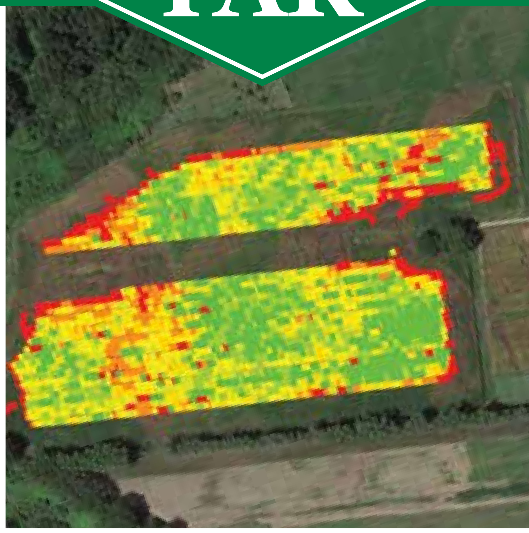
Northern Crop Research Site

Research Summary 2016

ADDING VALUE TO THE BUSINESS OF CROPPING



Northern Crop Research Site 2015/16

This publication provides a summary of trials undertaken at the Northern Crop Research Site over the 2015/16 season, and their results. Key take home messages are provided for each trial.

Table of Contents

2015/16 Summary

FAR's Northern Crop Research Site is located at 82 Oaklea Lane, Tamahere, near Hamilton.

At the Northern Crop Research Site FAR runs research trials and demonstration plots in order to provide quality research and extension activities for New Zealand, and particularly North Island, cropping farmers. During the 2015/16 season FAR undertook nearly twenty different trials at the Northern Crop Research Site (NCRS).

Site changes

With the loss of a large portion of the Long Term Cultivation (LTC) trial to the new SH1 expressway in 2014, it was decided to abandon the LTC trial this season. A new LTC trial has been established well away from SH 1 and this is now entering its third season. Results from the new LTC trial are given later in this booklet.

Weather station

In spring 2015 a state-of-the-art weather station was installed at the NCRS site. This station records air and soil temperature, rainfall, soil moisture and leaf wetness every thirty minutes. This data will be valuable for interpreting trial results from the site in the context of the weather conditions experienced.

Field days

On 10 December 2015 FAR held its first annual Northern Crop Research Field Day, an event which saw nearly 300 growers visit the site and listen to twelve speakers over eight different time slots. This successful event will be repeated on 15 December 2016.

Figure 1. The weather station at NCRS records air temperature and relative humidity, rainfall, soil moisture and temperature, leaf wetness and solar radiation.

Table 1. Rainfall records for Waikato.

	Northern Crop Research Site 2015/16 (mm)	30 Year Average Hamilton Airport (mm)	NCRS Monthly Percentage of 30 Year mean
Nov-15	30	89	34%
Dec-15	96	105	91%
Jan-16	226	82	275%
Feb-16	101	74	137%
Mar-16	126	84	150%

Figure 2. Aerial photograph of Northern Crop Research Site, February 2015.

Winter cover crops for weed control

Take home messages

- Oat and ryegrass residue provided a good physical barrier that inhibited weed incursion.
- Alsike clover suppressed weed incursion despite low residue cover.
- All herbicide treatments provided good weed control and reduced weed cover.
- Plots where weeds were left untreated without any winter cover crop residue present yielded significantly lower.
- In maize fields with low to moderate weed populations, significant yield loss due to weed competition could be avoided through the use of a cover crop.

Introduction

Winter cover cropping in maize farming systems can suppress weeds and contribute to increased final crop yields. Pre- and post-emergence herbicide applications are a significant cost to growers.

Methods

A field demonstration trial was conducted to evaluate the effect of winter cover crop stubble and residue on the subsequent weed emergence and growth of spring planted maize. Six winter cover crop species were established in strips in April 2015:

- faba bean (*Vicia faba*)
- oats (*Avena sativa*)
- red clover (*Trifolium pratense*)
- Persian clover (*T. resupinatum*)
- alsike clover (*T. hybridum*)
- annual ryegrass (*Lolium multiflorum*)

Seven weed management strategies were established prior to maize planting. Four strategies included the winter cover crop stubble and residue (with or without a post-emergence herbicide weed control programme), while three strategies had stubble removed (bare-ground) that was either left untreated (control), or had a pre-emergence or post-emergence herbicide weed control programme applied. Maize hybrid Pioneer P9411 was planted on 16 November 2015. Individual plots were 3 x 6.1 m, with 8 rows of maize planted. The seven weed management strategies (treatments) were replicated six times (Table 2). The herbicides used are listed in Table 3.

Results

The establishment and final ground cover of the winter crops varied between species, as did the persistence of their residue following maize establishment. Clovers provided low ground cover and their residue had degraded by the time of maize canopy closure (10 weeks post-crop emergence (WPE)). Only about a third of the faba bean residue remained at canopy closure, compared to 80%+ of the oat and ryegrass residue remaining at maize canopy closure. This provided a good physical barrier to inhibit weed incursion, but also inhibited and delayed maize establishment. Few maize plants established in some thick patches of ryegrass residue. These plots were also more susceptible to slug damage despite slug pellet application at planting.

Figure 3. Oat plot showing the influence of trash on maize emergence.

The site had a low to moderate weed pressure, which was influenced by the previous winter cover crop and the herbicide treatment applied. In treatments that did not receive herbicides to control the weeds, the bare-ground plots generally had higher weed cover than plots where winter cover crop stubble remained, except for alsike clover. All plots that received herbicide treatment had good weed control and reduced weed cover, with the 2x post-emergence schedule generally providing the best weed control.

Leaf area measurements of leaf 7 at 8.5 WPE showed that weeds left untreated had not inhibited maize development at this time, however by 14.5 WPE, leaf 12 areas were reduced because of untreated weeds in bare-ground plots of faba bean, red clover and Persian clover. In contrast, leaf 12 areas were not reduced by oats, ryegrass or alsike clover due to lower weed numbers caused by their stubble or allelopathic suppressive effects on weeds.

Maize grain yield was low overall (6.0 - 9.4 t/ha, Table 2) due to the high level of common rust that infected all maize plants, regardless of cover crop or treatment. The bare-ground untreated weedy plots had significantly lower grain yield compared to other treatments. However, winter crop stubble without any herbicide applied had no significant reduction in yield. In maize fields with low-moderate weed populations and where an appropriate winter cover crop is used, significant yield loss due to weed competition could be avoided (Table 2).

An economic costing exercise of the regimes showed that none of the bare-ground, winter cover crop or herbicide treatment regimes provided a positive economic return on investment this season, mainly due to low grain yields. Although winter cover crops tended to have higher costs than bare-ground treatments, their biomass could be harvested for silage and sold to off-set these costs.

Figure 4. Pre-emergence bare-ground treatment maize plants (left) and post-emergence Persian clover cover crop maize plants (right), 14 December 2015.

Table 2. Maize harvest data of mean plant population, cob number and grain yield.

	Treatment	Total plants (cobs/6 m)	Total cobs (cobs/6 m)	Cob grain (g/cob)	Plot grain (t/ha)[2]
1	Untreated (no-crop)	41.4 ab[1]	39.8 ab	69 a	6.0 a
2	Pre-em (no-crop)	42.5 a	40.9 a	105 b	9.4 b
3	Post-em (no-crop)	41.3 ab	38.4 ab	96 b	8.1 b
4	Crop only[3]	39.3 b	37.7 b	103 b	8.6 b
5	Crop + incorp + Post-em[3]	40.8 ab	39.2 ab	104 b	8.9 b
6	Crop + Post-em[3]	39.6 ab	38.6 ab	111 b	9.3 b
7	Crop + Post-em x 2[3]	39.6 ab	38.5 ab	111 b	9.3 b

[1] Treatments followed by the same letter are not significantly different from each other ($P<0.05$).
[2] Yield adjusted to 14% moisture content.
[3] Combination of all crop results.

Conclusion

Winter cover crop programmes have potential for suppressing weed incursion with minimal negative effect on establishing maize and final yields, and these are comparable to conventional herbicide-based programmes. Further work is being undertaken at NCRS in 2016/17.

Table 3. Trial treatment list, detailing pre-plant mechanical and herbicide treatments applied to the winter cover crops and the pre-emergence and post-emergence herbicide treatments relating to maize establishment.

			Pre-plant		Pre-emergence		Post-emergence	
Trt no.	Cover crop	Mechanical Treatment	Herbicide	Rate (prod/ha)	Product	Rate (prod/ha)	Product	Rate (prod/ha)
1	Bare-ground	Untreated	-	-	-	-	-	-
2	Bare-ground	None	-	-	Roustabout + Sharpen	3 l + 150 g		
3	Bare-ground	None	-	-			Arietta mix[2]	200 ml
4	Faba bean	Mow	Gramoxone + Weedmaster[1]	4 l + 2.7 l				
4	Oats	Mow	Weedmaster[1]	2.7 l				
4	Red clover	None	Weedmaster + Granstar[1]	2.7 l + 40 g				
4	Persian clover	None	Weedmaster + Granstar[1]	2.7 l + 40 g				
4	Hytas clover	None	Weedmaster + Granstar[1]	2.7 l + 40 g				
4	Ryegrass	Mow	Weedmaster[1]	2.7 l				
5	Faba bean	Mow/Incorporated	Gramoxone + Weedmaster[1]	4 l + 2.7 l			Arietta mix[2]	200 ml
5	Oats	Mow/Incorporated	Weedmaster[1]	2.7 l			Arietta mix[2]	200 ml
5	Red clover	Incorporate	Weedmaster + Granstar[1]	2.7 l + 40 g			Arietta mix[2]	200 ml
5	Persian clover	Incorporate	Weedmaster + Granstar[1]	2.7 l + 40 g			Arietta mix[2]	200 ml
5	Hytas clover	Incorporate	Weedmaster + Granstar[1]	2.7 l + 40 g			Arietta mix[2]	200 ml
5	Ryegrass	Mow/Incorporated	Weedmaster[1]	2.7 l			Arietta mix[2]	200 ml
6	Faba bean	Mow	Gramoxone + Weedmaster[1]	4 l + 2.7 l			Arietta mix[2]	200 ml
6	Oats	Mow	Weedmaster[1]	2.7 l			Arietta mix[2]	200 ml
6	Red clover	None	Weedmaster + Granstar[1]	2.7 l + 40 g			Arietta mix[2]	200 ml
6	Persian clover	None	Weedmaster + Granstar[1]	2.7 l + 40 g			Arietta mix[2]	200 ml
6	Hytas clover	None	Weedmaster + Granstar[1]	2.7 l + 40 g			Arietta mix[2]	200 ml
6	Ryegrass	Mow	Weedmaster[1]	2.7 l			Arietta mix[2]	200 ml
7	Faba bean	Mow	Gramoxone + Weedmaster[1]	4 l + 2.7 l			Callisto mix; Astound Ultra[3]	200 ml + 1.5 l
7	Oats	Mow	Weedmaster[1]	2.7 l			Callisto mix; Astound Ultra[3]	200 ml + 1.5 l
7	Red clover	None	Weedmaster + Granstar[1]	2.7 l + 40 g			Callisto mix; Astound Ultra[3]	200 ml + 1.5 l
7	Persian clover	None	Weedmaster + Granstar[1]	2.7 l + 40 g			Callisto mix; Astound Ultra[3]	200 ml + 1.5 l
7	Hytas clover	None	Weedmaster + Granstar[1]	2.7 l + 40 g			Callisto mix; Astound Ultra[3]	200 ml + 1.5 l
7	Ryegrass	Mow	Weedmaster[1]	2.7 l			Callisto mix; Astound Ultra[3]	200 ml + 1.5 l

[1] Weedmaster 540 was used and Pulse added to tank mix at 0.1% v/v. [2] Arietta mix (Arietta 200 mL + Gesaprim 1 L + Hasten 0.5% v/v).
[3] Callisto mix (Callisto 200 mL + Gesaprim 1 L + Synoil 1% v/v) applied early post-emergence; Astound Ultra applied late post-emergence

Fungicide use on maize

Take home messages

- The use of fungicides on two of the four hybrids increased grain yield by 2.1 and 2.3 t/ha.
- In the hybrid 34P88, improved disease control and reduced leaf disease did not translate into improved grain yield.

Background

This trial was carried out to further quantify the yield effects of fungicide use in maize, after a significant benefit in grain yield was obtained by the use of fungicides in the 2014/15 trial.

Method

The trial paddock was ploughed, and just prior to planting, cultivated by a spring-tine crumble roller. Four hybrids of varying disease resistance and comparative relative maturity (CRM) were planted in strips on 6 November 2015 using a John Deere MaxEmerge planter. All hybrids were planted at 90,000 seeds/ha, with starter fertiliser of 150 kg/ha Nitrophoska blue extra (12:5:14 + Mg and trace elements) applied. The pre-emergence herbicides saflufenacil (Sharpen at 150 gms/ha) and acetachlor (Roustabout at 3 l/ha) were applied on 8 November. Weed control was excellent.

Plots were 7 m long and eight rows wide. Neutron probes were installed to give data on soil moisture. Fungicide treatments were applied at V7, pre-tassel, both V7 and pre-tassel or nil fungicide applied (control). Four replicates were established. Note that this trial design did not allow us to compare hybrids, just the difference between fungicide treatments within hybrids.

At leaf stage V7 on 23 December 2015, a combination of the fungicides pyraclostrobin (Comet at 1 l/ha) and epoxiconazole (Opus at 1 l/ha) were applied using a boom sprayer fitted with air induction nozzles and calibrated to a 220 l/ha water rate. At pre-tassel (21 January 2016) the same fungicides at the same rates were applied using a CO_2 powered back pack sprayer with an air induction nozzle high clearance mini–boom.

On 12 February 2016, ten adjacent plants in each of the 64 treatment plots were scored for leaf disease by examining the leaves above and below the cob. Leaf disease levels were generally low.

Following black layer and plant dry down, cobs were hand harvested, shelled, weighed and had moisture content measured.

Results

There was no fungicide effect on grain yield of hybrids 34P88 and N51-N4, a small response in P0021 and a larger response in DKC5783 (Table 4 and Figure 5).

Disease scores are shown in Figure 6 as percentage of leaf area with common rust. The data represents a combination of scores from the leaf above and below the cob.

Figure 6 shows that the control plots have significantly higher levels of disease than all of the fungicide treatments. However, there was no significant difference between the three different fungicide regimes. Leaf disease symptoms (common rust) were generally low. The higher incidence of disease with the control treatment of 34P88 hybrid did not translate into a significant yield loss.

Figure 7 shows soil moisture levels in the trial area. Tasselling and pollination occurred from 21 - 28 January. Soil moisture levels were not in deficit during this period.

Discussion

There were significant yield differences between untreated and fungicide treatments in two of the four hybrids in the trial, in a season where moisture was not limiting pollination.

In the 2014/15 season a similar trial with six different hybrids achieved an average 3.4 t/ha increase in yield of the fungicide treated plots over the unsprayed controls. In the 2014/15 season the site experienced an extremely dry period over the moisture sensitive pollination period, and only the fungicide treated plots had adequate pollination and kernel development.

International research has shown that strobilurin (QoIs) fungicides can increase yields, even in the absence of disease. These fungicides are known to improve water and nitrogen use efficiency, delay senescence as well as improving stalk strength. We surmised last season that the increase in yields from the fungicide application was due to at least some of these benefits that allowed the plants to better synchronise pollination. One of the purposes of this season's trial was to further investigate this effect. Unfortunately this season's weather was quite different and not dry over the pollination period, nor was common rust pressure severe enough to produce the large gains from fungicide use shown in the preceding year.

We did however, see a trend for increased yields and lower leaf disease when compared to the untreated controls. We will continue investigating the effect of fungicide treatments on maize next season.

Table 4. Hybrids used in the trial, giving producers rust tolerance rating.

Hybrid	CRM	Seed Supplier	Company Disease Ratings
P0021	100	Genetic Technologies Limited	6 out of 9
N51-N4	104	Corson Maize	6 out of 7
34P88	109	Genetic Technologies Limited	5 out of 9
DKC5783	107	Pacific Seeds	6 out of 9

Table 5. Maize grain yield of different hybrid and time of fungicide treatments (t/ha at 14% moisture).

Fungicide	34P88	DKC5783	N51-N4	P0021
Control	11.3	9.7a	12.6	9.3a
V7	11.7	11.3b	13.6	10.6bc
Pre tassel	11.0	11.6b	13.8	11.4c
Both	11.2	12.0b	13.7	9.9a
LSD (10%) within hybrid of fungicide treatment timing				1.3

Results with the same letter beside them are not significantly different to other treatments for that hybrid. Results with no letter beside them are not significantly different.

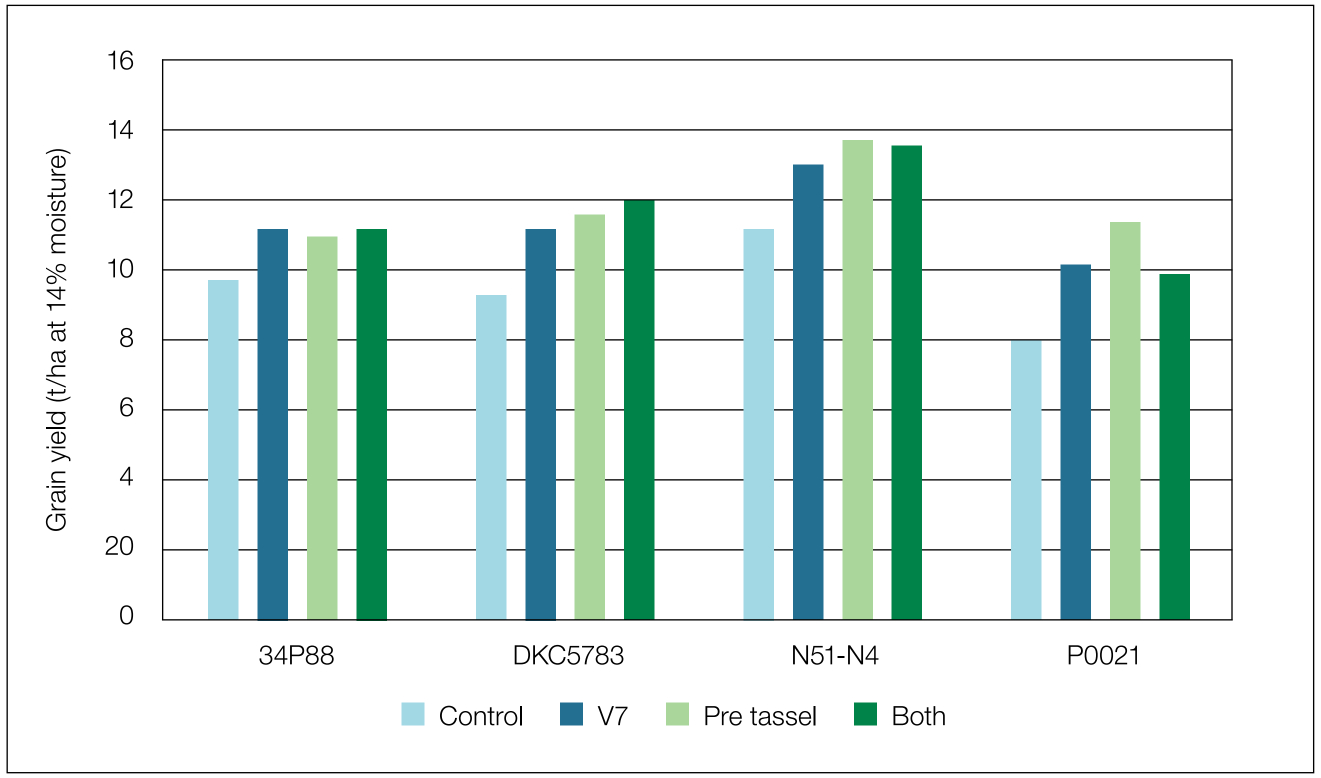


Figure 5. Fungicide response in different maize hybrids.

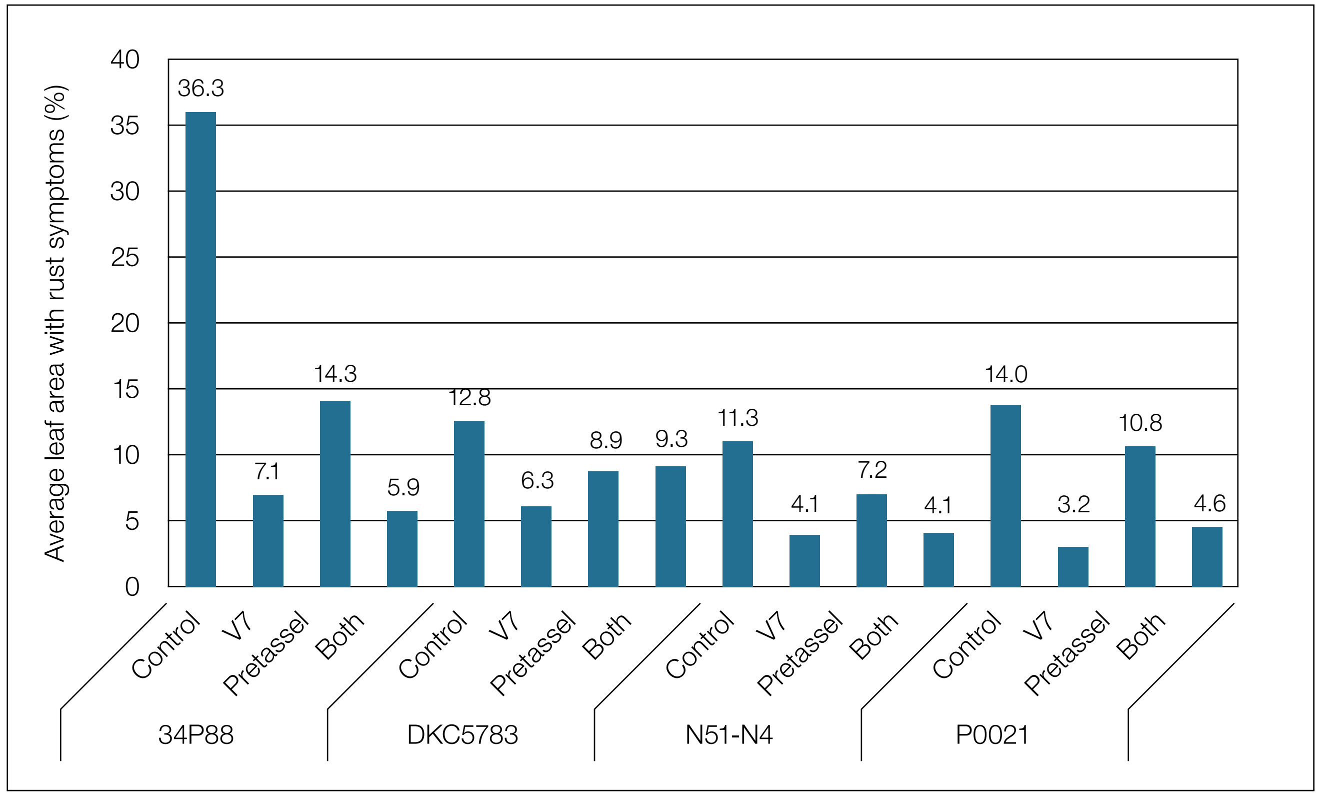


Figure 6. Disease symptom incidence on leaves above and below cob.

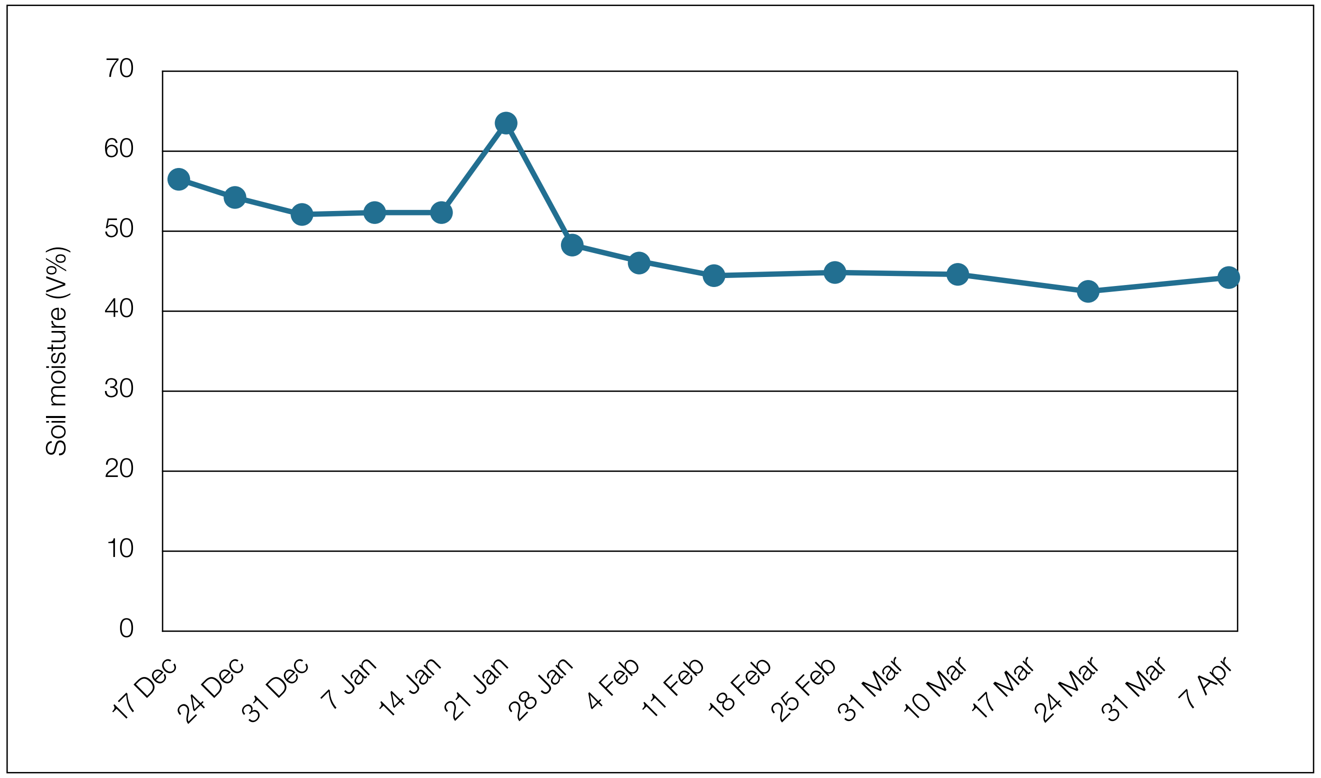


Figure 7. Total soil profile moisture over pollination period, silk emergence occurred from 21-28 January.

Long term cultivation trial

Take home messages

- Data from the old long term cultivation trial shows no significant difference between maize grain yields from no-till, strip-till and full cultivation treatments.
- It is too soon to draw conclusions from the new long term cultivation trial.

Introduction

Cultivation practices can strongly influence important soil processes, which can in turn affect the sustainability and profitability of arable cropping systems in both the short and longer term. There are many advantages from decreasing cultivation, including reduced establishment costs, retention of soil moisture, improved soil structure, less carbon loss, reduced soil erosion and the limiting of soil compaction. However, while these benefits are generally well accepted, such approaches have had limited uptake by maize farmers in New Zealand.

In 2008, FAR established a long-term cultivation trial to support the development and adoption of reduced cultivation and establishment practices for successful maize production. Three cultivation practices were included: full conventional cultivation (FC); strip till (ST) and direct drill (DD). Each year incremental improvements have been made to the technologies associated with ST and DD and key agronomic issues have been resolved.

Objective

The aim of the long term cultivation (LTC) trial is to compare the effect of conventional tillage, strip tillage and direct drilling on the establishment and subsequent crop performance and profitability of maize each year, and also their long term effects on soil conditions.

Method

In 2014 a new expressway was built which resulted in the loss of two replicates of this long term trial and the trial was abandoned in 2015. A new LTC trial was established in 2014. This report will examine the findings of the new LTC trial but still consider the findings from the old one.

The entire trial area was sprayed with 2.5 l/ha of Glyphosate 540 in September 2015. This killed the annual ryegrass cv. Tama that was planted following the previous maize harvest, as well as any weeds present. Strip–tilling of that treatment was carried out with two passes of a SoilWarrior cultivator in mid-September 2015. In late September the conventional cultivated plots were disc ripped and power harrowed just prior to planting. Planting of the trial was carried out on 10 October with a John Deere MaxEmerge planter equipped with residue removers and reduced inside diameter gauge wells suited to both direct drilling and planting into cultivated soil.

The trial comprised four replicates, each of eight row strips of maize with the three cultivation treatments. The strips were 97 metres long, and arranged in a random order, with buffer rows at the edge of the block. Row spacing is the standard 762 mm (30 inches).

At planting, 150 kgs/ha of Nitrophoska Extra (12:5:14 +Mg+trace elements) starter fertiliser was placed 50 mm to the side and below the maize seed (Pioneer hybrid P9911) at a population of 90,000 seeds/ha. On 11 October pre-emergence herbicides saflufenacil (Sharpen 150 gms/ha) and acetachlor (Roustabout 3 l/ha) were applied using a 12 m boom equipped with air induction nozzles and calibrated to 220 l/ha water.

Following maize seedling emergence, neutron probes were installed to monitor soil moisture levels from under the three treatments. Emergence counts were also undertaken.

Following grain black layer and plant dry down, the strips were combine harvested, weighed into a weigh wagon, sampled for moisture and analysed using a Dickey John GAC 2100 Agri moisture meter.

Results

Plant populations in two of the direct drill strip plots were badly reduced by birds and had to be replanted. We believe this is because we did not increase the ground pressure on the planter for the direct drill treatments. In future we will use Mesurol treated seed, and ensure ground pressure is increased to place the seed at the correct depth. The yield results (Table 6) exclude the two bird damaged plots from the data analysis.

There was very little difference in soil moisture graph between the three treatments at the 0 to 20 cm depth. Data from the previous long–term trial showed, on average a 3% higher soil moisture in the direct drilled treatments than in the full cultivation treatments.

Table 6. Grain yield from different crop establishment treatments (t/ha at 14% moisture)

	New Long Term Cultivation trial		Old Long Term Cultivation trial	Cost of cultivation and planting ($/ha)
	Harvest 2016	Harvest 2015	2008-2015	
Full cultivation	12.1	10.5	11.8	$500
Strip till	12.4	10.3	11.2	$360
Direct drill	10.9 *	9.4	12.0	$150

* Average of two replicates only.

Discussion and conclusions

In the first two years of this new LTC trial the direct drilled plots have yielded significantly less than the cultivated plots. This is surprising given the seven years data from the previous LTC trial when no significant differences in yield were noted. However, two additional factors need to be considered. Firstly, this new site had been cultivated for 15 years prior to establishing the LTC trial, and overseas research suggests at least a four year time frame for no-till crop establishment to create a new equilibrium in soil state. Secondly, bird damage caused problems this year in the direct drilled plots (possibly slightly shallower seed placement) and two replicates were replanted (omitted from the data analysis). The yields in the three direct drilled plots analysed also had quite a yield range, from 9.5 to 12.3 t/ha.

Establishing maize by direct drilling has considerable cost benefits based on the seven year data from the previous long term cultivation trial. For the 2016/17 season no-till maize crop establishment trials will be established in the Rodney, Waikato and East Cape regions.

Figure 8. Long term cultivation trial no-till plot, 6 November 2015.

Maize Hybrid Performance Trials (MPT)

Take home messages

- Second year of MPT programme with twice as many trial sites as last year.
- Yield difference between leading hybrids was not significant.

The MPT trial programme was established in 2014 to provide an independent maize hybrid testing scheme which would provide objective measurements of the agronomic and quality performance of commercial maize hybrids available to the New Zealand arable industry across appropriate production regions.

For the 2015/16 season trials were established in the Waikato (two sites), Bay of Plenty, Rangitikei, Manawatu and Canterbury. The trial design was a fully replicated, small plot design which included standard hybrids for comparison.

The full methodology and results of the MPT programme are available on the FAR website.

One of the six MPT sites in the 2015/16 season was established at Northern Crop Research Site, and the results are given in Tables 7 and 8 below. The same six MPT sites are being established for the 2016/17 season.

Table 7. Maize Hybrid Performance Trial silage results from NCRS, 2015/16 season.

Hybrid	CRM	Days to 50% silk emergence	Plants per hectare	Days to harvest	DM (%)	Yield (t DM/ha)
P0791	106	77	93878 bg	130	42.0 be	24.7 a
C56-C4	106	78	97428 ae	125	36.1 gj	24.7 a
PAC432	107	78	95330 ae	130	39.9 ef	23.8 ab
N39-Q1	97	75	94819 af	129	46.7 a	23.8 ab
C78-S8	114	83	89416 hi	136	34.5 ij	23.8 ab
Z71-F1	111	81	96880 ae	130	37.4 gh	23.8 ab
PAC456	108	81	88712 i	129	37.7 fg	23.4 ac
PAC343	104	77	93404 dh	130	41.2 ce	23.4 ac
37Y12	95	75	99094 a	125	36.0 gj	23.3 ac
P0021	100	75	98235 ac	125	36.0 gj	23.3 ac
PAC230	98	75	93664 ch	129	43.9 b	23.0 ac
PAC249	95	75	96021 ae	129	43.0 bd	22.9 ac
Olympiad	112	81	95652 ae	136	36.6 gi	22.9 ac
Afinity	100	78	98884 a	125	34.6 ij	22.9 ac
C29-A1	96	76	83849 j	129	44.2 b	22.6 ac
N51-N4	104	77	98186 ac	125	35.0 hj	22.5 bc
33M54	112	84	97937 ad	136	36.3 gj	22.4 bc
Plenitude	107	82	95990 ae	136	35.6 gj	22.3 bc
34P88	109	81	95560 ae	130	37.9 fg	22.3 bc
Sirus	117	85	94757 af	136	29.9 k	22.2 bd
Maximus	102	75	98526 ab	125	33.9 j	21.8 bd
G49-T9	104	75	90598 gi	129	40.8 de	21.5 cd
Titus	82	68	93004 ei	125	43.3 bc	20.1 d
Mean		**78**	**94775**	**130**	**38.4**	**22.9**
LSD 10%			**4673**		**2.4**	**2.1**
CV%			**4.2**		**5.0**	**7.7**

Table 8. Maize Hybrid Performance Trial grain results from NCRS, 2015/16 season.

Hybrid	CRM	Days to 50% silk emergence	Plants per hectare	Harvest moisture (%)	Test Weight (kg/hl)	Yield (t/ha at 14% moisture)
PAC343	104	77	93999 bd	17.3 de	71.9 bd	12.3 a
PAC432	107	78	96928 ac	17.3 de	70.5 cf	12.1 ab
PAC230	98	75	93169 cd	16.5 fg	71.8 be	12.1 ab
PAC249	95	75	96416 ad	16.4 fg	71.1 bf	12.1 ab
37Y12	95	75	99915 a	16.9 eg	72.8 b	11.6 ac
Plenitude	107	82	96748 ad	18.4 c	70.2 dg	11.4 ad
P0021	100	75	99843 a	16.9 eg	71.6 be	11.3 ae
Afinity	100	78	97334 ac	16.5 fg	70.5 cf	11.2 be
C29-A1	96	76	85174 e	16.2 g	68.2 hj	10.9 ce
N39-Q1	97	75	94096 bd	16.6 eg	68.4 gi	10.8 cf
Sirus	117	85	99900 a	23.6 a	69.6 fh	10.6 cf
Titus	82	68	91769 d	17.0 ef	75.0 a	10.6 cf
N51-N4	104	77	95364 ad	16.5 fg	69.9 eh	10.4 df
Olympiad	112	81	94398 bd	17.9 cd	66.5 j	10.4 df
34P88	109	81	98352 ab	19.3 b	72.1 bc	10.3 ef
Maximus	102	75	93918 bd	18.3 c	67.1 ij	9.9 f
Mean		**78**	**95458**	**17.6**	**70.4**	**11.1**
LSD 10%			**4998**	**0.7**	**1.8**	**1.0**
CV%			**4.5**	**3.6**	**2.2**	**7.4**

Hybrids with the same letter beside them are not significantly different for the characteristic listed. When no significant difference for a given parameter is found among hybrids, “ns” (non-significant) replaces an LSD value.

Figure 9. Maize hybrid performance trial at NCRS, 6 November 2015.

Prior crop effect on maize performance

Take home message

- Maize grain grown after a clover cover crop yielded significantly higher than maize grown after an annual ryegrass cover crop.

Introduction

In New Zealand maize grain is often grown season after season in the same ground, and most often without a cover crop over winter. The classic Midwest United States crop rotation of soybeans-maize allows the maize to benefit from the nitrogen fixed by the leguminous soybean. Growing soybean is not viable in New Zealand, but other legumes may be useful cover crops in rotation with maize.

Objective

The objective was to determine the nitrogen contribution to a maize crop from a previous legume cover crop.

Methods

The western side of the paddock had previously grown a crop of Persian clover (cv. Enrich) while the eastern side a crop of annual ryegrass (cv. Tama). The paddock was ploughed and cultivated prior to planting. Deep mineral N tests were taken to 60 cm, and AmaizeN calculated that an additional 135 kgN/ha was required for an expected grain yield of 13 t/ha.

Maize hybrid P9411 was planted at 90,000 seeds per hectare on 10 October 2015, with four fertiliser treatments, being Haracoat™ PSCU37 applied at 150 and 220 kg/ha; as well as Urea (46%N) at 300 kg/ha, and a nil fertiliser treatment.

The trials then received identical crop management until harvest i.e. pre-emergence herbicides sprayed on the 11 October 2015, using 150 gms/ha saflufenacil (Sharpen) and 3 l/ha acetachlor (Roustabout) at 220 l/ha water rate applied through air induction nozzles at 4 bars pressure on a 12 m boom sprayer.

Following black layer and dry down, 2.5 metres of the centre two rows of each treatment plot's cobs were harvested, shelled and weighed. Moistures were taken and results converted to the standard grain yield at 14% moisture. Deep mineral N soil tests (0 to 90 cm) were also taken in each harvested area of each treatment.

Results

The graph in Figure 10 below, shows the significant yield advantage to the maize grain crop, following the legume cover crop compared to the ryegrass cover crop. The maize following ryegrass did not reach the yield potential of about 13 t/ha, with other factors constraining yield.

Table 9 gives the results of deep N soil tests carried out at the conclusion of the trial. There was a similar amount of nitrogen in the soil in the two cover crops.

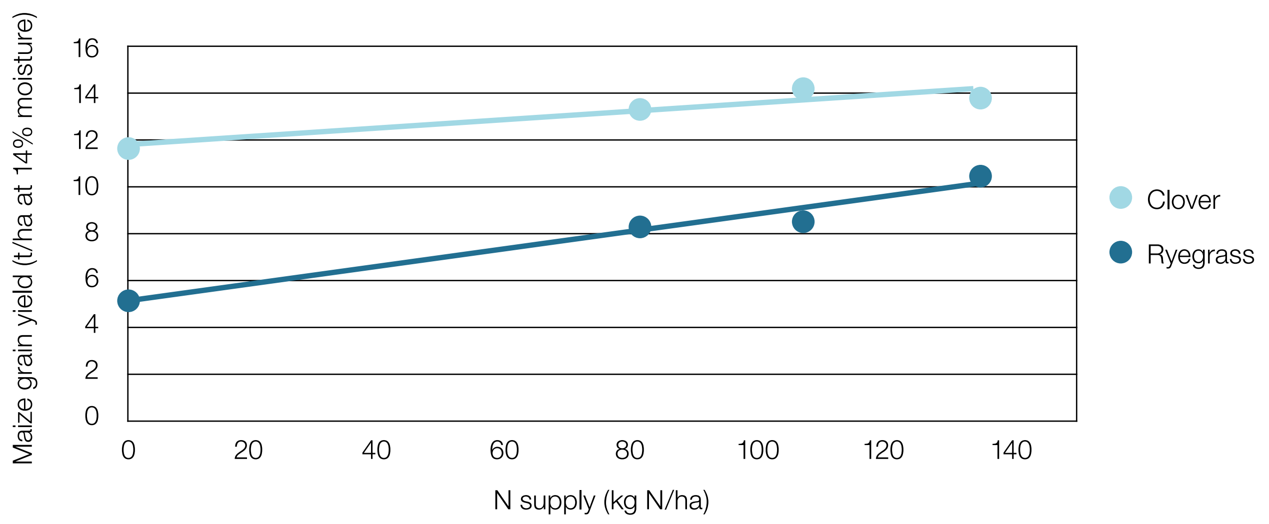


Figure 10. Yield response to previous crop rotation and applied nitrogen. LSD (P = 0.05) for fertiliser treatments within each crop is 1.9 t/ha.

Table 9. Deep N soil test results from trial site, before and at completion of trial.

		Clover			Ryegrass		
	Soil Depth	Ammonium-N (mg/kg)	Nitrate-N (mg/kg)	Total Mineral N (kg/ha)	Ammonium-N (mg/kg)	Nitrate-N (mg/kg)	Total Mineral N (kg/ha)
Sept 2015	0-30 cm	3.0	6.0	30	2.0	5.0	20
	30-60 cm	3.0	5.0	26	7.0	<1.0	23
April 2016	0-30 cm	2.3	10.9	43	5.1	10.5	52
	30-60 cm	2.6	1.3	12	2.1	1.0	10
	60-90 cm	2.3	1.4	12	1.8	2.0	7
	0-90 cm	2.4	4.5	66	3.0	4.5	68

Discussion

In this trial the maize grown after the clover crop yielded significantly more than maize grown after an annual ryegrass cover crop. If the only difference resulting from the two previous crops is the supply of nitrogen, we should have seen similar yields in the maize from the treatments supplied with 135 kg N/ha. Because this is not the case, there appears to be another factor different between the two previous crops' histories. It is possible that the considerable maize residue through which the ryegrass was direct drilled resulted in some nitrogen being immobilised while breaking down this high carbon material.

Conclusion

We conclude that legumes have an advantage compared to ryegrass in enhancing grain yield and reducing nitrogen inputs. This difference was not predicted from the pre-planting soil nitrogen test results.

Further trials are being undertaken to investigate this effect in the 2016/17 season.

Intercropping cover crops in maize

Take home message

- Herbicide residues can affect cover crop establishment when sown inter-row before crop canopy closure.

Introduction

Intercropping within maize crops is a method to establish cover crops before the maize is harvested. This method is relevant for maize grain crops that are harvested in late autumn/winter, as paddocks can be too wet to drill and cover crops sown at this time will develop slowly as the weather is turning cold. This trial was seen as an opportunity to try a number of seeding approaches and establish how different species and plant types react when planted at different times in established maize crops. As such, some treatments are not suitable for commercial situations.

Method

The trial had three sowing times, V5 (26 November 2015), V8 (16 December 2015) and at the beginning of maize dry down (17 March 2016); two sowing methods (broadcast and hand buried) and seven cover crop species treatments:

- red clover
- Persian clover
- lupin
- annual ryegrass
- legume mix (red clover, Persian clover, lupin and faba bean)
- four way mix (red clover, Persian clover, chicory and annual ryegrass)
- control (no cover crops planted)

The maize was sown on 15 October 2015.

One of the main concerns with intercropping cover crops in maize is their establishment in soils containing herbicide residues. Herbicide treatments in this trial were Roustabout at 3 l/ha and Sharpen (saflufenacil) at 150 g/ha, applied 12 October 2015. Acetachlor is active on annual grasses and many broadleaf weeds and it has residual soil activity of up to ten weeks. Saflufenacil has activity on legumes for three weeks, and brassicas and some other broadleaf species for four weeks after application.

Generally, the broadcast treatments had approximately 40% more seed applied than the buried treatments to allow for greater losses.

Results and discussion

Results from the first dry matter cut indicate differences in the rate of establishment, particularly when assessed according to sowing method. The V5 sowing had lower establishment in the broadcast than the buried treatments, with the red clover and chicory having the best establishment in the broadcast treatments. The V8 sowing had very little accumulated dry matter at time of the first assessment (50 days after sowing), consequently this data was not included here. The dry down sowing had the most even establishment. It is suspected that the increase in the rate of germination of the broadcast treatments from sowings 1 - 3 is largely due to herbicide residues diminishing over the trial period.

Analysis revealed that differences at V5 between sowing method and cover crop species were highly significant in both sowings, while the interaction between sowing method and cover crop species was highly significant in the V5 sowing but not significant in the dry down sowing. This finding supports the hypothesis that the effect of the herbicides was greater in the V5 sowing compared to the dry down sowing.

Results shown in Table 10 show how the composition of species established at the first dry matter cut had changed by the time of the second dry matter cut. Overall the species that provided the greatest yields in the V5 sowing (chicory and red clover) happened to be the species with perennial growth habits. These species largely maintained their size under the maize canopy and began growing again in the early autumn when the maize began drying down and allowed light to pass through the canopy. The other species largely did not survive the summer, in this trial they also happened to be the annual species.

Establishing cover crops without affecting maize yields is an important consideration in this work. It was decided the only treatments worth harvesting to assess effects on grain yields were the plots with the greatest dry matter accumulation in the V5 sowing. It was found that the presence of the interplanted cover crops had no significant effect on grain yields. This relationship will be explored in future research.

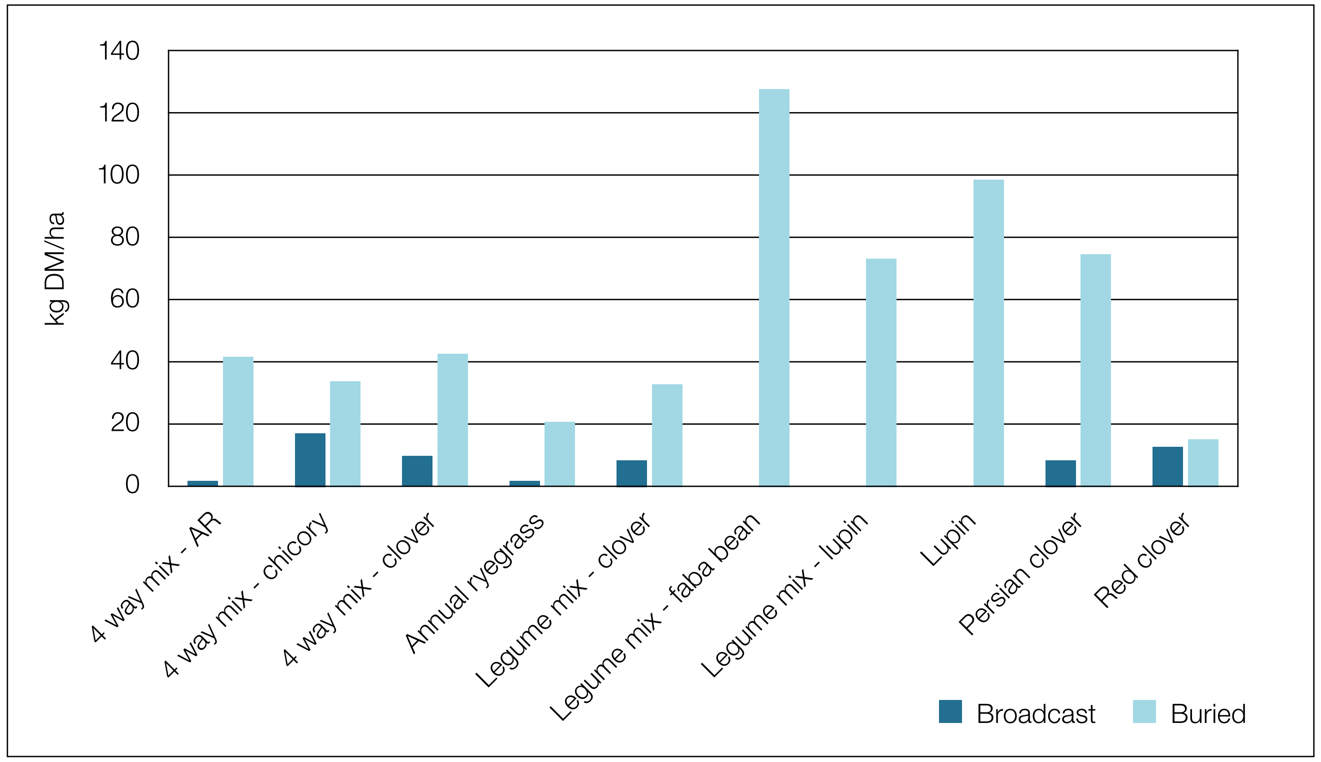


Figure 11. V5 sowing, cover crop dry matter accumulation (sown 26/11/15, harvested 20/1/16 (55 days after sowing)). The 4 way mix plots contained red clover, Persian clover, chicory and annual ryegrass; the legume mix plots contained red clover, Persian clover, faba bean and lupin; the other four treatments were monocultures of, annual ryegrass, lupin, Persian clover and red clover. Clover in the legume mix and 4 way mix is combined Persian clover and red clover.

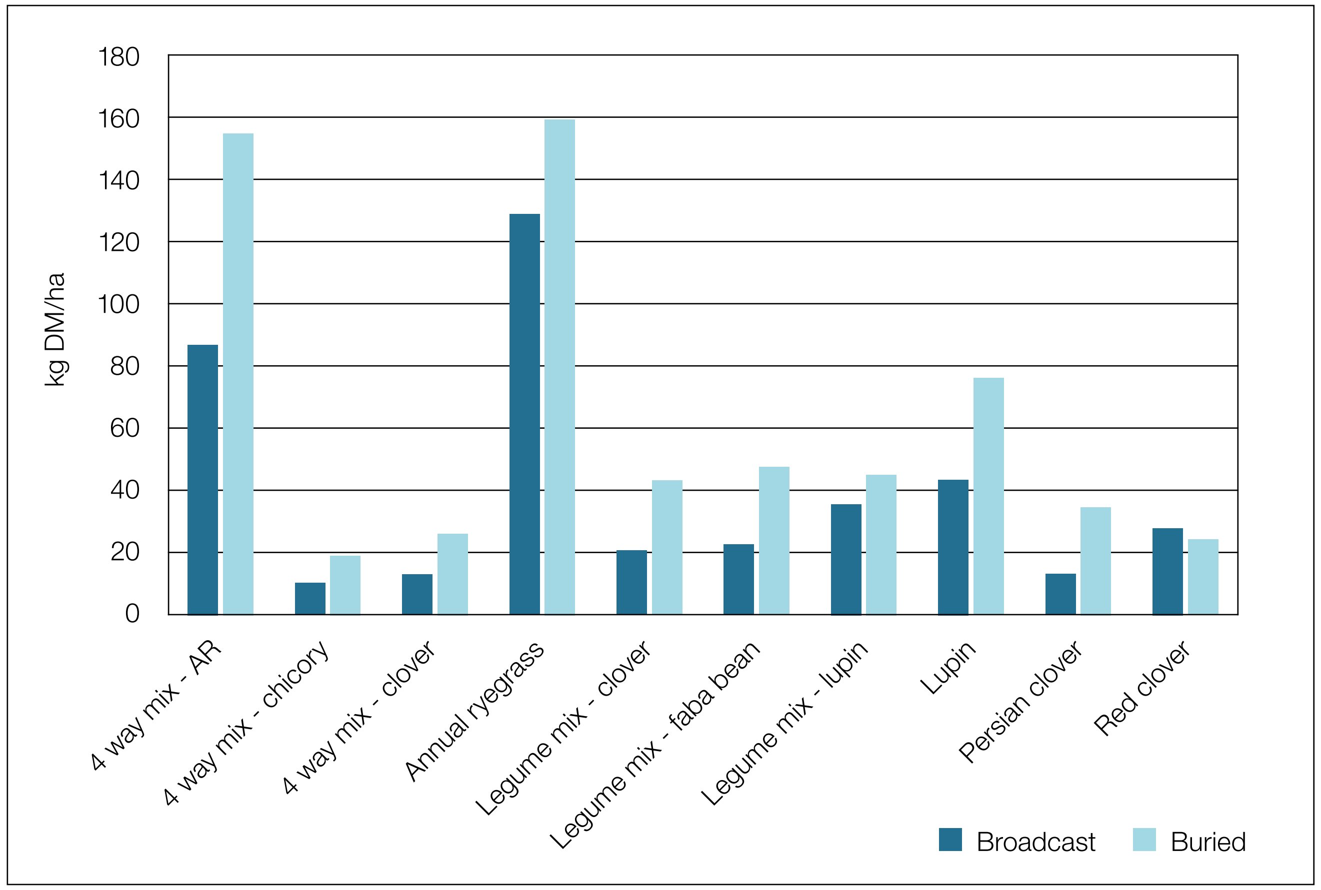


Figure 12. Dry down sowing, cover crop dry matter accumulation (sown 17/3/16, harvested 6/5/16 (50 days after sowing).

Table 10. Analysis of V5 and dry down sowing dry matter cuts.

	V5 sowing	Dry down sowing
Sowing method	11.8*	13.2*
Cover crop species	26.5*	29.5*
Method x species	37.4*	41.7 n.s.

* indicates 99% percent confidence of differences between population means and n.s. indicates the populations are not significantly different.

Conclusions and future work

Residues of the maize herbicides in the soil between the maize rows appeared to have an impact on cover crop establishment. Hand burying the cover crop seed appeared to reduce the effect of residues from the maize herbicides. It is suspected that the disturbance caused by burying the seed interfered with the herbicide residual activity in the soil surface layer. Further work will be done to investigate how different cover crop species are affected by different herbicides and spray application timings.

Chicory and red clover provided promising results. Further species with similar growth habits (somewhat shade tolerant, biennial, perennial etc.) will be trialled next season.

Photo 13. Sown 22 January 2016.

Photo 14. Sown 23 March 2016.

Photo 15. Sown 6 May 2016.

Photos 13-15. Hand sown 4 way mix plot (chicory, red clover, Persian clover and annual ryegrass).

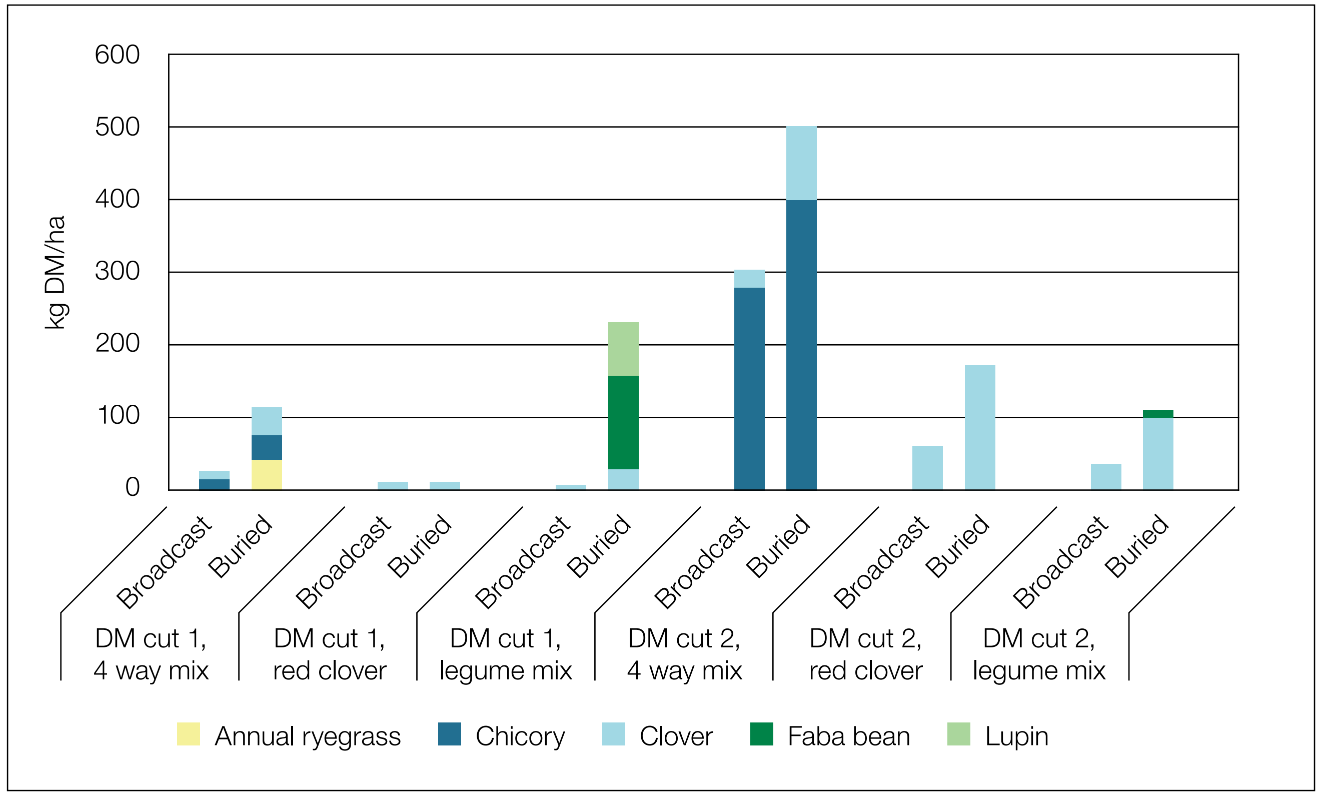


Figure 16. Dry matter accumulation of treatments and species within them for V5 sowing cut 1 (55 days after cover crop sowing) and V5 sowing cut 2 (152 days after sowing (27/4/16)). Clover in cut 1 was a mix of red and Persian clover, cut 2 was only red clover as the Persian clover had died off. Cut 1 LSDs (5%) sowing method = 154.3, species = 189.1, cut 2 LSDs sowing method = 22.7, species = 39.3.

Barren and underperforming maize plants

Take home messages

- High and medium vigour seed lines had similar emergence rates.
- Deeper sown (10 cm) seed had slower emergence rate to normal sowing depth (5 cm), but by 10 days after sowing the emergence rates were the same.
- High density sowings (>120,000/ha) had delayed and lower silking percentage of plants, and fewer normal cobs.

Background

Barren and underperforming maize plants, often called functional weeds, are common in maize crops. A trial was established to assess the effect of some potential contributing factors. This was a non-replicated preliminary trial set up in a criss-cross pattern design. In the densely populated plots it was anticipated smaller cobs would develop due to a lack of space and nutrients, however, in this trial we were trying to identify the causes of abnormal cob development rather than the direct effect of overcrowding on yield.

Method

Variables assessed included sowing density (90,000, 120,000, 180,000 and 240,000 seeds per hectare), seed line vigour (97% and 88% cold test seed vigour) and sowing depth (5 cm and approximately 10 cm depth). The trial was sown using a John Deere MaxEmerge planter with the different seed lines and sowing depths arranged across individual seed box units. The sowing rate was changed as the planter moved down the trial.

Five meter plots were assessed for seedling emergence, silking timing and cob weight at harvest. The primary cob from each plant was harvested on 29 April 2016, the husks were removed and complete cobs were dried. These cobs were individually weighed and grouped into normal sized and underdeveloped cobs.

Results and discussion

Seed line vigour did not affect the rate of seedling emergence or the number of seedlings emerged (Figure 18). It is likely that greater differences would be found if a seed line with lower vigour was used, but it is not likely that seed lines with lower vigour will be used in commercial situations. It should be noted the time of sowing was early November, into relatively warm soil conditions, and greater differences in emergence could be seen if sowing occurred into cooler soil conditions.

Unsurprisingly, the deep sown treatments were slower to emerge than those sown at regular sowing depth, with the deep sown population approximately one day behind. While the deep sown treatments were slower to emerge ultimately the same number of seedlings emerged (Figure 19).

Silking dates occurred later and with greater variance as sowing rates increased (Figure 20). Silk emergence and pollination is a critical time in plant development and if the timing of the silk emergence and pollen shed does not synchronise, it will adversely affect yields. This result suggests plant crowding, as well as environmental issues such as drought, could have an impact on kernel pollination.

Across both sowing depths, as the sowing rate increased from 90,000 to 240,000 seeds/ha the average number of normal cobs decreased from 87% to 44%. Sowing depth and seed line vigour did not have a significant effect on small cob development.

Figure 17. High population density maize, 28 January 2016.

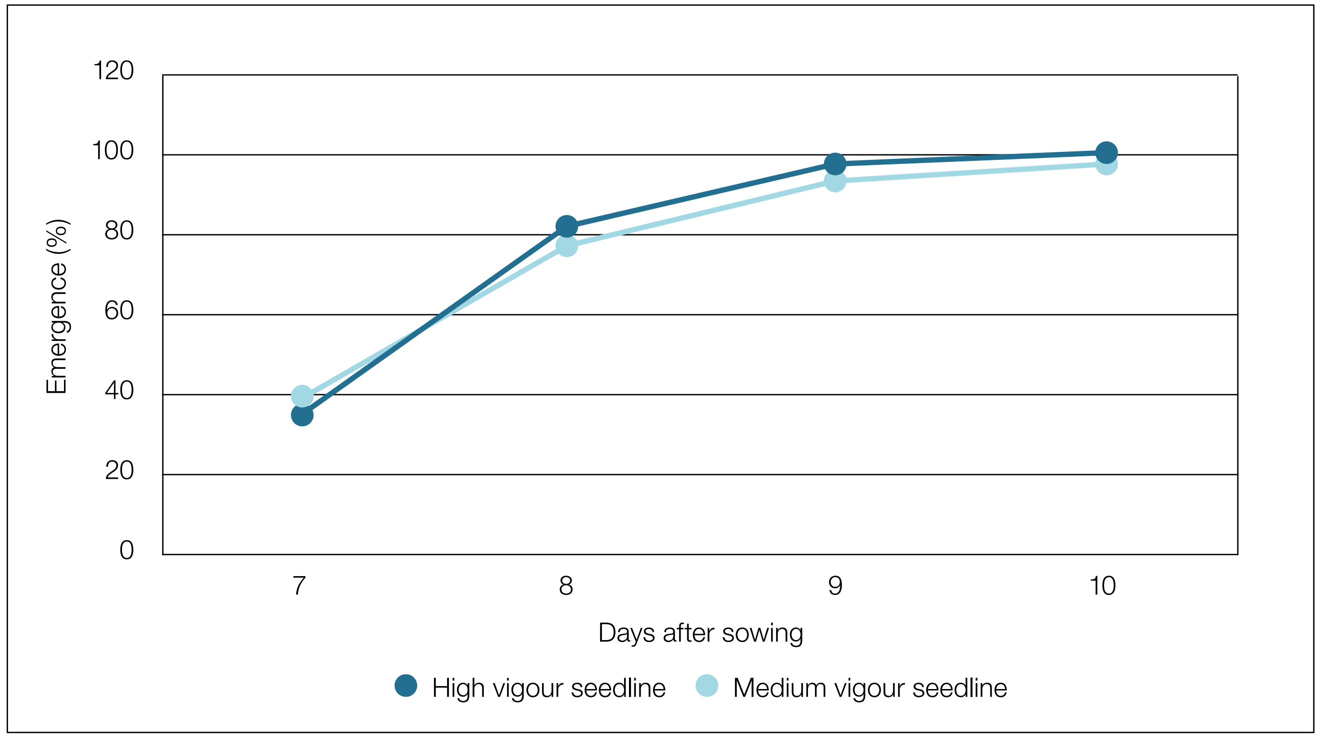


Figure 18. Percentage of seedlings emerged across 4 days, data grouped according to seed line vigour. Percentages created as a proportion of seedlings germinated 11 DAS (days after sowing). Average total emerged seedlings per treatment: high seed line vigour = 118, medium seed line vigour = 118 (LSD (5%) = 50.6).

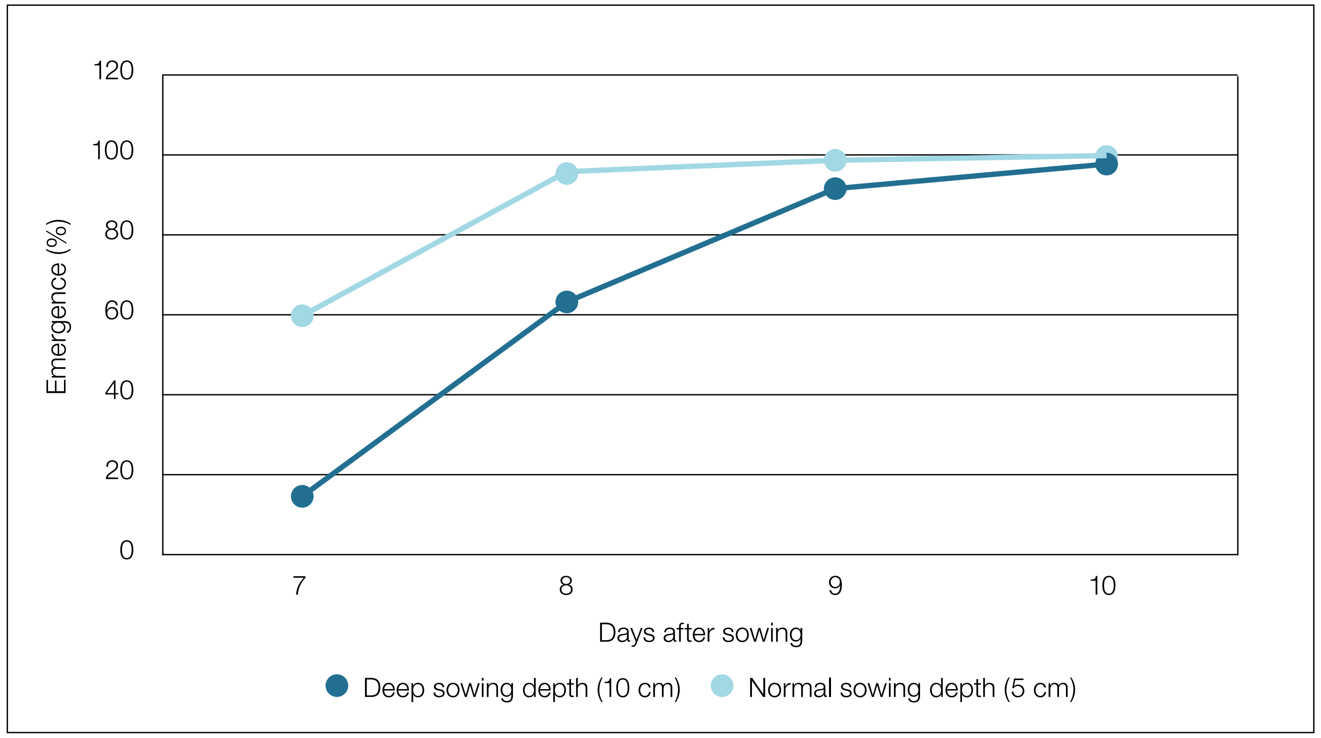


Figure 19. Seedling emergence over four days, with data grouped according to sowing depth. Percentages created as a proportion of seedlings germinated 11 DAS (days after sowing). Overall mean emerged seedlings, normal sowing depth = 120, deep sown = 116.

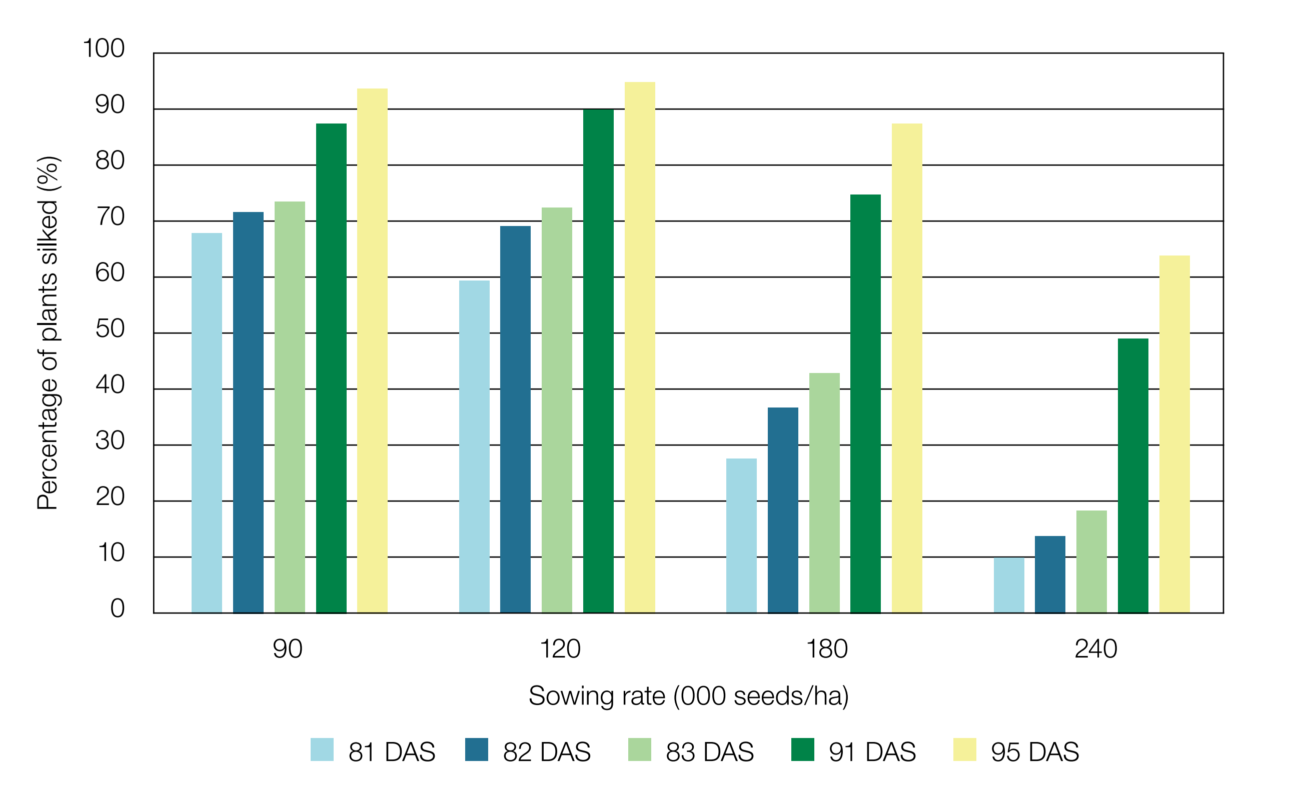


Figure 20. Percentage of plants with silk emergence across five dates, data grouped according to sowing rate. Proportion of plants with silk emergence calculated as a percentage of plants counted at cob harvest.

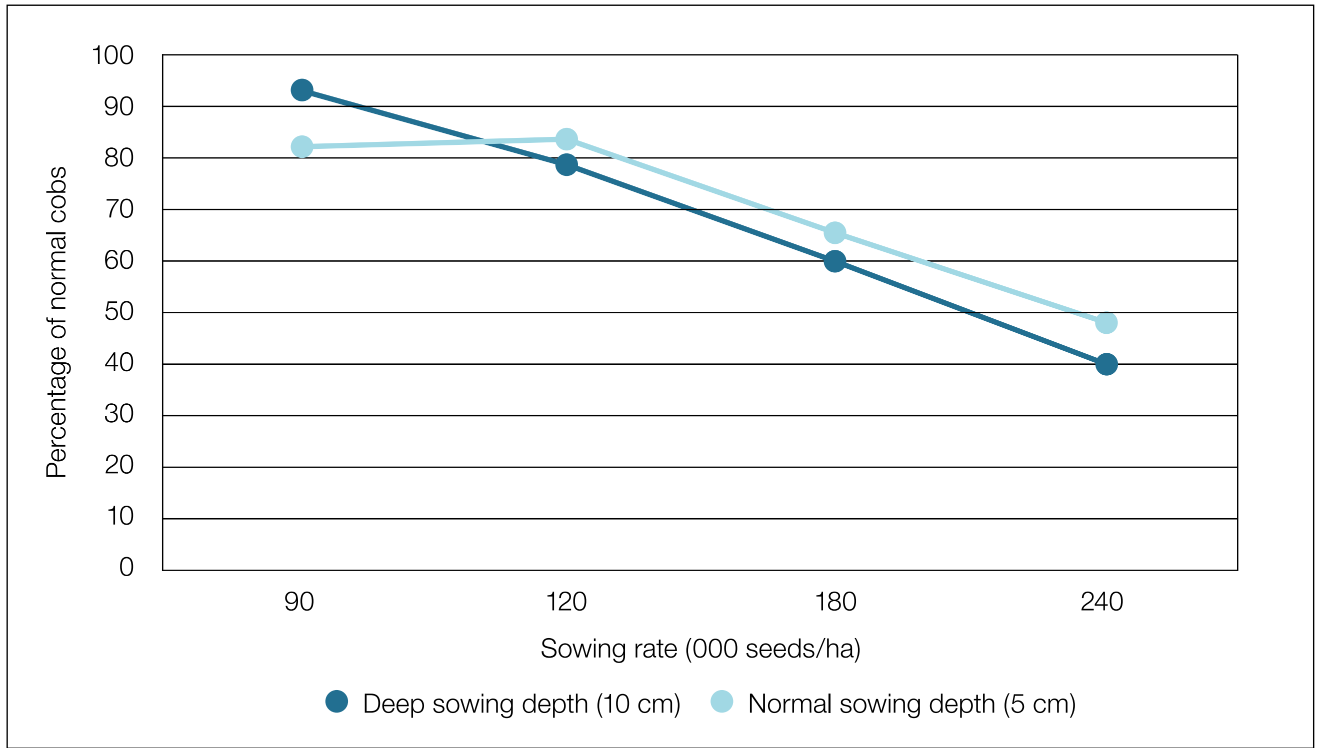


Figure 21. Percentage of plants with normal cobs, analysed according to sowing rate and sowing depth.

Conclusions

Deeper sowing led to a small delay in seedling emergence, but this result had no substantial impact on cob development. High plant density appears to affect silking timing and tassel/silking synchrony and this ultimately leads to the development of greater numbers of smaller cobs. Further work could look at the relationship between plant density and abnormal cob development.

Integrated management of slugs

Take home message

- Low slug density (12 slugs / m^2) resulted in significant yield loss and economic loss.

Introduction

Slugs are a common pest in crops, especially in crops established using no-till techniques. FAR is currently involved in research supported by the MPI Sustainable Farming Fund which aims to develop a set of best practice guidelines for integrated slug management. As part of this project, in spring 2015 an experiment was set up at NCRS to investigate the relationships between slug density, the extent of slug grazing on seedlings and the final yield of maize grown under field conditions.

Figure 22. Rings installed after maize planting.

Methods

After the maize plants first emerged from the ground, fifty galvanised iron rings (32 cm diameter x 15 cm deep) were hammered into the soil to a depth of approximately 5 cm, such that each ring enclosed two maize seedlings.

The rings were populated with either zero, one, two, five or ten slugs, which were contained by securing a coarse nylon mesh over the rings and the rings were left covered for about 10 days, until seedlings in untreated plots were pushing against the mesh. After this time, one of the two seedlings was randomly selected from each plot, oven dried at 80°C and dry weight recorded. The other plants grew until harvest, and their wet and dry weights were recorded at that stage to indicate plant biomass and maturity. No other food sources were present in the rings.

Results

Initial findings show that even relatively low (12 slugs / m^2) populations of slugs present in a maize paddock at establishment will cause significant financial damage to the crop (see Table 11).

This Sustainable Farming Fund project will continue with an evaluation the effect of time, cultivation techniques and weather conditions on the breakdown of EDTA, methiocarb and metaldehyde slug pellets.

Figure 23. Ring showing plants at maturity - note severely stunted plant due to slug damage.

Table 11. Effect of slug populations on maize crop performance.

Slugs per m²	0	12	25	62	124
T / ha DM	20.49	15.97	12.59	6.21	0.16
Income (25c/kg DM)	$5,121	$3,993	$3,147	$1,552	$40
Lost income from slug damage ($/ha)	n/a	-$1,129	-$1,975	-$3,570	-$5,081
Estimated Return (Extra income per $ slug control)[1]	n/a	$4.70	$8.23	$14.87	$21.17

[1] Cost of control is estimated at $240 per hectare, which includes two applications of slug baits.

Forages for Reduced Nitrate Leaching

Small plot trials to test crop management strategies for feeds with reduced N loading Waikato

Take home message

- Fodder beet had the highest carbohydrate to protein ratio.

Introduction

The Forages for Reduced Nitrate Leaching project aims to identify good management practices for producing feed of high nutritive value and low N content suitable for grazing or conservation. The 2015-16 trial at NCRS was the third season of small plot evaluations of crops to provide high quality feed, with management that will not add to winter nitrate leaching loads.

Methods

Plant species selected for this trial had to be suited to the site's soil and climate and have a feed quality profile suitable for adding, in different proportions, to animal diets. Crop and management combinations were also evaluated in terms of their ability to support improved environmental outcomes.

In Waikato grazing systems, crops are required primarily for summer and autumn supplementation of pasture. Feed quality needs to be high to support production up to 1.1 to 1.2 kg milk solids/cow per day and maintain cow condition. Protein requirements for lactation are 15-16% in the whole diet. Crops tested in small plot trials included rape, sunflowers, soybeans, linseed, fodder beet, sorghum, oats, chicory and maize. In the 2015-16 season, we repeated the treatments tested in 2014-15. These comprised nitrogen and potassium fertiliser rates on fodder beet (cv. Jamon), and plant population and nitrogen interactions in forage rape (cv. Goliath) and forage sorghum (BMR revolution).

Absolute levels of protein content and total carbohydrate are important for their base feed value, however crops with high carbohydrate to protein ratios (CHO:PR) have additional benefits (Figure 25) if they comprise high proportions of diets. There were a range of values for CHO:PR ratios that can be related to crop management, however there were strong groupings associated with crop type. Fodder beet stood out as the best 'high CHO-low protein' feed; maize, rape, sunflower had intermediate CHO:PR ratios, while sorghum, cereals (oats), linseed chicory, clovers were on the lower end of the scale. The optimum CHO:PR ratio depends on the feed requirement for lactation, maintenance and animal growth, however if reduced nitrate leaching is the target, then higher ratios are preferred as long as the animals receive the minimum dietary protein requirements.

Figure 24. Forage rape in Forages for Reduced Nitrate Leaching trial, 15 April 2016.

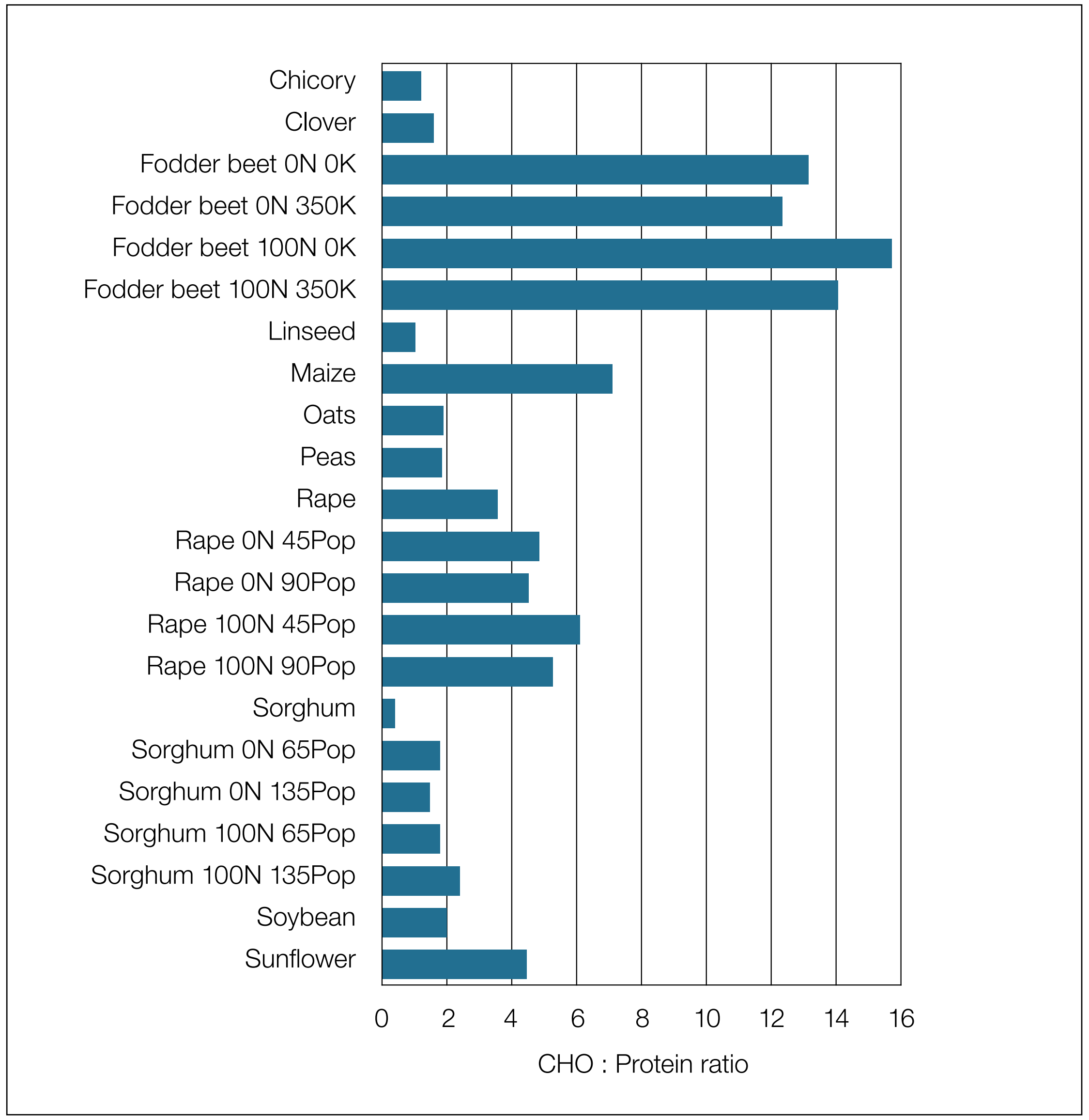


Figure 25. Ranges for carbohydrate:protein ratio (CHO:PR) for crops in Waikato small plot trials (0 and 100 kg N/ha; 0 and 350 kg K/ha; and populations treatments (plant per m^2).

Forage sequence trial

Take home messages

- Similar yields to traditional maize-annual ryegrass rotations are possible with a combination of alternative autumn and spring sown crops.
- Alternative crops may offer a more flexible harvest window, and therefore sowing window for autumn-sown crops.

Introduction and method

The aim of this trial was to maximise dry matter production and fulfil forage quality requirements by testing alternative cropping rotations for dairy runoff and support blocks. In the Waikato, single crop maize is hard to beat for yield, but establishing maize can compromise production of other crops. This trial is part of a project investigating crop sequences that might give a similar yield to maize in terms of total dry matter production over multiple years. The sequences that were planted were:

Standard: ryegrass – maize – ryegrass – maize

Mixed crop and animal: triticale silage – forage sorghum – barley silage – grazing maize

Cropping: faba bean/clover – maize – clover – sugar beet

Results and discussion

Overall, the maximum difference in total dry matter yield between sequences over 2 years was 5.1 t/ha. The second year had lower annual yields than the first year (Table 12). Where the trial started with an autumn sowing of the crops all on the same date, the second season saw the spring crop sowing dates evened up (though still not all sown on the same date).

The autumn harvest date of the spring crops showed the potential for variations in crop rotation. Whereas maize silage has a defined harvest window, sowing a crop such as the grazing maize or sugar beet (lifted) offers much more flexibility to harvest when convenient or when there is feed demand. Flexible harvest date also allows for flexibility in sowing date for the following crop, with higher yield potential expected from earlier autumn sowings. The sugar beet (20.6 t/ha) and grazing maize (7.3 t/ha) yields obtained in the trial were lower than would be expected in a paddock situation.

The various crops grown in the trial cover a range of feed qualities allowing crops to be selected to fill nutritional needs at certain times of the year and may also be used for breaking disease and pest cycles. Persian clover yields (2.1 t/ha) from the autumn sowing were lower than alternative options, but offer a high protein (24.7%) option that can also provide substantial nitrogen to following crops.

Table 12. Total dry matter yield by year for each of the three crop sequences.

Crop sequence	Year 1 yield (t DM/ha)	Year 2 yield (t DM/ha)	Total yield (t DM/ha)
Standard	35.1	27.0	62.1
Mixed crop and animal	35.4	22.7	58.1
Cropping	33.7	23.3	57.0

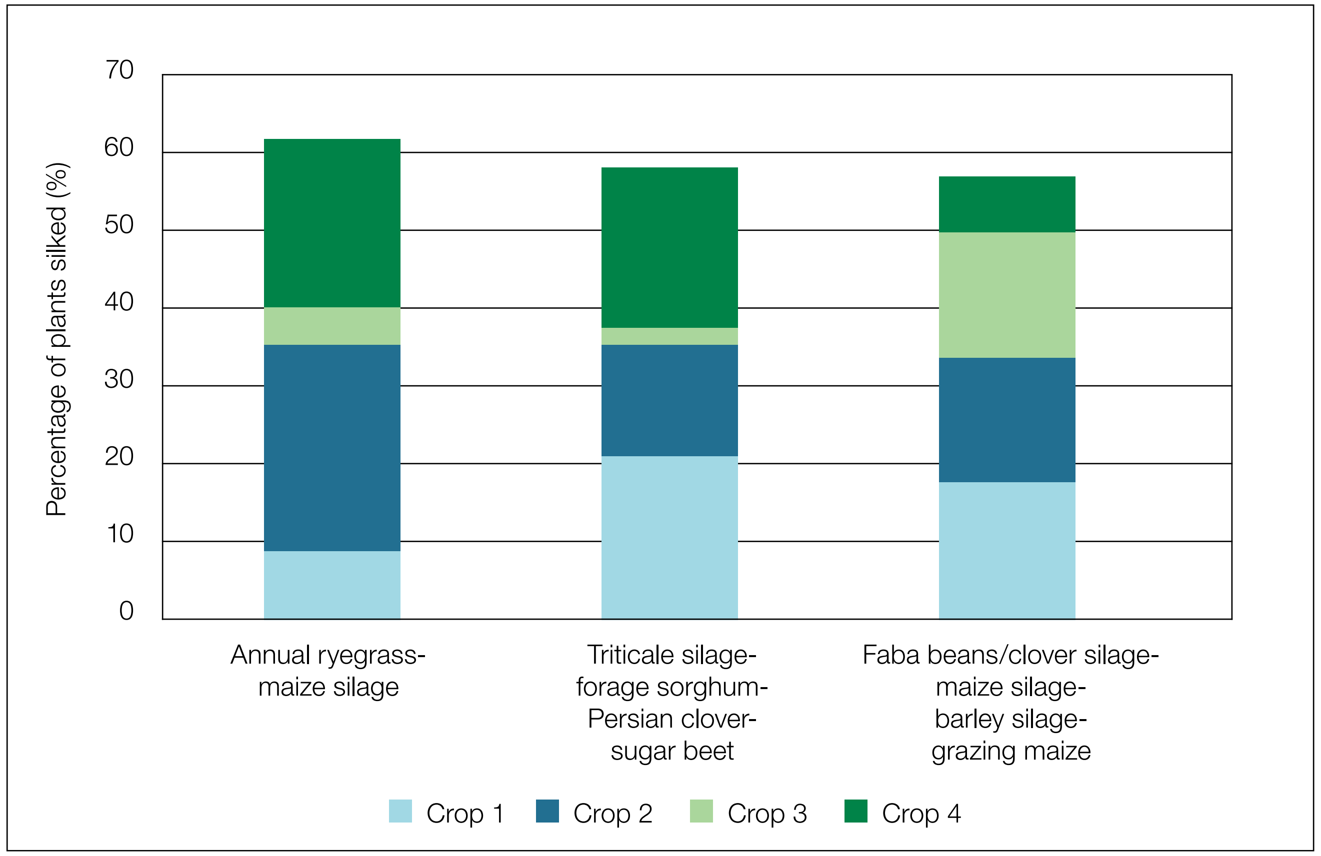


Figure 26. Total dry mattier yield from each rotation after the end of two years, by crop.

Figure 27. Persian clover and Tama ryegrass, 14 October 2015.

Spring barley cultivar evaluation

Take home messages

- Spring sown barley, for use as whole cereal silage or grain, is a viable crop for the Waikato.
- If small areas of barley are grown, bird and rodent pressure may be substantial.

Objective

To evaluate the yields of six spring barley cultivars in the Waikato.

Method

The trial was sown on 15 October 2015. Herbicide (Firebird at 300 mls/ha. 220 l/ha water rate air induction nozzles at 4 bars pressure) was applied on 18 October, and the barley emerged on 27 October.

100 kg/ha Sustain (45 units N) was spread on 2 November 2015, and 250 kg/ha Sustain was applied on 27 November.

1 l/ha Aviator (prothioconazole) fungicide was applied 6 December 2015.

15 December – sprayed 1 l/ha Aviator + Terpel (PGR) at 1.25 l/ha. The trial block was fully covered by suspended bird netting prior to flowering, to prevent bird damage.

The six spring barley cultivars evaluated were CRBA144, Liberator, Shada (SYN410-235), Sanette, Piper (SYN411-287) and RGT Planet (SFR85-014).

Results

The trial was harvested by hand cutting a sample from each plot, on 11 February 2016.

Mean yields ranged between 6.0 and 7.3 t/ha, with no significant differences between cultivars. There was some variation between plots (CV% 14.2). These yields are around 3 t/ha lower than those recorded in the Manawatu in the same year from the same cultivars, however the trial experienced high bird and rodent pressure, despite being fully enclosed by nets.

Figure 28. Barley trial, 6 November 2015.

Miscanthus

Take home message

- Miscanthus may have a role as a shelter belt crop, but its feed value is very low as a forage crop.

Miscanthus (*Miscanthus x giganteum*) has been established at NCRS for two years. It was planted to investigate its suitability as a crop for the application of dairy shed effluent (DSE), as it uses nutrients to grow rapidly, and reduces the risk of the nutrients leaching from the soil profile.

The miscanthus was harvested in December 2015, shortly after the photo in Figure 29 was taken (yield 11.8 t/ha DM) and again in April 2016 (yield 3.6 t/ha DM), giving a total of 15.3 t/ha dry matter in the year from April 2015 to April 2016.

Miscanthus has a low feed value, and therefore may have a limited use in the dairy feed ration (Table 13). However, it has been used as a shelterbelt crop in the South Island, as traveling irrigators can travel through it. Work by the Bio-Protection Research Centre at Lincoln University has found that the increase in pasture dry matter production caused by the shelter effect of the miscanthus is greater than the loss in dry matter from the area producing miscanthus.

Figure 29. Miscanthus in November 2015, shortly before first harvest.

Table 13. Feed value of miscanthus.

Hybrid	7 May 2015	15 April 2016
Nitrogen % of dry matter	1.3	1.0
Dry matter (%)	37.1	32.1
Crude protein % of dry matter	7.9	6.2
Acid detergent fibre % of dry matter	42.6	44.7
Neutral detergent fibre % of dry matter	67.8	68.7
Ash % of dry matter	7.5	6.3
Organic matter % of dry matter	92.5	93.7
Soluble Sugars % of dry matter	7.9	3.4
Starch % of dry matter	1.8	0.6
Crude Fat % of dry matter	2.0	1.5
Dry organic matter digestibility %	35.8	38.9
Metabolisable energy (MJ/kg DM)	5.7	6.2
Non-structural carbohydrate	14.7	17.3
Organic matter digestibility in vivo	38.7	41.5

Impact and management of Argentine stem weevil and other seedling pests

Take home messages

- Argentine stem weevil and other pests are a problem for seedling establishment for grass and cereal crops.
- Plants emerging from insecticide treated seed suffered less damage.

Introduction and method

The aim of this trial was to determine the extent and severity of damage caused by Argentine stem weevil (ASW) and other insect seedling pests to the establishment of barley, rye corn, wheat and ryegrass.

In particular, ASW is the most destructive pest of ryegrass and young cereal crops in New Zealand. Larval mining kills tillers and adult feeding destroys seedlings. Control of ASW when establishing crops or pasture has been achieved through a range of management strategies including timing of sowing to minimise adult damage, endophytes and biological control by a parasitoid wasp that attacks and eventually kills adult ASW. However, there has been a reported resurgence of ASW damage in susceptible grasses and cereals. Subsequent research has now shown that parasitism is reduced, possibly through weevil resistance to the bio-control agent. All grasses and cereals, regardless of endophyte status are susceptible to damage by adult weevils at establishment. If seed treatment is not used, a new sowing could be wiped out.

As part of a Sustainable Farming Fund project supported by FAR, AgResearch has been involved in a study to determine what levels of damage ASW and other insect pests (e.g. springtail) have on establishment and performance of cereal and ryegrass species.

Method

A replicated trial of barley (cv. CRBA144), rye corn (cv. Amilo), wheat (cv. Viceroy) and annual ryegrass (cv. Moata) was sown on 15 October 2015. Each species comprised both an insecticide seed treatment along with an untreated control. An initial damage assessment was done on 29 October 2015 and a follow up on 12 November 2015. On each occasion, the number of plants, and the percentage and type of damage recorded in a 0.5 m transect.

Results

The mean seedling numbers were significantly higher in the insecticide protected ryegrass compared to the control. Barley, rye corn and wheat showed no difference in plant establishment or damage to plants between insecticide protected and untreated seed (results not shown). Overall, insect damage to seedlings was low, and comparable to another study undertaken on the FAR site over the same time period. Ground conditions were very dry with nil to little rain over the sampling period and this may have contributed to the lower level of attack. While insect damage was found for all treatments, it was significantly higher in untreated plants of barley and wheat compared to insecticide treated seed (Figure 30).

Table 14. Argentine stem weevil damage in treated and untreated plots.

	Total damage (%)		
	Control	Insecticide	
Barley	6.9	1.4	P < 0.001
Ryecorn	12.0	9.0	
Wheat	4.1	1.5	P = 0.031
Ryegrass	6.2	7.2	

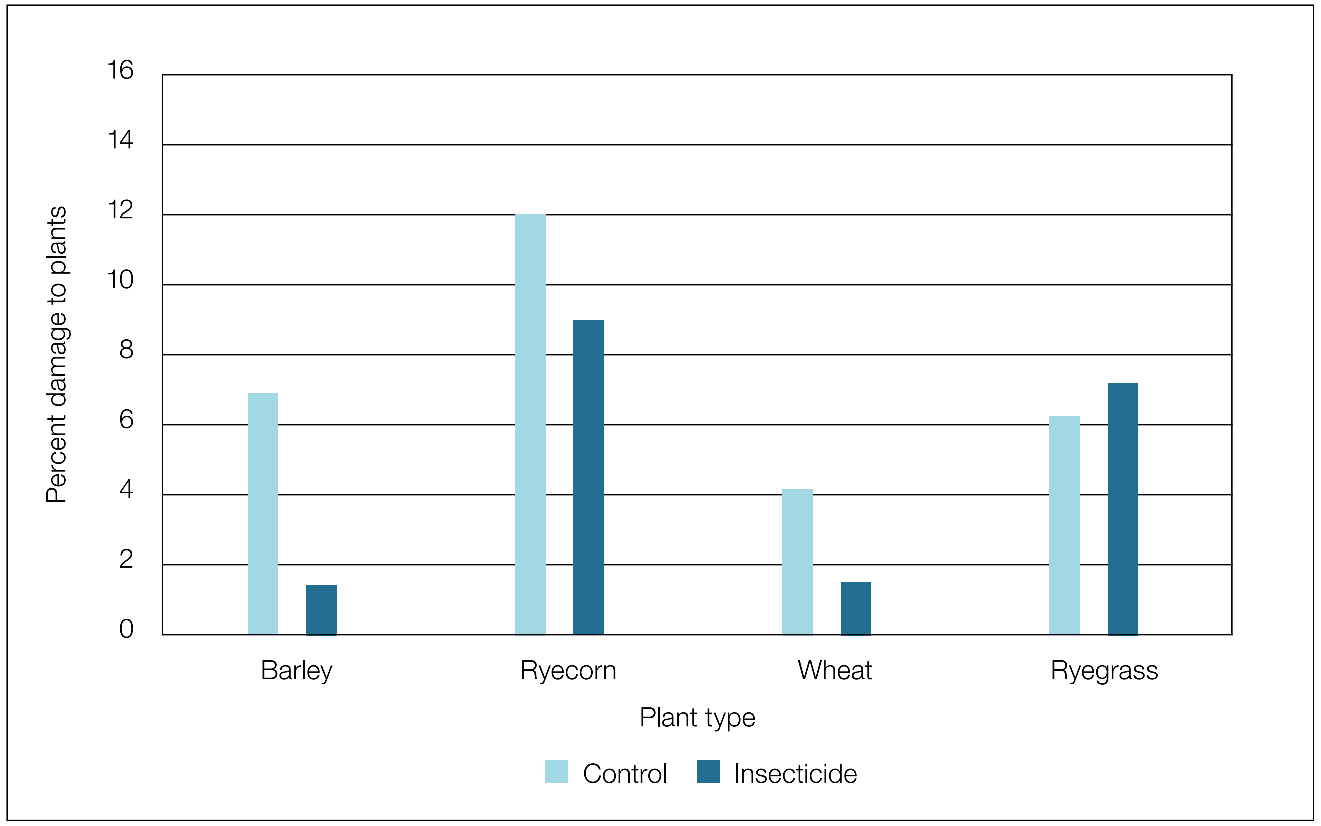


Figure 30. Comparison between plant species and seed treatments in % seedlings damaged observed in the second assessment (12 November 2015). * indicates that the level of damage was significantly different (P>0.05).

Figure 31. Maize seedling damaged by Argentine stem weevil on left, healthy seedling on right.

Endnote

This is the second time FAR has produced an annual summary of trials undertaken at Northern Crop Research Site. We hope that the results presented are of value to you. If you have any comments or observations about the work reported on here, or have suggestions to make about further work you would like to see done, please contact us:

Allister Holmes
Research & Extension Team Leader
allister.holmes@far.org.nz
027 833 1155

Mike Parker
Research Manager – Agrichemicals
mike.parker@far.org.nz
021 960 078

Sam McDougall
Field Research Officer
sam.mcdougall@far.org.nz
0274 688 8803

Nick Pyke
CEO
nick.pyke@far.org.nz
021 374 083

Alan Henderson
Board Member
Northern North Island
07 871 9934

Acknowledgements

We acknowledge the assistance and support of the following:

AgResearch Limited

AgrowQuip New Zealand Limited

Dairy NZ

Genetic Technologies Limited

John Austin Limited

John Deere New Zealand

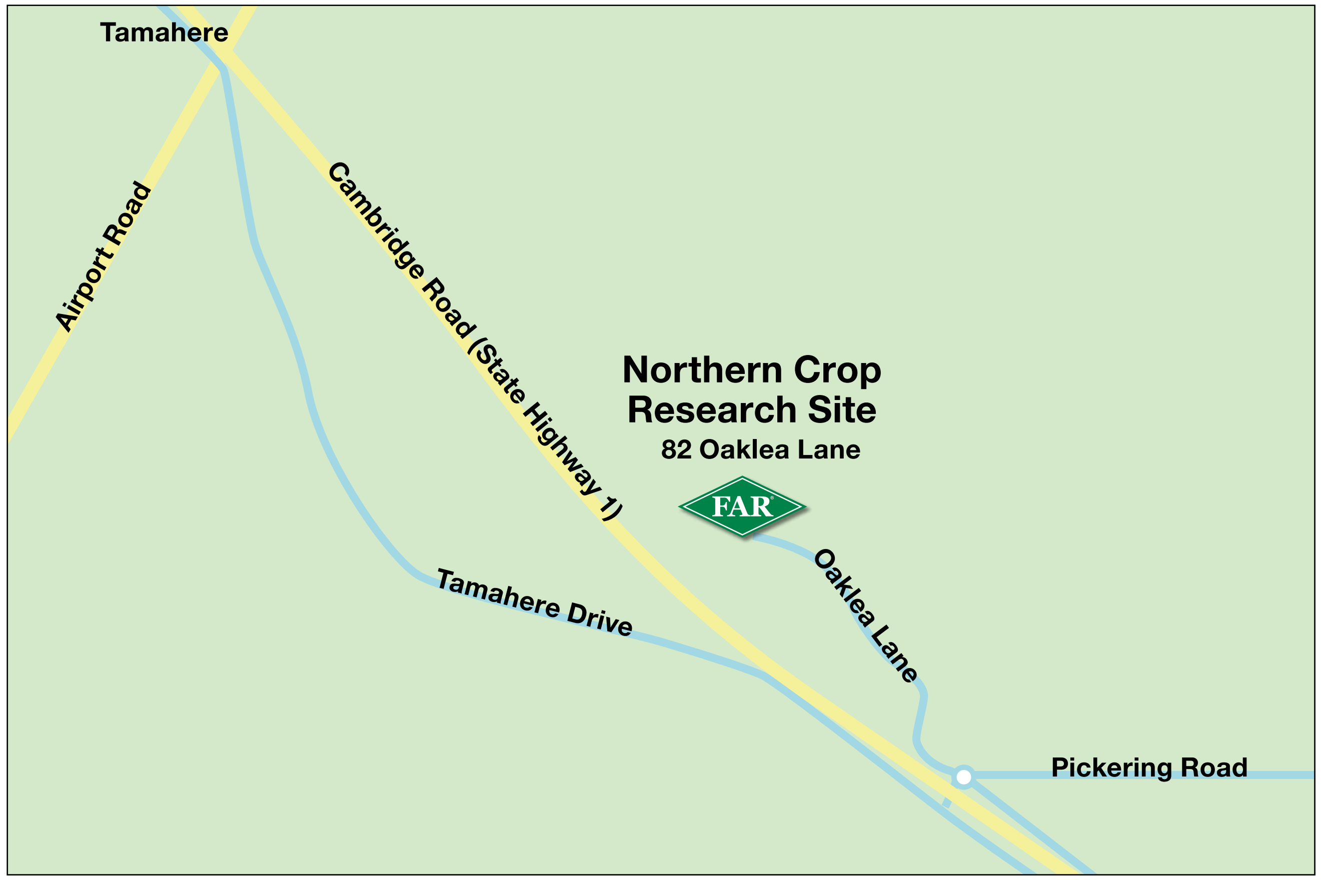
Maize Technical Committee, NZPBRA

Ministry for Business, Innovation and Employment

MPI Sustainable Farming Funding

Plant & Food Research Limited

W Sinton Limited



ADDING VALUE TO THE BUSINESS OF CROPPING

Northern Crop Research Site 2015/16
978-0-9941286-1-4 (Print)
978-0-9941286-2-1(Electronic)

Foundation for Arable Research
PO Box 23133, Templeton, Christchurch 8445, New Zealand
Phone: +64 3 345 5783 • Fax: +64 3 341 7061 • Email: far@far.org.nz • Web: www.far.org.nz