Northland Pastoral Extension:

Research Stocktake

NORTHLAND NATURALLY
FIRST REGION OF NEW ZEALAND

Sustainable Farming Fund

Insect Pests

Contents

1.0 Cricket damage and population assessment, and the damage potential of black field cricket

References:

Cricket Damage and Population assessment, and The Damage potential of black field cricket.

MAF – Popular Summaries of Research Results November 1982 and November 1983.

Author: RH Blank

Conclusions:

- Cricket populations in 1982, 1983 averaged over the January to April period, ranged up to 42/m2.
- Paddocks with high cricket population suffered severe pasture damage with up to 50% of the pasture killed.

Results:

- Pasture production in the January to May period 1983, was significantly related to cricket density/m2. For every 20 crickets/m2, 500 kg DM/ha of pasture was lost.
- The major benefit from baiting for crickets was to protect the loss of high producing pasture species. In addition there was some immediate benefit from increased pasture production.
- 1983 had only 30% of the pasture loss to crickets compared to the previous year, but with total pasture production being down by 50% in 1983, the damaging effect of the crickets was still severe: i.e. in dry summers the pasture damage threshold levels are much lower than in wetter years.

Cricket Density Number / m2	***Pasture Loss kgDM/ha***
5	420
15	1260
25	2100

2.0 The use of insecticidal baits to control black field crickets

References:

Cricket Damage on the Kaipara Clay Flats Ruawai in 1982.

Proceedings for the 35th NZ Weed and Pest Control Conference, 1982, Pages 113-118.

The Use of Insecticidal Baits to Control Black Field Crickets – Time and Rates.

MAF – Popular Summaries of Research Results November 1982.

Author: R. Blank, Bell, Page and Olson

Conclusions:

- Dairy farms that did not bait for Crickets in 1982, had 20-28% reduction in milk production compared to farms that did bait for crickets.

- This production loss was equivalent to 42 kg of milk solids per hectare. At current 2005 prices, this would be worth $190 per hectare.

- Aerial, postal and ground surveys established that over 80% of the Kaipara Clay flats in the Ruawai – Dargaville area, was infested with high numbers of black field crickets and suffered pasture damage in summer and autumn of 1982.

Method:

- After an initial aerial survey, a postal survey was carried out in 1982 of dairy farms in the Ruawai – Dargaville area. This was after two years of moderate to severe cricket damage.

Results – Survey

- 1982 was drier than normal, following good summer seasons in 1980 and 81.

- Based on farmer estimates, cricket numbers were low (0-10 /m2) on 76% of the area in 1981, but numbers were high (greater than 10 /m2) on 84% of the area in 1982.
- In 1981, 11% of the area (10% of farmers) baited compared to 53% of the area in 1982.
- Approximately 70% of the bait was applied in March and April or at a low rate; both factors reducing the effectiveness of baiting.

- The aerial survey showed farms with a known history of cricket baiting, being lush and green in contrast to neighbours who had not baited.

- Farms that baited and obtained good cricket control were able to maintain summer milk production levels similar to the previous year, whereas on farms with high cricket number, summer production was markedly reduced.

Results – time and rate of baiting:

- January plus March baiting, and January only baiting gave the best cricket control over the whole season, with 76% and 60% respectively fewer crickets than where untreated.

- February and March baiting gave poor control at 37% and 31% respectively.

- There was little difference in control levels achieved, using 10 to 5 kg of bait per hectare. A rate of 2.5 kg/ha gave 20% lower level of control.

- Levels of control can be reduced by massive flight and reinvasion from adjoining land. The January plus March baiting was the only treatment to give reasonable control (74%) of egg population. These results confirm the advantage of early bait applications in late January followed up by a second March baiting if reinvasion occurs.

3.0 Adoption by Northland farmers of a pest management package to control black field cricket

References:

Adoption by Northland farmers of a pest management package to control black field cricket.

New Zealand Entomologist Vol 8, 1984, pages 37-41.

Author: R H Blank

Overview:

- This paper describes the extension and adoption of a pest management package for use by farmers for the control of black field cricket.

- Blank and Bell developed a simple flushing technique for assessing black field cricket populations. The advantage of this technique is that cricket control, e.g. baiting, can be used before moderate to severe pasture damage occurs.

  Previous research had quantified pasture damage and had developed baiting strategies for preventing damage. This research work, coupled with the new population assessment technique (flushing) enabled the development of the pest management package.

Results:

- A cricket survey was conducted in January 1983.

	Cricket Population	
Region	Number Farms	Number/m2
Kaitaia	15	63
Kaikohe	3	69
Dargaville	10	35
Whangarei	9	17
Warkworth	7	165
Helensville	2	40
Huntly	3	25
Hauraki	7	145
Northland Average		65

Adoption by farmers:

- An effective extension campaign in 1983 created a high level of awareness of the cricket problem.

- A measure of the adoption of baiting for cricket control can be seen by the quantities of bait sold in Northland.

Year	*Tonnes Cricket Bait*	*Seasonal Rainfall*
1979	84	Dry
1980	34	Wet
1981	26	Wet
1982	71	Dry
1983	950	Dry

Higher quantities of bait would have been sold in 1983, but stocks of grain and maldison were exhausted by late February.

The quality of bait sold represents the treatment of 76,000 ha of pasture in Northland.

Benefits:

- Cricket population on many farms which baited had averaged from 20-50 crickets/m2. These crickets if left uncontrolled would have resulted in severe pasture damage from:

    - Loss of pasture yield
    - Death of pasture species
    - Loss of pasture seed
    - Weed invasion

The major benefit of baiting has probably been the maintenance of quality pasture species which will ensure pasture growth in future seasons.

Under 1983 product prices,

- The cost of control was $8 - $16 for single or double bait application.
- $110 per hectare return on dairy farms.
- $60 per hectare return on sheep and beef farm.
- $7.1 million return from the value of pasture feed saved, to Northland farmers in 1983.

4.0 A survey of cricket infestation and damage in 1982 in Northland

References:

A survey of cricket infestation and damage in 1982 in Northland.

MAF – Internal report.

Author: R Blank

Overview:

- As part of a study to quantify cricket damage in Northland, a survey was undertaken of farm advisory officers who were asked to estimate cricket density and damage levels in their regions plus post questionnaires to 20 farmers in each region.

Cricket Density				
		Estimate of Areas affected %		
Cricket density / m2		0-4	5-20	Greater than 20
Area	*Soil*			
Kaitaia	Clay flats	10	70	20
	Clay hills	15	70	15
	Volcanic hills	65	35	0
	Sand and peat	90	10	0
Kaikohe	Clay-flats-rolling	5	70	25
	Volcanic steep	0	95	5
	Volcanic rolling	80	20	0
Dargaville	Clay flats	10	40	50
	Volcanic-gumland hills	70	25	5
	Sand	100	0	0
Whangarei	Clay flats	91	8	1
	Clay hills	84	15	1
Warkworth		100	0	0

- Pasture losses on clay soils were considered to be higher than on other soils.

  Estimates of pasture loss and summer milk production loss due to cricket damage:

	% summer and autumn feed loss			*% summer milk loss*		
Cricket density / m2	*0-4*	*4-20*	*>20*	*0-4*	*4-20*	*>20*
Clay soils	0-10	20-25	40-50	0-5	10-20	30-60
Other soils	0-5	5-20		0-2	2-5	5-40

- Farmer Survey

  Farmers considered cricket populations were low over 53% of their farms in 1981, but high (greater than 20/m2) on 40% of the area in 1982.

  But a high proportion of farms surveyed were on soils unfavourable for crickets.

  Infestations of Northland Regions in 1981 and 82 based on farmer estimates.

	% Area infested with crickets					
	1981			1982		
Cricket Density / m2	*0-10*	*10-20*	*>20*	*0-10*	*10-20*	*>20*
Kaitaia	40	38	22	49	24	27
Kaikohe	40	47	12	10	31	59
Dargaville	100	0	0	52	29	19
Whangarei	41	45	14	30	17	53
Warkworth	68	13	19	34	34	32
TOTAL	53	33	14	33	27	40

Discussion:

- Summer and autumn rainfall (Dec-April) in Kaitaia, Kaikohe and Dargaville regions was 50-100 mm lower than the 25 year normal, whereas Warkworth and Whangarei had greater than 50 mm more rain than normal. This difference in rainfall pattern is reflected in both:
  - Cricket densities obtained
  - Pasture damage estimates
- Clay flats and clay hills had higher populations than volcanic, sand or peat soil types.
- The low level of crickets implied by farmers from the Dargaville area is because the clay flats were excluded from this study.

5.0 Control of crickets – a flushing technique for estimating cricket density

References:

Control of crickets – a flushing technique for estimating cricket density MAF Aglink and internal reports.

Author R H Blank

Overview:

The black field cricket can cause pasture production losses of up to 2,000 kg dry mater per hectare. On high producing dairy farms, such losses can be worth $200 per hectare (1982 prices) due to reduced summer milk production and reduced autumn feed supply. Crickets can be controlled using bait.

The flushing technique is particularly suitable for assessing cricket populations early in the summer enabling bait to be applied (if necessary) before damage has occurred.

Maximum benefits from early baiting:

Crickets cause significant pasture production loss and damage from January until the adults die naturally in March. The amount of damage is proportional to the length of time crickets are present. Hence, bait applied in March will prevent only a small amount of damage (e.g. 25%), whereas bait applied in late January will prevent up to 90% of potential damage. Maximum benefits are obtained from early bait application.

Need for assessments of cricket densities:

Infestations of crickets are unpredictable. They are difficult to detect for putting in place control measures at the optimum time in early summer. At this time most young crickets remain hidden in cracks in the soil or under dense pasture. When adults become visible, in autumn much damage has already occurred. During a dry summer large amounts of pasture can be destroyed before crickets are recognized as a problem.

When to assess cricket populations?

- Assess cricket populations using the flushing technique in mid to late January when pasture growth has slowed and the sward has begun to open up.
- If bait was applied, particularly at the lower rate and under drought conditions, re-assess populations in early March in case of reinvasion by flight.

Flushing solutions:

The technique which has been developed for assessing cricket density uses an irritant to flush crickets from cracks to the soil surface where they can be counted.

Either a weak pyrethroid solution or a weak detergent solution can be used to flush crickets. Cypermenthrin (Ripcord 40% EC) and decamethrin (Decis 2.5% ED) are very effective flushing agents. These pyrethroids will flush approximately 1.5 times more crickets than the detergent Tepol which is the main ingredient in commercial dishwashing liquids.

Mix 0.4 m (12 drops) of Ripcord 40% EC or 7 ml of Decis 2.5 % EC, or 4 ml of Tepol per 10 litres of water. The exact concentration is not too important, provided solutions are not more or less than 20 times these levels. Solutions can be made up in a watering can or some other suitable container from which the solutions can be easily poured.

Flushing techniques:

1. Select cracked area typical of your paddock.

2. Pour the pyrethroid or detergent solution down the crack. About 2 litres of solution is needed to ensure adequate wetting of the underground portions of a 30 cm crack.

3. Count the crickets which are flushed up to the edge of the crack or onto the soil surface. The small crickets present in January are readily irritated and move onto the ground surface. Adult crickets during the heat of the summer are flushed to the edge of the crack and counted inside the crack. Avoid sudden movements or casting a shadow which may drive crickets back down the crack. A reasonable count should be completed after 2-4 minutes observation.

4. Cricket density per m2.

5. Counts may be easier early in the morning as crickets will move out of the cracks more readily when conditions are cool.

Selection of sampling sites and number of flushing counts:

Select 4 to 10 paddocks or sampling sites concentrating on areas with a past history of cricket attack. If a farm has major soil or topographic difference which may influence cricket population levels it may be worthwhile assessing several sites from each.

Take 5 to 10 flushing counts spread out across each of the sampling sites.

For example, counts at 20-40 paces across a paddock.

The objective of the sampling plan outlined is to obtain a balance between a good estimate in individual paddocks and a good estimate across the whole farm.

Are counts of crickets on the soil surface necessary?

Usually over 90% of the crickets are hidden down cracks in the soil during the daytime in summer and it is not necessary to count the few that are on the surface.

Occasionally however, crickets may be present on the surface in larger numbers during cold conditions particularly after rain. This behavior is common in late autumn, but the sampling procedure outlined is primarily aimed at preventing damage occurring before autumn. Obviously, if high numbers of crickets are seen on the soil surface then there is no need to carry out any sampling,

Care should be taken not to confuse the native cricket which jumps when disturbed and is more easily noticed than the shy black field cricket. The small stages of the black field cricket can be distinguished by the white stripe across the back which native crickets lack. Black field crickets grow up to 4 cm compared to the much smaller native crickets (1cm).

Action thresholds:

A decision to bait crickets will depend primarily upon cricket numbers but stocking rate, feed supply and summer rainfall should also be considered. Follow the suggested action thresholds outlined in the graph below.

New grass is very susceptible to cricket damage and should be baited at very low cricket densities (e.g. above 3/m2).

Bait recipe

A rate of 250 ml of maldison (Malathion 50% emulsifiable concentrate) is mixed per 10 kg of grain. Wheat, barley or crushed maize make suitable baits.

Recommendations:

- Assess cricket populations using the flushing technique in mid to late January.
- If crickets greater than 10/m2 apply bait at 10 kg/ha.
- Re-assess cricket population in early March in case of re-invasion by flight.

6.0 Differentiate between black field cricket and black beetle damage in Northland pastures under drought conditions

References:

Differentiate between black field cricket and black beetle damage in Northland pastures under drought conditions.

NZ Journal of Experimental Agriculture, 1986, Vol 14 Pages 361-367.

Author R Blank, Bell, Olson.

Overview:

- During a drought in 1982-83, many farms suffered severe pasture damage, throughout Northland.
- Eight farms were investigated where black beetle was assumed to be responsible for this pasture damage.
- Investigations involved hand sorting and wet sieving soil cores taken from damaged pasture. Presence of black beetle larvae and crickets was determined from examining frass and noting the presence of tunneling.
- Black beetle and crickets were the only insects found in abundance.
- Of 8 farms surveyed:
  - 6 farms on clay or semi-volcanic soils, had low black beetle numbers but high black field cricket egg number.
  - 2 farms on sandy soils had moderate to high black beetle numbers and nil or very low cricket number.
  - This suggests that the crickets were responsible for the severe pasture damage on the clay or semi volcanic soil farms, rather than black beetle.
- Because of the major differences in the ease and practicality of controlling crickets versus black beetle, it is important to know which insect is present. Many farmers who suffered severe pasture damage during the drought of 82-83, believed black beetle was responsibly for damage rather that crickets.
- Black beetles cause damage by chewing though the root system of pasture plants which under severe attack, can be rolled back. Crickets preferentially consume the green leaf parts of pasture plants, but will also consume stem and root tissue if no fresh leafy growth is present. This continuous and severe defoliation of pasture plants during dry summer periods, leads to plant death.
- Cricket population can be assessed using a simple flushing technique to determine if, and how much bait should be applied. Crickets can be controlled easily and cheaply using maldison treated grain baits. Black beetle control is considerably more difficult to achieve: insecticide must be applied in November or early December, and needs rain to be effective. Decisions on control have to be made in spring, before either summer conditions or larvae population are know. Insecticidal control is expensive and is not used as a routine insurance against pasture damage from black beetle.

Results:

- 1982-83 season was a drought period: Kaitaia received 51% of its normal rainfall fro the period August 1982 up to March 1983. This being one of the driest summers on record.

- This drought was the overriding factor predisposing farms to damage. The drought put severe pressure on the pasture due to overgrazing by livestock as well as insects and enhancing the survival of high populations of insects.

- Symptoms of pasture damage done by these 2 insects are very similar: large areas of bare ground with stalky grasses that frail to respond to autumn rains. The root pruning symptoms of black beetle can be confused with cricket damage.

- Results suggest that:

    - The cricket populations on the 6 affected clay or semi volcanic soils were high to very high at 40-100+ / m2. These populations would have caused severe pasture damage; e.g. populations of 10-20 /m2 can give severe damage.
    - Black beetle populations on the clay and semi volcanic farms were low and at non-damaging levels.
    - The two farms on sand soil, had moderate (35/m2) to high (109 /m2) black beetle populations. It is thought that black beetle larvae population of 40-60 /m2 in rye, white clover pasture in dry seasons will cause significant damage. Kikuyu is tolerant: it can tolerate populations up to 40 /m2 without major damage. But in this 83/84 drought year, on sandy soils the black beetle, combined with drought conditions, severely affected both ryegrass and kikuyu based pastures.

7.0 Effects of white fringed weevil and black beetle populations on pasture species

References:

Effects of white fringed weevil and black beetle populations on pasture species.

NZ Journal of Agricultural Research, 1982, Vol 25, Pages 405-414.

Author: P King, Meekings, Mercer.

Overview:

- The change in populations and effects of these insects on various newly sown pasture species were measured.
- Location: Otakanini Research area, near Helensville, on a Red Hill – Tangitikii sandy clay soil. This had been the site of very high pasture and forage crop yields.
- Various grass, white and red clovers were sown in September 1975. Springtail and slug control undertaken. Paspalum, phalaris and kikuyu were transplanted. Base potassium and super phosphate were applied 4 times per year, plus nitrogen was applied up to 200 kg/N/ha/year.
- In November 1975, black beetle adults were introduced into sub treatment plots. In November 1977, further adults and eggs were introduced in an attempt to establish damaging black beetle and populations.

Population movement:

Black beetle (February) populations in non-insecticide pasture species treatments in Trial 1

Treatment	*Black beetle / m2*		
	1976	1977	1978
Ryegrass only	62	0	13
White clover only	25	0	0
Ryegrass/white clover	43	0	0
Phalaris/white clover	45	0	0
Phalaris/ryegrass/white clover	71	0	0
Paspalum/white clover	30	0	0
Paspalum/phalaris/white clover	74	12	26
Kikuyu/white clover	37	0	0
Kikuyu/Phalaris/white clover	19	0	13
Cocksfoot/Phalaris/white clover	48	0	0
Cocksfoot/Phalaris/red clover	45	0	0

- The population average 45/m2 of black beetle was at potentially damaging numbers, in the first year only. The paspalum and phalaris and w/c treatment was the only one to have some black beetle present in year two.

- Following the introduction in November 1977, the populations of black beetle in 77/78 summer were surprisingly low because of an unexplained mortality over the Nov-Feb period.

Pasture composition and yield

- The only treatment to show pasture damage with dry matter being 28% and 24% lower in the summer and autumn period, in the presence of black beetle, was the ryegrass only treatment; and the ryegrass and w/c treatment in summer at 30% lower production.

- In spite of black beetle populations of above 70/m2 in the phalaris – rye w/c and paspalum – phalaris w/c treatments and above 45 /m2 in other treatments with phalaris or cocksfoot present, no pasture damage was evident.

- In the ryegrass sites with black beetle damage, the ryegrass content was significantly lower in winter (36 and 67%) with more weeds and clover. But the ryegrass content improved by the spring again.

- Phalaris is resistant, paspalum, kikuyu and cocksfoot are tolerant of black beetle.

- Other trial survey work in Northland for black beetle populations:

    - 1981 survey in Maungatapere, Redhill (Dargaville) and Kaikohe showed low populations in spring and autumn. Plus there had been little pasture damage that could be attributable to black beetle over recent years, up to 1981.
    - Black beetle populations assessed from 1976-85 on a Redhill sand near Dargaville. Black beetle summer larvae population ranged up to 40/m2 in ryegrass dominant and 77/m2 in kikuyu dominant pastures without causing pasture damage or drop in pasture production.

8.0 Effect of black beetle, in association with nitrogen and summer spelling, on pasture production on sandy soils

References:

Effect of black beetle, in association with nitrogen and summer spelling, on pasture production on sandy solids.

NZ Journal of Agricultural Research, 1998, Vol 31 pages 445-453.

Author: R Blank, Olson

Overview:

- Previous studies showed black beetle in association with drought conditions caused severe pasture damage on sandy soils, north of Kaitaia.

- In this study, from 1983 to 1986, on sandy soils, insecticide control of black beetle resulted in small, short lived increases in pasture production.

- Black beetle populations were medium to high:

    - 11 to 27 /m2 on ryegrass pastures
    - 16 to 112 /m2 on kikuyu pastures.

- Nitrogen responses were very strong varying from 17 kg to 35 kg DM/kg N.

Method:

- Trials carried out in 1983/84, 1984/85 and 1985/86 at Pukenui and Ngataki, North of Kaitaia.

- These trials investigated the effect of insecticide, nitrogen and summer spelling from grazing, on pasture production.

Results:

- Black beetle population: there were no significant interactions of black beetle density with nitrogen or grazing treatments. Black beetle was at low to moderate densities on ryegrass sites over the 3 years, but developed high population on the kikuyu site in 1985-86.

- Insecticides reduced black beetle larval population by 89% average on all sites and seasons.

- Pasture responses to insecticide applications followed a similar pattern over the 3 season. These were small short lived increases in production from the insecticide treatment in December which averaged just 340 kgDM/ha on ryegrass and 80 kgDM/ha on kikuyu.

- Over a 12 month period there was no advantages in pasture growth for control of black beetle.

Pasture Production – Insecticide versus non insecticide treatment of black beetle.

Average	*Pasture Production – kgDM/ha/year*	
	Insecticide Treatment	Non Insecticide Treatment
Kikuyu Dominant	6710	6923
Ryegrass Dominant	10280	10070

- Nitrogen responses were very strong over the whole 3 year period.

	Nitrogen Response – kgDM/kg N	
	Spring	*Winter*
Rye Dominant	35	25
Kikuyu dominant	25	17

Time of application of nitrogen:

Mid May 1984
Early October 1984
Early April 1985
Late September 1985
Early June 1986

Urea applied at 25 kgN/ha each application.

- Insecticides used to control black beetle reduced pasture pulling in one year in the three, for both ryegrass and kikuyu, but this advantage did not increase pasture production.

Discussion:

- The most susceptible soils for black beetle damage are the coastal sands and peaty soils, which occupy approximately 12% of Northland.

- Survey near Dargaville from 1976-85 black beetle summer larvae populations:
    - Averaged 19/m2 and up to 40/m2 on ryegrass
    - Averaged 40/m2 and up to 77 /m2 on kikuyu dominant pastures, without causing pasture damage or growth decrease.

Conclusion:

- Insecticide control of black beetle is not a practical means of increasing pasture production.

- In contrast, the strategic use of nitrogen may give reliable pasture production increases.

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August 2005

A project coordinated by the Northland Pastoral Farming Development Group