



TONIC

GUIDE FOR DAIRY FARMS

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Plantain is a winter-dormant flat weed. **Tonic** plantain is a winter-active, upright forage species. It is a broad leaved, coarse rooted herb that can adapt to a range of soils, rainfalls and other climatic conditions. **Tonic** has seasonal drymatter (DM) production strengths in summer, autumn and winter. **Tonic** is an obvious upright cultivar in all seasons; this is not the case with the majority of commercially available plantain varieties.

Features of Tonic Plantain

PLANT

- Upright growth in all seasons
- Exceptional summer/autumn and winter growth
- High forage quality (protein and digestibility)
- Good drought tolerance
- Elevated mineral content (Zn, Cu, Se, Mg, Ca, K)

FARM BENEFIT

- Reduce impacts of summer/autumn deficits in pasture quantity and quality
- Improves milk production when pasture quality drops
- Has the potential to reduce facial eczema spore levels
- Beneficial crop for effluent disposal
- A break crop to reduce insect populations (e.g. black beetle, clover root weevil)
- Useful crop to remove grass weeds (e.g. Yellow Bristle Grass)

Performance of Tonic

Recent DairyNZ research indicated that when the quality of ryegrass was moderate (10.5 MJ ME/kg DM), milk solid yields were similar from cows fed 100% ryegrass pasture or ryegrass pasture supplemented with herbs. However, when ryegrass quality dropped to 9.6 MJ ME/kg DM, cows fed first year **Tonic** plantain as 20-40% of the diet ate about 1 kg DM more and produced about 17% more milk solids (Lee and Minnee, 2012).

Energy (MJ/kg DM)	11-12
Protein (% DM)	16-28
Fibre (% DM)	25-33
Sugars + starch (% DM)	9-20
Minerals (% DM)	11-16
% reproductive stem or seedhead in the sward	0-20

There seem to be several reasons for the improved milk production; **Tonic** has good protein levels, contains condensed tannins which may improve protein supply to dairy cows, and high energy (average 11-12 MJ ME/kg DM). 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. The range in ME over two seasons in a Waikato trial was 11-12, with the protein ranging from 16-28%.

Other Benefits

Tonic, like chicory and legumes, is processed faster in the rumen than ryegrass. This has the potential to increase daily intakes. Cow appetite can be reduced in summer due to high temperatures, grazing **Tonic** may overcome this problem due to **Tonic** having a low drymatter percentage, being upright and easily grazed by the cow especially compared to ryegrass at this time. The high protein and digestibility of **Tonic** in summer and autumn is ideal to balance with high fibre and low protein forages (e.g. maize silage, ryegrass pastures and kikuyu).

Daily growth rates are around 80-100 kg DM/ha/day in summer and autumn, but can be as high as 120 kg DM/ha/day over Jan/Feb. Second year crops can be equally as productive as first year crops due to plant numbers persisting and remaining relatively constant.

Soil Types

Tonic is suited to many soil types, with growth and persistence being maximised on soils with high fertility that do not frequently become waterlogged (e.g. poorly developed ex-swamp land). **Tonic** has been successfully used on a wide range of soil types in the Bay Of Plenty (BOP), Waikato and Northland regions, including peat soils; with the only limitation being the ability to prevent pugging damage in winter and early spring. Free draining paddocks should be selected if the crop is planned to be kept for more than two summers.

Uses of Tonic

1. MIXED WITH A GRASS/CLOVER PASTURE

This is the most common use of **Tonic** because it requires very little change to pasture establishment and management practices, and provides more dry matter of a high quality through the summer and early autumn period.

Seed is mixed at the rate of 1 to 3 kg/ha, depending on the content required. Establishment success can vary 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 tetraploid ryegrass or tall fescue (the rate should be kept to 1kg or less when sown with tall fescue).

2. AS A SPECIAL-PURPOSE CROP

This is often the best way to realise the full benefits of herbs on a dairy farm, as it provides a large amount of high quality feed over summer. It also allows for selection of suitable soil types and grazing management that is specific for **Tonic**. Sowing rates are 8-14kg/ha, with or without white and red clover. A pure crop can also be useful for eradicating grass weeds (e.g. yellow bristle grass, couch) as grass specific herbicides can be used over the crop.

Tonic without clover could also be beneficial in eliminating the food source for clover root weevil, with plantain crops also being a less favoured feed source for black beetle.

3. OVER-SOWN INTO PASTURE

Good establishment can be achieved by spreading seed just prior to grazing in spring. This suits grass pastures planted in autumn without plantain which require broadleaf weed control in the first winter. **Tonic** is also an effective way of extending the life of open or damaged pasture and boosting summer production and quality.

DairyNZ research has shown that the fastest feed and highest early production is achieved via spray drilling.

4. EFFLUENT CROP

Tonic is responsive to nutrients and can be extremely productive throughout the year. These characteristics make it an ideal forage for mining nutrients from effluent paddocks. Effluent paddocks provide a lot of high quality feed for grazing in summer, with effluent being able to be applied throughout the life of the crop due to its winter activity.

5. UNDERSOWING

Tonic can be successfully undersown or broadcast at 3-4kg/ha into thinning perennial pastures to extend pasture life or until the paddock returns to the cropping/regrassing phase.

Economics of Tonic

A crop of **Tonic** can cost between \$900 and \$1,300/ha to establish where contractors are used for all operations, and the maximum number of inputs are included. Recent yield work from DairyNZ and Massey university suggest **Tonic** can reliably yield between 16,000 and 19,000 kg DM/ha and often for consecutive years. The other consideration when analysing the cost of feed from using **Tonic** is the higher utilisation rate than perennial ryegrass pastures. **Tonic** can regularly be utilised to 85% of pre-grazing mass without any impact on future regrowth. It is also important to remember that each kg of DM is of high feed value particularly through summer and early autumn.

Establishment of Tonic

Tonic is more sensitive than ryegrass to sowing depth and soil temperature but not as sensitive as Chicory. It establishes best when sown into warm soils (10-12°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, as the plant develops quickly and reaches its full potential through the summer and autumn. Although successfully established through late summer and early autumn plantings, late-autumn planting should be avoided as plant development does slow with reducing temperature and it is good to avoid the first grazing occurring in July or August.

With a special-purpose **Tonic** sowing, weeds should be thoroughly eliminated before sowing to reduce competition during establishment. Many weeds can be controlled post establishment with a wide range of herbicides (talk with your local Agricom representative for chemicals specific to **Tonic**).

In ryegrass pasture where **Tonic** is going to be included it is important to identify if weeds will need to be managed. It is expected that pastures will require a hormone spray after establishment, **Tonic** should be left out of the initial mix with the **Tonic** (at least 3 kg/ha) and clover seed spread just before grazing in spring.

Soil fertility status is the same as what is required for ryegrass/clover pastures. A soil test should be taken in autumn before spring-planting **Tonic**; this allows time for lime to be applied and become effective. Nitrogen fertiliser improves the establishment of **Tonic**, especially when temperatures allow for active growth.

Californian thistles and various other thistles can easily be eradicated with herbicides post establishment, however it is recommended that if these are likely to become an issue that an annual ryegrass is drilled in the autumn prior to the spring establishment of **Tonic**. Some farmers precede their spring **Tonic** establishment with a spray-drilled annual ryegrass pasture in the autumn, allowing more time to control difficult weeds.

Tonic can be successfully established after cultivation or direct-drilling (spray-drilling) and by broadcasting. Direct-drilling may be more suitable on some soil types. Suggested programmes for both cultivated and direct drilled methods are listed below.



Picture 1: **Tonic** Plantain - deep fibrous root system

EXAMPLE OF A GOOD ESTABLISHMENT PROGRAMME WHEN CULTIVATING

1. Plan to plant pasture when soils are 10-12°C and rising, this is most likely to be late September in a Waikato environment for example.
2. Spray out existing pasture. Talk to your local retail Representative or Agricom Representative for chemical advice specific to **Tonic** plantain.
3. Wait for 10-12 days, then mouldboard plough, roll furrows and power harrow to shallow depth.
4. Apply establishment fertiliser – Nitrogen (N) for rapid establishment, and Phosphate and Potassium for long-term production (DAP is generally applied at a rate of 200-250 kg/ha at establishment).
5. Sow 8-10 kg/ **Tonic** plantain with a roller-drill, light chain harrows, then finally with a Cambridge roller. Seed must not be planted deeper than 10-15 mm (ideal is 10 mm).
6. Spray-irrigate to germinate if there has been no rain after sowing (if this is an option).
7. Monitor weeds and if found contact your local Agricom Representative. Clean the tank thoroughly before adding water/chemical, and maintain agitation while spraying. If grass seedlings are also present (e.g. summer grasses), a grass-specific herbicide should be added to the mix.
8. Apply Nitrogen 3-4 weeks after planting, then after each grazing.
9. First grazing of the whole paddock should occur when **Tonic** plants have seven true leaves (the crop will be about 25 cm high), and aim to leave a 3-5 cm residual.

EXAMPLE OF A GOOD ESTABLISHMENT PROGRAMME WHEN SPRAY-DRILLING

1. Plan to plant pasture when soils are 10-12°C and rising, this is most likely to be late September (for example in the Waikato).
2. Spray out existing pasture. Talk to your local retail Representative or Agricom Representative for chemical advice specific to **Tonic** plantain.
3. Monitor slug populations and treat if required before drilling, as **Tonic** seedlings are highly prone to slug damage. Many farmers apply slug bait as a precaution; some contractors can apply this at drilling.
4. Wait for 3-5 days and then drill seed at a shallow depth (ideal is 10 mm). Contractors have found the higher rate of 10-14 kg/ha of seed is needed to achieve good plant populations due to the variation in seeding depth. To improve plant coverage even further, consider sowing 5 kg/ha with the drill and 5 kg/ha spread with fertiliser.
5. Apply establishment fertiliser – if the drill has a fertiliser box, use DAP (or similar) at 120-150 kg/ha. If there is no fertiliser box, broadcast it at 250 kg/ha DAP at drilling.
6. Rolling after drilling may be needed for drills that leave an open and loose drill slot.
7. Monitor weeds and if found contact your local Agricom Representative. Clean the tank thoroughly before adding water/chemical, and maintain agitation while spraying. If grass seedlings are also present (e.g. summer grasses), a grass-specific herbicide should be added to the mix.
8. Apply Nitrogen 3-4 weeks after planting and then after each grazing.
9. First grazing of the whole paddock should be when plants have seven true leaves (crop will be about 25 cm high), leaving a 3-5 cm residual.

ESTABLISHING PLANTAIN INTO EXISTING PASTURE

Tonic seed germinates quickly in suitable conditions and has been successfully sown into existing pastures at 4-6 kg/ha. Research has shown that when done well it provides significant production gains in summer and autumn production. Production gains are greatest when seed is drilled – broadcasting can still be successful. Coated seed should be used and pastures monitored for slugs.

HERBICIDE RESIDUES: Do not plant **Tonic** within the withholding periods for residual herbicides.

Management of Tonic

Tonic is most productive and persistent when it is rotationally grazed, and spelled until 2-4 leaves per plant have fully re-grown (the 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.

Grazing frequently has an impact on persistence. For example, in DairyNZ trials consistently grazing crops when they reached 15 cm height reduced **Tonic** plant density by 10% by the second summer. Grazing when soils are wet will also lead to plant losses. However, **Tonic** is much more robust under winter grazing than chicory (Lee, 2012).

Tonic is an extremely productive plant that is very responsive to fertiliser. Its main requirement is Nitrogen. Farms with specialist **Tonic** pastures under irrigation are applying 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. **Tonic** (unlike ryegrass) is responsive to Nitrogen fertiliser over summer. Phosphate, Sulphur and Potassium should be applied at rates to maintain the crop that reflects the higher stocking rates (e.g. 200% of farm average).

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

When using **Tonic** as a two-year crop, it is advisable to spell **Tonic** from grazing during autumn to allow plants to develop about 7 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.



Picture 2: Crop should be grazed before it reaches 30cm. Seed head matures and reduces in palatability after 20-25 days.

Systems for Dairy Farms

Tonic the Forage Crop

It is ideal to establish several paddocks of pure **Tonic** pasture close to the dairy shed. To ensure a daily 3-hour diet of plantain, the amount of **Tonic** pasture planted should be about 5-6 ha per 100 cows.

Grazing of whole paddocks may be required for the first 1-2 grazings while establishing the crop. Once well-established, an area of **Tonic** (about 0.3 ha per 100 cows) should be fenced off, and cows moved onto this break for 2-3 hours. Some farmers prefer to do this just before afternoon milking, as cows move quickly from their day/grass paddock to the **Tonic** (reducing walking time to the dairy shed), and it stimulates cow appetite when they would normally have a low appetite on grass due to higher temperatures. Fences are moved the following day and the exercise is repeated. Back-fencing is preferred to ensure good regrowth, but this can be impractical. If there are 6 paddocks of **Tonic** on a farm, back-fencing is not essential as strip-grazing of each paddock can be completed within two days, resulting in very little grazing of re-growth plants.

The system provides for a 25 day grazing rotation, but may need to be adjusted if growth of **Tonic** is unusually slow or fast. It provides a daily diet of **Tonic**, which is important because it provides a consistent quality of feed through a rotation.

DairyNZ experience has found that when pasture quality was low, per cow production can increase by two-three litres/cow or 17% per day from just a couple of hours of grazing **Tonic** each day (Lee, 2012). Given the small land area required, the per-hectare profitability of this is very high.

Tonic will grow through winter, and is particularly active in the North Island, so will provide some grazing in early-spring (4 t/DM/ha).

Persistence

On average **Tonic** will reliably survive as a productive stand for 2-3 summers. Exactly how long it lasts is often related to weed grass control, good grazing management of wet soils and allowing it to re-seed in the second and third years through the summer grazings (this often happens without trying).

Weed Grass Control

Tonic is also useful for controlling problem grass weeds (e.g. yellow bristle grass, couch). As **Tonic** is not a grass, grass-weed herbicides can be used over **Tonic** crops at any stage, and allow several weed sprays to occur when conditions are ideal for control. The other large advantage of **Tonic** is its time in the ground. If the crop is run for two consecutive summers multiple applications of grass selective herbicides can be achieved.

White Clover

Ideally, if it is planned for **Tonic** stands to last more than two summers, white clover should be broadcast into the paddocks once weed control is achieved and when chemical residues allow.

4 kg/ha of **Tribute** white clover would be the ideal cultivar for this job.

Tonic Pastures

In some cases **Tonic** will be used as short to medium term pasture and not a crop. In these situations **Tonic** is a ryegrass alternative and is highly desirable to sow with white clover.

The advantages these pastures have will reflect those described earlier around summer production and quality. Some individuals have found **Tonic** pastures as being ideal options for spring deferred feed. This enables a concentration of grazing pressure on other parts of the farm to maintain early summer pasture quality. While the **Tonic** based pasture may lose quality with age and seedhead, experiences suggest that **Tonic** pasture can recover quality both faster and more easily than a spring deferred perennial ryegrass pasture.

Effluent

Tonic is a valuable crop to grow on effluent paddocks for both environmental and farm production reasons. This is mainly due to its high yield potential and good spread of summer and cool season growth.

Tonic with Asset AR37

Tonic will grow at the same rate as a 3-5 year old perennial ryegrass pasture from midwinter to early spring. For farmers seeking extra winter activity **Tonic** could be established with **Asset AR37** Italian ryegrass. Mixing these two cultivars or introducing the **Asset AR37** in the autumn is a good tool for putting additional feed in front of animals for the winter. If **Asset AR37** is established in the spring with **Tonic** it will not go to seed head – meaning that it maintains a high quality vegetative growth pattern throughout its first summer.



Picture 3: **Tonic** plantain in its second year planted with **Asset AR37**

Plantain Varieties

Of the plantain varieties currently available, **Tonic** is the only cultivar with animal trials that show positive results.

Fraser and Rowarth (1996) clearly show that the plantain cultivar Grasslands Lancelot had very poor summer quality and resulted in poor lamb live weight gain compared to perennial ryegrass. The first work done on **Tonic** by Moorhead et. al (2002) showed **Tonic** to be superior to perennial ryegrass for summer lamb finishing. Subsequently positive work using **Tonic** has been carried out on deer, ewe lactation, lambs to weaning and through DairyNZ milk production work.

Tonic is the first plantain to demonstrate an upright growth habit throughout the year including winter. This is very important as, combined with good cool season growth, **Tonic** is accessible to the grazing animal all year round. This is not the case with the majority of other plantain cultivars commercially available.



Picture 4: **Tonic** (background) next to other commercially available lines of plantain (foreground) in late autumn, Canterbury, NZ.



Picture 5: **Tonic** (left) vs. another commercially available plantain (right), Canterbury, NZ.

Limitations of Plantain

Tonic is relatively simple to use effectively and successfully on farm. There are some circumstances that may result in poor results from plantain.

Although productive in a normal upper North Island summer **Tonic** will not grow as quickly as chicory or lucerne under severe moisture deficits. This can occur on very light soils.

Persistence of **Tonic** can be poor on heavy and poorly-drained soils where pugging damage cannot be avoided. It can also have reduced persistence when mixed with dense grasses in wet soils. It is not uncommon to see significant reductions in plant numbers within 12 months if the paddock has been flooded or waterlogged for long periods of time.

Managing the establishment of large areas of a farm in **Tonic** each spring may require feed budget planning to ensure farm feed deficits are not created. It normally takes 8-10 weeks from planting to first grazing, with the total time a paddock is out of the grazing round being 9-12 weeks (depending on the speed of establishment programme).

Plantain has the potential to cause bloat, although this is less likely than on clover-dominant pastures. Actual cases have been rare, because most grazing occurs outside the high risk period in early spring, it is fed as a small part of a daily diet, and it is usually grazed in the afternoon rather than the morning. Nitrate levels can also reach high levels in plantain but cases of toxicity are rare and are no greater than any other forage species.

There are anecdotes that dairy cows have refused to eat plantain at certain times of the year and, unfortunately, it is not known what may cause this. In the three years of growing plantain at Scott Farm (DairyNZ) in the Waikato the cows have never refused to eat it, however, there have been times when it takes them longer to graze the feed available to the desired residual. To minimise the risk of unpalatability, plantain swards should be grazed relatively frequently (≤ 25 cm height) when the seed head is relatively immature and before the leaves become too old and fibrous. In addition, frequent applications of Nitrogen are essential to keep the plant actively growing.

Adding **Tonic** to a chicory crop mixes is not recommended. While chicory is also a herb, it has several differences to plantain. Adding **Tonic** also reduces herbicide options, and makes pasture composition unpredictable.