



**CHOICE
CHICORY
GUIDE
FOR LAMB
FINISHING.**

FEATURES OF CHICORY

Grasslands®

Choice

Chicory

Chicory is a perennial herb with a deep tap root, providing high forage quality and high warm season drymatter production. **Choice** chicory has been thoroughly proven on farms, and in research, to substantially improve production both per animal and per hectare. It can be considered as a regrowth summer crop that in the right soil conditions can last 2-4 years.

- High forage quality (protein and digestibility)
- Quality feed for lamb finishing
- High summer growth
- Slow winter growth in cold climates
- Good drought tolerance, deep tap root (1.5 m)
- Elevated mineral content (Zn, Cu, Mg, Ca, K)
- Reduced facial eczema spore levels
- Good grazing tolerance

Performance of Chicory

Choice chicory is an excellent option for growing lambs from weaning to their final liveweight target.

Typically, lambs on chicory grow at 200-350 grams/day and **Choice** can potentially support around 40 lambs per hectare through summer and autumn. It can provide multiple grazings for 2-4 years or more, particularly when planted with legumes.

Chicory has good protein levels (22-27% CP), and high energy often testing over 12.5 MJME/kg DM when leafy. This quality does not deteriorate to the extent ryegrass does over summer; so in late summer and autumn, quality differences between the two species can be large, especially in a first year **Choice** crop.

There are a number of reasons for improved lamb liveweight gains relative to ryegrass. Chicory is processed significantly faster in the rumen than ryegrass, increasing the potential intake for lambs. Lamb appetite can be reduced in summer due to high temperatures and the grazing of chicory may offset this problem due to leafy chicory being low fibre and highly preferred over ryegrass.

Daily growth rates in a pure sward are around 80-100 kg DM/ha/day in summer and autumn, but can be as high as 120 kg DM/ha/day in January and February when soil moisture is not limiting. Second year crops tend to produce less than the first year from spring to autumn and have the added complication of seeding which inevitably leads to a drop in quality.

Chicory ideally should be planted in spring to obtain a "free lunch" whereby the plants remain vegetative rather than going reproductive during the first summer. This minimises the need to control seed head and results in very high quality feed in the first summer. If chicory is autumn sown the plants vernalise during winter and will become reproductive the following spring. Second year crops, which require seed head control, are also important in a lamb finishing system if late spring grazing is part of the strategy.

USES OF CHICORY

1. AS A SPECIAL-PURPOSE CROP

This is the best way to realise the benefits of chicory because it provides the greatest amount of high quality feed over summer. It also allows for selection of suitable soil types, and grazing management that is specific for chicory. Seed is sown with or without white and red clover. A pure crop can also be useful for eradicating grass weeds (e.g. browntop, couch) as grass-specific herbicides can be used over the crop. Planting without clover could also be beneficial in eliminating the food source for clover root weevil, with chicory/clover crops also being unfavourable for many clover pests.

SPECIALIST CHICORY STAND

CULTIVAR	SOWING RATE (KG/HA)
Choice chicory	8-10

Some farmers have found 8 kg/ha is needed to allow enough plants to survive into the second season. At this rate clover is not likely to establish well. Some farmers choose not to use clovers to attempt to disrupt clover root weevil populations before planting a new perennial pasture. This is particularly important in areas of Southland.

CHICORY AND WHITE CLOVER STAND

CULTIVAR	SOWING RATE (KG/HA)
Choice chicory	8
Attribute white clover	2
Emblem white clover	2
TOTAL	12

In this mix option, white clover is used for longer term ground cover, quality and nitrogen fixation. The white clovers often struggle to contribute through the first few grazings but by the second summer become very important.

CHICORY AND WHITE AND RED CLOVER STAND

CULTIVAR	SOWING RATE (KG/HA)
Choice chicory	6
Relish red clover	4
Attribute white clover	3
TOTAL	13

The **Relish** red clover in this mix will add to the persistence of the stand, often outlasting the chicory under less suitable conditions for chicory. Again, the legumes will struggle to compete with a strong establishing chicory crop, however once established they become more important over time.

2. AS PART OF A RELISH RED CLOVER SYSTEM

Many farmers are choosing to plant a legume species such as **Relish** red clover prior to planting chicory. This is an economic way to eradicate a wide range of weeds, while building up soil N. The chicory can be drilled into **Relish** stands approaching three years old, and the chicory can take full advantage of the soil N reserves.

3. MIXED WITH A GRASS/CLOVER PASTURE

This is still a common use of chicory because it requires very little change to pasture establishment and management practices. It is an easy way to increase animal production from a pasture. Seed is mixed at the rate of 1-4 kg/ha, depending on the content required. Establishment can be poor when mixed with high rates of perennial ryegrass, when sown in cold soils, or when planted too deep (>12 mm). Best results come from sowing with highly palatable grasses such as Italian ryegrass, Timothy, tall fescue or prairie grass.

CULTIVAR	SOWING RATE (KG/HA)
Choice chicory	4
Manta Italian ryegrass	12
Attribute white clover	4
Relish red clover	5
TOTAL	25

4. OVERSOWN INTO PASTURE

Good establishment can be achieved by spreading seed just prior to grazing in spring. This suits grass pastures planted in autumn without chicory which require thistle spraying in the first winter.

ESTABLISHMENT OF CHICORY



Chicory germination and early vigour is very sensitive to soil temperature.

Chicory is more sensitive than ryegrass to sowing depth and soil temperature. It establishes best when sown into warm soils (12°C +) at 10 mm in depth, where there are low amounts of competition from other plants in the first three months. Spring sowing is highly preferred, with late autumn planting to be avoided.

Weeds should be thoroughly eliminated before sowing as post establishment herbicides for chicory are limited. Many weeds can be controlled in the early stages of establishment with flumetsulam based herbicides at recommended rates. The addition of grass herbicides is also recommended in many instances; products like Clethodim can be used for grass specific control. It is vital that weed control is well timed and applied at good water rates exceeding 150 L/ha of water. Weeds should be sprayed when they are approximately the size of a \$2 coin.

In grass mixes where it is expected that pastures will require a hormone spray after establishment, chicory should be left out of the initial mix and chicory (at least 3 kg/ha) and clover seed spread or direct drilled just before grazing in spring.

Soil fertility requirements are similar to those required by ryegrass/clover pastures. Take a soil test in the autumn before spring planting chicory as this allows time for lime to be applied and become effective. Nitrogen fertiliser improves establishment of chicory, especially when temperatures allow for active growth.

If weeds, especially Californian thistle, are an issue, spray-drill annual ryegrass during autumn into paddocks that will be planted in chicory the following spring. This allows chemical control of weeds over the autumn (more effective time to target thistles). Using an Italian ryegrass like **Manta** from an autumn establishment for 18 months prior to spring sowing chicory helps the total feed supply (two winters) and provides more time to target thistle control.

Chicory has been successfully established after cultivation or direct drilling (spray-drilling). Direct drilling may be more suitable on some soil types

In all cases careful review of all herbicide residuals for previous crop history should be noted as chicory is a susceptible species to a number of commonly used cropping herbicides.



Flumetsulam can be applied to young chicory seedlings

ESTABLISHMENT OF CHICORY

EXAMPLE OF A GOOD ESTABLISHMENT PROGRAMME WHEN CULTIVATING

1. Plan to plant chicory when soils are 12°C and rising, most likely to be late September to mid October.
2. Spray out existing pasture with glyphosate + insecticide. Observe withholding periods for livestock.
3. Wait for 10-12 days, mouldboard plough, roll furrows, power harrow to shallow depth.
4. Prepare seed bed to a sowable quality and allow at least a 4 week fallow to germinate as many weeds as possible prior to sowing. Spray again or undertake final cultivation.
5. Apply establishment fertiliser – nitrogen (N) for rapid establishment, and phosphate and potassium for long term production.
6. Sow with a roller-drill, light chain harrows, then finally a pass with a Cambridge roller. Seed must not be planted deeper than 12 mm (ideal is 10 mm). Seed to soil contact is critical for a uniform establishment.
7. If possible, spray-irrigate to germinate if no rain after sowing.
8. Monitor weeds, and if found, spray only with flumetsulam. Clean the tank thoroughly before adding water/chemical, and maintain agitation while spraying. Apply when weeds are small (approx \$2 coin) as it will not kill some large weeds, and it has a residual effect to control late-germinating weeds. If grass seedlings are also present (e.g. browntop), a grass-specific herbicide should be added to the mix (e.g. clethodim).
9. Apply nitrogen 3-4 weeks after planting, then after each grazing. Typical rates are 30 units of N.
10. First graze whole paddock when plants have seven true leaves (crop will be about 25-30 cm high), leaving a 7-10 cm residual. An October planted crop will typically take 65-75 days to reach its first grazing.

EXAMPLE OF A GOOD ESTABLISHMENT PROGRAMME WHEN SPRAY-DRILLING

1. Plan to plant chicory when soils are 12°C and rising, most likely to be late September.
2. Spray out existing pasture with glyphosate + insecticide. Observe grazing withholding periods.
3. A double spray programme is ideal to allow surface material to break down and hard to kill weeds to germinate prior to direct drilling.
4. Monitor slug populations and treat before drilling as chicory seedlings are highly prone to damage. Many farmers apply slug bait as a precaution; some contractors can apply bait whilst drilling. If slugs are present pre drilling, pre baiting 5-7 days pre drilling is recommended.
5. Wait for 3-5 days, then drill seed at a shallow depth (ideal is 10 mm). To improve plant coverage even further, consider sowing 60-70% of the seed with the drill and 30-40% of the seed broadcast with fertiliser.
6. There are large improvements in establishment speed if fertiliser can be put through the drill – if the drill has a fertiliser box, use DAP (or similar) at 120-150 kg/ha. If no fertiliser box, broadcast 250 kg/ha DAP at drilling.
7. Rolling after drilling may be needed for drills that leave an open and loose drill slot.
8. If possible, spray-irrigate to germinate if no rain after sowing.
9. Monitor weeds, and if found, spray only with flumetsulam. Clean the tank thoroughly before adding water/chemical, and maintain agitation while spraying. Apply when weeds are small (approx \$2 coin) as it will not kill some large weeds, and it has a residual effect to control late germinating weeds. If grass seedlings are also present (e.g. browntop), a grass-specific herbicide should be added to the mix (e.g. clethodim).
10. Apply nitrogen 3-4 weeks after planting, then after each grazing.
11. First graze whole paddock when plants have seven true leaves (crop will be about 25-30 cm high), leaving a 7-10 cm residual.

HERBICIDE RESIDUES

Do not plant chicory within the withholding periods for residual hormone herbicides (e.g. Clopyraid, Tordon Max®, Dicamba) that may have been applied on previous crops. It is not advisable to plant chicory stands after brassica crops, as they may harbour and spread root diseases which can affect chicory.

MANAGEMENT OF CHICORY



Stem should be grazed before it goes past this soft-stem stage.



Chicory is most productive and persistent when it is rotationally grazed, and spelled until 2-4 leaves/plant have fully regrown (crop will have a mass of about 3000 kg DM/ha, or 15-20 cm height). Between spring and autumn this will mean a 21 to 35 day rotation.

In mid spring (October) of the second season, chicory plants will develop a reproductive stem. This should be grazed off, close to the ground, while it is small (< 10 cm) and soft (see photo). A second grazing just two weeks later will reduce stem regrowth for the rest of the season.

Chicory is an extremely productive plant that is very responsive to large amounts of fertiliser. Its main requirement is nitrogen, and the clover in the sward will not be able to provide enough fixation for maximum chicory growth. Farms with specialist chicory pastures under irrigation may apply nitrogen (e.g. 60 kg/ha of urea) after every grazing, but for lower-input systems 2-4 applications of 80 kg/ha of urea over spring and early summer will be adequate for moderate carrying capacities. Phosphate, sulphur and potassium should be applied at maintenance rates that reflect the higher stocking rates (e.g. 200% of farm average).

Specialist stands of chicory without grass will tend to suffer winter annual grass ingressions (e.g. *poa annua*) after 1-2 seasons. These can be controlled with grass-selective herbicides to improve spring production and persistence.

When using chicory as a two year crop, it is advisable to spell chicory from grazing during autumn to allow plants to develop about 6 leaves per plant by the end of May, then carefully graze this off while soils are dry. Grazing in early spring also needs to be done carefully to avoid damage from pugging and treading.

Due to the relatively short lived nature of chicory in a farm system, autumn spelling the stands to develop tap root reserves for the following spring is not required.

Soil Types

Chicory is suited to many soil types, but growth and persistence is maximised on soils with high fertility that do not frequently become waterlogged (e.g. poorly developed ex-swamp land). It has been successfully used on many soil types, including heavy clay soils, with the major challenge being the prevention of pugging damage in winter and early spring where the expectation of the crop persistence is greater than 18 months. Fertile, free draining paddocks remain the best option if a 2-4 year crop is planned.

SYSTEMS FOR LAMB FINISHING



Grazing rotations are important to maximise production.



It is ideal to establish several paddocks of pure chicory/clover pasture with good access to stock water. To ensure a daily intake for lambs, enough area should be planted to enable a good rotational grazing policy.

Grazing of whole paddocks may be required for the first 1-2 grazings while establishing the crop. Once well established, an area of chicory can be grazed for 3-5 days with a mob of lambs, while longer rotations will require back fencing to avoid lambs grazing regrowth leaves from the crowns of plants. Some farmers prefer to set stock summer crops and draft lambs off as they become prime. Although this is easier to manage, the maximum output from the crop will be obtained by allocating a set drymatter intake to lambs under a rotational grazing policy. Research has shown significant advantages in favour of rotational grazing over set stocking **Choice** chicory. This is primarily due to rotational systems allowing the chicory plant to reach its growth potential while a set stocked plant is consistently getting its new growth eaten before it is realising this growth potential.

This system ideally should provide for a minimum 25 day grazing rotation, but may need to be adjusted if growth of chicory is unusually slow or fast. It supplies a daily diet of chicory, which is important because it provides a consistent quality of feed through a rotation. It has also been observed that lambs can be less willing to eat chicory if they have not grazed it for a week or longer.

Farmer experience and research has shown consistent live weight gain on chicory stands with 200-350 grams/day achievable as an average across the season.

Choice chicory will grow through winter, especially on the warmer sunny faces, so will provide some grazing in early spring although not as much as ryegrass. To counter the reduction in early spring carrying capacity, a crop rotation with **Manta** Italian ryegrass can be used, this also helps with weed control (see establishment section). For example, if a farm has six paddocks of chicory for grazing, two would be planted each year, and in their third autumn planted in Italian ryegrass. This would mean that in each spring, the slower growth from four chicory paddocks will be balanced by the extra growth from two Italian ryegrass paddocks. An additional method to overcome this issue is to plant annual ryegrass in the autumn into paddocks identified for planting into their first crop of chicory during the following spring.

Chicory allows chemical options to control problem grass weeds (e.g. couch or brown top), which harbour "take all". This is particularly important if forage cereals are going to be used in the rotation. Because chicory is not a grass, grass-weed herbicides can be used over chicory crops at any stage, and allow several weed sprays when conditions are ideal for control. Grass should be considered a weed in chicory stands and ideally should be controlled prior to the grasses tillering, as this will allow for lower rates of chemical and more cost effective control.

CONSIDERATIONS OF GROWING CHICORY



Chicory does not persist indefinitely, due to fungal root diseases slowly increasing in the soil and overgrazing when in pure swards. **Choice** chicory will tend to persist longer than the semi-annual cultivars which can thin more in their first winter and spring. Persistence of chicory is poor on heavy and poorly drained soils, due to pugging damage, when planted with dense grasses and/or when grazed under wet conditions.

Many weeds, including buttercup (giant and annual), stinking mayweed, and chickweed can be controlled with a registered herbicide. Chicory is however susceptible to thistle herbicides, so these need to be controlled before establishment, and after establishment by way of mowing, grubbing, spot spraying, or wiping. One of the most commonly used tools for cleaning up thistles is the use of **Manta** Italian ryegrass as a break crop prior to establishing **Choice**.

Chicory will not grow at the same rate as modern ryegrasses from mid winter to early spring. Experience has shown that this leads to only one grazing being missed in early spring (August) on chicory paddocks compared with grass pastures, after which chicory provides as much or more grazing.

Managing the establishment of large areas of a farm in chicory each spring may require feed budget planning to ensure farm feed deficits are not created. It normally takes 65-75 days from planting to first grazing, with the total time a paddock is out of a grazing round being 9-12 weeks (depending on speed of establishment).

Old pastures can be sprayed out once pasture growth on the farm starts to exceed animal consumption, thereby controlling overall farm feed surplus without creating a deficit.

Where longer lived chicory crops are used, crops in their second spring provide as much spring grazing as ryegrass from September onwards. Where plant numbers are declining ryegrass can be direct drilled during autumn into older chicory crops to compensate for loss of grazing when establishing new chicory crops the following spring. Picking the right paddocks and keeping chicory for multiple years also means a reduced chicory area is planted in spring, thereby reducing feed planning issues.

Vernalisation and consequently seed head production is a feature of second year crops. Grazing management and potentially topping may be required to limit this. Grazing is preferred but topping may need to be considered where paddocks have developed a volume of stem.

Economics of Chicory

A crop of chicory can cost between \$1,300 and \$1,600/ha to establish where contractors are used for all operations and the maximum number of inputs are included. This equates to a cost of feed produced (excluding post establishment fertiliser) of about 14-18 cents/kg DM for a six month crop growing around 8-10 t DM/ha, or 7-10 cents for a two year crop (accumulating between 16-18 t DM/ha). It is important to note that there is potential in some regions for outstanding growth however not all chicory crops are sown into environments with the same potential. It is also important to remember that each kg of DM grown is of high feed value contributing to improved lamb outcomes over and above most other feed sources, especially general pastures. This is consistent in all environments.

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