

# Future Forage Systems Project

## Plantain/clover Hub Notes Tokaroa Farm, 3<sup>rd</sup> September 2015

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### *Future Forage Systems - Background*

The East Coast Future Forage Systems Project provides the opportunity to road-test a range of forage technologies such as lucerne, plantain and annual clovers – both as crops and on hill country. Where possible, this will consist of on-farm demonstrations where new options are benchmarked against existing farm practice. Once we understand how these alternatives perform locally, we can look at integrating them into farming systems.

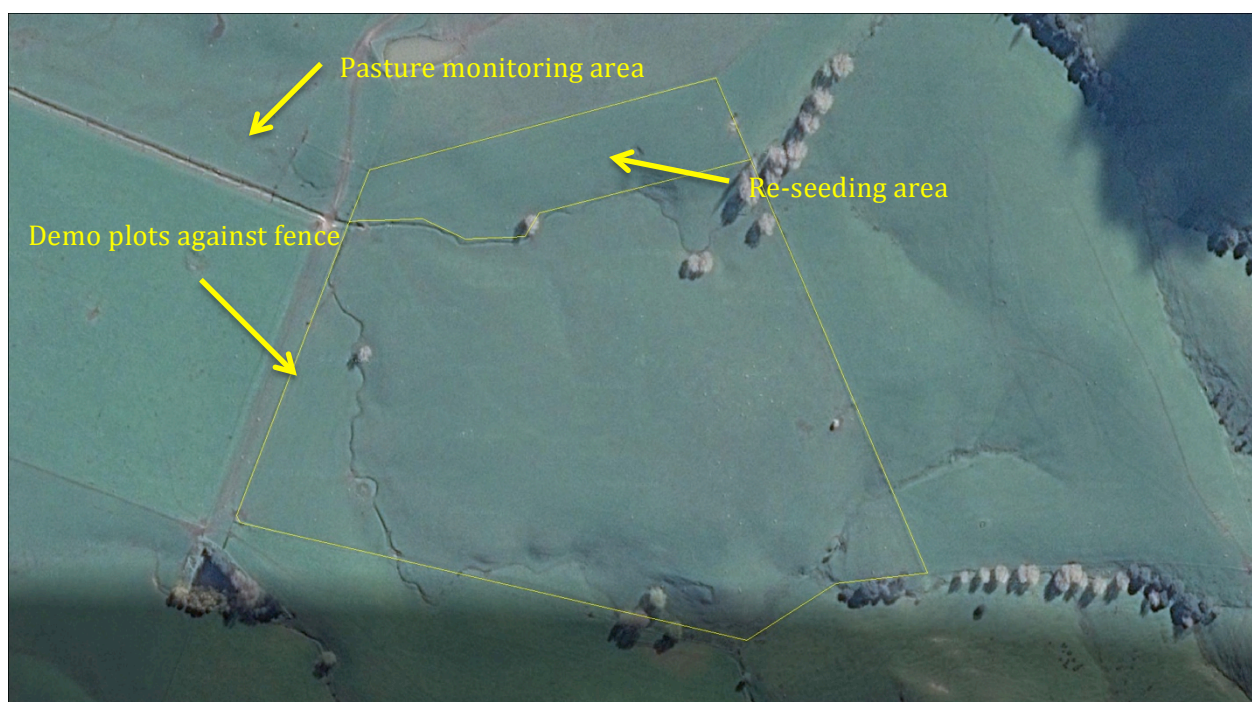
The focus at Tokaroa is to understand the contribution that plantain and clovers can make to lamb and ewe growth rates and how it impacts on the whole farm system. Additional studies will look at reseeding of annual clovers

## 1. Plantain - Second Rush – 12.0 ha

### Objective:

- Evaluate establishment of plantain sown with perennial and annual clovers on summer dry flats.
- Obtain seasonal production and animal performance data under dryland Wairarapa conditions.
- Measure seed set and hard seededness of annual clovers following different closing dates.
- Monitor regeneration from seed bank (over several seasons).

Figure 1 – Trial site layout



### Treatments

#### Cultivation

- Spray, summer fallow
- Disk, power harrow, drilled with power harrow and then rolled
- Note – the intention was a second spray prior to sowing but it was not applied because there was so little live vegetation at sowing.

#### Seed Mix

- White clover (2 cultivars) – ‘Tribute’ or Sustain 2 kg/ha, Kopu II 2kg/ha
- Red clover – ‘Sensation’ 5 kg/ha
- Persian clover - ‘Lightning’ 2 kg/ha
- Balansa clover – ‘Bolta’ 3 kg/ha
- Arrowleaf clover – ‘Arrotas’ 2 kg/ha

- Persian clover – ‘Lightning’ 2 kg/ha
- Plantain – ‘Tonic’ 6 kg/ha

Seed cost \$280/ha (ex GST)

### **Fertiliser**

Lime – 2.5 t/ha at first cultivation

DAP - 250 kg/ha at sowing

**Closing Dates** - Three closing dates to look at seed production using on the northern 2ha area. These areas will be grazed up until closing. Closing dates to be used are:

- 5 October
- 19 October
- 2 November
- 16 November

### **Measurements**

- Plantain/clover growth rate
- Dry matter production compared to nearby pasture
- Animal weights on and off and number of grazing days
- Number of seed heads, seed yield and percentage of hard seeds

### **Timeline**

- **5 December 2014** – Sprayed (3 l WeedMaster 540T/ha (glyphosate) and 70 ml/ha Hammer (carfentrazone-ethyl) plus Pulse.
- **Late December** - Mid rip tiger disk (\$120/ha)
- **February** - Cultivated to break up clods (\$80/ha)
- **26 March 2015** – Sown with one pass power harrow direct drill (150/ha)
- **15 May 2015** – Seedling counted
- **20 May 2015** – Sprayed all northern areas with 250 ml/ha Crest (Haloxypop-P @ 130 g ai/ha) and 0.5 litre/ha, 2.5 litres/ha Dictate (Bentazone) in 200 litres/ha) and and 0.5 litre/ha Bonza (wetting agent).
- **20 May 2015** – Spray nettle affected areas with and 50 ml Headstart (flumetsulam) in 200 litres/ha.
- **10 July 2015** – Plant production measured
- **21 August 2015** – Plant production measured

### **Results:**

**Weeds.** During April 2015 it became apparent that areas of the paddock had significant numbers of grass, flat thistle or nettle seedlings developing and all but the southern facing areas were sprayed in May.

**Ducks.** Paradise duck have been preferentially grazing much of the small sown areas of Persian clover. As they concentrate in small areas quite a bit of foliage has been affected. Often all 3 trifoliolate leaves have been removed with only petioles left. Overall plants may not have suffered too much they have compensated by growing laterally whilst being grazed.

**Insects/slugs.** None seen and no apparent damage

**Plant establishment.** Very good numbers of seedlings had established when counted on 15 May 2015.

**Seedling counts in the trial area 8 weeks from sowing**

	Area	Species	Seedlings per m <sup>2</sup>
15-May-15	Paddock	Plantain	163.8
		Clover	360.4

**Production. Pasture** – Six cages were placed in a nearby paddock on 27 May 2015. Production cuts were taken and cages replaced on trimmed sites for rate of growth measurements.

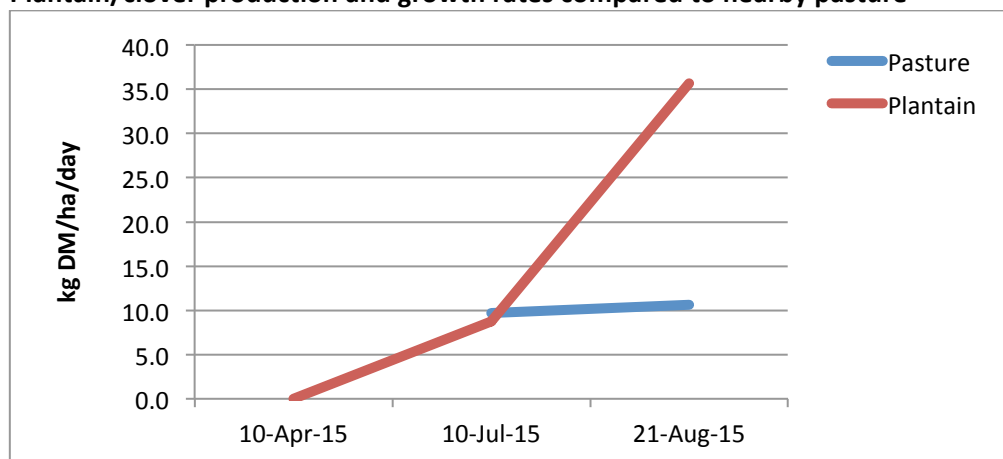
**Plantain/clover production and growth rates compared to nearby pasture**

Date Cut	Treatment	Days	Total kg DM/ha	Growth rate kg DM/day
10-Jul-15	Pasture control	54	523.7	9.7
	Plantain/clover North	106	933.4	8.8
	Plantain/clover South	106	2528.9	23.9
21-Aug-15	Pasture	42	446.3	10.6
	Plantain	42	1498.3	13.6

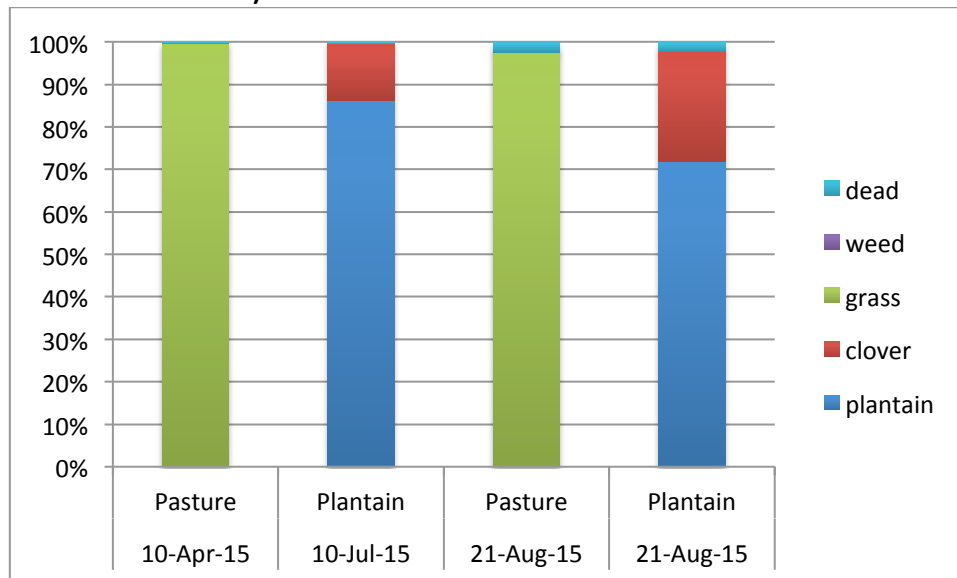
**Sward composition – Percentage of plantain, clover, grass, weeds and dead material**

Date Cut	Treatment	% Plantain	% Clover	% Grass	% Weed	% Dead
10-Jul-15	Pasture control					
	Plantain/clover North	86.1	13.5	0.0	0.0	0.4
	Plantain/clover South	75.3	15.6	5.9	3.2	0.4
21-Aug-15	Pasture control		0.0	97.6	0.0	2.4
	Plantain/clover North	71.9	25.8	0.1	0.0	2.2

**Plantain/clover production and growth rates compared to nearby pasture**



**Composition Plantain/clover and pasture control (% plantain, clover, grasses, weeds and dead material at each cut)**



***Tokaroa Farm***

- Area 607 (585 effective)
- 80 ha in plantain/clover (15%)
- Farmed in conjunction with Bush Gully 808 ha, 30 km away, managed by Dan’s brother Matt.

***What plantain has enabled:***

Compared to 5 years ago

- Moved from a 30/70 fat store to a 70/30 fat/store operation
- Increase in cull ewe weights of 3-4 kg carcass weight and 3 weeks earlier slaughter.
- Greater percentage of first draft lambs and first draft away earlier. Second draft going forward 3-4 kg ahead
- Stores lambs doing 300g day post weaning (these are bottom third)

***Discussion points:***

- Dry autumn causes establishment problems.
- Lack of spray prior to drilling – did this force the need for the post emergence spray
- Establishment on northern vs southern faces
- Effect of post emergence spray on production.
- Effectiveness of most emergence spray on grasses and weeds
- What percentage of Tokaroa Farm should be plantain/clover
- Surpluses – are there any and when

## 2. Annual clover – small plot trial – 12.0 ha

### Objective:

- Measure the development of currently available cultivars of arrowleaf, balansa, gland, Persian and subterranean clovers under dryland Wairarapa conditions.
- Measure seed set and hard seededness following different closing dates.
- Monitor regeneration from seed bank (over several seasons).

### Treatments

#### Cultivar and Species

Fourteen plots 15m x 3 m were sown with a single cultivar of an annual clover. These were:

1. 15 kg/ha 'Trikkala' subterranean clover – tolerates water logging
2. 15 kg/ha 'Antas' subterranean clover – high winter and spring growth, poor seed burial
3. 15 kg/ha 'Woogenellup' subterranean clover - mid flowering
4. 15 kg/ha 'Rosabrook' subterranean clover -
5. 15 kg/ha 'Denmark' subterranean clover – replacement for 'Mt Barker' – mid to late flowering
6. 15 kg/ha 'Leua' subterranean clover – mid to late flowering
7. 15 kg/ha 'Karadale' subterranean clover – mid to late flowering
8. 6 kg/ha 'Arotas' arrowleaf clover – intolerant of waterlogging
9. 6 kg/ha 'Cefalu' Arrowleaf clover – intolerant of waterlogging
10. 4 kg/ha 'Lusa' Persian clover– tolerates waterlogging
11. 4 kg/ha 'Lightning' Persian clover– tolerates waterlogging
12. 4 kg/ha 'Viper' Balansa clover
13. 4 kg/ha 'Prima' gland clover – winter active, very early flowering

### Measurements

- Flowering date and duration
- Seed production
- Number of seed heads, seed yield and percentage of hard seeds

### Timeline

- **5 December 2014** – Sprayed (3 l WeedMaster 540T/ha (glyphosate) and 70 ml/ha Hammer (carfentrazone-ethyl) plus Pulse.
- **26 March 2015** – Sown with one pass power harrow direct drill
- **15 May 2015** – Seedling counted
- **20 May 2015** – Sprayed all northern areas with 250 ml/ha Crest (Haloxypop-P @ 130 g ai/ha), 2.5 litres/ha Dictate (Bentazone) in 200 litres/ha and 0.5 litre/ha Bonza (wetting agent)

### Notes on species and cultivars

**Arrowleaf clover (*Trifolium vesiculosum*)** Originally from the Mediterranean, Arrowleaf clover is

developing a reputation for very good growth in late spring and summer. An annual legume, it is suitable for sheep/beef grazing or hay/silage production. Provides valuable high quality feed over late spring/summer. It is relatively new to New Zealand and has been used successfully in Hawke's Bay for lamb fattening and as a late season hay crop. As a single species during November and December it grew at 153kg DM/ha/day in a Lincoln University experiment. 'Arrotas' produced 9,800 kg DM/ha compared with 3,370 kg DM/ha from subterranean and 1,790 kg DM/ha from white clover. It is widely used in temperate Australia and USA where annual rainfall is below 500 mm. Lamb growth rates of 254 g/day on Arrowleaf only pastures for November to January have been reported from dry land Victorian trials. Does not tolerate cold conditions or wet feet.

#### **Balansa clover (*Trifolium michelianum*)**

Balansa clover is a self-regenerating annual clover, with most growth occurring over spring in cold climates but winter growth can be quite impressive in warmer parts of the North Island. It has been used as an alternative to subterranean clover where soils are wet in winter. As it seeds above ground, plants need to be spelled or lightly stocked in the first spring to allow enough seed to be set for future regeneration. The seed shed by plants can require more than one year to germinate, so plants are not always present in the second winter after planting. Requires careful management to ensure re-establishment from seed.

**Persian clover (*Trifolium resupinatum* L. var. *majus* Boiss. (ssp. *majus*))** Persian clover is native to wider Persia (Turkey, Afghanistan, Iraq, Iran) and Greece and performs well in temperate dryland pastures of southern Australia. Persian clover is very tolerant of waterlogged soils during winter and has some tolerance to saline conditions. Very softseeded and prone to false strikes.

In a recent trial in Marlborough Persian clover produced the most amount of dry matter of 8 clovers trialled, growing 19,300 kg DM over 250 days. Very good lamb and ewe growth rates have been reported from Hawkes Bay. When grown as a pure stand phytotoxicity has occasionally been reported in ewes in New Zealand.

#### **Gland clover (*Trifolium glanduliferum*)**

Little work has been done with Gland clover in New Zealand. Gland clover can be used as a component of long-term pastures or in the pasture phase of cropping rotations to provide high quality fodder for livestock. Very winter active and extremely early flowering. Poor performer in most trials.

#### **Subterranean clover (*Trifolium subterraneum* L.)**

Named for its ability to bury its seed, its seed heads bend and are pushed into the soil surface after flowering, so the plant survives the summer as a seed. As an annual, the plant disappears from pastures during summer. The seeds germinate when rainfall resumes, but some can fail during subsequent dry spells ("false strike"). Different cultivars have different amounts of hardseed.

Subclover is useful in dry east coast regions, particularly in situations too dry for white clover, where it can contribute up to 20% of the herbage during the cool season. However, it is important to minimise grazing during flowering to allow maximum seed set and to use cultivars with an appropriate flowering time to ensure it sets seed before the dry summer. Late-flowering cultivars are best suited to NZ.

## Results:

**Plant establishment** – Seedling establishment was poorer than expected and probably related to the dry conditions at sowing

### Clover seedling counts (seedlings/m<sup>2</sup>) by establishment technique 8 weeks from sowing

Plot	Clover	Cultivar	Seedlings /m <sup>2</sup>
1	Subterranean	Trikkala	51.1
2	Subterranean	Antas	85.5
3	Subterranean	Woogenellup	101.5
4	Subterranean	Rosabrook	71.2
5	Subterranean	Denmark	68.6
6	Subterranean	Leura	59.4
7	Subterranean	Karridale	Late sown
8	Arrowleaf	Arotas	172.2
9	Arrowleaf	Cefalu	140.6
10	Persian	Lusa	120.4
11	Persian	Lightning	61.9
12	Balansa	Viper	80.0
13	Gland	Prima	149.9
14	Mix		81.7

**Ducks.** Paradise duck have been preferentially grazing much of the small sown areas of Persian clover. As they concentrate in small areas quite a bit of foliage has been affected. Often all 3 trifoliate leaves have been removed, leaving behind only the petiole only. Overall it does not appear that that the plants have suffered too much as they have grown laterally whilst being grazed.

### Lessons/observations to date:

- Ducks
- Second spray prior to sowing

### Discussion points:

- Winter activity of different species and cultivars
- Definite differences in subterranean clover cultivars
- Monitoring & measurements



## Plantain Notes

### Establishment and weed control

Plantain should be sown in autumn once sufficient rainfall has occurred. Seed should be sown at a depth of 10 mm at rates of 6-8 kg/ha when sown alone, or 1-3 kg/ha when sown in a mixture (seed size is approx. 500,000/kg). Plantain will also establish when broadcast (followed by rolling) onto a well prepared seedbed. With careful preparation plantain has been successfully oversown into uncultivable hill country, however it is essential that good seed-soil contact occurs and that the existing sward is well controlled or suppressed.

Annual clovers (arrowleaf, balansa and Persian) have been shown to be very compatible with plantain. Larger leaved white clovers should also be considered as they will withstand rotational grazing.

Plantain can be fairly slow to establish and does not compete well with other species with high seedling vigour. A well prepared, weed free seedbed is necessary as post emergence weed control can be difficult. Pre-emergent weed control is important as plantain does not tolerate phenoxy-based herbicides (e.g. 2, 4-D, MCPA, MCPB), diflufenican or flumetsulam, so it can be difficult to control many weed species that may begin to compete with it. Currently there are no labelled recommendations for controlling grasses or weeds in plantain. What are people using ?

Springtails can be a problem as seedlings establish. Careful monitoring (every three days) should be undertaken.

### Grazing management

Initial grazing management is critical to maintain plant numbers as the timing and severity of the first grazing after sowing will affect plantain survival and persistence. If plants are only grazed after they have six fully developed leaves (typically 25-30 cm high with 'Tonic') plant losses are generally less than 10%. Grazing earlier than this increases plant losses and reduces pasture persistence as root reserves will not have built up to support post-grazing regrowth.

Because of its high palatability, plantain will be normally be preferentially grazed in mixed pastures. As with lucerne, plantain should be rotationally grazed to prevent damage to the crown and growing points, and to maintain feed quality. Plants should only be grazed down to 8 cm and then left for about 2 – 6 weeks before re-grazing when regrowth should be about 20 - 25 cm high. This translates to pre-grazing herbage levels of 2000/3500 kg DM/ha and post-grazing residuals of 1000/2000 kg DM/ha.

Feed quality and palatability decline with flowering as the proportion of stalk increases. Frequent grazing will minimise the production of seed heads. Animals typically graze the younger, more palatable leaves first. Grazing frequency is a compromise between maximising animal production and allowing plants time to recover from grazing. Frequent grazing (every 2 weeks) down to 8 cm is recommended as a compromise between best production and nutritive value

**Persistence:** - Few studies have reported contributions of plantain in mixed swards at greater than 15%, 4-5 years after establishment. Plants are lost from the sward through competition from other species and by grazing and damage. If pugging occurs during wet weather, plant populations can be severely reduced. While plantain appears tolerant of hard grazing it must be allowed to recover to 5-7 leaves or 25-30 cm in height, which allows critical root reserves to be replenished. Plantain is very free seeding and, if allowed, seed set over summer can exceed 400 kg/ha. It has been advocated that allowing older, thinner plantain pastures can be rejuvenated by letting them set seed. Bare ground is a requirement for successful reestablishment from seed.

Repeated over grazing and grass invasion are the most common reasons for stand decline. Spraying to remove grasses is generally very successful.

Plantain moth has been a problem in some instances from the second year onwards in the late summer and autumn.. There are no formal recommendations as to when to spray. If many of the newest leaves are being attacked spraying should be considered. .... What are people having success with

## Plantain/grass comparisons

There have been a small number of trials which have compared animal performance on both grass/clover and plantain/clover, these have been summarised below. All have shown an advantage to plantain/clover.

### Summary of lamb growth on plantain and pasture

	Lamb growth rate (LWG/day g) on grass (DO%)	Lamb growth rate (LWG/day g) on plantain (DO%)	Lamb growth rate (LWG/day g) advantage to plantain	Lamb growth rate (LWG/day g) on plantain corrected for DO% advantage of 2%	Lamb growth rate (LWG/day g) advantage after DO% correction	No. farms
Lambs on hoggets	229	280	+51 (+22%)	302	+73 (+32%)	3
Lambs on ewes	297	342	+45 (+15%)	364	67 (+22%)	5
Lambs post weaning lambs	190	230	+40 (+21%)	252	62 (+33%)	3

### Summary of ewe and hogget performance on plantain and pasture at weaning

	Ewe/hogget weight (kg) off grass	Ewe/hogget weaning weights (kg) off plantain	Ewe/hogget weight advantage (kg) to plantain	Ewe/hogget weight (kg) corrected for DO% advantage of 2%	Ewe/hogget weight advantage (kg) to plantain after correction	No. farms
Hogget at weaning	57.1	61.8	+4.7 (8.2%)	64.5	+7.4 (+13%)	3
Ewe at weaning	66.4	75.3	+8.9 (+13%)	78.6	+12.2 (+18%)	4