Product Guide

2021 Spring

BARENBRUG

Now is the perfect time to consider your sowing options.

Good pasture is the cornerstone of New Zealand farming. You cannot buy a cheaper, more efficient and natural source of feed than your own grass, clover, herb or crop.

But not all pasture or crop is equal. If you want to get the best out of your livestock and land, you need the right match to your situation. Inside this guide you'll find the information you need to help select and grow superior pastures for your farm.

Contents

Value of cultivar choice

Investing in the correct plant genetics is a key decision in pasture renewal. Cultivar choice affects a wide range of things including persistence, cool season yield, the heading date in grasses and late spring quality of a paddock and its palatability.

How do you value this?

One way is to look at an old ryegrass cultivar like *Nui*. At first glance it may look easier on the wallet than newer options but a quick cost:benefit analysis shows it is anything but.

It all comes down to performance. Comparative trials show a modern ryegrass, like *Maxsyn* with *NEA4* endophyte or *Governor* with *AR37*, will grow 2-3 t DM/ha a year more than *Nui*. On a sheep farm, that adds up to more ewes/ha, and more lambs too. On a dairy farm, extra growth advantage means more milk in the vat. See the example below.

Bottom line? The correct cultivars, matched to the needs of the situation, pay for themselves surprisingly quickly, and after that, they're highly profitable. New pasture genetics also have other benefits that old cultivars (like *Nui*) simply cannot match. Palatability and feed quality are higher, so animals perform better. Winter and early spring growth is much better, giving you more feed when you really need it, plus better nitrogen uptake. Novel endophytes can enhance animal health and pasture persistence.

You wouldn't use a 30 year old ram or bull in your business because today's choices are so much more productive. Pasture is no different.

Example

Cost vs benefit: Modern ryegrass/white clover seed mix

Cost	
Typical modern seed	$335/ha
Typical 'cheap' seed	$125/ha
Extra cost*	$210/ha

* Estimated cost based on 20 kg/ha ryegrass & 4 kg/ha white clover.

Benefit - Sheep/beef	Benefit - Dairy
Extra 3 ewes/ha @ $110 GM** = $330	Extra 171kg MS/ha @ $6 = $1026/year◆
Faster lamb growth (10% faster) from better pasture quality*** = $62	Less cost production (30%◆◆) = $360/year
Extra benefit each year = $392/ha	Extra benefit each year = $840/ha

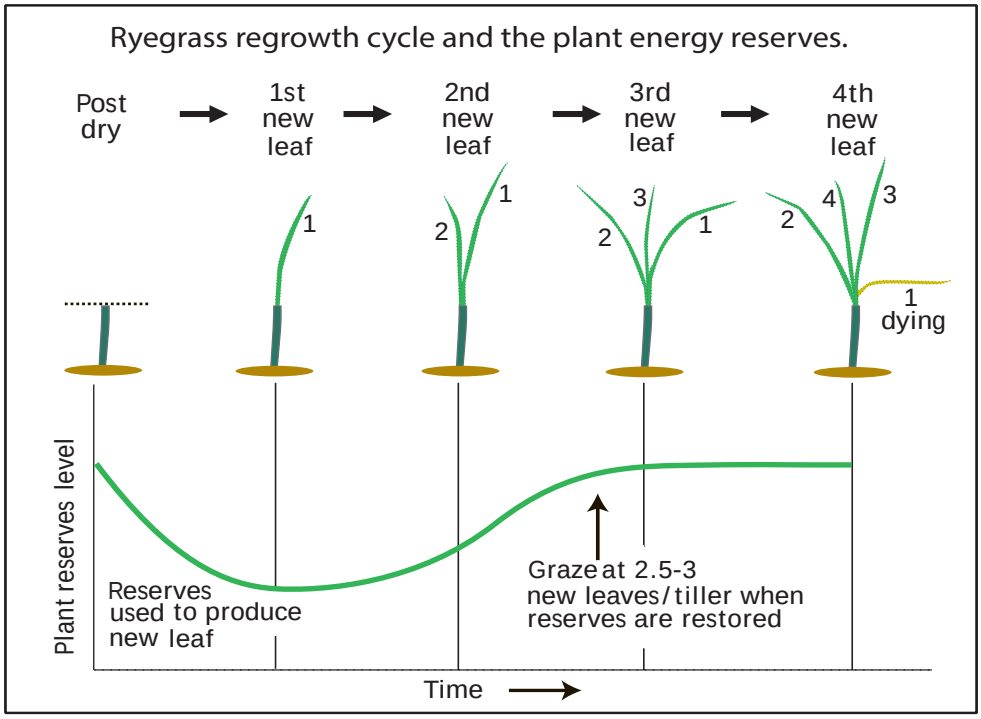
Assumptions:
**Extra 2 t DM/ha grown on sheep farm. Ewe gross margin (GM) = Income $110/ewe (1.2 lambs @ $90, cull ewes @ $12, $17.50 wool) less $27.50/ewe costs.
*** Lamb LWG from Lincoln University trials at Ashley Dene, Alto ryegrass grew lambs 10% faster than Nui (over 5 separate 8 week periods). $ benefit based on 15g/day faster LWG, 20 lambs/ha for 120 days = 36 kgLW @$1.70/kg = $62.
◆Extra milk solids (MS) based on 3 t DM/ha/year extra pasture; 80% utilisation; conversion to milk at 14kg DM/kgMS.
◆◆ Variable costs of extra MS produced vary farm to farm, but assumed 30% of income.

Improve ryegrass persistence

The most commonly sown grass, ryegrass, needs to be well cared for to persist, and perform. If you look after it, it will look after you.

How to help pasture persist

1. Feed your pastures well. Soil phosphate and pH are particularly important for plant persistence. Ensure your soil fertility levels are correct, and keep them maintained.
2. Minimise plant death over summer. The most typical cause of plant death is a combination of moisture stress + overgrazing + insect feeding. For insect protection, use endophyte, combined with pasture cultivars bred for persistence. To avoid overgrazing in the dry a number of strategies help:
   - Sow summer crop (e.g. chicory, rape) to take pressure off pasture.
   - Have supplement on hand to feed out (or have access to supplement).
   - Plan ahead for key stock policy decisions to reduce feed demand (e.g. selling lambs store, milking once a day, selling trading stock).
   - Look after the best pastures - you can't look after every pasture, but look after your best and newest paddocks, as they'll grow fastest when rain comes.
3. Once it rains, don't change anything till pastures regrow. Grazing a pasture recovering from the dry too early can kill it – plants need 2-3 leaves per tiller so they have restored their reserves and will regrow quickly post-grazing.
4. Manage winter grazing to avoid damage from cattle. Spread stock out, or use a sacrifice area to keep them off your good paddocks. Use finer, denser ryegrass cultivars (like *Maxsyn*, *Governor* or *Rohan*) because they cover the ground and protect the soil better.



5. Consider other options. In very dry areas, alternative pastures may be better than ryegrass. Options include *Bareno* pasture brome and *Safin* cocksfoot.

Improving environmental outcomes

Summary

Every farm is unique, and that means every plan to minimise environmental impact is unique, too. Strategies that work for one system may not work for the farm next door, and vice versa. When it comes to pastures, however, science has shown us even small changes can make a big difference.

Grow in winter

With the wet winter-spring period the main risk time for N leaching, the more winter growth in the system, the more soil N is taken up. Modern plant breeding has helped greatly in this - today's perennial ryegrasses grow 20-30% more winter DM than their 20-year-old predecessors. To really soak up even more N in winter, sow the highest yielding Italian ryegrass (e.g. *Tabu+*) or cereal (e.g. *Hattrick* oats).

Cover up

Nothing loses soil N in winter like bare ground. Post autumn fodder beet, for example, sow a winter a winter active species like *Catch-crop+* see page to catch the remaining N before it may leach in winter. Don't wait till the whole paddock is bare – sow half as soon as the crop is grazed. Earlier sowing gives much better yield and N uptake.

Min till

It means more careful weed and pest control, but establishing new pasture through minimum tillage releases less N than cultivation, and also uses less diesel. Long term it is better for soil structure too.

Mix it up

Deep rooted plantain is known to mitigate N leaching in several ways. Cool-season active plantain (e.g. *Captain*) is even better – more growth when the risk of N loss is highest (and more feed when it is needed most).

Graze higher

As ryegrass tillers grow to have 3 leaves, water soluble carbohydrate (WSC) goes up and protein (i.e. N) goes down. Many pastures in New Zealand are grazed at around 2-2.5 leaves/tiller; if grazing can be delayed until closer to the 3 leaf stage, less N comes out of livestock. With their high palatability, mixed diploid/tetraploid pastures are easiest to manage this way.

Break later

Use 24 hour grazing to give cows a new paddock in the afternoon. Cows eat about 70% of their intake in the first half of the grazing. Putting them into a new paddock when ryegrass carbohydrate levels are highest and protein levels are lowest in the late afternoon means there's less N going into them. 24 hour grazing has no effect on cow production compared with 12 hour grazing (and is easier with half as many stock shifting decisions too!)

Captain CS plantain mitigates N in several ways.

Utilise more

Raising per cow intake and MS production with tetraploid ryegrass and optimal grazing management can give the same total MS yield from fewer cows. The Lincoln University Dairy Farm is a great example of this, going from 680 cows to 560 cows and producing a similar profit. A key part of its efficiency gain is from more feed going into milk, less into cow maintenance, and a lighter environmental footprint. An added benefit is that fewer heifers are needed, further reducing the environmental footprint.

The same principles hold for breeding ewes, cows or finishing stock. Higher production per animal or faster growth rates means greater efficiency and a lower environmental footprint. An example of this for lamb finishing is on page.

Fix for free

Legume-rich pastures need less artificial N fertiliser. Use high performance red, white and annual clovers, as they fix 25 kg atmospheric N/ha for every tonne of DM grown (and provide higher animal performance too).

High performance clovers - like Weka - help cut the need for artificial N fertiliser.

Prevent pugging

Compacted, waterlogged soils release more greenhouse gases than soils with healthy structure. They are more prone to runoff and soil loss, with overland flow of sediment, phosphorus (P) and faecal material to waterways. They require more tractor work for seedbed preparation and sowing, and more fertiliser to ensure growth of subsequent crop or grass growth.

Mind the dirt

Soil bared out by over-grazing is at higher risk of wind-blow or gully erosion than soil protected by pasture plants, even on flat land. Maintaining vegetative ground cover through pasture maintains and improves soil organic matter and structure, and enhances biological activity.

Maxsyn perennial ryegrass

Maxsyn is the next generation perennial ryegrass for all farm systems, delivering superior persistence, improved summer growth and tillering, and a great endophyte.

Highest total yield

Maxsyn is the next generation with the highest yield of any perennial ryegrass we've released.

Shines in summer

Maxsyn's strength is its warm season growth. It is easier to graze in spring (encouraging new daughter tillers) and has strong summer tillering, helping it persist.

Summer is a time most farm systems are short of feed, so extra pasture is highly valued. Visually you can see the difference, with *Maxsyn* holding its green colour longer into hot summer conditions.

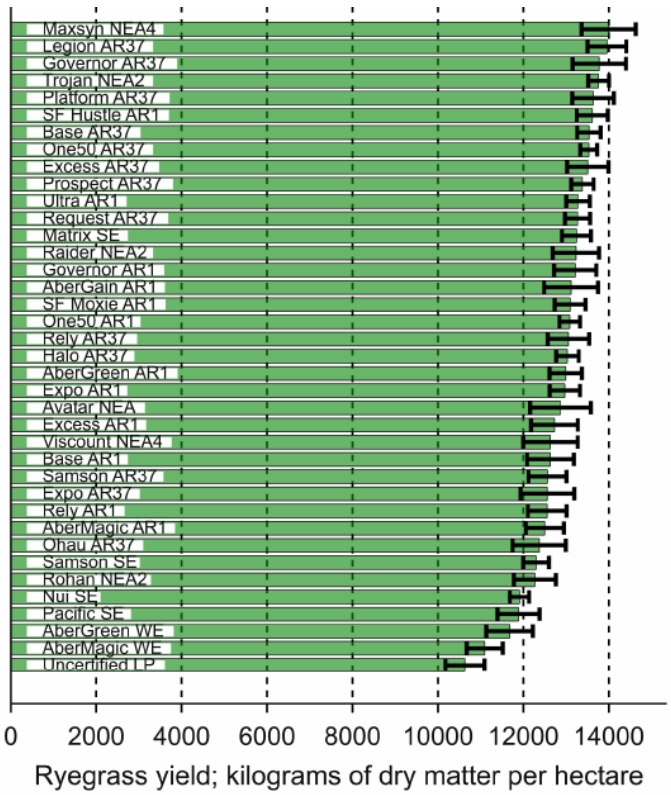
5 Star Nationwide in the FVI

Maxsyn has a top 5 Star rating in the 2021 DairyNZ Forage Value Index, across all regions. It delivers a predicted average $512/ha extra operating profit (range $423-$605 depending on region). For more detail visit www.dairynz.co.nz/fvi

Unbeaten in NFVTs

Maxsyn's unbeaten in the 2020-21 industry National Forage Variety Trials (NFVT) for total yield across all New Zealand trials.

"All New Zealand Trials - Total Yield"



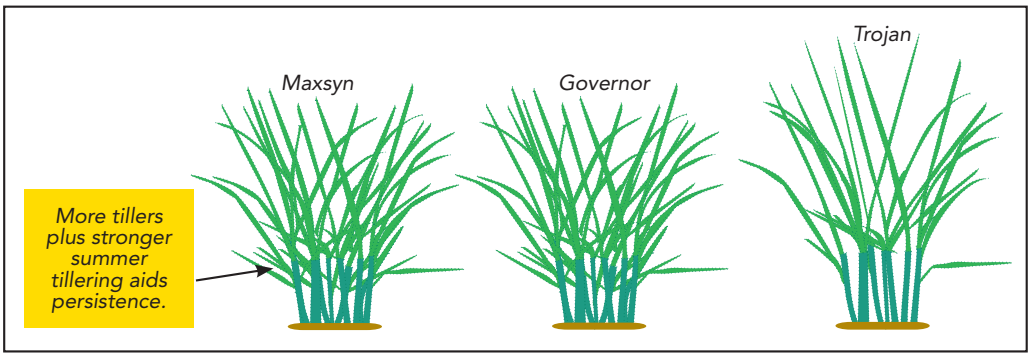
Superb pedigree

Maxsyn began as a cross between elite *Alto* and *Arrow* plants, with the top progeny from this combination then rigorously selected to become 'the best of the best'.

Its lineage is reflected in its name, which harks back to *Bronsyn*, the best-selling perennial ryegrass in the 2000s; and *Yatsyn 1*, the original game-changer.

Densely tillered

The more tillers a pasture has, the more robust and persistent it is. *Maxsyn* is denser than *Trojan*, and similar to *Governor* ryegrass.



1 + 1 = 3

Maxsyn has excelled in our breeding and trial programme, particularly on tough sites in the hotter climate of the upper North Island and on difficult soils.

Maxsyn and *NEA4* endophyte together add up to more than their parts. This combination is showing excellent persistence in the field under real life pressures such as moisture stress, heat, insects and overgrazing, sometimes all at once.

For dairy cows and beef, *Maxsyn NEA4* provides ryegrass staggers free pasture. For sheep and deer, there is a very low risk of ryegrass staggers when grazing *NEA4* endophyte.

Sowing *Maxsyn*

Maxsyn's features mean it can improve farm systems in a range of situations.

Dairy		kg/ha
Next generation dairy pasture	*Maxsyn* perennial ryegrass	18-22
	Kotuku white clover	2
	Weka white clover	2
	Total	22-26
Dairy		**kg/ha**
Next generation pasture with extra palatability (*4front*) plus reduced N leaching (*Captain CSP*)	*4front* perennial ryegrass	15
	Maxsyn perennial ryegrass	10
	Kotuku white clover	2
	Weka white clover	2
	Captain CS plantain	2
	Total	31
Sheep, Beef, Deer		**kg/ha**
Next generation sheep, beef, deer pasure	*Maxsyn* perennial ryegrass	16-20
	Weka white clover	2
	Apex white clover	2
	Safin cocksfoot	2-3
	Total	22-27

Governor perennial ryegrass

***Governor* is our great all-rounder, with persistence, yield, and density, and is our option where *AR37* or *AR1* endophyte is required.**

Genetic legacy

The persistence of *Bronsyn*, with the high DM yield and palatability of *Tolosa*, make *Governor* an ideal diploid ryegrass for dairy, sheep and beef systems.

Persistent

Governor has shown outstanding survival through drought and high insect pressure under grazing in farm trials across the country. Fine and densely tillered, we believe it is the premium *AR37* cultivar for persistence. It is also available with *AR1* endophyte for situations where *AR37* isn't required.

Seasonal growth

A key feature is *Governor's* ability to grow more DM on the shoulders of the season, in early spring and autumn, when it is most needed.

All-rounder

With a +8 days heading date, low aftermath heading and better rust resistance than its parents, *Governor* is the reliable, persistent all-rounder.

Where to sow

Pasture type	High animal performance	High yield, persistent pasture	More density & robustness	Persistence key requirement	Toughest, non-ryegrass situations
	Increasing persistence →				
Example	*Maxsyn/ 4front mix*	*Trojan*	*Governor OR Maxsyn*	*Rohan SPR*	*Bareno Safin*
Description	*Maxsyn* provides density and robustness, tetraploid *4front* adds high palatability driving animal intakes.	*Trojan* provides an excellent balance of high DM yield and very good persistence, that will suit many situations.	*Governor* and *Maxsyn* are fine, dense cultivars that provide robust, high yielding pastures.	*Rohan SPR* is a very persistent spreading ryegrass suited to hill country and tougher conditions.	Some situations are just too tough or dry for ryegrass. This is where *Bareno* pasture brome and *Safin* cocksfoot suit.

Suggested seed mix

Dairy		kg/ha
Top performing all-round dairy pasture	*Governor* perennial ryegrass	18-22
	Kotuku white clover	2
	Weka white clover	2
	Captain CS plantain	2
	Total	24-28
Sheep, Beef		**kg/ha**
Top performing, all-round pasture	*Governor* perennial ryegrass	16-20
	Weka white clover	2
	Apex white clover	2
	Safin cocksfoot	2-3
	Total	22-27

Trojan perennial ryegrass

On the market for 10 years now, *Trojan* gives proven high performance, and persistence, with strong shoulder growth in both early spring and autumn.

Endophyte

Trojan contains *NEA2* endophyte, a mixture of different endophyte strains providing:

- Good control of adult black beetle and Argentine stem weevil.
- Very good control of pasture mealy bug (provisional rating).
- Moderate control of root aphid.

Feed quality

Trojan is late heading (+13 days) with a low level of aftermath heading, giving it better feed quality in late spring and summer. In trials for the DairyNZ Forage Value Index *Trojan* showed very high feed quality with an average 12.5 MJME/kg DM through the year.

Resistance

Trojan has good resistance to rust, and very good resistance to plant pulling.

Species classification

Trojan was bred as a perennial ryegrass and performs as one. It has a low level of tip awns (hairs) on its seed so under the seed certification regulations this means it is classified as *Lolium boucheanum*. In terms of pasture performance it is a perennial ryegrass.

Sowing *Trojan*

Dairy		kg/ha
Top performing dairy pasture	*Trojan* perennial ryegrass	18-22
	Kotuku white clover	2
	Weka white clover	2
	Captain CS plantain	2
	Total	24-28
Sheep, Beef, Deer		**kg/ha**
Top performing pasture	*Trojan* perennial ryegrass	16-20
	Weka white clover	2
	Apex white clover	2
	Safin cocksfoot	2-3
	Total	22-27

Rohan spreading perennial ryegrass

Rohan is a unique spreading perennial ryegrass (SPR), giving sheep and beef farmers a tough but easy-to-manage, hill country pasture.

Spreading habit

Rohan SPR's spreading habit helps it fill bare areas in a pasture that may otherwise be occupied by weeds (see photo below). This means *Rohan SPR* competes against weed ingression.

The spreading habit also helps recovery from adverse climatic events, particularly extended dry periods, because it spreads to fill space where ryegrass tillers may have died.

Rohan SPR is not indestructible. Like all ryegrasses it will perform best under reasonable management and soil fertility. But its spreading habit improves persistence.

Rohan stolon spreading across the ground.

Sheep & beef system fit

The key with any pasture is matching a cultivar to a particular situation. So where does *Rohan SPR* fit? Looking at different pasture types across properties, based on persistence:

Pasture type	High animal performance	High yield, persistent pasture	More density & robustness	Persistence key requirement	Toughest, non-ryegrass situations
	Increasing persistence →				
Example	*Maxsyn/ 4front mix*	*Trojan*	*Governor OR Maxsyn*	*Rohan SPR*	*Bareno Safin*
Description	*Maxsyn* provides density and robustness, tetraploid *4front* adds high palatability driving animal intakes.	*Trojan* provides an excellent balance of high DM yield and very good persistence, that will suit many situations.	*Governor* and *Maxsyn* are fine, dense cultivars that provide robust, high yielding pastures.	*Rohan SPR* is a very persistent spreading ryegrass suited to hill country and tougher conditions.	Some situations are just too tough or dry for ryegrass. This is where *Bareno* pasture brome and *Safin* cocksfoot suit.

Easy to manage

Under semi-intensive to semi-extensive farm systems it is not easy to maintain pasture quality in late spring. A continual comment from farmers with *Rohan SPR* is that it 'always looks good', it stays greener and leafier and is usually preferentially grazed. *Rohan SPR* in on-farm trials has shown a 0.7 higher ME than some other cultivars in November and December.

Three year old Rohan SPR (green) sown beside Nui ryegrass (brown) in the same paddock in Central Otago. Rohan is much preferred by stock.

NEA2 & animal health

Rohan SPR with *NEA2* endophyte provides very low staggers risk pasture for sheep and staggers free pasture for cattle. In the 16 years we have sold *NEA2*, no ryegrass staggers have been seen in sheep or cattle on commercial farms.

High yield in dry conditions

Under ideal conditions *Rohan SPR* does not have the same yield potential as cultivars such as *Maxsyn*, producing about 10% less. But under tough, dry conditions *Rohan* will likely persist and yield more over the life of a pasture.

Suggested seed mixes

Sheep, Beef, Deer		kg/ha
Tough easy to manage pasture	*Rohan* perennial ryegrass	16-20
	Weka white clover	2
	Apex white clover	2
	Safin cocksfoot	2-3
	Total	22-27

Sub clover(s) are often added to this mix.

Tyson perennial ryegrass

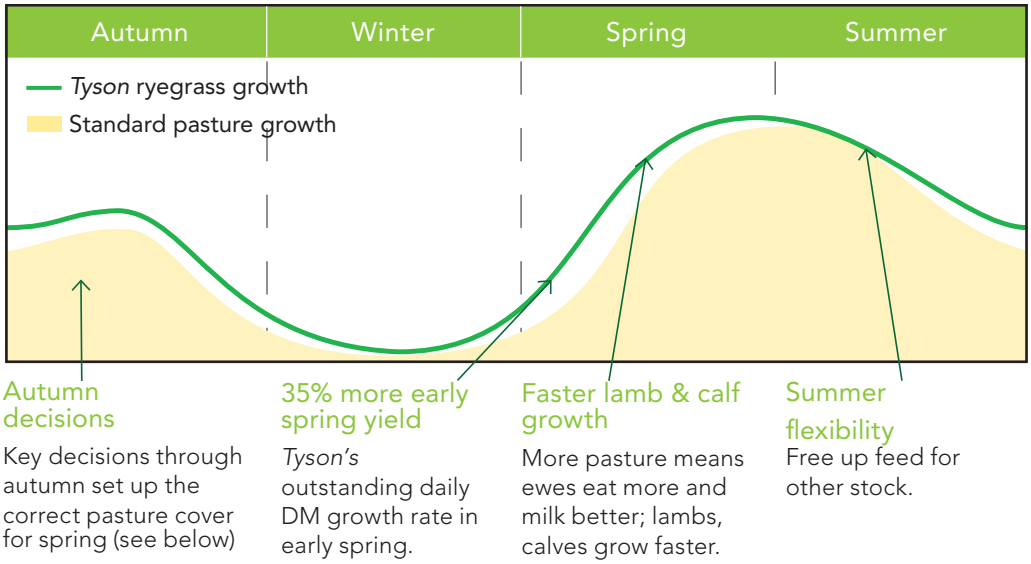
Tyson is the early lamb/calf feeder, providing an industry leading 35% more early spring growth, with strong yield year round, ideal for red meat systems. It now has *NEA4* endophyte to improve its persistence.

Increased efficiency

With its superb early growth *Tyson* is arguably the most exciting perennial ryegrass the red meat sector has seen. It can feed breeding stock better through early lactation, meaning better lamb and calf growth, which in turn allows more lambs or calves to be finished off mum. This is a key goal for sheep and beef farmers because:

- Early lambs meet early export schedules typically at better prices.
- Weaning check is avoided (2 weeks lost LWG) plus their dressing out percentage is higher.
- Extra feed is freed up for other stock, e.g. to improve ewe BCS prior to mating, or cattle trading.

Getting the best from *Tyson*



Cover target for lambing

While *Tyson* has the genetic potential to grow extremely well in early spring, it needs to be managed correctly if farmers are to capture its full potential. It should be set stocked in spring at a minimum cover of 1200-1300 kg DM/ha (or 3-4 cm pasture height) for singles, 1500-1600 kg DM/ha (or 4-5 cm height) for twins, or 1700+ kg DM/ha for triplets through lambing.

Otherwise, *Tyson* won't have the leaves to capture enough sunlight to grow to its genetic potential, which is the science behind the saying 'grass grows grass.' Also as pasture height drops so does bite size, and although ewes take more bites both their pasture intake, and lamb growth rate, drop.

DM yield

Tyson has outstanding early spring growth in August and September, growing 35% more than the trial mean yield in inland Canterbury (altitude 190 m ASL). Total yield of *Tyson* over the year is excellent, with strong seasonal yield in summer and autumn.

Many farmers have commented how many more ewes and lambs they've had to put on their *Tyson* paddocks during set stocking, due to its increased production.

The outstanding early growth of Tyson (left) stands out clearly in this trial. Photo taken in September.

Growth habit

Tyson is a fine leaved, densely tillered diploid perennial ryegrass suitable for both set stocking and rotational grazing.

Heading date

Tyson is the earliest heading of any perennial ryegrass on the market, with a -10 day heading date. For improved feed quality through the remainder of the season, *Tyson* was carefully selected for low aftermath heading.

Endophyte

Tyson has been upgraded to *NEA4* endophyte, providing good control of Argentine stem weevil, black beetle and pasture mealy bug, with no negative impacts on animal health. It is also available with Low endophyte.

Suggested seed mix

Sheep, Beef, Deer		kg/ha
Early lamb/calf feeding pasture	*Tyson* perennial ryegrass	16-20
	Apex white clover	2
	Weka white clover	2
	Morrow MS red clover (coated)	6
	Total	26-30

Possible additions

- *Captain* CS plantain at 2 kg/ha – provides extra summer feed value, lasts 2-3 years.
- *Safin* cocksfoot at 3 kg/ha - provides extra summer feed in drier conditions.

4front perennial ryegrass

4front NEA2 is the new benchmark in tetraploid ryegrass, with superior year-round growth, improved persistence, easy grazing and excellent animal performance. It's better for the environment, too.

Best of the best

4front NEA2 is the highest yielding tetraploid perennial we've bred, outgrowing several other cultivars. Equally important is the way it does this, with high yield across all seasons. *4front* has excellent growth in both the cool and warm seasons.

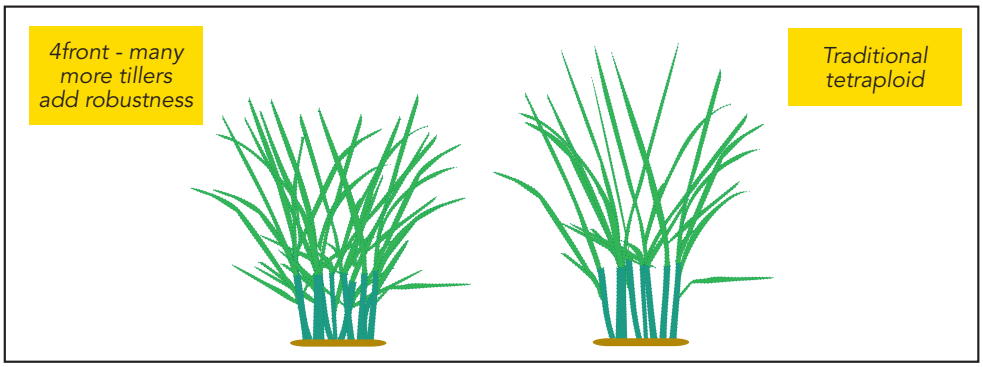
Seasonal DM yields Kirwee National Forage Variety Trial, run under rotational grazing 2016-2019

Entry	Autumn		Winter		Early Spring		Late Spring		Summer		Annual	
4front NEA2	3050	a	608	ab	1277	bd	2526	ab	3306	a	10966	a
AberGreen AR1	2954	ab	546	ab	1266	bd	2623	a	2904	cf	10506	ab
Base AR37	2869	ab	538	b	1175	de	2422	bc	3255	ab	10438	ab
SF Hustle AR1	2838	ab	596	ab	1239	be	2299	ce	3150	ac	10416	ac
Bronsyn SE	3031	ab	557	ab	1336	ab	2191	ef	2989	be	10400	ac
Trojan NEA2	2860	ab	599	ab	1188	ce	2361	cd	3068	ad	10374	ac
Governor AR1	2968	ab	643	a	1447	a	2246	df	2770	ef	10297	bc
One50 AR37	2882	ab	606	ab	1087	e	2272	de	3001	be	10079	bc
Platform AR37	2991	ab	550	ab	1108	e	2263	de	2827	df	9986	bc
SF Moxie AR1	2797	b	605	ab	1321	ac	2113	f	2659	f	9751	c
Trial Mean	2863		598		1272		2278		2956		10220	
LSD (5%)	244		102		146		143		289		661	

**Data from Kirwee, Canterbury trial P216KIR. Statistical significance lettering is given, yields with the same letter are not significantly different at the 5% LSD level. Breeding lines and non-commercial lines have been removed.*

More tillers

The more tillers in a pasture, the more robust it is. Each tiller is an individual which can be killed by a range of stressors, including drought, pugging, insects and overgrazing. *4front's* enhanced tillering helps it persist when conditions are tough.



Piece of cake!

Animals love tetraploids. For you, that simplifies grazing management. Soft, high ME, legume-friendly tetraploid pasture makes life easier for your stock, too. Every bite takes less effort, encouraging animals to eat more for higher daily intakes. The result? More milk in the vat, and faster LWG for finishing stock.

Grazing is hard work! A cow on pasture might take 25,000 bites every day; a ewe, 40,000. *4front's* soft leaves make a big difference to their quality of life.

Lose less N & GHG

With higher animal intakes and easier management, *4front* can help lighten your farm footprint.

Tetraploid ryegrass-based pastures, or tetraploid/diploid mixes, allow farm system changes to reduce N leaching while improving pasture growth and animal intakes, which is the future direction farming needs to take.

A dramatic example of this is the Lincoln University Dairy Farm (LUDF). It has cut N leaching by 40% and greenhouse gases (GHG) by about 22%, by making a range of systems changes including:

- Capturing more photosynthesis – pre-grazing covers are 300 kg DM/ha higher with tetraploids, growing an extra 1.2 t DM/ha/year across the farm.
- Longer grazing round (average 4 days longer) meaning fewer grazings per paddock and 30% better N use efficiency.
- Higher cow production (+26 kg MS/cow) from fewer cows and better pasture intakes.
- Applying 170 kg/ha/year less N fertiliser.

LUDF could not have achieved this without sowing tetraploid ryegrass in every paddock but one. Download the *4front System* from www.barenbrug.co.nz to learn more.

Mixing *4front* & *Maxsyn*

While *4front* can be sown alone on many farms, mixing *4front* with *Maxsyn* diploid perennial ryegrass extends its benefits to a wider range of farm systems.

Some farmers struggle to avoid over grazing straight tetraploids, and don't get the persistence they want. Adding a denser, finer diploid ryegrass to the mix makes it more robust. Diploid plants protect the tetraploid as on page 18.

Very low chance of staggers

For dairy cows and beef cattle, *4front NEA2* provides ryegrass staggers free pasture. For sheep and deer, ryegrass staggers grazing *NEA2* endophyte is a very low risk. In extreme situations, (e.g. drought where animals are forced to graze close to the ground), a low level of staggers might very occasionally be seen.

Suggested seed mixes

4front can improve animal performance and environmental outcomes across many farm systems. Below are three examples.

Dairy		kg/ha
Top performing tetraploid pasture, with *Captain* to reduce N leaching.	*4front* perennial ryegrass	25-30
	Kotuku white clover	2
	Weka white clover	2
	Captain CS plantain	2
	Total	31-36
Dairy		**kg/ha**
Top performing tetraploid/ diploid mix pasture, for greater robustness & density.	*4front* perennial ryegrass	15
	Maxsyn perennial ryegrass	10
	Kotuku white clover	2
	Weka white clover	2
	Total	29
Sheep, Beef, Deer		**kg/ha**
Top performing tetraploid/ legume/plantain finishing pasture.	*4front* perennial ryegrass	22-25
	Weka white clover	3
	Morrow red clover	4
	Captain CS plantain	2
	Laser Persian clover	3
	Total	34-37

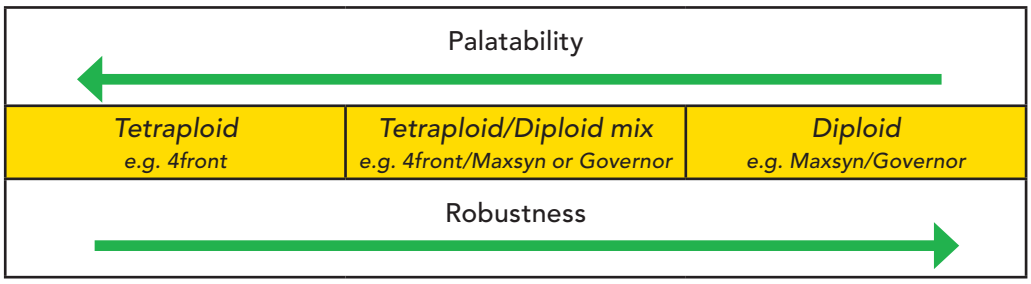
Mixing tetraploid & diploid ryegrass

Mixing *4front* with a diploid perennial ryegrass such as *Maxsyn* or *Governor* offers potential to produce higher animal performance, with easier pasture management, than traditional pasture.

Background

On many farms the tetraploid/diploid perennial ryegrass mix is now the norm striking a near-ideal balance between being easier to manage and robustness. This tetraploid/diploid mix fits a range of farm systems as it is more persistent than a straight tetraploid pasture, because diploid plants protect the tetraploid.

Tetraploid perennial ryegrass, like *4front*, has excellent DM yield and year-round growth, but being so palatable, many farmers have struggled to avoid over grazing and achieve the persistence they want. Adding a denser, finer diploid ryegrass to the mix changes the dynamics.



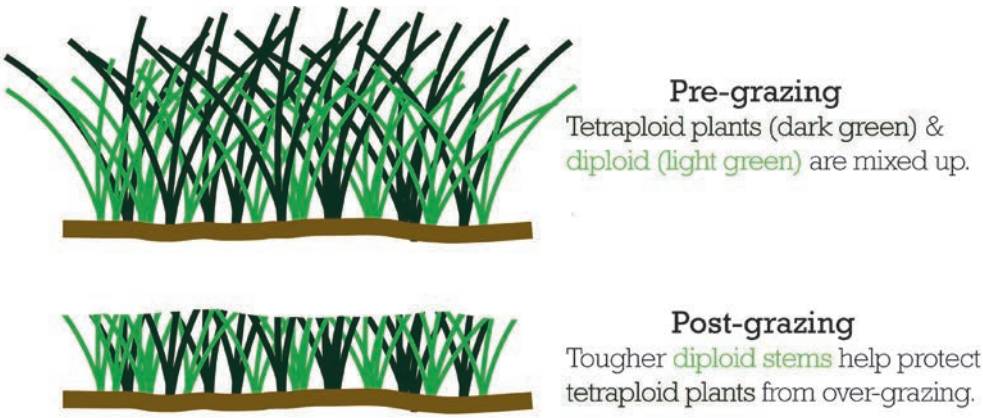
The tetraploid/diploid mix is an average of the two types, denser and more robust than a straight tetraploid, and more palatable than a straight diploid.

Palatability & stems

The palatability of the pasture is due to *4front's* soft stems, which give improved animal performance and hold quality even at high covers (e.g. 3500-3600 kg DM/ha) making them easy to graze.

While straight tetraploid pastures are often overgrazed, reducing persistence, in the mix they are protected by the denser, less palatable, diploid plants.

Diploid protects from overgrazing



Sowing rate

Barenbrug has tested different tetraploid/diploid perennial ryegrass mixes and recommends sowing half the normal rate of each cultivar, e.g.15 kg/ha of tetraploid *4front* (half of 30 kg/ha) plus 10 kg/ha of a diploid such as *Maxsyn* or *Governor* (half of 20 kg/ha).

Hogan annual ryegrass

Hogan sets the standard for tetraploid annual ryegrass, producing over 1.1 t DM/ha more (worth $400/ha) – and it looks fantastic too!

High value

Hogan establishes rapidly and out produces 30+ year old *Tama* by over 1.1 t DM/ha. *Hogan's* advantage is valued by the DairyNZ Forage Value Index at $400/ha extra profit, i.e. a 10+ fold return on the extra $35-$45/ha it costs to sow *Hogan* over *Tama*.

Fast establishment

Hogan is a tetraploid bred for rapid establishment (over 21% faster than *Tama*) to provide fast feed in autumn, a critical advantage particularly following dry summers.

Hogan is unbeaten in the annual ryegrass National Forage Variety Trial summaries.

Annual Ryegrass: All New Zealand trials (yields by season as a percentage of Mean and LSI)

Entry	No.of Trials	Establishment Autumn		Winter		Early Spring		Late Spring		Total	
		% of Mean	LSI	% of Mean	LSI	% of Mean	LSI	% of Mean	LSI	% of Mean	LSI
Hogan WE	7	109.1	6.6	106.3	5.3	101.4	4.4	107.5	5.1	105.8	3.5
Dash WE	10	97.8	5.8	97.8	4.6	105.2	3.8	107.1	4.4	103.4	3.1
Zoom WE	5	100.3	7.9	102.9	6.3	101.2	5.2	105.0	6.0	102.7	4.2
Winter Star II WE	7	102.4	6.5	103.9	5.2	103.6	4.3	101.2	5.0	102.6	3.5
Tama WE	17	87.4	4.1	97.9	3.3	95.0	2.7	92.3	3.2	93.3	2.2
Progrow WE	9	103.0	6.1	91.4	4.8	93.6	4.0	86.9	4.6	92.3	3.2
Mean (kg DM/ha)	82	1626		1786		2933		3662		10007	

NFVT Summary 1991 – 2020 (August 2020)
If two means differ by more than the sum of their least significant intervals (LSI), they are significantly different at the 5% level

Sowing rate

Hogan annual ryegrass can be sown alone, or mixed with oats or annual clovers as a winter crop. The *Hogan*/annual clover mix has less winter growth.

Dairy, Sheep, Beef, Deer		kg/ha
Winter-spring crop	*Hogan* annual ryegrass*	30
	Total	30
Winter-spring crop with annual clovers	*Hogan* annual ryegrass* *Laser* Persian clover	22 8
	Total	30

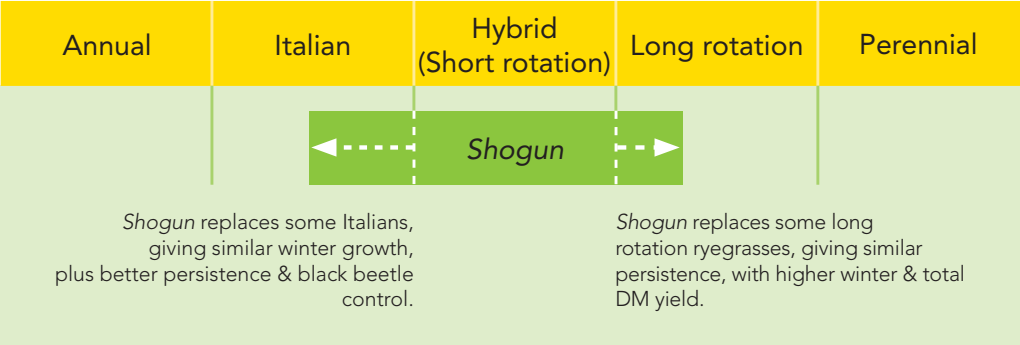
** Tetraploids are sown at a higher rate than diploids, because of their larger seed.*

Hogan annual ryegrass is owned and marketed by Barenbrug
Hogan annual ryegrass is protected under the NZ Plant Variety Rights Act 1987

Shogun hybrid ryegrass

Shogun hybrid ryegrass provides a phenomenal 1-3 year pasture that grows like an Italian ryegrass in winter, and like a perennial in summer, with tetraploid palatability too.

Shogun redefines ryegrass



High yield

In trials *Shogun* has significantly out-yielded other cultivars over a 1-2 year period. Below is the National Forage Variety Trial (NFVT) summary for a 12 month pasture.

NFVT Italian Ryegrass: All New Zealand trials (yields by season as percentage of Mean and LSI)

Entry	Number of Trials	Autumn		Winter		Early Spring		Late Spring		Summer		Total	
		% of Mean	LSI	% of Mean	LSI	% of Mean	LSI	% of Mean	LSI	% of Mean	LSI	% of Mean	LSI
Shogun NEA	12	95.4	5.1	96.7	4.2	107.4	3.4	112.0	3.6	120.1	6.2	109.4	3.0
Tabu+ WE	6	105.8	6.8	110.1	5.5	104.4	4.6	105.0	4.8	109.2	8.3	106.7	4.0
Asset AR37	22	99.8	3.8	102.7	3.1	98.0	2.6	99.0	2.7	111.1	4.7	102.6	2.2
Supercruise WE	11	106.7	5.2	107.5	4.3	97.3	3.5	102.3	3.7	102.3	6.4	102.5	3.1
Lush AR37	13	107.1	4.7	102.4	3.9	96.7	3.2	96.2	3.3	109.0	5.8	101.7	2.8
Asset WE	9	97.8	5.6	98.9	4.6	97.7	3.8	101.0	4.0	103.1	6.9	100.2	3.3
Feast II WE	36	99.4	2.8	99.5	2.3	99.9	1.9	99.6	2.0	99.8	3.5	99.7	1.7
Vibe WE	10	102.7	5.6	99.9	4.5	95.5	3.7	99.5	3.9	100.5	6.8	99.4	3.3
Blade WE	10	105.1	5.4	99.9	4.4	101.7	3.6	98.0	3.8	92.6	6.6	98.4	3.2
Sonik WE	9	96.9	5.6	100.1	4.6	102.6	3.8	98.6	4.0	93.6	6.9	98.1	3.3
Presto WE	10	97.8	5.5	92.9	4.5	101.3	3.7	98.4	3.9	91.7	6.8	96.5	3.3
Moata WE	24	85.6	3.6	89.3	2.9	97.3	2.4	90.4	2.5	67.0	4.4	84.9	2.1
Mean (kg DM/ha)	82	1678		1799		2950		4088		3791		14306	

NFVT Summary 1991 – 2020 (August 2020). If two means differ by more than the sum of their least significant intervals (LSI), they are significantly different at the 5% level

Fast establishment

Shogun's fast establishment is comparable to that of an Italian ryegrass. This allows paddocks resown with *Shogun* to be brought back into the grazing rotation more quickly than those renewed with perennial or other hybrid ryegrasses.

Black beetle control

Shogun with *NEA* endophyte has good control of black beetle, equal to *4front NEA2*.

1-3 year option

Under good grazing management *Shogun* is a 1-2 year option in summer dry areas, 2-3 years in summer moist. Persistence is aided by its *NEA* endophyte.

Great animal health

NEA endophyte is one of the most animal safe endophytes available. However, there is a low risk of *NEA* endophyte causing a low level of ryegrass staggers in sheep or deer in extreme situations (where animals are forced to graze right into the base of a pasture in very summer dry conditions).

Feed quality

Shogun has excellent summer quality, with a late heading date (+13 days) and little aftermath heading or seeding through the summer.

Palatability

When sheep or cattle like a pasture, they eat more of it, and liveweight gains (LWG) increase. *Shogun* delivers high animal intakes and growth rates.

Suggested seed mixes

Dairy		kg/ha
High performance 1-3 year pasture	*Shogun* hybrid ryegrass	30
	Kotuku white clover	2
	Weka white clover	2
	Total	34
Undersowing as fast establishing 1-3 year pasture (with black beetle control)	*Shogun* hybrid ryegrass	13-20*
	Total	13-20*
Sheep, Beef, Deer		**kg/ha**
High performance finishing pasture	*Shogun* hybrid ryegrass	30
	Weka white clover	2
	Apex white clover	2
	Morrow MS red clover (coated)	6
	Total	40

**Sowing rate depends on how thin pasture to be undersown is. Tetraploids are sown at a higher rate than diploids, because of their larger seed.*

Extreme palatability differences in animal testing trials in spring, when there were no fences between plots set stocked with lambing ewes. Shogun NEA is front left and back right; Alto SE ryegrass is front right and back left.

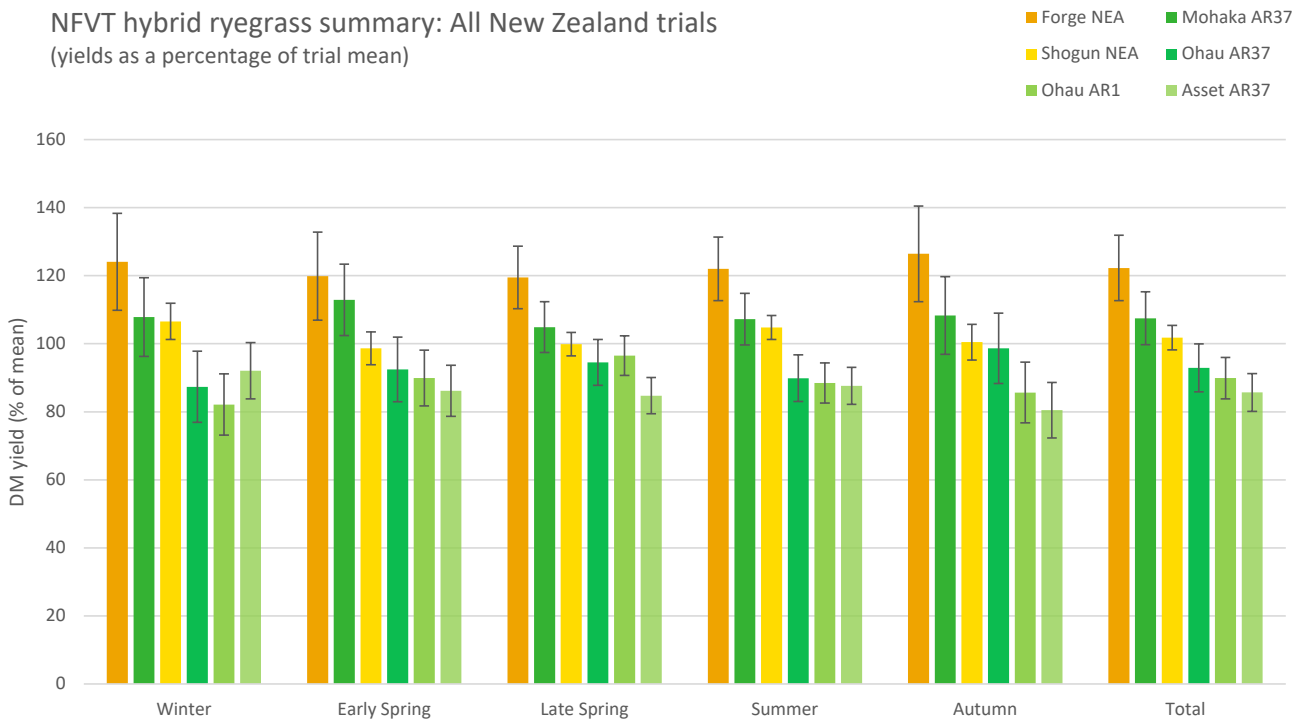
Shogun Hybrid Ryegrass is owned and marketed by Barenbrug
Shogun Hybrid Ryegrass is protected under the NZ Plant Variety Rights Act 1987

Forge tetraploid hybrid ryegrass

Forge NEA is a game-changer for 3-5 year pastures, the new champion medium-term ryegrass. Year-round yield is exceptional; tetraploid ME and palatability deliver superb animal performance. Plus environmental benefits too.

Grow (much) more

Forge is in a league of its own in yield, producing 15% - 36% more DM year-round than other hybrids over 3 years in the New Zealand NFVT trial summarys.



**NFVT Summary 1991 – 2020. Statistical LSI are on top of bars. If two means differ by more than the sum of their least significant intervals (LSI), they are significantly different at the 5% level.*

Cool season active

Autumn-winter-early spring growth is increasingly sought-after in our farm systems. It provides feed when it is often most needed, and most expensive. It also helps lighten your farm footprint, utilising soil N at the time of highest risk for N leaching.

Forge's cool season growth is unbeaten – in autumn producing 18% - 46% more; in winter producing 16% - 42% more - than other hybrids in the 3 year NFVT summary above.

Tasty as

Animals love tetraploids – they are soft, legume-friendly, rich in energy and easy to eat. *Forge's* ME and palatability encourage high intakes, optimal per head performance and improved efficiency. It's easier to manage, too.

Lose less N & GHG

With higher animal intakes, easier management and extra cool season growth, *Forge* can help lighten your farm footprint.

Tetraploids can be grazed at higher covers, meaning you grow more pasture, or it can be turned into an environmental benefit through growing the same amount of pasture for less N fertiliser. And with most N lost through the cool season when soils are saturated, *Forge's* extra winter yield better mitigates this.

The palatability and high feed value also allow you to produce more per animal, which can be captured in lower stock numbers, lowering greenhouse gas (GHG) production - as well as reducing animal health costs.

System fit

- Dairy farms: Sow *Forge* as the backbone of high performance, high MS producing 3-5 year pasture, that is easy to graze, and with significantly faster establishment and more winter growth than a perennial ryegrass.
- Sheep and beef: *Forge* will generate high meat yield per ha, through its yield, palatability and high clover content, and provides significantly more cool season LWG potential than a perennial ryegrass.
- Undersowing: *Forge* establishes rapidly, with fast regrowth, making it ideal to direct-drill into thin, runout pastures to extend their life for 2-5 years.

Persistent

Forge's persistence in trial has been very good for a tetraploid hybrid, thanks to high tiller density and a focus on persistence in its breeding.

Suggested seed mixes

These mixes can be adjusted to meet specific requirements, and other species can be added as needed such as *Captain CS* plantain.

Dairy		kg/ha
High performance 3-5 year pasture	*Forge NEA* hybrid ryegrass	30
	Kotuku white clover	2
	Weka white clover	2
	Total	34
Sheep, Beef, Deer		**kg/ha**
High performance finishing pasture	*Forge NEA* hybrid ryegrass	25-30
	Weka white clover	2
	Apex white clover	2
	Morrow MS red clover (coated)	6
	Total	35-40
Undersowing		**kg/ha**
Sow into thin pasture to extend performance	*Forge NEA* hybrid ryegrass	13-20*
	Total	13-20

**Sowing rate depends on how thin pasture to be undersown is. Tetraploids are sown at a higher rate than diploids, because of their larger seed.*

Forge Hybrid Ryegrass is owned and marketed by Barenbrug
Forge Hybrid Ryegrass is protected under the NZ Plant Variety Rights Act 1987

Tabu+ Italian ryegrass

Tabu+ is a record-breaker, with explosive establishment speed and superior cool season growth. It's the only 5 star ryegrass in the Forage Value Index for both winter feed amd 12 month pasture categories.

Multi-use

Tabu+ is suitable as an 8-12 month high performance crop; can last 2-3 years in areas with mild summers, or can be used for undersowing into run out pasture to boost winter-spring growth. In dense pastures spraying before drilling is recommended. Note: In situations where a pasture is required for 2-3 years *Shogun NEA* may be a better option.

High DM yield

Tabu+ is unique in having the top 5 star rating in the 2021 DairyNZ Forage Value Index across all regions, for both the winter feed and 12 month categories.

5 Star Nationwide in the FVI

Tabu+ is the top yielding Italian ryegrass in the National Forage Variety Trials (NFVT) 12 month pasture summary, with significantly more winter growth. It is out yielded only by *Shogun NEA* hybrid ryegrass.

NFVT Italian Ryegrass: All New Zealand trials (yields by season as percentage of Mean and LSI)

Entry	Number of Trials	Autumn		Winter		Early Spring		Late Spring		Summer		Total	
		% of Mean	LSI	% of Mean	LSI	% of Mean	LSI	% of Mean	LSI	% of Mean	LSI	% of Mean	LSI
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Asset AR37	22	99.8	3.8	102.7	3.1	98.0	2.6	99.0	2.7	111.1	4.7	102.6	2.2
Supercruise WE	11	106.7	5.2	107.5	4.3	97.3	3.5	102.3	3.7	102.3	6.4	102.5	3.1
Lush AR37	13	107.1	4.7	102.4	3.9	96.7	3.2	96.2	3.3	109.0	5.8	101.7	2.8
Asset WE	9	97.8	5.6	98.9	4.6	97.7	3.8	101.0	4.0	103.1	6.9	100.2	3.3
Feast II WE	36	99.4	2.8	99.5	2.3	99.9	1.9	99.6	2.0	99.8	3.5	99.7	1.7
Vibe WE	10	102.7	5.6	99.9	4.5	95.5	3.7	99.5	3.9	100.5	6.8	99.4	3.3
Blade WE	10	105.1	5.4	99.9	4.4	101.7	3.6	98.0	3.8	92.6	6.6	98.4	3.2
Sonik WE	9	96.9	5.6	100.1	4.6	102.6	3.8	98.6	4.0	93.6	6.9	98.1	3.3
Presto WE	10	97.8	5.5	92.9	4.5	101.3	3.7	98.4	3.9	91.7	6.8	96.5	3.3
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2000% ROI

Tabu+ produced an extra 3.4t DM/ha over *Moata* as a 12 month crop. For an additional seed cost (e.g. $50/ha) for *Tabu+*, that equates to a 2000% ROI, given this extra feed is valued at about $0.30/kg DM or an extra $1020/ha operating profit (value calculated from the DairyNZ FVI).

Soaks up winter N

The more winter growth in a farm system, the more N captured before it leaves the soil. *Tabu+* hits its peak in May-August, and its super-fast cool season growth pulls up more N than slower growing pastures.

Sowing *Tabu+*

Winter ryegrass crop		kg/ha
	Tabu+ Italian ryegrass	20-22
Winter ryegrass crop with annual clovers		**kg/ha**
	Tabu+ Italian ryegrass	16-18
	Laser Persian clover	8
	Total	24-26
2-3 year pasture option		**kg/ha**
	Tabu+ Italian ryegrass	18-22
	Morrow MS red clover (coated)	6
	Kotuku or *Apex* white clover	2
	Weka white clover	2
	Total	28-32
Undersowing		**kg/ha**
	Tabu+ Italian ryegrass	10-15*
	Kotuku or *Apex* white clover	1.5
	Weka white clover	1.5
	Total	13-18

**Sowing rate varies depending on how thin pasture to be undersown is.*

Tabu+ has explosive establishment speed and cool season growth.

Bareno brome

Bareno persists and performs where perennial ryegrass fails, excelling on tough, summer dry sheep and beef country with free-draining soils.

Flexible

Bareno provides a palatable, persistent pasture for dryland farming that can tolerate both rotational grazing and set stocking. *Bareno's* persistence may decline in coastal areas north of Taupo, so it is not suited to these regions.

Highly palatable

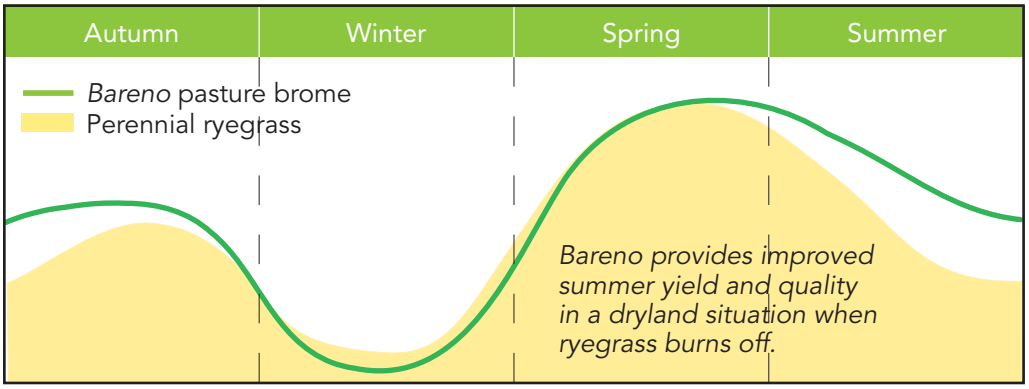
A strong feature of *Bareno* is its palatability through all seasons:

- It remains palatable, even when seed heads are present, and stays greener and leafier than ryegrass in summer.
- *Bareno* can support a high legume content (40% sub and white clover has been measured in spring).

High yield

On Lincoln University's Silverwood Farm, a dryland breeding property in inland Canterbury, *Bareno* produced 12.5 t DM/ha/year, 9% more than new sowings of perennial ryegrass (11.5 t DM/ha), with excellent spring, summer and autumn growth.

Seasonal growth



Sow early

Brome grasses are slower to establish than ryegrass, so make sure to:

- Sow when warm - soil temperature 12°C+.
- Prepare a good seedbed, preferably using a summer fallow

Sowing *Bareno*

Sheep, Beef, Deer		kg/ha
Persistent and palatable dryland pasture	*Bareno* pasture brome	25-32*
	Can be added: *Safin* cocksfoot Sub clover *Apex* white clover *Morrow* red clover	Inclusion of species depends on situation. Seek advice if unsure.

**Bareno sowing rate high because brome grasses have large seeds.*

Bareno Pasture Brome is owned and marketed by Barenbrug
Bareno Pasture Brome is protected under the NZ Plant Variety Rights Act 1987

Bareno management

Growing *Bareno*

Brome grasses are slower to establish than ryegrass. If you spend a little extra time on correct sowing and early management, you'll be rewarded with good results.

Preparation

A summer fallow prior to late summer/early autumn sowing is the recommended best practice to establish *Bareno* pasture in dry areas. This allows moisture to be carried from the spring through to sowing, ensuring good results even in a dry autumn. Prepare a run-out paddock by spraying out or cultivating in spring (Oct/Nov) before pastures dry out. If there is a further weed strike, spray or cultivate lightly again before drilling.

Timing

If cultivating, prepare a fine, even, weed-free seed bed to allow correct seed depth and soil moisture retention for fast germination. Direct drilling has proven to be very successful. This fits well with summer fallow management.

Bareno is best sown when soil temperatures are above 12°C, during late summer or early autumn. This gives plants time to adequately establish before winter. Establishment is much slower in cool conditions.

Drilling

Sow seed shallow, at 10-20 mm. Take care when drilling - the seed may not flow well through some drills.

Managing *Bareno*

Bareno should not be overgrazed in its first year to allow plants to fully establish. *Bareno* can set seed quickly, however seed heads are much more palatable than those of other pasture grasses.

In dry summer conditions, *Bareno* pastures should not be bared out (although they will tolerate this better than ryegrass). Post-grazing covers of 3-4 cm will ensure persistence and regrowth through summer. Remember the plant's reserves in grasses are above the ground (not in the roots).

Bareno pasture brome is a persistent, easy to manage pasture, seen here at Mt. Possession in Canterbury.

Safin superfine cocksfoot

Safin is an innovative superfine leaved cocksfoot, very tolerant of dry conditions, lower soil fertility and overgrazing, but doesn't get clumpy and take over pastures like older cultivars.

More clover

Safin doesn't spread across the ground and choke out clovers like traditional cocksfoot. This means it encourages higher clover populations as well as being easier to graze.

Early growth (with high total DM)

A key feature of *Safin* is its increased production in winter and early spring. DM growth is critical through lambing or calving for dryland farming systems, to finish stock prior to potential summer dry conditions. *Safin* has an advantage through this period, as shown below, and in the paddock it is noticeably faster to get away in spring.

Over the whole year total DM production of *Safin* is very good.

Cocksfoot yields in Canterbury*

Entry	Winter	Early spring	Late spring	Summer	Autumn	Total
Safin	123 a	124 a	104 a	105 a	119 a	110 a
Wana	82 b	117 ab	96 a	106 a	113 a	104 a
Vision	96 ab	108 ab	106 a	98 a	95 a	102 a
Kara	109 ab	107 ab	95 a	105 a	98 a	102 a
LSD (5%)	32	22	10	17	41	13

**Combined analysis of 2 trials run on Barenbrug Research farm, Courtenay, between 2004 and 2009.*

Tiller density

Safin is a 'superfine' cocksfoot, which in fact looks very similar to ryegrass. It is finer and denser than other cocksfoots on the market, with significantly more tillers as shown in the table below. On its release *Ella* was considered fine leaved, but *Safin* sets a new benchmark, with 41% more tillers than *Ella*.

Cocksfoot tiller density in Canterbury dryland grazing trial

Entry	Tillers/m²	Relative to *Ella* at 100%
Safin	431 a	141 %
Tekapo	303 b	91 %
Greenly	270 b	81 %
Vision	270 b	81 %
Kara	245 b	73 %
Trial mean	334	95
LSD (5%)	70	23

Pest control

Once established *Safin* is tolerant to grass grub and Argentine stem weevil (ASW) attack. However, seedlings are susceptible at sowing and *AGRICOTE* Grass seed treatment is recommended where these pests are a risk. Cocksfoot has no endophyte and is therefore safe to graze low over summer.

Managing *Safin*

Cocksfoot is slower to establish than ryegrass. In a ryegrass-based pasture little cocksfoot is often seen until the first summer after it has been sown, after which the content of cocksfoot will increase, especially under dry conditions.

If sowing a specialist cocksfoot-based pasture, sow early while soil temperatures are above 12°C. A summer fallow, to conserve moisture prior to a late summer/early autumn sowing, is recommended in (potentially) autumn dry conditions.

Cocksfoot is lower in feed value and palatability than ryegrass if it becomes long or rank, so it should be kept short and leafy through spring. Graze cocksfoot when it has 3-4 leaves/tiller to maintain good feed value. The feed value of cocksfoot declines if it grows to 5 leaves/tiller. In grazing trials, animal performance is reasonably good where cocksfoot has been kept leafy. Maintaining good legume content in cocksfoot pastures will also improve animal performance.

Cocksfoot is more tolerant of low-moderate soil fertility than perennial ryegrass. However, it is very responsive to nitrogen fertiliser, generally at higher response rates than ryegrass, and this can be a very useful tool to promote growth, as well as improving feed value and protein content.

Sowing *Safin*

Dairy, Sheep, Beef, Deer		kg/ha
As component of pasture mix	*Safin* cocksfoot	3
For cocksfoot-based pasture	*Safin* cocksfoot	8-10
	Sub clover	6-8
	Apex white clover	2
	Weka white clover	2
	Total	18-22

Older, traditional cocksfoot (left) can form unpalatable clumps in a pasture, compared to superfine Safin cocksfoot (right).

Safin Cocksfoot is owned and marketed by Barenbrug
Safin Cocksfoot is protected under the NZ Plant Variety Rights Act 1987

Kotuku white clover

Kotuku is a very fast establishing, nutritious, high yielding large leaved white clover with superior summer growth.

Why *Kotuku*?

White clover is critical for nutritive value and N fixation in pastures. It is also an important source of protein and ME for milking and growing stock, particularly in summer. *Kotuku* shows excellent seasonal growth, and outperforms all other trialled cultivars over the critical summer period.

High yield

This mixed sward trial included one entry without clover (no clover). The effect of clover on N fixation and yield is seen in the trial, with *Kotuku* showing particularly good yield due to its compatibility with ryegrass.

Seasonal DM yield data 2013-2016, Courtenay, Canterbury. Trial mean = 100.

Entry	Autumn	Winter	Early Spring	Late Spring	Summer	Total
Kotuku	117 a	107 bc	107 ab	109 a	121 a	114 a
Kopu II	114 a	115 a	112 a	109 a	110 b	111 ab
Kotare	105 bc	106 c	108 a	111 a	108 bc	106 bc
Tribute	102 bc	105 c	109 a	107 ab	102 bd	105 c
SF Quest	106 b	114 ab	111 a	105 ac	98 d	104 cd
Mainstay	110 ab	101 cd	100 c	99 bd	102 bd	102 cd
Weka	99 cd	97 de	100 bc	106 ac	101 cd	100 de
Bounty	94 de	88 f	92 d	97 cd	102 cd	97 e
Huia	88 e	91 ef	92 d	95 d	97 d	95 e
No clover	46 f	67 g	59 e	55 e	29 e	44 f
Trial mean (kg DM/ha)	1765	721	970	1659	3101	8509
Signficance	***	***	***	***	***	***

**Data from Courtney, Canterbury, 2013-2016. Statistical significance lettering is given, yields with the same letter are not significantly different at the 5% LSD level.*

High-yielding Kotuku suits both dairying and red meat finishing systems.

Fast establishment

Kotuku has consistently shown fast establishment. As well as improving clover establishment, this can assist with broadleaf herbicide applications, where new clovers need to be at the 3-4 trifoliate leaf stage before spraying.

Oversowing advantage

Oversowing existing pastures with clover can be a good way to increase clover content of pastures. *Kotuku* is ideal for oversowing due to its very fast establishment speed, competing better with existing pasture.

Establishment speed of Kotuku (left) versus Mainstay.

Persistence

Kotuku has demonstrated robust persistence for a large leaved cultivar, and has a medium stolon density. This makes it well-suited to driving summer production in dairying and dry stock finishing systems.

Suggested seed mixes

Dairy		kg/ha
Top performing dairy pasture	*Maxsyn* perennial ryegrass *Kotuku* white clover *Weka* white clover	18-22 2 2
	Total	22-26
Sheep, Beef, Deer		**kg/ha**
For high palatability tetraploid finishing pasture	*4front* perennial ryegrass *Kotuku* white clover *Weka* white clover *Morrow MS* red clover (coated)	30 2 2 6
	Total	40
Clover oversowing		**kg/ha**
Kotuku is ideal with its fast establishment	*Kotuku AGRICOTE* Oversow*	5-6

**AGRICOTE Oversow seed coating has a lime coating for improved spread distribution and soil contact. It has no withholding period so can be sown up to 3 days prior to grazing or immediately following.*

Weka white clover

Weka **is a medium leaved high yielding white clover suited to all grazing systems. It has a strong spreading habit, and excellent tolerance to clover root weevil.**

High yield

In trials *Weka* has shown very high total yield, with good growth in all seasons, particularly through autumn and winter.

Yield scores of medium-large leaved clovers 2003-08*

Cultivar	Autumn	Winter	Early spring	Late spring	Summer	Total
Weka	6.1 a	5.2 a	5.8 a	6.0 a	5.8 a	5.8 a
Tribute	5.6 ab	4.4 a	5.7 a	5.9 a	5.8 a	5.5 a
Sustain	4.6 b	4.5 a	4.8 b	5.2 b	5.2 a	5.0 b

**Combines yield scores over 4 trials in the Waikato 2004-08 & 2005-08, & Canterbury 2003-06 & 2005-08. Yield scored on 1-9 basis, where 9 = very high yield. Yields with same letter not significantly different at 5% LSD level.*

Persistence

Weka has excellent persistence because of its high tolerance to CRW, dry conditions, pugging and hard grazing, and its strong spreading habit. Yield scores under high levels of CRW attack show *Weka* is a very good choice for these conditions.

Yield of medium-large leaved clovers under CRW attack*

Cultivar	Yield under CRW attack
Weka	5.5 a
Tribute	4.9 b
Sustain	4.1 c

**Combines 5 yield scores over 2 Waikato trials in 2006 & 2007 in periods of high CRW damage. Yield scored 1-9, where 9 = very high yield. Yields with same letter not significantly different at 5% LSD level.*

Sowing *Weka*

All systems		kg/ha
Productive, persistent clover combination	Perennial ryegrass	18-30
	Weka white clover	2
	Kotuku or *Apex* white clover	2
	Total	22-34

Weka's strong spreading habit and high CRW tolerance help it persist.

Weka White Clover is owned and marketed by Barenbrug
Weka White Clover is protected under the NZ Plant Variety Rights Act 1987

Apex white clover

Apex is a robust, persistent clover, with good tolerance of hard grazing, summer dry conditions, and clover root weevil.

Medium small leaf size

Apex has a medium-small leaf size, with significantly more stolon growing points than traditional cultivars like *Huia*, for improved drought and pest tolerance.

Good persistence

A key feature of *Apex* is its improved persistence. A four year trial under grazing in the Waikato showed *Apex* has excellent persistence into the fourth year, with the highest fourth year yields.

High yield

Apex has shown high yields in sheep grazing trials, particularly in winter, spring and autumn.

Yield in three Manawatu sheep grazing trials (Huia = 100)*

Cultivar	Winter	Spring	Summer	Autumn
Apex	156 a	139 a	108 a	127 a
Huia	100 b	100 b	100 a	100 b
LSD (5%)	22	18	15	18

** Woodfield et al. NZ Grassland Association 63: 103-108*

Spreading growth

Apex spreads strongly across bare ground, increasing legume content.

Sowing *Apex*

Sheep, Beef, Deer		kg/ha
For more clover in drier or tougher grazing systems	Perennial ryegrass (e.g. *Rohan*)	18-20
	Safin cocksfoot	2-3
	Apex white clover	2
	Weka white clover	2
	Total	24-27

Apex White Clover is marketed by Barenbrug
Apex was bred under a cooperative programme with AgResearch Grasslands
Apex White Clover is protected under the NZ Plant Variety Rights Act 1987

Morrow MS red clover

Morrow multi-stemmed (MS) red clover's high stem number gives improved grazing tolerance, with its deep tap root delivering high summer-autumn yield.

Great pedigree

Morrow comes from a tough family. Most red clovers wouldn't last long under intensive rotational dairy grazing on light, upper North Island soils. But *Morrow's* parents did. Over time, they adapted, survived, and produced well, even after repeated droughts.

We took plants from these old pastures, and bred and selected the best of them for high yield, persistence and flowering to create a game-changing, multi-stemmed red clover for improved production and persistence under grazing.

Longevity

Red clover's biggest drawback has always been limited persistence under grazing. *Morrow's* improved grazing tolerance – helped by its high stem count and semi-prostrate form - means it will keep boosting production year on year. Like all red clovers *Morrow* will persist best on free-draining soils under a longer summer grazing round.

Quality + yield when it counts

High ME and high DM together create ideal late spring and summer finishing feed, giving high quality as grass ME drops off, and driving rapid liveweight gains for lambs and cattle.

Red clover seasonal yield in dryland Canterbury*

Entry	Early spring		Late spring		Summer		Autumn		Winter		Total yield	
Morrow	6.4	a	7.0	a	7.4	a	7.7	a	5.4	a	6.8	a
Tuscan	6.1	ab	6.7	a	5.5	b	6.0	ab	6.1	a	6.1	ab
Rossi	5.2	ac	5.7	ab	5.3	bc	6.3	ab	5.5	a	5.5	b
Relish	4.3	c	4.3	b	3.7	c	5.3	b	3.0	b	4.0	c
Trial mean	4.9		5.6		5.4		5.8		4.4		5.3	
%CV	20.1		18.0		16.5		18.4		21.3		12.8	

**Data from 2 years of pure sward trial, grazed by sheep. Trial sown 2016. Yield visually scored on 1-9 basis, where 9 = highest yield.*

Morrow's excellent summer yield and feed quality make it ideal for stock finishing.

CRW tolerance

Red clover is tolerant of clover root weevil, providing pasture species diversity and extra legume content.

Free N

Red clover fixes its own nitrogen, adding it naturally to pastures in a slow, continual way. This will be ever more important to provide N on farm, as fertiliser comes under increasing environmental scrutiny. *Morrow* can fix over 200 kgN/ha based on its yield (about 25 kg/N per t DM grown).

Phyto-oestrogen levels

Morrow has low-medium phtyo-oestrogen levels. As a precaution, avoid grazing high levels of red clover when mating ewes or hoggets, 3-6 weeks either side of mating.

Suggested seed mix

All systems		kg/ha
Productive, persistent clover combination	Perennial ryegrass	18-30
	Morrow red clover (coated)	6
	Kotuku or *Weka* white clover	4
	Total	28-40
Sheep, Beef, Deer		**kg/ha**
Two year high LWG finishing crop	*Captain CS* plantain	10
	Laser Persian clover	4
	Vista balansa clover	3
	Morrow MS red clover (coated)	6
	Weka white clover	4
	Total	27
Tetraploid perennial ryegrass - finishing		**kg/ha**
Fantastic feed quality combined with animal performance.	*4front* tetraploid perennial ryegrass	24
	Weka white clover	2
	Apex white clover	2
	Morrow MS red clover (coated)	6
	Captain CS plantain	2
	Total	36

Morrow Red Clover is owned and marketed by Barenbrug
Morrow Red Clover is protected under the NZ Plant Variety Rights Act 1987

Zulu II arrowleaf clover

Zulu II annual clover has two contrasting roles. First, it's a high ME legume for finishing stock or silage from early spring through into summer. Second, it shows great potential to get N into hill country pastures, managed to reseed and regenerate.

Yield + quality

Zulu II can transform low-yielding dry paddocks into palatable, productive pastures growing over 10 t DM/ha, with highest growth rates through spring and early summer. Feed value is excellent, with less risk of bloat than other annual clovers.

System fit

Zulu II can be used as an autumn sown crop for stock finishing, or for a persistent legume in hill country where it is managed to set seed in the summer, to germinate in the subsequent autumns. It has a high level of hard seed which will persist in the soil for many years. *Zulu II* has also been used successfully with spring sown chicory, providing N fixation in this summer crop.

Management

If used in conjunction with chicory, graze the crop according to best practice for the chicory. For persistence in hill country *Zulu II* must be managed carefully to allow reseeding in the first year. Typically these paddocks should not be grazed during flowering. After seed set remove plant residues in late summer to open up the pasture and promote better seedling regeneration in autumn. *Zulu II* is tolerant of moderately acidic soils. Sow treated seed.

Sowing *Zulu II*

Dairy		kg/ha
Chicory/annual clover crop	*501 Chicory*	8
	Zulu II arrowleaf clover	8
	Total	16
Sheep, Beef, Deer		
8-10 month pure clover sward (manage to reseed & build soil N)	*Zulu II* arrowleaf clover	10
Hill country oversow mix	*Safin* cocksfoot	8
	Weka white clover	2
	Apex white clover	2
	Sub clover	6
	Zulu II arrowleaf clover	4
	Total	22

High-yielding Zulu II is palatable and productive, with excellent feed value.

Zulu II Arrowleaf Clover is owned and marketed by Barenbrug

Vista balansa clover

Vista annual clover produces high ME feed in winter and early spring for grazing, silage or hay. Its excellent tolerance to waterlogging makes it ideal for poorly drained soils.

Fills the gap

Vista was selected for improved growth during winter and early spring to help fill the typical early feed deficit on many farms.

System fit

Vista will significantly improve feed quality and early season production for cows, sheep and beef when autumn-sown with annual/Italian ryegrass for winter and early spring grazing. This mix will also make high quality silage.

A straight sward of *Vista* is excellent feed for lactating ewes and growing lambs before the paddock goes into spring-sown crop.

Management

Vista is very adaptable, and can handle a range of different grazing systems. For maximum animal performance and pasture regrowth, graze down to 4-5 cm residual.

Sowing *Vista*

Dairy		kg/ha
Winter ryegrass crop	*Hogan* annual ryegrass	22
	Vista balansa clover	4
	Laser Persian clover	4
	Total	30
Sheep, Beef, Deer		
7-9 month pure finishing sward	*Vista* balansa clover	6
Winter oat crop	*Hattrick* oats	80
	Vista balansa clover	8
	Total	88

Vista balansa clover is ideal for grazing, silage or hay.

Vista Balansa Clover is owned and marketed by Barenbrug

Laser Persian clover

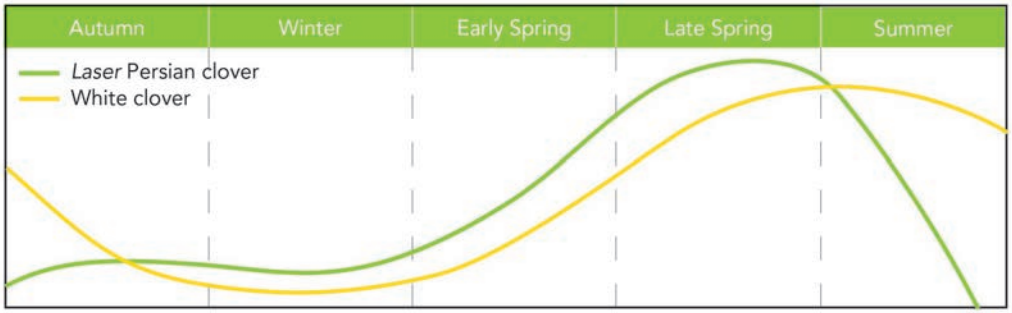
Laser annual clover is fast establishing, and produces high-quality feed from winter through early summer, for improved animal production and finishing, or silage/hay.

Later growth

Laser has a different growth curve to *Vista* and *Zulu II*, flowering 30 days later, so extending growth into summer.

System fit

On dairy farms, add *Laser* to short-term pastures to improve feed quality and extend DM and animal production in autumn, and then from early spring to early summer. For sheep and beef, it is an excellent option to increase feed quality for higher liveweight gains. *Laser* also suits hay/silage making. *Laser* will establish faster, and yield considerably more than white clover in a 8-10 month cropping situation.



Management

Laser can be grazed down to residuals of 2-3 cm during winter. In spring, rotationally graze to residuals of 4-5 cm to maximise animal performance, and pasture regrowth. Avoid over grazing, which will remove developing stems.

Conditions

Laser can tolerate mild salinity, cold temperatures and partially waterlogged soils. It is susceptible to slugs and springtails during establishment. Use treated seed, slug bait if needed, and include an insecticide at spray out. *Laser* is resistant to clover scorch.

Sowing *Laser*

Dairy		kg/ha
12-18 month high performance crop	*Tabu+* Italian ryegrass	16-18
	Laser Persian clover	4
	Vista balansa clover	4
	Morrow MS red clover (coated)	6
	Total	30-32
6-8 month winter crop	*Hogan* annual ryegrass	22
	Laser Persian clover	4
	Vista balansa clover	4
	Total	30
Sheep, Beef, Deer		
8-10 month pure finishing sward	*Laser* Persian clover	10
Two year finishing crop	*Captain CS* plantain	10
	Laser Persian clover	4
	Vista balansa clover	3
	Morrow MS red clover (coated)	6
	Weka white clover	4
	Total	27

Laser Persian Clover is owned and marketed by Barenbrug

501 Chicory

501 Chicory is a fast establishing, high ME, 6-8 month summer crop with high yield. It can provide an extra grazing over other cultivars, and its erect growth habit means high utilisation.

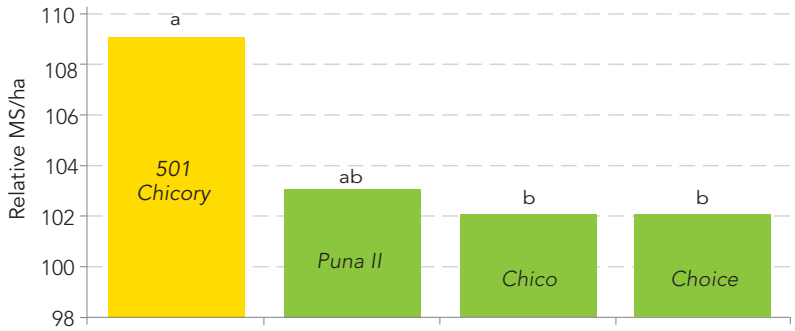
Rapid establishment

501 Chicory establishes very quickly, meaning less down time before the first grazing. In trials and on-farm across a wide range of different soil types *501 Chicory* growth has stood out right from the start, particularly in dry conditions.

Excellent DM yield

501 Chicory's extra yield is predicted to produce an extra 7% kg MS, giving an additional income of $350/ha (based on $7/kg MS) over some other chicorys.

Modelled Chicory MS production (Relative to trial mean = 100).



Data based on yield info from the combined trial analysis of Cambridge 11-12, and Canterbury 12-13. 2 trial lines have been removed from the graph. Assumptions used were: ME of chicory is 12 MJ ME/kg DM and 132 MJ ME to produce 1kgMS.

Avoid FEI milk penalties

Industry trials have shown chicory has no effect on FEI (Fat Evaluation Index) milk grading system, whereas DairyNZ's rule of thumb is to feed less than 3kg DM/cow/day of PKE to avoid milk penalties.

Advantage of *501 + Morrow*

The combination of *501 + Morrow* red clover or *501 + Zulu II* arrowleaf clover performs well. Like *501*, these clovers are deep rooted giving them a significant advantage in summer dry conditions. These clovers fix nitrogen reducing fertiliser requirements for the crop and subsequent pasture.

High ME

Chicory, red clover and arrowleaf clover are highly palatable to livestock and are all high in ME. During summer dry conditions, they will maintain an ME of around 12, whereas ryegrass pastures generally maintain an ME of 9-10.5.

Management

Sow chicory into a fine, weed-free seed bed where soil temperatures are consistently above 12°C in spring. Roll before and after sowing to help get a uniform germination. Graze when plants reach the seven leaf stage. Targets for grazing are:

- Pre-grazing targets: 3000 kg DM/ha or 25-35 cm height.
- Post-grazing residual target: 5 cm.

Environmental gains

501 Chicory offers a range of important environmental benefits:

- Its deep tap root (up to 1.5 m) improves soil structure;
- Mines deep soil N and can recover excess soil N left after winter-grazed crops;
- It doesn't need insecticide sprays (unlike brassica crops);
- Research has shown heifers grazing chicory urinated more frequently without increasing urinary output, or urinary N, potentially reducing N loading and subsequent nitrate leaching from soil,
- Facial eczema spores are much lower than on ryegrass pastures.

How many ha?

For dairy farms, sow 3 ha of *501 Chicory* per 100 cows to provide 3 kg DM of chicory/cow/day. Area to be sown can be calculated from the following table:

Chicory/cow to be fed	Area of chicory to sow	Daily area of chicory*
2 kg DM/day	2 ha/100 cows	0.1 ha/100 cows
3 kg DM/day	3 ha/100 cows	0.15 ha/100 cows
4 kg DM/day	4 ha/100 cows	0.2 ha/100 cows

**Assuming 21 day grazing rotation.*

When to resow pasture

501 Chicory will look great going into autumn. In spite of this it is more important to get new pasture established early, rather than continue to graze chicory into late autumn.

Suggested seed mixes

Use		kg/ha
For a chicory crop	*501 Chicory*	8-10
	Total	8-10
Chicory/red clover crop	*501 Chicory* *Morrow MS* red clover	6-8 4
	Total	10-12
Chicory/annual clover crop	*501 Chicory* *Zulu II* arrowleaf clover	8 8
	Total	16

501 Chicory is owned and marketed by Barenbrug
501 Chicory is protected under the NZ Plant Variety Rights Act 1987

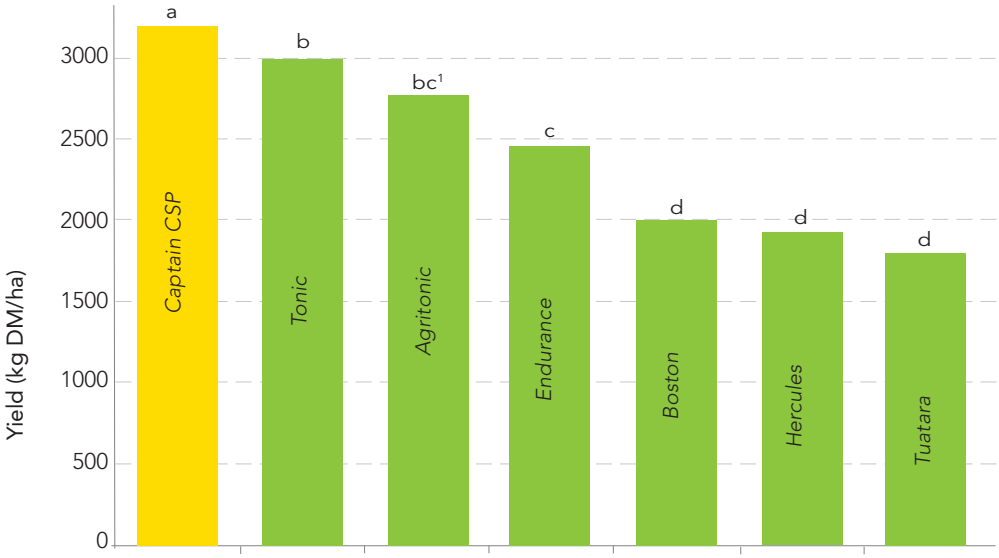
Captain CS plantain

As well as reducing N leaching, *Captain* cool season plantain (CSP) has significantly more growth in this period - the most valuable feed in farm systems.

Outstanding cool season production

Captain CSP yields significantly more through the cool season period as shown in the graph below. Plantains vary hugely in winter growth, as is clearly visible in the photo at the bottom of this page.

Cool season DM yield data combined from three one year dryland Canterbury trials sown between 2013 – 2018*



**Cool season yield is a total of autumn, winter & early spring periods. LSD (5%) lettering given on yield bars, cultivars with the same letter are not significantly different. ¹ Provisional rating, culitvar has only been in one trial.*

Reduced N leaching

Initial investigations indicate that plantain can mitigate N leaching via a number of mechanisms, including direct activities on soil N mineralisation and direct uptake of N through growth. The greater cool season activity of *Captain CSP* will enhance both of these mechanisms when it is most needed, as N leaching mainly happens when soils are wet through the late autumn, winter and early spring.

Captain CSP (centre) showing its significant cool season yield advantage over other cultivars on 30 July at Courtenay 190 m ASL.

High total DM yield

Captain CSP produces strongly across the other seasons too. It's deep roooting, with high summer yield providing additional protein and feed quality over the warmer months, particularly in summer dry areas.

Animal performance

Plantain is easily digestible, improving stock appetite especially over dry summer months when grasses are of lower feed quality. It is also higher in essential minerals like P, K, S, Ca, Mg, Na, Zn, Cu, B and Co than ryegrass/clover pastures.

Plant type

Captain CSP is a distinctive narrow-leaved plant with upright growth habit for high utilisation. It has a deep, coarse root system, and good compatibility with other species. It has good persistence, and can last three years under good management.

Sheep, beef, deer systems

Captain CSP can be used as a high LWG finishing crop, for example mixed with red, white, and annual clovers. Here the annual clovers (Persian, balansa) provide most of the legume through the first year, with red and white clovers providing it after that.

Dairy systems

Captain CSP can be used as a summer crop, or sown as part of a pasture mix at 2-4 kg /ha to increase summer feed quality in dryland situations. *Captain* can also be used as part of a specialist high-yielding, quality 2-3 year pasture, with *Shogun NEA* hybrid ryegrass and *Kotuku* white clover.

Suggested seed mixes

Sheep, Beef, Deer		kg/ha
Two year high LWG finishing crop	*Captain CS* plantain	10
	Laser Persian clover	4
	Vista balansa clover	3
	Morrow MS red clover (coated)	6
	Weka white clover	4
	Total	27
Perennial pasture mix	*Tyson* or *Rohan* SPR ryegrass	18
	Safin cocksfoot	4
	Weka white clover	4
	Morrow MS red clover	4
	Captain CS plantain	2
	Total	32
Dairy		**kg/ha**
Perennial pasture mix	*Trojan* or *Governor* ryegrass	22
	Kotuku white clover	2
	Weka white clover	2
	Captain CS plantain	2
	Total	28
Specialist 2-3 year pasture	*Shogun NEA* hybrid ryegrass	30
	Kotuku white clover	4
	Captain CS plantain	2
	Total	36

Bombardier EG kale

Bombardier easy-graze (EG) kale means farmers can look after stock better, with more energy per bite and less wastage, which is better for both animals and the environment.

Better wintering

Wintering systems are under the spotlight, with a focus on caring for animals well, and reducing mud in crops. *Bombardier EG* kale helps achieve this as it's palatable and easier to graze right to the base, providing high utilisation with high animal performance.

This can improve animal intake particularly in adverse weather, when grazing time may be limited. Reduced wastage also means increased efficiency, which is better for the environment.

Ewes broke into these kale strips overnight, and camped on the Bombardier EG (right of centre).

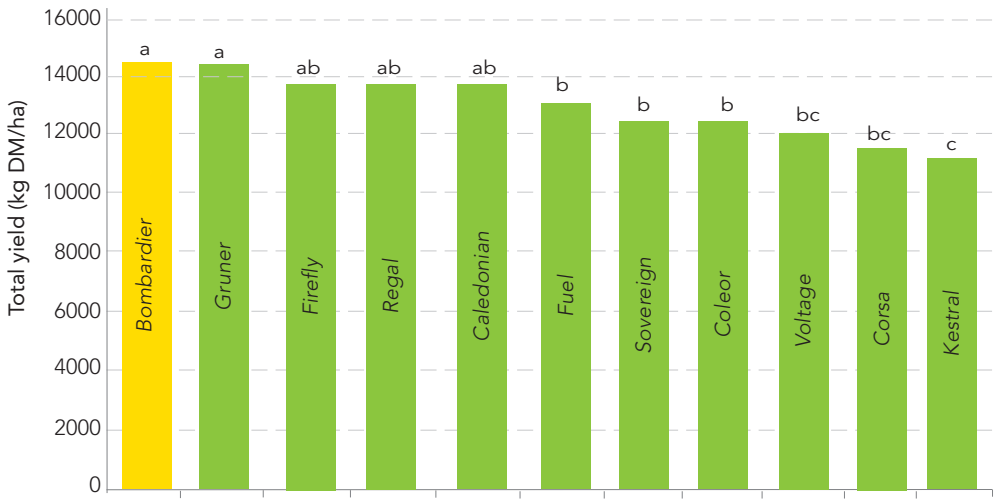
Systems fit

Bombardier EG kale suits systems where higher animal intakes and performance are required. These include dairy cow grazing for increased BCS; heifer, bull and steer systems where weight gain is critical; and sheep systems for good stock performance.

Excellent yield

The total yield of *Bombardier EG* kale is very high.

Kale total DM yields 2006-2018 (combined analysis of 12 trials*)



**Combined analysis of 12 trials from 2006-2018, varieties in two or more trials are presented. Cultivars with the same statistical significance letter are not significantly different at the LSD 5% level.*

Environmental benefits

Bombardier provides several extra benefits. Its very high utilisation means more efficient use of nutrients, plus less crop residual, which reduces the energy required for sowing the following catch crop or pasture. High palatability and intake rates better suit on/off grazing systems to reduce mud creation.

More ME/bite (right to the ground!)

Bombardier has exceptional feed quality, so animals get more ME per bite. This advantage reaches right to the ground, meaning easier utilisation than other cultivars. *Bombardier* has higher ME (lower in fibre) in the bottom third of its stem.

Kale feed quality as metabolisable energy (ME) in MJ ME/kg DM*

Cultivar	ME whole plant	ME bottom 1/3 stem
Bombardier EG	12.4 a	11.5 a
Fuel	12.1 ab	10.8 ab
Caledonian	12.0 ab	10.4 b
Voltage	12.0 ab	9.6 bc
Regal	11.9 b	10.5 b
Sovereign	11.9 b	10.2 b
Gruner	11.8 b	9.4 c
Corsa	11.3 c	9.6 bc
Trial mean	12.1	10.6
LSD (5%)	0.4	0.8

**From 5 trials run from 2006/07 to 2017/18. Cultivars were in at least two trials. Cultivars with the same statistical significance letter are not significantly different at the LSD 5% level.*

Rape alternative

With its very high stem quality, *Bombardier* can be used in place of an autumn and/or winter grazed rape crop, with several advantages.

- It does not require ripening pre-grazing
- It presents fewer animal health problems
- It is more flexible in the time of grazing.

Later sowing

Management of *Bombardier* is similar to other kales except we recommend a later sowing date (late November onwards). Sowing in areas prone to high winds and crop lodging should be avoided. While *Bombardier's* very soft stems are ideal for grazing they do make it more susceptible to lodging than traditional kales.

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
	Sow				Graze						

Days to graze:	100-170 days
Typical yield:	12-16t DM/ha; potentially higher in good conditions
Typical ME:	12.4 MJ/ME
Sowing rate:	5 kg/ha

Bombardier kale is marketed by Barenbrug

Caledonian kale

Caledonian is a tall, high yielding kale with softer stems that provides excellent winter feed for cattle. Its good stem quality increases animal performance and crop utilisation over older tall cultivars. It has good winter hardiness and good club root tolerance.

High yield

In trials *Caledonian* has shown excellent yield for a high ME kale.

Total DM yield*

Cultivar	Mean = 100%	t DM/ha
Gruner	111 a	15.5 a
Regal	101 b	14.2 b
Caledonian	100 b	14.1 b
Fuel	98 bc	13.7 bc
Coleor	95 bd	13.4 bd
Sovereign	90 cd	12.6 cd
Voltage	89 de	12.4 de
Kestrel	83 e	11.6 e
Trial mean (t DM/ha)	100=14.0	14.0

**From 10 trials in Southland (5), South Otago (1) & Canterbury (4) from 2007/08 to 2014/15.*

High utilisation

The results below are from a Lincoln University trial. Cows grazing *Caledonian* had the same crop utilisation (88-91%) and achieved the same body condition score (BCS) gain as the intermediate height kale Regal. However, the 1.5-1.6 t DM/ha higher yield of *Caledonian* allowed more cow grazing days.

Measurement	Sown 1 November		Sown 15 November	
	Caledonian	*Regal*	*Caledonian*	*Regal*
Yield (t DM/ha)	17.3	15.8	14.4	12.8
Utilisation (%)	88	88	91	89
Intake (kg DM/cow/day)	9.4	9.4	9.7	9.5
Cow grazing days (days/ha)	1620	1479	1351	1199
BCS* gain of cows	0.45	0.47	0.48	0.47

**Cows were grazed for a 6 week period during winter 2008. *BCS = Body condition score.*

Sowing rate 5 kg/ha

We recommend sowing *Caledonian* at 5 kg/ha (in good conditions where >10 t DM/ha is expected). Trials show an increased yield of 1.3 t DM/ha (or 9%) over sowing 4 kg/ha*.

DM yield of *Caledonian* at two sowing rates

Sowing rate	DM Yield (t DM/ha)
Caledonian @ 5 kg/ha	15.7
Caledonian @ 4 kg/ha	14.4

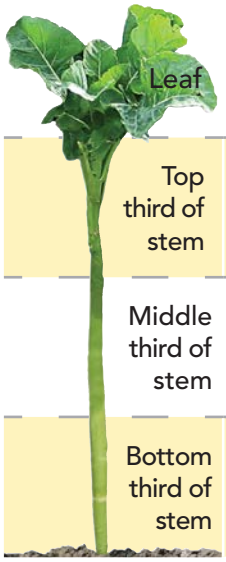
**Based on REML analysis of 3 trials (Winton, Telford & Darfield) in 2006/07 over 3 cultivars (Gruner, Caledonian & a breeding line).*

Quality stems

Caledonian is a marrow stem cultivar with significantly better stem ME than traditional tall cultivars like *Gruner* or *Rawera*. The main difference in feed quality is in the bottom third of stems - this is important as they make up 30% of total yield, and cattle knock a significant amount of leaf to the ground where it is wasted.

Crops with poor stem quality create a dilemma. Grazing well, to get higher crop utilisation, will reduce weight gain, while achieving good liveweight gain means accepting poorer utilisation.

Leaf and stem ME of medium-tall cultivars*



Plant part	Cultivar					
	Kestrel	*Caledonian*	*Sovereign*	*Regal*	*Gruner*	*Rawara*
Leaf	12.9 a	**12.7 ac**	12.9 a	12.8 ac	12.8 ab	12.5 c
Top third of stem	13.6 a	**13.4 ab**	13.0 c	13.3 ab	13.2 bc	13.4 ab
Middle third of stem	12.9 a	**12.0 bc**	12.2 ab	11.6 c	11.8 c	11.8 bc
Bottom third of stem	12.5 a	**10.6 b**	10.5 bc	10.4 bc	9.9 c	9.8 c

**From 3 trials in Southland (1) & Canterbury (2) from 2006/07 & 2007/08. Average yield from these trials was 13.1 t DM/ha. Statistical significance lettering given for 5% LSD level, cultivars with the same letter are not significantly different.*

Using *Caledonian*

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Sow						Graze			

Maturity date:	150-220 days
Typical yield:	15-20 t DM/ha summer moist; 9-12 t DM/ha dryland
ME:	11-12 MJ/kg DM
Sowing rate:	4-5 kg/ha

Caledonian kale is marketed by Barenbrug

Invitation swede

Invitation is a late maturing, yellow-fleshed swede, with very high bulb and leaf yield. It provides winter feed with excellent animal health for sheep, cattle and deer.

High yield & disease tolerance

Invitation produces excellent total DM yields with good dry rot tolerance and resistance to club root and powdery mildew. Invitation is not recommended as a second crop.

Total DM yield, dry rot tolerance and club root infection level.

Cultivar	Total DM yield*		Dry rot tolerance**				Club root***	
	(Trial mean =100)		% of bulbs not infected		% bulbs badly infected		% of bulbs not infected	
Invitation	112	a	57	a	5	a	97	a
Aparima Gold	103	b	36	ab	11	a	100	a
Major Plus	96	c	10	bc	56	b	18	bc
Dominion	92	c	6	c	71	b	23	b
Domain ◇	74	d	NT	NT	NT	NT	NT	NT
Trial mean	12.6 t DM/ha		21%		41%		60%	

From 8 Southland trials, from 2006/07 to 2011/13. **From a Southland trial in 2008/09 under moderate to high dry rot pressure in a 2nd crop paddock. * From a Southland trial in 2010/11 under moderate to high club root pressure in a 2nd crop paddock. NT = Not tested. Statistical significance lettering given for 5% LSD level, cultivars with same letter are not significantly different. = Provisional results. Domain was in 2 of the 8 trials.*

Late flowering

Invitation is very late flowering, meaning the crop stays vegetative longer into spring than other cultivars. This minimises the chance of animal health problems associated with 'bolting' swede crops, as seen in spring 2014 in Southland. No issues were reported on *Invitation* swedes.

Swede flowering scores*

Cultivar	Lack of flowering	
Invitation	7.2	a
Major Plus	6.7	ab
Domain	6.5	ab
Dominion	4.8	c
HT Swede	3.4	d
Aparima Gold	3.1	d
Trial mean	6.1	

**Results from 2 trials in Southland sown 2008 and 2012. Statistical significance lettering given for 5% LSD level, cultivars with the same letter are not significantly different. Scored on a 1 - 9 basis. Where 1 = full flowering swede crop, 4 = stem elongation, green seed head appeared, 7, small degree of elongaton, 9 = no sign of stem elongation.*

Good leaf yield

Invitation produces high leaf yields showing a significantly higher leaf percentage than other cultivars in trials. This lifts the overall protein level of the crop and is helpful when introducing swedes into an animal's diet, particularly for younger stock.

Bulb & leaf keeping

Invitation has shown high bulb keeping ability and leaf retention in trials, helping maintain its feed quality and quantity through to the end of winter.

Using *Invitation*

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Sow						Graze			

Maturity date:	170-250 days
Typical yield:	10-18 t DM/ha (depending on season)
ME:	12-14 MJ/kg DM
Sowing rate:	0.5-0.8 kg/ha ridged 0.8-1.5 kg/ha drilled

Invitation produces a higher proportion of leaf than other varieties, providing more protein.

Invitation swede is marketed by Barenbrug

Interval rape

Interval is a tall, fast establishing rape ideal for summer, autumn and winter feed. It is tough, dependable, and has been proven to yield very well across a wide range of conditions.

Flexible sowing date

Interval can be sown from spring through to early autumn to provide a bulk of high quality feed typically in 90-110 days. Spring sowings can be grazed in summer/early autumn then left to regrow for winter feed.

High yield

Interval has performed well in trials, providing excellent DM yield.

Total winter DM yield*

Cultivar	Trial mean = 100%	
Interval	126	a
Goliath	125	a
Greenland	118	a
Winfred	92	b
Titan	88	b
Trial mean (t DM/ha)	5.3	

**Results from 2 trials in Canterbury during 2008 and 2009 (February sown, June/July harvested). Statistical significance lettering given for 5% LSD level, cultivars with the same letter are not significantly different.*

Utilisation & other benefits

Compared to most kales (not *Bombardier* though), rape typically has higher stem feed quality, and is better utilised by stock after 90 days. *Interval* has excellent tolerance of dry conditions. It also has strong frost tolerance and resistance to powdery mildew.

Using *Interval*

Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
	Sow										
				Graze							

Maturity date:	90-110 days
Typical yield:	5-8 t DM/ha (depends on sowing time & no. of grazings)
Typical ME:	12 MJ/kg DM
Sowing rate:	4 kg/ha

Interval has excellent DM yield and utilisation.

Interval rape is marketed by Barenbrug

Dynamo turnip

Dynamo turnip is a high yielding summer crop for dairy cows. It provides large volumes of low cost quality feed with a high proportion of bulb, and good bulb keeping ability.

DM yield

In trials *Dynamo* has shown high yield, not significantly different from the other top cultivars.

Replacing a poor performing pasture with a crop of *Dynamo* makes financial sense. It can provide feed for around 20 c/kg DM*.

Low cost summer feed

*Turnips for 20 c/kg DM - assumptions:

- Turnip crop yield 11.5 t DM/ha, with 12 ME.
- 5.5 t of old pasture growth is forgone while the paddock is in crop.
- Cost of growing crop = $1200/ha (spray out plus insecticide, full cultivation, fertiliser, treated seed, slug bait, two post emergence herbicides/insecticides).
- $1200/6000 kg DM extra yield = 20 c/kg DM

High bulb percentage

Summer turnips produce their yield in different ways. *Dynamo* produces a good level of bulb (around 48% of total yield), giving it an advantage in seasons when high levels of leaf diseases or pests are present.

Using *Dynamo*

Oct	Nov	Dec	Jan	Feb	Mar
Sow			Graze		

Maturity date:	60-90 days
Typical yield:	8-16 t DM/ha (depending on season)
ME:	12 MJ/kg DM
Sowing rate:	2-3 kg/ha

Dynamo summer turnip is marketed by Barenbrug

Fodder beet

Fodder beet types

It's important to choose the correct fodder beet for your requirements. Good starting points for this decision are bulb DM content, and whether the crop is to be grazed, grazed and lifted, or only intended to be lifted. Fodder beet can be largely divided into three groups:

Low bulb DM% (12-15%)

Lower yield potential, usually with a high % of bulb above ground (50%+). Only suited to grazing in situ.

Medium-high bulb DM% (16-20%)

Higher yield potential than low DM % types, and can be grazed in situ e.g. *Robbos*. Some can also be successfully lifted or grazed

Lifting types

Bulbs sit lower in the ground, generally not suitable for grazing in situ. Very high DM % types (e.g. *Blizzard*) are best for maximum yield potential and increased storage life.

System fit

Thanks to its ability to grow a large volume of high quality, high utilisation feed that can be used from autumn to spring, fodder beet suits several different farm systems. Its high yield potential also frees up land for other uses, which is a major plus. Alternatively you can increase daily allowances for improved live weight gains.

This crop provides flexible winter grazing and can also be used to extend dairy cow lactation by either grazing in situ or lifting and feeding to stock on pasture. Successful grazing entails correct stock transition.

For further information see Barenbrug Fodder Beet Product Guide or download the guide from www.barenbrug.co.nz

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
Robbos												
Dairy	Precision sown.						Extend lactation, start winter transition.		Winter feed.		Supplement spring pasture covers.	
Beef/Sheep/Deer	Precision sown.						High ME feed for liveweight gain or maintenance from autumn to spring.					
Blizzard												
Lifting fodder beet	Precision sown.						Mechanically lifted and fed to stock for a high ME supplement from autumn through to early summer.					

Maturity:	Once herbicide withholdings are met. 170 days+ to maximise yield.
Typical Yield	18-24 t DM/ha average. 25 t DM/ha+ possible with good summer moisture and fertility.
Sowing rate:	80,000 seeds/ha grazing. 100,000 seeds/ha lifting.

Robbos fodder beet

Robbos is an excellent, consistent performer with more leaf protein for a better balanced diet, coupled with consistent high DM yield.

Higher leaf protein

As fodder beet is so high in carbohydrate, *Robbos*' higher leaf protein, due to its excellent leaf quality, will provide a better-balanced diet for animals.

Alternatively, this could be turned into a cost saving of around $1125/ha* by using as less expensive supplement when grazing *Robbos* crops.

Robbos leaf tested at 24.5% protein at the start of winter, versus *Feldherr, Brigadier, Monro* and *SF1505Bv* which averaged 21%.

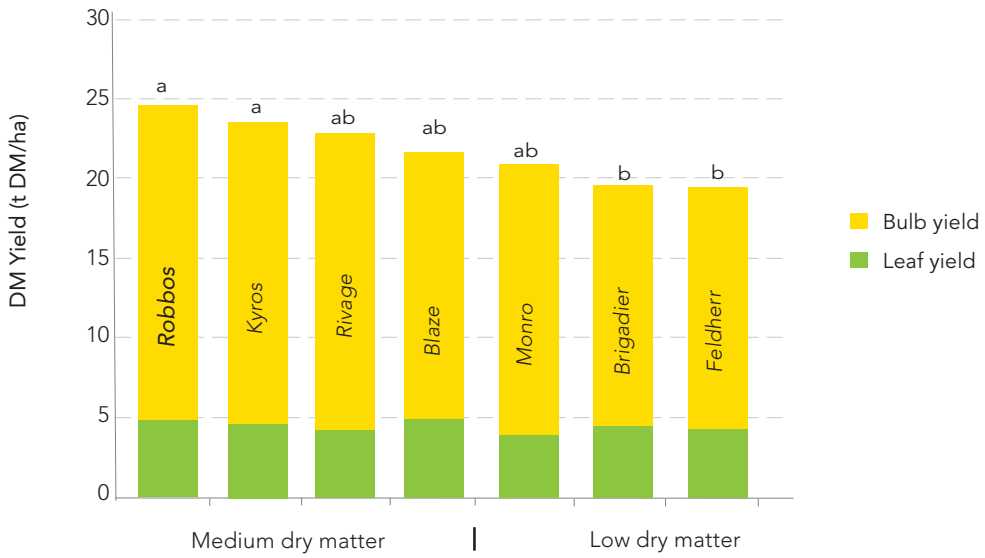
Robbos (middle 3 rows) showing excellent leaf holding ability versus Kyros (left) and Enermax (right) in Canterbury trial.

*(*Based on feeding 7.5tDM/ha (3kgDM/cow/day) good silage with 17% crude protein @$0.40/kgDM, versus good hay with 15% crude protein @$0.25/kgDM; We recommend feed testing crops & supplement before setting diet.)*

Very high DM yield

Of the grazing types, medium DM beets provide significantly more yield and stock carrying capacity than the low DM beets. And within the medium DM cultivars *Robbos* has shown consistently high DM yield.

Fodder beet DM yields - medium and low drymatter (DM) cultivars



**Combined analysis of 5 trials from 2014-2017, varieties in two or more trials are presented. Cultivars with the same statistical significance letter are not significantly different at the LSD 5% level.*

Robbos fodder beet is marketed by Barenbrug

Robbos fodder beet

Palatable

Robbos has relatively soft orange-yellow bulbs, suitable for grazing by all stock types. Its high leaf quality can also help with transitioning stock onto beet.

Above ground %

Robbos bulbs typically sit 45-50% out of the ground, and their good palatability make them easy for stock to graze. The high proportion of above ground DM ensures less soil ingestion and very high utilisation.

Bulb above ground %*

Cultivar	% of bulb above ground	
Brigadier	53	a
Rivage	47	b
Blaze	46	bc
Robbos	**45**	**bc**
Kyros	44	bd
Enermax	41	cd
Blizzard	**40**	**d**
Trial mean	44	
LSD (5%)	5.2	

**From 3 trials in Canterbury from 2008/09 to 2014/15. Cultivars were in at least two trials. Cultivars with the same statistical significance letter are not significantly different at the LSD 5% level.*

Using *Robbos*

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Dairy	Precision sown						Extend lactation, start winter transition		Winter feed		Supplement spring pasture	
Sheep, beef & deer	Precision sown						High ME feed for liveweight gain or maintenance from autumn to spring					

Feeding method:	Multi-use. Typically grazed (can be lifted)
Typical yield:	18-24 t DM/ha average; > 25 t DM/ha with summer moisture*
Typical ME:	12-13 MJ/ME
Sowing rate:	80,000-100,000 seeds/ha

Robbos fodder beet is marketed by Barenbrug

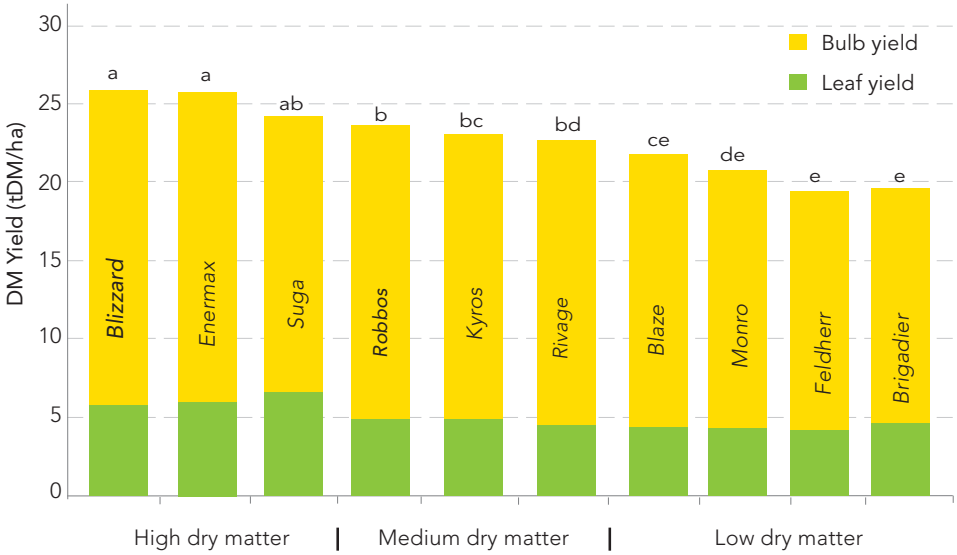
Blizzard fodder beet

Blizzard is a very high yield/ha fodder beet suitable for lifting. It has excellent leaf holding ability and disease resistance, and a 20-22% DM content.

High DM yield

Blizzard has performed very well in trials, with significantly higher total DM yield than low - medium DM cultivars. *Blizzard* is not recommended for grazing because it has a high proportion of the bulb in the ground, reducing utilisation, but making it ideal for lifting.

Fodder beet DM yield - all types



**Combined analysis of 5 trials from 2014 – 2017, varieties in two or more trials are presented. Cultivars with the same statistical significance letter are not significantly different at the LSD 5% level.*

Storage

The higher DM content of *Blizzard* enables it to be kept for longer in a windrow after being lifted. When leaves are removed. *Blizzard* can be stored for up to 5 months, but bulbs will dry out over time, so DM % may need to be re-tested to allow for accurate feed allocation.

Using *Blizzard*

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Precision sown						Mechanically lifted and fed to stock for a high ME supplement from autumn through to spring					

Feeding method:	Lifting only
Typical yield:	20-25 t DM/ha average; > 26 t DM/ha with summer moisture
Typical ME:	12-13 MJ/ME
Sowing rate:	100,000 seeds/ha

**If leaf is removed when lifting reduce these yields by 5-6 t DM/ha.*

Blizzard fodder beet is marketed by Barenbrug

Hattrick greenfeed oats

Hattrick is an easy to manage winter crop. It is most often sown mixed with T*abu+ Italian* or *Hogan* annual ryegrass, or *Laser* Persian clover, to extend growth into spring.

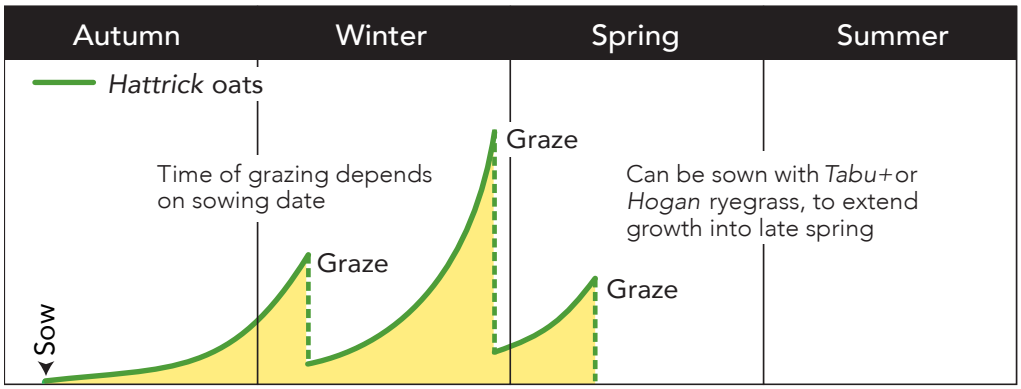
Management

Hattrick is leafy, high yielding, and more adapted to multiple grazings than some other oat cultivars. It can usually be grazed 2-3 times depending on management. For best regrowth graze at 30 cm height, leaving a 7-10 cm residual. Growth can be boosted by strategic use of nitrogen fertiliser, for example applying 30 kg N/ha after grazing.

Feed value

Leafy *Hattrick* oats have a digestibility of 80% (ME = 12 MJ/kg DM) and contain 13-15% protein.

Growth curve



Sow early

For maximum winter production *Hattrick* oats should be sown early (February/March). Insecticide protection against Argentine stem weevil may be necessary in some areas.

Hattrick oats can be sown alone, but are most commonly sown with Italian or annual (e.g. *Tabu+* or *Hogan*). Mixing *Hattrick* with a ryegrass increases feed value and extends growth through spring.

Sowing *Hattrick*

Dairy, Sheep, Beef, Deer		kg/ha
For a large bulk of winter feed	*Hattrick* forage oats	120
	Total	120
For extended feed into late spring	*Hattrick* forage oats *Tabu+* Italian ryegrass	50 20
	Total	70
Or	*Hattrick* forage oats *Hogan* annual ryegrass*	50 25
	Total	75
For increased late spring quality	*Hattrick* forage oats *Laser* Persian clover	80 8
	Total	88

**Hogan sowing rate 30% higher than Tabu+, because it is a tetraploid with larger seeds.*

Hattrick green feed oats are marketed by Barenbrug

Catch-crop+

This dual species catch-crop mix (*Tabu+* and *Hattrick* oats) takes up N and increases ME, with the flexibility and reduced resowing costs from being a 12-18 month pasture.

Why catch-crop?

Catch-cropping becomes mandatory next season, so the more we do now to make it as easy and successful as possible, the better.

Fast-growing species such as oats and Italian ryegrass quickly cover ground left bare after autumn or winter forage crops have been grazed. In doing so they utilise soil N and other nutrients deposited during grazing and prevent these from leaching. They also protect soil quality. Benefits are both environmental, and systemic, as catch-crops provide valuable feed.

Why oats + grass?

Barenbrug trials show the *Catch-crop+* mix will capture soil N very well, with increased re-growth and feed quality. And rather than a 1-2 cut or graze system of oats alone, the *Tabu+* provides a high performance 12-18 month pasture, reducing the need and cost of immediate resowing. Yield at the first silage cut or grazing is like a straight cereal crop, but from the 2nd grazing onwards, this mix has better re-growth and ME.

System fit

In summer-moist areas, sow *Catch-crop+* ex autumn or winter crop for:

- Efficient utilisation of soil N deposited during crop grazing, to reduce leaching.
- A high quality/yield spring silage crop with multi-graze and/or multi-cut flexibility.
- *AGRICOTE* Clover can be oversown to improve feed quality and fix N.

In dryland areas, sow *Catch-crop+* ex autumn or winter crop for:

- Efficient utilisation of soil N deposited during crop grazing, to reduce leaching.
- Grass growth summer (moisture dependant), with fast response to autumn rain for high quality winter feed.

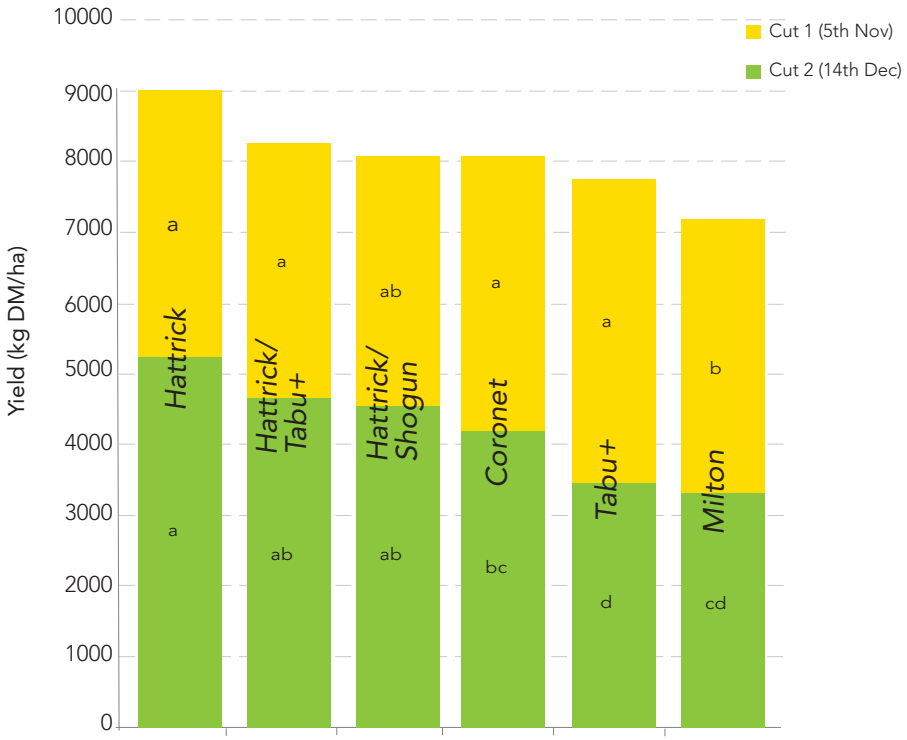
Testing the range of catch-crop options.

Trial results

Results below are from a late winter/early spring sown catch-crop trial at Courtenay, Canterbury, to look at the performance of oats and mixes over the first two cuts.

Hattrick oats showed high performance as a catch crop, outyielding several other oat cultivars in the first cut. Mixing *Hattrick* with *Tabu+* Italian ryegrass did not significantly decrease yield at the first two cuts, but provides the flexibility and reduced sowing costs of continued cutting/grazing for the next 12-18 months.

Total yield, split into first two harvests, of a late-winter/early-spring catch-crop*



** Trial sown 14 Aug 2020, with cut 1 - 5 Nov 2020 (at 83 days) and cut 2 on 14 Dec 2020 (at 122 days). Statistical significance letterings given on bars for LSD 5%, bars with the same letter are not significantly different.*

Sowing *Catch-crop+*

- Sow *Catch-crop+* at 75kg/ha. It comes in 25kg bags, containing 18kg *Hattrick* and 7kg *Tabu+*, for sowing at 3 bags/ha.

Agricote seed treatment

AGRICOTE helps protect your seedling plants, to ensure good even establishment of new pastures and crops.

Best possible start

Establishment is a critical time for a new pasture or crop as its potential performance is determined in this early stage. Different AGRICOTE seed coatings aid establishment by helping protect your seedling plants from insects and fungal diseases and by supplying nutrients to clovers.

If you have a pasture or crop that fails, the main cost (usually 75-80%) is the lost feed. There is also an additional cost in resowing as the example below shows.

Example - cost of a pasture failure.

What happens	Autumn pasture fails to establish
Cost of lost DM	Loss of 5 t DM/ha production (from April – September) = $1500/ha (valued at 30c/kg DM*)
Cost of resowing spring	= $500/ha (to re-spray, light cultivation, buy seed & resow)
Total cost failure	= $2000/ha

**April – September pasture has a high value of 30c/kg DM as this is a feed deficit period.*

Order your seed with *AGRICOTE* coating to get the following (Y=Yes):

Grass seed treatment

Seed treatment	Insect protection			Fungal pathogens		Other	Sowing rate
	Argentine stem weevil	Black beetle	Grass grub	*Fusarium*	*Pythium*	Weight build up	
AGRICOTE GRASS	Y	Y	Y	Y	Y	Nil	Same as bare

Clover seed treatment

Seed treatment	Insect protection	Fungal pathogens			Additives		Other	Sowing rate
	Nematodes	*Fusarium*	*Pythium*	*Rhizoctonia*	Lime	Nutrients	Weight build up	
AGRICOTE CLOVER	Y	Y	Y	Y	Y	N, P, Mn, Zn, Mo	75%	4kg/ha
OVERSOW CLOVER	N	N	N	N	Y	Y	Y	4-6kg/ha

Brassica seed treatment

Seed treatment	Insect protection			Fungal pathogens		Additives	Other	Sowing rate
	Nysius	Spring tails	Aphids	*Fusarium*	*Pythium*	Molybdenum	Weight build up	
AGRICOTE BRASSICA	Y	Y	Y	Y	Y	Y	Nil	Same as bare

Insect control rating for endophytes

Summary

These ratings are indicative and may vary slightly between cultivars. If Argentine stem weevil or black beetle are present at sowing, an appropriate seed treatment is recommended to improve insect resistance during establishment. The ratings in this table are based in part on glasshouse studies where test plants are 100% infected with endophyte, whereas commercial seed must meet minimum standards of 70% of seeds infected. These tables were compiled by AgResearch, Barenbrug, Cropmark, Grasslanz, PGG Wrightson Seeds, Seed Force and DLF.

Endophyte insect control for perennial ryegrass, festulolium & short-term (hybrid) ryegrass.

Endophyte Brand	Argentine stem weevil	Pasture mealy bug	Black beetle	Root aphid	Porina	Grass grub	Field cricket
Diploid perennial ryegrass							
AR1	++++	++++	+	-[2]	-	-	Not tested
NEA2	+++	(++++)	+++	++	Not tested	-	Not tested
NEA4	+++	(++++)	+++	++	Not tested	Not tested	Not tested
AR37	++++[1]	++++	+++	++++	+++	+	Not tested
Standard endophyte	++++	++++	+++	++	+	-	Not tested
Without endophyte	-	-	-	-	-	-	Not tested
Tetraploid perennial ryegrass							
AR1	(+++)	(++++)	+	-[2]	-	-	Not tested
AR37	(+++)[1]	(++++)	+++	++++	(+++)	+	Not tested
Without endophyte	-	-	-	-	-	-	Not tested
Italian and short term (hybrid) ryegrass							
AR1	++	(++++)	+	-[2]	Not tested	-	Not tested
NEA	Not tested	(++++)	+++	Not tested	Not tested	-	Not tested
AR37	+++[1]	(++++)	+++	Not tested	Not tested	-	Not tested
Without endophyte	-	-	-	-	-	-	Not tested
Festulolium							
U2	++++	(++++)	++++[3]	++++	(++)	+++	+++
Continental tall fescue							
MaxP (AR584)	Not tested	Not tested	+++	(++++)	Not tested	(++)	+++
Without endophyte	-	-	-	-	-	-	-

Notes on Tables

- \- No control.
- \+ Low level control: Endophyte may provide a measureable effect, but is unlikely to give any practical control.
- ++ Moderate control: Endophyte may provide some practical protection, with a low to moderate reduction in insect population.
- +++ Good control: Endophyte markedly reduces insect damage under low to moderate insect pressures. Damage may still occur when insect pressure is high.
- ++++ Very good control: Endophyte consistently reduces insect populations and keeps pasture damage to low levels, even under high insect pressure.
- ( ) Provisional result: Further results needed to support the rating. Testing is ongoing.

1. AR37 endophyte controls Argentine stem weevil larvae, but not adults. While larvae cause most damage to pastures, adults can damage emerging grass seedlings. In Argentine stem weevil prone areas it is recommended to use treated seed for all cultivars with novel endophyte.
2. AR1 plants are more susceptible to root aphid than plants without endophyte.
3. Active against black beetle adults and larvae.

Endophyte animal safety

Summary

These ratings are indicative. Animal performance and health can vary under different management systems and between seasons.

The information in this table is based on animal safety trialling protocols designed to expose animals to simulated worst-case scenario management. This involves forcing them to graze deep into the base of pure perennial ryegrass pastures that have been allowed to grow for several weeks over late spring/summer (similar to a hay crop) where they will encounter the highest concentrations of harmful endophyte chemicals if these are present.

This management does not represent normal farm practice although similar situations may arise on farms in in rare circumstances. Under normal farm grazing practices, the contribution of basal pasture material to total animal dry matter intake is relatively low and therefore the intake of harmful chemicals (if they are present) is diluted. Thus, the likelihood of adverse effects on animals is reduced, but the potential for problems to occur may still exist if the endophyte brand is rated < 4-star for 'freedom from staggers' and/or there are comments on animal performance which flag potential issues.

Comments on animal performance have been moderated based on information from other trials (in addition to the formal animal safety testing protocols), consideration of the 'normal' grazing management practices implemented on farm (see previous paragraph), and recognition that animal diets are very seldom pure ryegrass. Other dietary components such as clovers or non-ryegrass grass species, crops or supplements will dilute the intake of endophyte alkaloids.

Endophyte brand	Freedom from staggers		Effects on animal performance
	Sheep and lambs	Cattle and dairy cows	
AR1	++++	++++	High level of animal performance
AR37	+++	++++	Typically provides a high level of animal performance. Can cause ryegrass staggers in sheep and lambs in extreme circumstances. Lamb liveweight gain can be reduced during periods of severe staggers. While ryegrass staggers has not been observed in cattle and dairy cows, it could occur on rare occasions.
NEA	++++	++++	High level of animal performance
NEA2	++++	++++	Typically provides a high level of animal performance. Lamb liveweight gain could be reduced in extreme circumstances. While no effects have been observed in cattle and dairy cows, body temperature could be elevated on rare occasions.
NEA4	++++	++++	Typically provides a high level of animal performance. Lamb liveweight gain could be reduced in extreme circumstances. While no effects have been observed in cattle and dairy cows, body temperature could be elevated on rare occasions.
U2	++++	++++	High level of animal performance
MaxP (AR584)	++++	++++	High level of animal performance
Standard endophyte	+	++	Can cause ryegrass staggers in sheep and lambs, and significantly decrease lamb growth rates in summer and autumn, and significantly increase dags In dairy cows, it has been shown to depress milksolids production through summer and autumn.
Without endophyte	++++	++++	High level of animal performance

Key to ryegrass staggers ratings:

+ Likely to cause severe staggers in most years

++ Can cause severe staggers in some years

+++ Can cause severe staggers occasionally

++++ Very unlikely to cause staggers

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Barenbrug New Zealand T 0800 449 955 E mail@barenbrug.co.nz W www.barenbrug.co.nz