



East Coast Innovation Farm Programme

Improving legumes on dryland hill country

TUESDAY, 3 NOVEMBER 2020

Tourere, Central Hawkes Bay

WEDNESDAY, 4 NOVEMBER 2020

Te Awaawa, Masterton



0800 BEEFLAMB (0800 233 352) | WWW.BEEFLAMB.NZ.COM
BY FARMERS. FOR FARMERS

Our strategy



Vision

Our desired future for NZ's sheep and beef producers

**Profitable farmers,
thriving farming
communities,
valued by all
New Zealanders**

Priorities

How we generate impact



Unlocking market potential



Enhancing our environmental position



Supporting farming excellence



Government & public insight & engagement



Building a great organisation



INNOVATION FARM PROGRAMME

How the Innovation farm programme works

Our Innovation Farms bring together the best scientific minds and farming visionaries to investigate specific technology and on farm innovations. The programme has up to 8 farmers involved at any one time and their involvement tends to last around 3 years.

The farms focus on developing new knowledge and on delivering results that can be picked up by early adopters and high-performing farmers.

Innovation farm projects are likely to be technical in nature and involve unproven or new-to-market technologies. They tend to look at a narrow category of farming activity, rather than taking a whole-farm approach.

! Biosecurity

The recent outbreak of *Mycoplasma bovis* has highlighted the importance of on-farm biosecurity. When attending a B+LNZ field day please ensure you have clean footwear and vehicles are not carrying fresh muck or vegetation. This will help reduce the risk of spreading weeds, pests and diseases onto our host farms and across our country. To stay clean, we need to be clean.

+ Health and Safety

B+LNZ is committed to taking all practicable steps to ensure the safety of all those involved in the delivery of and participation in B+LNZ events. We recognise that this farm, like every farm, has risks associated with it. But we are committed to providing a safe environment by identifying those risks and then eliminating or minimising them. There is a farm tour

component of this field day and we ask that all attendees comply with the instructions delivered by B+LNZ staff members. **Helmets are compulsory.**

Passengers should not be carried on a quad bike designed for one person. However, one passenger may be carried where there are no alternative vehicles available and following an assessment of whether the carriage of a passenger is safe in all circumstances. Where a passenger is taken, the following conditions apply:

- Speed is not to exceed 20km/h
- Passenger is to be carried on the side of the rear load carrier facing forward
- Passenger weight is to be utilised to suit terrain (i.e. place on uphill side when traversing an incline)
- Passenger is to be physically able to ride unsupported and is to listen to and react promptly to the operator's instructions.

Our sponsors & support

The farmers involved in the programme would like to thank all those who have contributed.



- Governance Group – Sandra Faulkner, George Tatham, Bruce Wills, Simon Glennie
- Wairarapa Farm Support – Shaun Draper, Emily Crofoot, Dan Nicholson, Andy Donaldson, Sully Alsop
- Gisborne Farm Support – Jeremy Darby, John Osborne, Tim Rhodes, Mark Gemmell, James Anderson

Eastern North Island Innovation Farm Programme (2016-2020)

The aim of this programme is to get more annual legumes into dryland hill country using two different approaches:

- **Changing management to increase existing sub clover**
- **Introducing arrowleaf clover**



Subteranneum clover



Arrowleaf clover

The work has been split over 3 farms in Gisborne, Central Hawkes Bay and the Wairarapa, each with different management approaches. All three farms are focused on using clovers to increase lamb weaning weight in order to increase sheep returns. This also provides a safety valve of de-stocking before the onset of dry conditions.

Increasing legume content - why do it?

White clover typically grows in November/December by which time competing grasses have taken much of the soil moisture from dryland. Under these conditions, white clover struggles to survive. Annual clovers, on the other hand, are well-adapted to dryland. They flower and set hard seed which only germinates as the seed coat breaks down, often over a number of years. This adaptation protects the plant against having all seeds germinate in the event of a false strike. However, under set stocking the opportunities for flowering and re-seeding are limited and for this reason much of dryland hill country has very low levels of sub clover. But legumes are a key driver of production and increasing clover content will lift ewe milk production and provide a higher ME feed for suckling lambs

Baker Ag presented an analysis at a recent B+LNZ Wairarapa Farming For Profit day (Aug 2020) that showed that in a flock of 2000 ewes at 140% lambing, the effects of increasing the lamb weaning weight by 1 kg meant 5-6% more lambs finished Prime off Mum (POM) and a benefit to the bottom line of \$7,710. Increasing weaning weight by 4 kg meant an additional \$30,840.

Lamb weaning weight

	Base 27kg	28kg (+1 kg)	29kg (+2 kg)	30kg (+3kg)	33 kg (+4 kg)
Sheep sales - purchases	\$262,235	\$269,945	\$277,655	\$285,365	\$293,075
Wool	\$43,192	\$43,192	\$43,192	\$43,192	\$43,192
Total	\$305,427	\$313,137	\$313,137	\$328,557	\$336,267
Difference		\$7,710	\$15,240	\$23,130	\$30,840



Wairakaia - Rob and Sandra Faulkner

The farm is 600 ha with an average rainfall of 1000 mm. Around 140 ha is cultivatable (includes 10 ha citrus) with 200 ha of medium hill and 260 ha of steep hill country. The sheep policy is 1850 breeding ewes with a lambing percentage of 160%. Lamb weaning weights 5 years ago were 28 kg. Since Rob has been utilising plantain and clovers in the system, weaning weights have increased to 32 kg across the whole farm. A further 640 hoggets are mated and dock 80-90%. Winter lambs are purchased in autumn and killed early spring @ 21 kg carcass. Cattle policy is 130 breeding cows and 30 R2 heifers mated each year. Around 70 R1 heifers and 70 R1 bulls are purchased each year. Additional heifers/steers are purchased as required. The livestock cropping policy involves 32 ha of chicory/plantain/clover mixtures, 10 ha of brassica and 75 ha of Winterstar annual ryegrass planted after squash and seed maize.

Rob has had a lot of success with mixtures of annual clovers and plantain on cultivatable land in the last 5 years. This has allowed him to develop a system where he can identify potential cull ewes carrying twins at scanning and lambing them on plantain/clover. The exceptional performance from these plantain/clover pastures means that ewes are rotationally grazed and stocked at 12 ewes/ha. At weaning these cull ewes are killed at carcass weights of 37 kg along with around 80% of lambs at carcass weights of 19.5 kg. These results have led Rob to the current project of lifting performance of all stock through better quality feed on hill country. The aim is a system that suits the environment and where large numbers of lambs are drafted at weaning. This enables Rob to be in control of the situation - not the summer dry.



The programme at Wairakaia

Oversowing arrowleaf (full spray-out)

Arrowleaf is an erect tap rooted annual clover widely used in Australian dryland. It is seen as the most promising of the erect annual clovers for dry hill country as it produces high quality feed and is hard seeded. It is also a vigorous seeder so once a seed bank is established we expect to see ongoing germination from the hard seed for many successive years.

In April 2016, 4 ha of easterly facing hill was sown in 12 kg/ha arrowleaf (Arrotas) following a double spray-out with 5 l/ha glyphosate in Dec 2015 and Mar 2016. Yields of around 10 Tonne/ha were produced in spring 2016. The paddock was lightly grazed with lambs in Aug/Sep with no grazing after 25th September. The paddock was left to maximise seed set - measured at 425 kg/ha. The hard-seeded nature of arrowleaf meant no germination for 12 months so 7 kg/ha plantain was sown as a cover crop in April 2017. One issue that arose was that the trash resulting from the seed set was difficult to clean up and made establishment of the plantain difficult. The trash also made a great environment for slugs.



Edwards - arrowleaf allowed to set seed (Nov 2016)



Edwards - cleaning up with cows (Feb 2017)



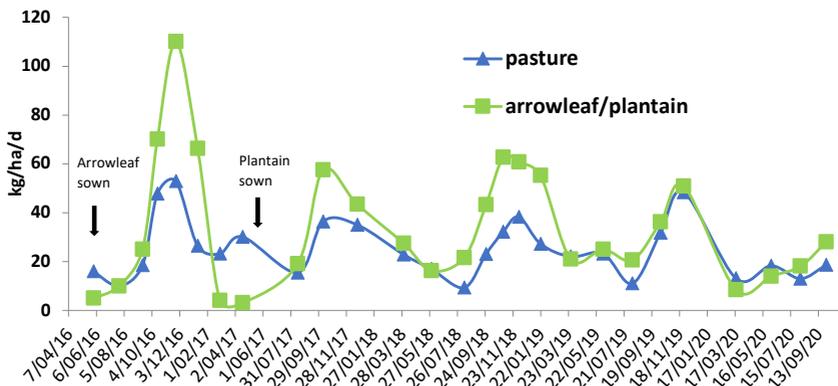
Edwards - after oversowing with plantain (Sep 2017)



Edwards - 3 years later (Sept 2019)

Nevertheless, a plantain crop was established. Yields progressively declined and after 4 years yields from the oversown paddock were the same as an adjacent resident pasture. Over 4 years the arrowleaf/plantain produced 30% more DM than the pasture (44.0 vs 33.7 tonne) but 50% more on an ME basis, assuming an average ME of 11 MJ for arrowleaf/plantain and 9.5 MJME for the resident pasture.

Edwards - arrowleaf/plantain v resident pasture



Annual dry matter production after oversowing with arrowleaf (Apr 2016) and plantain (Apr 2017) and compared with an adjacent resident pasture

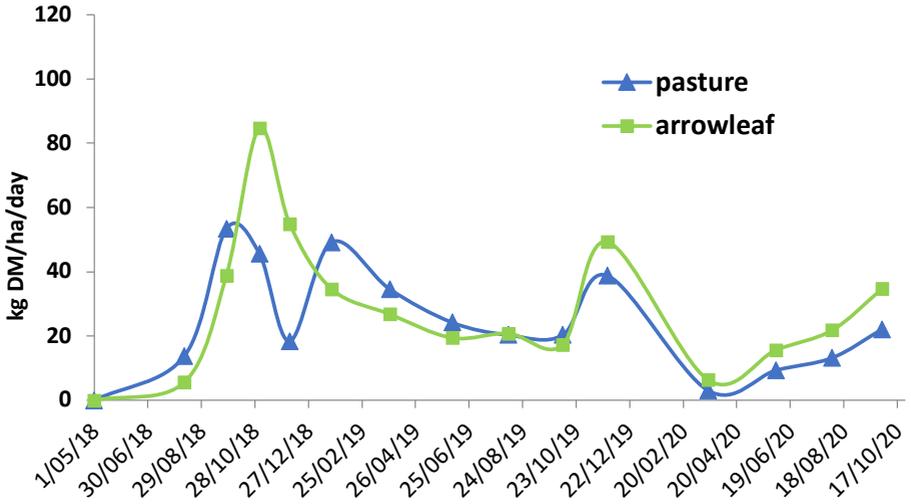
Year	Arrowleaf/plantain	Resident pasture
2016/17	11724	9398
2017/18	10681	8167
2018/19	12876	7966
2019/20	8729	8170
Total	44010	33692

Oversowing arrowleaf (suppressant spray)

In autumn 2018, a 5 ha north facing paddock was given a suppressant spray (700 ml/ha glyphosate) and oversown with 12 kg/ha of arrowleaf clover (Zulu 11). The suppressant spray did not impact on total DM production in Year 1 and the higher summer yield of the oversown arrowleaf may be due to the tap root (> 50 cm) accessing deeper moisture than the shallower root system of resident pasture. Arrowleaf set seed in 2018 but because it is hard-seeded, very little arrowleaf was present in 2019. However, grazing through the extremely dry summer of 2019/20 opened up the pasture and when rain came in March the paddock was a carpet of arrowleaf clover seedlings.



Ram - arrowleaf v resident pasture



Ram - after autumn rain (Apr 2020)

Oversowing legumes into a forestry block

The objective was to establish annual clovers before pine re-planting, allow clovers to set seed and have a seed bank of annual clovers which will give higher quality feed for finishing lambs during the early years of a developing pine plantation. Logs were harvested in Jan 2017 and the area burnt in April 2017. The area was oversown with balansa (3 kg/ha) and sub clover (mix of Antas/Woogenellup/Denmark) was sown at 9 kg/ha in late April followed by slug bait and a weed spray in July 2017. Clovers were grazed until early October and then allowed to set seed. The area was grazed in 2018 and then planted in pines in 2019.

Regenerating clovers can be seen in 2020. The benefits are expected to be higher quality feed and better lamb growth over several years when lambs are lightly grazed whilst the pine plantation is establishing.



Watergreen-Tourere – Pete Swinburn and Suzanne Hoyt

A partnership between the Swinburn and Isles families with Pete Swinburn running the operational aspects and Bruce Isles the financial side. The farm is 1250 ha with 56% cultivatable and the remainder medium and steep hill country. Average rainfall is 1000 mm and soils range from heavy clay flats through to papa/sandstone hill country. The sheep policy is 2500 breeding ewes and 750 hoggets mated. Average lamb weaning weights are 26-27 kg

with around 20% of lambs drafted POM. Winter lambs are purchased in autumn and killed in early spring. Cattle policy is to have all trading cattle with around 500 weaners and 200-400 R2 cattle purchased with flexible sale and slaughter decisions based on season and feed. An annual cropping programme involves 450 ha annually with 100 ha of summer or winter brassica, 200 ha of plantain and 150 ha of Moata or perennial ryegrass.



The programme at Watergreen-Tourere

Oversowing arrowleaf (full spray-out)

Following the success at Wairakaia the previous year, the intention was to establish a crop of arrowleaf clover on steep hill country and maximise the amount of hard seed in the soil. This would then provide a seed bank of hard seed for many years.

A steep dryland block mostly in native grasses was put through a summer crop and sown in arrowleaf (Zulu 11) at 12 kg/ha on 8th April 2017 with hoof and tooth treatment for 48 hours. Establishment costs for spray, seed, insecticide, slug bait and fertiliser was \$764/ha. Arrowleaf grew at 18 kg DM/ha/day through winter. Hoggets were lightly grazed through winter followed by light grazing with ewes and lambs through spring. In early October, the paddock was shut up to set seed, ultimately producing seed yields of 1380 kg seed/ha. Whilst the paddock grew 10.5 Tonnes of high-quality dry matter, much of this was un-utilised.

Over the last 2 years (excluding Year 1 seed set which produced 10544 kg DM/ha) the arrowleaf and plantain has averaged 7600 kg DM/ha (~ 11 MJME). The resident pasture in an adjacent steep north facing paddock has produced an average of 3600 kg DM/ha (~ 8 MJME). The resident pasture is largely ratstail, browntop and hair grasses with no clover to be seen. Our estimates are that in the 2 years post establishment, the plantain/arrowleaf has produced close to 3x the feed energy on an ME basis as the resident pasture.



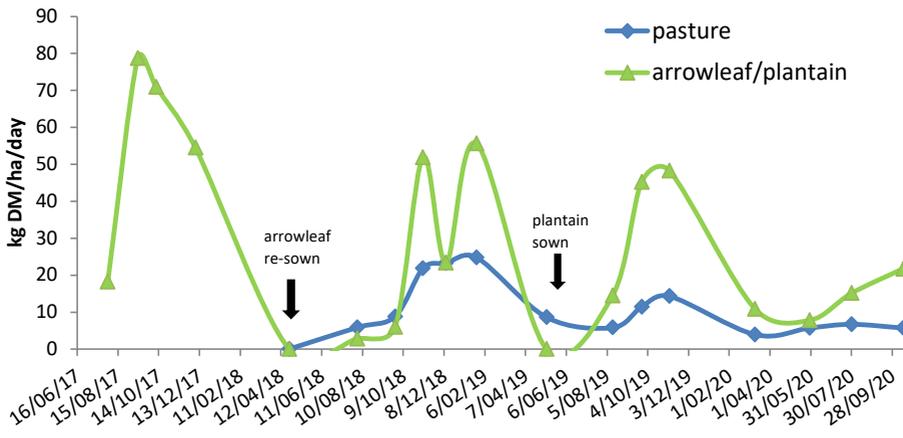


Right Triangle (March 2020)



Right Triangle (September 2020)

Right Triangle - arrowleaf/plantain v resident pasture



Fertility effects on legume content

Clover content on Tourere's north facing hill country is typically very low (<1% clover was present in Cloustones in Nov 2016). Soil tests showed a pH of 5.6, Olsen P's of 21 and Sulphur levels of 7. The paddock was given a suppressant spray (500 ml Glyphosate 360) and insecticide (Lorsban) and oversown with sub clover (12 kg/ha Antas/Woogenellup) red clover (4 kg/ha Morrow) and white clover (4 kg/ha Weka) together with slugbait (Metarex) and 200 kg/ha DAP. This lifted clover content to 6.4% in October 2018 - still deemed a relatively poor response. Clover herbage analysis showed Mo levels of 0.03 mg/kg (almost non-existent - optimum levels should be 0.15 - 0.2 mg/kg) and led to a replicated fertiliser trial being established in April 2018 with the following treatments.

- Control
- Potassium (Potassium chloride @ 50 kg K/ha)
- Phosphorus (Triple Super 2 @ 50 kg P/ha)
- Molybdenum (Mo at 100 g/ha)
- Sulphur (Sulphur 90 @ 50 kg S/ha)
- Lime (2 Tonne fine lime/ha)
- Lime + Molybdenum + Sulphur (rates as above)

The combination of Lime, Sulphur and Molybdenum resulted in a significant increase in visual clover content - to 23% in October 2018. There were no significant effects of the other fertiliser treatments. The lack of response to Molybdenum was surprising but it may be that the low pH (5.6) meant that the applied Mo was not able to be utilised. When lime was applied and the pH raised the applied Mo was able to be utilised by the clovers.



**Fertiliser effects on visual clover content
(Treatments applied 18 May 2018)**

Treatment	2018			2019
	8 Aug	5 Oct	15 Jan	1 Oct
Control	10.4	12.7	6.5	5.9
K	13.2	17.5	9.5	9.6
P	14.5	17.4	7.9	10.7
S	12.2	15.6	5.7	8.0
Lime	12.6	12.6	8.5	8.6
Mo	10.2	15.3	8.7	10.9
Lime Mo S	19.0	22.7	11.8	15.3

Oversowing sub clover (no suppressant spray)

In an attempt to increase the clover content in steep resident pasture (bottom Triangle) an oversowing trial was carried out in June 2019 using sub clover (Wooegenellup) - both uncoated and coated with inoculant/rhizobia, lime and molybdenum. Seed was spun on at 12 kg/ha (uncoated) and 20 kg/ha for coated seed. This was done on both steep and easier aspects of the same paddock. Oversowing worked on the easier contour - increasing clover content to 13-18% a year after oversowing. However, oversowing on the steep face was unsuccessful. Seed coating had no effect on establishment success.

**Visual clover % following oversowing on a north facing slope
with no clover previously present (Treatments applied June 2019)**

Date	Contour					
	Steep			Medium		
	Control	Uncoated	Coated	Control	Uncoated	Coated
1/10/19	0	1.9	1.7	0	10.4	8.9
5/11/19	0	2.2	2.0	0	12.3	12.1
25/5/20	0	1.7	0.0	0	9.0	8.6
30/7/20	0	1.9	0.0	0	13.5	18.3
14/9/20	0	1.4	0.0	0	18.8	18.0
Average	0	1.6	0.7	0	12.8	13.2



Te Awaawa Farm - Richard and Becks Tosswill

Richard and Becks farm 646 ha (622 effective) wintering 5600 stock units in the Gladstone district. The contour is medium to steep with 9% cultivatable land. A normal season has 850 mm rainfall and is winter wet and summer dry. The Tosswills farm 2800 Texel-cross ewes and over-mate 1000 replacement ewe lambs with 100 Angus breeding cows and heifers. Ewes lamb at 150% with an average lamb weaning weight of 30 kg, where they average 45% POM. The goal is to increase this to 60-70% killed POM to reduce exposure to store markets in dry seasons. Whilst the business has traditionally been 80% sheep they have been moving closer to a 60:40 sheep:cattle policy. They have added more cattle trading to allow for flexibility in the summer dry environment, lessen risk and a more manageable workload. They want to use cattle to improve pasture quality and sheep performance.

Having seen the results that can be achieved with plantain and clovers, the Tosswills became involved with this programme with the goal of increasing pasture quality on hill country and lifting the performance of their ewe flock. Given they have limited cropping country, they look at their sub clover country now as their new cropping country with their new clover management practices.

With less than 10% cultivatable, Richard wants to improve the quality of hill country pastures and use annual sub clovers to drive lactation, increasing weaning weights and overall livestock performance. He also wants to minimise the use of chemicals so needs to achieve these increases through appropriate management practices.



The programme at Te Awaawa

Demonstrating new annual clovers

At the commencement of the programme we set out to demonstrate the effects of oversowing a range of new annual legumes. A small area (~ 0.5 ha) on a dry north face was fenced off and hard grazed prior to sowing. Part of the area was given a suppressant glyphosate spray and sub clover, balansa clover, red/white clover and arrowleaf clover were oversown in autumn 2017 onto both sprayed and unsprayed areas. Sub clover (Antas/Woogenellup mix) was sown at two rates (120 kg/ha and 12 kg/ha).

The high rate of 120 kg/ha of sub was done to provide a similar number of seeds/ha as the much smaller arrowleaf seeds. Stock were used to tread the seed and then slugbait (4 kg/ha Metarex) was applied was applied at sowing. The area was grazed with cattle through winter and allowed to set seed in spring 2017.

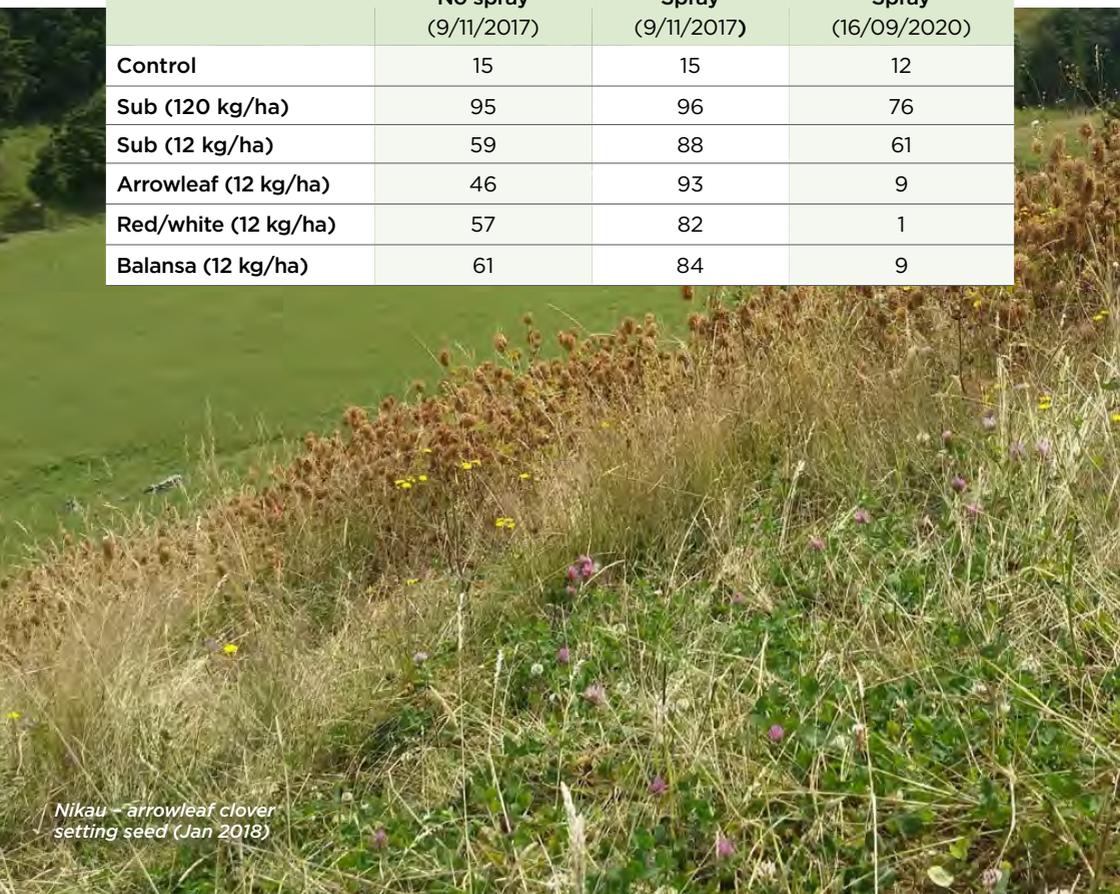
Three years on from the initial sowing, the sub clover is performing well, with the arrowleaf and balansa showing limited promise. Whilst the red/white clover grew well initially, it had virtually disappeared by May 2020.





Visual clover content (% of sward) in spring following autumn oversewing either with or without suppressant spray

Visual clover content			
	No spray (9/11/2017)	Spray (9/11/2017)	Spray (16/09/2020)
Control	15	15	12
Sub (120 kg/ha)	95	96	76
Sub (12 kg/ha)	59	88	61
Arrowleaf (12 kg/ha)	46	93	9
Red/white (12 kg/ha)	57	82	1
Balansa (12 kg/ha)	61	84	9



Changing management to increase clover content

In November 2016, the clover content in Hughes, a north facing paddock was measured and found to have 11% visual clover. This paddock was subdivided in April 2017 and one side managed in order to encourage clover growth and seeding. This involved hard grazing in late summer/autumn to allow seeds to germinate then a 6 week break and cattle grazing through late winter and spring. Cattle were removed in early October. This resulted in a massive lift in clover content (11% → 42%) and re-seeding of sub clover. The other side of the paddock was managed as part of the winter ewe rotation and then set stocked with ewes and lambs in spring. This has enabled an improvement in clover content over time.

Effect of allowing seed set on visual clover content (%)

	Control	Seeding allowed
Nov 2016 - prior to changing management	11	11
Nov 2017 - stock excluded and managed for seeding	13	42
Sep 2020 - after 3 years of normal grazing	15	35



Fertility effects on legume growth

A fertiliser trial was laid down at Te Awaawa with treatments which were identical to that at Watergreen-Tourere (page 13). Soil tests prior to the trial indicated a pH of 5.9 an Olsen P of 20 mg/L and Organic Sulphur levels of 7 mg/kg. Fertiliser treatments were applied on 5th May and plots grazed prior to stock being excluded in August. Visual clover content peaked at around 40-50% in October. Whilst clover content was variable, fertiliser treatment had no significant effect on clover content.

It is interesting to contrast the results from exactly the same trial and treatments – visual clover content at Watergreen-Tourere was around 15% in October but 40-50% at Te Awaawa.

Fertiliser effects on visual clover content (Treatments applied 5 May 2018)

Treatment	22/8/18	5/10/18	31/1/19
Control	29.8	56.3	6.6
K	22.3	48.7	4.8
P	22.2	51.1	7.3
S	27.4	51.1	6.2
Lime	18.9	40.5	8.
Mo	25.5	43.1	6.5
Lime Mo S	27.3	47.2	9.4



Oversowing without suppressant spraying

Sub clover @ 12 kg/ha (mix of Antas and Woogenellup) and white clover @ 8 kg/ha (mix of Apex and Weka) were oversown onto a hard, dry north face in Hughes in May 2017. No suppressant spray was used but insecticide and slug bait were applied after stock treading. The block was grazed with cattle through winter and spring and de-stocked in spring and allowed to flower and set seed. In Nov 2017, visual clover content was 72% in the oversown area and 25% in the area which had not been oversown. The results of the 2017 seed set can be seen in the current clover dominant sward – currently there is 50% visual clover in the oversown area versus 20% in the control area.

Visual clover content (%) 6 months after oversowing and 2 years later

	Control	Oversown
Nov 2017 – stock excluded and managed for seeding	25	72
Aug 2020 – after 2 years of normal grazing	17	34



*Hughes - control block
25% clover (Nov 2017)*



*Hughes - oversown area
72% clover (Nov 2017)*



*Hughes - control area using
exclusion cage (Sep 2020)*



*Hughes - oversown area using
exclusion cage (Sep 2020)*

A further block (Samuels) was oversown with 10 kg/ha of sub clover (mix of Antas/Denmark) and slug bait on 17 June 2019. After seed treading the paddock was then grazed with cattle through winter and early spring. In mid-spring the paddock was split with a hot wire. One half was left to set seed and the other continued to be grazed lightly by R2 heifers. The results of this seed set are not expected until autumn 2021. However there has been a cost to not grazing with cattle – dissection analysis of the sward in Aug 2020 found 28% dead matter in the area which was grazed with cattle through spring versus 49% dead matter in the area from which cattle were removed to allow sub clover seeding.



Impact of increasing clover content on financial performance

The effects of managing 20 ha of north facing country each spring for sub clover seed set were modelled on Farmax by Ed Harrison of Baker Ag. The assumption was that the amount of clover would increase over time and that in a steady state situation the feed quality on northern faces would increase from 10.4 to 12.0 MJME between August and December. Increased lamb growth rates meant that weaning weights on the sub dominant north facing country would improve from 30.4 kg to 34.7 kg. Across the whole farm, lamb weaning weights increased from 30.4 kg to 31.9 kg and the proportion of lambs sold POM increased from 29% to 46%. This meant there were 434 fewer lambs through the summer. Using a long-term lamb price of \$6.50/kg and with earlier slaughter and slightly heavier lamb carcass weights, average lamb values increased by \$6.70. The impact across the farm was an increase in total revenue of \$43,800 (7%).

Key Messages

What have we learnt about arrowleaf

- Arrowleaf is capable of very high yields (8-10 Tonne) of high-quality feed in mid-late spring. Ewes put on 100 g/d and twin lambs grew at 318 g/d on steep hill country in CHB.
 - Arrowleaf does not like cold or wet conditions so is more vigorous on the dry ridges and is better suited to warm north faces.
 - Arrowleaf is almost dormant in winter so it is susceptible to weed competition. But in spring it can out-compete everything with growth rates up to 140 kg/ha/day. We have had success in late sowing (early July) as sowing closer to its active growth period means it can better compete with weeds and grasses.
 - Arrowleaf is a prolific seeder and can set in excess of 1 Tonne seed/ha even from a late sowing. However, trying to achieve maximum seed set (i.e. leaving arrowleaf ungrazed) results in too much trash. This is difficult to clean up and results in a haven for slugs. The trash also makes it difficult to get good seed-soil contact when oversowing the following year.
- Leaving a mass of un-grazed arrowleaf to set large amounts of seed and generate trash was a mistake we made in the early days of the project. Small plot work at Poukawa showed we can graze arrowleaf later into spring and still get adequate seed set. In fact, the later we grazed arrowleaf the further we pushed vegetative growth into summer.
 - The concept of getting arrowleaf seeds into the soil and then having them germinate in subsequent years does work. However there does seem to be considerable variation between years in how much hard seed germinates.
 - Getting successful establishment is challenging – as it is with any oversowing. Slugs are also a major issue with arrowleaf as arrowleaf seems to be the most palatable item in the sward (much more palatable than sub clover).
 - **The combination of achieving good germination, having to re-sow a cover crop in the second year and dealing with slugs means that arrowleaf is a challenging species to manage on hill country.**

Management for increasing sub clover content on dryland hill country

- **The key is a change in thinking and a focus on clovers and their importance.**
- Get down and look at your pastures. If you have sub clover present, the best way to increase it is to allow it to flower and set seed. The Dick Lucas theory is that there should be sub clover plants at least every 2 metres in September/October.
- Low pH will limit clover growth as will low Molybdenum levels. This work showed that we needed lime, Mo and Sulphur to get a clover response.
- Aspect and site selection are important. There is little point in trying to manage for sub clover on a southerly face where white clover is present.
- Focus on a manageable area - it is easy to bite off more than you can chew.
- Open up pasture in summer/autumn to let resident sub clover seed germinate.
- Avoid grazing for 6 weeks after rain to let seedlings get their roots established.
- Either graze with cattle through winter or short sharp grazing with large mobs of ewes. For the rest of winter and early spring the idea is to keep the resident vegetation down (but do not overgraze it) and give the establishing clover a chance. This means either set stocking with cattle or a sheep rotation at twice the normal speed.

- Once sub clover flowers are visible (typically early October) either retire from grazing for 6 weeks or continue grazing with cattle. **Avoid set stocking with ewes and lambs.** Taking a block out at this time of year is difficult but it is helpful to improve the better country (e.g. with plantain/clover) and use the extra feed generated to enable strategic spring de-stocking of a different hill block each year.
- A paddock managed for clover flowering and seeding can provide a clover dominant sward for lambs at weaning. Thereafter, the paddock is managed as per normal.
- Because hard seed is produced, it takes time for the seed coat to break down, so the effects of seed set generally won't be seen for 18 months.

Oversowing legumes - best practice

- If clover is absent or at low levels in mid-late spring you may need to oversow. Throw out a cage or freezer basket at set stocking and see what you're actually growing!
- Ensure you are targeting the right legume species. White clover won't survive on north facing slopes. Sub clover won't survive on south facing slopes.
- Open up the area through grazing as much as possible. Seed landing on a thatch of browntop is unlikely to germinate.
- Resist the temptation to rush in with an early autumn sowing. Oversowing into dry conditions results in poor germination. Don't start your suppressant spray or oversowing programme until there

is mud – usually this means April or May. We have successfully sown Arrowleaf as late as the 1st July.

- Time your suppressant spray close to when you are going to oversow. Spraying too far in advance of oversowing means the grass has time to recover and provide competition for the germinating legume seed.
- Include an insecticide with your suppressant spray. Springtails are very fond of newly germinating clover seed.
- Check the germination certificate of the seed.
- Ensure the seed is inoculated. The inoculant has a limited life span so best practice is to keep the inoculant in the chiller and inoculate the seed yourself just before you are ready to sow.
- Slugs also like germinating clover seedlings. Don't think you can skimp on slug bait!
- It is a real challenge to get an even seed spread from a helicopter. Ironically some wind is a great equaliser as seed overlaps and is less likely to result in misses. Ask the operator to split the seed and go over it twice.
- Get as much stock treading as possible. But keep treading to less than 72 hours after sowing or seed will be germinating and be damaged by stock.
- Monitor for pest damage.
- **Thereafter grazing management to minimise damage to germinating seedlings (see previous section).**

Resources

Beef + Lamb New Zealand

There are a range of resources available on the Knowledge Hub on the B+LNZ website
www.beeflambnz.com

On Farm Research

Go to nzforagesystems.co.nz and look through the library.

Lincoln University

Guide for subterranean clover identification and use in New Zealand – compiled by the Lincoln University Dryland Pastures Research Team.

Go to research.lincoln.ac.nz and search for “**sub4spring**”.

Table 1: Grazing management to maintain and increase resident sub clover on farm scale and for introducing new sub clover cultivars into existing pastures.

When	1. Acceptable resident sub clover
September	<p>Paddock walk to identify sub clover populations</p> <p>More than 1 sub clover plant/patch every 2 m.</p> <p>Normal stocking rates, keep grazing above 1200 kg DM/ha.</p> <p>Aim to manage up to 20% of the sub clover pasture paddocks/ blocks each year in a sub clover friendly manner to allow more reseeded than normal (steady state).</p>
Mid-Sep onwards	<p>Identify when sub clover flowers are obvious</p> <p>This will depend on the sub clover cultivar (check the Sub Clover Guide – Search for “sub clover identification” on the B+LNZ website Knowledge Hub).</p> <p>Spelling the pasture</p> <p>Spell the selected paddock(s) by closing up for 4 to 5 weeks. Alternatively remove sheep and lightly stock with cattle to keep on top of the grass to limit the amount of grass seed produced.</p>
Summer grazing	Graze hard, as required depending on rainfall
Feb until significant autumn rain (over 20 mm)	<p>Remove any tag</p> <p>Keep grazing pasture down to 700 kg DM/ha. Opening up the pasture will aid sub clover seed germination and establishment.</p>
Autumn	<p>Monitor rainfall and watch for sub clover germination: sub clover germination triggered by rainfall > 20 mm.</p> <p>Spell to allow sub clover establishment: allow sub clover seedlings to reach 3-4 leaf stage.</p> <p>Then graze preferably with cattle to control long grass.</p>
Winter	<p>Graze as required</p> <p>Keep pasture above 1200 kg DM/ha. If possible spell lambing paddocks to build a sub clover rich pasture which is great feed for lactating ewes.</p>
Spring	<p>Select a new set of paddock(s) to manage for sub seed set</p> <p>This should be a routine as part of a farm plan pasture rotation.</p>

<p>2. Low or no resident sub clover</p>	<p>3. Drilling sub clover into existing pasture (rolling hill country)</p>
<p>Paddock walk to identify sub clover populations Less than 1 sub clover plant/patch every 2 m.</p> <p>Plan to oversow with sub clover seed next autumn:</p> <ul style="list-style-type: none"> • Investigate sub clover cultivar options (see Sub Clover Guide). • Soil test – use recent results or get soils tested: check that pH is > 5.6, Olsen P is 10-18, and Sulphate-S > 8. • Order sub clover seed – need 10 kg/ha. 	<p>Plan to drill selected paddock(s) with sub clover next autumn:</p>
<p>Grazed as normal (Sep to Jan)</p> <p>If some resident sub clover is present aim to keep pasture above 1200 kg DM/ha.</p> <p>Photos: sub clover flowers are small - about 10 mm long and 3-4 mm wide. Mt Barker (on left in picture) has red-banded flowers which helps with cultivar identification in the spring. Tallarook flowers (on right in picture) have no bands.</p>	<p>Grazed as normal (Sep to Jan). Consider herbicide in Oct-Nov and before drilling late Feb to mid-Mar.</p> 
<p>Remove any tag (Jan/Feb)</p> <p>Chew the pasture down hard to 700 -1000 kg DM/ha. Opening up the pasture will aid resident and oversown or drilled sub clover seed germination and establishment.</p>	
<p>Oversow with sub clover seed and apply fertiliser if required (mid-March). Trample seed in with sheep.</p>	<p>Drill in sub clover seed and apply fertiliser if required in February (if soil is moist) to mid-March</p>
<p>Monitor rainfall and watch for sub clover germination: sub clover germination triggered by rainfall > 20 mm.</p> <p>Spell to allow sub clover establishment: allow sub clover seedlings to reach 3-4 leaf stage. Then graze preferably with cattle to control long grass.</p>	
<p>Grazed lightly in the first year</p> <p>Keep pasture above 1500 kg DM/ha. Control grass so clover is not shaded. Lamb on pasture.</p>	<p>Grazed lightly in the first year</p> <p>Can lamb on the new paddock. Keep pasture above 1500 kg DM/ha and consider using lower stocking rates than normal but don't let pasture mass exceed 3000 kg DM/ha.</p>
<p>Identify when sub clover flowers are obvious – usually mid-Sept onwards depending on cultivar</p> <p>Spell the paddock for at least six weeks to maximise seed set. Ideally take stock off when pasture mass is down to about 1500 kg DM/ha.</p> <p>Then graze with cattle to get on top of the tall grass and/or herbs.</p> <p>Ongoing management as previously outlined for acceptable sub clover content.</p>	



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