rates make it ideal for utilising surplus nutrients
- 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

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

SOWING DATE COMPARISON

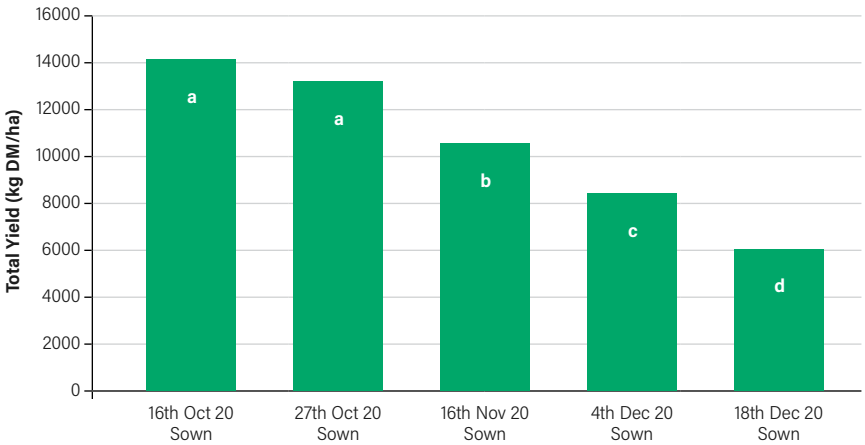
In addition to running yield trials between cultivars, Agricom has also been looking into other aspects such as different sowing dates of **Choice** and how this effects the total yield grown (kg DM/ha) to maximise production. Figure 13 shows sowing **Choice** in October provides the highest drymatter production taken up until end of April.

The key points found from sowing Choice in October:

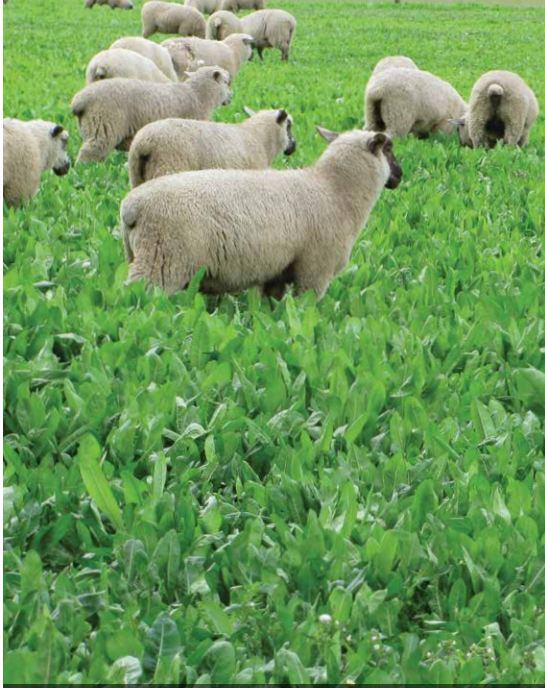
- Early first grazing (early-mid December) to boost milk production when ryegrass quality is low from seed head development
- Maximises number of grazings; 6-8 grazings from an October sowing versus only 2-3 grazings from a late sowing

The take home message here is aim to sow chicory by mid-October, as there could be up to a 50% loss of yield (kg DM/ha) by planting in December.

Figure 13. Total accumulated yield (kg DM/ha) until the end of April 2021, from five sowing dates between the 16th of October 2020 and the 18th of December 2020, for Choice chicory in the Waikato.



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



Choice pre sheep grazing paddock.

Choice post sheep grazing paddock.

Ecotain®
ENVIRONMENTAL PLANTAIN

Pure Sward	10-12 kg/ha
Ecotain Dominant Clover Mix	12 kg **Ecotain®** 4 kg clover
Diverse Pasture Mix	1-3 kg/ha

- **New Pasture:** Include 3-4 kg/ha of **Ecotain®** environmental plantain in your perennial pasture mix. Include 6-8 kg/ha of **Ecotain** in your Italian or hybrid pasture mix
- **Undersow:** Direct drill 4-8 kg of **Ecotain** into damaged or open pasture
- **Broadcast:** Broadcast 4-8 kg of **Ecotain** into damaged or open pasture

For more establishment options and advice visit **agricom.co.nz**

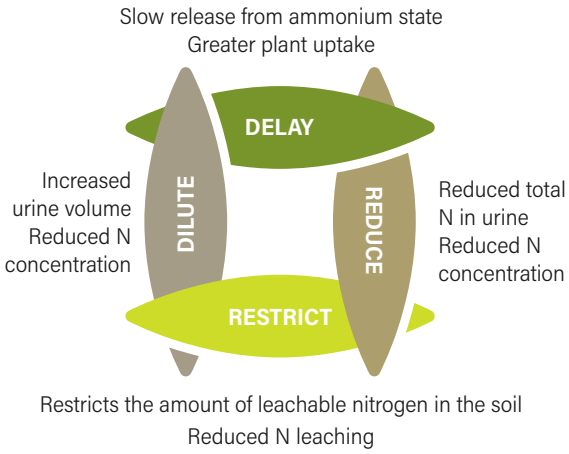
REDUCE NITRATE LEACHING WITH THE ONLY PROVEN ENVIRONMENTAL PLANTAIN

- New Zealand's only proven environmental plantain that functions in four independant ways to reduce N leaching from the urine patch
- Very similar annual drymatter quantity and quality to ryegrass pasture
- Increases feed quality and/or supply during summer and autumn
- Improves speed of sward recovery after summer dry
- Improves cool season activity of pasture base
- Suitable as a 2-3 year crop option
- Establishes and competes in perennial ryegrass pastures

ANIMAL PERFORMANCE BENEFITS

- Positive impact on milk production when grass quality drops in summer
- Elevated mineral content (Zn, Cu, Se, Mg, Ca, K)
- Has the potential to reduce facial eczema spore levels
- Reduces dag production in sheep
- Liveweight gain benefits with higher dressing out percentage in lambs and cattle

ECOTAIN® - THE ONLY PROVEN ENVIRONMENTAL PLANTAIN PODCAST



1. DILUTE

Ecotain® environmental plantain increases the volume of urine animals produce, which means the N being excreted is in a more dilute form, resulting in a reduced N load in the urine patch.

2. REDUCE

Ecotain reduces the amount of dietary N which is excreted in urine, compared with ryegrass. This reduces the amount of N released into the soil via the urine patch.

3. DELAY

In urine patches from animals grazing **Ecotain**, the conversion from ammonium to nitrate is delayed. Slower conversion allows plants a greater opportunity to uptake N, significantly reducing the potential for leaching.

4. RESTRICT

The presence of **Ecotain** plants in the soil restricts the amount of leachable nitrogen in the soil.

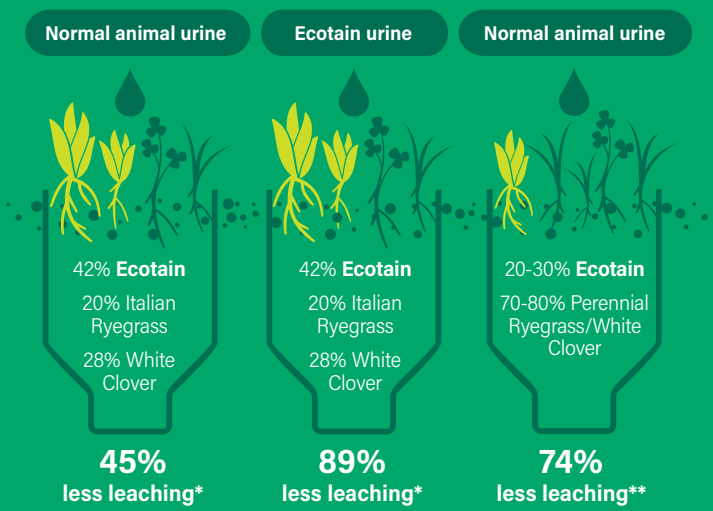
THE POWER OF 4

Ecotain® environmental plantain has been shown to reduce nitrogen leaching from the urine patch. Lincoln University lysimeter studies showed a reduction in nitrogen leaching by up to 89% from the urine patch compared with a ryegrass, white clover pasture. The diagram to the left demonstrates the four mechanisms working together.

ENVIRONMENTAL FUNCTIONALITY

Research has demonstrated that not all plantains (current cultivars or breeding lines) are capable of reducing nitrate leaching from the urine patch through the four mechanisms **Ecotain** can – dilute, reduce, delay and restrict.[1] In all other agronomic aspects as well as environmental, **Ecotain** is an excellent example of a high quality, productive, forage plantain. Figure 14 represents the outcomes of a lysimeter study with the first and third lysimeter demonstrating the Restrict function alone while the second lysimeter represents all four functions working together.

Figure 14. Nitrate leaching reductions using different urine and pasture mix treatments from lysimeter research.



[1] Judson *et al*, 2018
* From the urine patch *(Woods, 2017 used with permission)*. Compared to control ryegrass/white clover pastures.
** Carlton *et al*, 2018

Ceres

AgriTonic

Plantain

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 12 pure stand

- Strong all year round growth pattern
- Upright growth habit
- High tiller density
- Suitable addition to grass pasture mixes and high legume density pastures

GRAZING TOLERANCE.

Example of plants that were selected to create **AgriTonic**, showing the high leaf/tiller density.

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.

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.

* **Tonic** is one of the original forage plantains, and is considered as an industry standard.

Grasslands®

Sensation

Red Clover

Perenniality	Perennial
Oestrogen	Low-moderate
Leaf Size	Medium
1000 Seed Weight (grams)	2.5
Ploidy	Diploid
Suggested Sowing Rate (kg/ha)	4-6 grass or brassica mix

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

ULTIMATE FOR SILAGE SYSTEMS.

Sensation red clover has been bred in New Zealand by AgResearch. It has been proven on farms and in trials to be extremely successful. **Sensation** begins growth early in spring while retaining the strong summer growth common to the species.

Sensation has been selected for, and has, low to moderate levels of formononetin (a plant oestrogen which has been found to reduce sheep fertility in some cultivars with high levels).

Sensation is a more upright cultivar than **Relish**, making it the better fit for silage and hay systems.

Grasslands®

Relish

Red Clover

OUTSTANDING PROVEN PERSISTENCE.

Perenniality	Perennial
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)

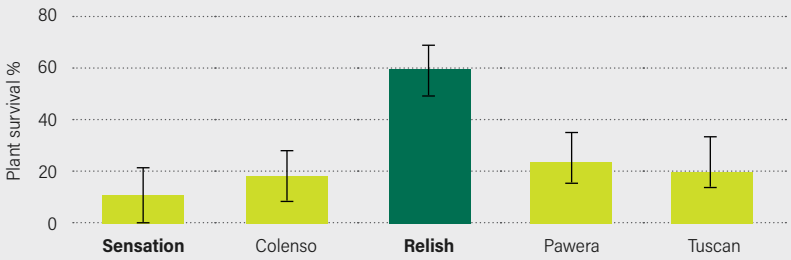
RELISH THE REWARDS OF RED CLOVER PODCAST

Relish red clover 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 **Relish** showed significantly greater growth and persistence over all other varieties. 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 15. Plant Survival (%). Percentage of Red Clover Plants Surviving after Three and a Half Years Under Cattle Grazing in the Manawatu



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.

RED CLOVER FOR FINISHING LAMBS

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.

In a series of Agricom experiments, groups of lambs (n=10-55) were rotationally grazed on red clover, perennial ryegrass/white clover pasture, or spring-sown leafy turnip, over two years. 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.

Additional benefits include;

- **Relish** persists for two or more summers
- Improves nitrogen cycling for future crop rotations
- Has the option to conserve surplus as silage or hay

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.

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/day (kg/ha/day)	9-17	9-17	1.5-5.3

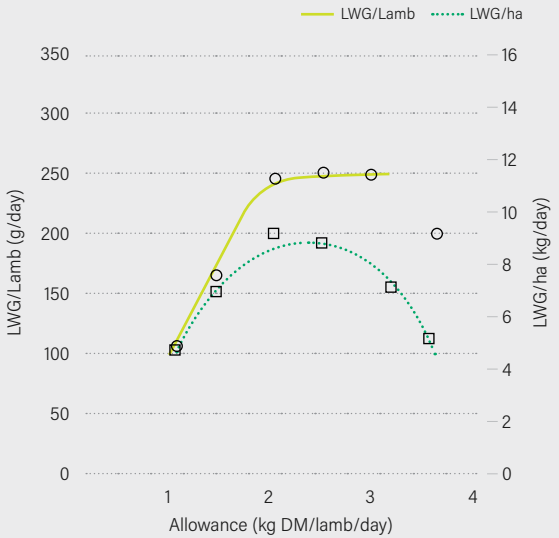
MAXIMISING ANIMAL PRODUCTIVITY

Maximising animal productivity from red clover stands is a balance between high stocking rates and fast growing animals (Figure 16).

Key points;

- Low allowance creates high utilisation and poor per head liveweight gains along with reduced liveweight gain per-hectare despite high stocking rates
- High allowance, liveweight gain can be reduced due to an increase in poorer quality forage and liveweight gain per-hectare rates can be lower
- Liveweight gain maximised at a lamb allowance of 2 kg DM/ha/day, as lambs grew fast and stocking rate was optimised

Figure 16. Effect of Daily Allowance of Red Clover on Liveweight Gain of Lambs



NEW

Grasslands®

Manta

Italian Ryegrass

Ploidy	Diploid
Suggested Sowing Rate (kg/ha)	20-25 Manta undersowing 12-15
Heading Date	Late (+15)
Endophyte	Nil **AR37** available 2024
Rust Tolerance	Very high

BIG, PERSISTENT, AND HIGHLY PRODUCTIVE.

- Very strong winter growth
- High total yield
- Broad visual plant type in all farm systems
- Low aftermath heading for an Italian ryegrass

Seasonally **Manta** demonstrates very strong establishment and winter growth, peaking in performance through late September until the end of its first summer. While **Manta** is currently Nil endophyte, it has a particularly strong second winter growth habit which is productive and highly visual. With its strong establishment, **Manta** is ideal for undersowing into thinning or run-out pastures.

Jivet

Annual Ryegrass

Ploidy	Tetraploid
Suggested Sowing Rate (kg/ha)	25-30
Heading Date	Late
Perenniality	Annual
Winter Activity	Very high

RAPID WINTER GROWTH WITH EXCELLENT SPRING PERFORMANCE.

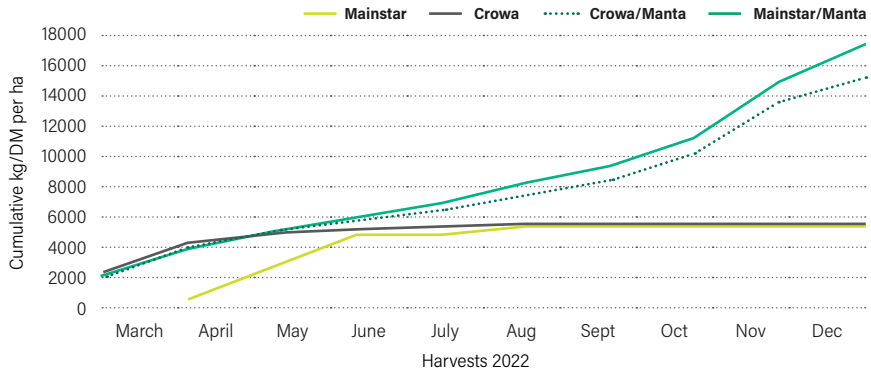
- Later maturing
- Excellent winter production
- Excellent disease resistance
- Autumn sow at 25-30 kg/ha

Jivet is a short-term option with very fast establishment and excellent production. **Jivet** is most suited for silage production and characteristics include a large upright leaf for ease of mowing, disease resistance and high ME for animal performance.

Mixed Forage Cropping

Winter crops such as oats and forage rape are commonly sown alone, when grazed in winter they often leave bare ground and don't have regrowth potential through the cold, wet months of July and August. Sowing oats and forage rape with either **Jivet** annual ryegrass or **Manta** Italian ryegrass is a great way to provide a significant catch crop of ryegrass regrowth after the primary crop has been grazed. Mixed cropping can often give variable ratios of composition between the primary crop of oats or forage rape or the grass sown with them, the actual ratio of the crop at first grazing will be influenced by seasonal conditions at establishment, which may favour one or the other of the mix components.

Figure 17. Cumulative harvest from late summer sown winter feed options highlighting the advantage in multiple regrowths when utilising mixes containing Manta Italian ryegrass



This is ideal for late autumn or early winter feed sown in March or early April, ideally grazed by sheep or young cattle to get the best regrowth potential from the **Manta** Italian ryegrass.

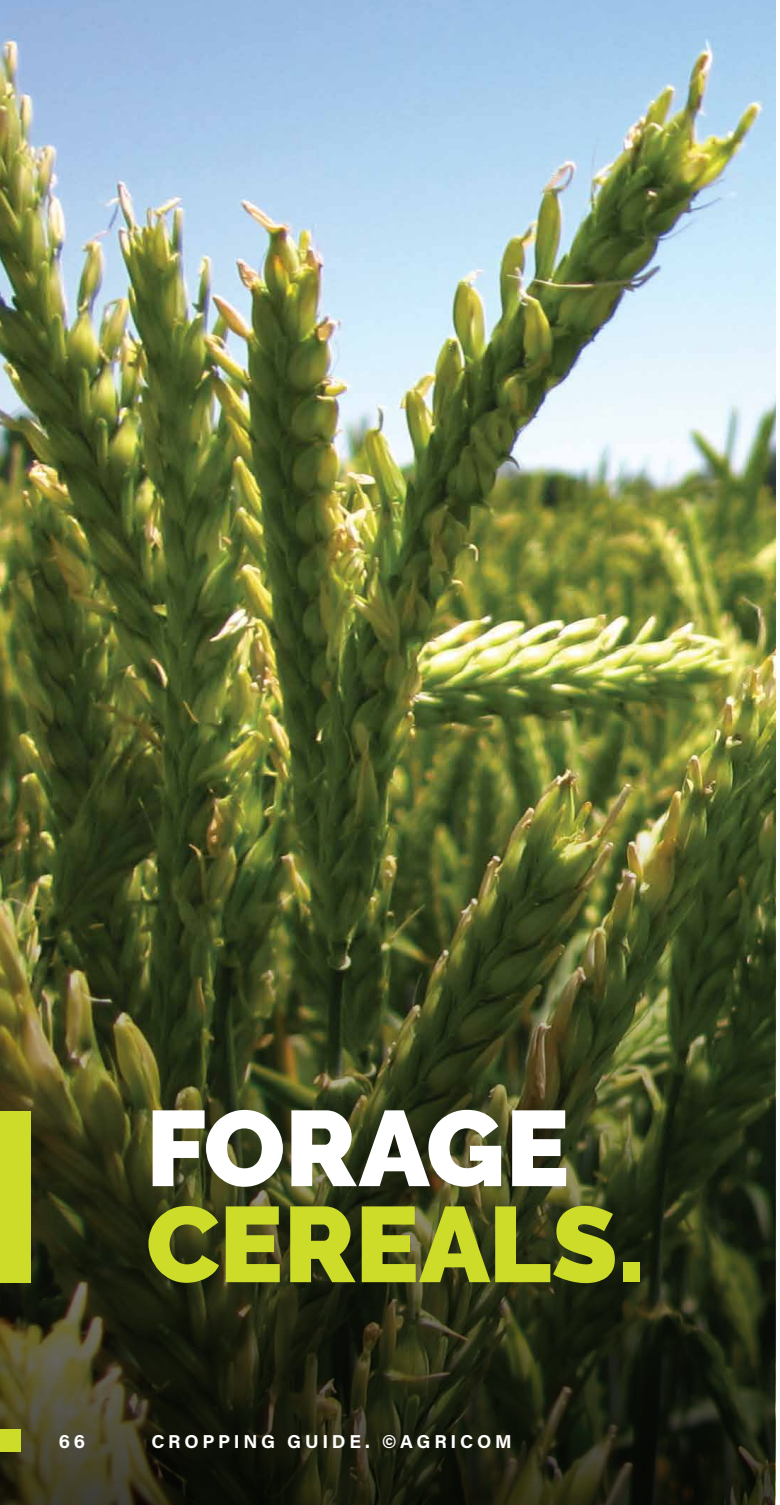
EXAMPLE MIX ONE: OAT AND ITALIAN RYEGRASS	RATE (KG/HA)
Crowa forage oats	80
Manta Italian ryegrass	20
TOTAL	**100**

This mix is suited to a late February to early March sowing, where it is likely suitable for grazing by mid-May and could be grazed through the first half of winter. Back fencing will provide the greatest chance for regrowth once enough of the paddock is opened up.

EXAMPLE MIX TWO: FORAGE RAPE AND ITALIAN RYEGRASS	RATE (KG/HA)
Spitfire forage rape	3
Manta Italian ryegrass	12
TOTAL	**15**

Crowa forage oats/**Manta** Italian ryegrass mix on the 3rd June 2022. Front of plot is regrowth from a harvest at the start of May left for a June yield measurement.

The same plot of **Crowa** forage oats/**Manta** Italian ryegrass mix in the late spring showing composition change to a pure sward of Italian ryegrass.



FORAGE CEREALS.

Cereal Silage

Spring sown forage cereals are an excellent 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.

FORAGE OATS

Oats are used for quick production of GCCS, usually after a winter crop. These forage oats can be 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** and **Crowa** 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 (40-50 kg N/ha) being applied six 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.

BASIC MANAGEMENT RECIPE FOR KUDOS TRITICALE PLANTED IN SPRING FOR SILAGE

Kudos is the latest release triticale from Plant & Food Research and Agricom. **Kudos** is the preferred triticale cultivar to be grown for spring WCCS due to its high yield potential. **Kudos** can be planted from autumn to early spring.

TABLE 13A. TRITICALE – BASIC MANAGEMENT RECIPE FOR KUDOS TRITICALE PLANTED IN SPRING FOR SILAGE

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

BASIC MANAGEMENT RECIPE FOR MONTY BARLEY PLANTED IN SPRING FOR SILAGE

Monty barley can be sown later in the spring (Sept-Oct) and harvested earlier in the summer. **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.

TABLE 13B. MONTY BARLEY – BASIC MANAGEMENT RECIPE FOR MONTY PLANTED IN SPRING FOR SILAGE

Typical Timing	Action	Details (examples)
September	Spray out old pasture	Glyphosate at 3-6 l/ha + surfactant
September	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

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 to maximise yield potential.

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 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%.

Correct cheesy-dough stage

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	Best Use	Can also be used	Not recommended	Not recommended	For green chop cereal silage only	Not recommended
Milton or **Crowa oats**	Not recommended	Best Use	Best Use	Not recommended	For green chop cereal silage only	Not recommended
Prophet triticale	Not recommended	Not recommended	Can also be used	Best Use	Can also be used	Not recommended
Kudos triticale	Not recommended	Not recommended	Best Use	Can also be used	Best Use	Can also be used
Monty barley	Not recommended	Not recommended	Not recommended	Not recommended	Best Use	Best Use

When to Harvest Cereal Silage

When making silage from oat crops (GCCS), harvesting should only be done at the booting stage, as this species is not ideal for whole crop cereal silage.

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.

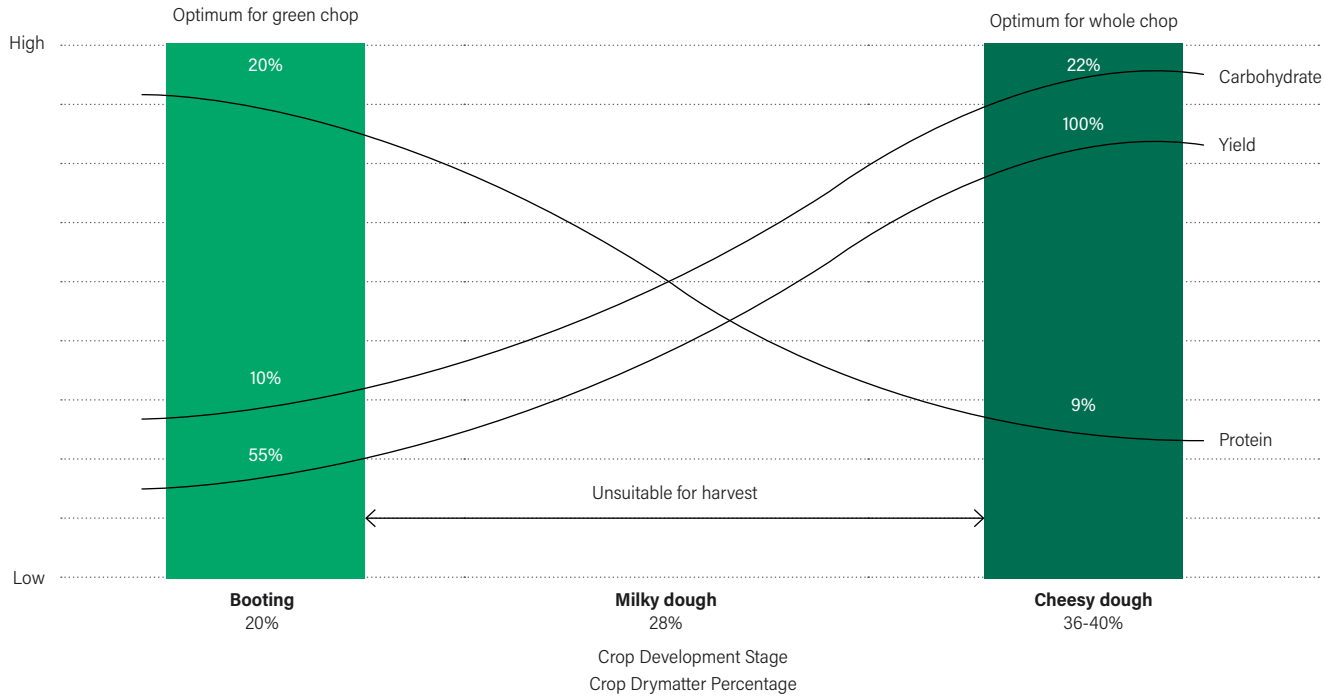
Triticale can be harvested at either the green chop or whole crop stage. The whole crop stage maximises yield and carbohydrate content of the silage (Figure 18), while the green chop stage maximises protein content at the expense of yield and carbohydrate.

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



Plant and Food

Kudos

Forage Triticale

VERY HIGH SILAGE YIELDS.

Intended Use	Whole crop cereal silage
Resistance to stripe rust	Moderate
Planting Time	Mid-autumn for grazing, or in Southland sow late winter 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 resistence to stripe rust and leaf rust
- High silage yields
- High energy and carbohydrate levels
- Very good cool season growth
- Sowing time flexibility

PRODUCT USAGE

Kudos delivers flexibility to farmers as it can be sown from mid-autumn through to early spring. **Kudos** can be grazed once when 2.5 t DM/ha has been reached, then left for whole crop cereal silage (WCCS). Careful management should be applied to avoid overgrazing and affecting regrowth. Spring sown **Kudos** results in high quality green chop or WCCS and is the preferred option for spring WCCS production. Spring sown triticale 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 variety **Prophet** is also used for silage production, but is generally planted in autumn primarily for winter grazing and spring silage.

SOWING

WCCS, **Kudos** can be sown from mid-autumn to early spring (April-September). The recommended sowing rate is 170-180 kg/ha to achieve 250-300 plants/m^2, but this will vary with seed size and sowing date (increase populations from 250 to 300 plants/m^2 for later sowings). Weed and aphid management is similar to cereals grown for grain.

TABLE 15. EFFECT OF SPRING SOWING DATE ON STRAW, HEAD, AND TOTAL YIELD (T DM/HA) AND DAYS TO HARVEST OF KUDOS TRITICALE IN CANTERBURY

Sowing date	Total Yield	Straw Yield	Head Yield	Harvest date	Days to harvest
29-Aug-19	17.1	8.5	8.6	14-Jan-20	138
30-Sep-19	13.8	6.4	7.4	31-Jan-20	123
29-Oct-19	12.3	6.3	6.0	19-Feb-20	113

HOODED SILAGE BARLEY.

Plant and Food

Monty

Forage Barley

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

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 8-14 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.

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

Plant and Food

Coronet

Forage Oats

HIGH QUALITY. HIGH UTILISATION.

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

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 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 18, page 69).

Coronet is also an 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.

Superior **Coronet** utilisation shown on right.

Plant and Food

Milton

Forage Oats

FAST FEED FORAGE OAT.

Intended Use	Single winter grazing, green chop cereal silage and catch crop
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
- Can be used as a catch crop

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

Milton oats can successfully be used as a catch crop by planting after winter crops. Catch crops are used to grow in cooler temperatures to cover the fallow ground and take up the urinary nitrogen deposited by winter grazing to help reduce the risk of nitrate leaching.

Like **Coronet** and **Crowa** oats, **Milton** can also germinate in relatively cold soils (5°C) compared with ryegrass. **Milton** can be planted 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, or early summer. **Milton** oats is faster to mature than **Coronet** oats, providing higher yields of feed earlier.

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

Intended Use	Green chop cereal silage, single winter grazing, catch crop
Resistance to rust	Very good
Planting Time	Autumn, winter, spring
Sowing Rate (kg/ha)	120 (can use 80/ha if in a mix eg. with Italian ryegrass)

IMPROVED DISEASE RESISTANCE

- Fast establishing
- Improved flexibility for green chop cereal silage – 7-10 days later maturing than **Milton**
- High yield potential across multiple sowing windows
- Proven performer in winter sown 'catch crop' trials under difficult conditions
- New Zealand bred

Agricom's latest release early-medium maturity oat has been selected as a fast starting, high yielding early to medium maturity type. Maturing slightly later than **Milton** oats, gives farmers more flexibility in terms of grazing and GCCS timing. Agricom has been evaluating **Crowa** for over three years across a wide range of climatic zones and farm systems to ensure it has the versatility and flexibility to perform to meet growers expectations. **Crowa** is faster to mature than **Coronet** oats, providing fast feed early. **Crowa** will be available in limited commercial volumes in 2023 and not in full production volumes until 2024.

Other Forage Products from Agricom

COMPLEMENTARY CULTIVARS

At Agricom we pride ourselves on providing a wide range of cultivars to farmers including a large range of brassicas, forage cereals, other grass species, legumes, herbs, fodder beet and ryegrass.

GRASSES

- Grasslanz® Three60 (NEW) — Perennial Ryegrass
- Grasslanz® Reason (NEW) — Perennial Ryegrass
- Cores ONE50 — Perennial Ryegrass
- Grasslanz® Legion — Perennial Ryegrass#
- Grasslanz® Prospect — Perennial Ryegrass#
- Grasslanz® Samson — Perennial Ryegrass
- Grasslanz® Halo — Tetraploid Perennial Ryegrass
- Grasslanz® Mohaka — Tetraploid Hybrid Ryegrass
- Grasslanz® Ohau — Tetraploid Long-Rotation Ryegrass
- Grasslanz® Asset — Italian Ryegrass

FESCUES

- Grasslanz® Hummer — Tall Fescue
- Grasslanz® Haven (NEW) — Tall Fescue
- Oakdon — Meadow Fescue

COCKSFOOT & OTHER GRASS SPECIES

- Grasslanz® Savvy — Cocksfoot
- Cores Atom — Prairie Grass
- Grasslanz® Gala — Grazing Brome

LEGUMES

- Grasslanz® Brace — White Clover
- Grasslanz® Attribute (NEW) — White Clover
- Grasslanz® Tribute — White Clover
- Grasslanz® Nomad — White Clover
- Coolamon — Subterranean Clover
- Resal — Persian Clover
- Viper — Balansa Clover
- Titan 5 — Lucerne
- Grasslanz® Torlesse — Lucerne

CEREALS

- Plant and Food Prophet — Forage Triticale
- Plant and Food Salute — Silage Barley

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#Prospect and **Legion** have been bred, selected and successfully tested as perennials and will function as perennial ryegrasses. Due to a small number of tip awns **Prospect** and **Legion** are certified *Lolium boucheanum.*

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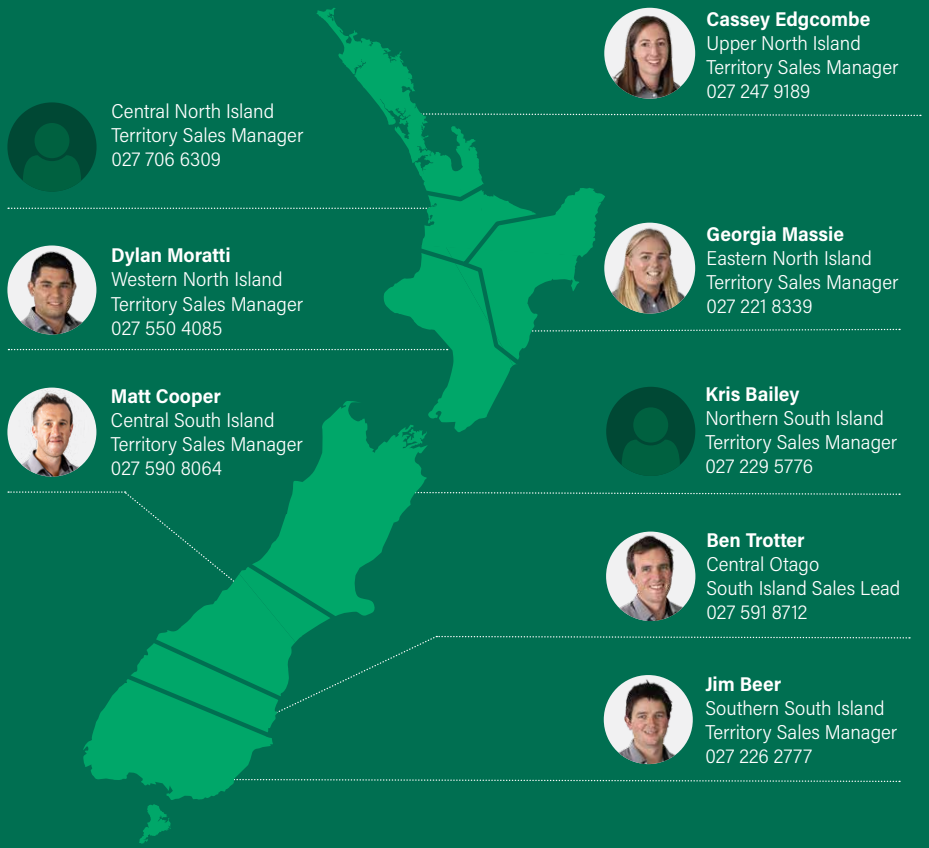

Central North Island
Territory Sales Manager
027 706 6309

Dylan Moratti
Western North Island
Territory Sales Manager
027 550 4085

Matt Cooper
Central South Island
Territory Sales Manager
027 590 8064

Cassey Edgcombe
Upper North Island
Territory Sales Manager
027 247 9189

Georgia Massie
Eastern North Island
Territory Sales Manager
027 221 8339

Kris Bailey
Northern South Island
Territory Sales Manager
027 229 5776

Ben Trotter
Central Otago
South Island Sales Lead
027 591 8712

Jim Beer
Southern South Island
Territory Sales Manager
027 226 2777

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Mark Brown
Australasian Brand Manager
027 220 4110

Allister Moorhead
Product Development Manager
027 433 7739

Glenn Judson
Animal Nutritionist
027 490 2033

Kaylee Spain
Nutrition Scientist
027 952 2845

Blake Gunn
North Island Forage Systems Specialist
027 406 0474

Fraser Harrison
South Island Forage Systems Specialist
027 404 5513

Angee Nagra
Upper North Island Extension Agronomist
027 216 8970

Kylie Dobbs
Lower North Island Extension Agronomist
027 335 3311

Luke Visser
Northern South Island Extension Agronomist
027 541 2232

Greg Dunshea
Central South Island Extension Agronomist
027 670 9776

Sam Anderson
Southern South Island Extension Agronomist
027 405 7195

Jessica Dunbar
Agronomy Project Coordinator
027 309 6543

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