beef+lamb new zealand

Ruapehu Pasture Pest Focus Group Field Day

Ohotu and Tohunga Stations

THURSDAY, 25 AUGUST 2016

Health and Safety

Atihau Whanganui Incorporation has taken all reasonable care in making sure your visit to their property is as safe as possible. Please take care when travelling over the property in vehicles, moving around yards and facilities and around livestock.

They clearly point out you enter this working farm at your own risk. The owner will accept no responsibility for any incident or injury to any person or property that takes place while you are visiting the farm.

For your safety, it is important that you follow all instructions given to you by facilitator Mel Poulton and that you stay with the group.

This field day includes travel between sites on public roads and a farm tour. Please make sure you are aware of the B+LNZ Operator and passenger guidelines. The requirements are intended to ensure your safety when operating or using vehicles at a B+LNZ Event. Any breach of these rules could result in you or someone else being seriously harmed. A copy will be displayed on site.

In the event of an incident, accident or emergency, please advise the health and safety point of contact (Jason Griffin B+LNZ 027 431 0225 or 0800 233 352) and where necessary dial 111.

B+LNZ take the health and safety of all attendees at this event seriously. If you should feel unwell, or notice any activity at this event you consider unsafe, please bring it to the attention of a B+LNZ staff member or Farmer Councillor.

B+LNZ also have a Host Responsibility Policy in relation to alcohol at events. This policy will be on display where alcohol is served. Please take time to read it, and ensure that you take all care and responsibility for the safe consumption of alcohol.

We have a first aid kit on site with the Health and Safety officer of the day.

We wish you a safe and enjoyable day.

We will be using a radio transmitter throughout the day so that you can listen to instructions, commentary and discussion as we travel from place to place.

Please tune your vehicle radios to:

You can text questions to: 027 220 5956

Contents

In association with:

beef+lamb new zealand

ATIHAU-WHANGANUI INCORPORATION
Toi tu te whenua

agresearch

PGG Wrightson

Welcome

Welcome to the B+LNZ Ruapehu Pasture Pest Field day on the Atihau Whanganui Incorporation finishing properties, Tohunga and Ohotu. Our sincere thanks go to Atihau Whanganui Incorporation for hosting this field day and undertaking the trial work which will benefit the wider farming community in the Ruapehu area.

This field day is part of the B+LNZ Western North Island Regional Delivery Plan. The objective of this programme is to provide farmers in the Ruapehu region with information, mitigation and management strategies for pasture pests that are incurring an economic impact in the region.

Funding for this programme has been made available by B+LNZ through your levies.

The objectives of this Field Day are to:

- Introduce and update farmers as to the on-farm science trials which focussed on creating on-farm solutions to pasture pests.
- Equip farmers with knowledge for identification, mitigation and management strategies of specifically Porina and Grass Grub
- That farmers in the Ruapehu area are able to confidently dig, identify, count, mitigate and manage pasture pests that impact in their region.
- Provide farmers with a resource on the pasture pests impacting in the region and where they can find further information.

Overview of Atihau – the farm business hosting the trials

Atihau is a Maori AgriBusiness Incorporation which was established in 1970 following an order of the Maori Land Court to take back 101,000 acres of land vested into the Aotea Maori Land Council by Whanganui Maori in 1903, Atihau Whanganui Incorporation currently farms 22,000 effective hectares. This is made up of 8 sheep and beef farms and 1 dairy farm farming 180,000 stock units in total.

Our vision is to farm in a sustainable manner within an integrated 1 farm framework whereby all our farms work together to maximise synergies and economies of scale.

We currently employee 40 staff across the farms and main office.

Ohotu Station

- 1380 effective hectares
- Mostly flat with some rolling land
- Mainly Ash soils
- Rainfall 1,200mm per year.
- Target to finish 30,000 lambs, and 1700 cattle per year
- 1000 1 year ewes lambed, ewes sold at weaning
- 4200 Grazing hoggets July-December
- 30,800 trading lambs in
- 30,600 lambs sold prime (average 17.5kg)
- 2,500 cattle including weaners, 1 year cattle and 2 year cattle.
- 1,842 cattle sold prime (steer average 305kg, heifer average 250kg)

STAFF: Three permanent, including manager and one part-time clerical

ESTABLISHED LAMB FEED:
112ha Red Clover – irrigated
87ha Tonic Plantain/Clover mix

CROPPING: 54ha Kale/Swede, 8.7ha Fodderbeet, 33ha Potatoes, 70ha new grasses

Tohunga Station

- 1,011 effective hectares
- Mostly flat to rolling with some steeper sidelings
- Mainly Ash soils
- Rainfall of 1,600mm per year
- Target to finish 18,000 lambs, 500 cattle per year, grow heifers out, and provide winter grazing for dairy cows from the Incorporation's Dairy farm
- 800 ewe hoggets lambed, ewes sold at weaning
- 1400 cattle wintered including weaners and 1 year cattle and dairy heifers

STAFF: Three permanent including manager

ESTABLISHED CROPS: 110ha plantain/red clover

CROPPING: 80ha Kale, 20ha Fodder beet, 36ha Fescue, 100ha new grasses

Given both Ohotu and Tohunga Stations are primarily finishing farms, the current production and financial performance in basic terms is outlined in the table below:

Table 1: Ohotu & Tohunga Farm performance

	Tohunga	Ohotu
No. lambs killed	19000	29000
Ave. weight of lambs	17.5	17.5
No. steers killed	400	800
Ave. weight of steers	295	295
No. heifers killed	250	400
Ave. weight of heifers	240	240
EFS $/ha	505	515

The pest problem for Atihau

Porina and Grass grub were becoming more and more prevalent particularly in our finishing crops. This has a significant impact on finishing capabilities. Although options for control were being put to us, some had various levels of efficacy and some had questionable effects on earthworms. Identifying the bugs at crucial times was important so that we could make informed decisions and we felt that we needed to upskill farm staff in this.

At the request of the Atihau Whanganui Incorporation, Beef + Lamb New Zealand began working together with Atihau, AgResearch and other local Ruapehu farmers to find solutions for managing insect pests that were having an economic impact in the area.

Together they formed the Ruapehu Pasture Pest Focus Group. This group has an aim of helping farmers to be proactive in predicting, recognising and dealing with the threat of insect pests and limiting their economic impact.

The following management projects were developed and science trials carried out on farm:

1. Assessing the effectiveness of liquid and granular insecticides and of nitrogen application on limiting grass grub damage in plantain
2. Evaluating the effects of Suscon Green applied at drilling on grass grub, the build-up of grass grub diseases in the soil and on earthworms
3. Results and findings from these two initial trials follow.

Pasture pests on Tohunga and Ohotu Stations

The major pests found on Tohunga and Ohotu stations are grass grub, manuka beetle and porina. Several other pests, e.g. Tasmanian grass grub, clover root weevil and Argentine stem weevil, are present but not in sufficient numbers to currently cause concern.

Grass-grub

Grass-grub, are New Zealand's most important native pasture pest. The adult grass-grub beetles, sometimes called brown beetles, are shiny tan/brown, about 10 mm long, and fly at dusk in spring and early summer. They are often attracted to lights in large numbers. They have two flight phases, the first is a mating flight and occurs very soon after the beetles emerge from the soil, the second consists of feeding flights and may occur for 2-3 weeks

The beetles live for a few weeks. During this phase the beetles mate and the females lay their eggs 100 to 150 mm under the soil. Each female lays about 30 eggs. On hatching the larvae feed on roots of a wide range of plants. As they grow they pass through three larval stages. Development from egg to adult usually takes 1 year but under severe environmental conditions (cold or drought) development of some grubs may be extended over two years. Damage to roots occurs mainly when grubs reach the third stage. For one-year life cycle grubs this is in autumn and early winter. Those grubs entering a two-year cycle do not reach the third stage until spring/summer causing damage in summer if sufficient numbers are present

Figure 1: Collection of pasture pests on Tohunga Station, photo taken 24th February 2016.

Several other beetle species resemble grass-grub beetles and their feeding can appear identical. The larvae of such beetles are very similar and expert advice may be required to correctly identify them.

Manuka beetle

Manuka beetle larvae are generally considered minor pasture pests but when populations occur in excess of 350/m2 they can cause damage similar to grass grub and like grass grub they feed on a range of plants.

The bright green adult beetles live for a few weeks during late spring and early summer. During this time they mate and the females lay their eggs in pasture soils at depths of up to 10 cm. Each female can lay 30 – 40 eggs. On hatching the larvae feed on roots of a wide range of plants. As they grow they pass through three larval stages. Development from egg to adult takes almost one year. Root damage usually becomes evident after the grubs have reached the third stage. Damage is usually noticed in autumn and early winter. The grubs are very similar to grass grub and often mistaken for them. Manuka beetle grubs are smaller but the different stages of each overlap and stage 3 manuka beetle grubs resemble stage 2 grass grub.

Porina

Porina are the caterpillars of 7 species of closely related moths. They look and behave very similarly. The moths fly in spring, summer and early autumn. The moths don't feed and live only a few days. During these flights female moths may lay over 3000 eggs scattered above the surface of pasture or grassy areas. The eggs hatch in 10 to 21 days and the young caterpillars construct silk lined casings on the soil surface. As the caterpillars grow they construct permanent burrows in the soil which eventually reach a depth of about 250 mm. They emerge from their burrows at night to feed, severing grass and clover leaves at the base of plants and dragging these back to their burrows where they are eaten.

When feeding on plantain they chew the base of the plant crown. The caterpillars are reluctant to venture far from their burrows and pasture damage initially appears as 5 to 6 cm in diameter bare areas around burrows. As food is depleted they move further from their burrows and if sufficient caterpillars are present, large areas of pasture are damaged or destroyed. Development from egg to adult takes 12 months. The caterpillars pass through eight to nine stages, moulting in between. For pest management purposes it is important for a farmer to be aware of this and to know when flights occur on their property. The most significant difference between species from a pest point of view is the timing of moth flights and therefore the timing of caterpillar development. While this will have minimal effect on the effectiveness of organophosphate insecticides it is an important consideration when applying diflubenzuron which is most effective against early larval stages.

All three of these pests are native insects and occur in most pastures most of the time. Whether or not they attain pest status is largely governed by paddock history and weather. Undisturbed pest populations are regulated by a range of natural diseases but if these relationships are disrupted, pest numbers rise and cause damage to pastures. The most common disruptions are cultivation and dry summers. In both cases we can expect to see damage usually 2-3 years later, sometimes between 1 and 4 years later. On top of this, current weather conditions in spring and summer can affect the severity of damage particularly for porina. Moist conditions, and or good pasture cover, during flights and egg laying favour pest survival. When damaging populations arise after dry summers, whole regions, and pastures of any age, are affected.

All three pests feed on a wide range of plants and they are able to take advantage of plants developed for agriculture. In many ways we should consider them as grazing stock, although unprofitable ones. Most grasses, all clovers, plantain, lucerne, brassicas can support these insects. Some however by nature of their structure can tolerate more insect pressure than others and some show resistance to insect feeding. Tall fescue, meadow fescue, cocksfoot, lucerne and brassicas, once established, are generally not damaged. Ryegrasses (except those with AR37 endophyte in the case of porina attack), white clovers and plantain are particularly vulnerable.

How many are too many?

Pests usually have a threshold level they need to exceed to cause damage. This can vary with region, temperature, soil fertility, plant type etc. Generally it is considered more than 200 grass grub/m2 (8 per 20 cm spade square) 400-600 manuka beetle larvae/m2 (16 -24 per spade) or 20 – 40 porina/m2 (1-2 caterpillars per spade) will cause economic damage. These numbers are when damage begins to occur, as numbers increase so does the damage but it is not always a linear response. At low levels plant production is reduced but higher level cause plant deaths and long term damage result.

Grass grub and manuka beetle tend to be very aggregated and damage often appears in discrete patches ranging from 1 to 5 m across.

Porina are more evenly distributed and damage usually appears over larger areas commonly 20-30 m or more wide.

The graphs below give an approximate indication of the cost in dollars per hectare ($/Ha) of each pest at different densities.

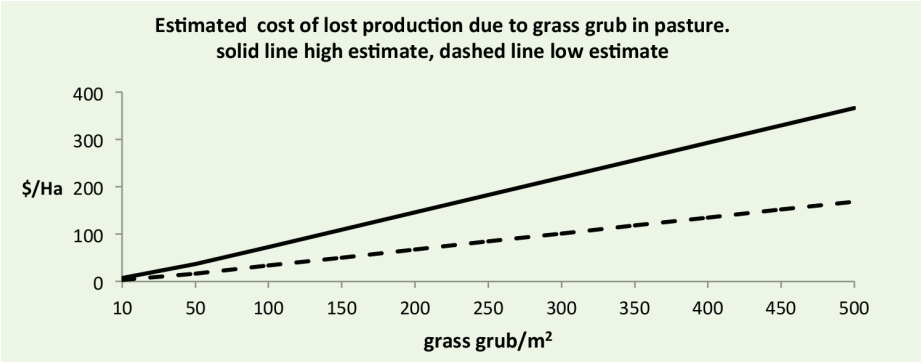


Table 2: Economic impact to the cost of production from grass grub populations

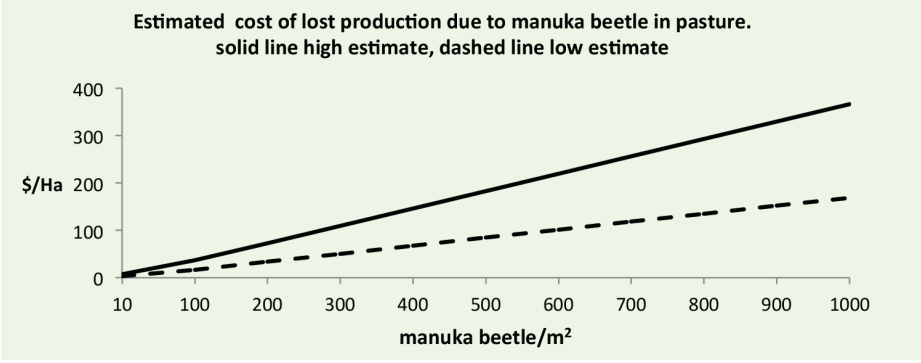


Table 3: Economic impact to the cost of production from manuka beetle populations

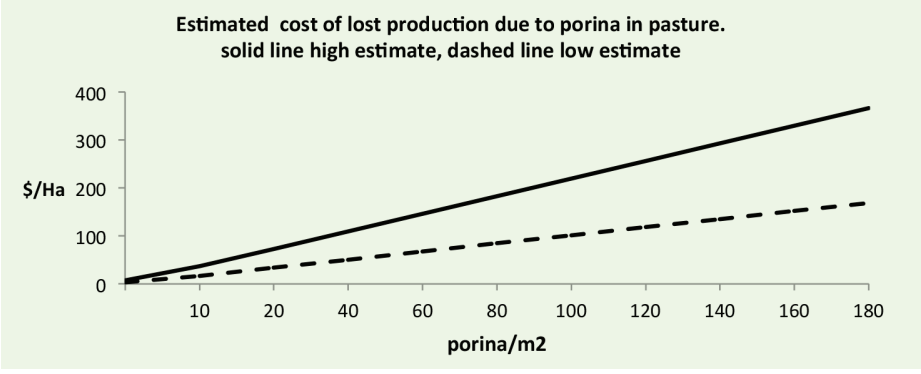


Table 4: Economic impact to the cost of production from porina populations

Combating these pests

Being forewarned is being forearmed. To quite an extent paddocks at risk of damage can be identified 2-3 years before damage occurs. The extent of damage can be predicted several months before it shows. By digging in 'at risk' paddocks and counting the number of grubs and/or porina present, the likely cost of their presence can be calculated from the graphs above. Dig several holes (up to 20) over a large area of each paddock. Count each pest and multiply the average number found by 25 (this converts the number per spade to number per m2).

For grass grub and manuka beetle control options are very limited. Where damaging numbers are present insecticide may be the only option. Applying chemical early, before damage shows, will provide the greatest economic return. Other options are, ensuring fertiliser (particularly nitrogen) levels are optimal – healthy plants will tolerate more insect feeding than plants under stress from other factors, and heavy stocking that can reduce grub numbers to a tolerable level - grubs must be near soil surface and soil must be moist for maximum effect.

For porina the cheapest option is diflubenzuron, an insect growth regulator. This must be applied when caterpillars are moulting and that happens more frequently when they are small so some knowledge of porina is necessary to achieve good levels of control. Note when porina moths fly. If you want to adopt an insurance policy against porina treat with diflubenzuron 8-12 weeks after the main flight period – but be aware there may be more than one main flight or flights may be drawn out. In such cases a single application may not be enough. The same strategy using conventional insecticides is not so restricted, a single application in March will control porina before any damage shows. Some areas report flights in April and in those areas a late April application is more applicable. Digging avoids assumption and allows informed decisions to be made i.e. do caterpillar numbers warrant treatment? Are the caterpillars a suitable size for diflubenzuron? If treatment is not considered until damage shows the only chemical option is to use an orgaonphoshate insecticide (diazinon or chlorpyrifos).

Local (in the Ruapehu area) porina flights this season have been 29 December, 27 January (main flight) 12 Feb (medium flight) and 28 February. In this case the optimal time for diflubenzuron or an organophosphate application would be late March.

Where grass grub, manuka beetle AND porina occur together the management strategy must account for all. The simplest approach may be a spray application of organophosphate insecticide alternatively a combination of options is necessary.

Trials on Tohunga and Ohotu Stations

Plantain under grass grub attack – Tohunga

In 2015 several young plantain stands were being hit by all the major pests found on Tohunga. To investigate combating these spray and prill diazinon formulations at label rates, and nitrogen as 100 kg/ha urea were applied to 20 x 10 m plots in each of 5 paddocks in early April. In mid-June the pest populations were measured, by digging 20 15x15 cm holes 25cm deep in each plot. Individual pest numbers were compared across treatments. In addition earthworm populations (Apporectodea caliginosa (grey worm) and Lumbricus rubellus (dung worm) were also measured).

Neither formulation of insecticide reduced any pest numbers. The most likely explanation for this is that the canopy formed by plantain leaves, even after grazing, prevented the insecticide reaching the root feeding grass grub and manuka beetle larvae or the porina grazing beneath that canopy. As expected the nitrogen, applied to see if extra nitrogen could compensate for pest feeding had no effect on pest numbers. Neither of the beneficial earthworm worm species present were affected by insecticide or nitrogen.

Given lack of pest control and a storm that hit the Ohakune region in 2015 no further measurements were taken.

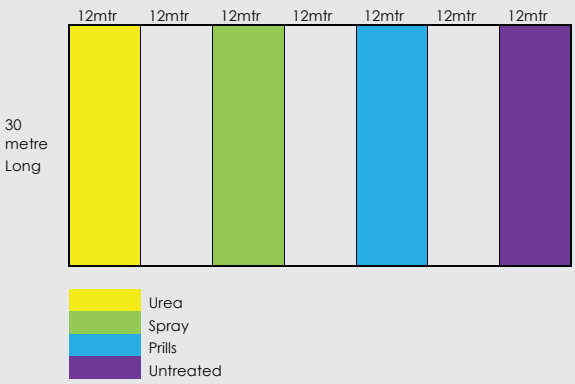
	Number/m2				
	Untreated	**diazinon spray**	**diazinon prill**	**Urea 100 kg/ha**	**Effect of treatment, cost of pest**
Grass grub	177	150	181	170	No difference $125/ha
Manuka beetle	218	190	208	246	No difference $ 75/ha
Porina	57	34	35	45	No difference $100/ha
Grey worm	262	250	239	225	No effect
Dung worm	123	95	102	99	No effect

Table 5: Application of insecticide and nitrogen to Plantain crop and the impact on pest and earthworm numbers at Tohunga Station

Plantain grass grub trial Tohunga Station

Plantain grass grub trial was set up to try and determine best practise with the least amount of environmental damage. Management of grass grub in lamb finishing crops is very difficult without the use of chemicals.

TRIAL SITE LAYOUT



Five paddocks were selected for five different trial sites. Each trial site was made up of three different grub management methods with a clean buffer zone between. Four cut cages were placed on trial sites to measure growth rates to assess the effectiveness of each method. Nitrogen at 100kg/ha, Diazanon prills @ 11kg/ha, Dew spray application @ 4ltr/ha with one clean zone with no application.

Photo shows how each was applied to trial and markers showing buffer zones in between. Prior to site selection grass grub counts were done so that sites had significant numbers of grass grub in all sited.

Once trial was set up, cage cuts were taken to assess the effect that each method had on plantain growth rates. Urea seemed to have the most consistent growth rates and had no effect on grass grub numbers at all.

Figure 2: Application methods for mitigating against pasture/forage pests

Small cage 600mmx600mm		0.36								
Large cage 900mm*600mm		0.54								
Plantain cuts 7/6/15						**Plantain Cuts 20/7/15**				
Site 1	**Neutral**	**Spray**	**Prills**	**Urea**		**Site 1**	**Neutral**	**Spray**	**Prills**	**Urea**
grams for period	90	130	120	180		grams for period	50	80	100	135
Cage sise m2	0.54	0.54	0.54	0.36		Cage sise m2	0.54	0.54	0.54	0.36
DM %	14.9	14.9	14.9	14.9		DM %	14.9	14.9	14.9	14.9
	18518.5	18518.5	18518.5	27777.8			18518.5	18518.5	18518.5	27777.8
	1666.67	2407.41	2222.22	5000.00			925.93	1481.48	1851.85	3750.00
	55.555556	80.24691	74.07407	166.6667			30.8642	49.38272	61.7284	125
Growth per day kg/dm	**8.3**	**12.0**	**11.0**	**24.8**		**Growth per day kg/dm**	**4.6**	**7.4**	**9.2**	**18.6**
Site 2	**Urea**	**Spray**	**Prills**	**Neutral**		**Site 2**	**Urea**	**Spray**	**Prills**	**Neutral**
grams for period	110	150	90	50		grams for period	55	50	35	40
Cage sise m2	0.36	0.36	0.36	0.36		Cage sise m2	0.36	0.36	0.36	0.36
DM %	14.9	14.9	14.9	14.9		DM %	14.9	14.9	14.9	14.9
	27777.8	27777.8	27777.8	27777.8			27777.8	27777.8	27777.8	27777.8
	3055.56	4166.67	2500.00	1388.89			1527.78	1388.89	972.22	1111.11
	101.85185	138.8889	83.33333	46.2963			50.92593	46.2963	32.40741	37.03704
Growth per day kg/dm	**15.2**	**20.7**	**12.4**	**6.9**		Growth per day kg/dm	**7.6**	**6.9**	**4.8**	**5.5**
Site 3	**Urea**	**Spray**	**Prills**	**Neutral**		**Site 3**	**Urea**	**Spray**	**Prills**	**Neutral**
grams for period	90	50	0	0		grams for period	20	20	0	0
Cage sise m2	0.36	0.36	0.36	0.36		Cage sise m2	0.36	0.36	0.36	0.36
DM %	14.9	14.9	14.9	14.9		DM %	14.9	14.9	14.9	14.9
	27777.8	27777.8	27777.8	27777.8			27777.8	27777.8	27777.8	27777.8
	2500.00	1388.89	0.00	0.00			555.56	555.56	0.00	0.00
	83.333333	46.2963	0	0			18.51852	18.51852	0	0
Growth per day kg/dm	**12.4**	**6.9**	**0.0**	**0.0**		Growth per day kg/dm	**2.8**	**2.8**	**0.0**	**0.0**

Comments from observation of cage cuts

20th July

Cages cut late this month due to rain and with four day of snow on the ground this month with a number of frosts in a row. I have written down a few notes on what I was observing when I cut and measured cages.

Site 1 Stumps
Site looks healthy. Old damage noticeable with new growth and no new damage to plants present.

Site 2 Spud road
Gaps between plants noticeable. Plant population about 50% since planting. No new grub damage. Plants showing signs of previous stress, and old grub damage. Improved colour with plant showing signs of recovery. Good clover population with minimal weeds present at this time.

Site 3 Pad
Very bad grub damage. Plant population at 30 - 40%, plants are larger and showing signs of stress. Previous grub damaged plants are showing new growth with a good clover population. Lots of regenerating pasture in gaps; will need to spray.

Site 4 Houtons
Excessive grub damage with plant population down to 20% on trial site. Paddock needs over sow to repair prior to spring growth. Some clover with lots of grass in the gaps of the crop.

Site 5 Sargent's
Gaps in sward very noticeable. High clover content. Over sow patches prior to spring growth. Good regrowth on plants present in paddock. May need cattle or it will go clumpy and rank.

April 2016

Grass grub damage in plantain is very significant and crop production is very low. Stock numbers are down to 800 lambs on 67ha of two year plantain. The expectation going into this season was grass grub levels would have peaked last season and would expect to see some milky sickness or amber disease coming back into grub population. There are some signs of disease with grub population now excessive. This area of the farm was a market garden and has had a grass grub problem for the last seven years. This problem has been managed with the use of chemicals year in and year out. Three seasons ago the area was sprayed twice in one season and plantain was sown with Diazanon prills. Two seasons from planting almost zero grub to excessive numbers of grub. Chemicals are obviously not the answer as it has killed natural organisms and made the problem unmanageable in a finishing system.

This coming season we will be direct drilling tall fescue with Diazanon prills. Two advantages of fescue are that it is a tap root and can tolerate some grub pressure. Secondly we will introduce cattle into this area of the farm.

Tohunga photo diary Plantain Damage

Figure 3: Photo taken 6/3/16 Across paddock

Figure 4: Photo taken 6/3/16 at feet

Figure 5: Photo taken 19/3/16 Across paddock

Figure 6: Photo taken 19/3/16 at feet

Figure 7: Photo taken 27/3/16 across paddock

Figure 8: Photo taken 27/3/16 at feet

Figure 9: Photo taken 12/4/16 Across paddock

Figure 10: Photo taken 12/4/16 At feet

Figure 11: Photo taken 12/4/16 Across paddock

Figure 12: Photo taken 27/4/16 at feet

Ohotu plantain protected from pest attack using chlorpyrifos (Suscon green) at sowing

The reason for using Suscon Green in plantain crops derived from the 2013-2014 season where we had 14ha of plantain wiped out by grass grub. Conditions wouldn't allow an effective spray programme, with our free draining volcanic soils and plantain having a fibrous root system. We were providing the ideal conditions for further outbreaks. We wanted to continue using plantain as it gives us reasonable growth rates in our long winters, while providing good growth rates for winter trading lambs, ewe hoggets or ewes with lambs at foot. The good results we have had and a healthy earthworm population means it has become standard practice for any new plantings in the future.

So, at Ohotu station, 54 hectares, 8 paddocks, of plantain with Relish red clover and Tribute white clover, was direct drilled in spring 2014. Suscon Green is designed to protect young crops and pastures from soil dwelling insect attack for 2-3 years. The questions posed with this approach were:

- Will the stands be protected?
- What is the effect of pest control on natural pest disease build-up?
- What is the effect of continuous exposure of earthworms to chlorpyrifos?

To answer these questions, pest and earthworm numbers were measured in each paddock in June 2015 and will be measured again in 2016 and 2017. Twenty 15 x15 cm holes 20 cm deep were dug in each paddock. The results are shown in Table 6 below.

	Number/m2					
	Grass grub	Manuka beetle	Porina	Grey worm	Dung worm	Total earthworms
Paddock						
Bush	34	0	5	436	59	495
Bruces B	69	59	10	221	78	299
Bruces A	39	29	0	186	83	270
Dons 2	88	15	5	270	103	372
Dons 1	39	20	10	657	132	789
Dons 3	83	20	5	490	34	524
Nohi	25	29	10	539	20	559
Nohi 1	74	10	10	828	49	877

Table 6: Insect pest and earthworm sampling at Ohotu Station 16 June 2015

Although common grass grub, manuka beetle larvae and porina were not found at levels high enough to cause concern with regard to loss of plants or significant production loss. It was pleasing to find some grass grub that appeared infected by natural diseases (amber disease and milky disease)

The earthworm species found, grey worm, and dung worm, are the most widespread introduced species in New Zealand and both are beneficial species. Very low numbers of a third introduced beneficial species, yellow tail *(Octolasion cyaneum)*, were also found. Earthworm numbers were generally good although Bruces B, Bruces A and Dons 2 are lower than could be hoped for but not unusually so.

Ecosystem bioprotection

A third area for investigation, called Ecosystem Bioprotection and closely linked to an AgResearch research programme of the same name, was intended to be "assisted build-up of natural pest diseases" by introduction of these naturally existing diseases in soil profiles to areas thought devoid of them. While some aspects of this have proceeded, such as measurement of diseases at Ohotu, it has not progressed as intended. Two main factors have caused this. Interrogation of earlier research has indicated that the methods thought feasible for implementation by farmers to introduce diseases had been tried and not shown to be efficacious and where commercial (Serratia entomophila for grass grub) or near commercial products (Yersinia entomophaga for porina) were thought to be available they have proved not to be. Progress in this area is likely to beyond the resources of the current project but if opportunities arise from related research it is hoped that they can be exploited at Tohunga and Ohotu.

New considerations for pest mitigation

Heavy stocking with cattle - Tohunga

An area explored by Brian on Tohunga has been heavy stocking to reduce grass grub and manuka beetle pressure. Heavy stocking has been shown to reduce grass grub numbers in Southland and Brian has also had some success and believes grass grub is no longer a problem. He is confident that grass grub can be managed to a certain degree with the use of cattle in a pasture system. The only challenge to this theory is that he has no on-farm trial data to back it up. As such, as part of this Ruapehu Pasture Pest Focus Group programme, we are going to do a trial based on the impact of cattle to pasture pest populations.

This year we aim to measure the impact of high stocking rates of young cattle on grub numbers by replicating the treatment and measuring grub numbers before and after stocking. We also want to measure the effect of treading on soil structure and compaction.

Establishing red clover, then after 3 years direct drilling plantain.
From a pest perspective the red clover should be able to tolerate pest feeding and allow natural diseases to build up in the paddock. When plantain is introduced after three years the critical conditions for pest attack should have passed there by avoiding exposure of plantain to significant pest pressure.

Establishing tall fescue and after 3 years direct drilling plantain.
Once established tall fescue will tolerate pest feeding and provide the same protect from pests as red clover to plantain established later.

Establishing plantain and after 3 years direct drilling red clover.
It is hoped that this system will allow plantain to be fully exploited for 2-3 years before being sacrificed to pests and replaced by red clover. As above in this time natural diseases will have established.

Systems to support land use change in hill country
A forage system is used to target key periods in a livestock production system to generate extra value above a normal grass pasture. It can be described as a specific forage eg. Red clover, or a mix of forages e.g. forage rape and plantain.

The purpose of a forage system is to:

- Achieve higher livestock production in terms of kilograms of meat & fibre
- Achieving livestock targets earlier
- Achieving a higher carrying capacity
- Improving the body condition or target live weight to insure future productive potential of breeding stock.

At no stage should crop forage systems be utilised without generating extra value above normal grass pastures.

A key component of forage systems is that they also fit neatly into a logical crop rotation plan. Their establishment and termination or evolution into other phases (like a forage rape crop under-sown with Tonic plantain transitioning from a rape crop to a plantain stand) is timed to achieve maximum benefit for the livestock system and minimal disruption to the rotation plan

An example of a forage system in a rotation could be as simple as 100 ha of relish red clover at any point of time, 40 ha for Asset AR37 all in a rotation, 20ha of relish being sown every year and 20 ha of Asset being sown in the last year of each finished Relish stand. This system not only provides the spring and summer forage but the Italian provides extra winter growth for other stock policy's such winter lamb trade or cattle grazing.

Examples of forage systems that provided significant advantages include Tonic plantain lactation pastures. These pastures are based around Tonic plantains winter and early spring growth at this time they provide significant and reliable lactation feed where lamb weaning weights can be greatly improved and up to 70% of lambs can be finished off the ewe compared to the norm of around 30% of grass pastures. This system also allows the ewe to wean two finished lambs and maintain if not put on body condition, benefiting the prioritisation of feed supplies through the summer. Stock classes that would benefit greatly include twin bearing hoggets, cull/late lambing ewes scanned for twins and possibly triplet flocks.

The key to a forage system like this is to understand the value being generated at key times like this and realising the forage system does not have to last more the 2-3 lactations to have a significant influence on total farm production. Other grazing periods may be significant but are not likely to be as profitable as the lactation phase in the animal system.

Another key to extracting maximum benefit is to focus on Tonic and Relish red clover forage systems as a cleaning phase in a rotation. The use of grass specific herbicides allows this forage to be used in a rotation to create a grass break for future renovation of perennial grass pastures making it an ideal way of breaking the brown top cycle in pasture renovation.

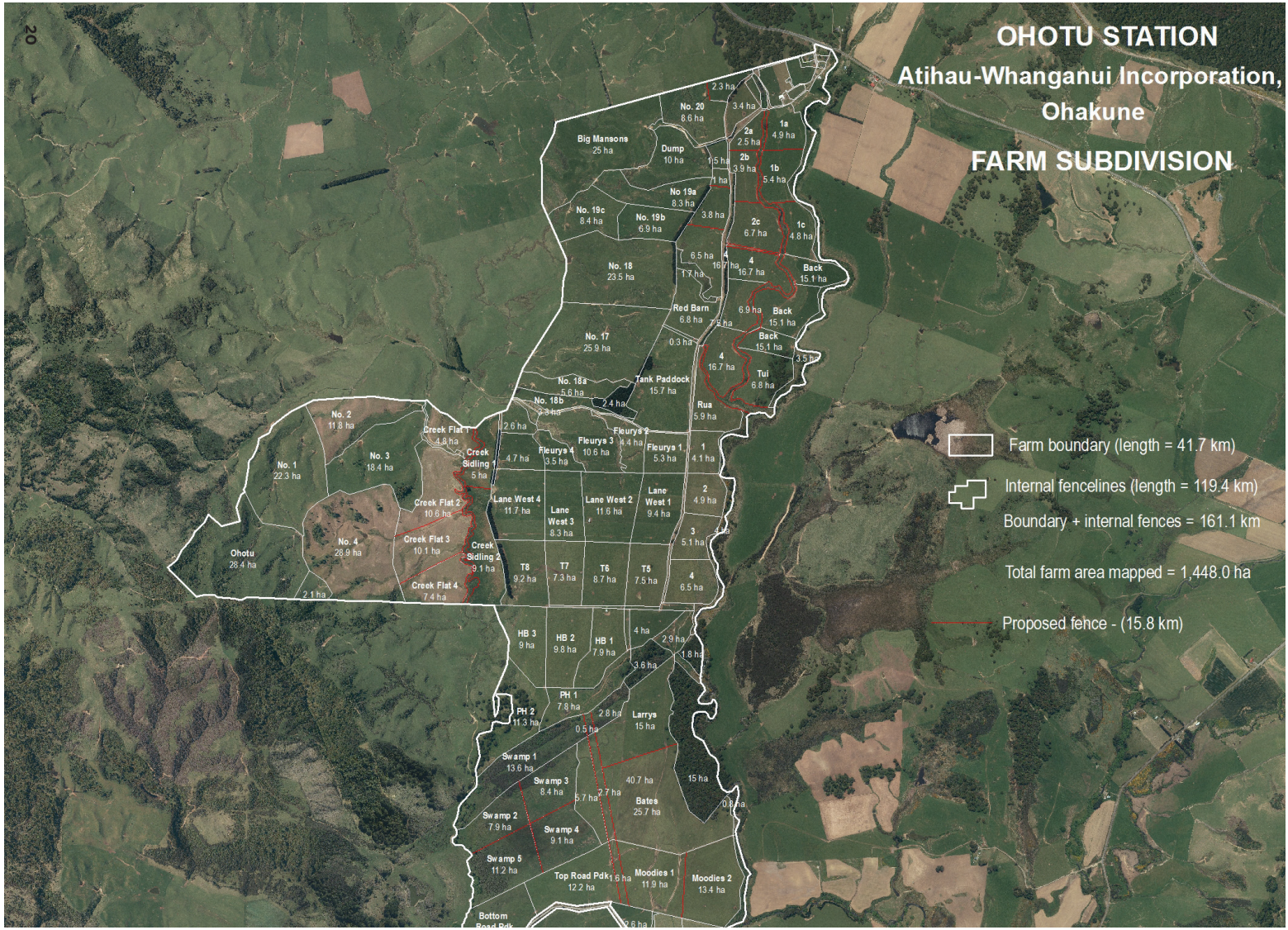
Building robustness into forage systems requires two phases

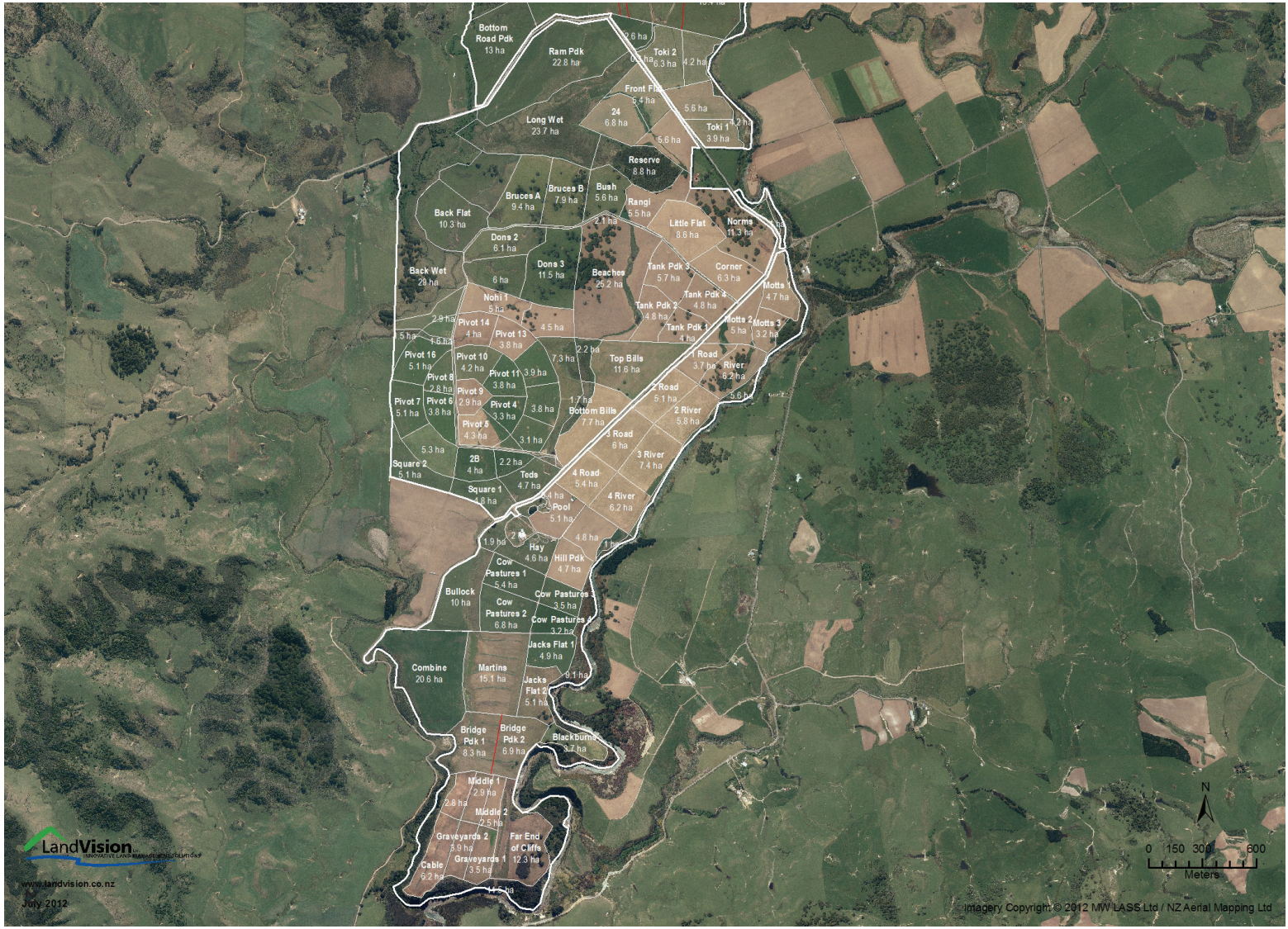
1. The acknowledgment of the value created over each period of time. This means when problems occur such as insects, flooding, pugging or weed burdens the worth of the forage can be fully analysed. This enables a realistic minimum period of performance required to have still made the system valuable.
2. To work through the drivers of not reaching this potential and the tools that can be used adapt the system to meet minimum requirements for benefit to the whole farm performance. An example is the challenge grass grub poses in limiting the stand life of finishing systems such a Tonic plantain. This issue with plantain in high grass grub areas could be as simple, as it doesn't have the total root mass to tolerate high grass grub levels for long.

The first question: Has Tonic produced enough economic and strategic value to have paid for itself, make a profit and have a beneficial effect on other parts of the farm. If it has then moving on in a rotation that reduces the grass grub may well be viable. If not this means using either slow release insecticide technology or introducing plants with greater root masses that may tolerate grass grub for longer such as red clover, tall fescue and Lucerne. While all affected by high rates of grass grub each have larger root masses that tolerate it for longer.

Figure 13: Relish used for set stocking and grazing lactation

Figure 14: Tonic for lactation grazing


OHOTU STATION
Atihau-Whanganui Incorporation,
Ohakune
FARM SUBDIVISION
Farm boundary (length = 41.7 km)
Internal fencelines (length = 119.4 km)
Boundary + internal fences = 161.1 km
Total farm area mapped = 1,448.0 ha
Proposed fence - (15.8 km)
Big Mansons 25 ha
Dump 10 ha
No. 20 6.6 ha
2.3 ha
3.4 ha
1a 4.9 ha
2a 2.5 ha
2b 3.9 ha
1b 5.4 ha
No 19a 8.3 ha
No. 19c 8.4 ha
No. 19b 6.9 ha
3.8 ha
2c 6.7 ha
1c 4.8 ha
No. 18 23.5 ha
6.5 ha
1.7 ha
16.7 ha
4 16.7 ha
Back 15.1 ha
Red Barn 6.8 ha
6.9 ha
Back 15.1 ha
No. 17 25.9 ha
0.3 ha
Back 15.1 ha
4 16.7 ha
Tui 6.8 ha
No. 18a 5.6 ha
Tank Paddock 15.7 ha
No. 18b 2.3 ha
2.4 ha
Rua 5.9 ha
No. 2 11.8 ha
Creek Flat 1 4.8 ha
2.6 ha
Creek Sidling 1 5 ha
4.7 ha
Fleurys 4 3.5 ha
Fleurys 3 10.6 ha
Fleurys 2 4.4 ha
Fleurys 1 5.3 ha
1 4.1 ha
No. 1 22.3 ha
No. 3 18.4 ha
Creek Flat 2 10.6 ha
Lane West 4 11.7 ha
Lane West 3 8.3 ha
Lane West 2 11.6 ha
Lane West 1 9.4 ha
2 4.9 ha
Ohotu 28.4 ha
No. 4 28.9 ha
Creek Flat 3 10.1 ha
Creek Sidling 2 9.1 ha
T8 9.2 ha
T7 7.3 ha
T6 8.7 ha
T5 7.5 ha
3 5.1 ha
4 6.5 ha
2.1 ha
Creek Flat 4 7.4 ha
HB 3 9 ha
HB 2 9.8 ha
HB 1 7.9 ha
4 ha
2.9 ha
1.8 ha
3.6 ha
PH 1 7.8 ha
PH 2 11.3 ha
2.8 ha
0.5 ha
Larrys 15 ha
Swamp 1 13.6 ha
Swamp 3 8.4 ha
5.7 ha
40.7 ha
2.7 ha
Bates 25.7 ha
15 ha
0.8 ha
Swamp 2 7.9 ha
Swamp 4 9.1 ha
Swamp 5 11.2 ha
Top Road Pdk 12.2 ha
1.6 ha
Moodies 1 11.9 ha
Moodies 2 13.4 ha
Bottom Road Pdk
2.6 ha


Bottom Road Pdk 13 ha
Ram Pdk 22.8 ha
Toki 2 6.3 ha
4.2 ha
Front Flat 5.4 ha
5.6 ha
24 6.8 ha
Toki 1 3.9 ha
Long Wet 23.7 ha
Reserve 8.8 ha
Bruces A 9.4 ha
Bruces B 7.9 ha
Bush 5.6 ha
Rangi 5.5 ha
Back Flat 10.3 ha
Little Flat 8.8 ha
Norms 11.3 ha
Dons 2 6.1 ha
Dons 3 11.5 ha
Beaches 26.2 ha
Back Wet 29 ha
Tank Pdk 3 5.7 ha
Corner 6.3 ha
Motts 1 4.7 ha
Tank Pdk 4 4.8 ha
Tank Pdk 2 4.8 ha
Nohi 1 5 ha
Pivot 14 4 ha
Pivot 13 3.8 ha
Tank Pdk 1 4 ha
Motts 2 5 ha
Motts 3 3.2 ha
Pivot 16 5.1 ha
Pivot 10 4.2 ha
Top Bills 11.6 ha
1 Road 3.7 ha
1 River 6.2 ha
Pivot 8 2.8 ha
Pivot 11 3.8 ha
Pivot 9 2.9 ha
2 Road 5.1 ha
Pivot 7 5.1 ha
Pivot 6 3.8 ha
Pivot 4 3.3 ha
Bottom Bills 7.7 ha
2 River 5.8 ha
Pivot 5 4.3 ha
3 Road 6 ha
3 River 7.4 ha
2B 4 ha
Square 2 5.1 ha
Teds 4.7 ha
4 Road 5.4 ha
Square 1 4.8 ha
4 River 6.2 ha
Pool 5.1 ha
Hay 4.6 ha
Hill Pdk 4.7 ha
Cow Pastures 1 5.4 ha
Bullock 10 ha
Cow Pastures 2 6.8 ha
Cow Pastures 3 3.5 ha
Cow Pastures 4 3.2 ha
Jacks Flat 1 4.9 ha
Combine 20.6 ha
Martins 15.1 ha
Jacks Flat 2 5.1 ha
Bridge Pdk 1 8.3 ha
Bridge Pdk 2 6.9 ha
Blackburns 3.7 ha
Middle 1 2.9 ha
Middle 2 2.5 ha
Graveyards 2 5.9 ha
Far End of Cliffs 12.3 ha
Graveyards 1 3.5 ha
Cable 6.2 ha
N
0 150 300 600
Meters
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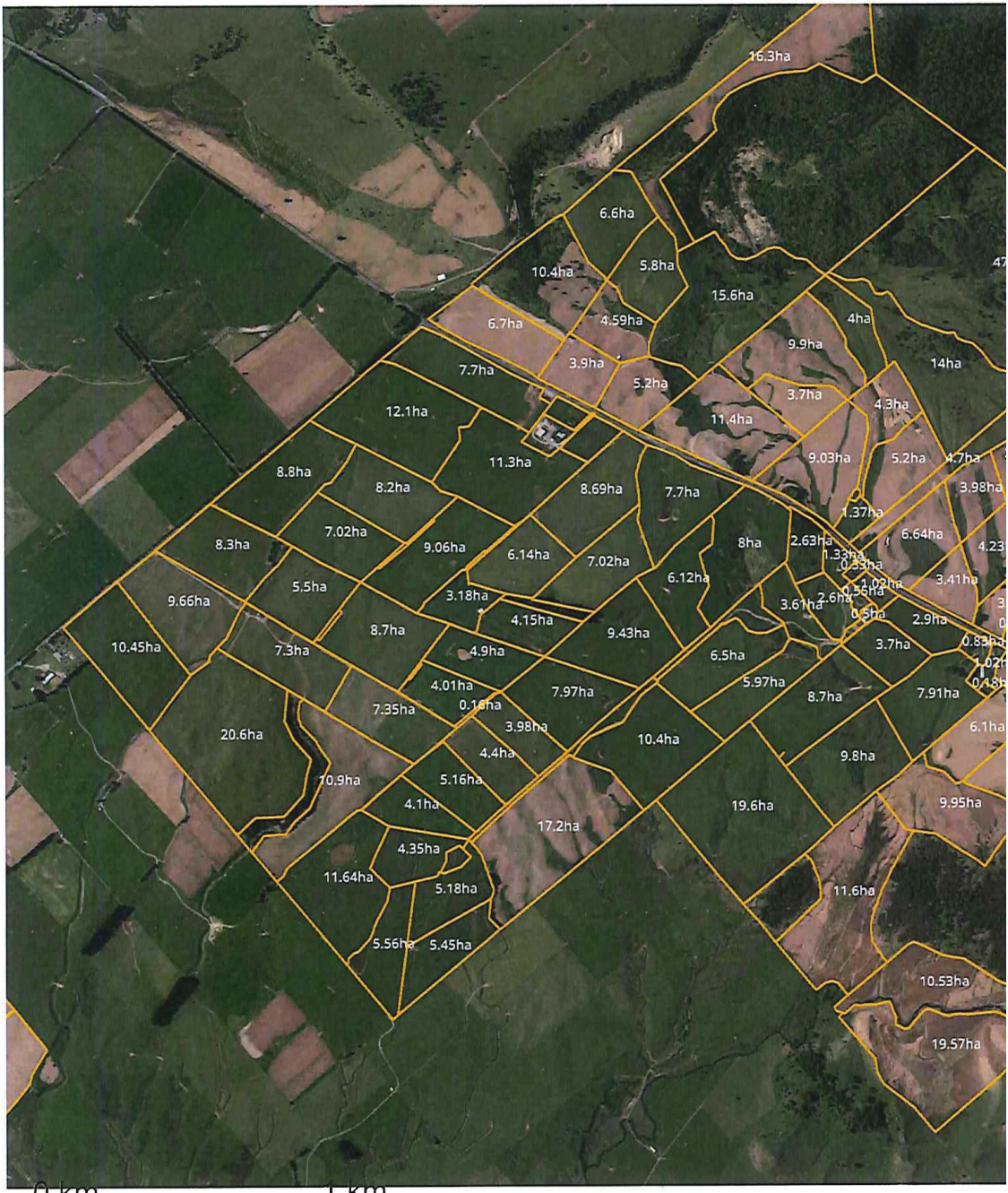
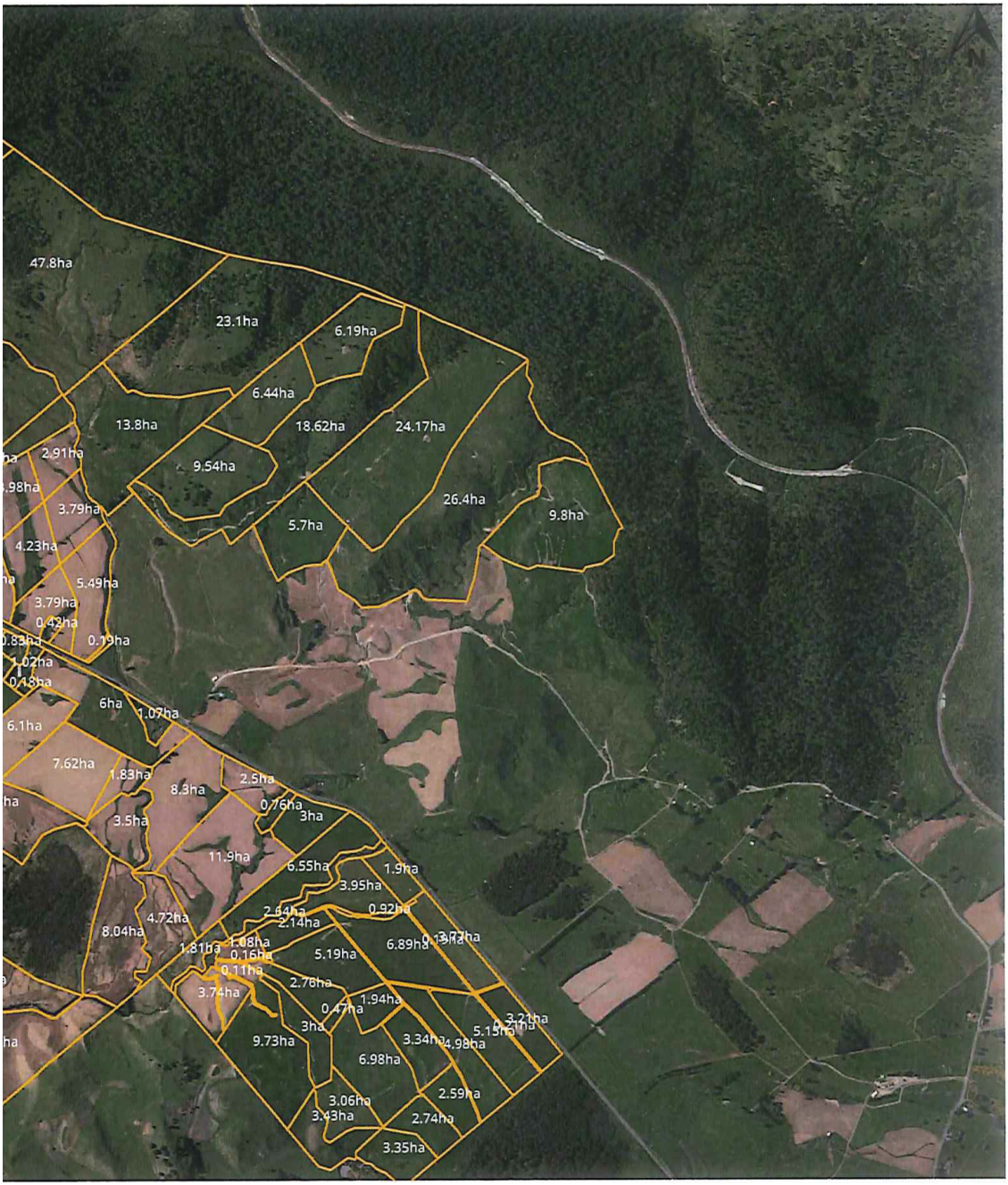


Tohunga - 13/07/16 8:48 AM © Farm IQ Systems Limited 2016

Farm - Total: 1152.60 ha, Effective: 1029.16 ha, Cultivatable: 809.44 ha


47.8ha
23.1ha
6.19ha
6.44ha
13.8ha
18.62ha
24.17ha
2.91ha
9.54ha
26.4ha
9.8ha
3.79ha
5.7ha
4.23ha
5.49ha
3.79ha
0.42ha
0.19ha
6ha
1.07ha
6.1ha
7.62ha
1.83ha
8.3ha
2.5ha
0.76ha
3ha
3.5ha
11.9ha
6.55ha
1.9ha
3.95ha
0.92ha
4.72ha
2.14ha
8.04ha
1.81ha
1.08ha
0.16ha
0.11ha
5.19ha
6.89ha
2.78ha
3.74ha
1.94ha
0.47ha
3ha
3.21ha
9.73ha
3.34ha
4.98ha
6.98ha
2.59ha
3.06ha
3.43ha
2.74ha
3.35ha

NOTES

NOTES

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