Plantain management (1-78b)

Introduction
This farm fact is based on NZ trials and experiences growing the plantain cultivar Tonic under dairy cow grazing. Other plantain cultivars may require different management. This farm fact focuses on management; for establishment guidelines see farm fact 1-78a.

Key points
- Plantain is an herb with a fibrous, coarse root system that produces 10-19 t DM/ha/year.
- Plantain tends to be more persistent than chicory, often producing the yields above for 2-3 years.
- Plantain should be grazed at 25 cm height; allowing the plant to grow for longer will reduce herbage quality as older leaves are more fibrous and more stem will have grown.
- To maximise yield and persistence avoid overgrazing (e.g. lower than 5 cm) and treading damage on wet soil.
- Plantain is highly responsive to nitrogen fertiliser.

Characteristics of plantain
Plantain grows throughout New Zealand however; it is best suited to dairy farm situations where the amount and quality of summer feed limits milk production.

Plantain plants have a fibrous, coarse root system which provides moderate drought tolerance. Despite the moderate drought tolerance, plantain still requires moisture to grow well, and under severe drought growth will be reduced. Under these conditions plants will wilt; however, they recover quickly following rain or application of irrigation or effluent.

Plantain yields recorded in New Zealand over a full year range from 10-19 t DM/ha/year (average = 16 t DM/ha). These yields are comparable to the annual yield of ryegrass pastures.

Growth rates of Tonic plantain between spring and autumn range between 25 and 80 kg DM/ha/day, potentially peaking at 140 kg DM/ha/day in summer. Growth rates during winter are lower (15-35 kg DM/ha/day).

Plantain tends to be more persistent than chicory, often remaining productive for 2-3 years. Plant numbers will decline over this time, with the rate of decline depending largely on weed control, nitrogen fertiliser application and grazing management (particularly during wet conditions to avoid pugging). Many weeds tend to invade plantain crops over time.

Management
1. As a pasture mix
Where plantain is in a pasture mix the paddock should be managed as it would be as a normal grass/clover pasture, grazing to residuals of 1500-1600 kg DM/ha.
2. As a special purpose crop

Plantain should be first grazed no earlier than the six leaf stage (i.e. the plants have six fully grown leaves). This is normally 7-8 weeks after spring-sowing. This ensures that plants have well-developed root systems to improve survival.

Aim to feed 20% of the cows’ daily diet in plantain over a sustained period as the rumen requires time to adjust to plantain like any change in feed type.

Target covers are:  
- Pre-grazing 25 cm height (generally about 2-4 weeks regrowth)  
- Post-grazing 5 cm height

These are the heights of the leaves, ignoring the stems.

Letting the leaves grow beyond 25 cm will not accumulate any more leaf, just increase growth of the lower quality stem.

Dairy cows will readily graze lower than 5 cm and management strategies need to be in place to ensure this does not occur.

Grazing should be avoided when soils are wet as treading damage has a major impact on plant survival.

Estimating yield and feed allowance

The dry matter percentage of plantain ranges from 9-20% so yields can vary by more than 50% if DM is over- or under-estimated.

Three methods for yield estimation and allocating feed are suggested:

1. Best practice
   - Bend a 2 m length of wire into a square of 0.5m x 0.5m (=0.25m2) or join a 1.77 m length of alkathene pipe into a circle
   - Place the square or circle in four randomly chosen places in the paddock
   - Cut the plantain inside the square or circle to 5 cm height
   - Bulk up the four samples and weigh
   - Multiply by 10,000 to get fresh weight (kg/ha)
   - Take 200 g sample of fresh plantain and dry in microwave
   - Re-weigh dry plantain
   - Calculate DM % (dry weight/fresh weight)
   - Calculate kg DM/ha (Fresh weight x DM%)
   - Allocate area based on 20% of cows diet (3-4 kg DM/cow/day)

2. Rising platemeter (RPM)
   Like pasture, the rising platometer can be used to estimate the yield of plantain crops. Take at least 40-50 readings in a ‘W’ shape across the paddock and calculate yield using the equation:
   \[ \text{Yield (kg DM/ha)} = \text{RPM height (clicks)} \times 94 + 455. \]
   This equation is affected by many factors so it is important to check post-grazing residuals as below to ensure adequate herbage allocation.

3. Height based yield assessment
   Plant density has a substantial impact on yield. Since plant density differs a lot between paddocks and over time it is difficult to provide estimates of plantain yield.
As a rough guide, a dense (~180 plants/m²), first year pure plantain crop at DairyNZ had a pre-grazing mass of 3300 kg DM/ha at 25 cm height. In comparison, a less dense crop (~80 plants/m²) had a pre-grazing mass of 2300 kg DM/ha at 25 cm height.

If we assume, on average, that the pre-grazing mass of plantain at 25 cm height is 2800 kg DM/ha and the post-grazing residual of 5 cm will be 1500 kg DM/ha. This gives an available grazing of 1300 kg DM/ha.

For cows to eat 3-4 kg DM per day:
- Allocate area based on 20-30 m²/cow
- Monitor cow grazing - optimum grazing reaches 5 cm residual height after about 3 hours
- If cows reach 5 cm in less than 3 hours increase allocated area
- If after 3 hours the grazing residual is more than 5 cm decrease the allocated area.

**Fertiliser requirements**

Annual maintenance phosphate, sulphur and potassium are the same for plantain as for ryegrass pastures. Plantain is very responsive to nitrogen fertiliser, even during the summer. At least two to four applications of 35 kg N/ha post-grazing are recommended over the spring/summer period.

**Dairy systems with plantain**

The preferred system is to establish several paddocks of pure plantain close to the dairy shed. To ensure a daily diet of 3-4 kg DM/cow/day of plantain (~20% of diet), the amount of plantain planted needs to be about 5-6 ha per 100 cows.

Once well-established, an area of plantain (about 0.2 to 0.3 ha per 100 cows) should be fenced off and cows moved onto this break for 2-3 hours. The electric wires are moved during the following day and the exercise is repeated. Back-fencing is preferred to ensure good regrowth.

This system provides for a 21 day grazing rotation, but may need to be adjusted if growth of plantain is unusually slow or fast. It provides a daily diet of plantain, which is important as it reduces any rumen adjustment needed if cows are switched from ryegrass to plantain part way through a rotation.

**Herbage quality**

Well-managed plantain (0-25% stem) generally has a lower dry matter content than ryegrass pasture and contains less fibre (Table 1). The metabolisable energy (ME) content is similar, although plantain may remain better quality than ryegrass during hot, dry summers.

As plantain leaves age, they become more fibrous, less digestible, and the quality of the crop declines regardless of stem content. This is one of the reasons why relatively frequent grazing (at 25 cm height) is recommended.

Plantain also has greater mineral content (P, K, S, Ca, Mg, Na, Zn, Cu, B and Co) than ryegrass pasture.
Table 1. Herbage quality of plantain and pasture.

<table>
<thead>
<tr>
<th></th>
<th>DM (%)</th>
<th>Protein (% DM)</th>
<th>Soluble sugars + starch (% DM)</th>
<th>Fibre (% DM)</th>
<th>Digestibility (% DM)</th>
<th>ME (MJ/kg DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plantain</td>
<td>9-20</td>
<td>16-28</td>
<td>11-20</td>
<td>23-36</td>
<td>69-77</td>
<td>11.0-12.0</td>
</tr>
<tr>
<td>Pasture (spring to autumn)</td>
<td>10-30</td>
<td>12-28</td>
<td>8-21</td>
<td>40-55</td>
<td>65-85</td>
<td>9.5-12.5</td>
</tr>
</tbody>
</table>

DM = dry matter; ME = metabolisable energy. Quality may be outside these ranges depending on pasture/crop management.

Animal production

The milksolids response to plantain appears to depend on the quality of the pasture diet: if pasture quality consistently drops away in summer, then including plantain can increase per cow milksolids production.

At this stage there has not been any work done on the profitability of including plantain in a farm system, or what is the optimal proportion of the farm to have in plantain. Modeling work is underway in this area.

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 three years of growing plantain at DairyNZ in the Waikato 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.

Animal health

Plantain is considered to be low risk for facial eczema.

High nitrate levels can occur in plantain during periods of rapid growth or under certain environmental conditions (cold or overcast conditions after a period of good growing conditions). Under these conditions, a sample of the leaves should be tested for nitrates. Cases of toxicity are rare, however, probably as plantain is fed as a small part of the diet.

When grown with red and/or white clover, plantain crops have the potential to cause bloat, however; this is relatively low risk because most of the daily diet is still pasture/plantain in the recommended system.

Insect attack

In late February to mid-March, holes may begin to appear in plantain leaves. These are caused by caterpillars (e.g. common carpet moth, white butterfly, diamondback/cabbage moth).

As the caterpillars do not feed on roots or growing points, their impact is largely aesthetic. If damage is severe, however, the caterpillars can be controlled with an approved insecticide. Some farmers have also suggested that grazing every 21-24 days in late February to mid-March may reduce the caterpillar population or damage from the population.