

Future Forage Systems Project

Annual Clover Hub Notes Updated Okawa, 30th October 2013



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 Okawa is to understand the establishment and management of annual clovers as a high quality lamb feed and for optimising seed set

Upper Grove – 8.8 ha

Objective:

- Evaluate establishment of Arrowleaf and Persian clovers on summer dry flats.
- Obtain seasonal production under dryland Hawke's Bay conditions.
- Measure seed set and hard seededness of annual clovers following different closing dates.
- Monitor regeneration from seed bank (over several seasons).

Treatments

Cultivation

- Spray, summer fallow & cultivate (two passes of spring tyne cultivator)
- Spray, summer fallow & direct drill
- Spray, summer fallow & broadcast

Note – it was intended to double spray, with a second spray prior to sowing but the second spray was not applied because there was little live vegetation at sowing.

Seed Mixes

1. 12 kg/ha 'Arrotas' Arrowleaf clover – deep tap root well suited to summer dry
2. 12 kg/ha 'Bolta' Persian clover – tolerates waterlogging
3. 12 kg/ha 'Arrotas' Arrowleaf clover + 12 kg/ha 'Bolta' Persian clover

Closing Dates - Three closing dates to look at seed production using cages (2m * 2 m)

- early October
- early November
- early December

Measurements

- Plant establishment
- Dry matter production compared to nearby paddocks
- Animal weights on and off and number of grazing days
- Number of seed heads, seed set and percentage of hard seeds

Timeline

- **5 April 2013** – Cultivated and Sown
- **23 April 2013** – Checked for weeds - A few broadleaf weeds, mainly mallow, grass weeds mainly bromus species
- **3 May 2013** – Checked for weeds. Arrowleaf clover had advanced to 1 – 3 trifoliate leaves. Persian clover was still slower at 1 – 2 very small trifoliate leaves. Conditions are extremely dry and compromising establishment (Noted cotyledons were dying + some first true leaves appearing). Grass (mostly) and weed competition advancing.
- **15 May 2013** – Sprayed 250 ml/ha Crest / Galant (Haloxypop-P @ 130 g ai/ha) and 1 litre/ha Bonanza (Diflufenican @ 500g ai/ha), 3 litres/ha Troy / Basagran (Bentazone @ 1440 g ai/ha), 1 litre/ha Lorsban (chlorpyrifos @ 500g ai/ha) (all in 125 litres/ha).
- **6 June 2013** – Plant establishment counts made

- **25 June 2013** – Slug bait applied to all areas of Persian clover (SlugOut)
- **26 July 2013** - Pasture production cuts
- **23 September 2013** – Pasture production cuts
- **30 September 2013** – Production cuts taken in annuals
- **22 October 2013** – Production cuts taken in annuals and western arrowleaf paddock

Figure 1 – Trial site layout



Table 1 – Layout and treatments in inset trial area

Width		
2.9 m	No Seed	Direct drill Persian
2.9 m		Broadcast Persian
2.3 m		Direct Drill Arrowleaf
7.6 m		Broadcast Arrowleaf

Towards Track

Table 2 – Paddock treatments

Peg	Widths	Drill/Broadcast	Ground Treatment
O			
	Many	Persian	Uncultivated - direct drill
N			
	Many	Persian	Uncultivated - broadcast
M			
		Direct Drill Arrowleaf 12 kg/ha (buffer)	Uncultivated - broadcast
L			
	Many	Persian 12 kg/ha	Uncultivated - broadcast
K			
		Direct Drill Arrowleaf 12 kg/ha (buffer)	Uncultivated - direct drill
J			
	Many	Arrowleaf 12 kg/ha	Uncultivated - broadcast
I			
	2	Broadcast & Cultivated Arrowleaf 12 kg/ha	Uncultivated - broadcast
H			
	1	Broadcast Arrowleaf 12 kg/ha	Uncultivated - broadcast
G			
	Many	Arrowleaf @12kg/ha	Uncultivated - direct drill
F			
	1	Broadcast Arrowleaf 12 kg/ha	Uncultivated - broadcast
E			
	3	Direct Drill Arrowleaf 12 kg/ha plus one double drilled width (un pegged)	Uncultivated – direct drill
D			
	1	Direct Drill Persian 12 kg/ha	Uncultivated – direct drill
C			
	3	Direct Drill Arrowleaf 12 kg/ha	Uncultivated direct drill
B			
	1	Broadcast Persian 12 kg/ha	Uncultivated
A			
	Many	Arrowleaf @12kg/ha	Double cultivate - direct drill
Gate			
Track			

Results:

Plant establishment – In May it became evident that there were seedling establishment issues in parts of the paddock and areas of the southern are appeared to have suffered from an insect attack. Northern parts of the paddock were largely OK. There was also a very good strike of weed and grass seedlings after the late autumn rains. Grass weeds were sprayed on the 15th May with 250 ml/ha Crest (Galant) and 1 litre/ha Bonanza, 3 litres/ha Troy (Basagran) all in 125 litres/ha. In addition an insecticide (Lorsban) was added at 1 litre/ha. An unsprayed control strip was left in the middle of the paddock.

Seedlings establishment or percentage of ground cover by clover was measured on 6 June 2013 in the small trial plots. There were large differences between direct drilled and broadcast plots, with 4-5 times more plants establishing by drilling than by broadcasting (Table 3).

Seedling counts (Table 4) and percentage of clover cover scores (Table 5) were carried out for all paddock treatments. Whilst there was a wide range between treatments, establishment was far higher in the northern part of the paddock for all treatments.

Table 3 – Seedling counts in the trial area 8 weeks from sowing

Plot	Clover	Treatment	Seedlings per m ²
V	Persian	Direct drill	160.6
W	Persian	Broadcast	42.7
X	Arrowleaf	Direct drill	209.1
Y	Arrowleaf	Broadcast	42.5

Table 4 – Seedling counts by establishment technique 8 weeks from sowing

Plot	Clover	Cultivation	Paddock	Seedlings /m ²	
Gate	Arrowleaf	Tyne	Drilled	North	21.1
Gate	Arrowleaf	Tyne	Drilled	South	11.3
Gate	Arrowleaf	Tyne	Drilled	No Spray	28.0
A	Persian	None	Broadcast	North	54.5
A	Persian	None	Broadcast	South	24.7
A	Persian	None	Broadcast	No Spray	39.3
E	Arrowleaf	None	Broadcast	North	33.7
E	Arrowleaf	None	Broadcast	South	7.0
E	Arrowleaf	None	Broadcast	No Spray	6.7
Gate	Persian	Tyne	Drilled	North	21.6

Table 5 – Clover cover (%) by establishment technique 8 weeks from sowing

Plot	Clover	Cultivation	Sowing	Paddock	% Cover
B	Arrowleaf	None	Drilled	North	16.1
B	Arrowleaf	None	Drilled	South	16.1
B	Arrowleaf	None	Drilled	No Spray	18.3
C	Persian	None	Drilled	North	20.0
C	Persian	None	Drilled	South	6.5
C	Persian	None	Drilled	No Spray	14.4

Insects. Large areas of the southern side of the paddock appear to have been subjected to an insect attack shortly after germination. The damage was severe in large patches before it was noticed. No insects were evident when examined though we suspect red legged earth mite.

Slugs. Slug damage was evident on Persian clovers only in early July. The main effect is irregular chunks of leaf missing on one or more of the trifoliate leaf. Slug eggs were evident in the soil around plants. Slug bait (SlugOut – 18g/kg metaldehyde) was applied at 6 kg/ha to all Persian clover areas together with a 4 metre buffer either side.

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. If a larger area had been sown the

effect would have been diluted (unless more ducks arrived). Overall it does not appear that the plants have suffered too much they have grown laterally whilst being grazed.

Production. Pasture – Six cages were placed in a nearby paddock on 13 April 2013. Production cuts were taken and cages replaced on trimmed sites for rate of growth measurements (Table 6). Some cages were initially discarded as they were on unidentified high fertility sites. At the 23 September cut here was wide variation between cages (15-33 kg/DM/ha/day), which appeared to reflect soil fertility (previous urine/dung patches).

Table 6 – Pasture production in adjacent paddock

Date Cut	Days	Total kg DM/ha	Growth rate kg DM/day
26-Jul-13	113	2164.8	20.6
23-Sep-13	60	1621.5	27.0

Annual legumes: - Establishment throughout the paddock was extremely variable. Water has been lying in many places in the paddock at times during the winter. This has been reflected in establishment and pasture production. This has resulted in a wide variation in the amount of clover growth in cages. The best arrowleaf plots were from the driest locations.

Plots were caged on 6 August 2013 (3 cages on each clover plus one on an area predominant in subterranean clover), best areas were selected based on growth and numbers of plants per square metre. Dry matter cuts (to 6 cm) taken from a third of the caged area on 23 September 2013 (Table 7). These cuts will slightly underestimate the total dry matter per ha. There was wide variation within Arrowleaf (1880-4250 kg DM/ha) which appeared to reflect how wet the areas caged were, with the highest production coming from the best drained site.

When visually comparing the trial paddock to other arrowleaf paddocks at Okawa the best Arrowleaf in the trial paddock appears similar to the worst in the best arrowleaf paddocks and related to the winter wet conditions.

There has been little clover evident in the unsprayed areas from early September 2013 indicating that completion from grasses had suppressed the establishment of the sown Arrowleaf clover.

Table 7 – Dry matter production and growth rates

Cut Date	Clover	Total kg DM/ha	Growth rate kg DM/day
23 September	Arrowleaf	2921.2	17.1
	Persian	2220.8	13.0
	Sub clover + Arrowleaf	2833.9	15.9
22 October 2013	Arrowleaf	4305.2	47-68
	Persian	3638.6	38-73
	Sub clover + Arrowleaf	4851.3	39

The variation in standing dry matter between Arrowleaf cages was 2674-6326 kg DM/ha and between Persian cages 3105-4389 kg DM/ha. Growth rates were calculated by measuring what had grown between 23 October and 22 October (29 days).

Growth of Arrowleaf clover is now being assessed in a nearby paddock (immediately west of the trial paddock). On the 22 October 2013 cuts were made, standing dry matter averaged 3862 kg DM/ha

with a range of 3105-4389 kg DM/ha. This paddock was last grazed on 28 September to a residual of approximately 1500-1700 kg DM/ha. In this 22 day period the growth rate of the arrowleaf has been in the order of 100 kg DM/ha/day.

Lamb growth rates: - Growth of weaned lambs grazing other Arrowleaf paddocks for the period 30 September 2013 to 22 October 2013 averaged 303 g LWG/day. This included the lambs being shorn and having two days off arrowleaf when they were grazing grass. The top 20% of another mob averaged 516 g LWG/day for a 22 day period.

Lessons/observations to date:

- Spray/fallow initially very successful, but there was a major strike of weeds and annual grasses following rains. Should sowing be delayed until after rain and when first strike of weed seeds has occurred?
- Incorporation of a broad spectrum herbicide with a pre-sowing spray would be beneficial. Lorsban (Chlorpyrifos) is compatible with Roundup.
- Annual clover seedlings are very susceptible to competition during establishment to insect attack, attack by slugs and competition from weeds.
- The use of slug bait was successful in reducing the damage to Persian clover.
- Regular monitoring for pests and early intervention is necessary.
- Application of herbicides to control emerging weeds and grasses was very effective
- Direct drilling was superior to broadcasting seed and direct drilling into cultivated ground was more successful than direct drilling into unprepared ground.
- Slugs love Persian clover at all stages of growth
- Arrowleaf dislikes waterlogging even for short periods.
- Arrowleaf is a niche plant capable of growing at 100 kg DM/ha/day in the right conditions.

Discussion points:

- Cultivation/establishment techniques
- Managing for seed set – can we achieve a permanent crop. Will sowing some un-scarified seed help with future sowings in subsequent years.
- Management for optimising animal performance

Figure 2

Arrowleaf (left), Persian (right)



Slug damage on Persian clover

