Herbicide Efficacy in No-Till Farming Systems in Southern NSW ~2010~

Grassroots Agronomy

Introduction

Variable rainfall patterns over the past ten years in southern NSW have prompted the rapid adoption of no-till, stubble retained farming systems to maximise crop water use efficiency. Despite the many benefits of this system, the efficacy of pre-emergent herbicides remains one of the major concerns for growers and advisers who have adopted, or are considering adoption, of the system.

Pre-emergent herbicides play an important role in integrated weed management programs as they allow for rotation away from high risk Group A and B herbicides. However, poor efficacy of pre-emergent herbicides can still result in the rapid development of herbicide resistance, as has occurred with trifluralin resistance that is common in southern Australia.

The efficacy of many pre-emergent herbicides relies on the ability to incorporate them into the soil at sowing. In no-till systems, however, knife points and to a greater extent, disc openers, provide minimal soil disturbance at sowing to limit moisture loss, but which consequently also limit herbicide incorporation. Retained stubble also acts as a physical barrier to herbicide/soil contact. This issue is further confounded where livestock are included in the system, with stubble laid flat from trampling providing a physical barrier to herbicide uptake. Effective pre-emergent herbicide strategies are required to ensure the future sustainability of both herbicides and no-till farming systems.

Greg Condon
0428 477 348
gbcondon@westnet.com.au

Kirrily Condon
0417 677 640
kmcondon@westnet.com.au

Project collaborators:

Grassroots Agronomy
AgriTech Researching Agriculture
FarmLink Research

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Objectives

To identify the most effective pre-emergent herbicide strategies for use in no-till, stubble retained farming systems in southern NSW as part of an integrated weed management program.

Methodology

Three trial sites were located across southern NSW near Grenfell, Wagga Wagga and Lockhart in commercial paddocks currently utilising a no-till, stubble retained system. In each paddock, 11 herbicide treatments (Table 1) were applied by AgriTech pre-sowing* using a 6-metre boom in large, randomised plots, replicated three times for both disc and tyne sowing systems (see trial plan in Appendix).

Commercial seeders (Table 2) were used to sow the plots with wheat immediately after herbicide application (incorporated by sowing), using typical sowing speeds to ensure adequate soil throw and accurate seed placement.

*Dual Gold was applied post sowing, pre-emergent at the Wagga Wagga site.

Table 1 - Herbicide treatments, Herbicide Efficacy Trials 2010

Herbicides	Rates/ha	Indicative cost $/ha
Triflur X[1]	1.5L	$8
Triflur X[1]	3L	$16
Boxer Gold[1]	2.5L	$41
Boxer Gold[1] + Avadex Xtra	2.5L + 1.6L	$63
Sakura[2]	118g	na
Sakura[2] + Avadex Xtra	118g + 1.6L	na
Triflur X[1] + Avadex Xtra	1.5L + 1.6L	$30
Triflur X[1] + Avadex Xtra	2L + 2L	$38
Triflur X[1] + Logran	1.5L + 35g	$11
Triflur X[1] + Logran + Dual Gold[3]	1.5L + 35g + 500mL	$21
Triflur X[1] + Logran + Diuron[3]	1.5L + 35g + 500g	$17

*[1]**not** registered for IBS with disc seeders; [2]registration pending (due 2011); [3]not registered for IBS in wheat in NSW*

Table 2 - Seeding systems, Herbicide Efficacy Trials 2010

Location	Disc	Tyne
Grenfell	Daybreak disc on 375mm row spacing	Horwood Bagshaw & Ryan press harrows on 350mm row spacing
Lockhart	John Deere single disc on 250mm row spacing	Janke tynes & press wheels, Flexi Coil bar on 300mm rows
Wagga Wagga	Excel single disc on 250mm row spacing	Horwood Bagshaw & Knuckey press wheels on 375mm row spacing

Methodology cont.

AgriTech applying pre-emergent herbicide treatments at the Downside trial, April 2010

Monitoring

Intensive monitoring was undertaken by AgriTech throughout the season to assess herbicide efficacy and crop safety with assessments, where applicable, including:

- crop establishment - *plants per metre row, adjusted for row spacing = plants per metre^2*
- crop vigour - *visual assessment where 1=poor crop vigour, 9=high crop vigour*
- weed counts - *plant numbers in a strip or quadrat, depending on distribution within plot*
- weed control - *visual assessment relative to untreated buffers*
- panicle counts - *panicle numbers in a quadrat*
- yield - *using a small plot harvester*

Statistical analyses of all assessments were undertaken by AgriTech using analysis of variance and factorial analysis of variance.

Site selection

Although all trial sites were selected on the basis that they were used in no-till farming systems, each site was also selected based on expected differences in weed spectrum that are typical of the region.

The Wagga Wagga site had the heaviest weed burden, with very high populations of annual ryegrass *(Lolium rigidum)*. The Grenfell site also had high populations of annual ryegrass, while the Lockhart site had low populations of both annual ryegrass and wild oats *(Avena fatua)*.

Results

Different outcomes relating to herbicide efficacy were achieved at each site due to variations in weed density, soil moisture and stubble loads. However in relation to disc versus tyne seeding comparisons, the tyne seeder produced consistently better establishment and early crop vigour at all sites. Site specific results are as follows:

Grenfell

- Co-operators: Duncan Lander (disc) and Rob Johnson (tyne)
- Sowing date: 20th May 2010
- Variety: Livingston
- Stubble cover: 80% (wheat stubble)
- 2010 rainfall: 1015mm (Bureau of Meteorology)

- **Site conditions:** Livingston wheat was sown into moist soil and a thick residue of stubble retained from previous wheat crops. Following establishment, approximately 50mm of rain fell onto an already full profile, which remained wet for the entire season. 1015mm of rainfall was measured for the area in 2010, with 650mm falling between September and December. The wet conditions had a major bearing upon outcomes from this trial, particularly the disc treatments which suffered from poor establishment and severe herbicide damage.

Disc seeding into stubble with low to moderate ryegrass numbers at the Grenfell trial, May 2010

Results cont.

- **Establishment:** Plant numbers were significantly higher in the tyne compared with the disc (80 vs 30 plants/m^2 respectively, $P<0.05$ - Figure 1). Crop vigour was also better in the tyne treatments (Figure 2), which remained the case through the season. As the soil became wetter during winter, the disc area was unable to recover its vigour due to a range of factors including herbicide damage, yellow leaf spot, nitrogen deficiency and waterlogging.

Figure 1 - Crop establishment disc versus tyne, Grenfell

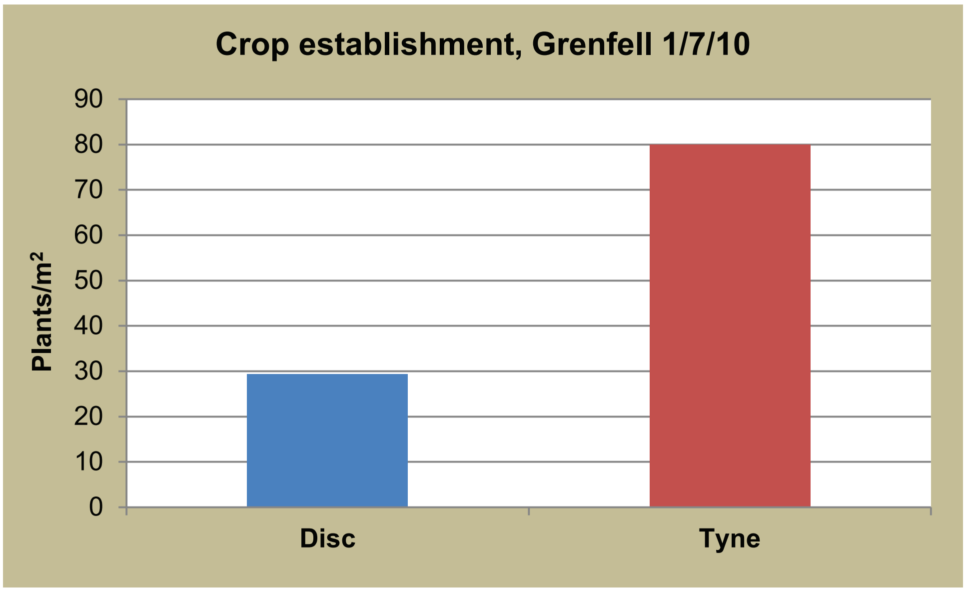
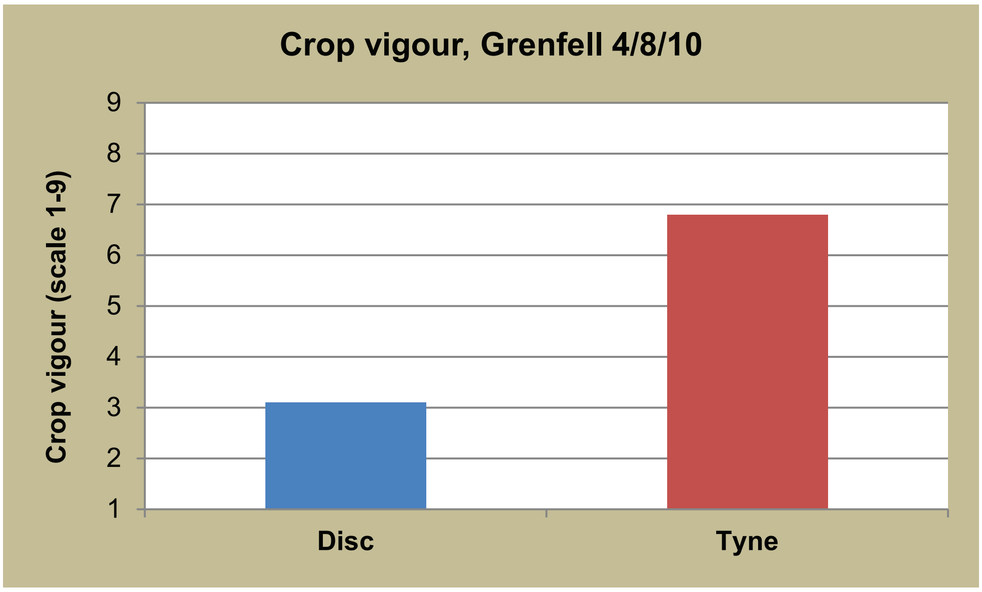


Figure 2 - Crop vigour disc versus tyne, Grenfell *(LSD P<0.05 = 0.7)*



Results cont.

- **Weed control:** Low to moderate ryegrass numbers were present at establishment. Although there were no differences in weed control between the disc and tyne systems (Figure 3), there were differences in efficacy between herbicide treatments. Compared with 1.5L/ha trifluralin, the Sakura treatments and Boxer Gold + Avadex Xtra gave significantly better ryegrass control (P<0.05 - Figure 4). Late ryegrass germinations and low crop competition meant the trial became heavily infested and was spray fallowed in October to prevent seed set.

Figure 3 - Weed control disc versus tyne, Grenfell *(LSD P<0.05 = 11.8)*

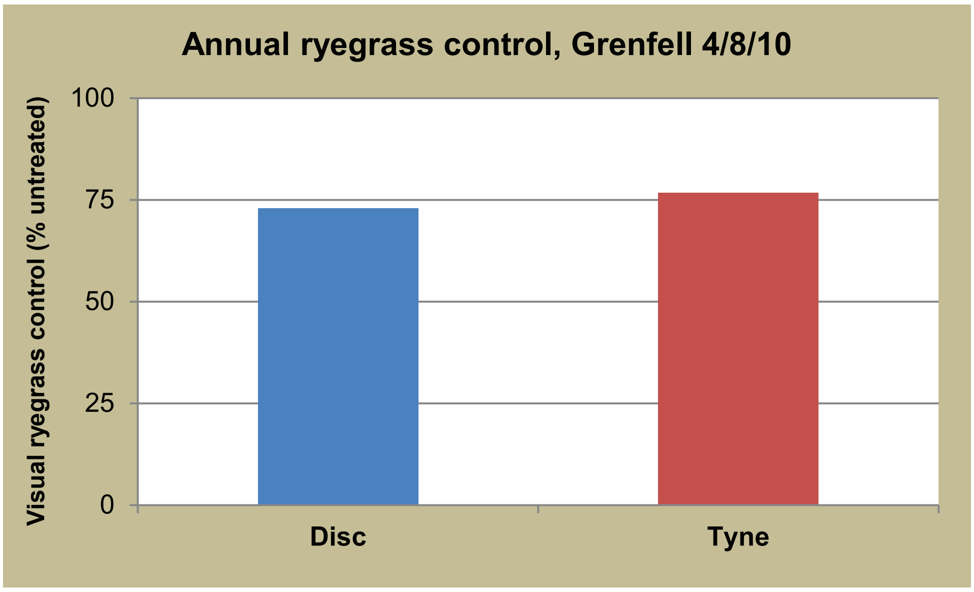
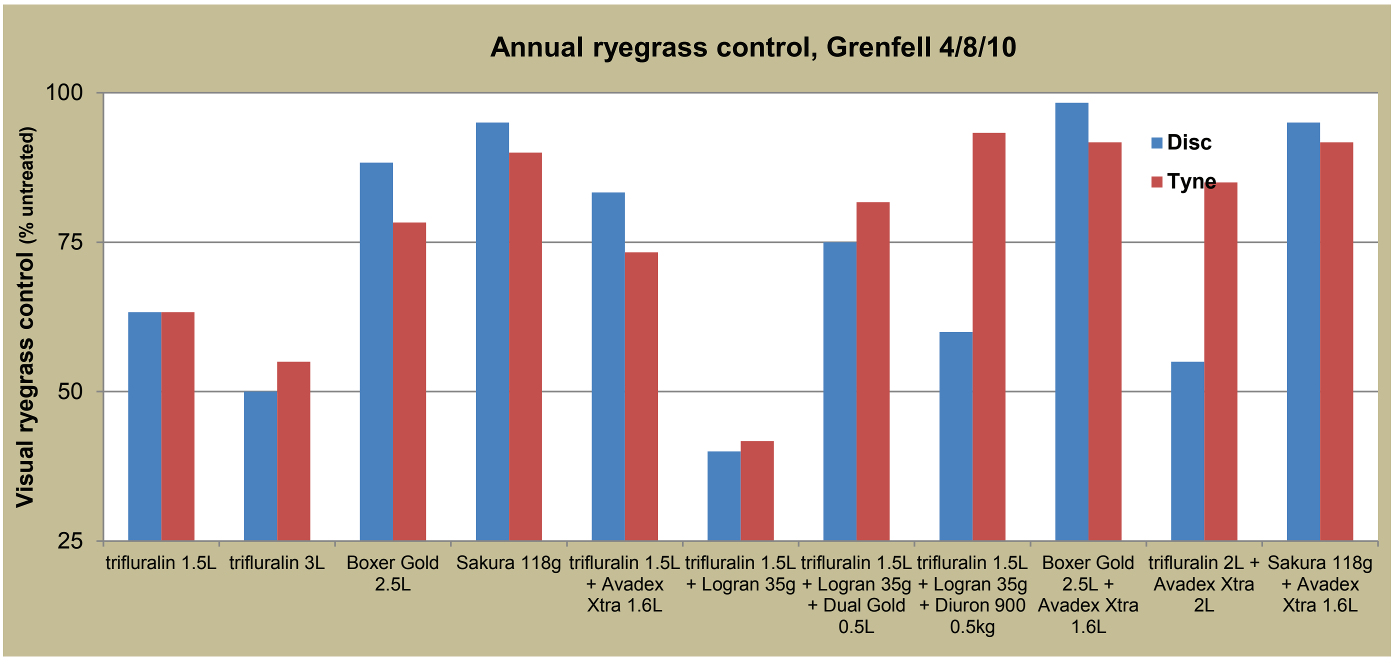


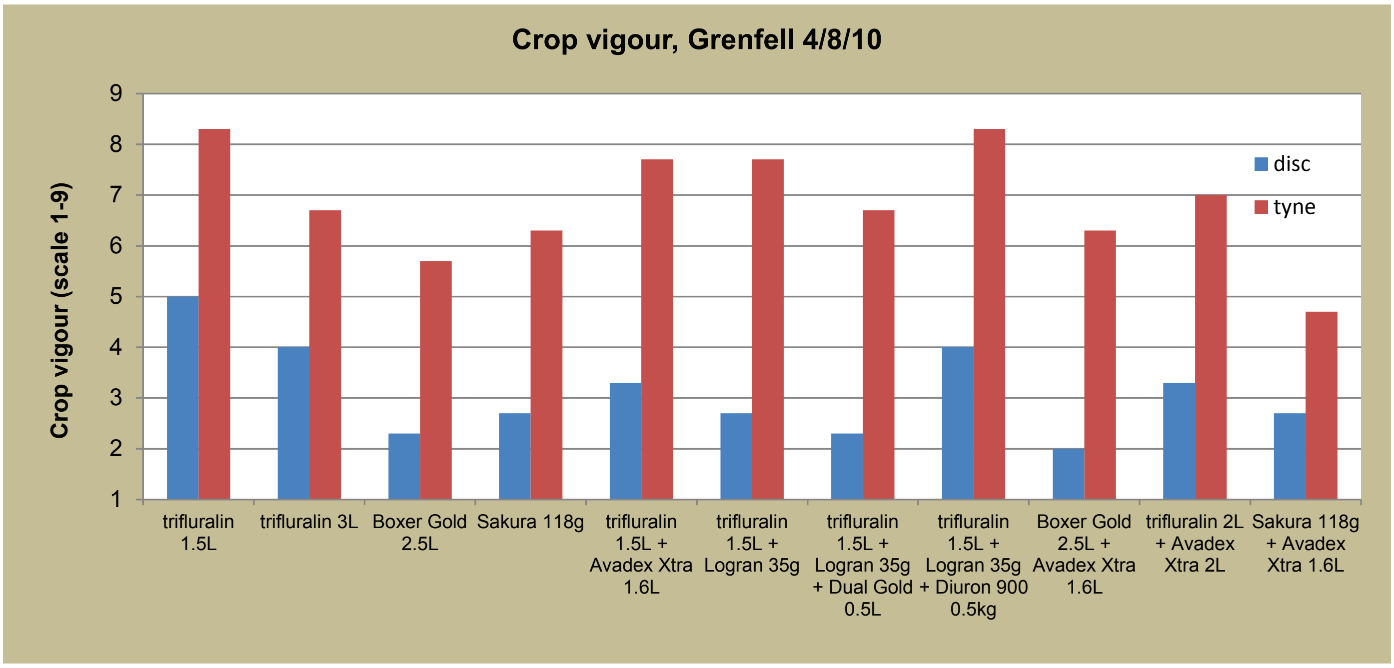
Figure 4 - Weed control herbicide comparison, Grenfell *(LSD P<0.05 = 39)*

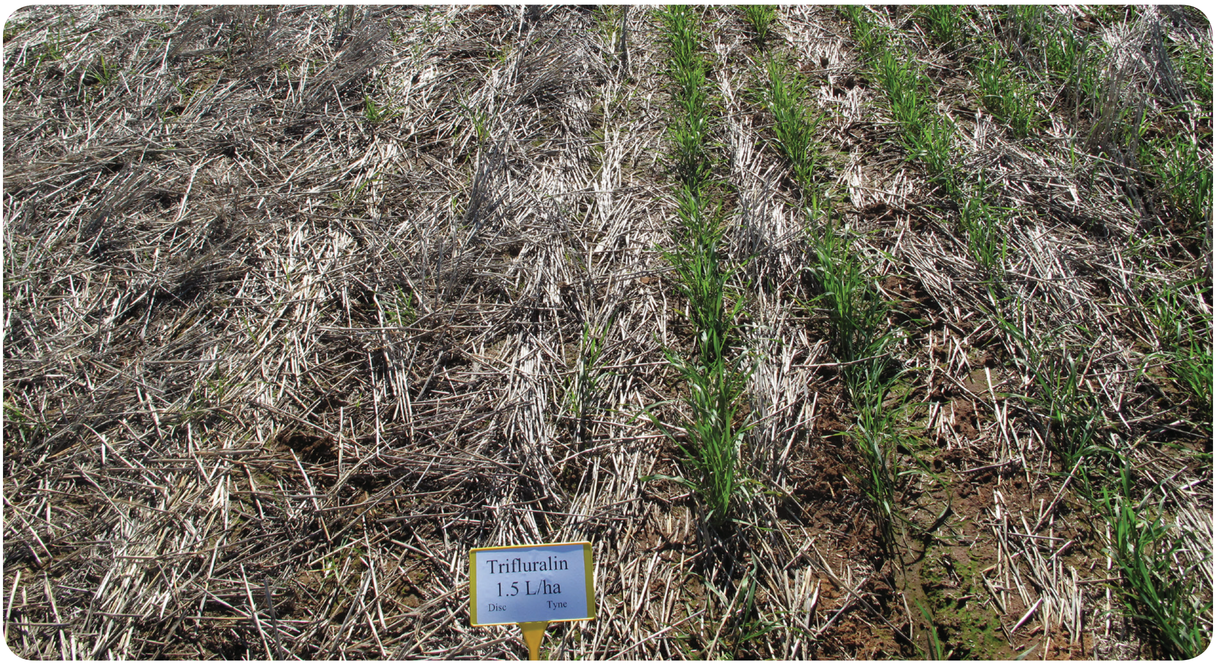


Results cont.

- **Crop safety:** Herbicide damage in the disc areas was particularly evident at this site, with the majority of herbicide treatments causing significantly more damage to crop vigour than 1.5L/ha trifluralin (P<0.05 - Figure 5). Damage was also evident in some of the tyne treatments, although the symptoms were only temporary. Yield estimates taken prior to spray fallowing showed the disc treatments to potentially average 0.36t/ha and the tyne treatments 1.0t/ha, with a range across all treatments of 0.15 to 1.37t/ha depending on herbicide, seeding system and weed control.

Figure 5 - Crop vigour herbicide comparison, Grenfell *(LSD P<0.05 = 2.2)*





Pre-emergent herbicides caused significant crop damage to the disc treatments (left) under very wet conditions at the Grenfell trial, July 2010

Results cont.

Lockhart

- Co-operators: Chug Kennedy (disc) and Brent Alexander (tyne)
- Sowing date: 14th May 2010
- Variety: Lincoln
- Stubble cover: 10-60% (burnt wheat stubble)
- 2010 rainfall: 945mm (Bureau of Meteorology)

- **Site conditions:** Lincoln wheat was sown mid-May into dry conditions and patchy stubble cover from an uneven burn to remove header trails. Very low ryegrass and wild oat numbers meant the trial could be retained through to harvest, allowing a valid comparison of disc and tyne systems in the relative absence of weeds.

- **Emergence:** Plant numbers were significantly higher in the tyne compared with the disc (120 vs 80 plants/m^2 respectively, $P<0.05$ - Figure 6), with disc emergence potentially affected by the presence of stubble remaining across the rows after sowing (inter-row sowing or sowing in the direction of stubble may have countered this). Greater early vigour by the tyne became less apparent as the season progressed (Figure 7).

Figure 6 - Crop establishment disc versus tyne, Lockhart *(LSD P<0.05 = 7)*

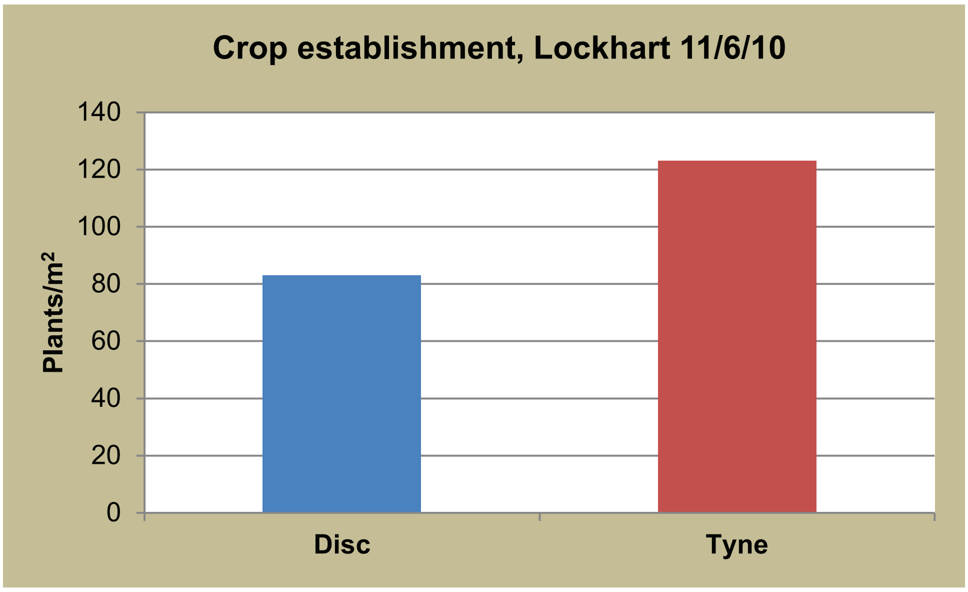
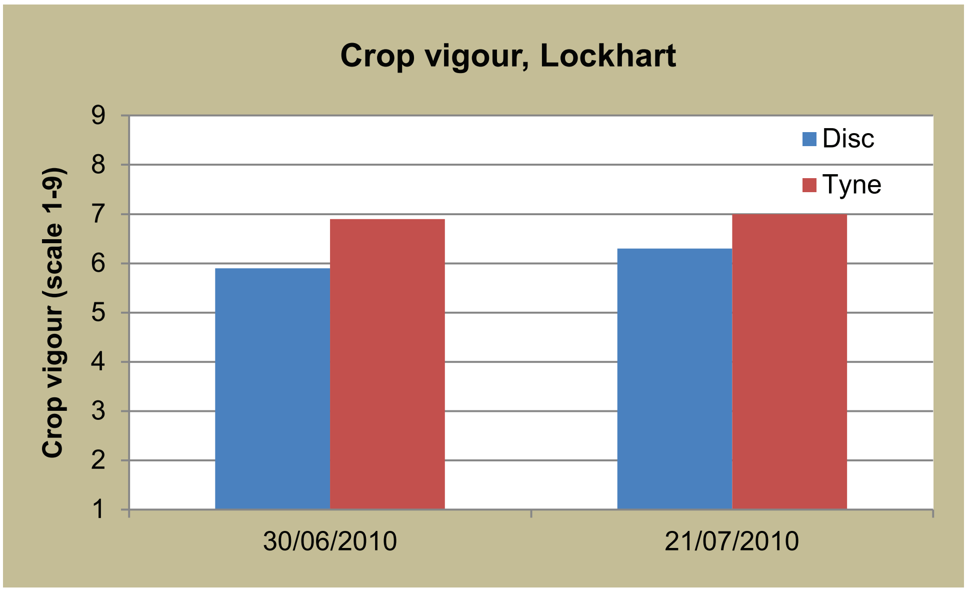
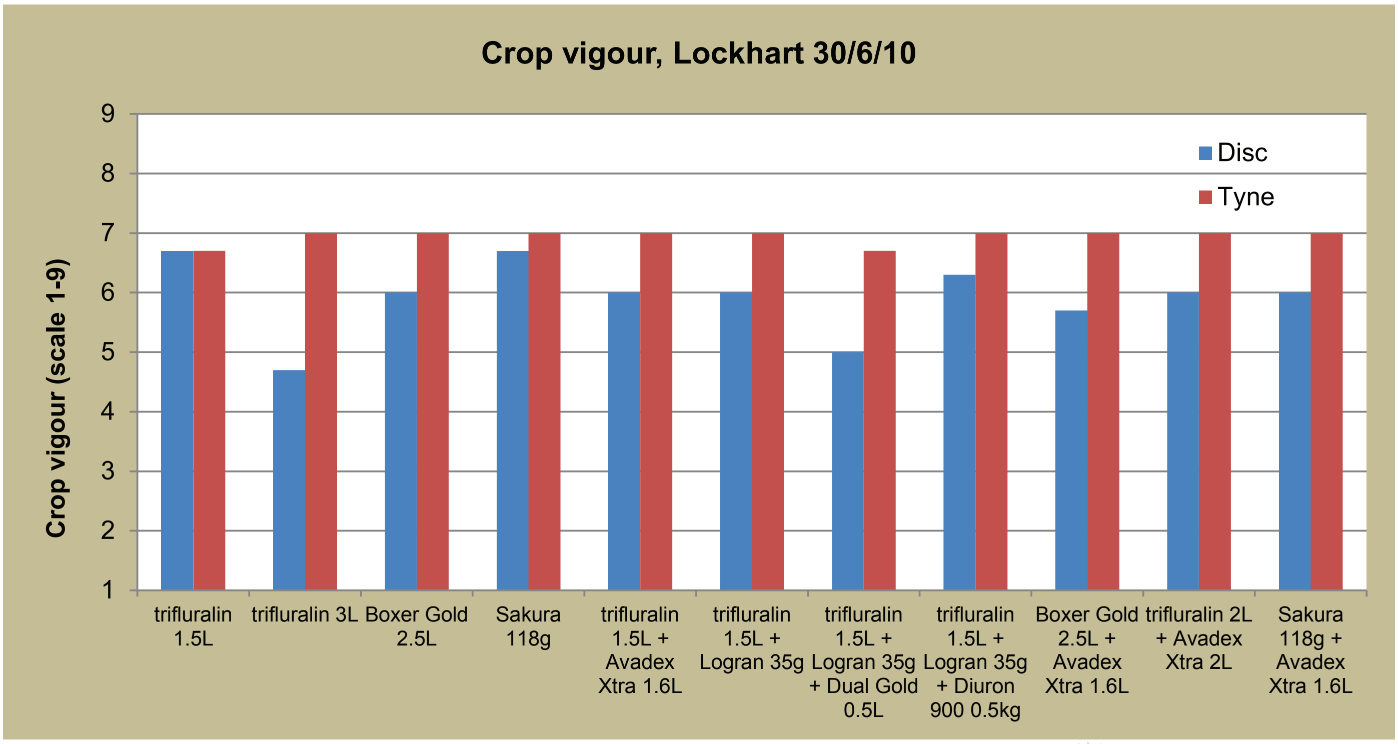


Figure 7 - Crop vigour disc versus tyne, Lockhart (LSD P<0.05 = 0.3 30th Jun; = 0.3 21st Jul)



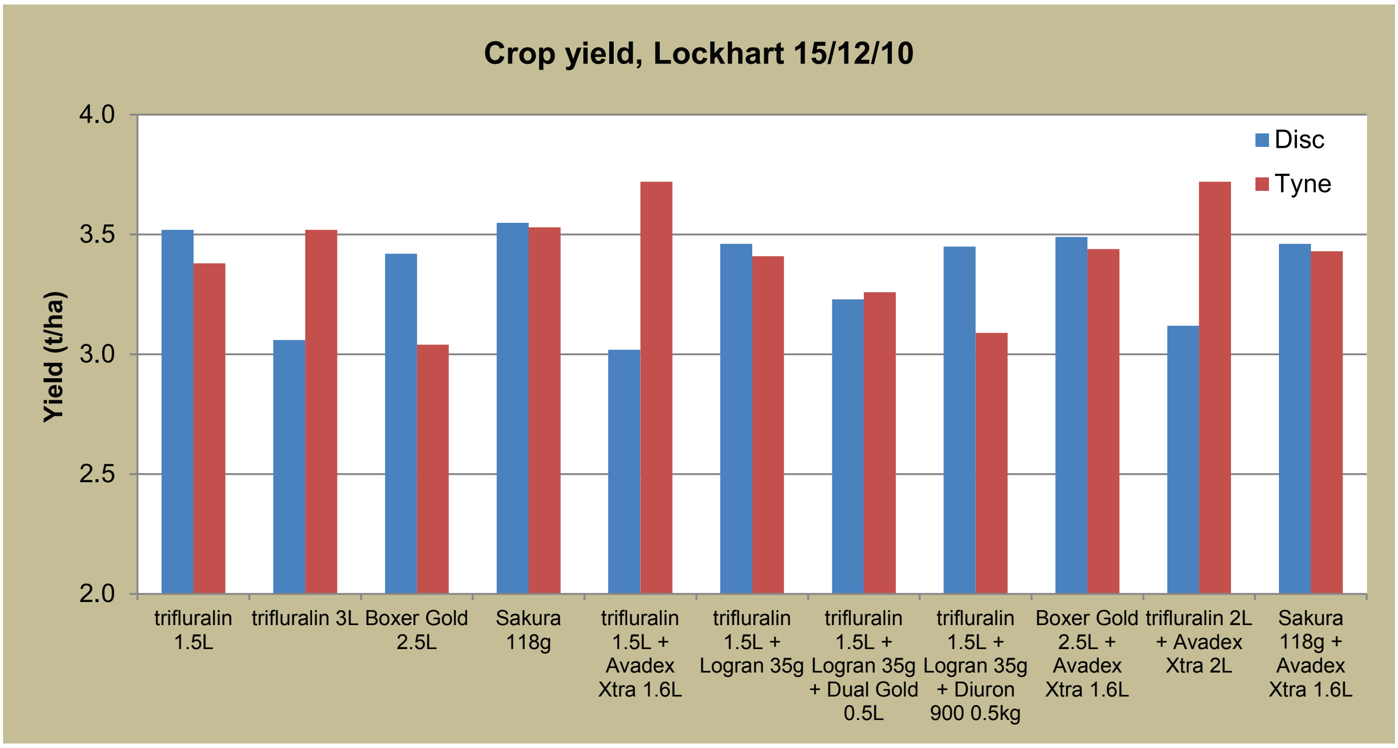
- **Weed control:** Very low weed numbers with uneven distribution across the trial prevented meaningful weed control data being collected.
- **Crop safety:** Conditions remained dry for approximately two weeks after the trial was established which reduced damage to the emerging crop from residual herbicides. While no herbicide caused crop damage in the tyne treatments, crop safety was compromised with 3L/ha trifluralin in the disc area. Compared with 1.5L/ha trifluralin, the higher rate significantly reduced crop vigour (P<0.05 - Figure 8) and resulted in a significant yield reduction of 13% (Figure 9).

Figure 8 - Crop vigour herbicide comparison, Lockhart (LSD P<0.05 = 0.9)



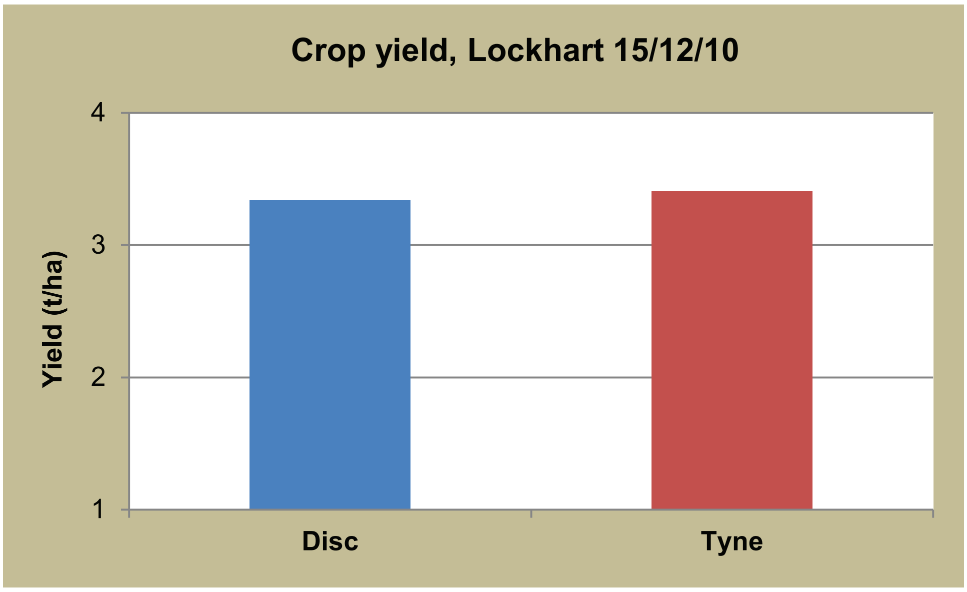
Results cont.

Figure 9 - Crop yield herbicide comparison, Lockhart *(LSD P<0.05 = 0.4)*



- **Yield:** There were no significant yield differences between the disc and tyne treatments (P>0.05 - Figure 10). This was a reflection of the drier nature of the site and subsequent improved crop safety with pre-emergent herbicides.

Figure 10 - Crop yield disc versus tyne, Lockhart *(LSD P<0.05 = 0.12)*



Results cont.

Wagga Wagga

- Co-operators: John & Brendan Pattison (disc) and Ben Beck (tyne)
- Sowing date: 13th April 2010
- Variety: Wedgetail
- Stubble cover: 50% (wheat stubble)
- 2010 rainfall: 966mm (Wagga Wagga Agricultural Institute, Bureau of Meteorology)

- **Site conditions:** Wedgetail wheat was sown early into good moisture and 50% stubble cover. Very high ryegrass numbers (up to 190 plants/m^2) with low crop competition due to early locust damage represented an extreme scenario to test pre-emergent herbicide efficacy. The trial was spray fallowed in October to prevent weed seed set.

Tyne seeding into stubble with very high ryegrass numbers at the Wagga Wagga trial, April 2010

Results cont.

- **Emergence:** Plant numbers were significantly higher in the tyne compared with the disc (80 vs 50 plants/m^2 respectively, $P<0.05$ - Figure 11). Greater early vigour by the tyne (Figure 12) allowed better recovery from early locust damage.

Figure 11 - Crop establishment disc versus tyne, Wagga Wagga *(LSD P<0.05 = 5)*

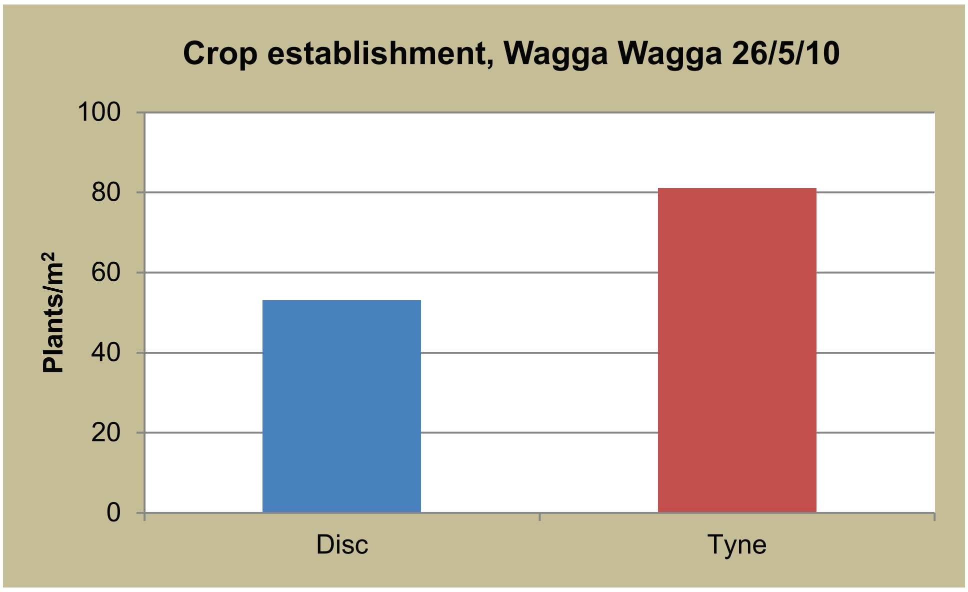
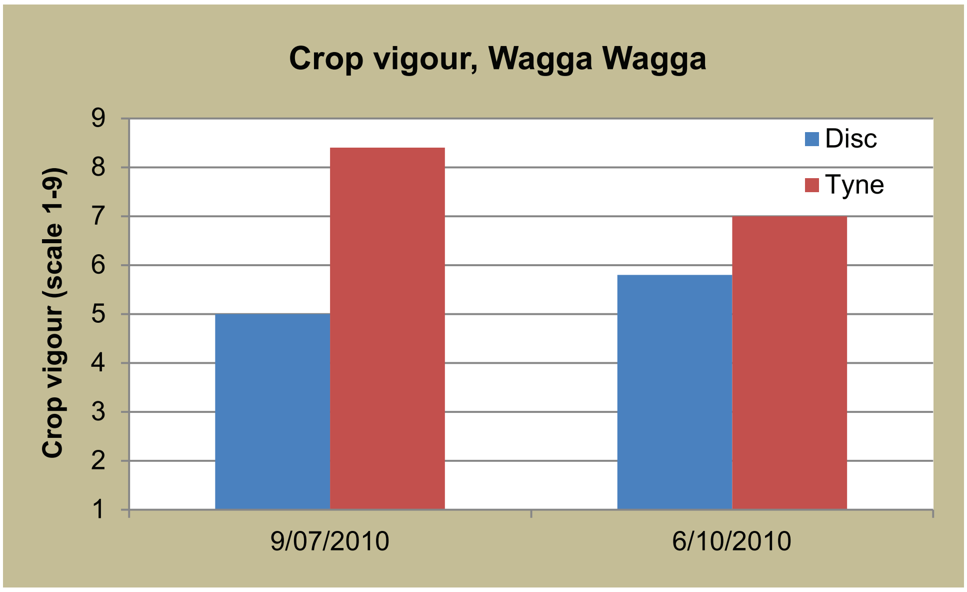
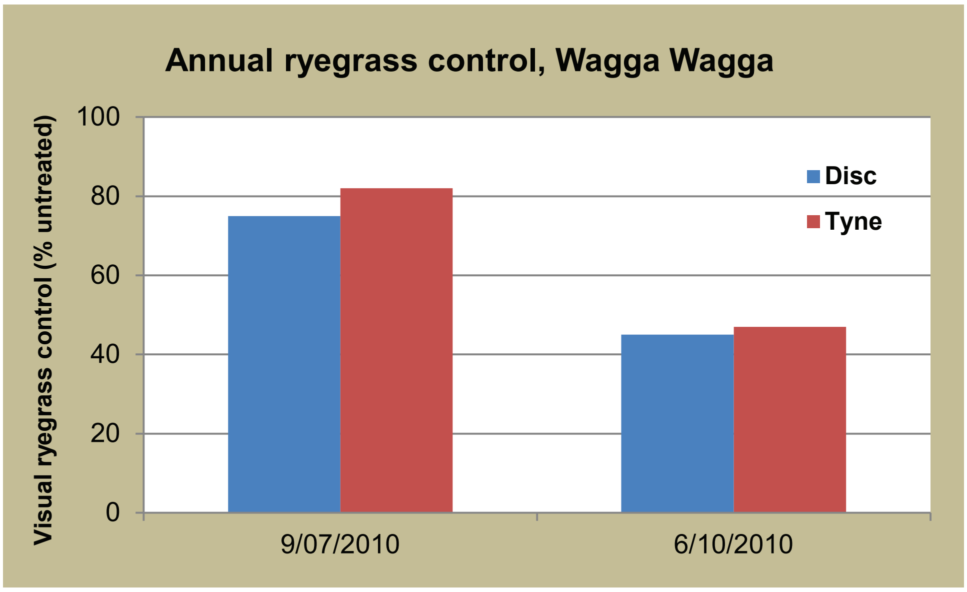


Figure 12 - Crop vigour disc versus tyne, Wagga Wagga *(LSD P<0.05 = 0.4 9th Jul; = 0.5 6th Oct)*



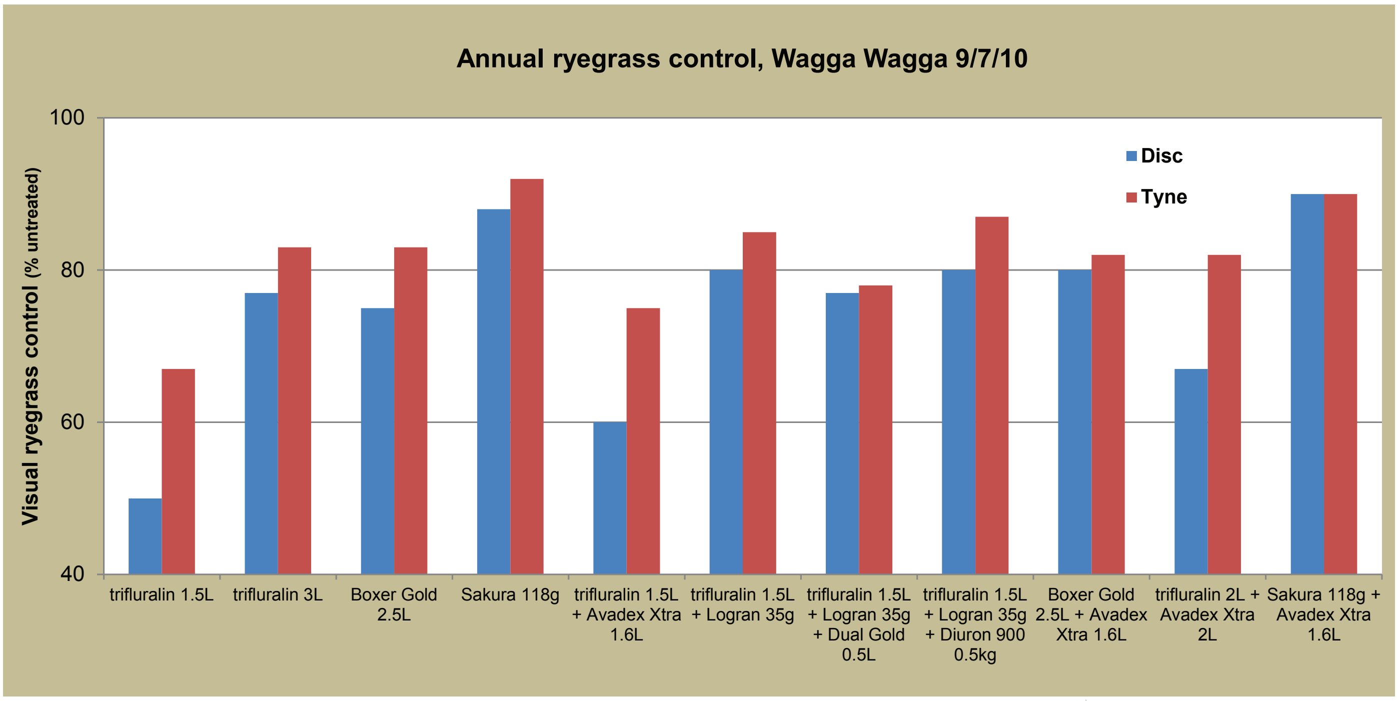
- **Weed control:** In the presence of very high weed numbers, weed control appeared better in the tyne treatments three months after application (significant at P<0.05), but this difference was not apparent later in the season (Figure 13).

Figure 13 - Annual ryegrass control disc versus tyne, Wagga Wagga *(LSD P<0.05 = 3 9th Jul; = 4 6th Oct)*



Sakura provided the best weed control for both systems. This was evident both mid-season (Figure 14), as well as later in the season when its residual activity provided excellent control of later germinating ryegrass populations resulting from the favourable season. The 1.5L rate of trifluralin provided the poorest ryegrass control, which was significantly improved at the 3L rate or with tank mixes including Logran, Dual Gold, Avadex Xtra and Diuron (P<0.05 - Figure 14).

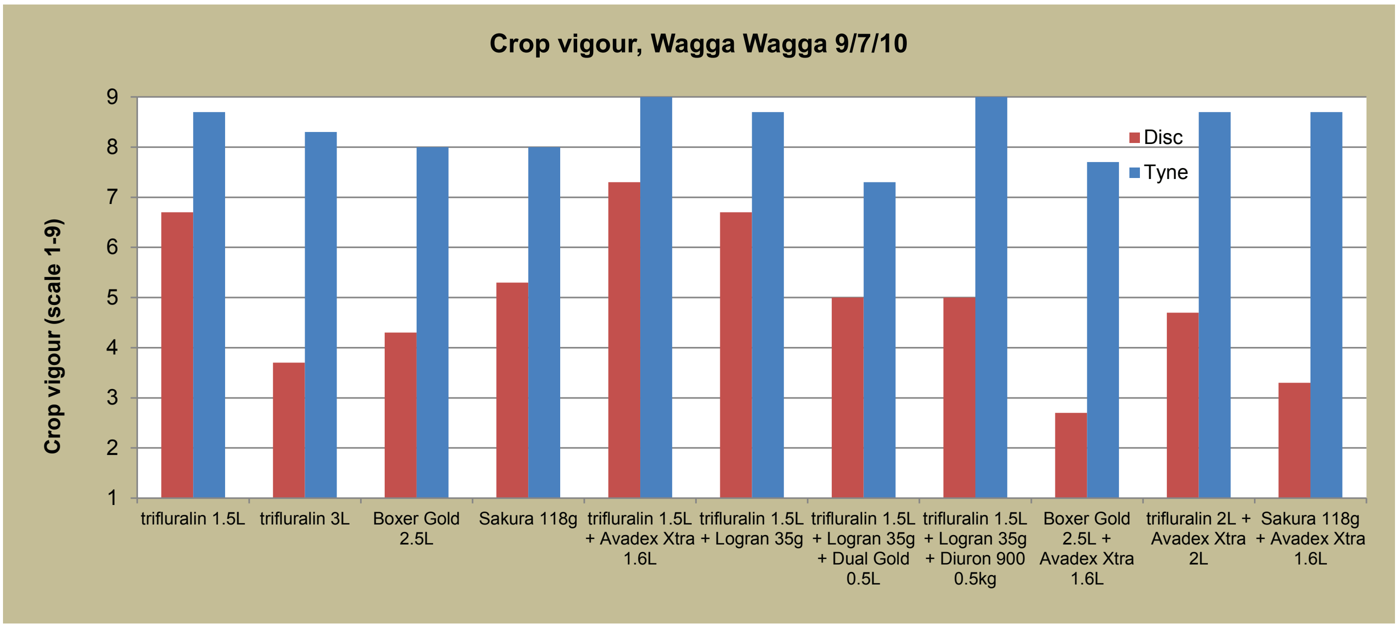
Figure 14 - Annual ryegrass control herbicide comparison, Wagga Wagga *(LSD P<0.05 = 9)*



Results cont.

- **Crop safety:** The impact of certain pre-emergent herbicides on crop safety was far more evident in the disc system than the tyne (Figure 15). Crop damage in the disc treatments was greatest with Boxer Gold + Avadex Xtra, although not significantly worse than Sakura + Avadex Xtra or 3L/ha trifluralin (P>0.05).

Figure 15 - Crop vigour herbicide comparison, Wagga Wagga *(LSD P<0.05 = 1.4)*



The Wagga Wagga trial was spray fallowed in October to prevent seed set of heavy populations of annual ryegrass, October 2010

Discussion of Results

Tyne seeding systems using knife points and press wheels are well recognised for their ability to accurately place seed at consistent depths across a range of soil types. Trial results from this project have shown they can also exceed disc seeding systems in crop establishment and early vigour when sowing conditions are favourable. However zero-till seeding using disc openers and full stubble retention is generating significant interest to further improve the gains made in no-till farming. Disc seeding allows higher sowing speeds and consistent seed placement into marginal soil moisture in the presence of stubbles, which in drier seasons, has achieved yield advantages over tyne systems, and often equal yields in more favourable seasons.

Crop Safety

No-till tyne systems have been rapidly adopted by growers in recent years, partly due to greater confidence in the use of pre-emergent herbicides. Growers and advisers now better understand the impact variations in sowing speed, row spacing and soil throw can have on herbicide efficacy. Label registrations also reflect this level of understanding, with the majority of pre-emergent herbicides now registered for use in no-till seeding systems using a knife point and press wheel.

While interest in disc seeders has also increased rapidly, aspects of the disc system need to be further investigated before widespread adoption occurs to ensure critical areas such as herbicide efficacy and yield are not compromised. The trials outlined in this report highlight the variability in crop safety that can occur with disc seeding in no-till systems when pre-emergent herbicides are incorporated by sowing (IBS), ranging from little crop damage at the drier Lockhart site to significantly greater damage at the waterlogged Grenfell site.

The trials were undertaken with commercial seeding equipment sown at typical speeds and sowing depths, and highlight the relative safety of using pre-emergent herbicides in tyne systems compared with discs. However the wet conditions at the Grenfell site served as an important reminder that some herbicides and higher rates can still be damaging in tyne systems. While the majority of pre-emergent herbicides are mobile when used in wet soils, some cause more crop damage in cereals than others due to greater mobility. Crops that are stressed during establishment due to waterlogging, poor nutrition or slow emergence (eg. from disc seeding) are put under greater pressure from pre-emergent herbicides and the industry needs to be aware of the variability that can occur.

To ensure crop damage is minimised across a range of soils and seasonal conditions, soil treated with residual pre-emergent herbicides needs to be removed from the furrow during seeding by soil throw. The ability to shift soil varies between disc seeders, with features such as row cleaners ahead of the single disc helping to reduce crop damage. Other factors, including disc size, disc shape, disc angle, closer plates and sowing speed all impact upon soil throw and the quantity of treated soil falling back into the seed furrow.

Weed Control

Despite significant differences in crop safety between disc and tyne systems, there was little difference in weed control between the two systems. This is a surprising result and may be particular to the unusually wet season. Pre-emergent weed control is typically more effective in tyne systems where additional soil throw results in better herbicide incorporation, although disc seeder adaptations such as Aricks residue managers have the potential to improve this aspect.

Discussion of Results cont.

Although there were no obvious differences in weed control between the sowing systems, there were variations in weed control between the pre-emergent herbicides treatments. For example, the low rate of trifluralin at 1.5L/ha, which has been commonly used as a pre-emergent herbicide strategy, was significantly less effective than all other herbicide treatments at the Wagga Wagga site, but not at Grenfell. However at both sites, Sakura used alone and in a tank mix with Avadex Xtra gave consistently high levels of ryegrass control. Boxer Gold also performed well at the Grenfell site, but was not as effective as some other herbicide treatments at Wagga Wagga. Sakura is expected to be available for the 2012 season.

Implications

The adoption of no-till seeding systems in southern NSW has increased rapidly over recent years as growers seek the benefits of increased water use efficiency. However it is important that the level of agronomy associated with these systems 'keeps pace' to ensure optimum and sustainable performance. The outcomes from this project have been significant in alerting growers, advisers and chemical company representatives of the extra diligence required to manage pre-emergent herbicide use in no-till systems, particularly where a disc seeder is used. The unusually wet season in 2010 further highlighted the issue, with many growers who had adopted disc seeding during the recent run of dry seasons unaware of the crop damage that can occur in wet conditions.

Manufacturers are already making adaptations to suit single disc openers that aim to throw more soil for improved herbicide safety with soil shifting row cleaners (eg. Tobin disc drill), seed boot shields with built in soil deflectors (eg. Daybreak) and a reversible and adjustable disc closer (eg. NDF Ag Design). The use of ground driven residue managers (eg. Aricks wheels) to displace soil and stubble from the seeding row is also being investigated for additional soil throw in pre-emergent herbicide use.

Although the project was invaluable in highlighting the risks associated with pre-emergent herbicide use in no-till systems, particularly disc systems, the major outcome of the project was that successful pre-emergent weed control can be achieved with minimal soil disturbance. Awareness of machinery configurations or adaptations to increase soil throw, as well as an understanding of the increased mobility of some herbicides and/or high rates in wet conditions, will help growers and advisers maximise herbicide efficacy in no-till systems. However this can only be achieved if herbicide use is managed as part of of an integrated weed management system. Keeping weed numbers low is critical in no-till situations, so a combination of chemical and cultural techniques such as burning canola header trails, cutting for hay/silage or header additions that destroy weed seeds at harvest, should be utilised to ensure sustainability of the system.

Recommendations

To further enhance the outcomes from the project, it is recommended that additional investment be made into comparing the performance of machinery adaptations designed to remove herbicide treated soil from the furrow in both disc and tyne systems, under different soil moisture conditions.

It is also recommended that greater awareness be made of the potential crop damage that can occur with the use of pre-emergent herbicides in wet conditions, particularly when incorporated with a disc seeder.

Acknowledgements:

- GRDC
- AgriTech NSW - Tony Single, Nic Amos, Peter Hamblin, Bruce Ramsey
- Co-operators - Rob Johnson, Duncan Lander, Ben Beck, Brendan Pattison, John Pattison, Brent Alexander, Chug Kennedy, Lachlan Caldwell, Heidi Gooden
- FarmLink Research
- Bayer, Syngenta, Nufarm

Appendices

Communication and Extension Activities (articles/handouts attached):

- Article for FarmLink newsletter, autumn 2010
- 'Farmwalk' at Grenfell trial site, July 2010
- 'Farmwalk' at Wagga Wagga (Downside) trial site, July 2010
- 'Farmwalk' at Lockhart trial site, August 2010
- Mid-season results forwarded to AAAC (southern NSW) members
- Various site visits by chemical company respresentatives
- Paper presented at GRDC Adviser Update at Young, February 2011
- Paper presentated at GRDC Grower Update at Junee, March 2011
- GRDC Groundcover article (in press)

Trial plan and statistical analyses (attached):

- Trial plan
- Grenfell ANOVA and Factorial Analysis of Variance
- Lockhart ANOVA and Factorial Analysis of Variance
- Wagga Wagga ANOVA and Factorial Analysis of Variance

FarmLink Project Update cont...

Herbicide Efficacy in No-Till Farming

Assessing the herbicide efficacy of various pre-emergent herbicides in disc and tyne sowing sytems.

(Grassroots Agronomy, AgriTech NSW, FarmLink; funded by GRDC, with support from Bayer, Nufarm & Syngenta)

2010 Trials

- A new project led by Grassroots Agronomy, funded through GRDC's Southern Agribusiness Trial Network.
- The project aims to demonstrate the differences (eg. crop safety and weed control) between a range of pre-emergent herbicides and how they compare in both disc and tyne sowing systems.
- 3 sites: Downside, Grenfell, Lockhart.
  - ***Trial details:***
    - Large scale plots are to be sown using farmer machinery in autumn 2010 (Downside sown in April - Figures 8 & 9).
    - Replicated pre-emergent herbicide treatments (Table 2) are applied by AgriTech prior to sowing using a six metre boom (Figure 7). All treatments are incorporated by sowing (IBS).
    - Each site will target one of the major weed issues in the region including resistant annual ryegrass, wild oats and mixed populations of annual grasses.
    - Monitoring will be undertaken during the season to assess herbicide efficacy (post sowing and post harvest), crop growth, yield, quality and gross margins.

Table 2 - Herbicide Efficacy Trial Treatments, 2010

Herbicides	Rates/ha
Triflur XL	1.5L
Triflur XL	3L
Boxer Gold	2.5L
Boxer Gold + Avadex Xtra	2.5L + 1.6L
Sakura#	118g
Sakura# + Avadex Xtra	118g + 1.6L
Triflur XL + Avadex Xtra	1.5L + 1.6L
Triflur XL + Avadex Xtra	2L + 2L
Triflur XL + Logran	1.5L + 35g
Triflur XL + Logran + Dual Gold*	1.5L + 35g + 500mL
Triflur XL + Logran + Diuron*	1.5L + 35g + 500g
control: untreated buffers	

*#registration pending (due 2011); *not registered for IBS in wheat in NSW*

Photo: G. Condon

7. Replicated pre-emergent herbicide treatments were applied pre-sowing (IBS) by AgriTech into a heavy ryegrass paddock.

Herbicide Efficacy in No Till Farming trial - Downside April '10

Photo: G. Condon

8. An Excel disc seeder (John & Brendan Pattison) was used to sow the disc area of the trial.

Herbicide Efficacy in No Till Farming trial - Downside April '10

Photo: G. Condon

9. A Horwood Bagshaw tyne seeder (Ben Beck) was used to sow the tyne area of the trial.

Herbicide Efficacy in No Till Farming trial - Downside April '10

Herbicide efficacy in no-till systems

a collaborative project between

Grassroots Agronomy, AgriTech & FarmLink

Lockhart 'farmwalk' - 12th August 2010

► **Aim**: To assess any differences in crop safety and weed control between a range of pre-emergent herbicides in disc and tyne sowing systems.

► **Sown**: 14th May 2010 using a John Deere single disc seeder and Flexicoil seeder with Janke tyne configuration.

► **Treatments**: Herbicides applied by AgriTech 14th May (IBS) using six-metre boom, as follows:

Table 1 - Herbicide Efficacy Trial Treatments, 2010

Herbicides	Rates/ha
Triflur X[1]	1.5L
Triflur X[1]	3L
Boxer Gold[1]	2.5L
Boxer Gold[1] + Avadex Xtra	2.5L + 1.6L
Sakura[2]	118g
Sakura[2] + Avadex Xtra	118g + 1.6L
Triflur X[1] + Avadex Xtra	1.5L + 1.6L
Triflur X[1] + Avadex Xtra	2L + 2L
Triflur X[1] + Logran	1.5L + 35g
Triflur X[1] + Logran + Dual Gold[3]	1.5L + 35g + 500mL
Triflur X[1] + Logran + Diuron[3]	1.5L + 35g + 500g

[1]***not*** *registered for IBS with disc seeders*

[2]*registration pending (due 2011);* [3]*not registered for IBS in wheat in NSW*

► **Results to date**:

» ***Disc v tyne (Figures 1-3):*** Tyne system had better establishment and early vigour. Significantly higher wild oat numbers in disc system, but no differences in ryegrass numbers (low pressure).

» ***Crop safety (Figures 4-5):*** Only 3L/ha trifluralin had a significantly greater impact on crop vigour than some other herbicides.

» ***Weed control (Figures 6-7):*** There was little difference in herbicide efficacy between the disc and tyne machines.

Figure 1

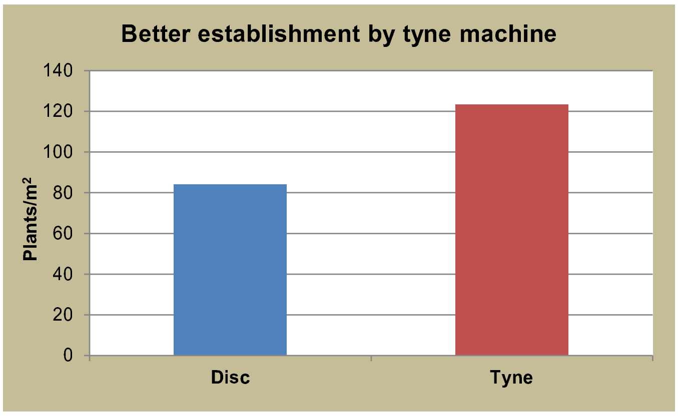


Figure 2

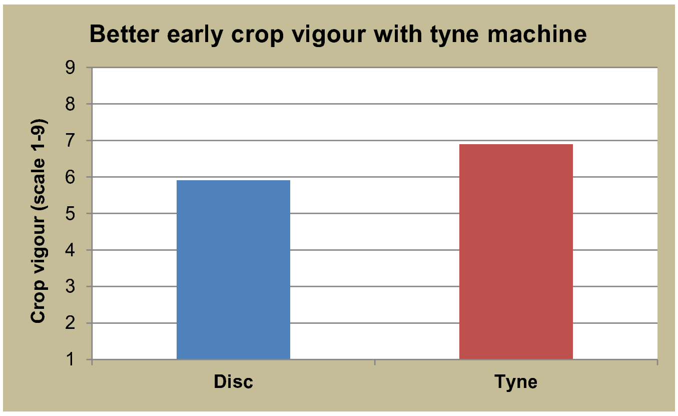
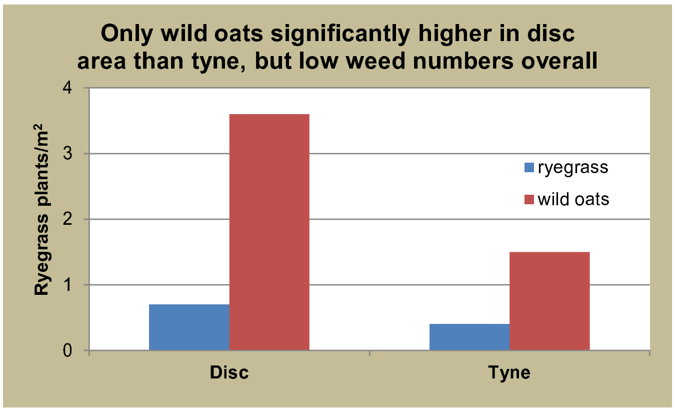


Figure 3



Project collaborators:

Grassroots Agronomy

AgriTech Researching Agriculture

FarmLink Research

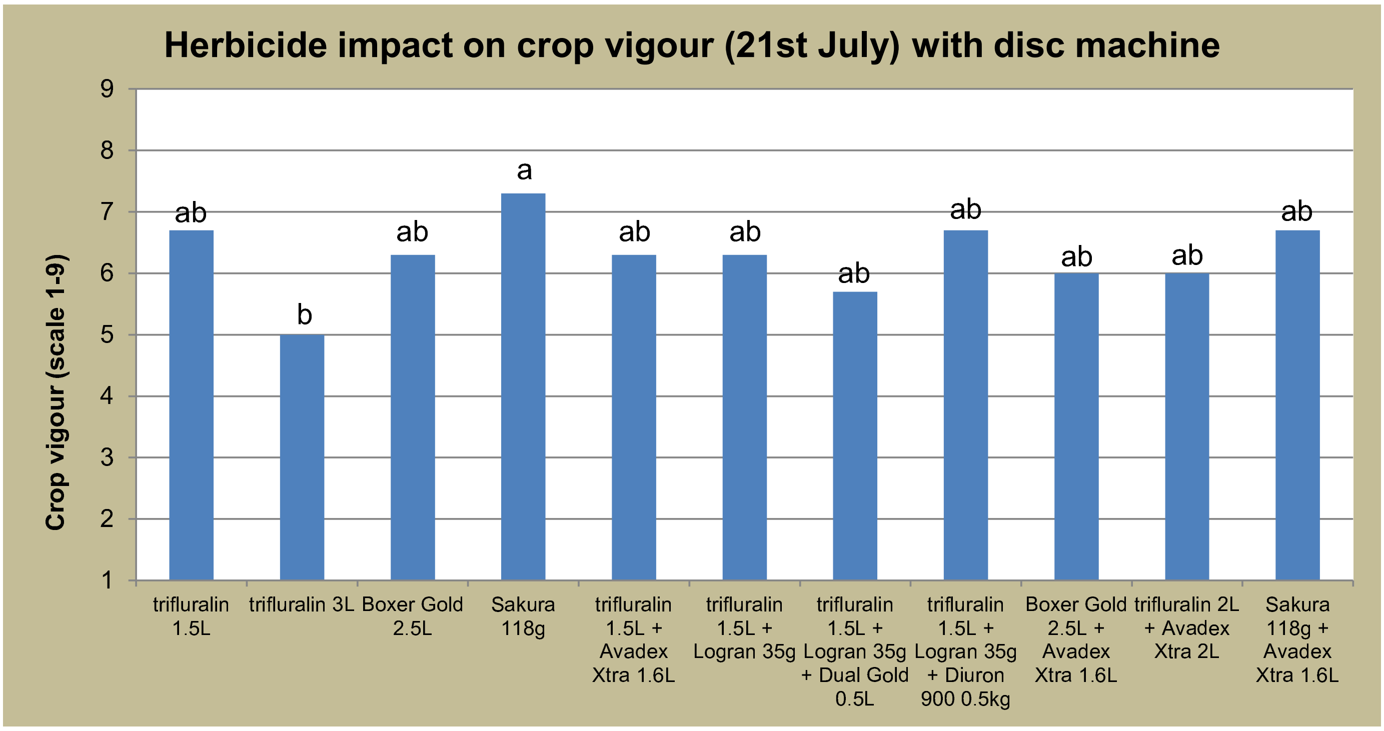
Project funded by:

GRDC Grains Research & Development Corporation

Supported by:

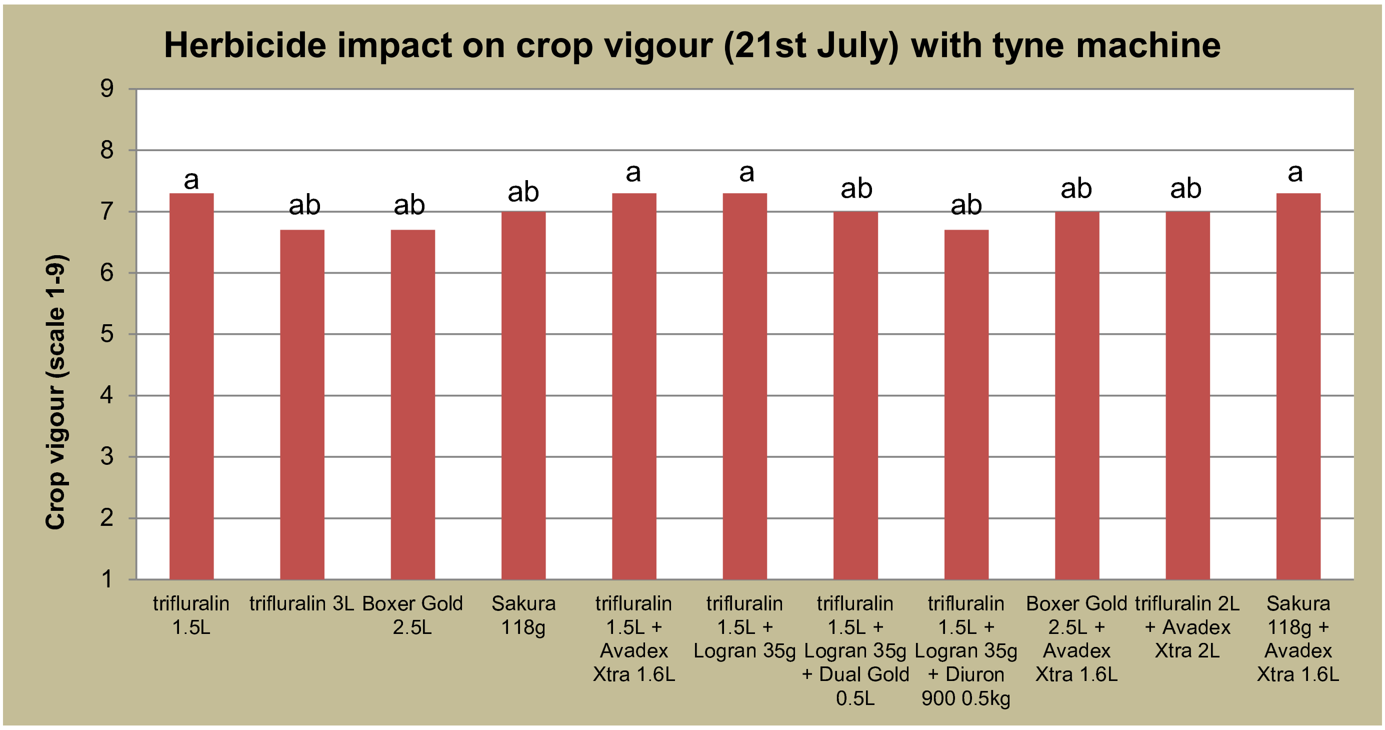
- Bayer
- Nufarm
- Syngenta

Figure 4



► Results with the same letter(s) are not significantly different, eg. 3L/ha trifluralin had a greater impact on crop vigour in the disc system than Sakura alone but was not significantly different to all other treatments.

Figure 5



► Results with the same letter(s) are not significantly different, eg. no herbicides had a significantly greater impact on crop vigour with the tyne machine.

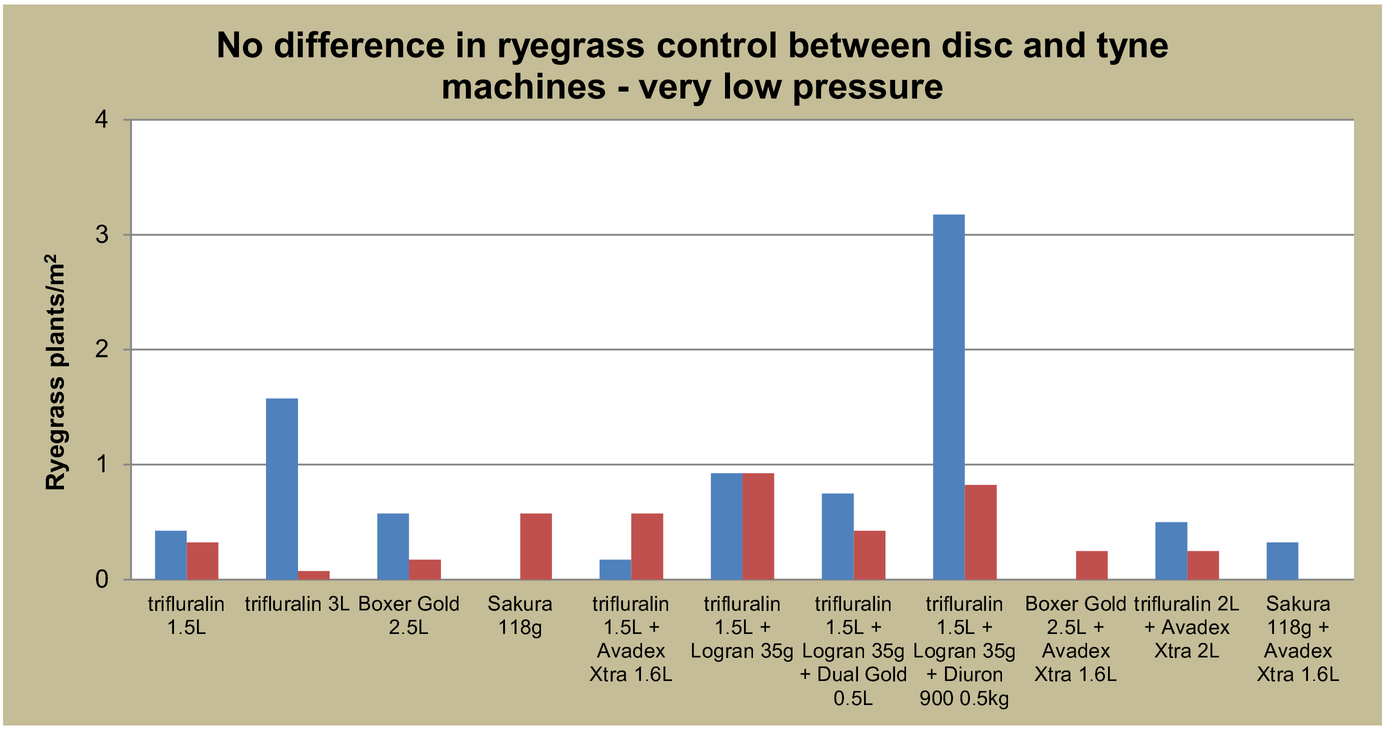
Project collaborators: Grassroots Agronomy, AgriTech Researching Agriculture, FarmLink Research

Project funded by: GRDC Grains Research & Development Corporation

Supported by:
- Bayer
- Nufarm
- Syngenta

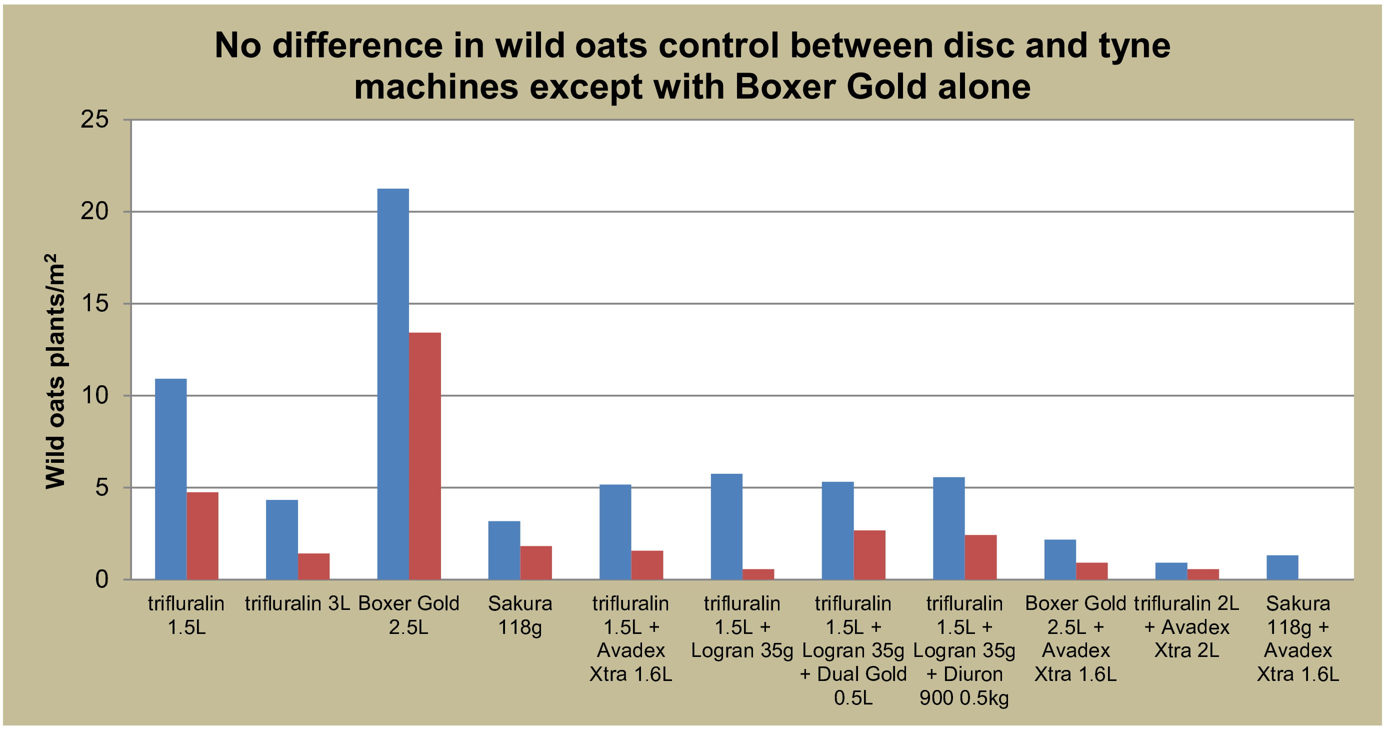
Herbicide efficacy in no-till systems

Figure 6



- ► Under very low weed pressure, there was difference in ryegrass control between the disc and tyne machines for each herbicide.
- ► Comparison *between* herbicides was unreliable due to variable weed distribution.

Figure 7



- ► The tyne machine only achieved better wild oat control than the disc machine with Boxer Gold (alone). All other herbicides performed similarly under each sowing system.

Project collaborators:

Grassroots Agronomy

AgriTech Researching Agriculture

FarmLink Research

Project funded by:

GRDC Grains Research & Development Corporation

Supported by:

- Bayer
- Nufarm
- Syngenta

Herbicide efficacy in no-till systems

a collaborative project between

Grassroots Agronomy, AgriTech & FarmLink

Downside 'farmwalk' - 28th July 2010

- **Aim**: To assess any differences in crop safety and weed control between a range of pre-emergent herbicides in disc and tyne sowing systems.
- **Sown**: 13th April 2010 using Excel disc and Horwood Bagshaw tyne seeders.
- **Treatments**: Herbicides applied by AgriTech 13th April (IBS) using six-metre boom, as follows:

Table 1 - Herbicide Efficacy Trial Treatments, 2010

Herbicides	Rates/ha
Triflur X[1]	1.5L
Triflur X[1]	3L
Boxer Gold[1]	2.5L
Boxer Gold[1] + Avadex Xtra	2.5L + 1.6L
Sakura[2]	118g
Sakura[2] + Avadex Xtra	118g + 1.6L
Triflur X[1] + Avadex Xtra	1.5L + 1.6L
Triflur X[1] + Avadex Xtra	2L + 2L
Triflur X[1] + Logran	1.5L + 35g
Triflur X[1] + Logran + Dual Gold[3]	1.5L + 35g + 500mL
Triflur X[1] + Logran + Diuron[3]	1.5L + 35g + 500g

[1]***not*** *registered for IBS with disc seeders*

[2]*registration pending (due 2011);* [3]*not registered for IBS in wheat in NSW*

- **Results to date**:
  - ***Disc v tyne (Figures 1-3):*** Tyne system had better establishment and early vigour, but more locust damage on disc. No significant differences in ryegrass numbers (high pressure).
  - ***Crop safety (Figures 4-5):*** Each herbicide reduced crop vigour significantly more under the disc system than the tyne system.
  - ***Weed control (Figures 6-7):*** Four herbicide treatments achieved significantly better ryegrass control under the tyne system.

Figure 1

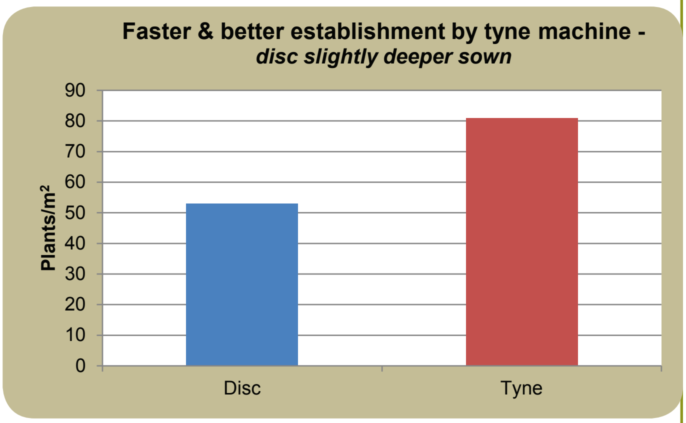


Figure 2

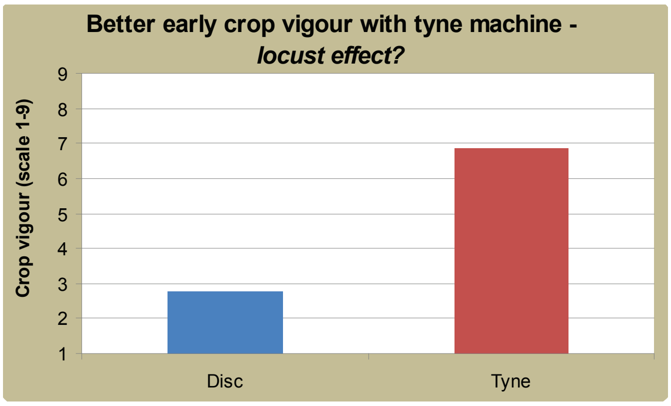
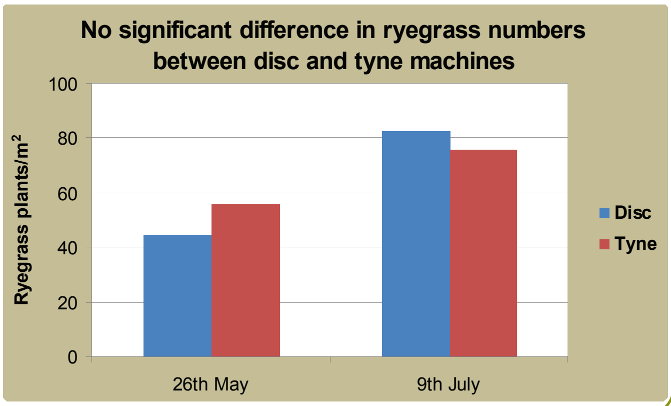


Figure 3



Project collaborators:

Grassroots Agronomy

AgriTech Researching Agriculture

FarmLink Research

Project funded by:

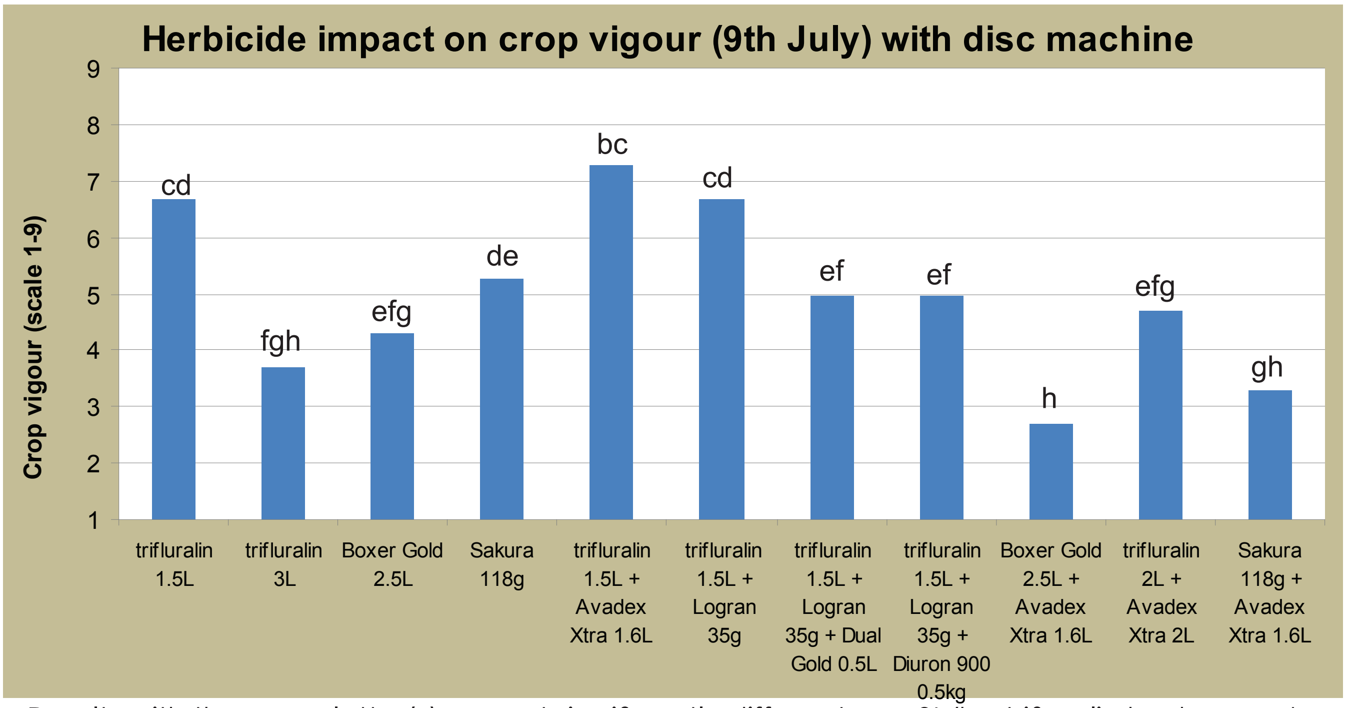
GRDC Grains Research & Development Corporation

Supported by:

- Bayer
- Nufarm
- Syngenta

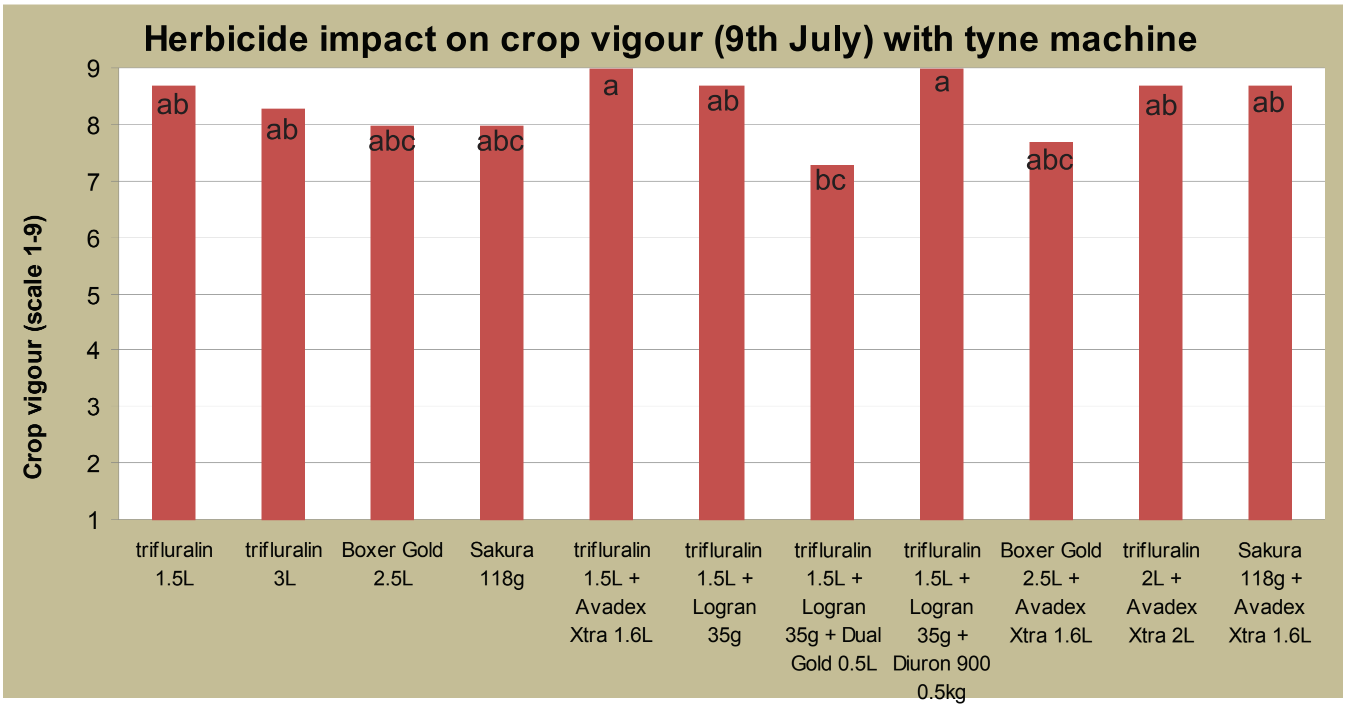
Herbicide efficacy in no-till systems

Figure 4



► Results with the same letter(s) are not significantly different, eg. 3L/ha trifluralin had a greater impact on crop vigour in the disc system than 1.5L/ha trifluralin. Each herbicide had a greater impact on crop vigour under the disc system than the tyne sytem.

Figure 5



► Results with the same letter(s) are not significantly different, eg. trifluralin + Logran + Dual Gold had a significantly greater impact on crop vigour in the tyne area than trifluralin + Avadex Xtra and trifluralin + Logran + diuron 900.

Project collaborators:

Grassroots Agronomy

AgriTech Researching Agriculture

FarmLink Research

Project funded by:

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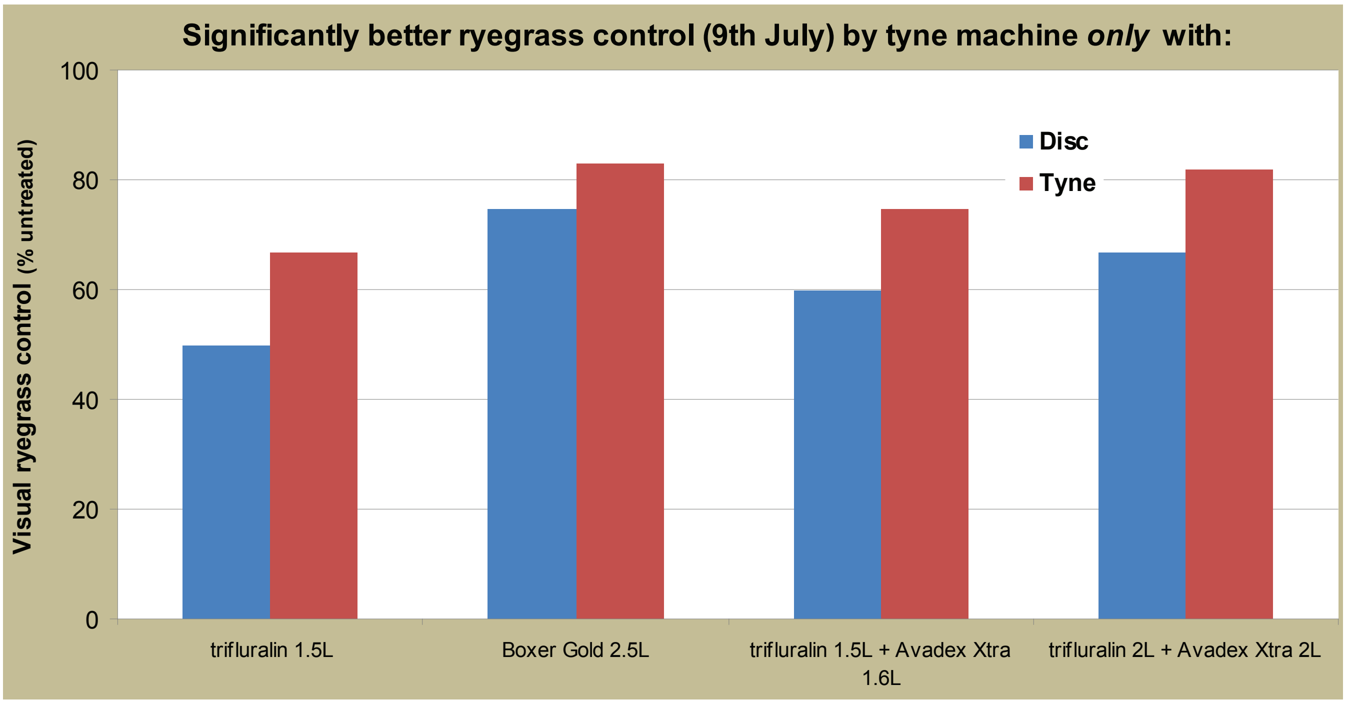
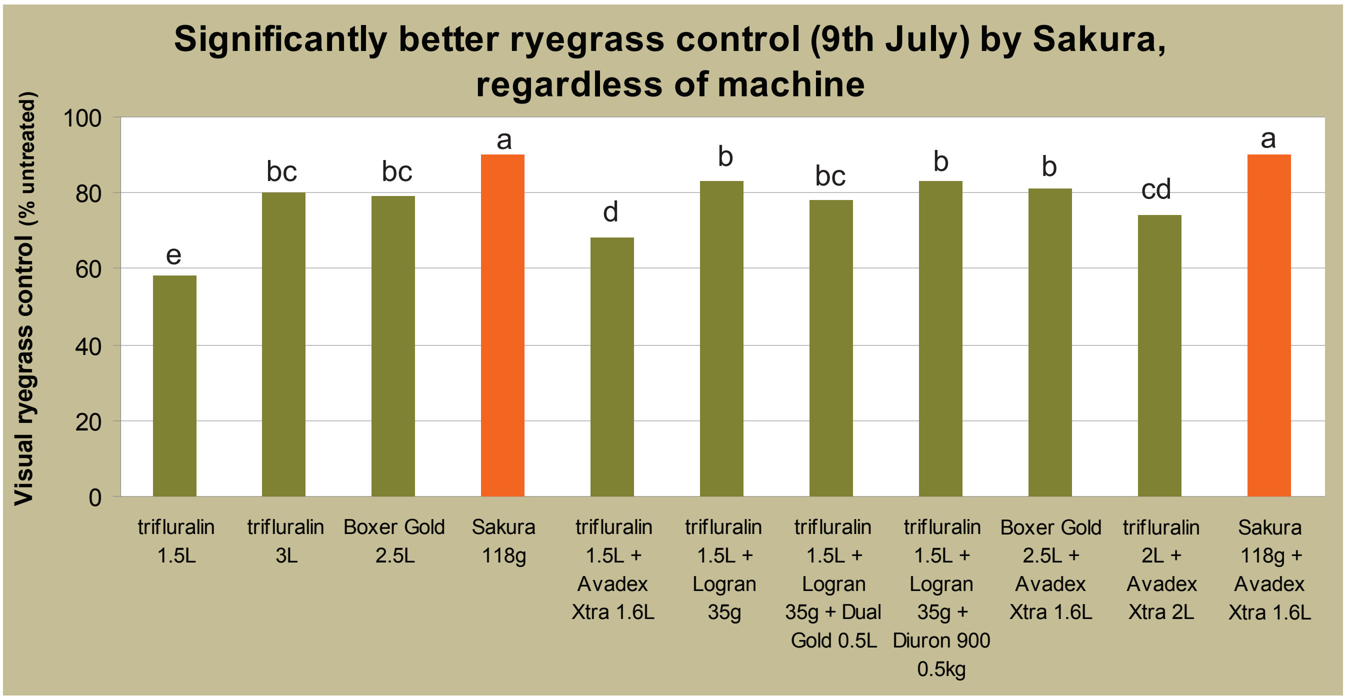
Herbicide efficacy in no-till systems

Figure 6



► Only the herbicides above achieved significantly better ryegrass control under the tyne system than the disc system (as at 9th July).

Figure 7



► Regardless of the type of seeder used, Sakura achieved significantly better ryegrass control than the other pre-emergent herbicides. (Results with the same letter are not significantly different).

Project collaborators:

Grassroots Agronomy

AgriTech Researching Agriculture

FarmLink Research

Project funded by:

GRDC Grains Research & Development Corporation

Supported by:

- Bayer
- Nufarm
- Syngenta

Herbicide efficacy in no-till systems

a collaborative project between

Grassroots Agronomy, AgriTech & FarmLink

Grenfell 'farmwalk' - Friday, 23rd July 2010

- **Aim**: To assess any differences in crop safety and weed control between a range of pre-emergent herbicides in disc and tyne sowing systems.
- **Sown**: 20th May 2010 using Daybreak disc and Horwood Bagshaw tyne seeders.
- **Treatments**: Herbicides applied by AgriTech 20th May (IBS) using six-metre boom, as follows:

Table 1 - Herbicide Efficacy Trial Treatments, 2010

Herbicides	Rates/ha
Triflur X[1]	1.5L
Triflur X[1]	3L
Boxer Gold[1]	2.5L
Boxer Gold[1] + Avadex Xtra	2.5L + 1.6L
Sakura[2]	118g
Sakura[2] + Avadex Xtra	118g + 1.6L
Triflur X[1] + Avadex Xtra	1.5L + 1.6L
Triflur X[1] + Avadex Xtra	2L + 2L
Triflur X[1] + Logran	1.5L + 35g
Triflur X[1] + Logran + Dual Gold[3]	1.5L + 35g + 500mL
Triflur X[1] + Logran + Diuron[3]	1.5L + 35g + 500g
control: untreated buffers	

[1]*not registered for IBS with disc seeders*
[2]*registration pending (due 2011);* [3]*not registered for IBS in wheat in NSW*

- **Results to date**:
  - ***Disc v tyne (Figures 1-3):*** Tyne machine better establishment and early vigour, but more ryegrass (relatively low pressure).
  - ***Crop safety (Figures 4-5):*** Some herbicides impacted on crop vigour with tyne machine, but all less impact than disc machine.
  - ***Weed control:*** No significant difference in ryegrass numbers between herbicide treatments. Visual ryegrass control still to be assessed.

Figure 1

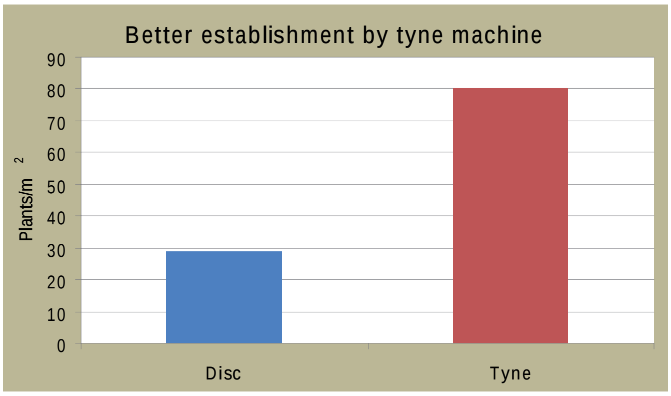


Figure 2

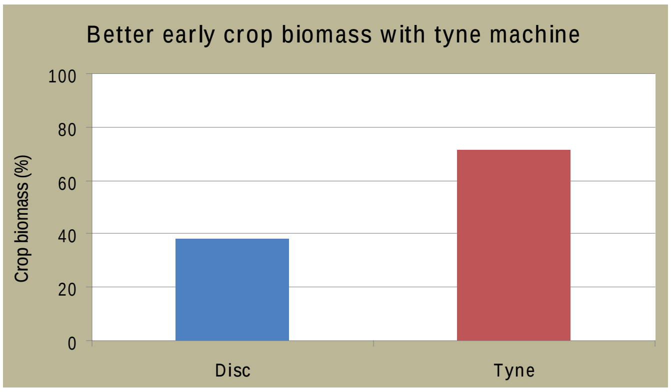
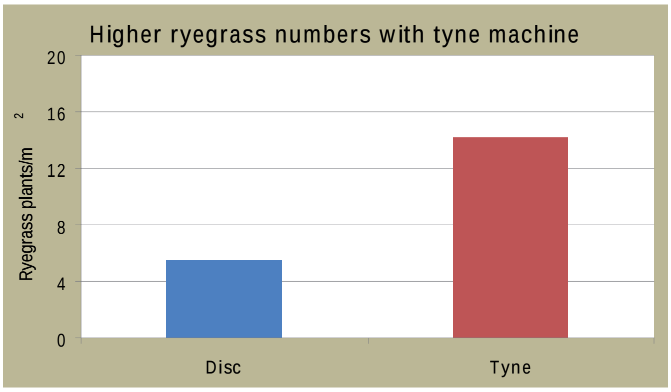


Figure 3



Project collaborators:

Grassroots Agronomy

AgriTech Researching Agriculture

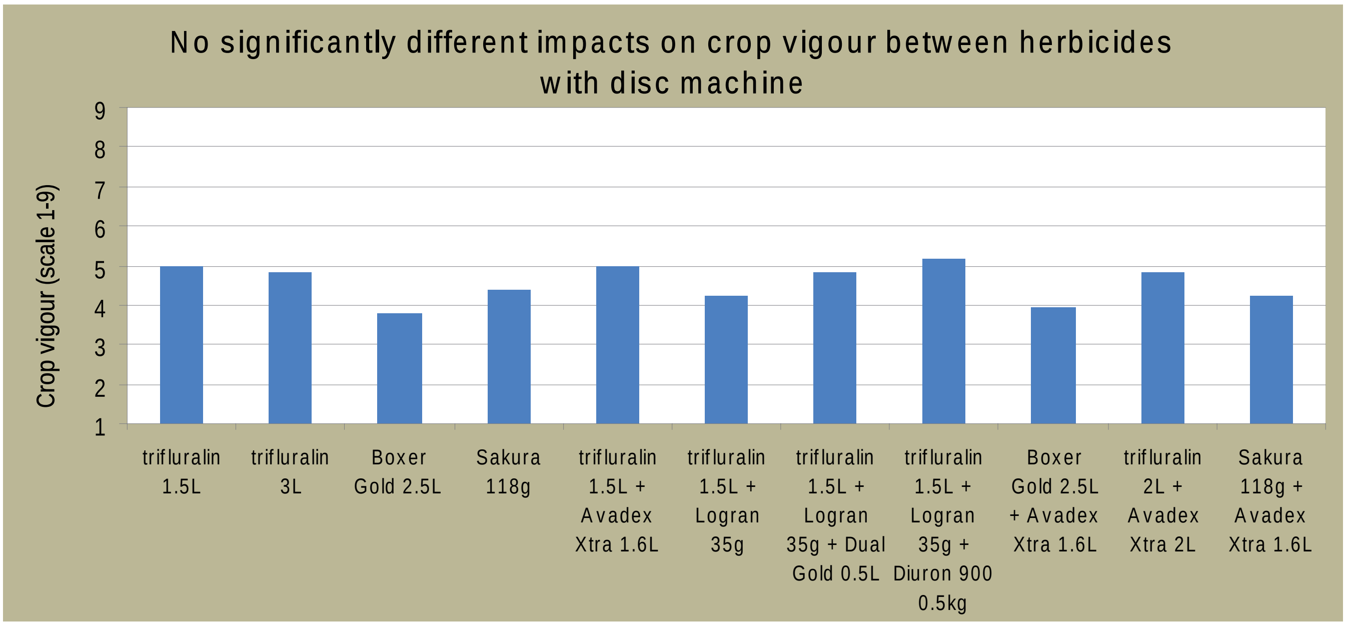
FarmLink Research

Project funded by:

GRDC Grains Research & Development Corporation

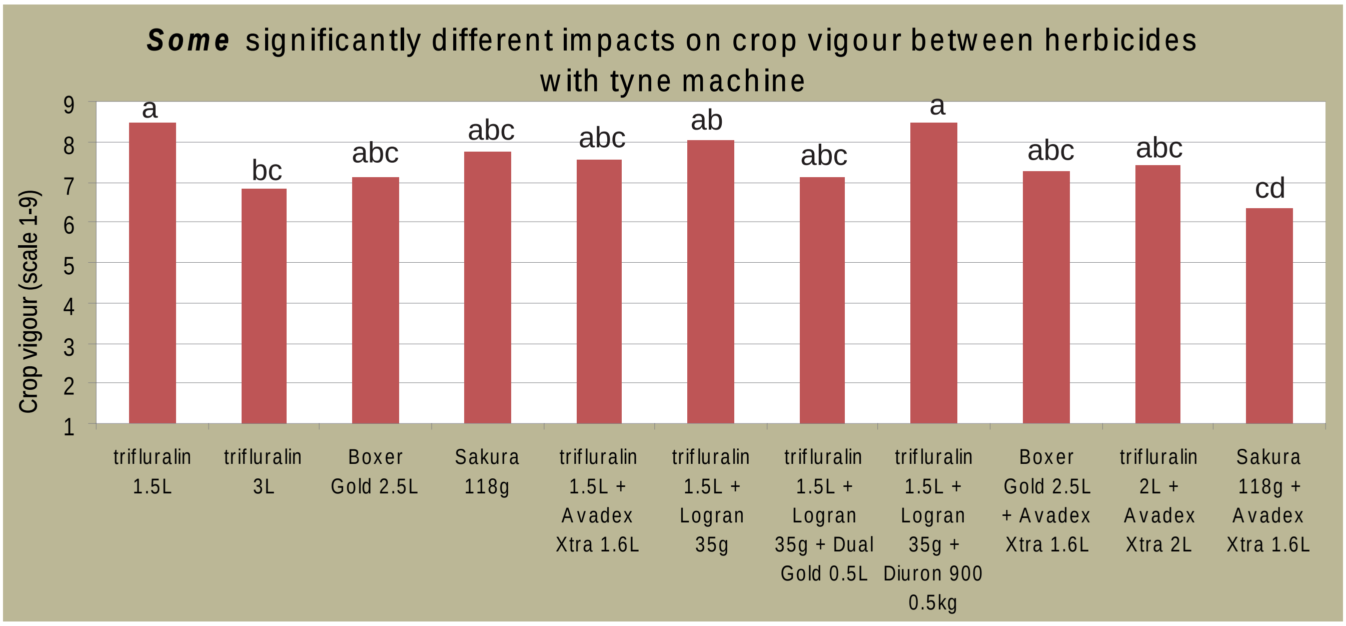
Herbicide efficacy in no-till systems

Figure 4



► All herbicides in the disc area had a similar impact on crop vigour, but all had significantly lower vigour than the tyne area.

Figure 5



► Results with the same letter(s) are not significantly different, eg. trifluralin at 3L/ha had a significantly greater impact on crop vigour in the tyne area than the 1.5L/ha rate, alone or with Logran + diuron, but was not significantly different to the remaining treatments.

Project collaborators:

Grassroots Agronomy

AgriTech Researching Agriculture

FarmLink Research

Project funded by:

GRDC Grains Research & Development Corporation

Herbicide Efficacy in No-till Farming Systems in Southern NSW

Greg Condon and Kirrily Condon, Grassroots Agronomy, Junee, NSW

Key Words
No-till farming systems, zero-till, weed management, pre-emergent herbicides, disc seeding, tyne seeding

Take home messages

- Disc seeding into wet soil in the presence of residual pre-emergent herbicides caused a severe reduction in wheat crop vigour compared with the tyne seeder.
- Tyne seeding resulted in consistently better establishment and early vigour than disc seeding, but weed control was generally similar for both systems.
- Under very high ryegrass pressure, Sakura provided significantly better weed control through to late spring in both disc and tyne systems. Boxer Gold and trifluralin mixes provided good to moderate ryegrass control compared to a low rate of trifluralin used alone.
- Weed management in no-till systems, especially where a disc opener is used, requires a high level of agronomic management to maintain crop safety and achieve satisfactory weed control. The majority of pre-emergent herbicides used in wheat are not currently registered for use with disc seeders*.

Variable rainfall patterns over the past ten years in southern NSW have prompted the rapid adoption of no-till, stubble retained farming systems to maximise crop water use efficiency. Despite the many benefits of this system, the efficacy of pre-emergent herbicides remains one of the major concerns for growers and advisers who have adopted, or are considering adoption, of the system.

The problem

Pre-emergent herbicides play an important role in integrated weed management programs as they allow for rotation away from high risk Group A and B herbicides. However, poor efficacy of pre-emergent herbicides can still result in the rapid development of herbicide resistance, as has occurred with trifluralin resistance that is common in South Australia.

The efficacy of many pre-emergent herbicides relies on the ability to incorporate them into the soil at sowing. In no-till systems, however, knife points and to a greater extent, disc openers, provide minimal soil disturbance at sowing to limit moisture loss, but which consequently also limit herbicide incorporation. Retained stubble also acts as a physical barrier to herbicide/soil contact. This issue is further confounded where livestock are included in the system, with stubble laid flat from trampling providing a physical barrier to herbicide uptake. Effective pre-emergent herbicide strategies are required to ensure the future sustainability of both herbicides and no-till farming systems.

Finding the solution

To help develop pre-emergent herbicide strategies relevant to no-till farming systems in southern NSW, a local consortium was funded by GRDC to implement three trial sites in 2010 comparing herbicide efficacy in disc and tyne (knife point) systems (Table 1). The sites were located near Grenfell, Wagga Wagga and Lockhart, with commercial machinery used to sow large scale, replicated plots at typical speeds to ensure soil throw and accurate seed placement. Pre-emergent herbicide treatments (Table 2) were applied by AgriTech using a six-metre boom and incorporated by sowing (IBS).

Table 1 – Trial details

Location	Wagga Wagga	Lockhart	Grenfell
Sowing date	13th April	14th May	20th May
Variety	Wedgetail	Lincoln	Livingston
Stubble cover	50%	10-60%	80%
Tyne seeder	Horwood Bagshaw & Knuckey press wheels on 375mm rows	Janke tynes & press wheels, Flexi Coil bar on 300mm rows	Horwood Bagshaw & Ryan press harrows on 350mm rows
Disc seeder	Excel single disc on 250mm rows	John Deere single disc on 250mm rows	Daybreak disc on 375mm rows

Table 2 - Herbicide treatments:

Herbicides	Rate/ha	Indicative cost $/ha
Triflur X[1]	1.5L	$8
Triflur X[1]	3L	$16
Boxer Gold[1]	2.5L	$41
Boxer Gold[1] + Avadex Xtra	2.5L + 1.6L	$63
Sakura[2]	118g	*na*
Sakura[2] + Avadex Xtra	118g + 1.6L	*na*
Triflur X[1] + Avadex Xtra	1.5L + 1.6L	$30
Triflur X[1] + Avadex Xtra	2L + 2L	$38
Triflur X[1] + Logran	1.5L + 35g	$11
Triflur X[1] + Logran + Dual Gold[3]	1.5L + 35g + 500ml	$21
Triflur X[1] + Logran + Diuron[3]	1.5L + 35g + 500g	$17
untreated buffers as control		

[1] **not** registered for IBS with disc seeders
[2] registration pending (due 2012)
[3] **not** registered for IBS in wheat in NSW

*Caution: Research on unregistered pesticide use. Any research with unregistered products reported in this document does not constitute a recommendation for that particular use by the authors or the author's organisation. All pesticide applications must accord with the currently registered label for that particular pesticide, crop, pest and region.

Results

Although different outcomes were achieved at each site due to variations in weed density, soil moisture and stubble loads, the tyne seeder produced consistently better establishment and early crop vigour at all sites. A summary of the other major outcomes are as follows:

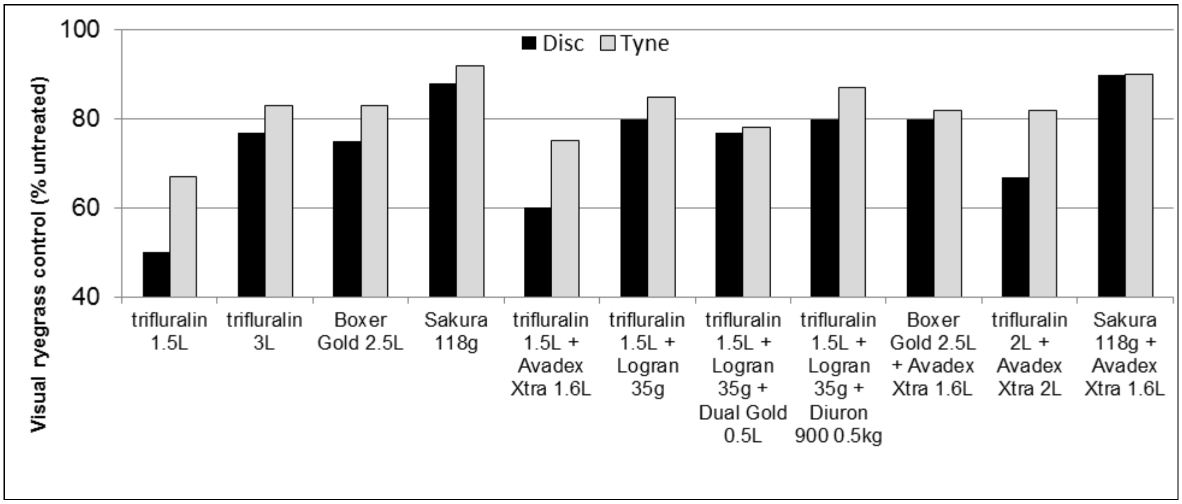
Wagga Wagga

- Site conditions: Wedgetail wheat was sown early into good moisture and 50% stubble cover. Very high ryegrass numbers (up to 190 plants/m^2) with low crop competition due to early locust damage represented an extreme scenario to test pre-emergent herbicide efficacy.
- Emergence: Plant numbers were significantly higher in the tyne compared with the disc (80 vs 50 plants/m^2 respectively, $P<0.05$). Greater early vigour by the tyne allowed better recovery from early locust damage.
- Weed control: There was little difference in ryegrass control between disc and tyne, with Sakura providing the best control for both systems. Boxer Gold, trifluralin at 3L/ha and trifluralin mixes with Logran, Dual Gold, Avadex Xtra and Diuron all provided significantly higher levels of control than trifluralin at 1.5L/ha ($P<0.05$, Figure 1). Sakura also provided

excellent residual control of ryegrass for later germinating populations resulting from the favourable season.

- Crop safety: The impact of certain pre-emergent herbicides on crop safety was far more evident in the disc system than the tyne. Crop damage in the disc treatments was greatest with Boxer Gold + Avadex Xtra, although not significantly worse than Sakura + Avadex Xtra or 3L/ha trifluralin (P>0.05).
- To ensure crop damage is minimised across a range of soils and seasonal conditions, soil treated with residual pre-emergent herbicides needs to be removed from the furrow during seeding by soil throw. The single disc openers used in this trial were unable to fully achieve this objective. The ability to shift soil does vary between disc seeders, with features such as row cleaners ahead of the single disc helping to reduce crop damage. Other factors, including disc size, disc shape, disc angle, closer plates and sowing speed all impact upon soil throw and the quantity of treated soil falling back into the seed furrow.

Figure 1 – Ryegrass control in disc and tyne systems at Wagga Wagga; *LSD (0.05) = 9*



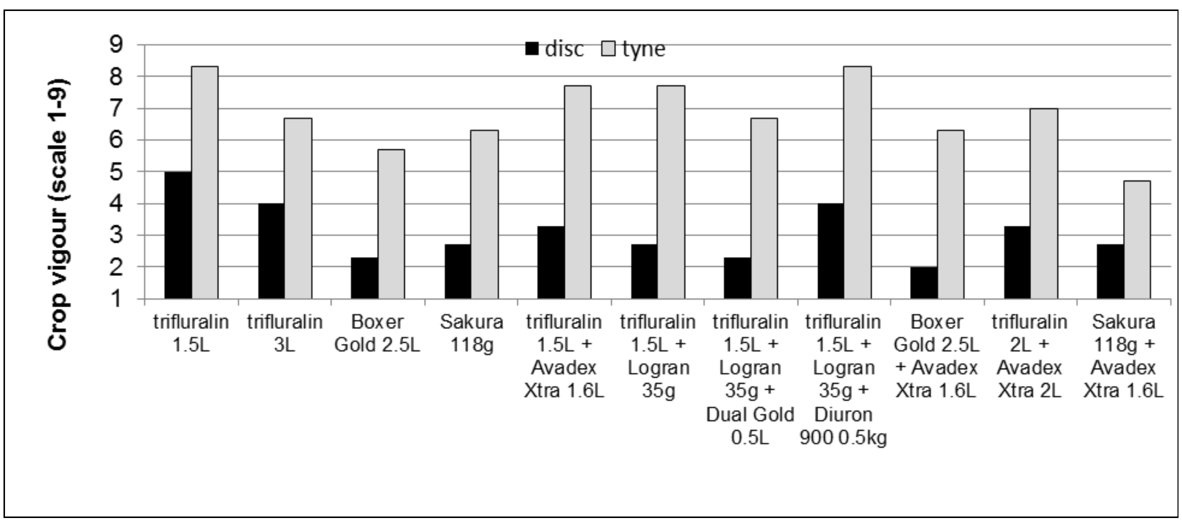
Lockhart

- Site conditions: Lincoln wheat was sown mid-May into dry conditions and patchy stubble cover from an uneven burn. Very low ryegrass and wild oat numbers meant the trial could be retained through to harvest, allowing a valid comparison of disc and tyne systems in the relative absence of weeds.
- Emergence: Plant numbers were significantly higher in the tyne compared with the disc (120 vs 80 plants/m^2 respectively, P<0.05), with disc emergence more affected by the presence of stubble and sowing across the seeding rows from the previous year. Greater early vigour by the tyne became less apparent as the season progressed.
- Crop safety: Conditions remained dry for approximately one month after the trial was established, which reduced damage from residual herbicides on the emerging crop. Crop safety was, however, compromised with 3L/ha trifluralin in the disc treatment, resulting in lower vigour and yield, although not significantly lower than other treatments (P>0.05).
- Yield: There were no significant yield differences between the disc and tyne treatments (P>0.05), a reflection of the drier nature of the site and subsequent improved crop safety with pre-emergent herbicides.

Grenfell

- Site conditions: Livingston wheat was sown into moist soil and a thick residue of stubble retained from previous wheat crops. Following establishment, approximately 50mm of rain fell onto an already full profile, which remained wet for the entire season. 1015mm of rainfall was measured for the area in 2010, with 650mm falling between September and December. The wet conditions had a major bearing upon outcomes from this trial, particularly the disc treatments which suffered from poor establishment and severe herbicide damage.
- Establishment: Plant numbers were significantly higher in the tyne compared with the disc (80 vs 30 plants/m^2 respectively, $P<0.05$). Crop vigour was also better in the tyne treatments, which remained the case through the season. As the soil became wetter during winter, the disc area was unable to recover its vigour due to a range of factors including herbicide damage, yellow leaf spot, nitrogen deficiency and waterlogging.
- Weed control: Low to moderate ryegrass numbers were present at establishment, with similar levels of control between the disc and tyne treatments. 1.5L/ha trifluralin + Logran gave the poorest control for both systems, although it wasn't significantly worse than some other treatments ($P>0.05$). With low crop competition, particularly in the disc treatments, and later germinations of ryegrass, the trial became heavily infested and was spray fallowed in October to prevent seed set.
- Crop safety: Herbicide damage in the disc areas was particularly evident at this site, with the majority of herbicide treatments causing significantly more crop damage than 1.5L/ha trifluralin ($P<0.05$), which recorded the least damage (Figure 2). Yield estimates taken prior to spray fallowing showed the disc treatments to potentially average 0.36t/ha and the tyne treatments 1.0t/ha, with a range across all treatments of 0.15 to 1.37t/ha depending on herbicide, seeding system and weed control.
- Despite the wet season, these yields are well below profitable targets for wheat in this region and highlight the risks associated with using pre-emergent herbicides at robust rates in no-till systems. The majority of pre-emergent herbicides are mobile when used in wet soils, with some causing more crop damage in cereals than others due to their mobility. Crops that are stressed during establishment due to waterlogging, poor nutrition or slower emergence from disc systems are put under greater pressure from pre-emergent herbicides and the industry needs to be aware of the variability that can occur.

Figure 2 – Crop safety in disc and tyne systems at Grenfell; LSD (0.05) = 2.2



Discussion

No-till farming utilising sound agronomy is a proven system of crop management that reduces production risk through improved soil structure, enhanced water use efficiency and ultimately stable profits for growers. Knife point and press wheel seeding systems are now well understood for their ability to accurately place seed at consistent depths across a range of soil types in the presence of pre-emergent herbicides. Awareness of differences achieved through variations in sowing speed, row spacing and soil throw are better understood by growers and consequently there is greater confidence with using pre-emergent herbicides in no-till systems. Label registrations now reflect this level of understanding, with the majority of pre-emergent herbicides now registered for use in no-till seeding systems using a knife point and press wheel.

Developments such as full stubble retention and zero-till seeding with discs are now being investigated for their value to further improve the gains made in no-till farming. Disc seeding allows higher sowing speeds and consistent seed placement into marginal soil moisture in the presence of stubbles, which in drier seasons, has achieved yield advantages over tyne systems.

Before these developments are widely adopted, aspects of the disc system need to be further investigated to ensure standards are maintained with key areas such as weed management and yield. The trials outlined in this report highlight the variability that can occur with disc seeding systems in no-till when pre-emergent herbicides are incorporated by sowing (IBS), ranging from little crop damage at the drier Lockhart site to significantly greater damage in the disc treatments at the waterlogged Grenfell site.

Growers and advisers will continue to improve on the no-till system in relation to crop safety with pre-emergent herbicides, particularly using disc seeding technology. Manufacturers are already making adaptations to suit single disc openers that aim to throw more soil for improved herbicide safety with soil shifting row cleaners (eg Tobin disc drill) , seed boot shields with built in soil deflectors (eg Daybreak) and a reversible and adjustable disc closer (NDF Ag Design). The use of ground driven residue managers (eg Aricks wheels) to displace soil and stubble from the seeding row is also being investigated for soil throw and pre-emergent herbicide use.

Further improvements to the no-till system, particularly in relation to canopy management in disc and tyne systems, is being investigated in another GRDC funded project in 2011.

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Heidi Gooden - Delta Agribusiness
Bayer, Syngenta, Nufarm
FarmLink Research

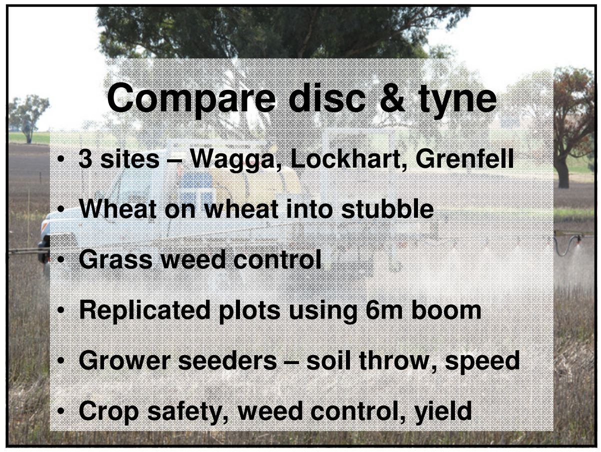
Author's contact details:

Greg Condon
Grassroots Agronomy
gbcondon@westnet.com.au
0428 477348

Herbicide Efficacy in No-till Farming Systems

Greg & Kirrily Condon
Grassroots Agronomy

Compare disc & tyne



- **3 sites – Wagga, Lockhart, Grenfell**
- **Wheat on wheat into stubble**
- **Grass weed control**
- **Replicated plots using 6m boom**
- **Grower seeders – soil throw, speed**
- **Crop safety, weed control, yield**

Project overview

- Rapid adoption of no-till, stubble retention
- Evolution of seeding systems
- Shift toward pre-emergent herbicides
- Knifepoint presswheel – on label
- Disc seeder issues
- Many questions, limited answers

Treatments - IBS

Triflur X	*1.5L*
Triflur X	*3L*
Boxer Gold	*2.5L*
Boxer Gold + Avadex Xtra	*2.5L + 1.6L*
Sakura	*118g*
Sakura + Avadex Xtra	*118g + 1.6L*
Triflur X + Avadex Xtra	*1.5L + 1.6L*
Triflur X + Avadex Xtra	*2L + 2L*
Triflur X + Logran	*1.5L + 35g*
Triflur X + Logran + Dual Gold	*1.5L + 35g + 500ml*
Triflur X + Logran + Diuron	*1.5L + 35g + 500g*

Collaborative research

- **GRDC funded**
- **Grassroots Agronomy**
- **Agritech NSW**
- **Growers**
- **Bayer, Nufarm, Syngenta**
- **FarmLink**

Wagga Wagga – Wedgetail 13th April

- Tyne
- Horwood Bagshaw Knuckey press wheels
- 375mm row spacing

- Disc
- Excel single disc
- 250mm row spacing

Lockhart – Lincoln 14th May

- Tyne
- Janke tynes & press wheels on flexi-coil bar
- 300mm row spacing

- Disc
- John Deere single disc
- 250mm row spacing

Wagga Wagga

- *50% stubble cover, locusts, early sown*
- *High ryegrass numbers, up to 190 plants/m² (fallowed in spring)*
- *Plant numbers higher in tyne 80 vs 50 plants/m²*
- *Weed control – no difference between disc and tyne, high pressure site weakest product 1.5L Triflur, residual with Sakura*
- *Crop safety – damage in disc*

Grenfell – Livingston 20th May

- Tyne
- Horwood Bagshaw Ryan press harrows
- 350mm row spacing

- Disc
- Daybreak disc
- 375mm row spacing

Lockhart

- *Dry site at sowing, patchy burn*
- *Wet in winter/spring after establishment*
- *Low weed pressure*
- *Plant numbers higher in tyne 120 vs 80 plants/m²*
- *Crop safety excellent, but 3L Triflur in disc*
- *Yield – no significant difference between disc or tyne 3.2t/ha versus 3.3t/ha*

Results

3 sites achieved different outcomes due to:

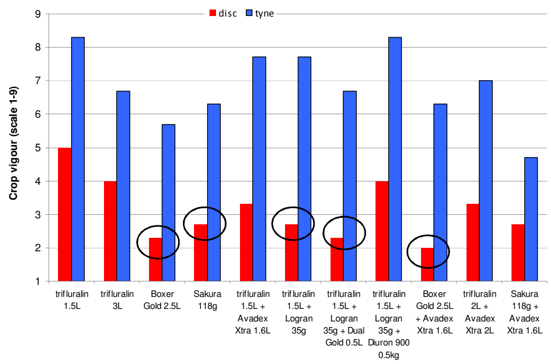
- **Weed density**
- **Soil moisture**
- **Stubble loads**

- **Tyne seeder produced consistently better establishment and early crop vigour yet…**

Grenfell

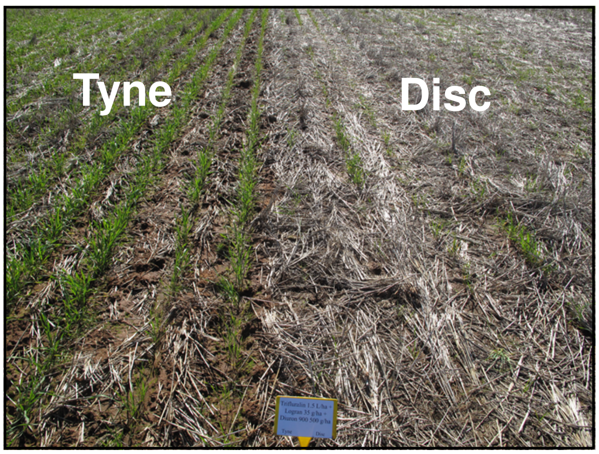
- *Sown into thick residue, wet soil*
- *Rainfall1015mm for year, 650mm Sep-Dec*
- *Moderate weed pressure (fallowed)*
- *Low plant numbers yet still higher in tyne 80 vs 30 plants/m²*
- *Disc area unable to recover during spring*
- *Weed control equal between disc & tyne*
- *Severe crop damage across all herbicides*
- *Low potential yield – combination of issues*

Grenfell Crop Safety - August



Disc technology evolving

- Zero-till allows higher sowing speeds, seed placement in marginal moisture, stubble retention
- Requires high level weed management
- IBS herbicide use not on label
- Variations in disc machines – soil throw
- Developments will continue – there is hope
- Part of an integrated system – agronomy first



Acknowledgements

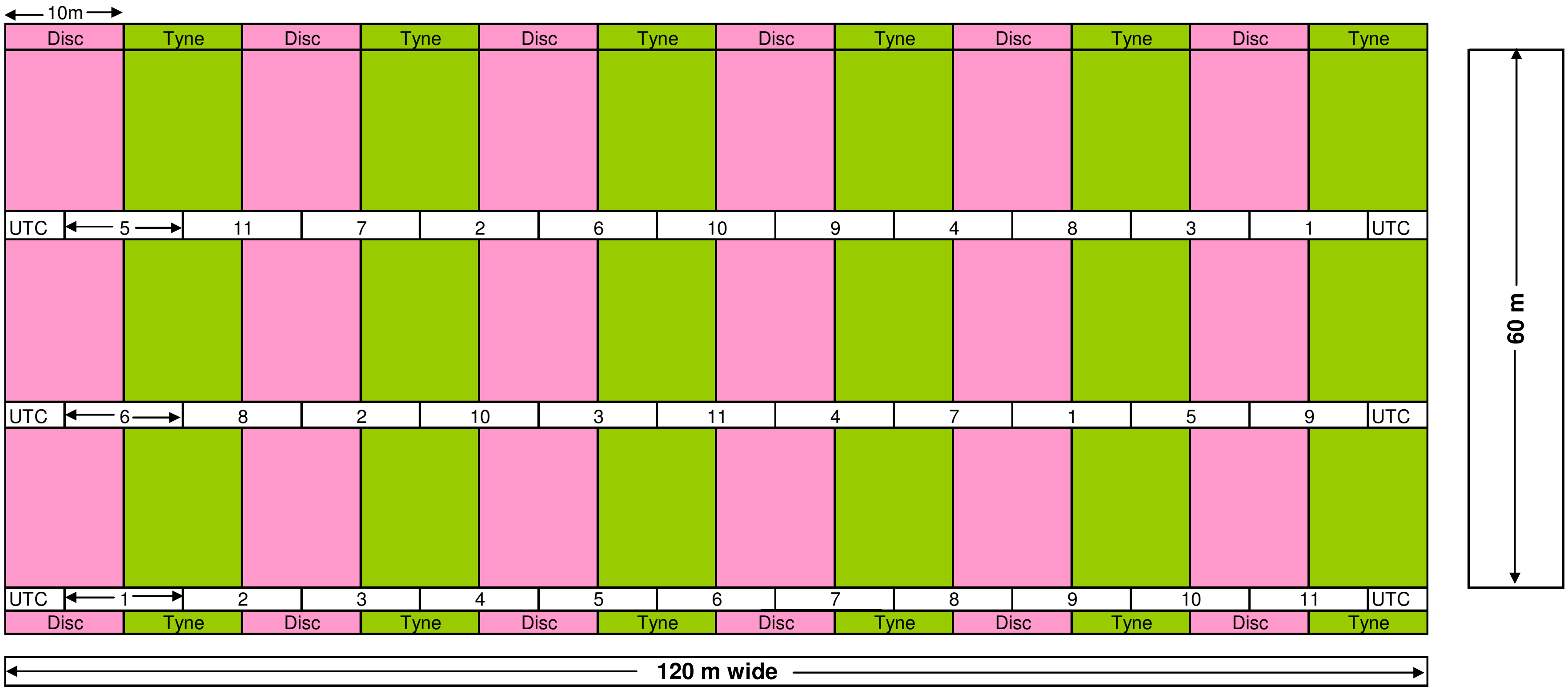
- Ben Beck, John & Brendan Pattison, Wagga Wagga
- Brent Alexander & Chug Kennedy, Lockhart
- Duncan Lander & Rob Johnson, Grenfell
- Tony Single, Nic Amos, Peter Hamblin, Agritech NSW

- Lachlan Caldwell, Lachlan Fertilisers Rural
- Heidi Gooden, Delta Agribusiness
- Bayer, Syngenta, Nufarm
- FarmLink Research

Summary

- No-till is a proven system of crop management
- Weed management using no-till seeding gear can be complex and risky yet…..
- Requires an understanding of key factors such as – soil throw, soil moisture, speed, row spacing
- Knife point press wheel systems now common practice – on label eg 3L Triflur
- Crop safety and weed control an issue with discs

TRIAL PLAN



No.	Treatment	Rate	Unit
1	Trifluralin	1.5	L/ha
2	Trifluralin	3	L/ha
3	Boxer Gold	2.5	L/ha
4	Sakura	118	g/ha
5	Trifluralin	1.5	L/ha
	Avadex Xtra	1.6	L/ha
6	Trifluralin	1.5	L/ha
	Logran	35	g/ha

No.	Treatment	Rate	Unit
7	Trifluralin	1.5	L/ha
	Logran	35	g/ha
	Dual Gold	0.5	L/ha
8	Trifluralin	1.5	L/ha
	Logran	35	g/ha
	Diuron 900	500	g/ha

No.	Treatment	Rate	Unit
9	Boxer Gold	2.5	L/ha
	Avadex Xtra	1.6	L/ha
10	Trifluralin	2	L/ha
	Avadex Xtra	2	L/ha
11	Sakura	118	g/ha
	Avadex Xtra	1.6	L/ha

Agritech Crop Research

Efficacy of various herbicides applied IBS with Disc and Tyne sowing.

Trial ID: W10-020 Protocol ID: W10-019
Location: Grenfell Study Director: Nic Amos
Investigator: Sue McGregor
Sponsor Contact: Greg Condon 0428 477 348

Crop Name										Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
Part Rated										Crop -	Crop -	Crop -	Crop -	Weed -	Weed -	Crop -	Crop -	Weed -	Weed -	Weed -	Weed -	Crop -
Rating Date										23/06/2010	1/07/2010	1/07/2010	1/07/2010	1/07/2010	1/07/2010	4/08/2010	4/08/2010	4/08/2010	4/08/2010	22/10/2010	22/10/2010	22/10/2010
Rating Type										Biomass	Biomass	Vigour	Counts	Counts	Counts	Biomass	Vigour	Control	Counts	Contol	Level	Estimated Y
Rating Unit										%	%	%	/1m row	/0.25m2	/1.0m2	%	1-9	%	per 0.25	%	1-5(5=wo	t/ha
Number of Subsamples										1	1	1	4	4	4	1	1	1	4	1	1	1
Crop Stage Majority										GS14-21	GS14,22	GS14,22	GS14,22	GS14,22	GS14,22	GS32	GS32			GS65	GS65	GS65
Pest Stage Majority																		GS13-G30	GS13-G30			
Assessed By										Nic	Rob	Rob	Rob	Rob	Rob	NA				NA		PH
ARM Action Codes															T1							
Trt		Treatment	Form	Form	Form		Rate	Appl	Comment													
No.	Type	Name	Conc	Unit	Type	Rate	Unit	Code	1	1	2	3	4	5	6	7	8	9	10	11	12	13
TABLE OF R MEANS																						
Replicate 1										47.0	57.5	63.6	18.2	2.5	9.9	51.8	5.1	77.0	3.6	-55.5	3.5	0.686
Replicate 2										59.8	58.0	63.9	18.8	2.1	8.4	50.0	4.6	72.5	2.7	-56.4	3.5	0.698
Replicate 3										57.7	60.9	71.6	21.6	2.8	11.4	49.1	5.3	75.2	3.4	-71.8	3.5	0.734
TABLE OF A MEANS																						
1	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		71.7	69.2	74.2	23.0	3.8	15.2	65.8	6.7	63.3	5.3	-51.7	2.5	0.700
2	HERB	Trifluralin	480	g/L	EC	3	L/ha	A		56.7	60.8	64.2	20.6	3.0	12.2	53.3	5.3	52.5	4.0	-75.0	3.3	0.742
3	HERB	Boxer Gold	920	g/L	EC	2.5	L/ha	A		50.0	56.7	60.0	17.7	0.6	2.3	44.2	4.0	83.3	1.3	-50.8	3.8	0.750
4	HERB	Sakura	850	g/kg	WG	118	g/ha	A		48.3	55.8	66.7	19.7	0.4	1.5	45.8	4.5	92.5	0.5	-15.0	3.3	0.858
5	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		61.7	59.2	69.2	20.5	1.8	7.2	56.7	5.5	78.3	3.1	-46.7	3.2	0.758
5	HERB	Avadex Xtra	500	g/L	EC	1.6	L/ha	A														
6	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		53.3	56.7	67.5	23.4	9.5	38.0	50.8	5.2	40.8	12.6	-116.7	3.7	0.525
6	HERB	Logran	750	g/kg	WG	35	g/ha	A														
7	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		51.7	55.0	65.8	18.8	3.1	12.5	46.7	4.5	78.3	2.8	-100.0	4.0	0.608
7	HERB	Logran	750	g/kg	WG	35	g/ha	A														
7	HERB	Dual Gold	960	g/L	EC	0.5	L/ha	B														
8	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		65.0	68.3	75.0	20.8	1.9	7.7	65.0	6.2	76.7	1.9	-65.0	3.5	0.892
8	HERB	Logran	750	g/kg	WG	35	g/ha	A														
8	HERB	Diuron 900	900	g/kg	WG	500	g/ha	A														
9	HERB	Boxer Gold	920	g/L	EC	2.5	L/ha	A		41.7	47.5	61.7	13.7	0.3	1.0	40.8	4.2	95.0	0.6	-34.2	3.7	0.792
9	HERB	Avadex Xtra	500	g/L	EC	1.6	L/ha	A														
10	HERB	Trifluralin	480	g/L	EC	2	L/ha	A		53.3	61.7	67.5	21.3	2.5	9.8	45.0	5.2	70.0	3.4	-108.3	3.5	0.650
10	HERB	Avadex Xtra	500	g/L	EC	2	L/ha	A														
11	HERB	Sakura	850	g/kg	WG	118	g/ha	A		50.0	55.8	58.3	15.2	0.3	1.3	39.2	3.7	93.3	0.3	-10.0	3.8	0.492
11	HERB	Avadex Xtra	500	g/L	EC	1.6	L/ha	A														
TABLE OF B MEANS																						
1	PROD	Disc							270 mm Row Spacing	38.2	33.9	50.3	11.0	1.4	5.5	23.6	3.1	73.0	2.7	-72.0	4.2	0.364
2	PROD	Tyne							375 mm Row Spacing	71.5	83.6	82.4	28.0	3.6	14.2	77.0	6.8	76.8	3.7	-50.5	2.8	1.048
TABLE OF AB MEANS																						
1	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		53.3	50.0	55.0	16.8	1.8	7.3	36.7	5.0	63.3	3.8	-56.7	3.0	0.483
1	PROD	Disc							270 mm Row Spacing													
2	HERB	Trifluralin	480	g/L	EC	3	L/ha	A		43.3	40.0	53.3	14.0	1.3	5.3	35.0	4.0	50.0	4.8	-83.3	3.7	0.400
1	PROD	Disc							270 mm Row Spacing													
3	HERB	Boxer Gold	920	g/L	EC	2.5	L/ha	A		26.7	25.0	41.7	9.5	0.3	1.0	13.3	2.3	88.3	0.3	-58.3	4.0	0.283
1	PROD	Disc							270 mm Row Spacing													
4	HERB	Sakura	850	g/kg	WG	118	g/ha	A		36.7	28.3	48.3	10.2	0.2	0.7	18.3	2.7	95.0	0.4	-20.0	4.3	0.433
1	PROD	Disc							270 mm Row Spacing													
5	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		43.3	36.7	55.0	12.3	0.8	3.0	35.0	3.3	83.3	1.3	-53.3	3.7	0.517
5	HERB	Avadex Xtra	500	g/L	EC	1.6	L/ha	A														
1	PROD	Disc							270 mm Row Spacing													
6	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		30.0	28.3	46.7	13.3	4.6	18.3	18.3	2.7	40.0	12.3	-133.3	3.7	0.267
6	HERB	Logran	750	g/kg	WG	35	g/ha	A														
1	PROD	Disc							270 mm Row Spacing													
7	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		36.7	26.7	53.3	9.9	2.3	9.3	16.7	2.3	75.0	1.9	-116.7	4.7	0.150
7	HERB	Logran	750	g/kg	WG	35	g/ha	A														

7 HERB	Dual Gold	960 g/L	EC	0.5 L/ha	B														
1 PROD	Disc					270 mm Row Spacing													
8 HERB	Trifluralin	480 g/L	EC	1.5 L/ha	A		53.3	48.3	56.7	13.8	2.0	8.0	40.0	4.0	60.0	2.0	-83.3	4.7	0.533
8 HERB	Logran	750 g/kg	WG	35 g/ha	A														
8 HERB	Diuron 900	900 g/kg	WG	500 g/ha	A														
1 PROD	Disc					270 mm Row Spacing													
9 HERB	Boxer Gold	920 g/L	EC	2.5 L/ha	A		20.0	13.3	43.3	3.3	0.2	0.7	8.3	2.0	98.3	0.1	-46.7	5.0	0.217
9 HERB	Avadex Xtra	500 g/L	EC	1.6 L/ha	A														
1 PROD	Disc					270 mm Row Spacing													
10 HERB	Trifluralin	480 g/L	EC	2 L/ha	A		40.0	41.7	53.3	10.0	1.6	6.3	20.0	3.3	55.0	3.1	-133.3	4.3	0.300
10 HERB	Avadex Xtra	500 g/L	EC	2 L/ha	A														
1 PROD	Disc					270 mm Row Spacing													
11 HERB	Sakura	850 g/kg	WG	118 g/ha	A		36.7	35.0	46.7	7.9	0.2	0.7	18.3	2.7	95.0	0.3	-6.7	4.7	0.417
11 HERB	Avadex Xtra	500 g/L	EC	1.6 L/ha	A														
1 PROD	Disc					270 mm Row Spacing													
1 HERB	Trifluralin	480 g/L	EC	1.5 L/ha	A		90.0	88.3	93.3	29.3	5.8	23.0	95.0	8.3	63.3	6.8	-46.7	2.0	0.917
2 PROD	Tyne					375 mm Row Spacing													
2 HERB	Trifluralin	480 g/L	EC	3 L/ha	A		70.0	81.7	75.0	27.2	4.8	19.0	71.7	6.7	55.0	3.3	-66.7	3.0	1.083
2 PROD	Tyne					375 mm Row Spacing													
3 HERB	Boxer Gold	920 g/L	EC	2.5 L/ha	A		73.3	88.3	78.3	25.8	0.9	3.7	75.0	5.7	78.3	2.3	-43.3	3.7	1.217
2 PROD	Tyne					375 mm Row Spacing													
4 HERB	Sakura	850 g/kg	WG	118 g/ha	A		60.0	83.3	85.0	29.2	0.6	2.3	73.3	6.3	90.0	0.5	-10.0	2.3	1.283
2 PROD	Tyne					375 mm Row Spacing													
5 HERB	Trifluralin	480 g/L	EC	1.5 L/ha	A		80.0	81.7	83.3	28.7	2.8	11.3	78.3	7.7	73.3	4.8	-40.0	2.7	1.000
5 HERB	Avadex Xtra	500 g/L	EC	1.6 L/ha	A														
2 PROD	Tyne					375 mm Row Spacing													
6 HERB	Trifluralin	480 g/L	EC	1.5 L/ha	A		76.7	85.0	88.3	33.5	14.4	57.7	83.3	7.7	41.7	13.0	-100.0	3.7	0.783
6 HERB	Logran	750 g/kg	WG	35 g/ha	A														
2 PROD	Tyne					375 mm Row Spacing													
7 HERB	Trifluralin	480 g/L	EC	1.5 L/ha	A		66.7	83.3	78.3	27.6	3.9	15.7	76.7	6.7	81.7	3.7	-83.3	3.3	1.067
7 HERB	Logran	750 g/kg	WG	35 g/ha	A														
7 HERB	Dual Gold	960 g/L	EC	0.5 L/ha	B														
2 PROD	Tyne					375 mm Row Spacing													
8 HERB	Trifluralin	480 g/L	EC	1.5 L/ha	A		76.7	88.3	93.3	27.8	1.8	7.3	90.0	8.3	93.3	1.8	-46.7	2.3	1.250
8 HERB	Logran	750 g/kg	WG	35 g/ha	A														
8 HERB	Diuron 900	900 g/kg	WG	500 g/ha	A														
2 PROD	Tyne					375 mm Row Spacing													
9 HERB	Boxer Gold	920 g/L	EC	2.5 L/ha	A		63.3	81.7	80.0	24.1	0.3	1.3	73.3	6.3	91.7	1.1	-21.7	2.3	1.367
9 HERB	Avadex Xtra	500 g/L	EC	1.6 L/ha	A														
2 PROD	Tyne					375 mm Row Spacing													
10 HERB	Trifluralin	480 g/L	EC	2 L/ha	A		66.7	81.7	81.7	32.6	3.3	13.3	70.0	7.0	85.0	3.8	-83.3	2.7	1.000
10 HERB	Avadex Xtra	500 g/L	EC	2 L/ha	A														
2 PROD	Tyne					375 mm Row Spacing													
11 HERB	Sakura	850 g/kg	WG	118 g/ha	A		63.3	76.7	70.0	22.5	0.5	2.0	60.0	4.7	91.7	0.3	-13.3	3.0	0.567
11 HERB	Avadex Xtra	500 g/L	EC	1.6 L/ha	A														
2 PROD	Tyne					375 mm Row Spacing													

Agritech Crop Research

Efficacy of various herbicides applied IBS with Disc and Tyne sowing.

Trial ID: W10-020 Protocol ID: W10-019
Location: Grenfell Study Director: Nic Amos
Investigator: Sue McGregor
Sponsor Contact: Greg Condon 0428 477 348

FACTORIAL/POOLED ERROR AOV For Wheat Crop 23/6/10 Biomass % 1 GS14-21 Nic (Data Column 1)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	33798.484848				
R	2	2055.303030	1027.651515	5.467	0.0078	8.4
A	10	4281.818182	428.181818	2.278	0.0309	16.0
B	1	18333.333333	18333.333333	97.534	0.0001	6.8
AB	10	1233.333333	123.333333	0.656	0.7573	22.6
ERROR	42	7894.696970	187.968975			

FACTORIAL/POOLED ERROR AOV For Wheat Crop 1/7/10 Biomass % 1 GS14,22 Rob (Data Column 2)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	49653.030303				
R	2	150.757576	75.378788	0.662	0.5211	6.5

A	10	2278.030303	227.803030	2.001	0.0578	12.5
B	1	40751.515152	40751.515152	357.875	0.0001	5.3
AB	10	1690.151515	169.015152	1.484	0.1793	17.6
ERROR	42	4782.575758	113.870851			

FACTORIAL/POOLED ERROR AOV For Wheat Crop 1/7/10 Vigour % 1 GS14,22 Rob (Data Column 3)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	27427.272727				
R	2	902.272727	451.136364	2.663	0.0815	7.9
A	10	1668.939394	166.893939	0.985	0.4707	15.2
B	1	17024.242424	17024.242424	100.503	0.0001	6.5
AB	10	717.424242	71.742424	0.424	0.9271	21.5
ERROR	42	7114.393939	169.390332			

FACTORIAL/POOLED ERROR AOV For Wheat Crop 1/7/10 Counts /1m row 4 GS14,22 Rob (Data Column 4)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	6491.061553				
R	2	146.030303	73.015152	3.634	0.0350	2.7
A	10	546.051136	54.605114	2.718	0.0114	5.2
B	1	4789.773674	4789.773674	238.421	0.0001	2.2
AB	10	165.445076	16.544508	0.824	0.6083	7.4
ERROR	42	843.761364	20.089556			

FACTORIAL/POOLED ERROR AOV For Wheat Weed 1/7/10 Counts /0.25m2 4 GS14,22 Rob (Data Column 5)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	1527.814394				
R	2	6.189394	3.094697	0.145	0.8658	2.8
A	10	420.793561	42.079356	1.965	0.0626	5.4
B	1	78.545455	78.545455	3.669	0.0623	2.3
AB	10	123.058712	12.305871	0.575	0.8250	7.6
ERROR	42	899.227273	21.410173			

FACTORIAL/POOLED ERROR AOV For Wheat Weed 1/7/10 Counts /1.0m2 4 GS14,22 Rob T1 (Data Column 6)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	24445.030303				
R	2	99.030303	49.515152	0.145	0.8658	11.3
A	10	6732.696970	673.269697	1.965	0.0626	21.6
B	1	1256.727273	1256.727273	3.669	0.0623	9.2
AB	10	1968.939394	196.893939	0.575	0.8250	30.5
ERROR	42	14387.636364	342.562771			

FACTORIAL/POOLED ERROR AOV For Wheat Crop 4/8/10 Biomass % 1 GS32 NA (Data Column 7)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	58643.939394				
R	2	84.848485	42.424242	0.337	0.7156	6.8
A	10	4918.939394	491.893939	3.911	0.0008	13.1
B	1	46933.333333	46933.333333	373.205	0.0001	5.6
AB	10	1425.000000	142.500000	1.133	0.3616	18.5
ERROR	42	5281.818182	125.757576			

FACTORIAL/POOLED ERROR AOV For Wheat Crop 4/8/10 Vigour 1-9 1 GS32 (Data Column 8)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	372.984848				
R	2	5.484848	2.742424	1.519	0.2308	0.8
A	10	51.151515	5.115152	2.832	0.0088	1.6
B	1	229.227273	229.227273	126.931	0.0001	0.7
AB	10	11.272727	1.127273	0.624	0.7846	2.2
ERROR	42	75.848485	1.805916			

FACTORIAL/POOLED ERROR AOV For Wheat Weed 4/8/10 Control % 1 GS13-G30 (Data Column 9)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	45074.621212				
R	2	230.303030	115.151515	0.206	0.8146	14.4
A	10	17828.787879	1782.878788	3.191	0.0040	27.6
B	1	236.742424	236.742424	0.424	0.5187	11.8
AB	10	3309.090909	330.909091	0.592	0.8110	39.0
ERROR	42	23469.696970	558.802309			

FACTORIAL/POOLED ERROR AOV For Wheat Weed 4/8/10 Counts per 0.25 4 GS13-G30 (Data Column 10)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)

Total	65	2329.746212				
R	2	9.575758	4.787879	0.131	0.8778	3.7
A	10	734.475379	73.447538	2.006	0.0571	7.1
B	1	16.500000	16.500000	0.451	0.5057	3.0
AB	10	31.604167	3.160417	0.086	0.9999	10.0
ERROR	42	1537.590909	36.609307			

FACTORIAL/POOLED ERROR AOV For Wheat Weed 22/10/10 Contol % 1 GS65 NA (Data Column 11)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	228253.030303				
R	2	3721.212121	1860.606061	0.576	0.5665	34.6
A	10	77428.030303	7742.803030	2.397	0.0236	66.3
B	1	7637.878788	7637.878788	2.364	0.1316	28.3
AB	10	3787.121212	378.712121	0.117	0.9995	93.8
ERROR	42	135678.787879	3230.447330			

FACTORIAL/POOLED ERROR AOV For Wheat Weed 22/10/10 Level 1-5(5=wo 1 GS65 (Data Column 12)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	150.484848				
R	2	0.030303	0.015152	0.006	0.9937	0.9
A	10	10.151515	1.015152	0.424	0.9270	1.8
B	1	29.333333	29.333333	12.242	0.0011	0.8
AB	10	10.333333	1.033333	0.431	0.9229	2.6
ERROR	42	100.636364	2.396104			

FACTORIAL/POOLED ERROR AOV For Wheat Crop 22/10/10 Estimated Y t/ha 1 GS65 PH (Data Column 13)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	LSD (.05)
Total	65	15.647577				
R	2	0.027348	0.013674	0.100	0.9050	0.225
A	10	0.974242	0.097424	0.713	0.7074	0.431
B	1	7.738789	7.738789	56.632	0.0001	0.184
AB	10	1.167879	0.116788	0.855	0.5808	0.610
ERROR	42	5.739318	0.136650			

Agritech Crop Research

Efficacy of various herbicides applied IBS with Disc and Tyne sowing.

Trial ID: W10-020 Protocol ID: W10-019
Location: Grenfell Study Director: Nic Amos
Investigator: Sue McGregor
Sponsor Contact: Greg Condon 0428 477 348

Crop Name										Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
Part Rated										Crop -	Crop -	Crop -	Crop -	Weed -	Weed -	Crop -	Crop -	Weed -	Weed -	Weed -	Weed -	Crop -
Rating Date										23/06/2010	1/07/2010	1/07/2010	1/07/2010	1/07/2010	1/07/2010	4/08/2010	4/08/2010	4/08/2010	4/08/2010	22/10/2010	22/10/2010	22/10/2010
Rating Type										Biomass	Biomass	Vigour	Counts	Counts	Counts	Biomass	Vigour	Control	Counts	Contol	Level	Estimated Y
Rating Unit										%	%	%	/1m row	/0.25m2	/1.0m2	%	1-9	%	per 0.25	%	1-5(5=wo	t/ha
Number of Subsamples										1	1	1	4	4	4	1	1	1	4	1	1	1
Crop Stage Majority										GS14-21	GS14,22	GS14,22	GS14,22	GS14,22	GS14,22	GS32	GS32			GS65	GS65	GS65
Pest Stage Majority																		GS13-G30	GS13-G30			
Assessed By										Nic	Rob	Rob	Rob	Rob	Rob	NA				NA		PH
ARM Action Codes															T1							
Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Comment 1	1	2	3	4	5	6	7	8	9	10	11	12	13
1	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		53.3 c-f	50.0 b	55.0 cde	16.8 de	1.8 a	7.3 a	36.7 ef	5.0 c-f	63.3 a-d	3.8 a	-56.7 a	3.0 a	0.483 b-e
	PROD	Disc							270 mm Row Spacing													
2	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		90.0 a	88.3 a	93.3 a	29.3 abc	5.8 a	23.0 a	95.0 a	8.3 a	63.3 a-d	6.8 a	-46.7 a	2.0 a	0.917 abc
	PROD	Tyne							375 mm Row Spacing													
3	HERB	Trifluralin	480	g/L	EC	3	L/ha	A		43.3 d-g	40.0 bc	53.3 de	14.0 ef	1.3 a	5.3 a	35.0 efg	4.0 e-h	50.0 cd	4.8 a	-83.3 a	3.7 a	0.400 cde
	PROD	Disc							270 mm Row Spacing													
4	HERB	Trifluralin	480	g/L	EC	3	L/ha	A		70.0 abc	81.7 a	75.0 abc	27.2 abc	4.8 a	19.0 a	71.7 bcd	6.7 a-d	55.0 bcd	3.3 a	-66.7 a	3.0 a	1.083 ab
	PROD	Tyne							375 mm Row Spacing													
5	HERB	Boxer Gold	920	g/L	EC	2.5	L/ha	A		26.7 gh	25.0 cd	41.7 e	9.5 efg	0.3 a	1.0 a	13.3 h	2.3 h	88.3 abc	0.3 a	-58.3 a	4.0 a	0.283 de
	PROD	Disc							270 mm Row Spacing													
6	HERB	Boxer Gold	920	g/L	EC	2.5	L/ha	A		73.3 abc	88.3 a	78.3 ab	25.8 bc	0.9 a	3.7 a	75.0 bcd	5.7 b-e	78.3 a-d	2.3 a	-43.3 a	3.7 a	1.217 a
	PROD	Tyne							375 mm Row Spacing													
7	HERB	Sakura	850	g/kg	WG	118	g/ha	A		36.7 fgh	28.3 cd	48.3 e	10.2 efg	0.2 a	0.7 a	18.3 fgh	2.7 gh	95.0 a	0.4 a	-20.0 a	4.3 a	0.433 cde
	PROD	Disc							270 mm Row Spacing													
8	HERB	Sakura	850	g/kg	WG	118	g/ha	A		60.0 b-e	83.3 a	85.0 ab	29.2 abc	0.6 a	2.3 a	73.3 bcd	6.3 a-d	90.0 ab	0.5 a	-10.0 a	2.3 a	1.283 a
	PROD	Tyne							375 mm Row Spacing													
9	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		43.3 d-g	36.7 bc	55.0 cde	12.3 ef	0.8 a	3.0 a	35.0 efg	3.3 fgh	83.3 abc	1.3 a	-53.3 a	3.7 a	0.517 b-e
	HERB	Avadex Xtra	500	g/L	EC	1.6	L/ha	A														
	PROD	Disc							270 mm Row Spacing													
10	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		80.0 ab	81.7 a	83.3 ab	28.7 abc	2.8 a	11.3 a	78.3 a-d	7.7 ab	73.3 a-d	4.8 a	-40.0 a	2.7 a	1.000 abc
	HERB	Avadex Xtra	500	g/L	EC	1.6	L/ha	A														
	PROD	Tyne							375 mm Row Spacing													
11	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		30.0 gh	28.3 cd	46.7 e	13.3 ef	4.6 a	18.3 a	18.3 fgh	2.7 gh	40.0 d	12.3 a	-133.3 a	3.7 a	0.267 de
	HERB	Logran	750	g/kg	WG	35	g/ha	A														
	PROD	Disc							270 mm Row Spacing													
12	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		76.7 ab	85.0 a	88.3 ab	33.5 a	14.4 a	57.7 a	83.3 abc	7.7 ab	41.7 d	13.0 a	-100.0 a	3.7 a	0.783 a-d
	HERB	Logran	750	g/kg	WG	35	g/ha	A														
	PROD	Tyne							375 mm Row Spacing													
13	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		36.7 fgh	26.7 cd	53.3 de	9.9 efg	2.3 a	9.3 a	16.7 gh	2.3 h	75.0 a-d	1.9 a	-116.7 a	4.7 a	0.150 e
	HERB	Logran	750	g/kg	WG	35	g/ha	A														
	HERB	Dual Gold	960	g/L	EC	0.5	L/ha	B														
	PROD	Disc							270 mm Row Spacing													
14	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		66.7 bc	83.3 a	78.3 ab	27.6 abc	3.9 a	15.7 a	76.7 a-d	6.7 a-d	81.7 abc	3.7 a	-83.3 a	3.3 a	1.067 ab
	HERB	Logran	750	g/kg	WG	35	g/ha	A														
	HERB	Dual Gold	960	g/L	EC	0.5	L/ha	B														
	PROD	Tyne							375 mm Row Spacing													
15	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		53.3 c-f	48.3 b	56.7 cde	13.8 ef	2.0 a	8.0 a	40.0 e	4.0 e-h	60.0 a-d	2.0 a	-83.3 a	4.7 a	0.533 b-e
	HERB	Logran	750	g/kg	WG	35	g/ha	A														
	HERB	Diuron 900	900	g/kg	WG	500	g/ha	A														
	PROD	Disc							270 mm Row Spacing													
16	HERB	Trifluralin	480	g/L	EC	1.5	L/ha	A		76.7 ab	88.3 a	93.3 a	27.8 abc	1.8 a	7.3 a	90.0 ab	8.3 a	93.3 ab	1.8 a	-46.7 a	2.3 a	1.250 a
	HERB	Logran	750	g/kg	WG	35	g/ha	A														
	HERB	Diuron 900	900	g/kg	WG	500	g/ha	A														
	PROD	Tyne							375 mm Row Spacing													
17	HERB	Boxer Gold	920	g/L	EC	2.5	L/ha	A		20.0 h	13.3 d	43.3 e	3.3 g	0.2 a	0.7 a	8.3 h	2.0 h	98.3 a	0.1 a	-46.7 a	5.0 a	0.217 de
	HERB	Avadex Xtra	500	g/L	EC	1.6	L/ha	A														
	PROD	Disc							270 mm Row Spacing													
18	HERB	Boxer Gold	920	g/L	EC	2.5	L/ha	A		63.3 bcd	81.7 a	80.0 ab	24.1 cd	0.3 a	1.3 a	73.3 bcd	6.3 a-d	91.7 ab	1.1 a	-21.7 a	2.3 a	1.367 a
	HERB	Avadex Xtra	500	g/L	EC	1.6	L/ha	A														
	PROD	Tyne							375 mm Row Spacing													
19	HERB	Trifluralin	480	g/L	EC	2	L/ha	A		40.0 e-h	41.7 bc	53.3 de	10.0 efg	1.6 a	6.3 a	20.0 fgh	3.3 fgh	55.0 bcd	3.1 a	-133.3 a	4.3 a	0.300 de
	HERB	Avadex Xtra	500	g/L	EC	2	L/ha	A														
	PROD	Disc							270 mm Row Spacing													
20	HERB	Trifluralin	480	g/L	EC	2	L/ha	A		66.7 bc	81.7 a	81.7 ab	32.6 ab	3.3 a	13.3 a	70.0 cd	7.0 abc	85.0 abc	3.8 a	-83.3 a	2.7 a	1.000 abc
	HERB	Avadex Xtra	500	g/L	EC	2	L/ha	A														
	PROD	Tyne							375 mm Row Spacing													
21	HERB	Sakura	850	g/kg	WG	118	g/ha	A		36.7 fgh	35.0 bc	46.7 e	7.9 fg	0.2 a	0.7 a	18.3 fgh	2.7 gh	95.0 a	0.3 a	-6.7 a	4.7 a	0.417 cde
	HERB	Avadex Xtra	500	g/L	EC	1.6	L/ha	A														
	PROD	Disc							270 mm Row Spacing													

22	HERB	Sakura	850 g/kg	WG	118 g/ha	A		63.3 bcd	76.7 a	70.0 bcd	22.5 cd	0.5 a	2.0 a	60.0 d	4.7 d-g	91.7 ab	0.3 a	-13.3 a	3.0 a	0.567 b-e
	HERB	Avadex Xtra	500 g/L	EC	1.6 L/ha	A														
	PROD	Tyne					375 mm Row Spacing													
LSD (P=.05)								22.62	17.61	21.48	7.40	7.64	30.54	18.50	2.22	39.01	9.98	93.79	2.55	0.6100
CV								25.0	18.15	19.61	22.98	187.36	187.36	22.29	26.96	31.55	186.61	0.0	44.42	52.36

Means followed by same letter do not significantly differ (P=.05, LSD)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Agritech Crop Research

Efficacy of various herbicides applied IBS with Disc and Tyne sowing.

Trial ID: W10-020 Protocol ID: W10-019
Location: Grenfell Study Director: Nic Amos
Investigator: Sue McGregor
Sponsor Contact: Greg Condon 0428 477 348

AOV For Wheat Crop 23/6/10 Biomass % 1 GS14-21 Nic (Data Column 1)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	33798.484848			
Replicate	2	2055.303030	1027.651515	5.467	0.0078
Treatment	21	23848.484848	1135.642136	6.042	0.0001
Error	42	7894.696970	187.968975		

AOV For Wheat Crop 1/7/10 Biomass % 1 GS14,22 Rob (Data Column 2)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	49653.030303			
Replicate	2	150.757576	75.378788	0.662	0.5211
Treatment	21	44719.696970	2129.509380	18.701	0.0001
Error	42	4782.575758	113.870851		

AOV For Wheat Crop 1/7/10 Vigour % 1 GS14,22 Rob (Data Column 3)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	27427.272727			
Replicate	2	902.272727	451.136364	2.663	0.0815
Treatment	21	19410.606061	924.314574	5.457	0.0001
Error	42	7114.393939	169.390332		

AOV For Wheat Crop 1/7/10 Counts /1m row 4 GS14,22 Rob (Data Column 4)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	6491.061553			
Replicate	2	146.030303	73.015152	3.634	0.0350
Treatment	21	5501.269886	261.965233	13.040	0.0001
Error	42	843.761364	20.089556		

AOV For Wheat Weed 1/7/10 Counts /0.25m2 4 GS14,22 Rob (Data Column 5)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	1527.814394			
Replicate	2	6.189394	3.094697	0.145	0.8658
Treatment	21	622.397727	29.637987	1.384	0.1816
Error	42	899.227273	21.410173		

AOV For Wheat Weed 1/7/10 Counts /1.0m2 4 GS14,22 Rob T1 (Data Column 6)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	24445.030303			
Replicate	2	99.030303	49.515152	0.145	0.8658
Treatment	21	9958.363636	474.207792	1.384	0.1816
Error	42	14387.636364	342.562771		

AOV For Wheat Crop 4/8/10 Biomass % 1 GS32 NA (Data Column 7)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	58643.939394			
Replicate	2	84.848485	42.424242	0.337	0.7156
Treatment	21	53277.272727	2537.012987	20.174	0.0001
Error	42	5281.818182	125.757576		

AOV For Wheat Crop 4/8/10 Vigour 1-9 1 GS32 (Data Column 8)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	372.984848			
Replicate	2	5.484848	2.742424	1.519	0.2308
Treatment	21	291.651515	13.888167	7.690	0.0001
Error	42	75.848485	1.805916		

AOV For Wheat Weed 4/8/10 Control % 1 GS13-G30 (Data Column 9)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	45074.621212			
Replicate	2	230.303030	115.151515	0.206	0.8146
Treatment	21	21374.621212	1017.839105	1.821	0.0487

Error	42	23469.696970	558.802309		

AOV For Wheat Weed 4/8/10 Counts per 0.25 4 GS13-G30 (Data Column 10)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	2329.746212			
Replicate	2	9.575758	4.787879	0.131	0.8778
Treatment	21	782.579545	37.265693	1.018	0.4646
Error	42	1537.590909	36.609307		

AOV For Wheat Weed 22/10/10 Contol % 1 GS65 NA (Data Column 11)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	228253.030303			
Replicate	2	3721.212121	1860.606061	0.576	0.5665
Treatment	21	88853.030303	4231.096681	1.310	0.2236
Error	42	135678.787879	3230.447330		

AOV For Wheat Weed 22/10/10 Level 1-5(5=wo 1 GS65 (Data Column 12)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	150.484848			
Replicate	2	0.030303	0.015152	0.006	0.9937
Treatment	21	49.818182	2.372294	0.990	0.4936
Error	42	100.636364	2.396104		

AOV For Wheat Crop 22/10/10 Estimated Y t/ha 1 GS65 PH (Data Column 13)

Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	65	15.647567			
Replicate	2	0.027340	0.013670	0.100	0.9050
Treatment	21	9.880900	0.470519	3.443	0.0003
Error	42	5.739327	0.136651		

RESULTS LOCKHART

Table 1: Wheat Plant Counts (plants/m^2) 28 DAA, Visual Crop Vigour (1-9) 47 and 68 DAA and Wheat Yield (t/ha) 215 DAA - Analysis of Variance

Part Rated					Wheat			
Rating Data Type					Counts	Visual Crop Vigour		Yield
Rating Unit					plants/m^2	1-9		t/ha
Rating Date					11/06/10	30/06/10	21/07/10	15/12/10
Crop Stage					GS 12	GS 23	GS 25	GS 99
No.	Disc/Tyne	Herbicide	Rate	Unit	28 DAA	47 DAA	68 DAA	215 DAA
1	Disc	Trifluralin	1.5	L/ha	96 d-g	6.7 ab	6.7 abc	3.52 ab
2	Tyne	Trifluralin	1.5	L/ha	126 abc	6.7 ab	7.3 a	3.38 a-g
3	Disc	Trifluralin	3	L/ha	60 h	4.7 e	5.0 d	3.06 efg
4	Tyne	Trifluralin	3	L/ha	121 abc	7.0 a	6.7 abc	3.52 ab
5	Disc	Boxer Gold	2.5	L/ha	88 d-g	6.0 bc	6.3 abc	3.42 a-e
6	Tyne	Boxer Gold	2.5	L/ha	112 bcd	7.0 a	6.7 abc	3.04 fg
7	Disc	Sakura	118	g/ha	89 d-g	6.7 ab	7.3 a	3.55 ab
8	Tyne	Sakura	118	g/ha	142 a	7.0 a	7.0 ab	3.53 ab
9	Disc	Trifluralin Avadex Xtra	1.5 1.6	L/ha L/ha	84 fg	6.0 bc	6.3 abc	3.02 g
10	Tyne	Trifluralin Avadex Xtra	1.5 1.6	L/ha L/ha	129 ab	7.0 a	7.3 a	3.72 a
11	Disc	Trifluralin Logran	1.5 35	L/ha g/ha	82 fgh	6.0 bc	6.3 abc	3.46 a-d
12	Tyne	Trifluralin Logran	1.5 35	L/ha g/ha	131 ab	7.0 a	7.3 a	3.41 a-f
13	Disc	Trifluralin Logran Dual Gold	1.5 35 0.5	L/ha g/ha L/ha	80 fgh	5.0 de	5.7 cd	3.23 b-g
14	Tyne	Trifluralin Logran Dual Gold	1.5 35 0.5	L/ha g/ha L/ha	112 b-e	6.7 ab	7.0 ab	3.26 b-g
15	Disc	Trifluralin Logran Diuron 900	1.5 35 500	L/ha g/ha g/ha	89 d-g	6.3 abc	6.7 abc	3.45 a-d
16	Tyne	Trifluralin Logran Diuron 900	1.5 35 500	L/ha g/ha g/ha	102 c-f	7.0 a	6.7 abc	3.09 d-g
17	Disc	Boxer Gold Avadex Xtra	2.5 1.6	L/ha L/ha	76 gh	5.7 cd	6.0 bcd	3.49 abc
18	Tyne	Boxer Gold Avadex Xtra	2.5 1.6	L/ha L/ha	124 abc	7.0 a	7.0 ab	3.44 a-e
19	Disc	Trifluralin Avadex Xtra	2 2	L/ha L/ha	84 fgh	6.0 bc	6.0 bcd	3.12 c-g
20	Tyne	Trifluralin Avadex Xtra	2 2	L/ha L/ha	127 ab	7.0 a	7.0 ab	3.72 a
21	Disc	Sakura Avadex Xtra	118 1.6	g/ha L/ha	87 efg	6.0 bc	6.7 abc	3.46 a-d
22	Tyne	Sakura Avadex Xtra	118 1.6	g/ha L/ha	127 ab	7.0 a	7.3 a	3.43 a-e
Prob (F)					**0.0001**	**0.0004**	**0.0131**	**0.0171**
LSD (P=0.05)					**24.4**	**0.93**	**1.08**	**0.38**
CV					**13.98**	**8.57**	**9.62**	**6.65**
Bartlett's X2					20.246	6.493	6.064	24.301
P(Bartlett's X2)					0.506	0.69	0.998	0.279
Replicate F					3.863	2.45	7.815	0.838
Replicate Prob(F)					0.0365	0.1095	0.0027	0.446
Treatment F					7.419	4.629	2.675	2.55

Means followed by same letter do not significantly differ (P=0.05, LSD)

RESULTS (Cont.) LOCKHART

Table 2: Wheat Plant Counts (plants/m^2) 28 DAA, Wheat Visual Crop Vigour (1-9) 47 and 68 DAA and Wheat Yield (t/ha) 215 DAA - Factorial Analysis of Variance

Part Rated				Wheat			
Rating Data Type				Counts	Visual Crop Vigour		Yield
Rating Unit				plants/m^2	1-9		t/ha
Rating Date				11/06/10	30/06/10	21/07/10	15/12/10
Crop Stage				GS 12	GS 23	GS 25	GS 99
No.	**Herbicide**	**Rate**	**Unit**	**28 DAA**	**47 DAA**	**68 DAA**	**215 DAA**
TABLE OF REPLICATE MEANS							
Replicate 1				110	6.5	6.4	3.30
Replicate 2				99	6.2	6.5	3.40
Replicate 3				100	6.6	7.1	3.40
Prob F				**0.0156**	**0.1063**	**0.0015**	**0.4891**
LSD (P=0.05)				**8.0**	**NSD**	**0.4**	**NSD**
TABLE OF HERBICIDE MEANS (A)							
1	Trifluralin	1.5	L/ha	111	6.7	7.0	3.45
2	Trifluralin	3	L/ha	90	5.8	5.8	3.29
3	Boxer Gold	2.5	L/ha	100	6.5	6.5	3.23
4	Sakura	118	g/ha	116	6.8	7.2	3.54
5	Trifluralin Avadex Xtra	1.5 1.6	L/ha L/ha	107	6.5	6.8	3.37
6	Trifluralin Logran	1.5 35	L/ha g/ha	107	6.5	6.8	3.44
7	Trifluralin Logran Dual Gold	1.5 35 0.5	L/ha g/ha L/ha	96	5.8	6.3	3.24
8	Trifluralin Logran Diuron 900	1.5 35 500	L/ha g/ha g/ha	96	6.7	6.7	3.27
9	Boxer Gold Avadex Xtra	2.5 1.6	L/ha L/ha	100	6.3	6.5	3.46
10	Trifluralin Avadex Xtra	2 2	L/ha L/ha	105	6.5	6.5	3.42
11	Sakura Avadex Xtra	118 1.6	g/ha L/ha	107	6.5	7.0	3.45
Prob F				**0.0722**	**0.0647**	**0.0548**	**0.3706**
LSD (P=0.05)				**NSD**	**NSD**	**NSD**	**NSD**
LSD (P=0.10)				**13**	**0.5**	**0.6**	**NSD**
TABLE OF TREATMENT MEANS (B)							
1	Disc	250 mm Row Spacing		83	5.9	6.3	3.34
2	Tyne	300 mm Row Spacing		123	6.9	7.0	3.41
Prob F				**0.0001**	**0.0001**	**0.0001**	**0.2655**
LSD (P=0.05)				**7.0**	**0.3**	**0.3**	**NSD**

RESULTS – WAGGA WAGGA (DOWNSIDE)

Table 1: Wheat Plant Counts (plants/m^2) 43 DAA and Visual Crop Vigour (1-9) 43, 87 and 176 DAA - Analysis of Variance

Part Rated					Wheat							
Rating Data Type					Counts		Visual Crop Vigour					
Rating Unit					plants/m^2		1-9					
Rating Date					26/05/10		26/05/10		9/07/10		6/10/10	
Crop Stage					GS 14,21		GS 14,21		GS 24-25		GS 61	
No.	**Disc/Tyne**	**Herbicide**	**Rate**	**Unit**	**43 DAA**		**43 DAA**		**87 DAA**		**176 DAA**	
1	Disc	Trifluralin	1.5	L/ha	54	efg	1.7	de	6.7	cd	4.7	g
2	Tyne	Trifluralin	1.5	L/ha	73	bcd	3.3	ab	8.7	ab	5.7	d-g
3	Disc	Trifluralin	3	L/ha	47	fg	3.7	a	3.7	fgh	5.0	fg
4	Tyne	Trifluralin	3	L/ha	84	abc	3.3	ab	8.3	ab	6.7	bcd
5	Disc	Boxer Gold	2.5	L/ha	54	efg	2.7	a-d	4.3	efg	6.0	c-f
6	Tyne	Boxer Gold	2.5	L/ha	98	a	3.0	abc	8.0	abc	7.0	abc
7	Disc	Sakura	118	g/ha	61	def	3.7	a	5.3	de	7.0	abc
8	Tyne	Sakura	118	g/ha	75	bcd	3.3	ab	8.0	abc	8.0	a
9	Disc	Trifluralin Avadex Xtra	1.5 1.6	L/ha L/ha	62	def	1.3	e	7.3	bc	6.7	bcd
10	Tyne	Trifluralin Avadex Xtra	1.5 1.6	L/ha L/ha	84	abc	1.7	de	9.0	a	7.3	ab
11	Disc	Trifluralin Logran	1.5 35	L/ha g/ha	62	def	2.7	a-d	6.7	cd	6.3	b-e
12	Tyne	Trifluralin Logran	1.5 35	L/ha g/ha	79	bc	3.0	abc	8.7	ab	6.7	bcd
13	Disc	Trifluralin Logran Dual Gold	1.5 35 0.5	L/ha g/ha L/ha	45	g	1.3	e	5.0	ef	6.3	b-e
14	Tyne	Trifluralin Logran Dual Gold	1.5 35 0.5	L/ha g/ha L/ha	70	cd	1.7	de	7.3	bc	7.3	ab
15	Disc	Trifluralin Logran Diuron 900	1.5 35 500	L/ha g/ha g/ha	62	de	2.3	b-e	5.0	ef	6.0	c-f
16	Tyne	Trifluralin Logran Diuron 900	1.5 35 500	L/ha g/ha g/ha	85	ab	2.0	cde	9.0	a	7.2	abc
17	Disc	Boxer Gold Avadex Xtra	2.5 1.6	L/ha L/ha	43	g	1.7	de	2.7	h	6.0	c-f
18	Tyne	Boxer Gold Avadex Xtra	2.5 1.6	L/ha L/ha	77	bc	2.7	a-d	7.7	abc	7.3	ab
19	Disc	Trifluralin Avadex Xtra	2 2	L/ha L/ha	48	efg	3.3	ab	4.7	efg	5.0	fg
20	Tyne	Trifluralin Avadex Xtra	2 2	L/ha L/ha	80	bc	2.3	b-e	8.7	ab	6.7	bcd
21	Disc	Sakura Avadex Xtra	118 1.6	g/ha L/ha	48	efg	2.3	b-e	3.3	gh	5.3	efg
22	Tyne	Sakura Avadex Xtra	118 1.6	g/ha L/ha	81	bc	2.0	cde	8.7	ab	6.7	bcd
Prob (F)					**0.0001**		**0.0046**		**0.0001**		**0.0005**	
LSD (P=0.05)					**14.6**		**1.25**		**1.44**		**1.22**	
CV					**12.86**		**29.54**		**12.79**		**11.21**	
Bartlett's X2					17.27		9.582		12.658		6.108	
P(Bartlett's X2)					0.695		0.984		0.759		0.996	
Replicate F					12.754		0.333		3.146		4.794	
Replicate Prob(F)					0.0002		0.7201		0.0629		0.0187	
Treatment F					10.088		3.187		17.286		4.416	

Means followed by same letter do not significantly differ (P=0.05, LSD)

RESULTS (Cont.) Wagga Wagga (Downside)

Table 2: Annual Ryegrass Visual Control (%) 43, 87 and 176 DAA, Ryegrass Counts (plants/m^2) 43 and 87 DAA and Ryegrass Panicle Counts (panicles/m^2) – Analysis of Variance.

Part Rated					Annual Ryegrass					
Rating Data Type					Visual Control			Counts		Panicle Counts
Rating Unit					%			Plants/m^2		Panicles/m^2
Rating Date					26/05/10	9/07/10	6/10/10	26/05/10	9/07/10	6/10/10
Crop Stage					GS 14,21	GS 24-25	GS 61	GS 14,21	GS 24-25	GS 61
No	Disc/ Tyne	Herbicide	Rate	Unit	43 DAA	87 DAA	176 DAA	43 DAA	87 DAA	176 DAA
1	Disc	Trifluralin	1.5	L/ha	74	50 i	25 jk	103 a	191 a	424 a
2	Tyne	Trifluralin	1.5	L/ha	71	67 h	27 jk	124 a	147 ab	369 ab
3	Disc	Trifluralin	3	L/ha	47	77 fg	28 j	29 de	90 b-e	397 a
4	Tyne	Trifluralin	3	L/ha	54	83 b-f	38 gh	52 bcd	99 bcd	309 bcd
5	Disc	Boxer Gold	2.5	L/ha	68	75 g	43 d-g	23 e	47 d-g	282 cde
6	Tyne	Boxer Gold	2.5	L/ha	60	83 b-f	42 efg	31 cde	47 d-g	233 d-g
7	Disc	Sakura	118	g/ha	58	88 abc	80 b	15 e	33 fg	93 hij
8	Tyne	Sakura	118	g/ha	61	92 a	78 b	52 bcd	39 efg	104 hij
9	Disc	Trifluralin Avadex Xtra	1.5 1.6	L/ha L/ha	77	60 h	28 j	74 b	107 bc	417 a
10	Tyne	Trifluralin Avadex Xtra	1.5 1.6	L/ha L/ha	52	75 g	35 hi	63 b	71 c-g	348 abc
11	Disc	Trifluralin Logran	1.5 35	L/ha g/ha	65	80 d-g	45 c-f	49 bcd	95 b-e	168 fgh
12	Tyne	Trifluralin Logran	1.5 35	L/ha g/ha	77	85 a-e	47 cde	50 bcd	97 bcd	247 def
13	Disc	Trifluralin Logran Dual Gold	1.5 35 0.5	L/ha g/ha L/ha	68	77 fg	42 efg	51 bcd	94 b-e	213 efg
14	Tyne	Trifluralin Logran Dual Gold	1.5 35 0.5	L/ha g/ha L/ha	35	78 efg	47 cde	55 bc	85 c-f	215 efg
15	Disc	Trifluralin Logran Diuron 900	1.5 35 500	L/ha g/ha g/ha	59	80 d-g	43 d-g	52 bcd	97 bcd	191 fg
16	Tyne	Trifluralin Logran Diuron 900	1.5 35 500	L/ha g/ha g/ha	52	87 a-d	50 c	61 b	92 b-e	158 ghi
17	Disc	Boxer Gold Avadex Xtra	2.5 1.6	L/ha L/ha	64	80 d-g	48 cd	17 e	45 d-g	237 d-g
18	Tyne	Boxer Gold Avadex Xtra	2.5 1.6	L/ha L/ha	49	82 c-g	40 fgh	52 bcd	45 d-g	343 abc
19	Disc	Trifluralin Avadex Xtra	2 2	L/ha L/ha	62	67 h	22 k	65 b	94 b-e	385 ab
20	Tyne	Trifluralin Avadex Xtra	2 2	L/ha L/ha	68	82 c-g	30 ij	56 bc	96 bcd	372 ab
21	Disc	Sakura Avadex Xtra	118 1.6	g/ha L/ha	66	90 ab	88 a	13 e	19 g	57 j
22	Tyne	Sakura Avadex Xtra	118 1.6	g/ha L/ha	86	90 ab	88 a	20 e	15 g	79 ij
Prob (F)					**0.4752**	**0.0001**	**0.0001**	**0.0001**	**0.0004**	**0.0001**
LSD (P=0.05)					**NSD**	**8.1**	**6.2**	**25.8**	**56.9**	**85.4**
CV					**31.53**	**6.12**	**7.89**	**30.28**	**42.3**	**19.68**
Bartlett's X2					12.737	15.46	18.583	47.7	36.402	16.11
P(Bartlett's X2)					0.918	0.799	0.612	0.001*	0.02*	0.763
Replicate F					1.592	25.59	113.4	37.631	18.707	28.229
Replicate Prob(F)					0.2261	0.0001	0.0001	0.0001	0.0001	0.0001
Treatment F					1.026	13.496	90.118	9.631	4.579	15.862

Means followed by same letter do not significantly differ (P=0.05, LSD)

RESULTS (Cont.) Wagga Wagga (Downside)

Table 3: Wheat Plant Counts (plants/m^2) 43 DAA and Visual Crop Vigour (1-9) 43, 87 and 176 DAA - Factorial Analysis of Variance

Part Rated				Wheat			
Rating Data Type				Counts	Visual Crop Vigour		
Rating Unit				Plants/m^2	1-9		
Rating Date				26/05/10	26/05/10	9/07/10	6/10/10
Crop Stage				GS 14,21	GS 14,21	GS 24-25	GS 61
No.	**Treatment**	**Rate**	**Unit**	**43 DAA**	**43 DAA**	**87 DAA**	**176 DAA**
TABLE OF REPLICATE MEANS							
Replicate 1				60	2.4	6.3	6.7
Replicate 2				67	2.6	6.7	6.5
Replicate 3				73	2.5	7.0	6.0
Prob F				**0.0001**	**0.8524**	**0.0512**	**0.0837**
LSD (P=0.05)				**6**	**NSD**	**NSD**	**NSD**
TABLE OF HERBICIDE MEANS (A)							
1	Trifluralin	1.5	L/ha	64	2.5	7.7	5.2
2	Trifluralin	3	L/ha	66	3.5	6.0	5.8
3	Boxer Gold	2.5	L/ha	76	2.8	6.2	6.5
4	Sakura	118	g/ha	68	3.5	6.7	7.5
5	Trifluralin Avadex Xtra	1.5 1.6	L/ha L/ha	73	1.5	8.2	7.0
6	Trifluralin Logran	1.5 35	L/ha g/ha	70	2.8	7.7	6.5
7	Trifluralin Logran Dual Gold	1.5 35 0.5	L/ha g/ha L/ha	57	1.5	6.2	6.8
8	Trifluralin Logran Diuron 900	1.5 35 500	L/ha g/ha g/ha	74	2.2	7.0	6.6
9	Boxer Gold Avadex Xtra	2.5 1.6	L/ha L/ha	60	2.2	5.2	6.7
10	Trifluralin Avadex Xtra	2 2	L/ha L/ha	64	2.8	6.7	5.8
11	Sakura Avadex Xtra	118 1.6	g/ha L/ha	64	2.2	6.0	6.0
Prob F				**0.0255**	**0.02**	**0.0001**	**0.0121**
LSD (P=0.05)				**11**	**1.2**	**1.0**	**1.1**
TABLE OF Disc v Tyne MEANS (B)							
1	Disc	270 mm Row Spacing		53	2.4	5	5.8
2	Tyne	375 mm Row Spacing		81	2.6	8.4	7
Prob F				**0.0001**	**0.5664**	**0.0001**	**0.0001**
LSD (P=0.05)				**5**	**NSD**	**0.4**	**0.5**

RESULTS (Cont.) Wagga Wagga (Downside)

Table 4: Annual Ryegrass Visual Control (%) 43, 87 and 176 DAA, Ryegrass Counts (plants/m^2) 43 and 87 DAA and Annual Ryegrass Panicle Counts (panicles/m^2) 176 DAA - Factorial Analysis of Variance

Part Rated				Annual Ryegrass					
Rating Data Type				Visual Control			Counts		Panicle Counts
Rating Unit				%			plants/m^2		panicles/m^2
Rating Date				26/05/10	9/07/10	6/10/10	26/05/10	9/07/10	6/10/10
Crop Stage				GS 14,21	GS 24-25	GS 61	GS 14,21	GS 24-25	GS 61
No.	Treatment	Rate	Unit	43 DAA	87 DAA	176 DAA	43 DAA	87 DAA	176 DAA
TABLE OF REPLICATE MEANS									
Replicate 1				64	84	54	29	45	190
Replicate 2				67	74	48	68	88	289
Replicate 3				57	78	37	54	105	289
Prob F				**0.3646**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**
LSD (P=0.05)				**NSD**	**3**	**5**	**15**	**24**	**40**
TABLE OF HERBICIDE MEANS (A)									
1	Trifluralin	1.5	L/ha	72	58	26	114	169	396
2	Trifluralin	3	L/ha	51	80	33	40	95	353
3	Boxer Gold	2.5	L/ha	64	79	43	27	47	258
4	Sakura	118	g/ha	59	90	79	33	36	99
5	Trifluralin Avadex Xtra	1.5 1.6	L/ha L/ha	64	68	32	69	89	382
6	Trifluralin Logran	1.5 35	L/ha g/ha	71	83	46	50	96	207
7	Trifluralin Logran Dual Gold	1.5 35 0.5	L/ha g/ha L/ha	51	78	44	53	89	214
8	Trifluralin Logran Diuron 900	1.5 35 500	L/ha g/ha g/ha	56	83	47	56	95	174
9	Boxer Gold Avadex Xtra	2.5 1.6	L/ha L/ha	57	81	44	34	45	290
10	Trifluralin Avadex Xtra	2 2	L/ha L/ha	65	74	26	60	95	378
11	Sakura Avadex Xtra	118 1.6	g/ha L/ha	76	90	88	17	17	68
Prob F				**0.7034**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**
LSD (P=0.05)				**NSD**	**7**	**9**	**29**	**45**	**78**
TABLE OF DISC v TYNE MEANS (B)									
1	Disc	270 mm Row Spacing		64	75	45	45	83	260
2	Tyne	375 mm Row Spacing		60	82	47	56	76	252
Prob F				**0.5258**	**0.0001**	**0.2025**	**0.0655**	**0.4496**	**0.6221**
LSD (P=0.05)				**NSD**	**3**	**NSD**	**NSD**	**NSD**	**NSD**