

Using brassicas for Better Returns



Contents

- 4 Bridging the forage gap
- 6 Where to grow forage brassicas
- 7 How to grow brassica crops for grazing
- 8 Feeding brassica crops
- 10 Feed value
- 12 Performance and financial implications
- 15 Health issues

The information in this booklet was supplied by Germinal GB Ltd, SAC Consulting and the National Animal Disease Information Service (NADIS) and compiled by Dr Liz Genever, AHDB Beef & Lamb.

Photography: AHDB Beef & Lamb and Germinal GB Ltd.

Introduction

Brassica crops can provide nutritious, cost-effective feeds for beef cattle and sheep.

They can increase output per hectare, both in terms of dry matter (DM) feed and animal performance. Out-wintering on brassicas can also allow more animals to be kept, with minimal extra capital investment in buildings.

Feed costs can be reduced by grazing in situ, because high DM yields can be produced quickly and little or no machinery is needed for harvesting and feeding out.

The crops can be used for out-wintering, to extend the grazing season or to help to fill a forage gap in dry summers. The aim is always to increase the amount of grazed forage in the diet, rather than relying on expensive supplements.

Brassicas can be useful in both arable and grazing rotations. They are a good break or cover crop and can benefit soil structure. They allow time for split lime applications and effective weed control before reseeding.

These crops do not fit into every system and site selection is crucial – especially when used for out-wintering. Attention to crop nutrition and agronomy is important for a successful yield.



Dr Liz Genever
Beef & Lamb Senior Scientist
AHDB Beef & Lamb

Bridging the forage gap

Every farm has a grass growth curve which represents the amount of grass grown in any one year – see Figure 1.

The green line shows a typical curve with a spring peak, a decline in summer followed by a second peak in autumn.

The blue line is the demand curve, which is the feed required by the stock on the farm. It increases as animals are born and grow, and declines as animals are sold or moved on.

This is a good way to visualise feed supply and demand. The shapes of the lines will change on each farm and from year to year.

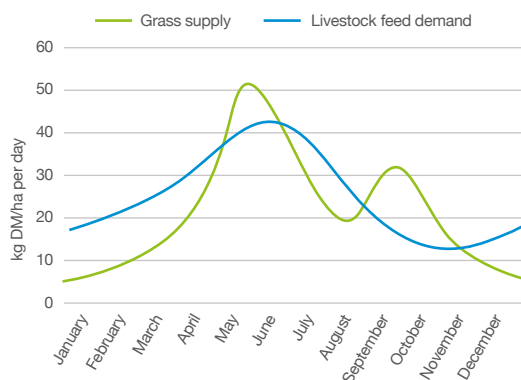


Figure 1. Example grass supply and demand curve

It may be possible to manipulate the grass supply curve by choosing different grass varieties or tactical fertiliser applications. The demand curve can be altered by changing calving and lambing dates or by marketing stock at different times. However, there will still be periods when there is a gap in the forage supply.

Once the forage gaps (when supply is below demand) have been identified, the strategic use of brassica crops can be planned. The gaps could also be filled by feeding silage or hay, but this will increase feed costs.



Take a whole-farm approach and consider:

- What are the total feed requirements for the stock on the farm?
- How are these feed requirements met under the current system?
- What opportunities are offered by brassicas?
- How much feed is needed from brassicas to exploit these opportunities?

Brassicas including kale, grazing turnips, stubble turnips and rape/kale hybrids are generally suitable for feeding to all classes of beef cattle and sheep.

Swedes are only recommended for cattle with fully mature teeth and are not suitable for broken mouthed sheep. Fodder beet, although technically not a brassica, can also be grazed in situ or lifted and fed.

Breeding cows in late pregnancy should not be grazed on brassicas, to avoid the risk of calving in an unsuitable environment.

Ewes in late pregnancy fed on root crops will generally need additional protein to ensure their feed requirements are met.

Crop selection

Having established the feed requirements from brassicas, appropriate crops can be chosen. This will depend on:

- When the crop will be fed
- The number and type of stock required to feed
- When the land intended for growing the crop becomes vacant, eg after first cut silage or stubbles after cereals

The range of sowing and feeding dates is summarised in the Table 1. In some cases (eg some varieties of grazing turnips and new rape/kale hybrids) crops can offer multiple grazing opportunities when drilled early in summer and managed appropriately. This would include grazing with a back fence and applying fertiliser to achieve regrowth of the crop.

The most suitable brassicas for grazing during the late winter months are kale, swedes and certain multi-graze rape/kale hybrids. Stubble turnips, grazing turnips and forage rape are less winter hardy, but are

ideal for extending the grazing season to the end of the year. They can also be used as catch crops for grazing during mid or late summer. Fodder beet is a higher input crop and it can be lifted and fed elsewhere, or grazed in situ.

There is considerable variation in performance between different varieties. Before buying look into:

- Yield (specifically usable yield)
- Disease resistance
- Digestibility of stems/bulbs/leaves
- Leaf-to-stem ratio
- Regrowth ability
- Winter hardiness
- Growing height
- Versatility

Ask for a forage variety, as some varieties of brassicas, especially kale, have been selected for use as game cover and have a greater proportion of stem, making them less suitable for grazing.

Table 1. Summary of sowing and feeding times for a range of crops

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Swedes	Sowing												
	Feeding												
Kale	Sowing												
	Feeding												
Stubble turnips	Sowing												
	Feeding												
Grazing turnips	Sowing												
	Feeding												
Rape/kale hybrid	Sowing												
	Feeding												
Forage rape	Sowing												
	Feeding												
Fodder beet	Sowing												
	Feeding												

Note: Sowing date will vary based on location, with areas in the south being able to sow earlier in the spring and sow later in the autumn.

Where to grow forage brassicas

Independent trials at the Scottish Agricultural College have shown that out-wintering can be successful on many farms, provided a proper field risk assessment is undertaken beforehand and the agronomic and grazing management is good.

Site selection is also important when grazing brassicas in the summer, but there is generally less risk of environmental damage such as soil run-off.



Field choice and preparation

- Choose fields where grass production is falling
- The soil must be free draining and dry quickly after rain
- Ideal sites offer shelter for livestock, but have sufficient air flow to allow fields to dry out
- Think about how to fence the field, how animals will access water and where to position a run-back (a loafing or grazing area at one end of the field where stock may find shelter) and bales
- Avoid steeply sloping fields or those close to watercourses
- Soil test eight weeks before sowing, pH should be at least 5.6 (optimum 5.8–6.2)
- Apply manures, fertiliser and lime according to soil test results
- Aim to control weeds before sowing

To minimise disease risks brassicas should not be continuously grown on the same area. A gap of four to five years (in drier areas), or seven to eight years (in wetter areas), between crops is advised.

If brassicas are grown for two consecutive years then a longer gap is required before the next brassica crop can be grown.

Environmental impact

Careful field selection is crucial to minimise the risk of soil poaching and run-off.

Fields with sandy soils, good soil drainage and gentle slopes are preferable to poorly drained, heavy clay soils or steep slopes where considerable run-off can lead to soil erosion. Fields should not be near watercourses. Buffer strips (such as uncultivated or undrilled land) should be left at the bottom of slopes or near areas where run-off is a risk.

Avoid vehicles travelling in the field during winter by putting bales out in the summer.

Organise feed fences to provide maximum frontage and a narrow strip of accessible fodder, but avoid overstocking.



How to grow brassica crops for grazing

Sowing

Early sowing leads to higher yields in both root and leafy brassicas. However, crops can become less digestible as they mature, so utilisation will fall if they are sown too early for the target grazing period.

Seed can be broadcast or drilled into a cultivated seedbed. Where conditions are suitable they can be direct drilled into an existing sward that has been sprayed off with glyphosate.

Direct drilling improves the retention of soil moisture and produces a firmer surface for grazing that is less prone to poaching compared to fields that are ploughed and then drilled.

- Drill when soil temperatures are 10°C and rising
- Direct drill into clean, open ground
- Sow seeds to a maximum depth of 10mm to ensure uniform germination
- Roll after sowing

Pest control

Treated seed can help protect seedlings against attack from insects and disease. Common pests include flea beetle,

diamondback moth and slugs. It is important to monitor crops closely throughout growth. Control is usually most cost-effective if the potential problem is spotted early. Seek advice from a qualified agronomist at the earliest opportunity and take prompt action if there is an identified problem. Control weeds in the previous crop, or by applying a pre-emergence herbicide after drilling.

Fertiliser

Brassicas respond well to good soil fertility and are particularly responsive to nitrogen (N) and phosphorus.

Where soil test results show indices for N, phosphate and potash at 0 or 1, applying fertiliser will create a cost-effective response. Seek advice from a FACTS qualified adviser and use Nutrient Management Guide (RB209) as a guide. Table 2 shows a typical application regime.

Brassicas are also prone to sulphur deficiency which is shown by yellowing of the leaves. If suspected, a tissue analysis is the best guide. 25kg SO₃/ha (8–24 units/acre) is recommended on soils at risk of deficiency.

Table 2. Example fertiliser application rates and timings for different crops

Crop	Nitrogen (N) kg/ha	Phosphate kg/ha	Potash kg/ha	N applied at sowing (% of total)	N applied later (% of total)
Swedes	40–100	45–105	80–215	50%	50% at 10–12 wks
Kale	40–130	20–80	70–200	50%	50% at 10–12 wks
Stubble turnips	40–100	25–85	20–110	60%	40% at 6–8 wks
Grazing turnips	40–100	25–85	20–110	100%	Further N may be applied for regrowth
Forage rape or rape/kale hybrid	40–100	25–85	20–110	100%	Further N may be applied for regrowth

Note: 100kg per ha equals 80 units per acre.

Source: Nutrient Management Guide (RB209) and Germinal GB Ltd

Feeding brassica crops

Some nutritionists recommend brassicas should not make up more than 50% of dry matter intake. However, producer experience suggests up to 70% inclusion can be achieved successfully.

Overfeeding can lead to reduced intake and performance, with health problems such as iodine deficiency (goitre) and anaemia becoming a risk (see page 15).

Brassicas should always be fed with ad-lib fibrous forage such as straw, baled silage or hay, to improve rumen 'scratch factor' and provide an alternative source of nutrition.

Out-wintered cattle have a higher energy requirement than housed cattle. Between 10–20% more energy should be allocated depending on their body condition, ground conditions and how much shelter there is provided.

Strip grazing

The key to successful feeding with brassicas is to strip graze, using an electric fence to maximise crop utilisation.

Each strip (break) should be long and narrow but allow all animals access to the crop at once, including the most timid animals. The fence should ideally be moved daily. The area needed can be worked out using the calculation on page 11.

Strip grazing small areas will provide the most efficient utilisation. Grazing larger areas will increase trampling and wastage.

Introduce stock to the crop slowly on full stomachs to avoid digestive upsets. Ideally start by allowing the stock access to the crop for one to two hours a day, building up to unrestricted access after seven to ten days.

It is strongly recommended that a wide-access run-back area is provided, in accordance with good agricultural practice. This will increase utilisation and animal welfare. It also reduce the risk of contamination of hides and fleeces.

Start grazing from the top of a sloping field, rather than the bottom, to reduce run-off. Avoid channelling stock through gateways to adjoining fields to minimise poaching.

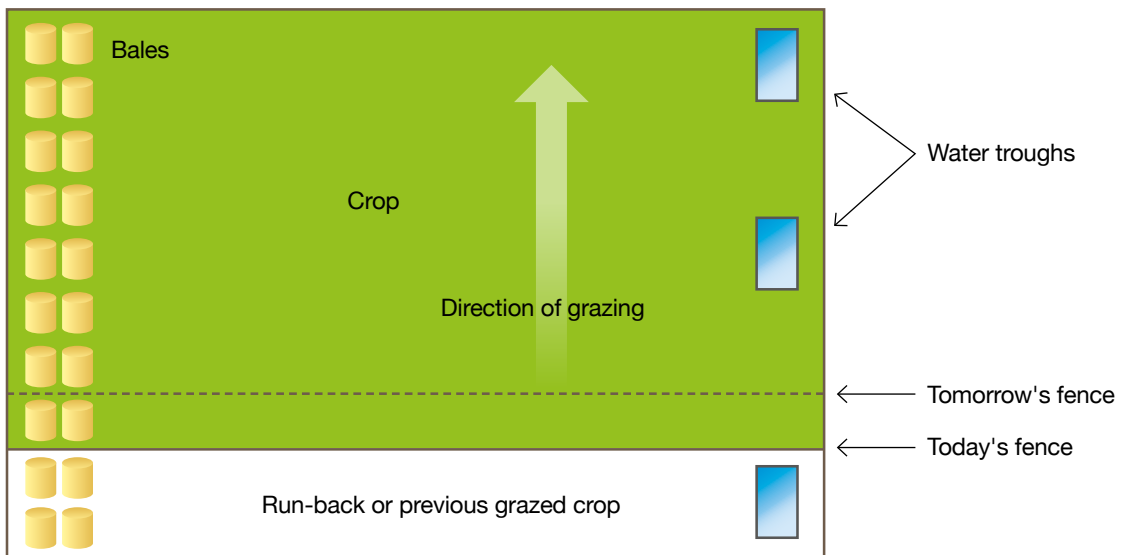


Figure 2: Example plan for establishing a feed face

Making fibre and minerals available

Generally no additional concentrates are needed when grazing brassicas, although minerals should always be available.

Brassicas are high in calcium which may pre-dispose pre-calving cows to hypocalcaemia if they are not fed low calcium forage, such as straw or hay, at the same time.

Brassicas are moderate to low in phosphorus and magnesium. Dry cow rations may require additional phosphorus and magnesium to meet the animals'

requirements in late pregnancy. They are also low in trace elements, particularly copper, iodine and selenium.

Livestock must have access to hay, straw or grass to graze, to promote saliva production and healthy rumen function. Bales placed in the field during summer reduce the need for machinery to go into the field during the winter, minimising soil compaction and run-off from wheelings.

An adequate water supply is essential at all times.

Top tips for feeding

Cattle

- Identify animals that will not eat brassicas and manage separately on a different system
- Do not feed brassicas to cows close to calving
- Only healthy animals in good body condition should be considered for out-wintering
- Do not out-winter old or thin cows
- Be careful if out-wintering in-calf heifers to ensure they do not get overfat and their mineral balances are correct
- Beef cattle must be fully functioning ruminant animals before they can be reared on brassicas; preferably above 200kg liveweight



Sheep

- Remove any lame sheep quickly from the crop for regular treatment, one to two times a week
- Do not graze older ewes or any breeding stock on roots as they may damage their teeth
- Clip the bellies of lambs and crutch before putting on brassicas to reduce fleece contamination
- Present clean lambs for slaughter. They may need to be moved off the crop for the last few weeks before marketing

Feed value

The energy level of brassicas is on par with high quality conserved forages but lower than that of cereals and concentrates. Crude protein content of leafy brassicas is high, between 14–20% although it is much lower in root crops such as swedes.

They have a high readily digestible carbohydrate content but are low in fibre, which is why they should be fed with a fibre source such as straw or hay to prevent rumen acidosis or bloat.

Top Tip

When used for finishing lambs, supplement root crops with sources of dietary protein and leafy crops with additional energy.

Remember average DM yield is based on crops with optimum levels of nutrients and good agronomy. If in doubt, measure the crop in field, plan feeding accordingly and re-adjust costings.

Table 3. Forage crop production and composition

	Sowing rate (kg/ha)	Days to grazing	Number of grazings possible	Summer/ winter use	Dry matter %	Digestibility (D-Value)	ME (MJ/kg DM)	CP (% DM)	% Utilisation	Average DM yield (kg/ha)	Growing Cost (£/ha**)
Swedes ¹	1.00	170–250	1	Winter	11–13	87	12–13	10–11	80	8,000	482
Kale ²	6.25	150–220	1	Both	15–17	80	10–11	14–17	80	9,000	465
Stubble turnips ²	5.00	60–100	1	Both	12–15	85	10–11	17–18	80	6,000	319
Grazing turnips ¹	5.00	60–100	2+	Both	12–15	75	10–11	17–18	75	3,000 (+2000 regrowth)	487
Rape/kale hybrid ²	6.25	90–110	2*	Winter	12–15	80	10–11	18–19	80	6,000	313
Forage rape ³	6.25	90–110	2	Both	10–12	80	10–11	19–20	80	4,800	244

Notes: Drilling methods are indicated as follows ¹precision sown, ²drilled and ³broadcast. *Take care when sowing early as this is a vigorous crop and if not grazed will bolt. **Variable cost of growing includes cultivation, seed bed preparation, seed, fertiliser and sprays (SAC, The Farm Management Handbook 2015/16).

Table 4. Stocking and cost guidelines for brassicas

	DM yield (kg/ha)	No. of animals per ha for 100 days (crop is 70% of diet)				Cost of brassica per animal (p/day*)			
		Suckler cows	Stores	Ewes	Lambs	Suckler cows	Stores	Ewes	Lambs
Swedes	8,000	10	11	70	54	72	63	9	6
Kale	9,000	10	11	66	51	62	55	7.8	5.2
Stubble turnips	6,000	6	7	44	34	64	56	8	5.3
Grazing turnips	3,000 (+2000 regrowth)	5	6	37	28	116	102	14.5	9.7
Rape/kale hybrid	6,000	6	7	44	34	62	55	7.8	5.2
Forage rape	4,800	4	5	29	23	61	54	7.6	5.1

Notes: Assumptions: 600kg suckler cows. Dry suckler cows requiring 68MJ ME/d. 350kg growing cattle gaining 0.75kg/d requiring 63 MJ ME/day. 70kg ewe requiring 10MJ ME/day. 30kg lambs gaining 200g/d requiring 13MJ ME/day. *Variable costs of establishment (SAC, The Farm Management Handbook 2015/16) with predicted intake related to production, 70% utilisation and 70% of diet from forage crop. Costs of fibre source and labour are not included.

Measuring dry matter

For accurate feed planning it is essential to measure the DM yield of the crop. This can easily be done by using a:

- 1m square frame
- Seed bag
- Pair of garden shears
- Scales

A number of samples should be taken from each field, picking representative sampling points.

1. Place frame in the forage crop
2. Use shears to cut each plant within the frame (about 10cm from the ground). Put the harvested crop in the bag
3. Hook bag onto scales and record the crop weight per metre squared (kg/m²)
4. To calculate DM yield/ha multiply the fresh weight per m² by 10,000, then multiply by the expected crop DM percentage (see table on page 10)

For example:
Kale from 1m² = 5kg fresh weight x 10,000
= 50,000kg fresh weight/ha
Average kale dry matter = 16%
50,000 x 0.16 = 8,000kg (8t) DM/ha

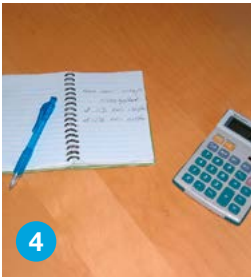
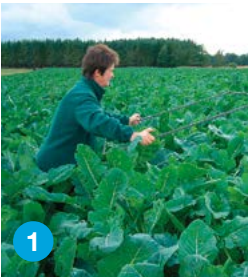


Table 5. Daily feed requirements

Row	Description	Example based on a 270kg weanling requiring 8kg DM/day	Your livestock and forage requirements
1	Livestock total intake. <i>Estimate total daily intake on the basis of a dry matter requirement of 3% of liveweight</i>	8kg DM/day	
2	Amount of brassica in the diet (How much of the diet will be grazed brassicas?)	70%	
3	Brassica daily requirement (row 1 multiplied by row 2, divided by 100)	5.6kg DM	
4	Number of livestock	25	
5	Daily requirement from brassica (row 3 multiplied by row 4)	140kg DM	
6	Estimated crop DM yield/m ² *	0.56kg DM/m ²	
7	Total daily grazing area required (row 5 divided by row 6)	250m ² of brassica	
8	Length of feed face	125m	
9	Fence to be moved (row 7 divided by row 8)	2m/day	

Notes: *Based on crop yields of 8t DM/ha (0.8kg DM or 5kg fresh weight (FW) per m²) multiplied by 70% utilisation

Performance and financial implications

Suckler cows

Trials at SAC demonstrated that under appropriate field conditions, non-lactating, spring-calving suckler cows can be out-wintered on kale and stubble turnip systems, with no concerns in relation to liveweight or condition loss.

However, it was noted that only cows in good condition at the start of the winter should be considered for out-wintering. Free-draining sites with good dry lying areas, electric fencing that could be moved easily each day and good stockmanship are all vital for the system to be successful.



Table 6. Relative costs and response of dry spring-calving suckler cows out-wintered on brassicas (based on SAC, 2005)

	Costs as a percentage of housed animals			Weight change (kg/day)
	Straw at £30/t	Straw at £50/t	Straw at £70/t	
Swede	80	88	97	0.21 Loss
Kale	57	65	74	0.14 Loss
Stubble turnips	61	70	78	0.21 Gain
Silage/deferred grazing	90	90	90	0.00 Loss
Housed (excl. shed fixed costs)	88	100	112	0.32 Gain

Note: Calculation assumptions: 180 day overwintering period, 5kg/head/day straw allowance. Silage/deferred grazing needs 10kg DM/head/day based on a 650kg cow requiring 1.5% bodyweight DM intake. Grass @ 6p/kg/DM for 60 days deferred grazing. Silage @ 13p/kg/DM for 120 days silage. Housing – cattle need an additional bedding/straw allowance of 2kg/head/day. Feed concentrates at 3kg/head/day @£240/tonne. Silage area requirement 0.1ha/head @ £213/ha.

Sources: Cattle Out-wintering Systems, SAC Consulting, The Farm Management Handbook 2015/16.

Growing cattle

Growth rates for growing cattle out-wintered on brassicas are reported to be between 0.6–0.9kg per day, although cattle can lose weight in the first weeks of grazing before growth rates are established. Gradual introduction to the crop reduces the risk of weight loss.

Good growth rates depend on feeding good quality forage with the brassicas. Silage or good quality hay would be preferable to straw.

In general, the limited information currently available suggests there is little difference in the overall cost of out-wintering cattle on brassica based diets in the UK, compared to housed diets. So there is scope for out-wintering where shed space is limited and/or when shed space can be used for alternative more lucrative purposes.

There are also potential savings through a reduced requirement for conserved forage, bought-in feeds, muck storage and disposal and other costs associated with housed cattle.

Practical experience with the SAC demonstration project indicates the amount of time involved in visiting out-wintering fields to move the electric fence each day, is similar to the time taken to feed and bed up a comparable group of animals, housed in straw bedded yards and fed indoors.

The work also showed that compensatory growth can be achieved cheaply at grass following the out-wintering period. As Table 7 shows, this resulted in similar weights being achieved to cattle reared indoors by the end of the following summer.



Table 7. Feed costs and performance of weaned suckled steers (2005/2006, SAC)

	Costs as a percentage of housed animals		
	Straw at £30/t	Straw at £50/t	Straw at £70/t
Relative costs over winter (with the base being housed)*	80	88	97
Growth rate over winter (kg/day)	57	65	74
Cost per kg gain (p/kg gain)	61	70	78
Growth rate at grass (kg/day)	90	90	90
Average growth rate over winter and summer since weaning (kg/day)	88	100	112

Notes: Calculation assumptions: Based on 30:70 fibre to brassica ratio. Daily dry matter requirement is assumed to be 3% of BW, therefore a 300kg steer would require approximately 3kg of straw or silage. Silage at £45/tonne and straw at £50/tonne. Five month wintering period.Sources: Cattle Out-wintering Systems, SAC Consulting, The Farm Management Handbook 2015/16.
*Includes forage crop, fibre source, labour and machinery.

Sources: Cattle Out-wintering Systems, SAC Consulting, The Farm Management Handbook 2015/16.

Finishing lambs

Brassicas are potentially cheap sources of feed for holding or finishing store lambs and finishing cull ewes. Growth rates up to 250g per day have been reported. However, performance can be variable and will depend on crop yield and efficiency of use.

Utilisation tends to be optimised when grazing pressure is high and weather conditions are good, as soiling of crops leads to rejection.

Table 8. Example of the type of performance possible from grazed brassicas compared to concentrate finishing

	Short keep lamb on forage rape	Short keep lamb on concentrates	Long keep lamb on swedes
Growth rate (g/day)	273	133	243
Hay fed (kg/lamb)	–	3.0	23.1
Concentrates or cereals fed (kg/lamb)	5	66	15
Total variable costs (£/lamb per day)	0.20	0.39	0.27
Total variable costs (£/kg LWG)	0.75	2.94	1.11

Source: SAC Consulting, The Farm Management Handbook 2015/16.



Health issues

Speak to your vet about the risks of using brassicas and how to incorporate prevention techniques into the health plan.

Photo-sensitisation

Cause: Compounds within the brassica cause the skin to be sensitive to sunlight and skin damage can result. Usually occurs when crops are grazed too early when they are still growing. More common with rape and kale.

Effect: Will generally affect young and animals with low pigment levels, eg white heads or faces. Can cause head and ears to swell and result in blisters and scabs.

Treatment: Remove stock.

Prevention: Ensure crops are grazed when mature (check 'Days to grazing' on page 10).

Nitrate poisoning

Cause: Nitrates accumulating in the leaves of the crop. Usually occurs where fast growing crops are grown in soil with high nitrate levels after rain which has followed a dry spell. Cool and overcast conditions and high N fertiliser use increases the risk.

Effect: Abdominal pain, scour, weakness, muscle tremors, drooling, mouth breathing or coma. Can cause death. May look similar to milk fever.

Treatment: Remove stock and feed high quality forage. The vet may recommend the use of methylene blue.

Prevention: Introduce stock slowly and avoid high use of nitrogen fertiliser.

Bloat

Consider the risk of bloat, as brassicas can be rapidly degraded in the rumen. It is essential to feed fibre alongside the crop and introduce non-hungry stock gradually.

Goitre

Cause: Brassicas, especially root crops, contain glucosinolates, which block the uptake of iodine from the diet. Brassicas are low in iodine which increases the risk of iodine deficiency which affects the thyroid gland and the hormones it produces.

Effect: A swollen thyroid gland in severe cases. More of a problem if pregnant animals are grazing crops, as it can cause stillbirths and increased pre-natal mortality. Can affect fertility.

Treatment: Remove stock and treat with an iodine supplement.

Prevention: Bolus animals with iodine and avoid grazing pregnant animals.

Kale anaemia (redwater)

Cause: Excess levels of amino acid compound S-methyl cysteine sulphoxide (SMCO) in the plants, which causes anaemia and appetite loss.

The levels of SMCO are worse when soil phosphate levels are low and nitrogen and sulphur levels are high. SMCO levels also increase when crops are flowering.

Effect: Weakness, red urine (particularly if the animals are grazing kale), reduced appetite, performance and fertility, goitre.

Treatment: Remove stock.

Prevention: Soil test and involve agronomist in fertiliser decisions. Avoid sulphur fertiliser unless needed. Ensure adequate copper and selenium levels in the diet.

Other diseases

Think about all diseases that are common when animals are introduced to new or increased levels of feed, such as pulpy kidney, redgut, pasteurellosis and polio-encephalomalacia (cerebrocortical necrosis or CCN). Vaccinate wherever possible and when the risk warrants it.

Beef and sheep BRP Manuals

Manual 1	Improving pasture for Better Returns
Manual 2	Assessing the business for Better Returns
Manual 3	Improving soils for Better Returns
Manual 4	Managing clover for Better Returns
Manual 5	Making grass silage for Better Returns
Manual 6	Using brassicas for Better Returns
Manual 7	Managing nutrients for Better Returns
Manual 8	Planning grazing strategies for Better Returns
Manual 9	Minimising carcase losses for Better Returns
Manual 10	Growing and feeding maize silage for Better Returns
Manual 11	Using medicines correctly for Better Returns

See the AHDB Beef & Lamb website beefandlamb.ahdb.org.uk for the full list of Better Returns Programme publications for beef and sheep producers.

Produced for you by:

Better Returns Programme

AHDB Beef & Lamb
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

T 024 7647 8834

E brp@ahdb.org.uk

W beefandlamb.ahdb.org.uk

Twitter @AHDB_BeefLamb

If you no longer wish to receive this information, please email us on comms@ahdb.org.uk

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