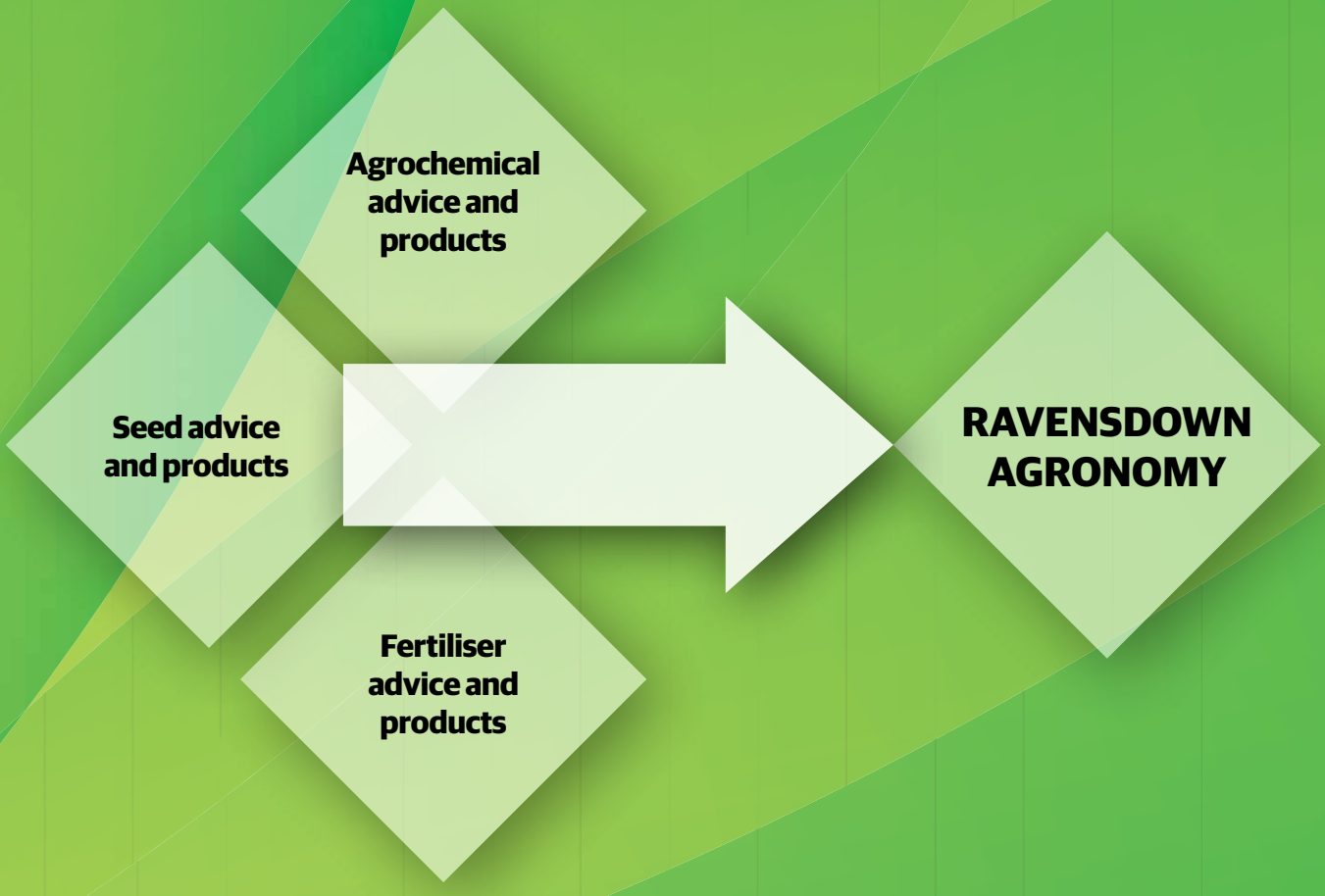
ravensdown

Winter Forage Crop Guide

Ravensdown's integrated approach

We all know, in nature nothing happens in isolation. It's the same with maximising forage production efficiency.

It comes down to a combination of fertile soil, quality seed, weed and insect pest management, grazing management, smart thinking, attention to detail and hard work. They all interact with each other and that's where Ravensdown has invested. We have a team of specialist agronomists backing up your agri manager, whose sole purpose is to maximise forage production on your farm through nutrient, seed and agrochemical advice . In this brochure, you'll find some of the tools and assistance we've developed to help with all of these.



Contents

4 steps for investing wisely

STEP 1

Get the highest return first

Why dilute your regrassing resources across the whole farm when you can funnel them into the areas that need them most?

Soil test

Our ARL lab can do an array of soil tests to give you a clear picture of what inputs you'll need for optimum growth.

Technology tools

HawkEye® is technology that helps you make smarter nutrient decisions for better economic and environmental outcomes. HawkEye combines three perspectives for a complete picture of optimal pasture production: integrating imagery from the sky; nutrient input and pasture quality on the ground; and advanced profiling in the soil.

Lime

Use lime to alter soil pH if needed. Optimum levels are between 5.8 and 6.2.

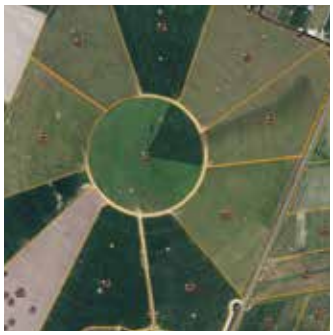
Paddock selection

It is vital to identify the worst performing paddocks and the reasons why the paddock isn't up to standard. For example, soil fertility or compaction, insect damage, weeds or pasture species present.

Pasture condition

In combination with forage and animal production records for each paddock, a visual pasture condition score, just like you do for your stock is recommended.

Condition scoring every paddock on the farm will help determine your under-performing paddocks and identify those which may need to be renewed.



HAWKEYE - MAP BASED SOFTWARE FOR SMARTER DECISION MAKING.

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SOIL TESTING – CREATES A CLEAR PICTURE OF INPUTS NEEDED

Match your forage selection to your feed requirements

STEP 2

You may have been using the same seed for years, but is it still the best available?

Use our expertise

Your regional agronomist has technical seed, fertiliser and chemical knowledge to offer while our innovative seed suppliers are constantly making breakthroughs in high performance.

The objective of the winter crop will largely influence the type of winter feed you sow. There is a huge range of products to choose from, your local agri manager and/ or regional agronomist can provide a sounding board to discuss the best options for you.

Timing

Ensuring the sown crop can be grazed at the right time and meets your expectations is very important. When it's time to sow your crop, matching the time you require the feed and stock classes to the right crop will significantly increase your success.

Just remember, although it can't always be avoided, monocropping encourages an increase in weeds, pests and diseases so paddock and / or crop rotation must be advised.

Brassica species and cultivars

There are a range of brassica species and cultivars with their own strengths and weaknesses. Making a well informed decision on what to use is important for the best outcome. Knowing your requirements and limitations for maximum crop yields will help with the selection process and increase your success rate.

Always identify your targets

STEP 3

There are two main rivals for your winter crop production: insects and weeds.

You also have two main remedies for reducing their impact – our expertise and agrochemical treatments.

Insects

Insects are the curse of winter forage crops with attack occurring at establishment and then later on once the crop is established. Inspecting the crop paddock prior to drilling will give you an indication of the levels of insects present. Seed treatment and the addition of companion insecticides to glyphosate, such as Toppel™ 500, in the spray-out will reduce the risk of insects affecting crop yields.

See page 15 to 19 for more details on the range of damaging insects and control options available to you.

Weeds

Identifying your problem weeds will allow you to control any that will cause issues after sowing. Docks, buttercups, thistles, yarrow, ragwort and sheep sorrel are examples of some weeds that aren't fully controlled with just glyphosate. Using companion herbicides will allow for more effective weed control (see opposite).

Weed and pest issues must be correctly identified, any underlying causes recognised and appropriate measures taken to ensure there are no negative effects on the establishment and performance of the newly sown crop.

Paddock preparation

STEP 4

Good paddock preparation, regardless of the sowing / drilling method used, will allow your sown crop to get the best start, increasing the return on your investment.

• **Weed and pest control** - starting with a flat, even and firm seedbed, that's free of weed and insect pressures will allow a consistent sowing depth and competition free establishment.

Sowing depth – the sowing depth of seed is important for a rapid and even establishment. It is a balance between ensuring adequate seed / soil contact, moisture supply for germination, and allowing the smaller brassica and chicory seeds to establish.
10-15mm sowing depth is the target.

Soil temperature – soil temperature is a major factor in determining germination speed. Soil temperatures above 10°C and rising are ideal for brassicas species.

COMPANION HERBICIDES	GRANIT® (tribenuron-methyl)	BACKUP® (thifensulfuron-methyl)	DICAM 480 (dicamba)	MULTIPLE® (clopyralid)	PASTURE GUARD® 2,4-D 680 (2,4-D ester)
Extra weeds controlled	Clovers, sheep sorrel, thistles, ragwort, wireweed, yarrow	Buttercup, dock	Clovers, dandelion, dock, mallow, pennyroyal, mayweed, ragwort, sheep sorrel, thistles, wireweed	Clovers, dandelion, plantains, thistles, yarrow	Nettles, ragwort, storksbill, thistles
Plant-back period					
Grasses and cereals	14 days	14 days	0 days	0 days	10 days
Clovers	14 days	14 days	28 days	3-6 months	21 days
Chicory	14 days	14 days	28 days	3-6 months	X
Plantain	14 days	14 days	0 days	3-6 months	X
Brassicas	14 days	14 days	0 days	0 days	28 days
Fodder beet	X	X	X	0 days	X
X – not recommended to be used in a sprayout prior to sowing these crops.					

COMPANION INSECTICIDE	TOPPEL 500 (chlorpyrifos)						HALEX CS (lambda-cyhalothrin)
Insects Controlled	Springtails	Army caterpillar	Cutworm	Nysius fly	Argentine stem weevil	Porina caterpillar	Cutworm
	200ml/ha	500ml/ha	600ml/ha	1.25L/ha	1.25L/ha	1.25 - 1.7L/ha	40ml/ha

Use our expertise

Jeremy Klingender

Product Manager - Seed

Jeremy joined Ravensdown in 2011 as an agrochemical technical manager. Jeremy has worked for many years in the field looking after forage crops, pastures and brassicas. His experience ranges from corporate farmers to lifestyle blocks, and summer dry areas like the East Coast to summer safe areas such as the Central Plateau.

George Kerse

Product Manager - Agrochemicals

George joined Ravensdown in 2010. He has more than 35 years' experience in the agrochemical and rural supply industry in New Zealand. Previous roles include; Product Development, Category Management and Sales Management with both agrochemical manufacturer and rural retail companies.

Will Waddell

National Agronomy Manager

Will joined Ravensdown in 2019 as an Agronomy Technical Manager.

Having grown up on a mixed cropping farm in Mid Canterbury, Will loved the integration of livestock with cropping.

Will graduated from Lincoln University with a B Comm Ag and his work experience prior to joining Ravensdown includes time working on a large cropping farm in Saskatchewan and 4 years as a farm systems and agronomy advisor with a leading proprietary seed company.

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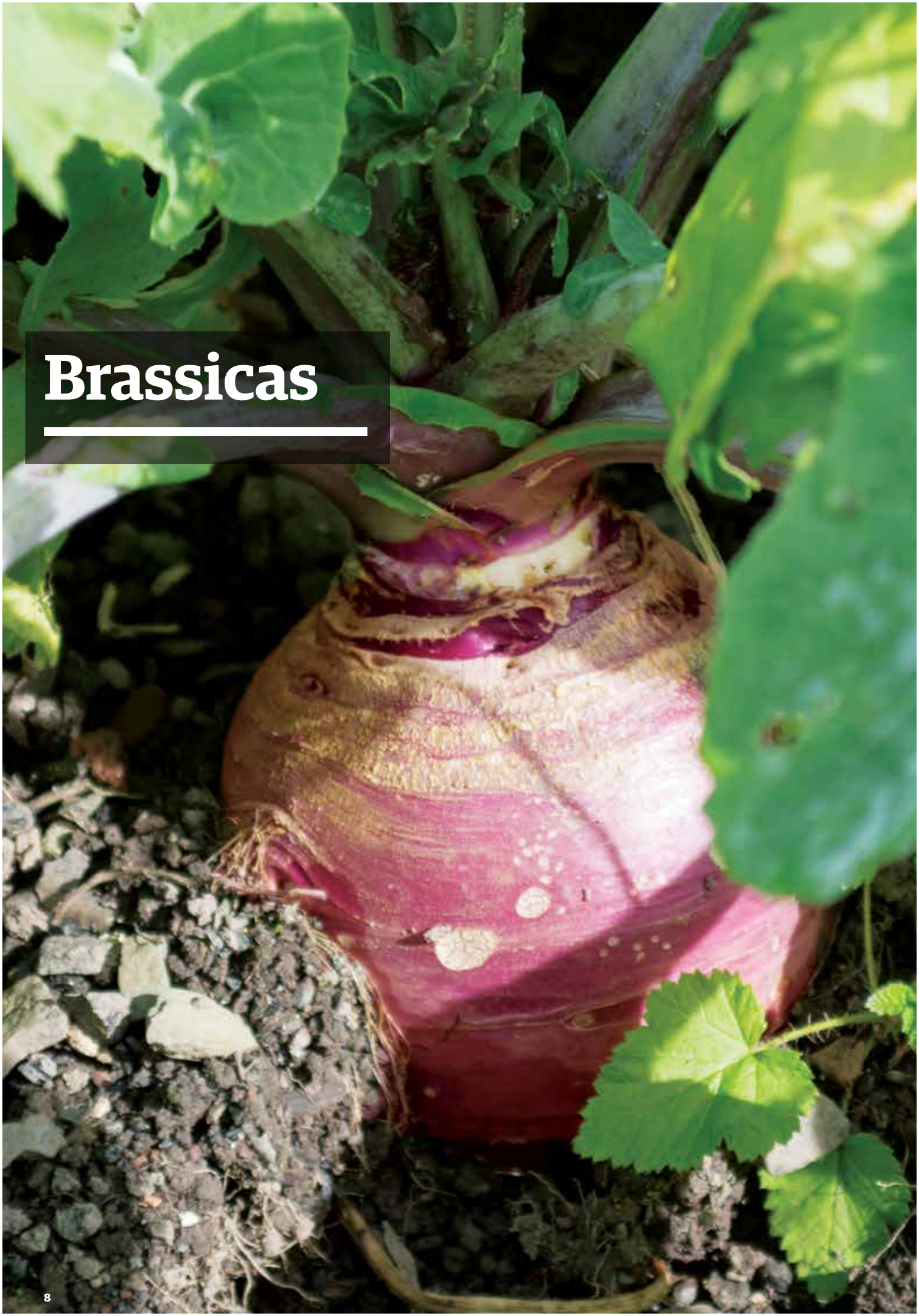


Brassicas

Cultivar descriptions

Kale

Also known as Chou Moellier, kales are mainly used as a winter feed with average yields around 12tDM/ha, however can grow up to 20tDM/ha. They are more tolerant of clubroot, but can get a form of dry rot called 'black leg' which reduces stem strength. Higher sowing rates lead to thinner and more palatable stems. Kales should be strip fed to reduce wastage, taking 150 to 220 days to reach maturity. Suitable for cattle, sheep, deer, but the taller varieties are best used only for cattle. Grazing must be light in late summer if regrowth is required. Hay or pasture run-off will improve the nutritional balance of stock grazing kale.

Rate: 4-5kg/ha

Type: Intermediate stem height

Stock suitability: Sheep, beef, dairy and deer.

General comments: Proteor is an intermediate stem kale with a high leaf-to-stem ratio. It is a typical green colour and has high yield potential. Proteor has good disease tolerance and winter hardiness.

Key traits:

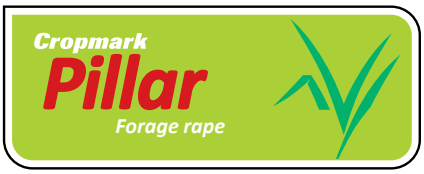
- High leaf-to-stem ratio
- High yield potential
- Good aphid tolerance
- For high performance livestock systems
- Good disease tolerance

	CULTIVAR	SOWING RATE (kg/ha) ALONE	STOCK	COMMENTS
MEDIUM SIZE	COLEOR	4-5	Sheep, beef, deer and dairy	Coleor is a high yielding, leafy, diploid kale of short to medium height, very high leaf-to-stem ratio and very good winter hardiness.
	KESTREL	4-5	Sheep, beef, deer and dairy	A leafy hybrid variety with short stems which was bred for low stem fibre content and high digestibility.
	SF VOLTAGE	4-5	Sheep, beef, deer and dairy	A medium stem kale suitable for all classes of livestock. Voltage has good disease resistance and tolerance to lodging.
INTERMEDIATE SIZE	PROTEOR	4-5	Sheep, beef, deer and dairy	An intermediate stem kale with a high leaf-to-stem ratio. It is a typical green colour and has high yield potential. Proteor has good disease tolerance and winter hardiness.
	REGAL	4-5	Beef, deer and dairy	An intermediate height kale bred for high leaf percentage and winter hardiness. It is high yielding and has good tolerance to brassica diseases.
	SF FUEL	4-5	Beef, deer and dairy	An intermediate kale with good resistance to brassica diseases. Is a deep green colour.
	SOVGOLD	4-5	Sheep, beef, deer and dairy	A high yielding intermediate height kale. It has high leaf-to-stem ratio and very good quality.
GIANT SIZE	CALEDONIAN	4-5	Beef, deer and dairy	A tall kale with good winter hardiness. It has high quality and is a high yielding cultivar.
	CORSA	4-5	Beef and dairy	A new generation high yielding, winter handy giant kale, with the highest leaf-to-stem ratio of giant kales and good aphid tolerance.
	GRUNER	4-5	Beef and dairy	A tall growing, single grazing, longer maturing, frost hardy variety with good resistance to lodging. It was bred as a winter feed for cattle.

Cultivar descriptions

Rape

Rape may be sown alone or in mixtures as a specialist summer to winter feed option. Rape can be sown from early spring to late summer and is generally ready to graze 12-16 weeks after sowing. Rape can be grown on lower soil fertility than most other brassicas and also soils with good soil fertility and moisture, yields of 8t DM/ha plus can be achieved. Do not grow in clubroot infected areas. Some care is required when grazing rape and it is best to allow the crop to fully mature before grazing and also gradually introduce rape into the diet to reduce the risk of animal health issues (see Grazing brassicas page 24).



Rate: Alone: 3-4, mix: 0.5-1kg/ha

Type: High yielding, multi-graze, maturity 90-110 days

General comments: A fast establishing, high yielding multi-graze, giant-type forage rape with strong regrowth potential, good aphid tolerance and disease resistance.

Key traits:

- Very high yielding with good regrowth potential
- Very fast establishing
- Good disease resistance
- Can be spring or autumn sown
- Suitable for sheep, cattle and deer

	CULTIVAR	SOWING RATE (kg/ha)		REGROWTH ABILITY	DAYS TO MATURITY	COMMENTS
		ALONE	MIX			
EARLY MATURITY	MAINSTAR RAPE	3-4	0.5-1	Good	70-90	Mainstar is a very versatile brassica, being suitable across a wide range of soil fertility and environmental conditions, stock classes and sowing times.
EARLY MATURITY	GREENLAND	3-4	0.5-1	Mod	70-90	Very late flowering, medium height rape. Good palatability with flexible multi-graze potential.
EARLY MATURITY	TITAN	3-4	0.5-1	Good	70-90	High yielding early maturing cultivar of intermediate height. Titan has high aphid and virus tolerance and has good palatability.
EARLY MATURITY	WINFRED	3-4	0.5-1	Mod	70-85	Winfred is an early maturing cultivar, with broad leaves, a high leaf to stem ratio, and good cold tolerance. High regrowth potential from multiple grazings.
LATE MATURITY	GOLIATH	3-4	0.5-1	Good	90-110	A giant type rape with high yield potential. Very good winter keeping potential and very good palatability.
LATE MATURITY	INTERVAL	3-4	0.5-1	Good	90-110	Interval is a tall, high producing rape with good tolerance to dry conditions and frost. It has good palatability and good regrowth.
LATE MATURITY	PILLAR	3-4	0.5-1	Good	90-110	A fast establishing, high yielding multi-graze giant-type forage rape with strong regrowth potential, good aphid tolerance and disease resistance.
LATE MATURITY	SPITFIRE	3-4	0.5-1	Good	90-110	Spitfire is a medium to tall rape with high dry matter yields and good tolerance to aphids. Its low DM stem gives it good palatability.

Cultivar descriptions

Swede

Swedes are sown November to early December, either ridged in wet cool areas, broadcast, or drilled to provide specialist winter feed for all livestock classes. They are a high quality, slow growing crop with better keeping ability than turnips. Swedes should not be sown in successive years in the same paddock as they are particularly susceptible to dry rot and clubroot diseases. Generally yellow fleshed swede varieties are commonly used for human consumption because of improved flavour compared to white fleshed types.

CULTIVAR	SOWING RATE (kg/ha)		FLESH COLOUR	DRY ROT	CLUB ROOT	COMMENTS
	RIDGED	DRILLED				
APARIMA GOLD	0.5	1	Yellow	Improved	Improved	Aparima Gold has a high leaf percentage and very good keeping ability. It is a high producing main crop swede variety.
CLUTHA GOLD	0.5	1	Yellow	Improved	Improved	Has been developed to supersede Aparima Gold. Clutha Gold has a significant yield advantage over Aparima Gold. With mid bulb maturity, good dry rot, powdery mildew and clubroot tolerance.
DOMAIN	0.5	1	Yellow	Improved	Improved	A new generation swede with dry rot tolerance. This early maturing traditional swede is very similar in growth habit to Doon Major and Dominion.
HT SWEDE	0.5	1	Yellow	Improved	Improved	Seed of HT™ brassica cultivars are bred to be tolerant to the chlorsulfuron herbicide.
INVITATION	0.5	1	Yellow	Improved	Improved	Invitation is a high yielding swede producing high quality feed for sheep, cattle and deer.
MAJOR PLUS	0.5	1	Yellow	Susceptible	Susceptible	A re-selection of Doon Major, producing up to 10% higher yields.
TRIUMPH	0.5	1	Yellow	Improved	Improved	A high yielding swede with good dry rot and mildew tolerance. This new generation swede has a uniform bronze / purple skinned bulb and very good leaf holding characteristics.

Fertiliser requirements

The current soil fertility, prior history and desired crop species and yield will determine the fertiliser programme for individual crops. Ask your Ravensdown agri manager for a fertiliser recommendation programme which may include a combination of capital applications (of lime or phosphate fertiliser), base fertiliser dressing (prior to sowing), starter fertiliser (at sowing) and one or more side dressings.

Nitrogen

The amount of nitrogen (N) required will depend on the paddock history and soil type. A soil N test (mineralisable N) will provide a guide to the soil N supply. Alternatively, the following information can be used as a general guide:

- Following good pasture: require starter N only (20-30kg N)
- Following run-out pasture/development phase: starter N plus several N-Protect® side dressings. This will ensure there is no shortage of N due to temporary immobilisation of N by the decomposing organic matter. Confine side dressings to 90-100kg/ha. In total, up to 200-250kg N may be required for kale, swedes and turnip crops sown into paddocks with a very low soil N status
- Second year crops: starter N, plus the option of one side dressing
- Longer term cropping: starter N plus the option of two side dressings

The first side dressing is typically applied four to six weeks after sowing. Excessive N can do two things, it may change the ratio to leaf from bulb, or it could run the risk of increasing nitrate levels. Avoid late N application unless growth is likely to continue for some time and wean stock onto the crop. The more N that is required the earlier side dressing should commence. If in doubt complete an herbage test.

Deficiency symptoms

N deficiency symptoms are pale yellow leaves with purpling edges of older leaves.

Phosphorus

Brassicas respond well to phosphorus (P) and in many instances P is often a limiting growth nutrient for crops. Ideally Olsen P status should be 25+ for sedimentary and ash soils, and 40+ for pumice and peat soils. P inputs as low as 20-30kg should only be used in good fertility situations and for short-term crops.

If paddocks have Olsen P levels of 10-15, capital P inputs are required to ensure the crop performs. Aim to raise the Olsen P status to 20+. Research by Crop & Food confirms brassicas to be highly responsive to P fertiliser. Where soil fertility is around Olsen P 15, recommended rates of P for various brassica types are:

- Rape: 20-35kg P
- Bulb Turnips and Leafy Turnips: 40-60kg P
- Kale: 80-90kg P
- Swedes: 50-80kg P

Remember that, on average, 10kg P will lift soil Olsen P by 1 unit to 15cm depth for sedimentary soils. At a 15cm soil depth, use 22kg P to lift the Olsen P by 1 on volcanic soils, and 14kg P for every Olsen P unit on pumice soils.

If soil fertility is low, use Triple Super to raise P levels. DAP is a good way to provide P to brassicas.

Where the P status is very low (Olsen P <12) put some P (as serpentine super) down the spout with the seed.

The benefit of banding will diminish as the soil P levels increase. If using DAP down the spout, keep rates less than 100kg DAP and broadcast the balance to avoid the risk of the fertiliser burning the seed.

At low P levels you may also wish to lift the P status, although some farmers will prefer to do this when they go back into permanent pasture. Triple Super is a good way to lift P status during the brassica phase. Early purpling usually means a P deficiency, but can also be due to poor P uptake in cool weather.

Where paddocks have high Olsen P levels (eg 30), it is very unlikely that crops such as kale will respond to P fertiliser.

Deficiency symptoms

Purpling, stunted and erect growing leaves. However this can be similar to symptoms for plant stress so a plant test is highly advised.

Fertiliser requirements

Boron

Brassicas respond well to boron (B), mainly for crop quality, however the rates may vary from zero with small leafy type brassicas to >25kg Borate 46 with high rainfall swede crops. Some soils have adequate B levels, thus will not require B fertiliser.

- As a general rule use 10-15kg/ha Borate 46 on most crops
- 20-25kg/ha of Borate 46 in wetter areas (split applications due to risk of boron leaching)
- Swedes are the crop most prone to brown heart, followed by kales and turnips. Leaf Turnips (eg Hunter, Pasja) are unlikely to require additional B
- If you are unsure as to whether a brassica crop such as kale or leafy brassica requires B, a B soil test may be of help.
- Don't put B fertiliser down the spout with seed
- B sprays complement rather than replace solid B, so verify whether spraying is warranted by herbage sampling

Deficiency symptoms

B deficiency symptoms are 'brown heart' of bulb brassicas and browning of stems in kale and rape. Symptoms are usually seen too late for any treatment so ensuring adequate B supply in the early to mid-stages of growth is recommended.

Potassium

Potassium (K) is usually not required unless soils have a low K status, eg West Coast soils and some soils in Taranaki / Manawatu. When a soil test indicates a deficiency (QT K<5), apply 50-100kg K/ha if following a potash-deficient pasture. Cropmaster 13 or Cropmaster 15 is a good way to provide this unless potash supers are used as a development phase for the paddock.

Deficiency symptoms

K deficiency symptoms are plants with yellow or purple leaf-tints with browning at the edge of the leaf. Wilting of older leaves may occur with a scorched look. Initially older leaves show signs of deficiency as dying leaf tips, then symptoms spread.

Sulphur

It is not necessary to use sulphur (S) on brassicas unless S levels are low (2-3), as S-methyl-cysteine sulphoxide (SMCO) compounds may be formed which reduce intake and weight gain. If S levels are >8 you are probably going to be susceptible to SMCO issues.

Research on kale has shown that the synthesis of SMCO is stimulated by the addition of N when soil sulphate-S is high (>10 ppm). Interestingly, addition of S-containing fertilisers (eg superphosphate) under high soil sulphate-S levels did not increase SMCO levels.

However, under low soil sulphate-S levels (4 ppm), application of S-containing fertilisers do increase the SMCO level. And when N is also applied, the kale leaf SMCO levels increase further (but the stem levels remain unchanged). Where no S fertiliser is applied, addition of N decreases the SMCO level in the stems, but leaf levels remain unchanged.

Don't get hung up on this issue, simply avoid high rates of sulphur (sulphur supers). Kale is more prone to the SMCO problem. Crop & Food research has shown no response to S fertiliser, even at sulphate levels around 3ppm.

Magnesium

If soil magnesium (Mg) levels are 7 or less, then consider applying 20-30kg Mg/ha. If in the optimum soil Mg range, then no Mg should be required.

Deficiency symptoms

Deficiency symptoms are interveinal yellowing, sometimes with reddish brown tints and early leaf fall.

Soil pH

Although brassicas can tolerate a range of pH, preferably lift pH to >5.5, liming will increase soil molybdenum availability. Preferably work lime into the soil.

On soils that are known to be low in molybdenum (with no previous molybdenum topdressing history), apply 100g/ha of sodium molybdate.

Trace Elements

Apply if the chosen paddock is known for particular trace element deficiencies, otherwise rely on herbage sampling.

Crop establishment

Triflow® 480

Selective pre-emergence soil incorporated herbicide for the control of certain annual grasses and broadleaf weeds in field and vegetable brassicas, lucerne, peas and specific vegetable crops

- For pre-plant weed control in brassicas, lucerne and certain other crops
- Controls a range of grass and broadleaf weeds
- Good residual activity for weed control during establishment

AGRECOVERY CP

ACTIVE INGREDIENT: **trifluralin** 480g/L
PACK SIZE: 20L

Sowing

Seed treatment

The use of seed treatment is highly recommended for all brassica seed to reduce the impact damaging insects may have on establishment.

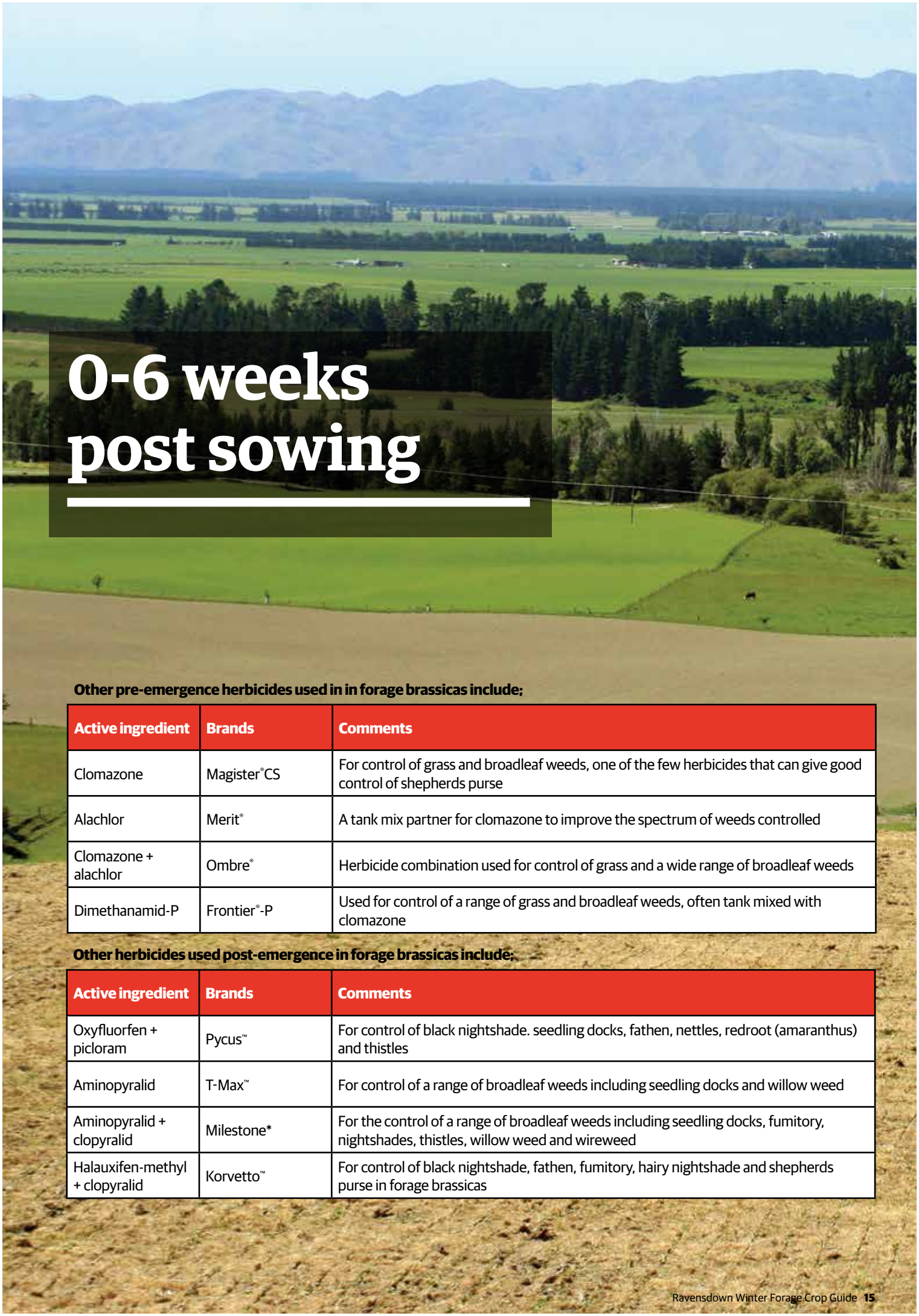
Crop monitoring is still required as brassica seedlings can still suffer damage when there are a high number of insects. Insects are controlled by ingesting the chemical from biting the plant, therefore with high numbers of insects there may be enough one-off bites to cause plant damage.

Sowing date

The sowing date depends on the maturity of the crop and the time of grazing. Once the grazing requirements and reason for the crop is understood, the type of brassica and sowing date can be easily worked out.

Sowing depth

Sowing depth for all brassicas should be around 10-15mm.



0-6 weeks post sowing

Other pre-emergence herbicides used in in forage brassicas include;

Active ingredient	Brands	Comments
Clomazone	Magister®CS	For control of grass and broadleaf weeds, one of the few herbicides that can give good control of shepherds purse
Alachlor	Merit®	A tank mix partner for clomazone to improve the spectrum of weeds controlled
Clomazone + alachlor	Ombre®	Herbicide combination used for control of grass and a wide range of broadleaf weeds
Dimethanamid-P	Frontier®-P	Used for control of a range of grass and broadleaf weeds, often tank mixed with clomazone

Other herbicides used post-emergence in forage brassicas include;

Active ingredient	Brands	Comments
Oxyfluorfen + picloram	Pycus™	For control of black nightshade. seedling docks, fathen, nettles, redroot (amaranthus) and thistles
Aminopyralid	T-Max™	For control of a range of broadleaf weeds including seedling docks and willow weed
Aminopyralid + clopyralid	Milestone*	For the control of a range of broadleaf weeds including seedling docks, fumitory, nightshades, thistles, willow weed and wireweed
Halauxifen-methyl + clopyralid	Korvetto™	For control of black nightshade, fathen, fumitory, hairy nightshade and shepherds purse in forage brassicas

0-6 weeks post sowing

Crop monitoring

Crop monitoring is vital for reducing the potential impacts of insects, weeds and any nutritional deficiencies affecting brassica establishment and growth.

The newly sown paddock should be checked one to two times a week looking for insects or signs of insect damage. Seed treatment will give six weeks control of insects in the vast majority of cases, however if insect numbers are very high, damage can still occur.

Damaging insects

Springtails *(Bourletiella spp.)*

- Brown to black in colour
- Up to 1mm long
- Chewing mouthparts

Damage symptoms:

- Damaged cotyledons and emerging growing points, causing damage up to the fourth leaf stage
- Half-moon notches seen in emerging leaves and pinpricks on the underside of the leaf
- Very difficult to see insects on the bare soil
- Place card or hanky on ground and tap, looking for insects 'springing' onto the hanky
- Multiple generations may be seen in one year.

Cultural control:

- Reduce trash in seed bed

Chemical options:

- Cropcote Plus™ Seed Treatment
- Toppel 500 at 200ml/ha with Widespread® 1000 at 25ml/100L of water, ideally in 200L of water per hectare

Nysius or wheat bug *(Nysius huttoni)*

- Adults are about 4mm long
- Pale green colour maturing to brownish-grey
- Camouflage appearance with silvery triangle at the end of the tail

Damage symptoms:

- Damages seedlings at ground level
- Causes ring-barking effect
- Increasing the risk of fungal or environmental (wind, snow) damage
- May kill the plant

Cultural control:

- Reduce trash in seed bed

Chemical options:

- Cropcote Plus™ Seed Treatment
- Toppel 500 at 1.25L/ha with Widespread 1000 at 25ml/100L of water, ideally in 200L of water per hectare

Slugs *(Deroceras reticulatum muller)*

Damage symptoms:

- Damage to establishing brassica crops particularly in direct drilled situations
- Chewing and rasping of cotyledons and leaves
- Nocturnal feeders

Cultural control:

- Reduce initial populations via
  - Heavy rolling
  - Cultivation
  - Mob stocking
- Reduce trash in seedbed
- Monitor slug numbers through the use of damp sacks

Chemical options:

- Endure 4-8Kg/ha, broadcast

  Endure can be mixed and spread with fertiliser
- Endure Mini 3-4Kg/ha, drilled with seed
- Endure Mini can be mixed with seed of a similar size to the bait

0-6 weeks post sowing

Damaging insects

Greasy cutworm *(Agrotis ispsilon)*

- Brown to greyish brown moths
- Larvae are greasy, going from light grey to dark brown
- 50mm long at maturity
- Nocturnal feeders
- Shelter in the soil profile during day time

Damage symptoms:

- Larvae eat young seedling at or just below ground level
- Plant wilting
- Plants 'cut-down' found

Cultural control:

- Cultivation

Chemical options:

- Halex^{cs} at 40ml/ha with Widespread 1000 at 25ml / 100L of water, ideally in 200-300L of water per hectare.

Herbicides

Weeds need to be assessed while crop monitoring. The weeds present will determine the specific herbicides to use.

Please refer to the label for further application information

Dicam 480™

A selective herbicide for control of certain hard to kill broadleaf weeds in conservation tillage programmes and in cereals, maize, some forage brassicas, waste areas and spot treatment in pastures

- Effective companion herbicide with glyphosate for a cleaner spray-out
- No plant-back period for brassicas, grasses, maize, cereals and some other crops
- Useful for post-emergence broadleaf weed control in many crops

AGRECOVERY CP

ACTIVE INGREDIENTS: dicamba 480g/L
PACK SIZE: 5L, 20L

Multiple®

A selective herbicide used to control clovers, yarrow, plantains, californian and other thistles in a range of crops, forestry and pre-cultivation

- A grass friendly herbicide ideal for control of thistles and other broadleaf weeds
- The best option for weed wiping californian thistles
- Can be used with glyphosate prior to beets, brassicas, grasses, cereals and maize

AGRECOVERY RW

ACTIVE INGREDIENT: clopyralid 300g/L
PACK SIZE: 5L, 20L

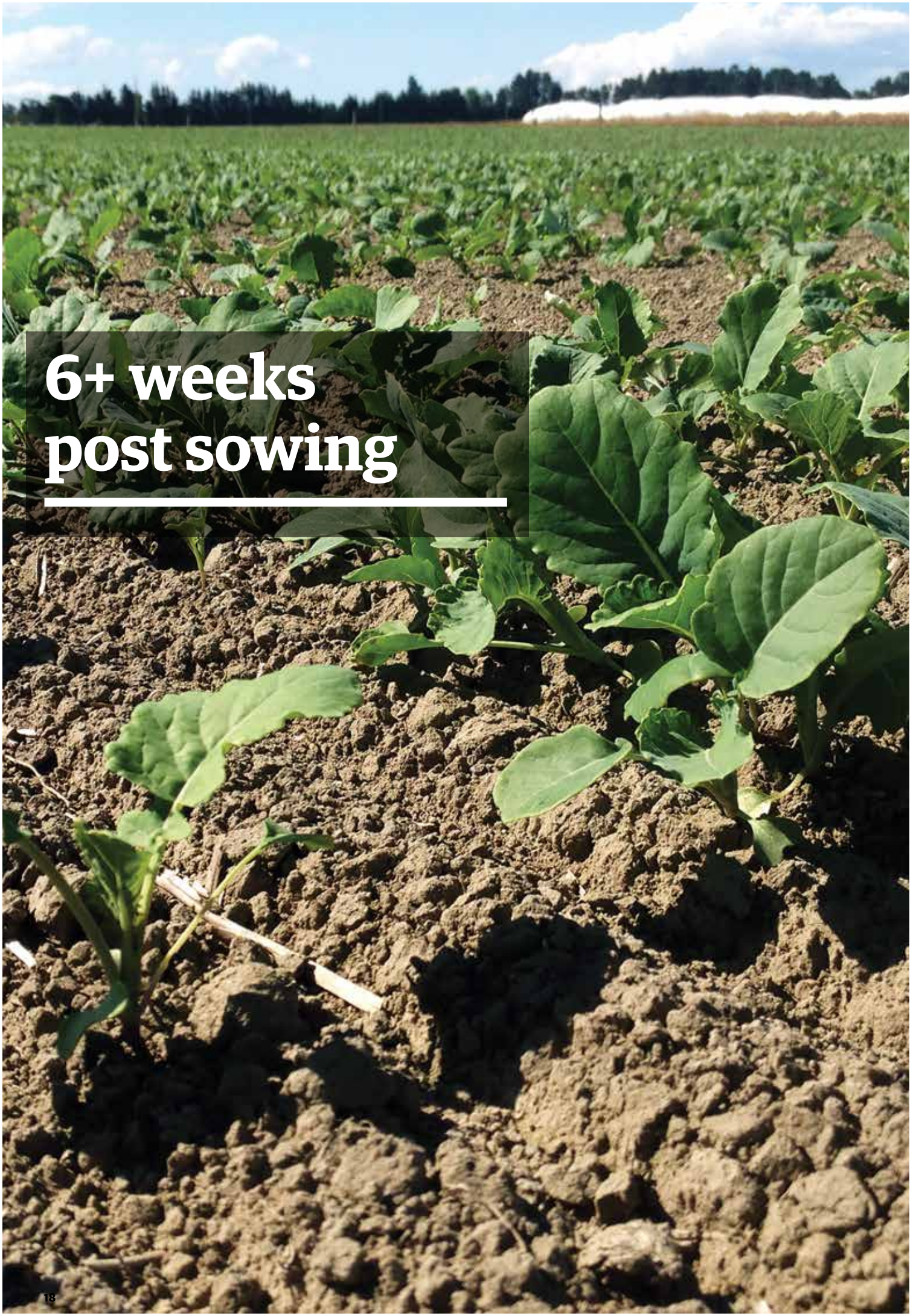
Purge

A selective herbicide for the control of certain broadleaf weeds in forage brassica crops

- For broadleaf weed control in all fodder brassica crops, including bulb crops
- Use with Collaborate(TM) Oil for best results
- Can be mixed with certain other herbicides and insecticides

AGRECOVERY RW

ACTIVE INGREDIENT: picloram 150g/L and **clopyralid** 225g/L
PACK SIZE: 5L



6+ weeks post sowing

6+ weeks post sowing

Crop monitoring

Crop monitoring should be continued but at a less frequent interval; a weekly crop walk will identify any potential insect issues that may be occurring or about to occur. A seed treatment only lasts up to six weeks, therefore chemical application will be required to control any insects present.

Fertiliser

Side dressing(s) of a coated urea should be applied depending on soil available nitrogen (N), crop type and yield expectations. N-Protect® should be applied at a minimum of 100kg/ha onto crops that have adequate soil moisture for growth. Further applications may be warranted for kale, up to the end of March. Keep in mind nitrate poisoning in high N soils. Do not apply closer than six weeks to planned grazing.

Damaging insects

Diamondback moth *(Plutella xylostella)*

- Adult moth is a small, slender, grey insect with a wingspan of 7-10mm. They do not cause damage
- Larvae are up to 7mm long and cause the damage
- Pupae are enclosed in loosely woven cocoons often found on the underside of leaves in the crop
- When disturbed larvae drop off leaves attached to a silk thread

Damage symptoms:

- Young larvae feed on internal leaf tissue causing white markings on leaves
- Older larvae feed underneath leaf surface
- Leaf has 'shotgun' appearance

Cultural control:

- None

Chemical options:

- Halex^{CS} at 40ml/ha with Widespread 1000 at 25ml/100L of water, ideally in 200-300L of water per hectare

Repeat applications may be required if populations are high.

Leaf miner (many species)

- Larvae are small, yellowish-green
- Similar to maggots in look

Damage symptoms:

- Larvae cause tunnels within the leaf tissue
- May reduce amount of photosynthesis carried out by the plant, hence yields are likely to be affected

Cultural control:

- Turnips are the most susceptible, however, only high damage is detrimental to yield
- Often the use of N in the autumn will encourage plant to grow through the damage

Chemical options:

- Refer to your agri manager for further information
- Often other insects need to be controlled at the same time, choose a suitable option from the table on page 20.

6+ weeks post sowing

Aphids (many species)

- Around 2mm long
- Can be yellow to dark green or grey
- Some are winged others are wingless
- Aphids will reduce crop yields and cause secondary virus infection as they are vectors (carriers) of brassica diseases

Damage symptoms:

- Infest brassicas in large numbers
- Suck the sap reducing the plants available energy for growth
- Crop wilting
- Seen most during times of plant stress

Cultural control:

- Some modern cultivars are more resistant to aphids

Chemical options:

- Toppel 500 at 300-400ml/ha with Widespread 1000 at 25ml per 100L of water, ideally in 200L of water per hectare. Can give a useful clean up early in the crop
- Otherwise use predator friendly aphicides where possible, such as pirimicarb or sulfoxaflor

Cabbage white butterfly *(Pieris rapae)*

- Caterpillars are dull green with small hairs
- 2-30mm in length

Damage symptoms:

- Larvae feed on leaf leaving behind a skeletonised leaf with ribs remaining
- Flights of the adult white butterfly are warning signs for crop damage

Cultural control:

- None

Chemical options:

- Halex^{CS} at 40ml/ha with Widespread 1000 at 25ml/100L of water, ideally in 200-300L of water per hectare

Repeat applications may be required if populations are high.

Other insecticides commonly used in forage and other crops.

Active ingredient	Brands	Mode of action group(s)	Comments
Permethrin + pirmiphos-methyl	Ambush™, Attack®	Group 1 + Group 3	Broad spectrum insecticide for control of a wide range of pests including; aphids, caterpillars, nysius and springtails in forage brassicas and other crops
Chlorantraniliprole + lambda-cyhalothrin	Ampligo®	Group 3 + Group 28	Broad spectrum insecticide for control of aphids, caterpillars, leaf miner and nysius in forage brassicas and other crops
Cyantraniliprole	Exirel®	Group 28 insecticide	For control of caterpillars, leaf miner and suppression of grey cabbage aphid in forage brassicas
Cyantraniliprole + pymetrozine	Minecto™ Star	Group 9 + Group 28 insecticide	For control of cabbage aphid, leaf miner, caterpillars and nysius in forage brassicas
Pirimicarb	Prohive™, Piritek®, Pirimor®	Group 1 insecticide	Carbamate insecticide for control of aphids in a range of crops
Spinetoram	Sparta™	Group 5	For control of springtails, nysius, caterpillars and leaf miner in forage brassicas and certain pests in other crops
Sulfoxaflor	Transform™	Group 4c insecticide	Predator friendly aphicide for aphid control and virus protection in a range of crops

12+ weeks post sowing

12+ weeks post sowing

Fertiliser

There may be a need / desire to apply another 100kg/ha of N-Protect 12 weeks post establishment. This will depend on the crop type, yield objectives and available soil N (known by soil test).

Whether or not N-Protect was applied at 12 weeks, it is highly advisable to apply the last side dressing of 100kg/ha of N-Protect 18 weeks post establishment (early to mid-March) for leaf brassica crops (ie kale). Excess N on bulb crops may change growth priority from bulb to leaf. An N application will set leaf crops up for winter and encourage one final accumulation of yield prior to the temperature cooling down.

Do not apply if grazing is commencing within six weeks after N application.

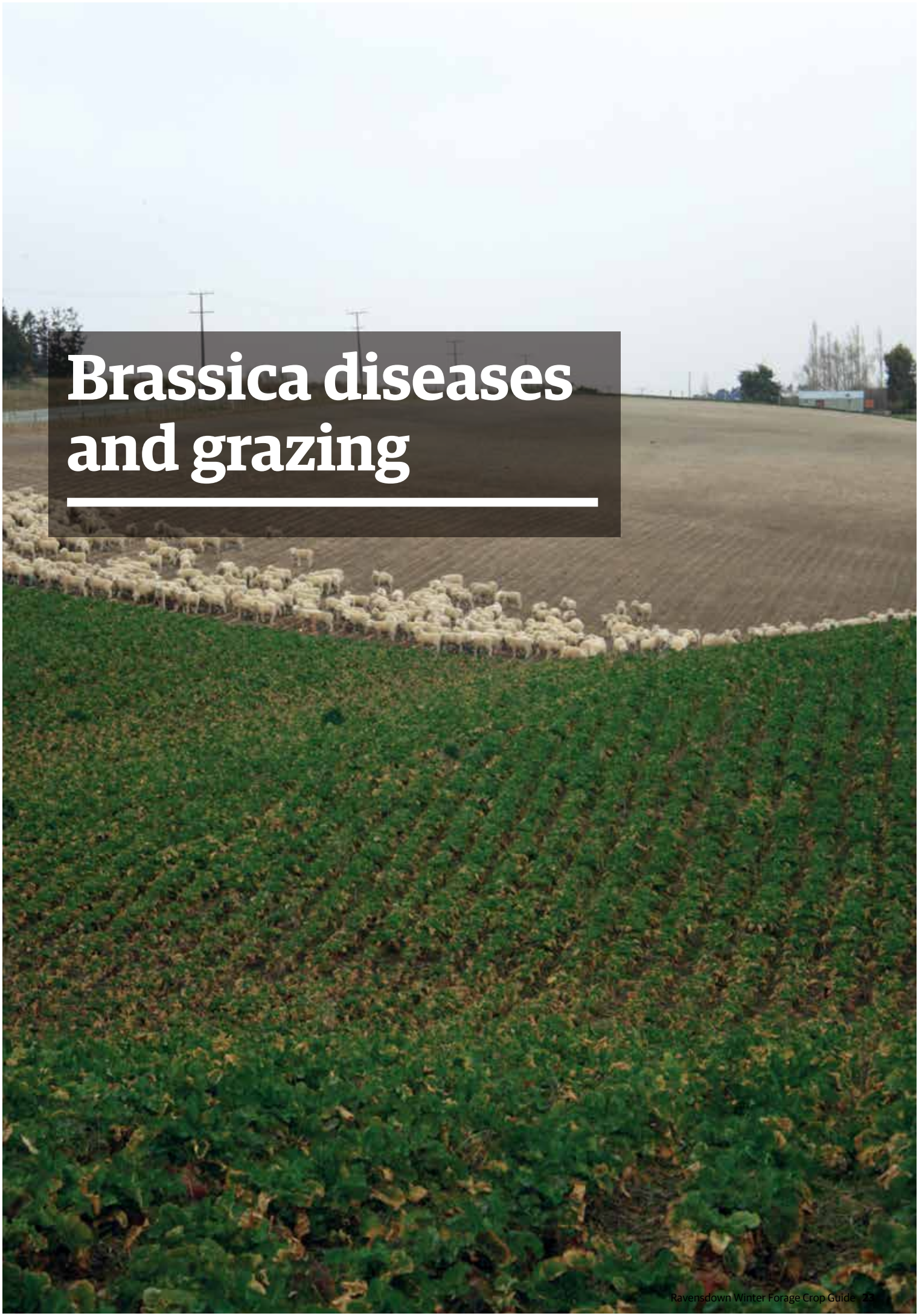
Damaging Insects

Crop monitoring for insects is still required as insect numbers can rapidly rise to damaging levels if conditions are right (warm and dry).

See table below or refer pages 17, 18, 20 and 21 for chemical options.

PEST(S) AND TREATMENT	SEEDLING TO YOUNG PLANT	MATURE PLANT OR REGROWTH
APHIDS - TOPPEL 500 AT 300-400ML/HA CATERPILLARS AND APHIDS, TANK MIX AN EFFECTIVE APHICIDE TO HALEX^{CS} AT 40ML/HA OR CHOOSE A PRODUCT FROM THE TABLE ON PAGE 20, OR TALK TO YOUR AGRI MANAGER	→	→
CATERPILLARS AND APHIDS TANK MIX AN EFFECTIVE APHICIDE WITH HALEX^{CS} 40ML/HA OR CHOOSE A PRODUCT FROM THE TABLE ON PAGE 20 OR TALK TO YOUR RAVENSDOWN AGRI MANAGER	→	→
CATERPILLARS AND LEAF MINER OR CATERPILLARS, APHIDS AND LEAF MINER, SELECT A SUITABLE PRODUCT FROM THE TABLE ON PAGE 20 OR TALK TO YOUR RAVENSDOWN AGRI MANAGER	→	→
DIAMONDBACK MOTH AND WHITE BUTTERFLY HALEX^{CS} AT 40ML/HA	→	→
LEAF MINER, OR APHIDS AND LEAF MINER SELECT A PRODUCT FROM THE TABLE ON PAGE 20 OR TALK TO YOUR RAVENSDOWN AGRI MANAGER	→	→

The inclusion of Widespread 1000 at 25ml per 100L of water for all insecticide application is recommended to increase effectiveness.



Brassica diseases and grazing

Brassica diseases

Clubroot *(Plasmodiophora spp.)*

- A fungal disease
- There are several strains of clubroot which are normally found on heavy soils

Damage symptoms:

- Irregular swelling of the root systems
- Plants often appear wilted and stunted
- Leaves sometimes purple through plant stress

Cultural control:

- Crop rotation and hygiene
- Clubroot is hosted on brassica species
- A non-brassica interval of at least six years is required once damage has been found
- The clubroot disease can be transferred through machinery, stock and water
- Tolerant brassica cultivars are available, however new strains of the disease develop quicker than plant breeding and may overcome tolerance

Chemical options: None

Dry rot *(Leptosphaeria maculans)*

- A fungal disease

Damage symptoms:

- Brown lesions on bulbs normally around the neck region
- Leads to bulb rotting
- Can be seen in kale (Black Leg)
- Black lesions / spots on kale stem

Cultural control:

- Crop rotation and hygiene
- If pressure was high in the previous year consider other forage options or more tolerant brassicas such as kale
- Non-brassica forages are recommended for six years post infection
- If paddocks become infested consider grazing first / early to realise crop yield prior to the bulbs dissolving from the rot

Chemical options: None

Powdery mildew *(Erysiphe cruciferarum)*

Damage symptoms:

- Extensive growth of white, powdery fungus on the upper and lower leaf surfaces
- Often more prolific in times of plant stress

Please note: Be careful not to confuse powdery mildew with downy mildew. Downy mildew cannot be controlled by trtifloxystrobin or cyproconazole fungicides. Phosphite can offer protection if applied early.

Cultural control:

- Crop rotation and hygiene
- Reduce crop debris
- Water and N

Chemical options: None

Grazing brassicas

Transition is vital

It is always best practice to transition animals onto a diet if there is a significant change. Depending on the type of crop this could be over several days or up to two weeks.

Animals should be introduced to brassicas and given adequate access to a fibre source such as mature pasture, hay, or straw. Ensuring animals are not hungry when they are put onto brassica crops will reduce the risk of gorging and subsequent health issues. Ensure stock have adequate levels of trace elements before grazing brassica crops; otherwise supplement them at an appropriate time during grazing.

Transitioning off brassicas is not as critical as transitioning onto brassicas, but doing this gradually is still best practice. This is not always easy to manage given grazing blocks are often mostly all crop, but just a few days transitioning would be sufficient. Feeding pregnant stock who are due to calve / lamb on brassica crops can lead to metabolic problems, so ideally transition back to a grass diet two weeks before calving / lambing.

As with crop establishment, close monitoring is required to ensure any animal health issues are noticed and treated prior to long-term damage occurring.

Brassica nutritional analysis

The table below shows the average feed value of different types of brassicas.

Table 1: All values are expressed as percentage of dry matter. DM% = dry matter percentage; MJ ME = mega joules of metabolisable energy; DOMD = digestibility; CP = crude protein; ADF = acid detergent fibre; NDF = neutral detergent fibre; WSC = water soluble carbohydrate.

BRASSICA	DM%	MJ ME	DOMD	CP	ADF	NDF	WSC	LIPID	ASH	LEAF %	STEM / BULB %
BULB TURNIP	10.1	11.7	89	14.2	18.9	22.5	27	NA	10.4	55.4	44.6
KALE	17.3	11.2	77	9.7	23.5	28	33.4	2.1	7	28.7	71.3
LEAF TURNIP (1ST CUT)	13.7	13	86.7	22.6	13.5	15.6	19.2	4.8	11.1	72	28
RAPE	14.3	12.9	88.1	10.8	20.3	23.2	27.3	2.9	9.1	67.2	32.8
SWEDE	10.3	13.8	93.5	13.7	13.9	15.2	49.8	1.8	6.1	25	75

Adapted from: Westwood, C.T; Mulcock, H, 2012. Nutritional evaluation of five species of forage brassica, Proceedings of the New Zealand Grassland Association 74

Potential animal health issues

Nitrate / nitrite poisoning

Background

Excess nitrate levels can accumulate in the plant if growth and photosynthesis is reduced under certain climatic conditions (ie overcast / warm conditions often after a drought).

In the rumen, nitrate is normally converted through to nitrite, ammonia and ultimately to microbial protein. Nitrate poisoning occurs when excess nitrite causes a sudden and drastic reduction in the oxygen-carrying capacity of the blood (by converting haemoglobin to methaemoglobin).

Symptoms

Animals will start panting and gasping for air and will die very quickly (within hours) if not given emergency veterinary assistance. The likelihood of this disease can be reduced by letting the crop mature (and preferably test it) before feeding out.

Risk reduction

Introduce animals onto the crop gradually at short grazing periods initially, and feed an additional fibre source. Don't let hungry animals onto suspect feed and again, be vigilant.

Grazing brassicas

Brassica Red-Water (also called SMCO poisoning, nutritional haemoglobinuria or kale anaemia)

Background

Brassicas contain a sulphur-containing substance called S-Methyl Cysteine Sulphoxide (SMCO), which has the potential to damage animals' red blood cells. In general, the SMCO concentration increases as the plant matures, with rapid increases during flowering.

Symptoms

Mild cases (SMCO intakes of 0.10-0.15g/kg live-weight per day) show a loss of appetite, poor growth rates, mild anaemia and digestive upsets. Severe cases (SMCO intakes of 0.18-0.35g/kg live-weight per day) have life-threatening anaemia, marked growth suppression, red-coloured urine ('red-water') and even death.

Risk reduction

Affected animals should be removed from the crop, placed on pasture and if required, involve your local vet.

Limit nitrogen and sulphur fertiliser to what the crop requires. Also introduce stock onto the crop gradually, graze for limited periods initially, and feed an additional fibre source (eg hay, silage or straw). Do not feed flowering brassicas to animals unless they are accustomed to it and always be vigilant while they are on the crop.

Goitre (induced / secondary iodine deficiency)

Background

Brassicas are typically low in iodine and contain substances called goitrogens (glucosinates) that block the uptake of iodine by the animal. Both factors can result in stock becoming iodine deficient, the most common symptom is offspring from these animals being born with enlarged thyroid glands in the neck.

Symptoms

In sheep particularly, severe cases can result in lambing problems, with many stillborn or weak (and occasionally hairless) lambs and a poor lamb survival rate. Iodine deficiency can also cause subclinical reproductive losses.

Risk reduction

Because iodine-amended fertilisers are of very little value due to poor plant uptake, ensure animals have sufficient iodine before grazing and supplement pregnant stock with iodine while on the crop.

Rape Scald

Background

Rape Scald is usually seen in lambs being fed on immature or second growth rape or Leaf Turnip, but is also occasionally seen in dairy cows, and can affect any brassica crops. As a result, animals become severely sun burnt on exposed areas of skin (usually the face) following normal doses of sunlight. Occurrence is sporadic and unpredictable.

The exact cause is still uncertain, but an unknown substance (historically thought to be similar to SMCO) from the plant accumulates in the skin and causes the skin to become overly sensitised to ultra-violet light.

Symptoms

Symptoms include swollen ears / face, shaking and rubbing at face, seeking shade. Occasionally red-water is seen. There is no specific treatment, but 'nursing' care and provision of shade is important. Rapid recovery is seen on withdrawal from crop.

Risk reduction

The management of grazing rape paddocks is similar to that for prevention of SMCO.

1. Ensure rape has ripened with purpled edges on leaves
2. Limit nitrogen application to 20-40kg/ha at sowing time; use a follow up fertiliser if needed but do not apply within four weeks of grazing
3. Use low sulphur fertiliser such as DAP or urea prior to sowing
4. Introduce rape slowly:
    - Run stock on the crop for one to two hours a day initially (about 20% of diet)
    - Build up to a maximum of 100% of diet by day seven to ten of introduction
    - Give supplementary feed such as straw while they graze
    - Alternatively allow the stock to have a pasture run-off paddock
5. Even once animals have adapted, continue to provide a supplementary high fibre feed source (eg hay, straw or silage) to dilute any anti-nutritional factors.

Fodder beet

Crop hygiene

The risk of both disease and insect damage is significantly increased where crops are sown in successive years in the same paddock.

Preventative management practices include residue and weed management, avoiding poor drainage areas and use of treated seed and partially resistant or tolerant varieties.

Contact your Ravensdown agronomists for help with the appropriate control products.

Irrigation requirements

Fodder beet can be susceptible to drought stress during establishment and early growth. Drought tolerance increases as the plant develops deeper and larger bulbs, however prolonged drought stress at any stage of the growing periods will reduce the end yield of the crop.

Apply irrigation little and often prior to canopy closure, reducing irrigation rotation length and quantity as the season progresses to encourage deeper rooting. This will allow increased access to nutrients and moisture. However, too much water in late autumn increases the humidity under the leaves which may increase the risk of diseases such as rust or leaf spot.

Fodder beet has relatively high water use efficiency and high yields are still achievable in dryland conditions, particularly if reliable rainfall occurs from germination through to canopy closure. The use of nitrogen in dryland systems early in the crop development is vitally important to get to canopy closure as soon as possible.

Fertiliser requirements

Fodder beet has the potential to develop roots to a depth of 2m and therefore soils should be well-drained and subsoiled (if necessary) to allow maximum root exploration for water and nutrient. The following pH and nutrient guidelines are to be used for constructing a fertiliser programme based on the soil test results of the paddock.

Optimum plant nutrient requirements

Using your soils tests from autumn and soil type, your agri-manager can structure a fertiliser programme for your needs.

Boron (B)

In New Zealand trials, neither B fertiliser rate nor timing had any effect on biomass production of fodder beet. However, B is an essential nutrient and deficiencies can result in heart rots in brassicas and generally applications are applied as a preventative although care should also be taken as there is a

risk of boron toxicity at high rates of B application. Early symptoms of hollow heart are usually seen where the growing point dies and turns black. This then develops and spreads from the heart to the crown, before spreading further to the shoulders. Again, care should be taken as Rhizoctonia infections can exhibit similar symptoms.

In fodder beet, apply boron fertiliser in the basal dressing (pre-sowing) following the guidelines below:

- If hot water soluble boron soil test is <1.0 ppm, then apply 10 kg/ha borate 46 (1.5 kg B/ha).
- If >1.0 no boron required.

Magnesium (Mg)

Magnesium levels should be maintained above the range of 8 (QTMg) and as many fodder beet paddocks are likely to have grazing of following crops in the rotation it is advisable to lift soil Mg levels to >12 with emphasis on animal health (>20 in the case of dairy farms).

Kieserite has been shown to be effective applied as a basal or sowing dressing in raising the leaf herbage Mg levels in vegetable and cereal crops and an application of 25-30 kg Mg/ha should overcome any deficiencies.

Nitrogen (N)

- Sandy soils with low N reserves: 100–150kg N/ha
- Medium and heavier soils with low N reserves: 50–100kg N/ha
- Medium and heavier soils with med-high N reserves: 50kg N/ha

New Zealand trials conducted over 2016-2018 have been unable to link critical AMN levels to specific yield responses. Over nine sites across the South and North Islands, no yield responses to N fertiliser applications above 100 kg N/ha were observed despite a range of soil N levels at establishment across the sites.

However, there was a consistent linear relationship between N fertiliser rate and N uptake in the plant. Meaning that higher N fertiliser rates did increase the protein of plants which also has implications for N recycling when the crop is grazed in situ. Crops that are established directly after a pasture phase are likely to require lower N inputs than a previously cropped soil due to higher potential for soil N release through mineralisation.

Ideally N recommendations should be derived from a Potential Mineralisable N soil test prior to cultivation and sowing.

Apply approximately 30–40kg N/ha at or immediately after sowing (eg as DAP) and the remaining post-emergence in two to three split applications (4 to 6 week intervals) of N-Protect. The rate of N typically used for side dressings is generally higher than those used on pasture, therefore the risk of N volatilisation

is increased. N applications should be targeted at the leaf area accumulation phase with fodder beet achieving 80-90% light capture at a leaf area index of three (60-150 days from sowing).

pH

- Optimum soil pH: 6.0–6.5

Additional lime should be applied if pH is less than 6.0 and ideally be incorporated at least six months before sowing.

Fertiliser requirements

Phosphorus (P)

- If Olsen P <15: basal of 50 kg P/ha (during seedbed preparation)
- If Olsen P 15-25: maintenance application of 20 kg P/ha (during seedbed preparation)
- If Olsen P >25: no P is required although it is recommended that a small amount of starter P (20 kg P /ha) is applied before sowing to aid rapid early establishment.

Phosphorus is a vital nutrient during establishment ensuring rapid seedling growth and early leaf cover. P is not required in large quantities, however Olsen P levels should be within the optimum range of 15–25 and 'starter' P applications are highly recommended.

Potassium (K)

New Zealand trials during 2016-2018 have found no specific yield responses to applied K but increases in K fertiliser rates resulted in a linear increase in the amount of K uptake. This trial work supports a critical QTK 3 for Fodder Beet. Potassium fertiliser management in fodder beet should be considered as part of the whole farm rotation, to ensure no limitation to K for crops and pasture following fodder beet.

All K fertiliser should be applied at sowing, as there is no yield benefit from splitting the K application.

General guidelines for Fodder Beet across all soil types are provided below:

- If QTK is <3, apply at 100 kg K/ha.
- If QTK is 3–5, apply at 50 kg K/ha.
- If QTK >5, no K required.

The TBK (sodium tetra-phenol-boron extractable) reserve K can be also be used on sedimentary soils to estimate K that may be plant available over a growing season.

Fertiliser recommendations, established during 2016-2018 are:

- If TBK is < 1.0, apply 100 kg K/ha
- If TBK 1.0-1.5, apply 50 kg K/ha
- If TBK >1.5, no K required.
- If both QTK and TBK tests are available, then use the test that shows the most limiting response.

For example, if QTK =2 and TBK =1.4, apply 100 kg K/ha.

Fodder beet is capable of accessing large amounts of K from soils even if the readily available K levels are low, and will take up more K than required if available, ie luxury consumption. Sedimentary soils are generally high in reserve K and usually do not require high rates of K fertiliser.

Sodium (Na)

As fodder beet originated from the shores of the Mediterranean Sea, it developed the ability to utilise Na (unlike most other plants) for cell expansion and osmotic function in bulb development. However, whether fodder beet plants grown in New Zealand require Na in large amounts is an area of uncertainty. Some NZ studies indicated that fodder beet yields were reduced when Na was excluded. However, others have not shown a clear response to Na application and results could be confounded by the interaction with Cl. Until further research is conducted in this area to confirm Na fertiliser requirements, accounting for varying levels in the soil Na and climatic inputs, Na as NaCl should be included as part of the overall fertiliser recommendation when conditions are met as indicated below.

- If QTNa <5 60 kg Na/ha (equivalent of 150kg/ha Agricultural Salt)
- If QTNa >5 No Na required.

Chloride is also essential for growth of fodder beet, but sufficient amounts will generally be applied with other nutrients, such as potassium and/or sodium (e.g. KCl, NaCl).

Sulphur (S)

Sulphur is not required in large quantities for fodder beet production (15-25kg/ha in the basal dressing will meet crop requirements) and as S is often added with other key fertilisers such as P no further S applications will likely be required.

Fertiliser requirements

The first few months

Walking the tightrope

It's a real balancing act between sowing the crop earlier and aiming for high yields, while keeping early sown crops from vernalising and going straight to flower. Sowing earlier allows more time in the ground for the fodder beet to accumulate yield through photosynthesis. Whereas planting earlier increases the risk the plants will vernalise. Vernalisation is a cold period required to tell the plant it's time to flower (go reproductive). For fodder beet, the temperatures in the first 90 days after the plant has reached the two leaves stage are important. Vernalisation is triggered if there are at least 17 days with a minimum temperature below 5°C.

To minimise the risk of vernalisation, sowing should be done when the soil temperatures are above 5°C (and rising) for at least one week, although temperatures above 10°C are preferred and are less likely to cause vernalisation.

Soil conditions

Irrespective of planting date, the paddock should have had a soil test completed in autumn to allow time for any major nutrient deficiencies to be remedied for maximum growth potential. The seedbed should be prepared four to six weeks ahead of planting to remove weed competition and germinating weeds should be killed immediately prior to planting.

Weed competition will affect yield, particularly up until canopy closure, and can also act as hosts for damaging insects such as springtails, cutworms and aphids.

Fodder beet seed is relatively small, therefore a fine and firm seed bed should be targeted to increase seed / soil contact and moisture content.

Currently almost all the crops grown are precision seeded with very little trial work looking at other sowing methods being done.

Sowing rate

The end use of the crop is the main factor determining the sowing rate with crops grown for in situ grazing aiming for 7–8 plants/m^2, whereas crops grown for lifting are aiming for 9–10 plants/m^2. Given fodder beet establishment is around 80% in good conditions the sowing rate for in-situ grazing should be at least 80,000 plants per ha, and for lifting no lower than 100,000 plants per ha.

A sowing depth of 1.5–2 cm is ideal for maximising yields.

Seed requirements

Seed treated with a fungicide and an insecticide is recommended to reduce the impact diseases and insects may have on the germinating plants. With fodder beet's slow establishment, the risk of insect attack is higher.

Speed is vital

The quicker the plants get to canopy closure the better for a couple of reasons;

1. Canopy closure means a reduced amount of light hitting the soil surface encouraging weeds to germinate
2. Maximum light interception of the fodder beet plants for photosynthesis

The speed of canopy closure is determined by the soil temperature, soil moisture and available nitrogen. Nitrogen is the key driver.

Weeds, pests and diseases

There is a vast amount of information, and confusion, around the types of chemicals and rates to use of these chemicals. The range and size of weeds has a large influence on this. Your agri manager and/or regional agronomist will be able to help you decide the best weed control options for you.

Insect pests such as springtails, thrips and cutworms feed on young seedlings and may decimate crops if not controlled. Regular monitoring is essential during early establishment and appropriate insecticides must be applied early. Insects such as the green peach aphid are also important vectors for transmission of viruses such as the Beet Western Yellows Virus. Leaf rust, powdery mildew and leaf spot diseases should be monitored and controlled if observed.

Many disease symptoms can be misdiagnosed as nutrient deficiencies so care should be taken diagnosing off visual symptoms alone.

Insects

Springtails

Symptoms and effect on crop:

Small brown, green or back insects up to 1mm long, will jump if disturbed. Damage cotyledons and emerging leaves up to the 4 leaf stage. Pin pricks can be seen on underside of leaves or half moon notched on leaf margins. Can be found by placing a white handkerchief or card on the ground and patting the surrounding soil, disturbed springtails will jump onto the handky/card.

Treatment (chemical and cultural):

More likely to be a problem ex-pasture. Easily controlled with seed treatment (Cropcote Plus) and /or foliar insecticide spray.

Very few insecticides are registered for use in fodder beet. Consult your agri manager or agronomy technical manager for further advice.

Nysius fly

Symptoms and effect on crop:

Adults are approximately 4mm long, pale green to brownish grey with a characteristic silvery triangle at the rear. Damage seedlings at ground level, causing a ring-barking effect.

Severe damage can lead to plant death.

Treatment (chemical and cultural):

Seed treatment (Cropcote Plus) and / or foliar insecticide sprays. Very few insecticdies are registered for use in fodder beet. Consult your agri manager or agronomy technical manager for further advice.

Cutworm

Symptoms and effect on crop:

Larvae can be found sheltering under large clods, stones or other trash in the paddock. Larvae can be light grey to dark brown, 50mm long at maturity.

Feeding damage is easily seen with leaves cut off, or the entire plant cut off at ground level.

Treatment (chemical and cultural):

Foliar sprays, either applied with pre-emergence herbicide or early post-emergence.

Very few insecticides are registered for use in fodder beet.

Consult your agri manager or agronomy technical manager for further advice.

Slugs

Symptoms and effect on crop:

Slugs' nocturnal feeding causes rasping / shredding damage to cotyledons and leaves.

Where pressure is high, significant crop mortality can occur.

Conventional cultivation will help reduce slug pressure by causing insect mortality and habitat disruption.

Paddocks should be monitored before drilling to check for slugs.

Treatment (chemical and cultural):

Sow slug bait (Endure Mini 3-4kg/ha) with seed, and / or broadcast or spread slug bait (Endure 4-5Kg/ha) immediately after drilling if significant numbers are found (three to four slugs / sack). Continue to monitor the crop during establishment.

Aphids

Symptoms and effect on crop:

Green peach aphid (Myzus *persicae*) and others.

Up to 2mm long.

Main damage is by transmission of virus eg Beet Western Yellows Virus.

Treatment (chemical and cultural):

Seed treatment will help reduce risk of early infestation. Foliar insecticides can be used to knockdown aphids found in the crop, but very few are registered for use in fodder beet. Consult your agri manager or agronomy technical manager for further advice.

Leaf Miner

Symptoms and effect on crop:

Larvae feed under the plant cuticle causing a whitened 'window' effect. On beet damage occurs as trails where the larvae have been feeding.

Treatment (chemical and cultural):

A systemic foliar insecticide is usually required to control leaf miner. Very few insecticides are registered for control of leaf miner in beet. Consult your agri manager or agronomy technical manager for further advice.

Diseases

Alternaria leaf spot

Symptoms and effect on crop:

Common where cruciferous crops are grown.

Fungus causes dark grey / brown lesions 2-10mm in diameter.

Yield losses can be caused due to loss of photosynthetic area, accelerated leaf senescence and defoliaton.

Usually occurs on older leaves weakened by senescence, poor nutrition or other plant stressors.

Often associated with Beet Western Yellows Virus.

Treatment (chemical and cultural):

Crop hygiene is important; effective removal of crop residues and unwanted volunteers and good weed management.

Crop rotation is important, utilise cultivars with better disease tolerance.

Fungicides may help control disease development.

Cercospora leaf Spot

Symptoms and effect on crop:

Circular spots on the leaves 3-5mm in diamater, with tan-grey coloured centres and darker reddish-brown margins.

Spots coalesce leading to severe defoliation.

Cercospora can be the most important and destructive foliar disease on beet and can cause up to 50% loss in crop yield.

Disease is favoured by warm (25-35°C) and humid conditions.

Treatment (chemical and cultural):

Disease is carried over by infected leaves and can be harboured by weeds.

Crop hygiene is very important; remove crop residues effectively and practise good weed management.

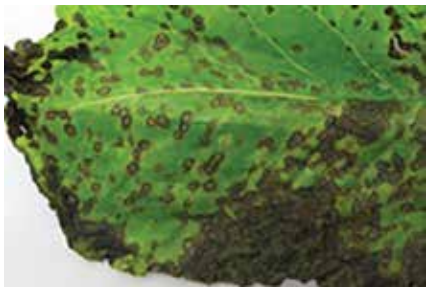
Irrigation management is important to provide sufficient moisture for crop growth without unnecessarily increasing humidity in the crop canopy.

Fertiliser inputs need to be accurately matched to crop requirements, avoid applying too much nitrogen and stimulating excessive foliar growth.

Crop rotation is important (two to three years) and utilising cultivars with better disease tolerance.

Seed treatment will afford some protection during establishment.

The beet fungicide Beetrizole® contains two active ingredients, cyproconazole and trifloxystrobin.



Monitor crops carefully after canopy closure and apply Beetrizole® fungicide at the first sign of disease.

A repeat application may be required after three to four weeks should reinfection occur if conditions favour disease.

Leaf rust

Symptoms and effect on crop

Small orange-brown spots on the leaf surface, typical rust symptoms.

In severe infections this can lead to defoliation after frost.

Crop yield can be significantly affected where disease pressure is high.

Warm moist weather favours disease, 15-22°C.

Treatment (chemical and cultural):

Disease over winters on crop residues and volunteer beets.

Crop hygiene is important; remove crop residues and unwanted volunteers.

May be seed borne, so seed treatment is important.

Crop rotation is important and it's best to utilise cultivars with better disease tolerance where possible.

Irrigation management is important to provide sufficient moisture for crop growth without unnecessarily increasing humidity in the crop canopy.

Fertiliser inputs need to be accurately matched to crop requirements, avoid applying too much N and stimulating excessive foliar growth.

The beet fungicide Beetrizole® contains two active ingredients, cyproconazole and trifloxystrobin. There are several brands available, including Mondo® and Escolta®.

Monitor crops carefully after canopy closure and apply Beetrizole® fungicide at the first sign of disease.

A repeat application may be required after three to four weeks should reinfection occur if conditions favour disease.

Images courtesy of Plant Diagnostics

Weeds, pests and diseases

Powdery mildew

Symptoms and effect on crop

White powdery appearance on the upper leaf surface of six to eight week old leaves.

Disease is favoured by mild winters and warm (25°C) and dry conditions.

Disease develops rapidly on moist soils but increased damage occurs in stressed crops.

Early infections can have a significant effect (20%) on crop yield.

Treatment (chemical and cultural):

Disease is carried over on crop residues and volunteers and is spread by wind.

Crop hygiene is important; remove crop residues and unwanted volunteers.

Irrigation management is important to provide sufficient moisture for crop growth without unnecessarily increasing humidity in the crop canopy.

Fertiliser inputs need to be accurately matched to crop requirements, avoid applying too much nitrogen and stimulating excessive foliar growth.

Avoid excessive N use and increase plant spacings to improve air movement.

Seed treatment will afford some protection during establishment.

The beet fungicide Beetrizole® contains two active ingredients, cyproconazole and trifloxystrobin.

Monitor crops carefully from canopy closure and apply a Beetrizole® fungicide at the first sign of disease.

A repeat application after three to four weeks may be required should reinfection occur or conditions favour disease.

Be careful not to confuse with downy mildew.

Downy mildew cannot be controlled by trifloxystrobin or cyproconazole fungicides.

Ramularia leaf spot

Symptoms and effect on crop

Fungus attacks mature to older leaves causing light brown 4-7mm grey spots which are more angular than cercospora.

Spores are spread by wind and rain splash.

Economically not as important as cercospora, rust or mildew.

Treatment (chemical and cultural):

Crop hygiene is important, practise good weed management and remove crop residues and unwanted volunteers.

Crop rotation is important and where possible utilise cultivars with better disease tolerance.

Higher plant density and sulphur deficiency favour disease.

Fungicides may help control disease development.

Rhizoctonia

Symptoms and effect on crop:

Soilborne disease that causes the bulb to rot.

Crop losses can be as high as 50% in severe cases.

The disease has a broad host range including many species of weeds and other crops.

Crown rot emanates from soil deposited on the crowns (wind, cultivation or water) and tip rot infections occur on the taproot and progresses upwards.

Both forms result in root rot.

Symptoms include wilting and collapse of leaves, and a dark rot of the bulb.

Disease is worst in heavy or poorly drained soils and high humidity.

Treatment (chemical and cultural):

Crop hygiene is importantpractise good weed management and remove crop residues and unwanted volunteers.

Early planting, good fertiliser management, improved drainage and good cultivation.

Crop rotation is important and where possible utilise cultivars with better disease tolerance.

Images courtesy of Plant Diagnostics.

Weeds, pests and diseases

Viruses

Beet mosaic virus

Symptoms and effect on crop:

Probably less common than Beet Western Yellows Virus.

Usually not of major economic importance in beet and effects on yield are relatively small.

Young leaves often show vein-clearing and older leaves show pronounced light and dark green mottle and are often puckered.

Infected plants are sometimes stunted but severe leaf distortion is uncommon.

Treatment (chemical and cultural):

The virus has a wide host range including *chenopodiaceae* (fathen), *solanaceae* (nightshade) and *leguminosae* (clovers, peas etc).

Crop hygiene will be important.

Precautions, management and control options would be similar to Beet Western Yellows Virus.

Beet western yellows virus

Symptoms and effect on crop:

Initial symptoms show 12-35 days after infection.

Yellowing develops in middle aged and older leaves as a mild chlorotic spotting on interveinal areas.

As the virus progresses, yellowing becomes more intense and more interveinal tissue turns yellow.

Older leaves become brittle, often invaded by secondary Alternaria species.

Severe infections can have a significant effect on crop yield.

The virus is spread by aphids, the main vector is green peach aphid (*Myzus periscae*).

Treatment (chemical and cultural):

Crop hygiene is important to remove alternate hosts eg cruciferous weeds.

Remove any green bridges that may provide sources of infection.

Seed treatment with an effective insecticide is very important.

Early foliar sprays to knockdown and repel early aphid infestation have not always been very effective at preventing virus transmission.

Spray timing relative to feeding by aphids carrying the virus is difficult to manage.

Be aware of the mode of action of insecticide use, to reduce risk of insecticide resistance developing in insect populations.

There are only very few insecticides registered for use in beet.

Seek advice from your agri manager or agronomy technical manager.

Fodder beet options

Beetril®

For control of broadleaf weeds in fodder beet, red beet and sugar beet

- Control of broadleaf weeds in fodder beet, red beet and sugar beet
- Pre-emergence treatments can be applied any time after sowing
- Post emergence treatments can be timed relative to weed emergence and growth stage regardless of crop stage (up to canopy closure)

AGRECOVERY

ACTIVE INGREDIENT: ethofumesate 50g/L, **metamtiron** 150g/L, **phenmedipham** 50g/L
PACK SIZE: 20L

Fumate™

For control of grass and broadleaf weeds in fodder beet, red beet, and barley grass and annual grass weeds in pasture and sports turf

- Control annual grass and some broadleaf weeds in fodder beet, red beet and ryegrass
- Used in pasture to control barley grass during the winter
- Used both pre- and post-emergence in fodder beet weed control programmes

AGRECOVERY CP

ACTIVE INGREDIENT: ethofumesate 500g/L
PACK SIZE: 10L

Fodder beet options

Replace®

For pre and post emergence use in red beet, fodder beet, sugar beet and mangolds

- For both pre and post-emergence control of a range of broadleaf weeds in fodder beet, red beet, sugar beet and mangolds
- Replace has the flexibility to be applied up to 6L/ha in a maximum of 3 applications per year
- Replace is compatible with most other fodder beet herbicides and can be tank mixed to improve the spectrum of weeds controlled

AGRECOVERY

ACTIVE INGREDIENT: metamitron 700g/L
PACK SIZE: 10L

Betamix

For the control of broad-leaved weeds in fodder, sugar and red beets

- For post-emergence control of a range of broadleaf weeds in fodder, sugar and red beets
- Betamix has the flexibility to be applied up to a total of 4.5L/ha in one or more applications per calendar year
- Betamix is compatible with most other fodder beet herbicides, including Fumate and Replace, and can be tank mixed to improve the spectrum of weeds controlled

AGRECOVERY

ACTIVE INGREDIENT: phenmedipham 160g/L, desmedipham 160g/L
PACK SIZE: 10L

Multiple®

A selective herbicide used to control clovers, yarrow, plantains, californian and other thistles in a range of crops, forestry and pre-cultivation

- A grass friendly herbicide ideal for control of thistles and other broadleaf weeds
- The best option for weed wiping californian thistles
- Can be used with glyphosate prior to beets, brassicas, grasses, cereals and maize

AGRECOVERY RW

ACTIVE INGREDIENT: clopyralid 300g/L
PACK SIZE: 5L, 20L

Beetrizole®

For disease control in fodder and sugar beets

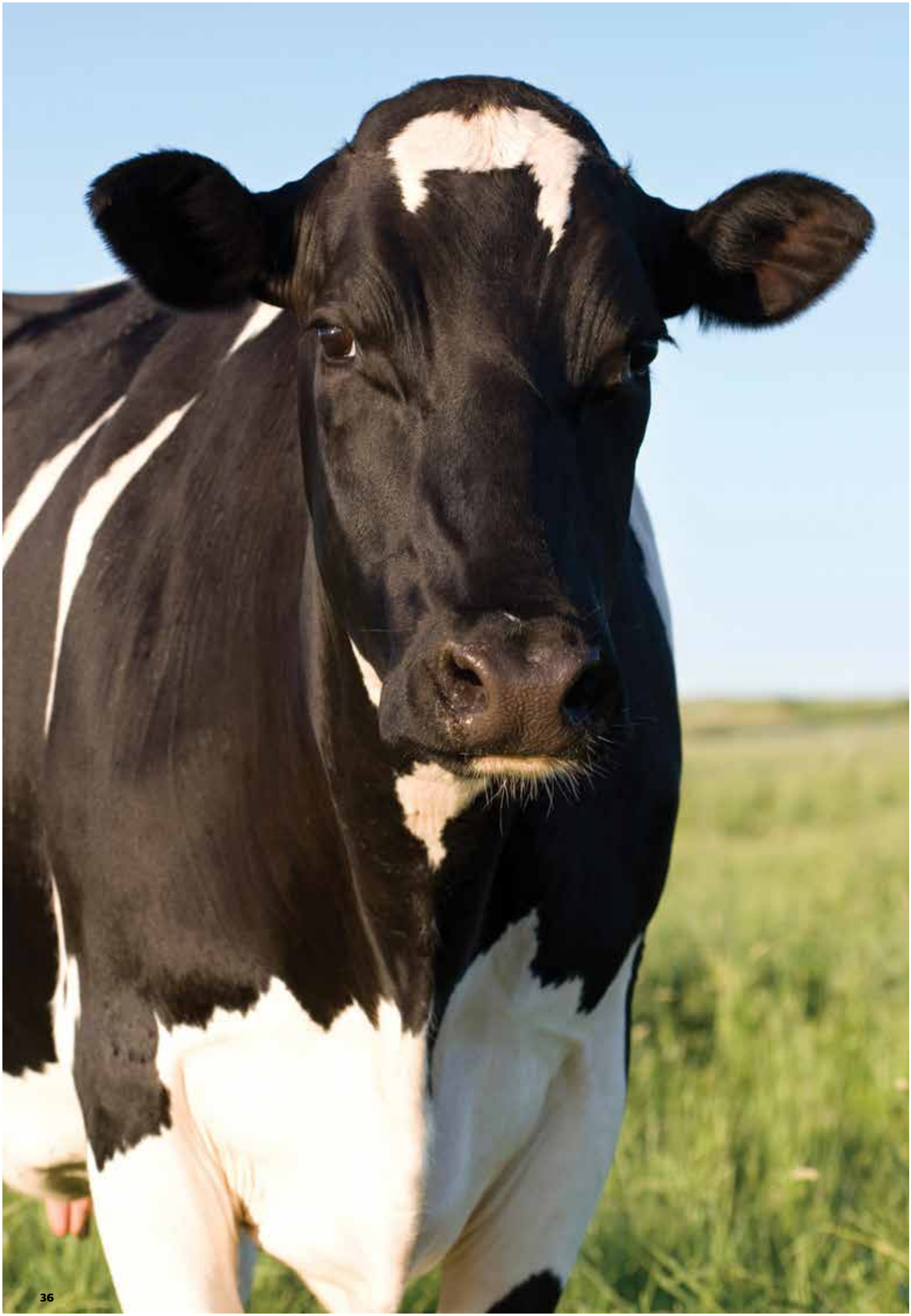
- Fungicide for disease control in fodder and sugar beets
- Beetrizole combines two active ingredients that both offer protectant and systemic activity for use as a preventative treatment for disease control in fodder and sugar beet
- Controls the most important diseases in beet crops; rust, powdery mildew, Cercospora and Ramularia leaf spots

AGRECOVERY

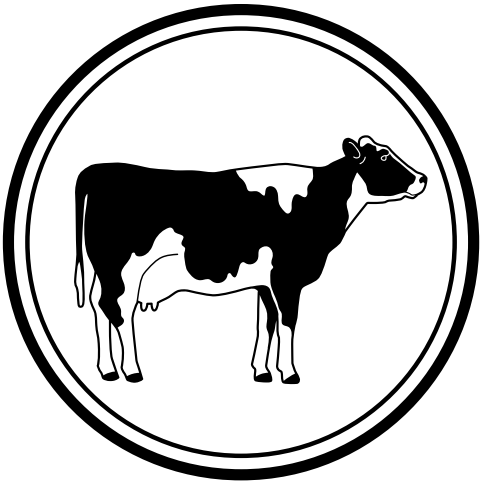
ACTIVE INGREDIENT: trifloxystrobin 375g/L, **cyproconazole** 160g/L
PACK SIZE: 5L

Other herbicides and fungicides used in fodder beet programmes include;

Herbicides	Brands	Comments
Clomazone	Magister®CS	A pre emergence herbicide for control of certain grass and broadleaf weeds
Desmedipham	Spark	To enhance the control of certain weeds in fodder beet and sugar beet when used in tank mix with Beetril
Chloridazon	Chloronion™	A pre- and post-emergence herbicide for weed control in fodder beet, red beet, sugar beet, mangolds, onions, chives and leeks
Phenmedipham + desmedipham	Betanal® Forte, Rifle™, Beetup Compact®	For broadleaf weed control in fodder beet, red beet and sugar beet
Ethofumesate + phenmedipham + desmedipham + metamitron	Betanal® Quattro	For broadleaf weed control in fodder beet, red beet and sugar beet



Feeding and animal health risks for fodder beet



Best practice for fodder beet transitioning

Fodder beet can form an important part of your herds' winter diet. It is a high energy, high value crop for feeding to cattle. To get the most value from your crop and your cows it is important to transition cows correctly onto fodder beet and manage this part of their diet with care to avoid metabolic problems.

Transition slowly

Fodder beet is high in carbohydrate and soluble sugars so the most important step is transitioning your cows onto the crop slowly. Mature cows should receive 1-2kg initially and youngstock no more than 0.5kg initially, increasing in 0.5kg amounts every second day over 21 days up to 7-8kg DM per cow per day.

Measure to know

It is important to measure your yield and feed allocation accurately when feeding crops. Talk to your Ravensdown agronomy technical manager about accurately measuring crop yields. It is also a good idea to get your fodder beet tested at the lab to check metabolisable energy, crude protein and starch and soluble sugar level, so you know what you are feeding out. ARL offer a full suite of testing for pasture and crops.

Prevent gorging

When you are setting up your breaks, it is important to make sure that all cows have adequate access to the crop so that they all transition effectively. Now you are ready to graze the crop, make sure the cows go onto the crop with adequate gut fill. To do this feed hay, straw, silage or baleage prior to the cows grazing the crop. This will prevent cows from gorging on the crop and help minimise the risk of acidosis.

Monitor

Just like with any crop or new grass, monitor the cows during the 21 day transition period. If you need to, stay at a lower feeding rate until cows have adapted to the crop. Signs of cows not adapting to the crop might be similar to down cow symptoms, scouring or cows may simply go off their feed. To avoid this from happening make sure you transition your cows slowly as per the above guidelines. If you are concerned, contact your vet immediately.

Allocations

Fodder beet is mainly fed in conjunction with supplements such as grass silage. Diet allocations in excess of 60–70% of fodder beet have not been recommended. However, recent developments of feeding practices in the New Zealand industry have promoted higher allocations of fodder beet for non-lactating dairy cows during winter and mature (eg ≥Rg 2) beef stock. Higher allocations have not been advised for lactating dairy cows or immature cattle.

On high fodder beet diets (>80% fodder beet), tops are an essential source of crude protein. Once the tops have been grazed and only the low-protein bulbs remain, an additional supplementary protein feed may be required. Importantly, for any feeding levels of fodder beet, animals must be transitioned onto fodder beet over a two to three week period. If this transition period is followed, there is no evidence to suggest that, even at higher allocations, fodder beet will impose greater health risks than other forage crops, eg brassicas. However, if fodder beet is fed at high allocations with low P supplements, stock may suffer from P deficiency and therefore P supplementation may be necessary. If management during the transition period is poor, animals are susceptible to oxalate poisoning and/or rumen acidosis. Therefore careful management during this period is vitally important. Seek advice from the Ravensdown animal health team or other industry experts before feeding fodder beet for the first time or at higher allocations.

Canterbury

In Canterbury crops, N and P concentrations are lower towards the end of the growing season and therefore may not meet the nutritional requirements of lactating animals without additional supplementation.

The Resource Management Regulations for Freshwater and Stock Exclusion came into force on 3 September 2020, with rules that apply to the following farming activities:

- stockholding areas
- fertiliser applications
- winter grazing
- intensification
- wetlands
- stock exclusion.

If you have any concerns, questions or need help with the above, please go to ravensdown.co.nz/services/environmental or contact the Ravensdown Environmental team at environmental@ravensdown.co.nz for guidance.

ravensdown

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