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Forage brassicas – quality crops for livestock production

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INTRODUCTION

Forage brassicas are members of the brassica family, which includes radish, turnip, swedes, broccoli, brussel sprouts, cauliflower and cabbage. Canola is an oilseed brassica which is not really suitable for grazing by livestock. The forage brassicas are mostly grown in cool temperate parts of NSW such as the tablelands and Monaro regions. They are commonly sown in spring and late summer in these regions to provide high quality feed in summer and

autumn when pasture quality is often low, or autumn and winter when pasture quantity is limited. Forage brassicas can provide quick and abundant feed, with high digestibility, energy, and protein. The crude protein content of brassica leaves ranges from 15 to 25 percent and that of turnips and swede bulbs from 9–16 percent. The metabolisable energy content ranges from 11–14MJ ME/kg DM. Forage brassicas can produce excellent livestock weight gains, for example 150–250 g/hd/day

Forage brassicas can provide quick and abundant feed, with high digestibility, energy, and protein.

(Photo: L Ayres)



for lambs and 0.8–1.2 kg/hd /day for growing cattle are common. The relatively low cost of establishing forage brassicas also makes them an attractive option for quick feed.

Forage brassicas can also form a useful part of a pasture improvement program. Weeds that are competitive to an autumn sown pasture are controlled by the paddock preparation for brassicas. Seedset of broadleaf and grass weeds are greatly reduced, leaving the paddock in an ideal condition for pasture or crop sowing. The brassica crop will also provide significant quantities of quality feed rather than the paddock being left fallowed. A spring sown brassica crop will leave a paddock in an ideal condition for direct drilling pasture in the following autumn.

Brassica crops can also reduce the incidence of soil-borne plant diseases. Brassica crops contain naturally occurring chemicals called glucosinolates. These chemicals break down in the soil to produce compounds that inhibit the growth of disease producing organisms such as the take-all fungus, which is regarded as one of the most serious root diseases of wheat. They also reduce the incidence of nematodes. While the level of these biofumigants varies between brassica types, all brassicas will deliver some benefit.

TYPES OF FORAGE BRASSICAS

The forage brassicas can be divided into 5 main types:

- Forage rape (*Brassica napus*)
- Leafy turnips or forage brassica hybrids (*Brassica campestris* spp.)
- Kale or Chou Moellier (*Brassica oleracea*)
- Turnips (*Brassica rapa*)
- Swedes (*Brassica napobrassica*)

The five types of forage brassicas differ in their characteristics and uses. In general the differences are:

Forage rape

Forage brassicas are also referred to as 'rape'. Most types have a stringent grazing management requirement and must reach maturity before being grazed. Maturity is indicated by a change in leaf colour to a purplish or bronze colour that occurs 10–14



Forage rape (Photo L Ayres)

Leafy turnip (Photo L Ayres)



weeks after sowing. Grazing prior to this is the major cause of several livestock health problems (see section on animal health issues). It is advisable to check with your local agronomist or seed company representative as some of the newer forage rapes on the market are more flexible and can be grazed early and late whilst maintaining quality.

Leafy turnips or forage brassica hybrids

Hybrids are crosses between various species of the brassica family. Most hybrids are crosses with turnips and various forms of oriental vegetables. Grazing leafy turnips can commence earlier than rapes (6–10 weeks), without waiting for the leaf to turn a characteristic bronze or purple colour. Leafy turnips can vary in their ability to maintain palatability and leaf quality with age.

Kales

Kale is also known as Chou Moellier. Kale is the tallest growing of all forage brassicas, and is slower to mature than the hybrid brassicas. It will produce large quantities of leaf and stem which is utilised mostly by cattle. Most kales have a characteristic winter habit, and a greater cold tolerance than other brassicas.

Turnips

Both turnip leaf and bulbs are utilised by grazing animals. The turnip bulb is a large storage organ that develops in the first year. Turnip feed dry matter is around 60% bulb and 40% leaf, depending on the size/age and variety of turnip. Turnips are best grazed once at maturity (10–16 weeks). Regrowth is possible from a light first grazing if the leaf growing points attached to the bulb are not damaged. Turnips suffer less from insect attack

Turnip bulbs can be round or tankard shaped.
(Photo: Stephen Pasture Seeds Pty Ltd)



than other forage brassicas, however they are not as drought tolerant.

Swedes

Swedes are most commonly sown in late spring/ early summer in areas with cold winters and moist summers. They require higher rainfall than turnips. Swedes have a larger bulb than turnips and are slower to mature (20–24 weeks). Swedes are better than turnips at maintaining bulb quality over winter. Grazing normally commences during winter and the crop is usually only grazed once. Swedes can be sown in a mixture with turnips to spread grazing times over several months.

Note: Varieties currently available are listed in the supplement to this Agfact.

Paddock Selection and Preparation

Soils

Brassicas can be grown in a wide range of soil types, but for best performance choose paddocks with good soil fertility and depth. Avoid shallow soils and waterlogged areas. A soil test should be taken to determine soil acidity and fertility for nutrient and lime requirements. In highly acidic soils pH (CaCl₂) less than 4.5, lime should be applied well before sowing brassicas.

Paddock selection

Crop area needs to be considered in relation to the number and type of livestock managed on the property. Some paddocks are sown to forage brassicas as part of the pasture establishment process to reduce weed problems and prepare paddocks for subsequent pasture sowing.

If possible avoid sowing brassicas on to westerly aspects as these do not hold as much moisture during the summer as other aspects. Sowing into paddocks which have a greater ability to retain moisture will ensure more water is available for crop growth during summer.

Pre-sowing Preparation

Initial ploughing or spray fallowing should be carried out preferably two months prior to sowing to control weeds and conserve soil moisture. Early workings will stimulate weed germination, and further cultivations or

chemical control measure will ensure the weed problems are reduced. Brassica seeds are very small, so a fine but firm seedbed is desirable. Avoid excessive ploughing as this can often cause a crust to develop on the surface of some soils, which can be detrimental to seedling establishment. Direct drilling is sometimes used but results can be variable. Successful establishment depends on good seedbed preparation, weed and pest control, soil type and rainfall following sowing.

SOWING

Sowing time

The type of brassica being sown and when the feed is required will determine sowing time (see Table 1). For summer feed most forage brassicas are planted early enough in spring (September/October) to capitalise on stored winter soil moisture and to capture reliable spring rainfall. In some environments favourable conditions may allow later sowings. Late sowings become highly dependent on unreliable summer rains and storms, and also make the crops more prone to aphid attack. Traditionally, turnips and kales are sown later, often in December, January, and February on summer rains to produce late autumn/ winter feed.

Seeding rate

Generally, rape and kale crops are sown at 3–5

kg/ha, and turnips and swedes at 0.5–1.0 kg/ha. The higher rates should be used if sowing into rougher seedbeds or if crops are irrigated. One kilogram of forage rape seed per hectare should provide enough plants to achieve 8–10 plants per square metre. Higher seeding rates may be required if direct drilling or broadcast sowing to compensate for a slight yield reduction or a poor germination. High rates for turnips often result in small, spindly turnip bulbs that can choke cattle.

Forage brassicas can be successfully undersown with pastures. Brassica sowing rates should be reduced by half to two thirds when undersowing pastures.

Sowing depth

Brassica seeds are very small so to ensure maximum germination, sow no deeper than 2 cm into a firm, moist seedbed. Sowing can be done through the small seeds box, the seed being dropped to the soil surface and then covered with a light harrowing. A band seeder will enhance results. Rollers can be used to aid seed soil contact and encourage better germination provided the soil surface is not likely to crust.

Seed treatments

Commercial seed treatments are available for use on brassica seeds. These include insecticides for redlegged earth mite and blue oat mite control, fungicides for seedling diseases and molybdenum (a trace element

Table 1. Seasonal sowing guide for forage brassicas

	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Forage rape	■						■						
Hybrids/ leafy turnips	■							■					
Kale			■						■				
Turnips			■							■			
Swedes			■							■			

* Note: Actual sowing and grazing times may vary depending on altitude, seasonal conditions and feeding requirements.

■ Sowing times ■ Grazing times

often deficient in acid soils). Broadcast and direct drilled crops may be more susceptible to seed theft by birds and may require a bird repellent. Consult your local agronomist for the latest treatments available.

CROP NUTRITION

For rapid growth and high quality feed, good crop nutrition is essential. Brassicas respond well to fertilisers and requirements will vary with soil type and paddock history e.g. highly improved or highly fertile soils may require less fertiliser.

Major Nutrients

Phosphorus (P)

Phosphorus is the main element required by brassica crops. Phosphorus rates of at least 15–20 kg/ha are suggested depending on soil phosphorous levels, and soil type. Drilling the fertiliser in at sowing allows a quick response to the available phosphorus. Starter or compound type fertilisers (containing varying amounts of P, N and S) are commonly used especially on poorer soil types.

Nitrogen (N)

Brassica crops are often sown with compound or starter fertilisers containing varying amounts of nitrogen. However care is needed, as too much N placed close to the seed at sowing can inhibit germination of the crop particularly in dry conditions. No more than 20 kg of nitrogen per hectare should be sown in close contact with seed. Paddocks low in fertility may require more N in the form of ammonium nitrate or urea. This can be applied 2–4 weeks after crop emergence. Pale leaf colour may also indicate that the crop is low in N. Urea is best applied just before rain to minimise volatilisation losses to the atmosphere. Approximately 50 kg/ha of N is commonly used and this can increase both yield and crude protein content. Care must be taken when grazing the crop after N application due to increased risk of nitrate poisoning (see animal health issues).

Sulphur (S)

On sulphur deficient soils, fertilisers containing a reasonable sulphur component should be used e.g. superphosphate or a compound fertiliser containing sulphur. Fertilisers containing sulphate sulphur are preferred to

those with elemental sulphur which is more slowly released.

Potassium (K)

Although not common, potassium deficiency can occur. Potassium deficiency can be corrected by adding a potash fertiliser. A soil test will determine if K is a limiting nutrient.

Trace Elements

Molybdenum (Mo)

In highly acidic soils, molybdenum deficiency is common. A fertiliser or seed treatment containing molybdenum to supply 50–100 g/ha can be used to overcome deficiencies. Alternatively, liming to increase soil pH may also overcome molybdenum deficiency.

Boron (B)

Boron deficiency while relatively rare has been known to occur particularly in recently limed soils or soils with a high pH. In situations where boron deficiency is suspected or has occurred, a boron fertiliser should be used to supply approximately 2 kg/ha.

CROP PROTECTION

Weeds

With sound planning and paddock preparation weeds are not normally a problem with brassicas. Brassica crops quickly become dense enough to smother germinating weeds. In low density or late sown crops, some summer weeds can cause problems e.g. Panic grass has been associated with photosensitivity if grazed in excess by livestock. Check with your local agronomist for weed control techniques and herbicides registered for use in brassicas.

Insects and other pests

Seedlings are very susceptible to insect damage especially by red legged earth mite and lucerne flea. Other pests such as cabbage white butterfly, cabbage moth, cutworms, cabbage centre grub and wingless grasshoppers can reduce yield by eating leaves and buds. Aphids also regularly cause problems through their sap sucking (reducing plant fluids) and as vectors for plant viral diseases. Most brassica varieties will suffer from some white butterfly and aphid attacks. Some varieties or types have aphid resistance. Slugs can be a problem in direct drilled crops, particularly with late winter/ early spring sowings. The risk is

increased when sowing into mulch which retains surface moisture.

Regular monitoring of brassica crops for insect pests is essential and timely control measures will prevent or at least minimise insect damage. Sowing brassicas out of the recommended time frame, especially in late spring often increases the risk of insect attack. Consult your local agronomist for registered insecticides or other control techniques.

Brassica Diseases

A number of diseases can seriously affect brassica crop production (see Table 2). Diseases can be caused by fungal, bacterial or viral pathogens. The most common diseases are clubroot, dry rots and mosaic viruses. Fortunately, most diseases are easily controlled by using resistant varieties, seed treatments and most importantly by having good rotations to avoid carry-over of disease on infected residues.

Blackleg in brassica leaf (Photo: G Murray)



Blackleg in brassica root system (Photo: G Murray)

Club root (Photo: G Murray)



Table 2: Major Diseases of Brassicas

Disease	Symptoms	Favourable conditions	Spread	Control
1. Fungal Blackleg <i>Leptosphaeria maculans</i>	Whitish spots and patches on leaves containing small black spots. Cankers can develop at base of stem, with plant dieing.	Wet weather soon after emergence favours infection of seedlings, when most severe damage occurs	Infected residues in soil. Wind can carry spores from infected plants. Rainsplash for local spread	Crop rotations Destroy all brassica residues
Sclerotinia stem rot <i>Sclerotinia sclerotiorum</i>	Wilting and death of stems; white lesion on stem, with white cottony growth in wet weather; black sclerotia form inside stem.	Prolonged wet weather during flowering	Sclerotia (resting bodies) survive in soil. Spores are blown short distances by wind	Rotation with grasses and cereals
Club Root <i>Plasmodiophora brassicae</i>	Wilted stunted plants, pale green to yellowish leaves. Knotted swellings form on roots.	Warm 20–25°C, wet acid soil conditions. Poorly drained soils.	Contaminated soil spread by machinery, animals, boots, irrigation water	Long rotations. Liming to increase soil pH helps reduce infection. Resistant varieties
Leaf Spot <i>Alternaria brassicicola</i> and <i>Alternaria brassicae</i>	Black, brown or greyish lesions on leaves and leaf blades. Concentric rings sometimes appear in lesions and surfaces develop a sooty appearance.	Warm, wet weather	Seed and stubble borne	Use disease free seed
2. Viral Various viral diseases, including beet western yellows virus, turnip mosaic virus and cauliflower mosaic virus	Irregular mosaic and crinkling of leaves, leaf yellowing. Affected plants are also smaller.	Seasonal conditions that favour aphid survival and movement	Aphids spread the virus from infected crops	Nil



Strip grazing improves utilisation of brassica crops. (Photo: Courtesy PGG Seeds)

GRAZING MANAGEMENT

Sound grazing management of brassica crops is essential to maximise plant yield, feed quality and feed utilisation and minimise the potential for animal health disorders. Grazing too late can cause excessive crop wastage and loss of feed quality. It can also cause increased susceptibility to insect attack and diseases.

Strip grazing with an electric fence will allow the crop to be utilised more effectively. Losses caused by trampling can be kept to a minimum, and by controlling stock movements all areas of the paddock can be utilised more uniformly. Strip grazing is more successful with beef and dairy cattle than with sheep.

Brassica crops have been associated with some animal health problems. The key to avoiding these problems is to understand how the crop and particularly the variety should be managed. Some brassicas can be grazed earlier than others. Introducing the animal to the crop slowly and monitoring adverse reactions can prevent most animal health problems.

Introduce grazing animals onto a brassica crop slowly, so that the rumen microflora have the chance to adjust to the high quality diet. It will normally take an animal up to a week to become accustomed to the new feed. Restricting grazing to 1–2 hours per day, slowly increasing to unrestricted access over 7–10 days will allow stock to become accustomed to

Ensure stock have a plentiful supply of water.
(Photo: L Ayres)



their new feed. Brassicas are highly digestible and have a low fibre content, so access to additional roughage such as hay may provide a more balanced diet and improved weight gains. This may also help to ration the brassica crop and improve crop utilisation.

Never give hungry animals the chance to gorge themselves on a lush brassica crop. Stock should always have access to plenty of good, clean water. Unlimited water supplies will ensure the animals' appetite is not suppressed and their metabolic requirements are met. This is especially important over summer when evaporation rates are higher.

In situations where brassica has been undersown with pasture, it is a good idea to have a smaller paddock or area sown completely to brassica. This smaller paddock is used to accustom stock to grazing brassicas before placing them onto the pasture and brassica paddock. Animals unused to brassica will tend to eat out the young pasture component before consuming the brassica.

Tainting of meat has been reported from butcheries. It is advisable to remove animals

from a brassica crop 3–7 days prior to slaughter to minimise the risk of tainting meat. To avoid milk taint in dairy animals, graze brassicas immediately after milking and ensure that the brassica crop does not constitute more than one third of the animals' diet throughout the day, and allow at least 4 hours to pass before milking.

Forage rapes

Most forage rapes will mature (as indicated by a change in leaf colour) in 10–14 weeks after sowing. Grazing must not commence until the plants are fully mature. This is evidenced by the purple / reddish or bronzed colouration of the leaves. Grazing prematurely can cause

Grazed round turnip bulbs (Photo L Ayres)



Purple colouration indicates when forage rapes are mature and ready to be grazed. (Photo L Ayres)



stock to suffer from photosensitisation. However, some of the newer forage rapes on the market are more flexible and can be grazed early without risk of photosensitisation.

Leafy turnip/forage brassica hybrids

Hybrids can be grazed prior to changes in leaf colour (maturity). Of the current hybrids, some require relatively early grazing (6–8 weeks) and may lose palatability and feed quality if grazing is delayed for too long.

Turnips and swedes

A range of turnip varieties are on the market with varying maturity times and importantly bulb shape. Bulbs are either round or tankard shaped.

Newer varieties are tankard shaped and these have the added advantage of sitting just above the ground so that stock can access them more easily. With round types, utilisation can be improved by lightly scarifying the turnips enabling stock easier access to them. Hollow or partly eaten bulbs which stock cannot access can rot. This often happens particularly after frosting when water freezes and ruptures tissues inside the bulb. Swedes will mature slightly later than turnips but are utilised in the same way.

Kale (Chou Moellier)

Kale can be grazed at any stage, but are usually kept into winter and grazed when stems are thick and fleshy.

ANIMAL HEALTH ISSUES

Livestock health problems from grazing brassicas are relatively rare and can largely be avoided by good agronomic and grazing management. Careful monitoring of stock performance and behaviour will allow any problems to be identified quickly and rectified if necessary. Do not hesitate to consult your veterinarian for advice should you suspect any animal health problems. Some livestock health problems that are known to occur include the following:

Photosensitisation

Grazing crops too early, prior to maturity can cause animals to suffer from photosensitisation. Young animals (especially lambs) are prone to photosensitisation, while animals with dark pigmented skins and wool covering are much

more tolerant. The most common sign of photosensitisation occurs on unprotected body parts such as the face and ears. Swelling occurs followed by blistering and scabbing of the ears and face. Rapes and kales are most commonly associated with the disorder, while turnips, swedes and hybrid brassicas are less likely to cause photosensitisation.

If the condition develops and is detected early, it can be reversed by removing the stock from the brassica crop and placing them in a shady area or in a shed. Following the grazing recommendations relating to varieties and maturity will largely avoid this problem.

Nitrate Poisoning

Nitrates accumulate in plant leaves and in very high concentrations may cause livestock death. This problem is largely caused by high soil nitrate levels following prolonged dry conditions being quickly taken up with rapid growth following rainfall or irrigation. Hungry livestock suddenly introduced to nitrate bearing plants are more exposed to nitrate poisoning. Cool, overcast conditions and nitrogenous fertilisers can also increase exposure to high nitrate levels. Introduce stock slowly to the brassica crop and never with an empty rumen to minimise problems.

Goitre (enlarged thyroid)

This is sometimes a problem in young lambs, where pregnant ewes have been grazing leafy brassica crops. Contact your veterinarian for advice on iodine supplements for lambs or supplements for the pregnant ewes

Kale Anaemia

This disorder (sometimes referred to as red water) can occur with all brassica crops, but is more common with kale crops. Anaemia is caused by excess levels of the amino acid compound S-methyl Cysteine Sulphoxide (SMCO) in the plant. SMCO causes a decrease in haemoglobin concentration and a depression of appetite. This condition tends to be worse when soil phosphorous is low and soil nitrogen and sulphur levels are high. Stock should be removed from the crop if they develop this disease.

Digestive Disturbances

The grazing of brassica crops for protracted periods can sometimes result in rumen stasis (rumen stops moving) and constipation.

Affected stock will appear depressed and lack appetite.

Respiratory Problems

Grazing brassicas have sometimes been associated with cases of pulmonary oedema (fluid in lungs). Affected animals display respiratory distress.

Blindness

Occasional outbreaks of the condition that involves blindness, aimless wandering and unpredictable hyperexcitability are observed in cattle grazing brassica crops.

Pulpy Kidney

Pulpy kidney is most common in young stock. Stock are most at risk when they have been on low quality feed for a period of time, and are then placed onto a highly digestible brassica crop. Vaccination is the best way to guard against this disease.

Bloat

Bloat is easily prevented by ensuring stock are full before putting them onto a brassica crop.

Choking

Although rare, cattle have been known to choke on turnip bulbs. The problem is reduced by using slightly lighter sowing rates so that the bulbs have the ability to grow larger, thereby minimising the risk of cattle swallowing them whole. Varieties that are tankard shaped rather than round can also reduce the potential for choking. Alternatively, sheep can be used instead of cattle if bulb size is a hazard.

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FURTHER READING

Agfact P.2.5.41 *Forage sorghum and millet*

Agnote DPI/367 *Cereals for grazing*

Agnote DPI/243 *Chicory: A high performance forage*

Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing (August 2002). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up-to-date and to check currency of the information with the appropriate officer of New South Wales Department of Agriculture or the user's independent adviser.

Always read the label

Users of agricultural (or veterinary) chemical products *must* always read the label and any Permit, before using the product, and strictly comply with the directions on the label and the conditions of any Permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or omitted to be made in this publication.

Pasture improvement

Pasture improvement may be associated with an increase in the incidence of certain livestock health disorders. Livestock and production losses from some disorders is possible. Management may need to be modified to minimise risk. Consult your veterinarian or adviser when planning pasture improvement.

The Native Vegetation Conservation Act (1997) restricts some pasture improvement practices where existing pasture contains native species. Inquire through your office of the Department of Land and Water Conservation for further details.

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Forage Brassica Varieties

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NSW Agriculture

Brassicas vary greatly in maturity, bulb shape, leaf to stem ratio, and winter hardiness. The choice of brassica and variety will depend on when the crop will be grazed, livestock class or type, and if multiple grazings are required.

Table 1. Guide to Forage brassica varieties available in NSW 2002

Variety	Maturity (weeks)	Sowing Rate (alone)	Comments
Forage Rape – <i>Brassica napus</i>			
Bonar	12–14	3–5 kg/ha	Relatively short stems
Giant	12–14	3–5 kg/ha	Taller growing than Rangii rape
Giant Emerald	12	3–5 kg/ha	Older variety on market for many years
Hobson	12–14	3–5 kg/ha	Giant type which has some aphid resistance
Leafmore	8–12	3–5 kg/ha	Cross between Winfred and Emerald varieties, has some winter activity
Maxima Plus	12–14	3–5 kg/ha	Bred for improved aphid tolerance
Rangii	12–14	3–5 kg/ha	Older variety sown for many years
Winfred	8–12	3–4 kg/ha	Can be grazed early or late and will maintain quality. Has winter activity. Multiple grazing. Early ripening.
Leafy Turnips or Forage Brassica Hybrids – <i>Brassica campestris</i> spp.			
Hunter	6–8	3–5 kg/ha	Cross between a Chinese cabbage and a turnip, multiple grazing
Pasja	6–8	3–5 kg/ha	Cross between a Chinese cabbage and a turnip, multiple grazing

Variety	Maturity (weeks)	Sowing Rate (alone)	Comments
Turnips			
Appin	12–14	1–3 kg/ha	Round turnip. High leaf to bulb ratio. Multi crowned
Barkant	12–14	1–2 kg/ha	Tankard bulb shape, high leaf proportion
Green Globe	14–16	1–2 kg/ha	Longest maturity time of all turnip varieties. Round bulb
Mammoth Purple Top	12–14	1–2 kg/ha	Most widely used variety, produces a large round bulb
New York	10–14	1–2 kg/ha	Round bulb. Better virus and disease tolerance than York Globe
Polybra	12–14	1–2 kg/ha	Tankard bulb shape
Rival	12–14	1–2 kg/ha	Tankard bulb shape. High proportion of leaf
Samson	12–14	1–2 kg/ha	Round turnip
Vollenda	12	1–2 kg/ha	Tankard bulb shape
York Globe	10–12	1–2 kg/ha	Superseded by newer varieties. Round bulb shape
Swedes			
Champion Purple Top	18–20	0.75–1 kg/ha	Late maturity
Dominion	18–20	0.75–1 kg/ha	Late maturity. Reddish skinned. Can be used as a culinary type
Highlander	18–20	0.75–1 kg/ha	Late maturity, hard bulb suitable for winter keeping
Kales			
Gruner	16–20 +	3–4 kg/ha	Tall growing variety with good cold tolerance
Kestrel	16–20 +	3–4 kg/ha	Shorter growing variety with higher leaf to stem ratio
Sovereign	16–20+	3–4 kg/ha	Intermediate height, higher leaf to stem ratio

Note: This table is only a guide and actual sowing rates may vary depending on soil fertility, paddock preparation and sowing technique, and if sown with other species. Sowing rate varies if sown with other species and also sowing method and paddock preparation.