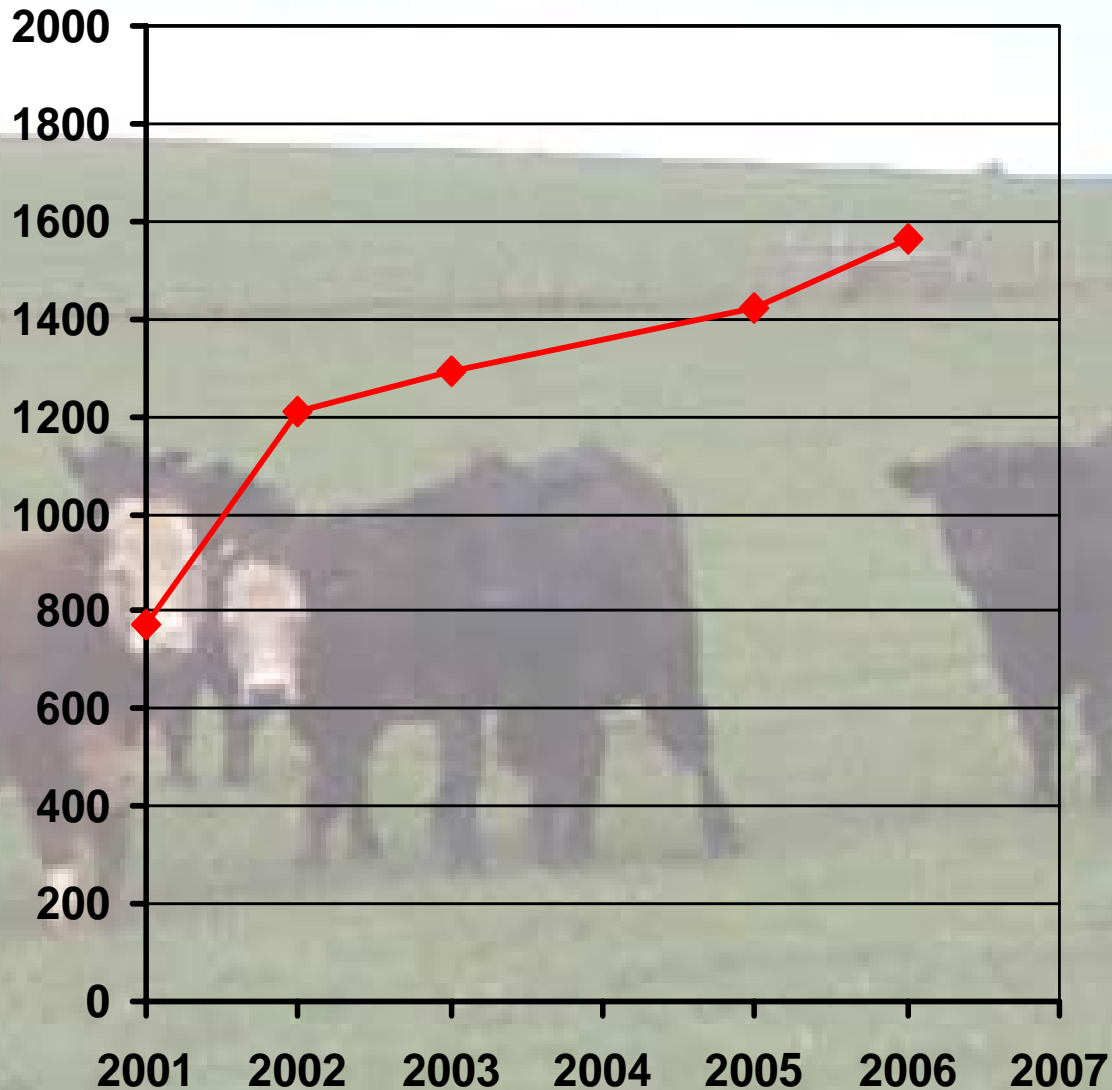


# Progress towards 2000 kg/ha of beef live-weight production



**Field Day - Winnaleah**  
**3 April 2007**

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Field Day notes prepared by  
Extensive Agriculture Branch - DPIW

# Progress Towards 2000 kg/ha of Beef Liveweight Production

## Summary

This is the second year of a three-year program to demonstrate the adoption of known technologies with the aim of producing 2000kg/ha beef liveweight in a year. Last year the positive effect of intensive rotational grazing was evaluated while this year focused on the use of nitrogen.

The nitrogen treatments trialed were nil, 45kg/ha of N applied once in the autumn and once in early winter and 30kg/ha of N applied after each monthly grazing rotation. All the treatments were intensive rotational grazed.

The nil nitrogen treatment produced 1020 kg/ha liveweight, the 45kg/ha N autumn and winter produced 1208 kg/ha liveweight and the 30kg/ha N after each rotation produced 1563 kg/ha beef liveweight gain.

The use of nitrogen for beef production is very profitable provided the extra pasture produced is utilised.

Next year assesses the value of irrigation in combination with best practice grazing management and nitrogen use.

## Acknowledgments

The success of this project has been due to the efforts of the following individuals and organisations:

Bruce and Sheryl Muirhead for the use of their property and the time of their farm staff.

Leon Quilliam as the former chairman of the Winnaleah-Ringarooma Meat and Cropping Discussion Group and project site manager and we would like to welcome John Wardlaw as the new chairman.

Thanks to all members of the Winnaleah-Ringarooma Meat and Cropping Discussion Group who have helped with the running of the trial.

Meat and Livestock Australia through David Falepau for their financial support.

Josh Sattler from Roberts for technical assistance and supply of some hardware.

Lester Rainbow and Incitec-Pivot for provision of all the fertiliser.

## **Background**

This site has previously been used to compare beef liveweight gain from perennial and short rotation ryegrasses for a three-year pasture break between cropping rotations. During the second and third year of these trials beef liveweight production exceeded 1000 kilograms per hectare (kg/ha). This seemed a significant achievement at the time.

At the completion of these trials a concept proposal was prepared to investigate the possibility of producing 2000 kg/ha beef liveweight at this site.

A partnership was developed between Meat and Livestock Australia, The Tasmanian Department of Primary Industries and Water, Muirhead Enterprises, Roberts and Incitec Pivot to progress this concept. All of these partners have been positive in their approach to this trial and have contributed resources to ensure its success.

The first stage of this program was to compare three grazing treatments for beef production and hence their ability to move us towards 2000 kg/ha of beef production. The three treatments were set stocking, which had previously been used at the site, a four-paddock rotation and intensive rotational grazing. The second stage was to use the best of the grazing treatments which was the intensive rotational grazing and then compare nitrogen treatments as described later.

## **Trial Establishment**

This phase of the trial was established in 2004. The existing pastures were sprayed out and re-sown to a permanent pasture based on Jackaroo perennial ryegrass (15 kg/ha), Astred red clover (3 kg/ha) and Pitau white clover (2 kg/ha).

The plots are all 1.86 hectares in area.

# **Grazing Treatments Evaluated - Winnaleah 2006-07**

## **Nil Nitrogen**

Intensive rotational grazing\*  
250kg/ha Super + Moly applied in the autumn  
No nitrogen applied  
Plots stocked on the 2nd May  
Two paddocks of two ha each receive this treatment

## **45kg/ha Nitrogen - Autumn & Winter**

Intensive rotational grazing\*  
250kg/ha Super + Moly applied in the autumn  
45kg/ha N as urea applied on the 10th April  
Plots stocked on the 2nd May  
45kg/ha N as urea applied on the 15th May  
Two paddocks of two ha each receive this treatment

## **30kg/ha Nitrogen each Rotation**

Intensive rotational grazing\*  
250kg/ha Super + Moly applied in the autumn  
30kg/ha N as urea applied on the 10th April  
Plots stocked on the 2nd May  
30kg/ha N as urea applied after each rotation until October  
Two paddocks of two ha each receive this treatment

\* Intensive rotational grazing – The paddock is divided into 28 equally sized segments with the stock being moved on Monday, Wednesday and Friday. They get two segments each on Monday and Wednesday and three segments on Friday. It takes four weeks to do one rotation.

## The Stocking Rate and Dry Sheep Equivalent Ratings

The number of stock on the plots and hence the stocking rate are set for each grazing period. Expressing stocking rate as number of animals per hectare does not take into account how well they are growing. During this report the stocking rate is expressed on a Dry Sheep Equivalent (DSE) rating as well as numbers/ha. The DSE rating is calculated at the end of each month and takes into account their live-weight and their rate of weight gain. The DSE ratings used are based on a 50 kg wether requiring 8.4 mega joules of metabolisable energy per day to maintain weight. The DSE ratings based on live-weight and rate of live-weight gain are shown in Table 1.

**Table 1. Dry Sheep Equivalent ratings.**

Live Weight	Dry Sheep Equivalents						
	Live-weight Gain (kg/day)						
	0	0.25	0.5	0.75	1.0	1.25	1.5
100	2.9	3.3	3.9	4.4	5.0	5.6	6.2
150	3.6	4.2	4.8	5.6	6.4	7.1	7.9
200	4.0	4.9	5.7	6.7	7.6	8.7	9.8
250	4.6	5.6	6.5	7.7	8.8	10.0	11.2
300	5.1	6.2	7.4	8.7	9.9	11.3	12.7
350	5.6	6.9	8.2	9.5	11.0	12.6	14.2
400	6.1	7.5	8.9	10.5	12.0	13.8	15.6
450	6.5	8.0	9.6	11.3	13.1	14.9	16.7
500	7.0	8.6	10.4	12.1	14.0	16.1	18.2
550	7.5	9.2	11.1	13.0	15.1	17.3	19.5
600	8.0	9.8	11.8	13.8	16.1	18.5	20.8

### **Management and production during 2006–07**

This phase of the trial commenced in autumn 2006 and concluded in summer 2007. Liveweight of the cattle and the amount of pasture available were measured every four weeks. A summary of results is shown in Figure 1.

The progress of the cattle through the year is detailed below on a seasonal basis.

#### **Autumn 2006**

All plots had good pasture cover when the animals were introduced. The first application of 30 units of N and 45 units of N was applied to the whole of each of the N plots on April 10. The plots were stocked on May 2 with six heifers on the nil N plots and seven heifers on the nitrogen plots as we expected these to respond to the nitrogen with extra pasture growth. The heifers had an average liveweight of 323 kg.

On May 15 the half of each of the N plots that had been grazed received its next treatment of N. The other half of each of these plots received its treatment in 14 days time. That was the finish for the 45N treatment. Each half of the 30N paddocks continued to get nitrogen every 28 days thereby receiving a total of seven applications.

The animals were weighed every 28 days, after one rotation of the paddock. The liveweight gain for cattle during autumn is shown in Table 2.

**Table 2. Live-weight of the cattle during autumn 2006**

Period	Date	Days	Liveweight (kgs) and (Growth Rate kg/day)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
Start	2-5-06		321	325	323
1	29-5-06	27	359 (1.37)	365 (1.48)	359 (1.34)

This was a good start showing the value of getting an autumn break with good pasture and thus animal growth rates on all treatments.

The plots are 1.86 hectares in area and the stocking rates (animals and DSE per hectare) are shown in Table 3. The Dry Sheep Equivalent (DSE) rating depends on the rate of liveweight gain and is shown in brackets. The DSE ratings used are shown in Table 1.

**Table 3. Stocking rate during autumn 2006**

Period	Date	Days	Stocking Rate number/ha and (DSE/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
Start	2-5-06		3.2	3.8	3.8
1	29-5-06	27	3.2 (42)	3.8 (51)	3.8 (48)

Our method of comparison between the grazing treatments is beef liveweight production per hectare. The liveweight produced during each grazing period and the total for autumn is shown in Table 4.

**Table 4. Liveweight production during autumn 2006**

Period	Date	Days	Liveweight Production (kg/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
<b>Start</b>	<b>2-5-06</b>				
<b>1</b>	<b>29-5-06</b>	<b>27</b>	<b>120</b>	<b>150</b>	<b>136</b>
<b>Total</b>			<b>120</b>	<b>150</b>	<b>136</b>

At the end of the first rotation there was slightly more feed available on the Nil N plots than when the trial started and we expected the cattle to keep on top of it, so the stock number was kept the same.

The pasture available on the 30N plots was slightly more than at the start but with the continuing applications of N we expected it to keep increasing so the stocking rate was increased in line with the philosophy of eating all the pasture grown.

On the 45N plots there was considerably more pasture available than on the other treatments reflecting the increased amount of N applied. The stocking rate was already too low as on each move higher than acceptable pasture residues were being left behind. Consequently the stocking rate on these plots was also increased.

**Table 5. Pasture available during autumn 2006**

Period	Date	Days	Pasture Available (kg DM/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
<b>Start</b>	<b>2-5-06</b>		<b>1063</b>	<b>1224</b>	<b>1122</b>
<b>1</b>	<b>29-5-06</b>	<b>27</b>	<b>1308</b>	<b>2102</b>	<b>1488</b>

### **Autumn Comments**

This was a good autumn with all cattle having good growth rates and we were able to go into winter with feed still available. The N treatments were already starting to show an effect with the 45N treatment building up a large feed wedge that we hoped would carry into winter.

## Winter 2006

The heifers were kept on the plots until June 26 when they were taken off and sold.

The plots were restocked on the same day with young steers averaging about 225kg.

The nil N plots were stocked with eight steers and the nitrogen plots were stocked with ten steers each. As can be seen in table 7 even though we increased the stock number the overall DSE rating decreased because of the lesser liveweight of the newly introduced animals. The same number of animals remained on all plots throughout winter.

The cattle had good growth rates throughout winter with growth rates being similar on all treatments emphasising the mild winter and good growing conditions. See table 6.

**Table 6. Liveweight of the cattle during winter 2006**

Period	Date	Days	Liveweight (kgs) and (Growth Rate kg/day)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
2	26-6-06	28	387 (1.01)	392 (1.00)	388 (1.00)
New cattle	26-6-06		221	232	224
3	24-7-06	28	244 (0.81)	256 (0.86)	248 (0.86)
4	21-8-06	28	272 (0.99)	282 (0.93)	280 (1.12)

The winter stocking rates and DSE ratings for winter are shown in Table 7.

**Table 7. Stocking rate during winter 2006**

Period	Date	Days	Stocking Rate number/ha and (DSE/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
2	26-6-06	28	3.2 (36)	5.9 (67)	4.8 (54)
New cattle			4.3	5.4	5.4
3	24-7-06	28	4.3 (31)	5.4 (41)	5.4 (39)
4	21-8-06	28	4.3 (38)	5.4 (45)	5.4 (50)



The higher liveweight gain on the nitrogen treatments was due to the increased stock numbers and increased pasture growth to feed them.

The liveweight produced per hectare during winter is shown in Table 8.

**Table 8. Liveweight of beef produced in winter 2006**

Period	Date	Days	Liveweight Production (kg/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
2	26-6-06	28	90	152	134
3	24-7-06	28	98	131	129
4	21-8-06	28	119	140	169
<b>Total</b>			<b>307</b>	<b>423</b>	<b>432</b>

Winter production on top of the good autumn production was setting up for a very large yearly total.

The pasture production on the 45N treatment was similar to the 30N treatment until August when the 30N treatment started to draw away showing the effect of the N running out in the 45N plots and the continuing use of N in the 30 N plots.

The amount of pasture available on the three grazing treatments through winter is shown in Table 9.

**Table 9. Pasture available during winter 2006**

Period	Date	Days	Pasture Available (kg DM/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
2	26-6-06	28	922	1406	997
3	24-7-06	28	739	1082	787
4	21-8-06	28	794	982	1184

By the end of winter things were already starting to dry off consequently there was never a large amount of available feed on any of the treatments.

### Winter Comments

There was an increase in beef production over winter from the 45N treatment of about 38 percent and about 40 percent for the 30N treatment compared to the nil N treatment.

## Spring 2006

Liveweight production during spring was from both core and extra animals. Extra stock was added to both nitrogen treatments in September to match pasture growth rates. The extra cattle remained on both treatments until the end of spring. The extras on these two treatments were moved between treatments to match feed supply and ensure efficient pasture utilisation on these plots.

The liveweight of the core animals is presented in table 10. There were eight core animals on the nil treatment and ten core animals on the nitrogen treatments.

**Table 10. Liveweight of the core animals during spring 2006**

Period	Date	Days	Liveweight (kg) and (Growth Rate kg/day)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
5	18-9-06	28	305 (1.18)	312 (1.21)	316 (1.57)
6	17-10-06	29	350 (1.55)	355 (1.48)	363 (1.62)
7	13-11-06	27	393 (1.59)	385 (1.11)	401 (1.41)

Cattle were still being added to the 30N plots at the end of spring but numbers were starting to be reduced on the 45N treatment as shown in table 11.

**Table 11. Stocking rate during spring 2006**

Period	Date	Days	Stocking Rate numbers/ha and (DSE/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
5	18-9-06	28	4.3 (44)	5.9 (59)	6.7 (72)
6	17-10-06	29	4.3 (57)	5.9 (77)	6.7 (90)
7	13-11-06	27	4.3 (62)	5.4 (63)	7.3 (103)

Average liveweight per animal during spring is reported from the core animals that remained on the plots for duration of the trial. Additional stock was added to utilise the spring flush of pasture but these animals had a different average liveweight to that of the core animals. The combined contribution of both these groups to spring liveweight gain per hectare is shown in table 12.

**Table 12. Liveweight of beef produced in spring 2006**

Period	Date	Days	Liveweight Production (kg/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
5	18-9-06	28	143	182	241
6	17-10-06	29	195	256	321
7	13-11-06	27	186	161	280
<b>Total</b>			<b>524</b>	<b>599</b>	<b>842</b>

**Table 13. Pasture available during spring 2006**

<b>Period</b>	<b>Date</b>	<b>Days</b>	<b>Pasture Available (kg DM/ha)</b>		
			<b>Nil Nitrogen</b>	<b>45kg/ha N Autumn &amp; Winter</b>	<b>30kg/ha N each rotation</b>
<b>5</b>	<b>18-9-06</b>	<b>28</b>	<b>785</b>	<b>1244</b>	<b>1578</b>
<b>6</b>	<b>17-10-06</b>	<b>29</b>	<b>1169</b>	<b>1384</b>	<b>2075</b>
<b>7</b>	<b>13-11-06</b>	<b>27</b>	<b>1118</b>	<b>999</b>	<b>1637</b>

By the middle of October pasture growth had reached its maximum and extra stock was needed on the 30N treatment to convert this additional pasture into liveweight gain.

Nitrogen ceased being applied to the 30N treatment on October 30 due to insufficient moisture. Seven applications of N was applied equating to a total of 210kg/ha

### **Spring Comments**

Liveweight production of the nil nitrogen treatments this spring was 209 kg/ha less than that achieved last year (524 v 733 kg/ha) due to the ongoing dry conditions. However the 30N treatment producing 842 kg/ha (60% increase over the nil nitrogen) shows the value of N in extending pasture growth in dry conditions. The production total for the six months since the trial started was 951 kg/ha for the Nil N treatment, 1172 kg/ha for 45N treatment and 1410 kg/ha for the 30N treatment.

## Summer 2006/07

On November 13 all Angus cattle over 400kg were taken off the plots and sold. This left the Nil N treatment with six animals (3.2/ha), the 45N treatment with seven animals (3.8/ha) and the 30N treatment with nine animals (4.8/ha). We nominated four animals as the core group on each of the treatments.

By the middle of December the grass had nearly stopped growing which is reflected in animal growth rates.

**Table 14. Liveweight of the core animals during summer 2006/07**

Period	Date	Days	Liveweight (kg) and (Growth Rate kg/day)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
13-11-06 (Cattle over 400kg sold)			351	368	352
8	11-12-06	28	376 (0.89)	389 (0.75)	379 (0.96)
9	8-1-07	28	385 (0.30)	387 (-0.06)	389 (0.36)
10	5-2-07	28	370 (-0.54)	368 (-0.68)	382 (-0.27)

On December 11 the remaining cattle over 400kg were removed for sale and the remainder were redistributed with 4 animals put on each plot. See table 15.

**Table 15. Stocking rate during summer 2006/07**

Period	Date	Days	Stocking Rate number/ha and (DSE/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
8	11-12-06	28	3.2 (37)	3.8 (38)	4.8 (56)
9	8-1-07	28	2.2 (16)	2.2 (13)	2.2 (17)
10	5-2-07	28	2.2 (13)	2.2 (13)	2.2 (13)

**Table 16. Liveweight of beef produced during summer 2006/07**

Period	Date	Days	Liveweight Production (kg/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
8	11-12-06	28	83	81	147
9	8-1-07	28	18	- 4	22
10	5-2-07	28	-32	-41	-16
<b>Total</b>			<b>69</b>	<b>36</b>	<b>153</b>

Beef production this summer as shown in table 16 was very poor due to the ongoing dry conditions with 45N treatment having the lowest figure, probably from carrying too high a stocking rate for too long and not having sufficient reserve of standing feed. The 30N treatment again had the best production both in growth rate and animal numbers but it too had run out of feed by January.

The cattle were left on the plots until February as they had no where else to go and as expected they lost weight.

The amount of pasture available during summer is shown in Table 17.

**Table 17. Pasture available during summer 2006/07**

Period	Date	Days	Pasture Available (kg DM/ha)		
			Nil Nitrogen	45kg/ha N Autumn & Winter	30kg/ha N each rotation
8	11-12-06	28	752	651	957
9	8-1-07	28	613	674	636
10	5-2-07	28	600	600	600

### Summer Comments

Beef production this summer was below the average of previous years but the overall total yearly production was very impressive. The irrigation treatments planned for next year will remove this effect of limiting moisture.

A summary of seasonal and total beef production for the year is shown in Table 18

**Table 18. Summary of beef production in 2006/07.**

<b>Season</b>	<b>Beef Production kg/ha Liveweight</b>		
	<b>Nil Nitrogen</b>	<b>45kg/ha N Autumn &amp; Winter</b>	<b>30kg/ha N each rotation</b>
<b>Autumn</b>	<b>120</b>	<b>150</b>	<b>136</b>
<b>Winter</b>	<b>307</b>	<b>423</b>	<b>432</b>
<b>Spring</b>	<b>524</b>	<b>599</b>	<b>842</b>
<b>Summer</b>	<b>69</b>	<b>36</b>	<b>153</b>
<b>Total</b>	<b>1020</b>	<b>1208</b>	<b>1563</b>

The 45 N treatment produced 188 kg/ha more beef liveweight than the Nil N treatment, an increase of 18 percent.

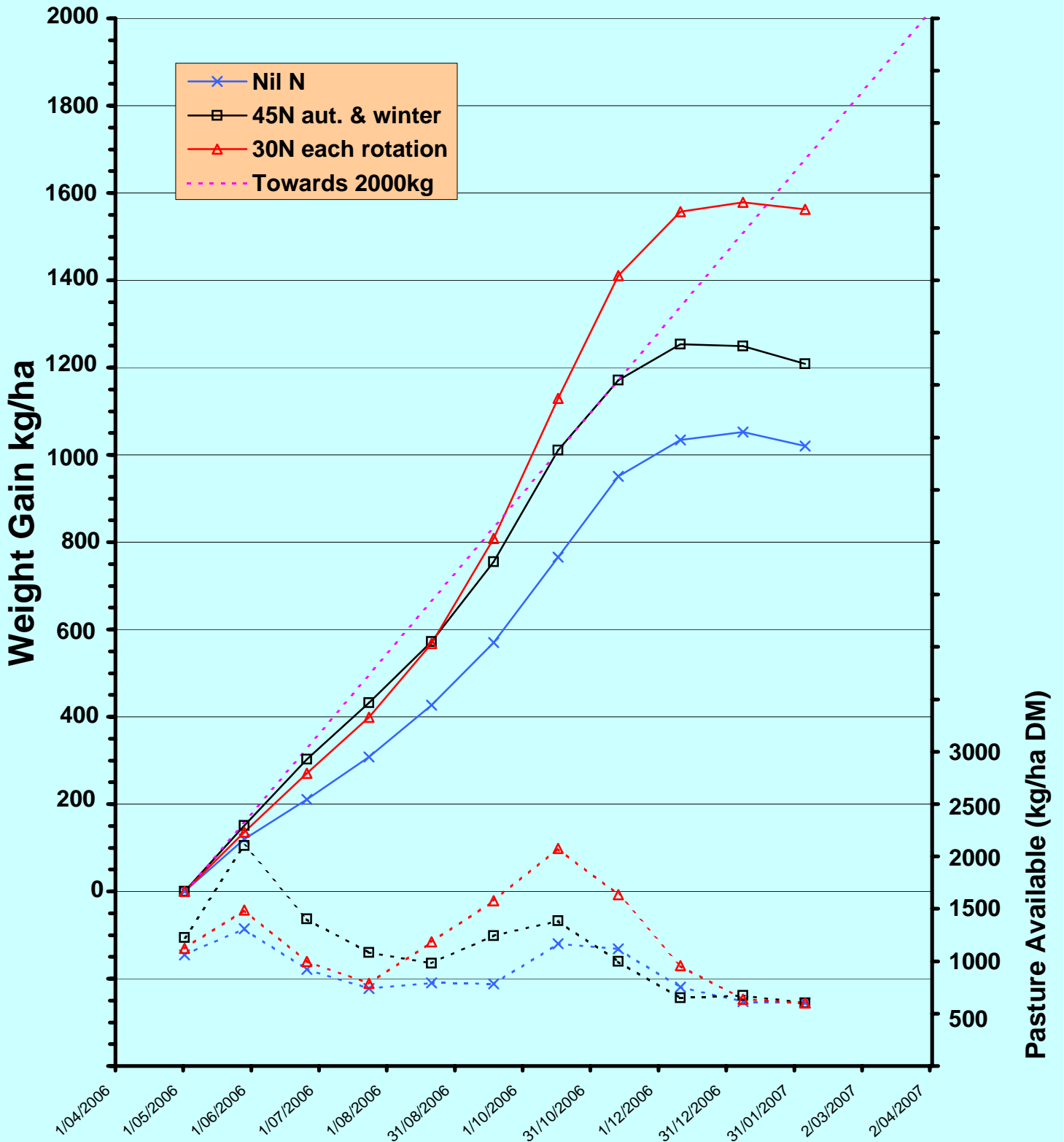
The 30N treatment produced 355 kg/ha more beef liveweight than the 45N treatment, an increase of 29 percent.

The 30N treatment produced 543 kg/ha more beef live-weight than the Nil N treatment, an increase of 53 percent.

Figure 1

# Liveweight Gain (kg/ha) & Pasture Available

Winnaleah 2006 - 2007



The tables below show the costs of applying the nitrogen applications.

### 45kg/ha N applied in the autumn and winter

#### Cost per ha of applying nitrogen

	2 *45kg N = 90kg N	
Nitrogen as Urea @ \$540/t or \$1.17 per kg of N	90kg * \$1.17 =	\$105.30
Spreading @ \$90/t (45kg = 1/10t)	\$9 * 2 =	\$18.00
Cartage @ \$11/t	\$1.10 * 2 =	\$2.20
	Total cost per ha =	\$125.50

### 30kg/ha N applied after each rotation

#### Cost per ha of applying nitrogen

	7 * 30kg N = 210kg N	
Nitrogen as Urea @ \$540/t or \$1.17 per kg of N	210kg * \$1.17 =	\$245.70
Spreading @ \$90/t (30kg = 1/15t)	\$6.00 * 7 =	\$42.00
Cartage @ \$11/t	\$0.72 * 7 =	\$5.04
	Total cost per ha =	\$292.74

### Economics of using Nitrogen

	Liveweight Production kgs/ha	Price per kg Liveweight					
		\$1.20	\$1.40	\$1.60	\$1.80	\$2.00	\$2.20
Nil N	1020	\$1224	\$1428	\$1632	\$1836	\$2040	\$2244
45N aut. & winter	1208	\$1452	\$1694	\$1936	\$2178	\$2420	\$2662
Less costs (\$125.50/ha)		\$1327	\$1569	\$1811	\$2053	\$2295	\$2537
<b>Profit (\$/ha)</b>		<b>\$103</b>	<b>\$141</b>	<b>\$179</b>	<b>\$217</b>	<b>\$255</b>	<b>\$293</b>
30N each rotation	1563	\$1876	\$2188	\$2501	\$2813	\$3126	\$3439
Less costs (\$292.81/ha)		\$1583	\$1895	\$2208	\$2521	\$2833	\$3146
<b>Profit (\$/ha)</b>		<b>\$359</b>	<b>\$467</b>	<b>\$576</b>	<b>\$685</b>	<b>\$793</b>	<b>\$902</b>
Increase in beef production to break even for 30N treatment	(kgs/ha)	244	209	183	163	146	133



### **Stage 3. Irrigation**

Given that grazing management and nitrogen application have been shown to improve autumn and winter production directly, and spring production indirectly through increased stocking rate then summer production becomes the limiter of total productivity. Irrigation is being routinely used to improve the profitability and reliability of cropping and dairy production but not so much for beef. The third phase of this work is therefore to investigate the use of irrigation.

The three treatments in this phase will be:

2 plots fully irrigated + 30 kg N /ha /month

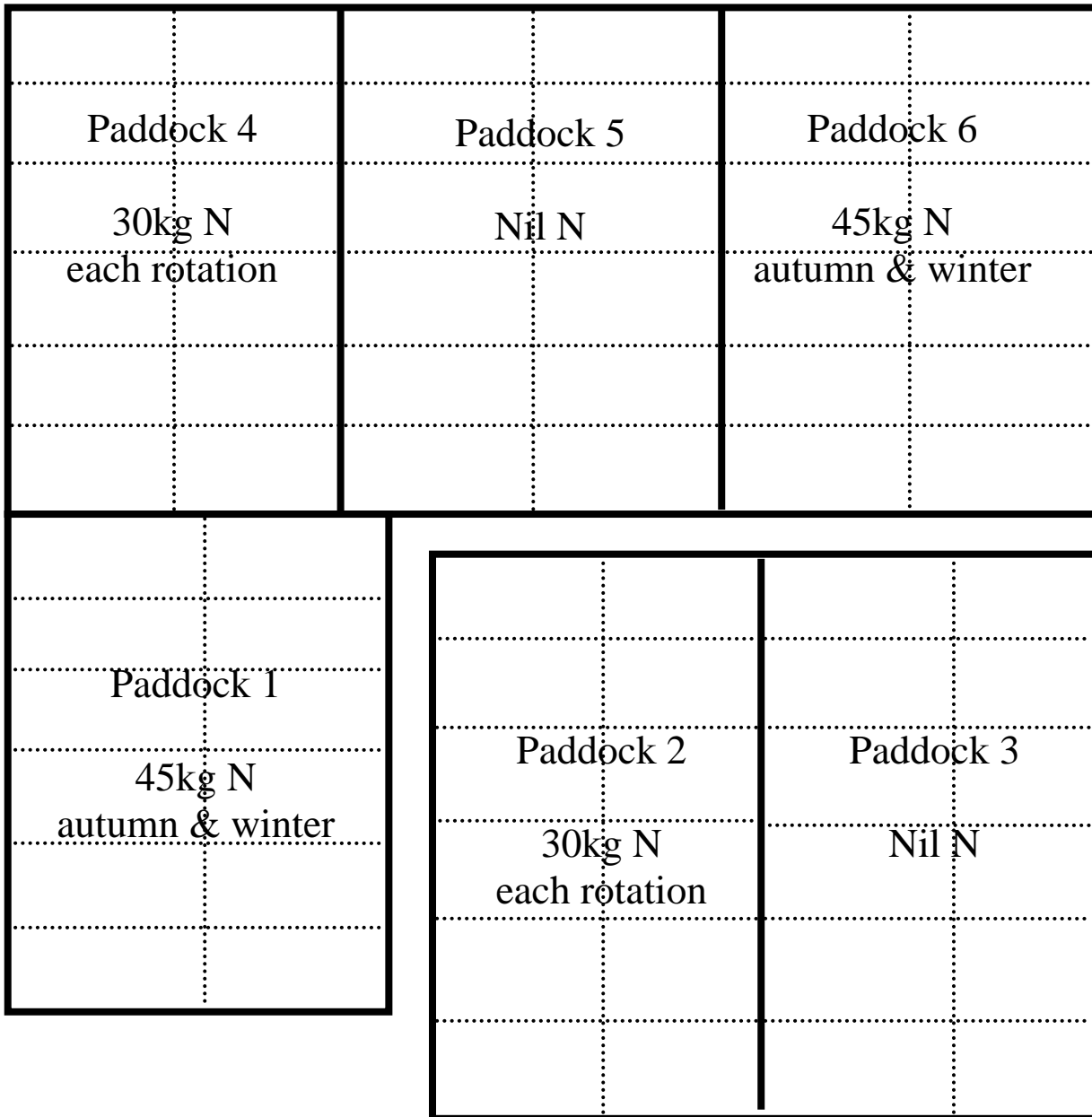
2 plots + 30 kg N /ha /month when moisture is not limiting

2 plots rotationally grazed with no nitrogen

The irrigation design has been completed and tenders called for supply of hardware.

# Winnaleah - Nitrogen Demonstration

2006 - 07



Paddock size = 1.86ha