Mixed Farming Systems:

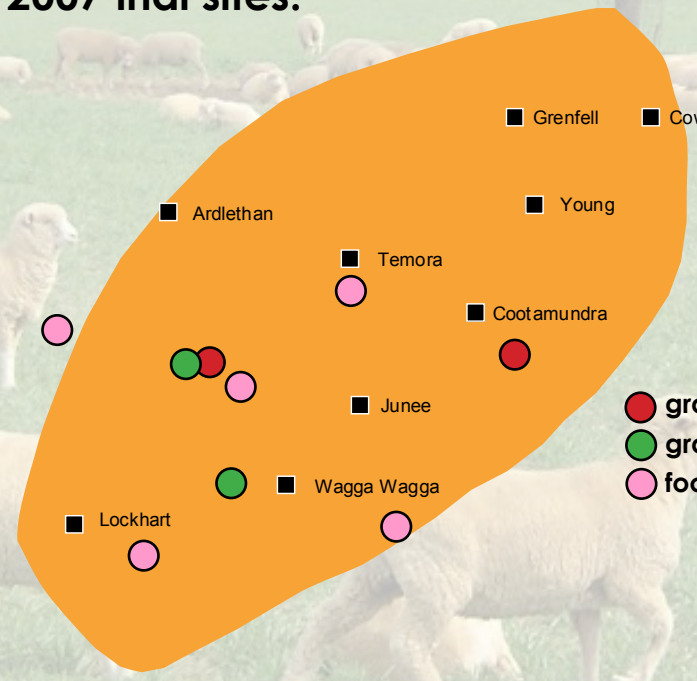
Grazing Cereals & Biodiversity

through the

Grain & Graze™ Profit through knowledge MURRUMBIDGEE

project

2007 trial sites:



- grazing cereal row spacings
- grazing management of wheats
- focus farms (biodiversity monitoring)

Project Partners:

FarmLink Research; Murrumbidgee Catchment Management Authority; NSW Department of Primary Industries; CSIRO; Charles Sturt University

Funded by:

mla; australian wool innovation limited; GRDC Grains Research & Development Corporation; Australian Government Land & Water Australia

filling the feed gap

2007 was the final research year of the Murrumbidgee Grain & Graze project* which focused on profitable options to fill the feed gaps in mixed farming systems. Results over the past 4 years have shown the significant early dry matter potential of grazing wheats, helping to fill the late autumn/early winter feed gap before pastures become productive. Several short term pasture species have also shown the ability to fill a 'feed quality' gap in the late spring/early summer period, although results were limited by poor seasons.

The positive response to grazing wheat trials early in the project led to a focus on grazing management. 'Crash grazing' of the earlier trials indicated that grazing wheats can tolerate more intensive grazing than traditionally recommended. A grazing management trial established at Wallendbeen in 2005 showed no yield penalty from higher stocking rates (32 lambs/ha compared with 17/ha), as long as stock were removed when the first node appeared. A similar trial was established for cattle in 2007 but unfortunately drought limited results.

Commencement of grazing was investigated in the 2007 grazing wheat trial. Although drought again prevented yield measurements, dry matter results at the end of the season showed no penalty from commencing grazing at 300kg DM/ha compared with 1200kg DM/ha. Ensuring the plants are well anchored before grazing is the critical factor.

In addition to grazing management, Grain & Graze trials also focused on animal performance on grazing wheats, complementing existing work by Hugh Dove (CSIRO) through a separate GRDC project. Results of both projects demonstrated marked increases in liveweight gain of young sheep on grazing wheats when they were supplemented with either sodium (as salt) or magnesium (as Causmag) - see page 16.

**The Murrumbidgee Grain & Graze project is a collaborative project between FarmLink, Murrumbidgee Catchment Management Authority, NSW Department of Primary Industries, CSIRO and Charles Sturt University.*

Grazing wheat preference trial, Marrar 2004

Grazing wheat management trial, Wallendbeen 2005

Short-term pasture trial, Henty 2006

Cattle liveweight trial, Ganmain 2007

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1. Effect of grazing commencement time and duration (by sheep) on grazing wheat

Project collaborators:
Peter Martin[1], Vince Van der Rijt[1]
Jim Virgona[2], FarmLink
([1]NSW DPI, [2]CSU)

Although drought affected the sheep grazing management trial in 2007, dry matter measurements showed that putting stock on early (~300kg DM/ha) did not affect the crop's ability to recover dry matter by the end of the season. Although late removal of stock (mid August) also had little impact on dry matter recovery, previous research has shown yields can be significantly reduced if crops are grazed past 1st node stage. The greatest impact on dry matter recovery resulted from grazing duration, with the shortest grazing period resulting in more dry matter at the end of the season. Unfortunately the trial could not be harvested to determine the impact these responses had on grain yields or gross margins.

Aim: To determine the effect of (sheep) grazing commencement time and duration on crop recovery.

Method: The trial was established in a commercial paddock of Wylah wheat at Collingullie, sown on the 5th May 2007 (Table 1a). Grazing by weaner lambs (ave. 42kg) commenced over two starting dates, 'early' & 'late', with a number of 'lock-up' times:

- 'Early' start: 25th June (~300kg DM/ha)
  - ► lock-up 1: 19th July
- 'Late' start: 20th July (~1200kg DM/ha)
  - ► lock-up 1: 31st July
  - ► lock-up 2: 8th August
  - ► lock-up 3: 16th August

Unfortunately the trial was drought affected and could not be harvested, but dry matter measurements still provided useful results.

Results:
'Early' grazing commenced on the 25th June at 300kg DM/ha. After 24 days, stock had grazed out the plots (down to 50kg DM/ha),

Table 1a - Sheep trial, Collingullie, 2007

Site Details	Collingullie
Co-operator	Malcolm & Des Kohlhagen
Sowing date	5th May
Variety	Wylah @ 54kg/ha
Stock type	weaner lambs (ave. 42kg)
Stocking rate	'early': ave. 18/ha 'late': ave. 28/ha
Grazing commenced	'early': 25th June 'late': 20th July
Grazing lock-up	final lock-up: 16th August *(see Method for details)*
Rainfall in-crop	187mm

Table 1b - Dry matter, Collingullie 2007

Lock-up date	Grazing days	Dry Matter at lock-up (kg/ha)	Dry Matter when hayed off - 23rd Oct (kg/ha)
'Early' grazing start: 25th June (298kg DM/ha)			
1: 19th July	24 days	53kg	3289kg^{c}
(9th - 16th Aug)*	7 days	180kg	3003kg^{cd}
'Late' grazing start: 20th July (1235kg DM/ha)			
1: 31st July	11 days	793kg	5296kg^{b}
2: 8th Aug	19 days	531kg	3168kg^{cd}
3: 16th Aug	27 days	317kg	2755kg^{d}
Ungrazed			8605kg^{a}
LSD	-	-	*493*

'early start' plots were rested after lock-up 1, with stock re-introduced for 1 week from 9th to 16th August.

NB: numbers followed by the same letter do not significantly differ

Figure 1b - Sheep trial, Collingullie, August 2007

Photo: K. Condon

filling the feed gap

with an average stocking rate of 18 lambs/ha. Liveweight gain during this period averaged 150g/head/day. Lambs were re-introduced to these plots 3 weeks later when the wheat had recovered (Table 1b).

'Late' grazing commenced on the 20th July at 1200kg DM/ha. After 11 days stock had grazed the crop down to 800kg DM/ha and the first area was locked-up. The second area was locked up 8 days later when the crop had been grazed to 500kg DM/ha. The final area was locked up 8 days later, on the 16th August, at 300kg DM/ha. Stocking rates during the 'late start' grazing period (27 days) averaged 28 lambs/ha, with an average liveweight gain of 150g/head/day.

A comparison of dry matter between all grazing treatments on the 10th August showed that recovery from over-grazing in the 'early start' plots was very slow, with a growth rate of 18kg DM/ha/day. In comparison, grazing for a shorter duration in the 'late' grazing treatment (1st lock-up) leaving a residual of 800kg DM/ha, resulted in a much faster recovery at 60kg DM/ha/day.

These differences in recovery were still evident by the time the crop had hayed off in late October, with the shorter grazing period (11 days) having significantly more dry matter than treatments which had been grazed for longer periods, ranging from 19 to 27 days.

However the timing of grazing, ie. 'early' or 'late' commencement, had no obvious effect on dry matter recovery. The date of lock-up also appeared not to influence dry matter recovery, although yields can be significantly reduced if crops are grazed past 1st node stage.

Not surprisingly, the ungrazed area grew significantly more dry matter than any of the grazed treatments. Unfortunately the impact of this on crop yield could not be measured, but previous Grain & Graze trials have shown that grazing can increase wheat yields due to water savings from reduced biomass. This may, however, be a factor of the dry years in which the trials were conducted.

Acknowledgements:
Co-operators: *Malcolm & Des Kohlhagen, Collingullie.*

Grazing systems for winter cereals

The following is a summary of a paper by Jim Virgona (CSU) et al describing results of a trial conducted at Wagga Wagga in 2007. The trial aimed to determine the benefits to livestock of including grazing cereals in the farming system, taking into account feed available from both the cereal crop and from the pasture being rested while the cereal crop is grazed.

- 30kg Merino x Dorper lambs at 12.5 lambs/ha were used to compare two grazing systems from June to October:
  - 18 weeks on lucerne pasture* *(~50% lucerne, 50% barley grass, annual ryegrass, capeweed)*
  - 6 weeks on lucerne pasture*, followed by 6 weeks on Wedgetail wheat, followed by 6 weeks on lucerne pasture*

**lucerne plots were subdivided to allow rotational grazing.*

- Liveweight gains were significantly higher from the lucerne/wheat system (20kg/head) than the lucerne only system (16kg/head). This difference can only be attributed to the grazing wheat which produced significantly higher lamb growth rates than the lucerne pasture in the lucerne only system (during the 2nd 6 week period).
- There were no differences in growth rates when lambs in both systems were grazing the lucerne pasture (during the 1st and last 6 week periods), despite the accumulation of additional feed when the wheat was being grazed.
- These results show the advantage of having grazing wheat available in mid winter for livestock production. However, further sytems-based research is required to determine how other aspects of livestock management (eg. stocking rate, lambing time, etc) could be changed to make better use of the high feed production from grazing cereals.

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2. Effects of cattle stocking rate on grazing wheat

Project collaborators:
Peter Martin[1], Vince Van der Rijt[1]
Jim Virgona[2], FarmLink
([1]NSW DPI, [2]CSU)

Unfortunately the 2007 Grain & Graze cattle trial was drought affected so response to grazing commencement time could not be measured. However the trial did show that higher stocking rates (6 and 7 beasts/ha) were required to make an impact on the feed available. Cattle liveweight gains over the 26 day period averaged 1.4kg/ha/day.

Aim: To determine the effect of cattle stocking rates on liveweight gain, dry matter and yield. *(NB: This trial was also meant to determine the impact of grazing commencement times, however low rainfall meant only one grazing period was possible).*

Method: The trial was established in a commercial paddock of Wedgetail wheat at Ganmain, sown on the 3rd May 2008 (Table 2a). The crop was grazed by weaner cattle (ave. weight 213kg) from the 27th July at 1500kg DM/ha to the 22nd August. Four stocking rates were used :

- 3 head/ha (21 DSE/ha)
- 4 head/ha (28 DSE/ha)
- 6 head/ha (42 DSE/ha)
- 7 head/ha (49 DSE/ha)

Dry matter was measured and cattle weighed before and after grazing. Unfortunately the trial was drought affected and could not be harvested.

Results:

Not surprisingly, dry matter remaining after grazing decreased as stocking rate increased. However only the higher stocking rates (6 and 7 beasts/ha) made an impact on the feed available with significantly less dry matter than the ungrazed area (Figure 2a).

The average liveweight gain of all cattle in the trial was 1.4kg/ha/day, with a range from 1.2 to 1.7kg/ha/day.

Acknowledgements:
Co-operators: *Ben & Hugh Cruikshank, Ganmain.*

Table 2a - Cattle trial, Ganmain 2007

Site Details	Ganmain
Co-operators	Ben & Hugh Cruikshank
Sowing date	3rd May
Variety	Wedgetail @ 50kg/ha
Stock type	weaner cattle (ave. 213kg)
Stocking rate	3, 4, 6 & 7/ha
Grazing commenced	2nd August
Grazing lock-up	22nd August
Rainfall in-crop	140mm

Table 2b - Dry matter & liveweights, Ganmain 2007

Stocking rate	Dry matter at end of grazing (kg DM/ha)	Liveweight gain (kg/day)
ungrazed	2759kg^{b}	-
3/ha	2233kg^{ab}	1.7kg
4/ha	1996kg^{ab}	1.5kg
6/ha	1657kg^{a}	1.2kg*
7/ha	1564kg^{a}	1.4kg
LSD	*820*	*NA*

NB: numbers followed by the same letter do not significantly differ.

****By chance, slower growing cattle were randomly allocated to this stocking rate.***

Figure 2a - Dry matter post-grazing, Ganmain 2007

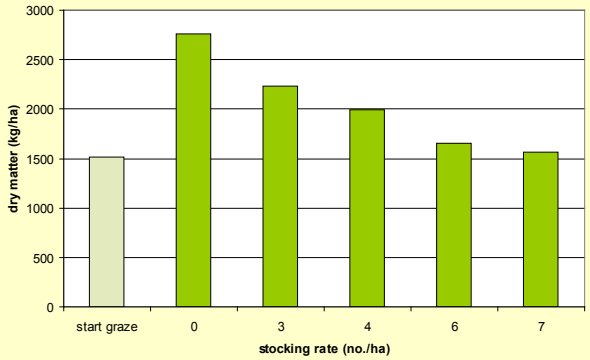


Figure 2b - Cattle trial, Ganmain, August 2007

Photo: K. Durham

3. Row spacing & plant density in grazing cereals

Project collaborators:
Peter Martin[1], Vince Van der Rijt[1], Jim Virgona[2], FarmLink
([1]NSW DPI, [2]CSU)

The row spacing trials were established in response to grower concerns about crop wastage, compaction and lower dry matter when grazing cereals are grown on wider row spacings. Unfortunately poor plant establishment in the wide row spacing confounded results, although dry matter measurements showed that plant growth compensated for low plant establishment to some degree in the wider row spacing. Wastage and compaction were unable to be measured due to the season.

Aim: To determine the effect of row spacing and plant density on dry matter and yield.

NB: Effects on crop wastage & stock compaction were also intended, but measurements were not possible due to the season.

Method: Two trials were sown at Muttama and Ganmain (Table 3a) with the following treatments:

- Row spacing:
  - 18cm (7")
  - 30cm (12")
- Plant density:
  - 140 plants/m^2
  - 200 plants/m^2
- Variety:
  - Breakwell triticale
  - Wedgetail wheat
  - Ventura wheat *(included as an ungrazed comparison at 140 plants/m^2 only)*

Dry matter measurements were made throughout the season. Although the trials were grazed, crop wastage and compaction measurements were unable to be taken. Unfortunately both trials were drought affected so the Ganmain site was not harvested and yield results at Muttama were affected by late regrowth after maturity.

Table 3a - Row spacing trials 2007

Site Details	Muttama	Ganmain
Co-operator	Jeremy Litchfield & Sandy Biddulph	Ben Cruikshank
Sowing date	10th May	9th May
Grazing period	30th July to 4th September	27th July to 22nd August

Figure 3a - Plant establishment, Ganmain, May 2007

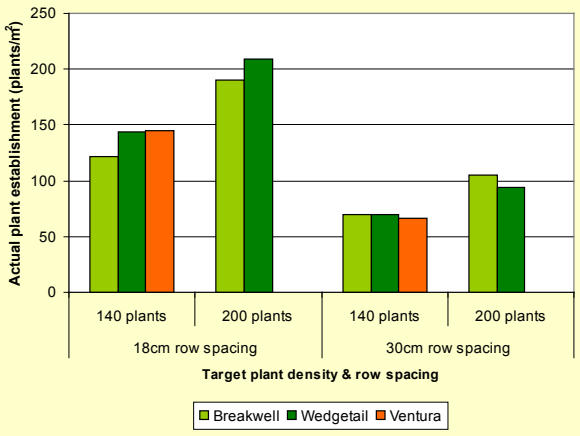


Figure 3b - Plant establishment, Muttama, May 2007

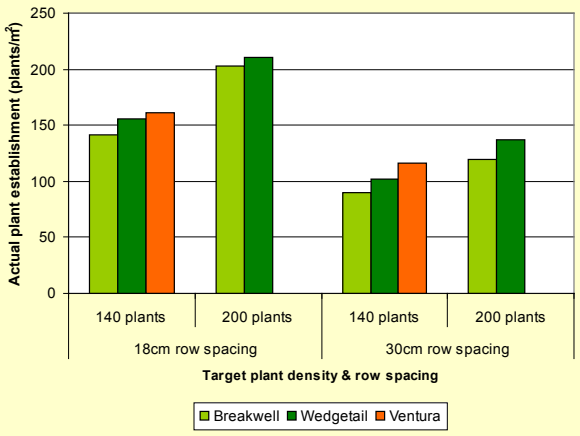
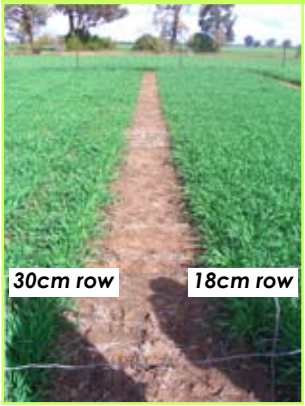


Figure 3c - Dry matter comparison, Ganmain, Aug 2007
left: Breakwell , right: Wedgetail



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Results:

Plant establishment

Target plant densities were achieved on the 18cm row spacing, but only 50% and 70% of target numbers were achieved in the 30cm spacing at Ganmain and Muttama respectively (Figures 3a & 3b).

A second trial was sown at Muttama to further investigate the low plant density issue, comparing 18cm and 36cm row spacing. A similar result occurred, with plant establishment averaging 75% of target in the wide row spacing compared to 100% in the narrow rows.

Establishment is typically lower on wider row spacings due to a combination of factors including intra-row competition (more seeds in the row) and fertiliser 'burn'. However low plant numbers in the wide rows in these trials (particularly at Ganmain) may also have been due partly to problems with seeder set-up.

Dry matter

Despite differences in plant establishment, compensation in plant growth meant dry matter differences between wide and narrow row spacings were not as great as differences in plant density. Dry matter in the wide row spacings averaged 70% and 80% of the narrow row spacings at Ganmain and Muttama respectively (Figures 3d & 3e), despite having only 50% and 65% of plant numbers. Although dry matter was higher at the narrow row spacing, it is difficult to draw conclusions due to the confounding effect of poor establishment in the wide row spacing.

Dry matter also increased with plant density (regardless of row spacing), although these increases were generally not significant (Table 3c). Plants typically compensate for lower plant numbers by producing more tillers and therefore more dry matter.

Between varieties, dry matter was also higher in Breakwell (at Ganmain) and Ventura (at Muttama), but again these responses were generally not significant (Table 3c).

Acknowledgements:

Co-operators: *Ben & Hugh Cruikshank (Ganmain), Sandy Biddulph & Jeremy Litchfield (Muttama).*

Table 3b - Pre grazing dry matter (kg/ha), July 2007

Variety	18cm row spacing		30cm row spacing	
	140 plant target	200 plant target	140 plant target	200 plant target
Ganmain				
Breakwell triticale	1372kg	1672kg	1086kg	1002kg
Wedgetail wheat	1092kg	1325kg	780kg	967kg
Ventura wheat	1119kg	NA	915kg	NA
lsd (0.05)	326			
Muttama				
Breakwell triticale	1745kg	1841kg	1410kg	1576kg
Wedgetail wheat	1355kg	1625kg	905kg	1481kg
Ventura wheat	1592kg	NA	1408kg	NA
lsd (0.05)	404			

Figure 3d - Pre grazing dry matter, Ganmain, July 2007

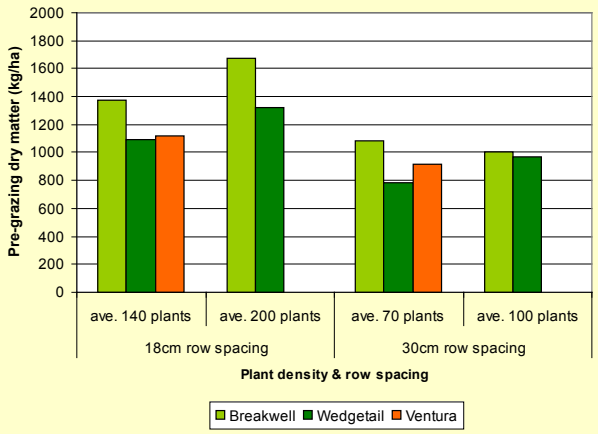
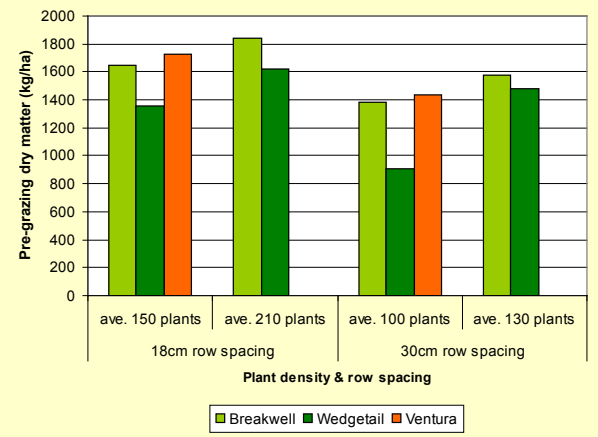


Figure 3e - Pre grazing dry matter, Muttama, July 2007



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Sheep responses to mineral supplements when grazing wheat

(Hugh Dove, CSIRO)

Research as part of the Murrumbidgee Grain and Graze Project in 2005 and 2006 and within GRDC Project CSP0009 has demonstrated **marked increases in liveweight gain of young sheep grazing dual-purpose wheats** (Mackellar, Wedgetail) **when they were supplemented with either Na (as salt) or Mg (as Causmag).** Results are summarised as follows, with further details on trials prior to 2007 available in the references supplied:

- A survey of the mineral content of cereal forages from across Australia showed that, relative to the mineral requirements of growing lambs, wheat forage was usually:
  - ► marginal for magnesium (Mg)
  - ► more than adequate for calcium (Ca)
  - ► high in potassium (K), with levels 5-7 times requirement
  - ► markedly deficient in sodium (Na)
- (Oat and barley samples had higher magnesium and much higher sodium contents).
- The marginal deficiency of magnesium in wheat forage, relative to the needs of growing animals, is compounded by the very high potassium to sodium ratio (often greater than 1000, compared with 5-10 in oats), which markedly reduces magnesium absorption in the rumen.
- It is therefore highly likely that part of the response to a sodium supplement is due to better magnesium absorption resulting from the reduced potassium to sodium ratio. However, a direct response to sodium is also possible given that wheat forage sodium levels are so low (often below 0.001% DM when the animal requirement is 0.07-0.09% DM).
- In 2007, a trial was established at Ginninderra (near Canberra) as part of the GRDC-funded project CSP0097 (H. Dove) to assess whether there was an additive effect of sodium and magnesium supplements in young animals on grazing wheat.
  - ► Merino hoggets grazed Mackellar wheat at a stocking rate of 33/ha for 30 days, either with no supplement or with ad lib supplements of salt (NaCl) or salt plus Causmag (1:1).
  - ► Hoggets without supplement grew at 177g/day. Those given the salt supplement grew 19% faster (211g/day) and those given salt + Causmag grew 31% faster (232 g/d) than unsupplemented sheep. This is despite the intake of the salt/Causmag mix being lower than that of the salt supplement alone.
  - ► These results indicate an additive effect of sodium and magnesium supplements in sheep grazing wheat forage.

References

- Dove, H. (2007). Mineral nutrition of sheep grazing dual-purpose wheats. Invited contribution in GRDC-sponsored Grains Research Technical Update, Wagga Wagga, NSW; 13-14 February, eds D. Kaminskas and S. Rawlings; pp. 71-75.
- Dove, H., McMullen, G. and Kelman, W.M. (2007). Liveweight gain responses to magnesium or sodium supplements in young sheep grazing dual purpose wheats. J. Anim. Feed Sci. 16, 465-70.
- Condon, K (2007). Grazing wheats - liveweight gains. FarmLink 2006 Research Report, pp. 13-14.
- Condon, K (2006). Grazing wheats - liveweight gains. FarmLink 2005 Research Report, pp. 21-22.

Supplement feeders used in the 2006 Grain & Graze trial at Marrar

Photo: G. McMullen