Future Forage Systems Project

Plantain and Oversowing – Field Day Notes

Castlepoint Station, 31 October 2013

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 Castlepoint Station is to improve the legume content of dry hill country by over-sowing a range of clovers

Current Trial Sites

Site 1 - Valley – 10.0 ha

Objectives:

- Evaluate success of over-sowing plantain and a range of annual clovers by aspect
- Seed set and hard seededness of annual clovers following different closing dates.
- Regeneration from seed bank (over several seasons).

Over-sowing seed mix:

- 5 kg/ha Tonic Plantain
- 7 kg/ha 'Arrotas' Arrowleaf clover – deep tap root well suited to summer dry
- 3 kg/ha 'Sensation' Red clover – tap rooted
- 3.5 kg/ha 'Bolta' Balansa clover – deeper and more extensive root system than white clover
- 3.5 kg/ha 'Enrich' Persian clover – tolerant of waterlogging
- 2 kg/ha 'Nomad' White clover

24 kg/ha Total

Fertiliser:

- 250 kg/ha Cropzeal 16N (NPKS 15.4, 8.0, 10.0, 9.6) at over-sowing

Measurements

- Seed and fertiliser distribution
- Seedlings at 9 weeks/plant numbers before first grazing
- Plant numbers at closing
- Number of seed heads, seed set and percentage of hard seeds

Timeline

- **22 November 2012** - 1st spray and fallow – 3l/ha Roundup Transorb (glyphosate) + 40g/ha Granstar (tribenuron-methyl) in 100 l water /ha
- **26 March 2013** - Spot spray variegated thistles with 2 l Agritone (MCPA) in 100 litres water/ha
- **28 March 2013** - 2nd spray - 2.5 l/ha Roundup Transorb (glyphosate) + 100ml/100l Pulse + 40 g/ha Granstar (tribenuron-methyl) in 100 l water/ha
- **3 April 2013** - Fertiliser - 250 kg/ha Cropzeal 16 (NPKS 15.4, 8.0, 10.0, 9.6)
- **4 April 2013** – Seed over-sown by helicopter
- **10 April 2013** - Post over-sowing grazing and treading with 2100 hoggets chased around the paddock for four hours
- **9-11 June 2013** - Counts of clover seedlings along a transect. Exclusion cages placed on representative sites
- **28**-**30 June 2013** – first grazing with 800 hoggets
- **10 August 2013** – production cuts taken
- **29 September 2013** – production cuts taken

Results:

Seed and fertiliser distribution – Collectors were placed at 6 metre intervals on a diagonal 48 metre line downhill across northern facing steeper country. Seed and fertiliser were sown on different days. There was a wide range in the sowing rates recorded in the collection buckets for clovers, plantain and fertiliser. Over a short transect the average rate of clover seed (38 kg/ha) twice the planned rate of 19 kg/ha (Figure 1). The average plantain over-sowing rate along the transect line was 8.4 kg/ha, nearly twice the planned rate of 5 kg/ha (Figure 2). There was a high correlation between clover seed and plantain seed in each collector, suggesting that the seeds were behaving similarly when being sown and that some areas were receiving more seed. Note – the individual seed weight for plantain is very similar to the average of the clovers over-sown.

Figure 1 - Clover over-sowing rate along downslope transect 0=uphill end (Target rate = 19 kg/ha)

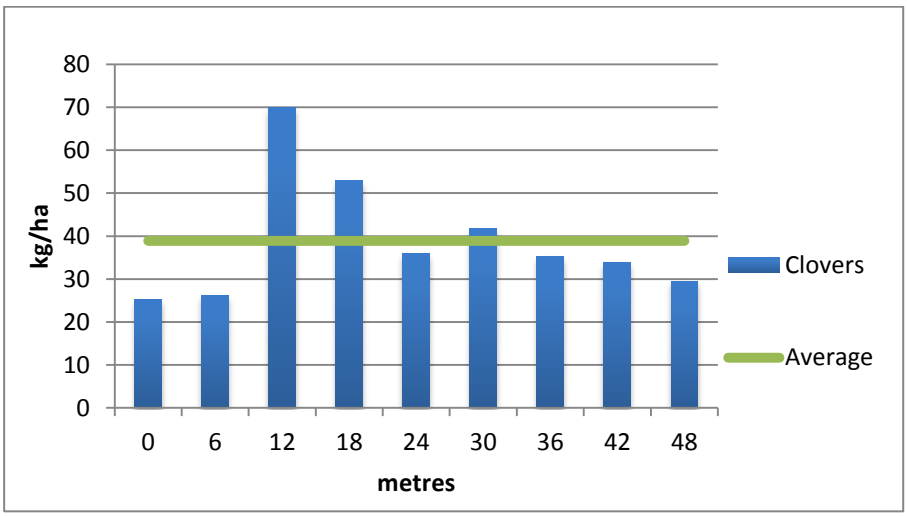
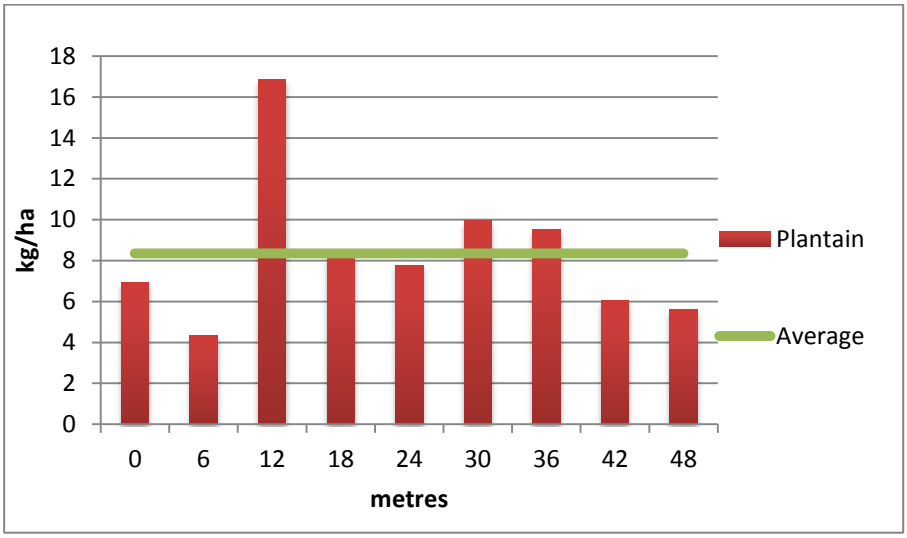


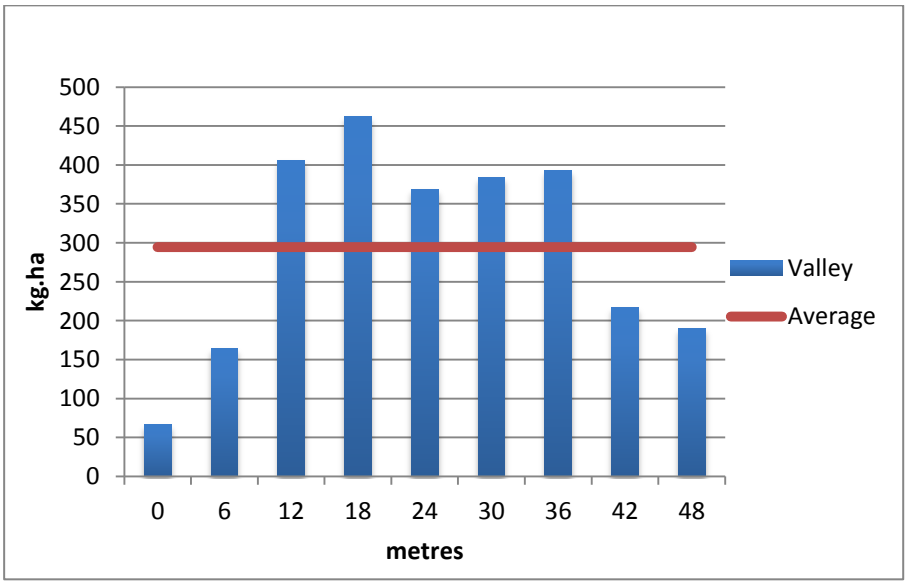
Figure 2 - Plantain over-sowing rate along downslope transect 0=uphill end (Target rate = 5 kg/ha)



Fertiliser along the transect averaged 294 kg/ha vs the target rate of 250 kg/ha. However there was a large range in the amount received by individual collectors, range 66-392 kg/ha (Figure 3).

The reasons for the high seeding rate collected are not easily explained as we do not yet have the helicopter flight paths. However, looking at the paddock there appear to be areas where there are less clover and plantain plants. A decrease in seed sown at one location will mean higher seed rates elsewhere.

Figure 3 - Fertiliser application rate along downslope transect 0=uphill (Target rate = 250 kg/ha)



Seedling establishment – Seedlings of clover and plantain were counted along 50 metre transects that covered a range of aspects (Table 1). Establishment of clovers and plantain was very good in all aspects other than southern slopes and the easy top slopes. There was very poor, almost nil, establishment of seedlings in the moist flats between the two hills - this area was not counted. The reason for the establishment failure could be due to distribution, residual effects of MCPA or insect damage. Establishment rates in excess of 100 clover plants per square metre are very good and reflect the high seeding rate used. The high establishment of plantain from over-sowing is very encouraging.

Table 1 - Seedling counts 9 weeks after over-sowing

		Seedlings per m^2	
Transect	Slope	Clover	Plantain
A	Dry north upper	114.2	77.8
B	Dry north lower	135.7	55.4
C	Moist flats	202.7	114.7
D	South slopes	50.2	46.5
E	Flat tops	53.1	27.5

Plantain and clover production - Cages were placed at 12 locations representing a range of aspects in Valley. Cages were cut at 2 cm above the ground on 10 August 2013 and 5 cm above ground 29 September 2013. After each cutting cages were replaced on representative areas that were then trimmed to 5 cm. Total dry matter (DM), growth rate per day and the proportion of grass, plantain, clovers, weed and dad matter were measured (Tables 2).

Table 2 – Production and pasture components from oversowing to 10 August 2013

			Growth rate					
Date	Land Class	kg DM/ha	kg DM/day	% Grass	% Clover	% Plantain	% Weed	% Dead
10/8/13	Flat moist	3406.7	26.4	16.7	5.2	73.0	1.1	4.1
	Flat top	2673.0	20.7	1.2	14.0	78.6	0.0	6.2
	Inter-track - North	2938.6	22.8	16.7	10.9	62.7	0.0	9.8
	Southern	719.0	5.6	2.9	11.7	76.7	1.7	7.0
	Eastern	1830.7	14.2	5.9	22.7	61.7	0.0	9.8
29/9/13	Flat moist	1918.6	39.2	20.5	11.4	55.5	11.5	1.0
	Flat top	3409.2	69.6	12.2	17.3	70.1	0.5	0.0
	Inter-track - North	1778.4	36.3	1.4	11.8	84.7	0.7	1.3
	Southern	1470.5	30.0	13.0	21.4	62.6	1.3	1.7
	Eastern	2613.5	53.3	4.5	35.7	48.2	8.0	3.6

On all sites there was a very high contribution of plantain to the sward (range 48 to 87%). The contribution of clover was in the range (5-35 %). The vigour of the plantain in the flat moist areas appears to have suppressed clover growth somewhat. The highest growth rate was on the moist flats as expected. For the period from oversowing until August, north facing inter-track areas produced 87% of that grown on the moist flats. When the first cut data is compared to similar land in Horse

(oversowing trial) production from clover and plantain at Valley was five greater (2938 kg/ha DM vs 566 kg DM/ha) for the same period (Table 3).

In the period August – September the growth rate equalled or exceeded 30 kg DM/ha/day on all land classes with a maximum recorded of 69 kg DM/ha/day. This comparing similar aspect and slopes in the annual clover alone trail (Horse) that produced 43 kg DM/ha/day (Table 4).

Lessons/observations to date:

- Fallow/double spray very successful - Good control of rats tail and rushes in particular
- Successful introduction of clovers and plantain into most aspects. Thatch preventing seedling establishment in some inter-track areas
- The sowing rate of platain of moist flats was probably too high 3-4 kg/ha may have been adequate.
- Seed/plant striping evident in some areas – less than ideal distribution of seed and fertiliser
- Large areas of moist country in middle flats with no seedlings – either not sown, spray damage or insect damage? But no bug damage evident in June. Thistle spray may have had an impact as excessive amounts of MCPA (Agritone) in the soil may temporarily inhibit seed germination/ plant growth.
- Poor seedling numbers on crest – desiccation of seedlings post over-sowing?
- Thistles require special attention. Thistle seedlings are providing large amount of competition on camp areas in August. Bty September thistles had become a problem in several areas of the paddock.

Grazing recommendations:

- Graze Valley when plantain has 6 or 7 true leaves. True leaves must be fully or very near fully expanded.
- Grazing should be done to minimise pugging as plantain crowns are very susceptible to damage when ground is wet.
- The first grazing should remove no more than 2/3 of the existing herbage. Leave 6-8 cm behind. This will require a hot wire along the bottom of the block to fence off areas with well advanced plants. Other areas may require fencing off and grazing as they become ready for the first graze.

Site 2 - Horse (16.6 ha) Oxen (11.2 ha) & Cob (10.9 ha)

Objectives:

- Directly improve the legume content of dry hill country (i.e. over-sowing without spraying) and obtain stock performance data if possible.
- Compare the effects of a sward suppressant spray on clover establishment
- Compare the effects of different closing dates on the ability of aerially seeding annual clovers to set seed and re-establish.

Over-sowing seed mix:

- 7 kg/ha 'Arrotas' Arrowleaf clover
- 3.5 kg/ha 'Bolta' Balansa clover
- 3.5 kg/ha 'Enrich' Persian clover
- 1 kg/ha 'Prima' Gland clover
  15 kg/ha total

Closing dates for re-seeding:

- Cob (right-hand side) – Control
- Horse – (middle) - Early close 1st November
- Oxen – (left hand side) - Later close 1st December
- Additional earlier closing dates within paddocks using cages.

Fertiliser:

- Nil at sowing – planned for autumn (not yet applied)

Measurements:

- Stock weights in and out. Numbers of stock and days grazed
- Seed and fertiliser distribution
- Seedlings at 9 weeks/plant numbers before first grazing
- Plant numbers at closing
- Number of seed heads, seed set and percentage of hard-seeds
- Animal performance

Timeline:

- **Summer management** - Grazed as hard as possible over the summer with ewes and cows
- **26 March 2013** - Chemical top two swaths along fence line and where cover is thick prior to aerial sowing - 150 ml/ha Roundup Transorb X (glyphosate) in 100 litres water/ha to Oxen
- **4 April 2013** – Over-sown by helicopter.
- **9-12 April** - Treading with 2300 mixed age ewes for 2 days in each paddock
- **3-6 May** – 2300 mixed age ewes for 2 days in each paddock
- **7-10 June** – 2300 mixed age ewes for 2 days in each paddock
- **10 June 2013** - Total counts of clover seedlings down transect. Cages placed
- **10 August 2013** – production cuts taken
- **29 September 2013** – production cuts taken

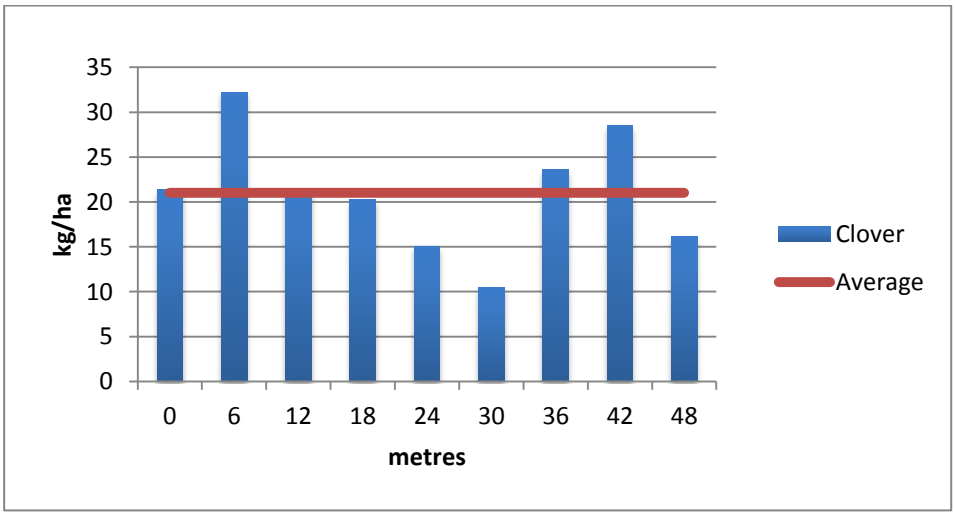
Results:

Seed distribution – Collection buckets were placed at 6 metre intervals straight down the slope for 48 metres to measure seed distribution. Over a short transect the distribution was variable (10-32 kg/ha) with the average rate of clover seed being 21 kg/ha compared to the planned rate of 15 kg/ha.

It became clear after seed germination that there were seed distribution effects within both Horse and Oxen. Visual banding of clover seedlings was clearly evident in many places within the paddocks. Some areas of the paddock have received higher seeding rates at the expense of other areas throughout the paddock where they must have received less, or possibly even no seed.

In order to further assess the distribution of seed throughout Horse on 11 August the number of 'new' clover seedlings were counted in a 40 * 40 cm quadrat every 1 metre along a transect from the bottom of the hill to the top fence. The bottom 150 metres consisted of a mix of near flat and easy slopes (Figure 5) while the rest were a mix of steeper and harder country compared to the first 150 metres. Distribution of established seedlings was variable along the transect and there were many instances of a bell shaped distribution over a 5-8 metre distance with a areas of no establishment in between. This provides further evidence that seed distribution by the helicopter was not as even as hoped for. The effect is that area that received seed often had an effective sowing rate far higher that the desired rate at the expense of areas that received less or in many cases probably no seed.

Figure 4 – Clover over-sowing rate along downslope transect 0=uphill (Target rate – 15 kg/ha)



Seedling establishment – Clover seedlings were counted along 50 metre transects that covered a range of aspects (Table 3). Establishment of clovers and plantain was low in all areas other than the sprayed steep northern aspect. While over-sown clovers are present throughout the over-sown areas their numbers are low - it appears that they have not established well because of competition from the existing sward. Further seedling counts will be undertaken although the low numbers present in June suggest that they are unlikely to make a significant contribution to production during the spring and summer as plant numbers are expected to continue to decline.

Table 3 - Seedling counts 9 weeks after over-sowing

	Spray Steep North	No Spray Moist North	Steep North
Seedlings per m^2	130.8	36.8	26.3

Dry matter production - Cages were placed at locations showing good or very good clover establishment after oversowing in both sprayed and unsprayed areas. Cages were cut at 3 cm above the ground on 10 August 2013 and again on 29 September 2013. After cutting cages were replaced onto new areas that represented good clover establishment, these areas were trimmed before cages were placed. Total dry matter (DM), growth rate per day and the proportion of grass, plantain, clovers, weed and dead matter were measured (Table 4).

It is clear that competition from resident grasses in unsprayed areas has resulted in far less clover establishing in these areas (Tables 4 & 5).

By the 10th August much of the clover present in unsprayed cages had disappeared (Table 4). After this measurement cages were placed on new 'good' areas of clover. By the 29th September there was more clover in the sward, suggesting that once the seedlings managed to become established they have persisted better as they got older (Table 5).

In August swards in sprayed plots produced nearly 1.5 times more dry matter, mostly through the contribution of clover, which was 20 times that of the unsprayed areas.

At the September cut the growth in sprayed areas continued to exceed that of unsprayed areas.

Table 4 – Production and pasture components from oversowing on good sites

Date	Treatment	kg DM/ha	Growth rate kg DM/day	kg DM/ha Grass	kg DM/ha Clover	kg DM/ha Weed	kg DM/ha Dead
10 August	Spray	569.9	4.4	290.1	222.8	0.0	57.0
	No spray	364.9	2.8	329.4	10.7	0.0	24.0
29 September	Spray	2138.4	43.6	1022.3	971.6	0.0	144.4
	No spray	1262.9	25.8	561.3	701.6	0.0	0.0

Table 5 – Pasture composition at cutting dates

Date	Treatment	% Grass	% Clover	% Weed	% Dead
10 August	Spray	50.9	39.1	0.0	10.0
	No spray	90.3	2.9	0.0	6.8
29 September	Spray	47.8	45.4	0.0	6.8
	No spray	44.4	55.6	0.0	0.0

Lessons/observations to date:

- **Arrowleaf clover** – on 29 September stem extension had commenced in plants within cages though this had not begun on plants still being grazed. No flowering was evident.
- **Balansa clover** – on 29 September immature flower heads were appearing on plants within cages. No flowers were evident within the grazed paddock areas. No stem extension was noticed on balansa plants.

- **Gland clover** – following sowing it appeared that there had been quite a lot of inoculation failure on gland clover seedlings. Many appeared small, stunted and very yellow, while others grew vigorously. Healthy plants grew straight up. By 29 September gland clover was in full flower in all cages and occasionally within the paddock. There appeared to be little gland clover within in the sward suggesting it may have been grazed out. While showy due to its very early flowering gland clover was making a very small contribution to the sward.
- **Persian clover** – on 29 September the large leaves on Persian clover were still evident within the paddock. On easier slopes there was visibly less Persian clover than in August. Exclusion cages were placed to see if it was still present within the sward.
- Pre-grazing not severe enough? Poor establishment where existing sward provided competition – better establishment where sprayed. 100 ml/ha Roundup Transorb did not provide enough suppression in moist areas
- Inoculation failure with some seedlings – gland clover?
- Contribution of gland clover to the sward is small.
- Over-sown large leaved clovers standing out quite well after two light grazings
- Some areas with good clover establishment but also very large areas with few plants.
- Seed striping was very evident in some places.
- Dry open northern sprayed areas can have high numbers of clovers.
- Significant competition in grassed areas.

Grazing recommendations:

- Post over-sowing - Graze twice as frequently in rotation. Allow to grow to only ¾ normal pre-graze height and remove stock when twice the normal residual is left.

Discussion points:

- Role of annuals – will they naturally re-establish in a sward without help. Will sowing some un-scarified seed help with future sowings in subsequent years.
- Role of tap rooted plants e.g. Arrowleaf/lucerne – in un-cultivatable hill country
- Can plantain be managed on un-cultivatable hill country, where does it fit?
- Risk of spraying/ and fallowing steep areas
- Future animal health benefits from increased legume diet