

Using brassicas for Better Returns



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Better Returns Programme

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Brassica crops such as kale, forage rape, grazing turnips, stubble turnips, swedes and new rape/kale hybrids, can provide nutritious, cost-effective feeds for beef cattle and sheep.

They can increase output/ha, 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, and make a good break crop between grass to grass re-seeds. They can also be used as a pioneer crop in uncultivated areas.

These crops do not fit into every system, and site selection is crucial – especially when used for out-wintering. However, many more producers could potentially benefit from introducing them onto their farm.



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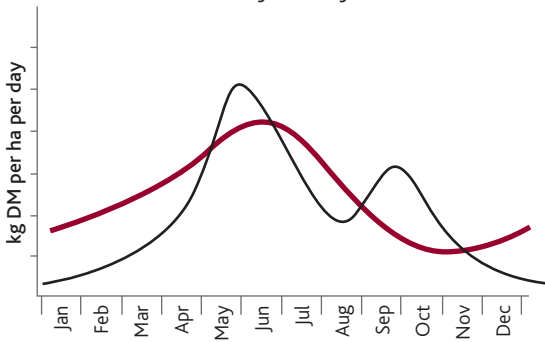
Bridging the forage gap

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

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

The red 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 graphs will change on each farm and from year to year.



Key:

- Grass supply
- Livestock feed demand

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 full requirements are met.

Where to grow forage brassicas

Independent trials at SAC 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 5.8-6.5).
- Apply fertiliser and lime according to soil test results
- 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.

Environmental impact

Careful field selection is crucial to minimise the risk of soil poaching and runoff.

Fields with sandy soils, good soil drainage and gentle slopes are preferable to poorly drained heavy clay soils or steep slopes where considerable runoff can lead to soil erosion. Fields should not be near water-courses. Providing a dry area of run-back is recommended.

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 and where conditions are good, can be direct drilled. Kill off any existing sward 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, diamond back 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 (P).

Where soil test results show indices for N, P and K (potash) at 0 or 1, applying fertiliser will create a cost effective response. Seek advice from a FACTS qualified adviser, and use *Fertiliser Manual (RB209)* as a guide. The following table shows a typical application regime.

Table 1: Example fertiliser application rates and timings for different crops

Crop	Nitrogen (N) (kg/ha)	Phosphate (P) (kg/ha)	Potash (K) (kg/ha)	N applied at sowing (% of total)	N applied later (% of total)
Swedes	40-100	45-100	80-215	50%	50% at 10-12 weeks
Kale	40-130	50-80	130-260	50%	50% at 10-12 weeks
Stubble turnips	40-100	25-85	20-110	60%	40% at 6-8 weeks
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

100kg per ha equals 80 units per acre. (Source: *Fertiliser Manual (RB209)* – and *Germinal GB*)

Brassicas are also prone to sulphur (S) deficiency which is shown by yellowing of the leaves. If suspected, a tissue analysis is the best guide. 10-30kg S/ha (8-24 units/acre) is recommended depending on deficiency severity.

Feeding brassica crops

Some nutritionists recommend brassicas should not make up more than 50% of dry matter intake. However, farmer 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 13).

Brassicas should always be fed with *ad lib* fibrous forage such as straw, silage or hay, to improve rumen 'scratch factor'.

Out-wintered cattle have a higher energy requirement compared to those housed indoors. At least 15% more feed energy may be required.

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 9.

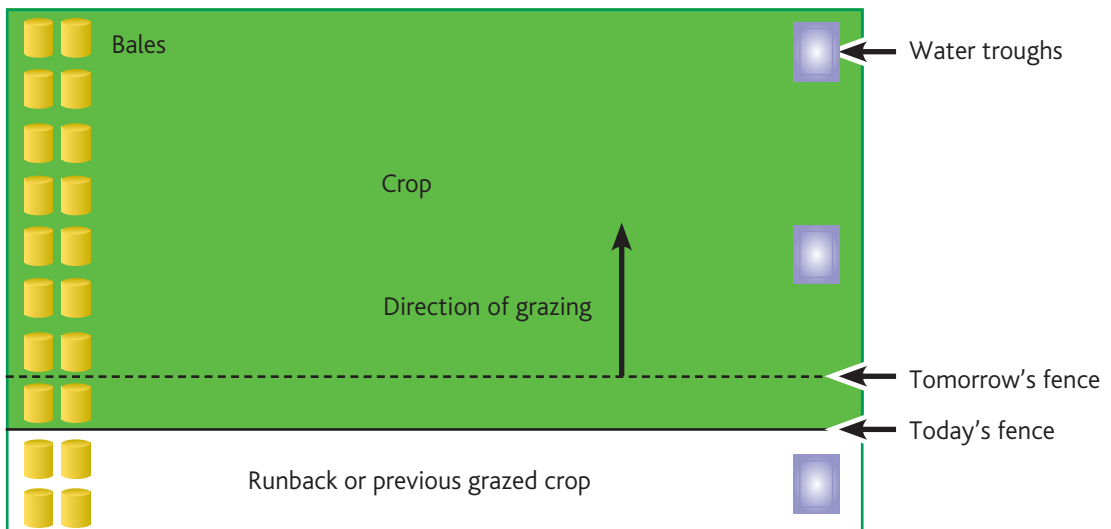
Strip grazing small areas will provide the most efficient utilisation. Grazing larger areas will increase trampling and wastage.

Introduce stock to the crop slowly on full stomachs to avoid digestive upsets. 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, and 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.

Example field plan



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 runoff 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 in-calf heifers or old/thin cows
- Foot-trimming before the feeding period will minimise lameness
- Beef cattle must be fully functioning ruminant animals before they can be reared on brassicas; preferably above 200kg liveweight



Sheep

- Check all sheep's feet before the feeding period, but foot trim only when necessary. 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. One comb width either side of the midline should be sufficient and will reduce the risk of skin damage
- 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 content of leafy and root brassicas is typically higher than that in other forages and similar to that in concentrate feeds and cereals.

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.

Roots tend to have lower protein content than leafy crops.

Top Tip:

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

Table 2: Forage crop production and composition

	Sowing rate (kg/ha)	Days to grazing	No. 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	402
Kale ¹	6.25	150-220	1	both	15-17	80	10-11	14-17	80	9,000	315
Stubble turnips ²	5.00	60-100	1	both	12-15	85	10-11	17-18	80	6,000	230
Grazing turnips ¹	5.00	60-100	2+	both	12-15	75	10-11	17-18	75	3,000 (+2,000 regrowth)	369
Rape/kale hybrid ²	6.25	90-110	2*	winter	12-15	80	10-11	18-19	80	6,000	203
Forage rape ³	6.25	90-110	2	both	10-12	80	10-11	19-20	80	4,800	160

* 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 2012/13). Drilling methods are indicated as follows ¹precision sown, ²drilled and ³broadcast.

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: Stocking and cost guidelines for brassicas

	DM yield (kg/ha)	Number 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	80	50	11	5
Kale	9,000	10	11	66	51	52.5	35	7	3
Stubble turnips	6,000	6	7	44	34	58	38	8	3
Grazing turnips	3,000 (+2,000 regrowth)	5	6	37	28	123	74	15	7
Rape/kale hybrid	6,000	6	7	44	34	51	34	7	3
Forage rape	4,800	4	5	29	23	53	40	8	4

Assumptions: 500kg suckler cows. Dry suckler cows requiring 68MJ ME/d. 300kg growing cattle gaining 0.75kg/d requiring 63MJ 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 2012/13) with predicted intake from 3% of liveweight and 70% utilisation. 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/m^2)

4. To calculate DM yield/ha multiply the fresh weight per m^2 by 10,000, then multiply by the expected crop DM percentage (see table on page 8)

For example:

Kale from $1\text{m}^2 = 5\text{kg}$ fresh weight $\times 10,000$

$= 50,000\text{kg}$ fresh weight/ha

Average kale dry matter = 16%

$50,000 \times 0.16 = 8,000\text{kg}$ (8t) DM/ha



Table 4: Daily feed requirements

	Example based on a 270kg weanling requiring 8kg DM/day	Your livestock and fodder crop 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 Brassica % of diet (How much of the diet will be grazed brassicas?)	70%	
3 Brassica daily requirement (box 1 x box 2)	5.6kg DM	
4 Number of livestock	25	
5 Daily requirement from brassica (box 3 x box 4)	140kg DM	
6 Estimated crop DM yield/ m^2 *	0.56kg DM/ m^2	
7 Total daily grazing area required (box 5 \div box 6)	250 m^2 of brassica	
8 Length of feed face	125m	
9 Fence to be moved (box 7 \div box 8)	2m/day	

*Based on crop yields of 8t DM/ha (0.8kg DM or 5kg fresh weight (FW) per m^2) \times 70% utilisation

Performance and financial implications of feeding brassicas

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 which had 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 5: Feed costs and response of dry spring-calving suckler cows out-wintered on brassicas (2005, SAC)

	Feed costs (p/cow/day) Straw costed at			Weight change (kg/day)
	£30/t	£50/t	£70/t	
Swede	95	105	115	Good 0.21 Loss
Kale	68	78	88	Satisfactory 0.14 Loss
Stubble turnips	73	83	93	Good 0.00 Loss
Silage/deferred grazing	107	107	107	Good 0.00 Loss
Housed (excl. shed fixed costs)	105	119	133	Good 0.32 Gain

Calculation assumptions

180 day overwintering period

5kg/head/day straw allowance

Silage/deferred grazing

Need 10kg DM/head/day based on a 650kg cow requiring 1.5% bodyweight (BW) DM intake

Grass @ 6p/kg/DM for 60 days deferred grazing

Silage @ 13p/kg/DM for 120 days silage

Housed

Additional bedding straw allowance of 2kg/head/day

Feed concentrates at 3kg/head/day @£240/tonne

Silage area requirement 0.1 ha/head @ £213/ha

Sources: Cattle Out-wintering Systems, SAC, The Farm Management Handbook 2012/13.

Growing cattle



Growth rates for growing cattle out-wintered on brassicas are reported to be between 0.6-0.9kg/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 and bought-in feeds, muck storage and disposal, and in the costs of heating, lighting and fuel to service housed cattle.

Practical experience with the SAC demonstration project indicates that 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 the table below shows, this resulted in similar weights being achieved to cattle reared indoors by the end of the following summer.

Table 6: Feed costs and performance of weaned suckled steers (2005/2006, SAC)

	Over-wintering treatments of weaned steers		
	Kale + straw	Kale + silage	Housed
Daily costs over winter (p/day)*	47	69	99
Growth rate over winter (kg/day)	0.74	0.76	0.87
Cost per kg gain (p/kg gain)	63	91	113
Growth rate at grass (kg/day)	0.65	0.59	0.55
Average growth rate over winter and summer since weaning (kg/day)	0.69	0.67	0.70

*Includes forage crop, fibre source, labour and machinery.

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, The Farm Management Handbook 2012/13

Finishing lambs

Table 7: 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 lambs on swedes
Growth rate (g/day)	273	133	243
Hay fed (kg/lamb)	–	3.0	23.1
Concentrates/cereal fed (kg/lamb)	5	66	15
Total variable costs (£/lamb/day)	0.21	0.46	0.29
Total variable costs (£/kg LWG)	0.78	3.46	1.18

Source: SAC, *The Farm Management Handbook 2012/13*.

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.



Health issues

Speak to your vet about the risks of using brassicas and how to incorporate prevention techniques into the farm 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 animals 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 8).

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. Also cool and overcast conditions and high N fertiliser use will increase 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 non-hungry stock slowly and avoid high use of nitrogen fertiliser.

Goitre

Cause: Brassicas, especially root crops, contain glucosinolates, which block the uptake of iodine from the diet. Brassicas are also low in iodine which increases the risk of iodine deficiency which will affect 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 on brassicas.

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.

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.

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 the risk warrants it.

Source: *Brassica Poisoning in Cattle. Feeding Lambs on Rape.* (www.nadis.org.uk)

Other BRP publications available

Joint Beef and Sheep BRP

- 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

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

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