Table 103 summarises the yield and harvest index (HI) of the slotting trial at Gnarwarre. With only two replicates in this trial, the yield differences were not significant. However, there was a trend to higher yield with ameliorants.

This trial was carried out in a wetter part of the paddock, an area not likely to experience a soil water deficit during any period of crop growth.

Despite the surface soil water dynamics of the soil, the Harvest Index was still very low, suggesting impediments to grain growth during different stages of yield development. This aspect will be addressed in future slotting trials.

Table 103: Grain Yield and HI of the Slotting Trial, Gnarwarre

Ameliorant in slot	Grain yield (t/ha)	Harvest index
Control (No slotting)	5.1	31.0
Back-fill (Slot opened and re-filled)	5.4	32.4
Gypsum (5t/ha)	5.9	32.6
Gypsum + P	5.3	32.6
Wool scour waste (5t/ha)	6.0	31.4

13.2 SPRING WATER USE TRIAL

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Aim:
To identify whether there is an advantage in using deep ripping or shallow cultivation compared to direct drill to improve the ability of crops to utilize soil water at depth.

Method:
Two sites have been used for this trial, one at Cressy the other at Gnarwarre.

Site 1 - "Weering" Cressy owner Mr S. Chirnside
Treatments were commenced in 2001. Table 104 summarizes the treatments for the duration of the project. In 2003 treatment 2 received a deep ripping, while the other treatments were direct drilled.

Site 2 - Gnarwarre, the eastern end of the Wilson block at the SFS site

Table 104: Summary of Treatments at the 'Weering' Site and 'Weering' Rainfall 2003

Year	Treatment No	Treatment Description
2001	1	Direct Drill
	2	Shallow Cultivation (10 cm)
	3	Deep Rip (30 cm)
	4	Deep Rip (30 cm) + Gypsum (2.5 t/ha)
2002	1	Direct Drill
	2	Shallow Cultivation (20 cm)
	3	Direct Drill
	4(a)	Direct Drill
	4(b)	Direct Drill + Gypsum (2.5 t/ha)
2003	1	Direct Drill
	2	Deep Rip (40 cm)
	3	Direct Drill
	4(a)	Direct Drill
	4(b)	Direct Drill

Month	mm
April	34.5
May	18.0
June	53.5
July	45.5
August	68.0
September	43.5
October	87.0
November	13.0
Total	363.0

Table 105: Agronomic Treatments for Weering

Year 2003	'Weering'
Cultivation Date	26/06/03
Planting Date	27/06/03
Variety	Gairdner Barley
Sowing Rate	80 kg/ha
Fertiliser	100 kg/ha MAP 100 kg/ha Urea 20/10/03
Herbicide	Roundup powermax 1 L/ha, 400ml Ester 400 mL/ha, Dimethoate 85 mL/ha 24/06/03; Ally 5 g/ha, MCPA 600 mL/ha, Fastac 125 mL/ha 14/08/03.
Fungicide	Bumper 250 mL/ha, Dimethoate 85 mL/ha 13/10/03; Bumper 250 mL/ha, Dimethoate 85 mL/ha 5/11/03.
Harvest Date	27/12/03

Results:

Table 106 shows the results of plot harvester sampling of a 20m cut in the center bed of each plot and above ground dry matter hand cuts (not converted to grain yield).

Table 106: Yield of Barley at 'Weering' 2003

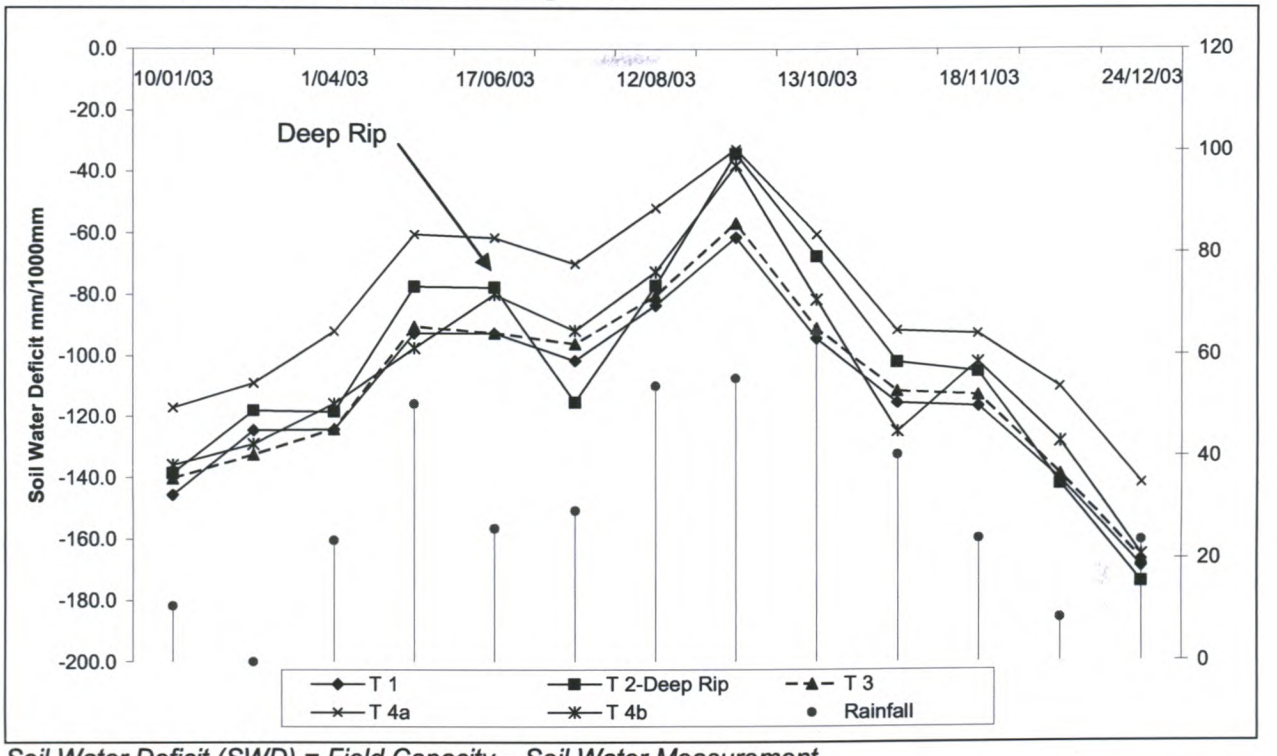
Treatment	Yield (t/ha)	Dry Matter (t/ha)
1. Direct Drill	6.43	16.96
2. Deep Rip	6.50	16.20
3. Direct Drill	6.47	18.45
4(a) Direct Drill	6.35	19.24
4(b) Direct Drill	6.16	18.02
LSD 5%	1.40	5.43

Yield response was fairly similar across all of the treatments with no significant differences between any of the treatments. It is interesting to compare treatment 1, direct drill for three years, with treatment 2, which has received continual cultivation. These two treatments were nearly identical in their yield response and dry matter weights. All of the treatments that were deep ripped in 2001 (3, 4a and 4b) had the greatest, though not significant, dry matter weight but failed to convert this to grain weight.

Soil Water

Figure 19 shows the soil water deficit, of the profile to 100 cm, in 2003.

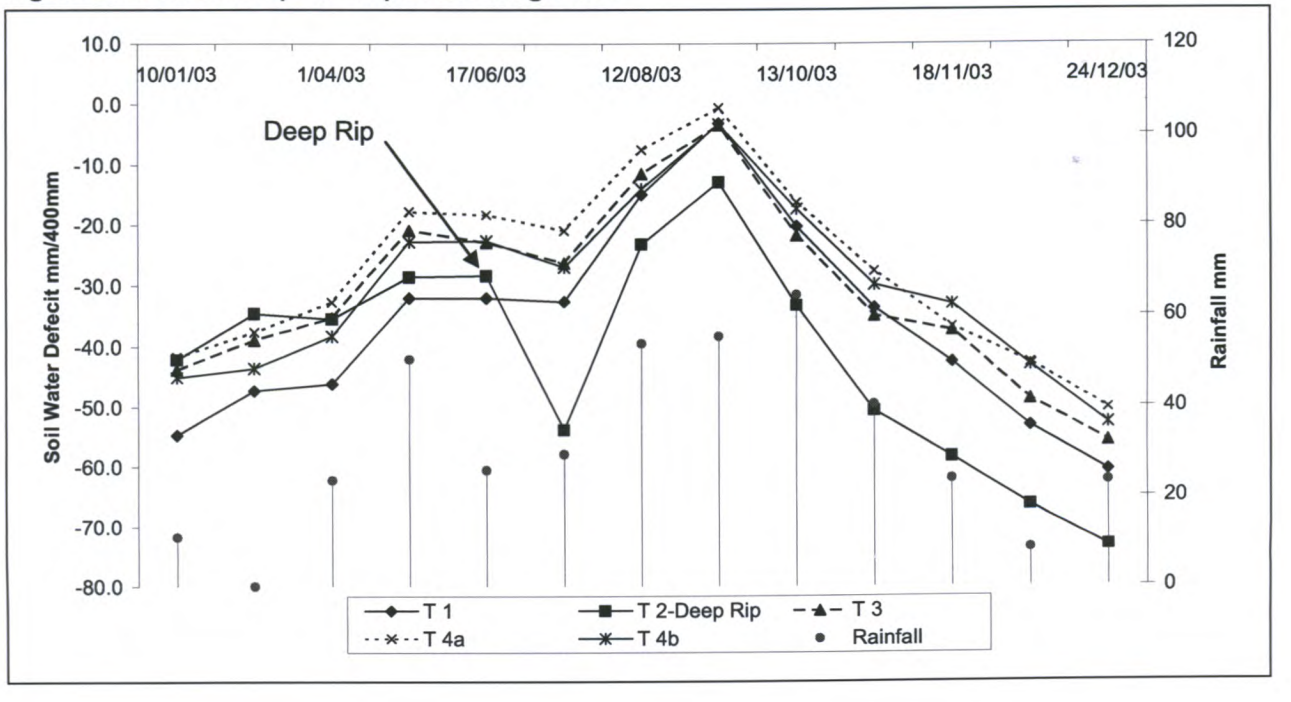
Figure 19: Soil Water (0-100 cm) at 'Weering' 2003



Soil Water Deficit (SWD) = Field Capacity – Soil Water Measurement

The soil water chart indicates a sharp decline in the soil water in the plots that were deep ripped in late June. This decline is highlighted in the soil water chart for 0-40 cm depth. It also shows that at this depth the soil water never reached the high point of the other treatments.

Figure 20: Soil Water (0-40 cm) at 'Weering' 2003



Total Water Use

Table 107 shows the total water use in all of the treatments. The water use is expressed as the ET_{Total} which is equal to rainfall less soil water. This shows that by deep ripping there was approximately 5% more water apparently used for grain production.

This extra water use was for neither grain nor dry matter production. It would appear to be soil evaporation losses after the deep ripping operation (see ET daily use).

Table 107: Soil Water Balance 'Weering' 2003

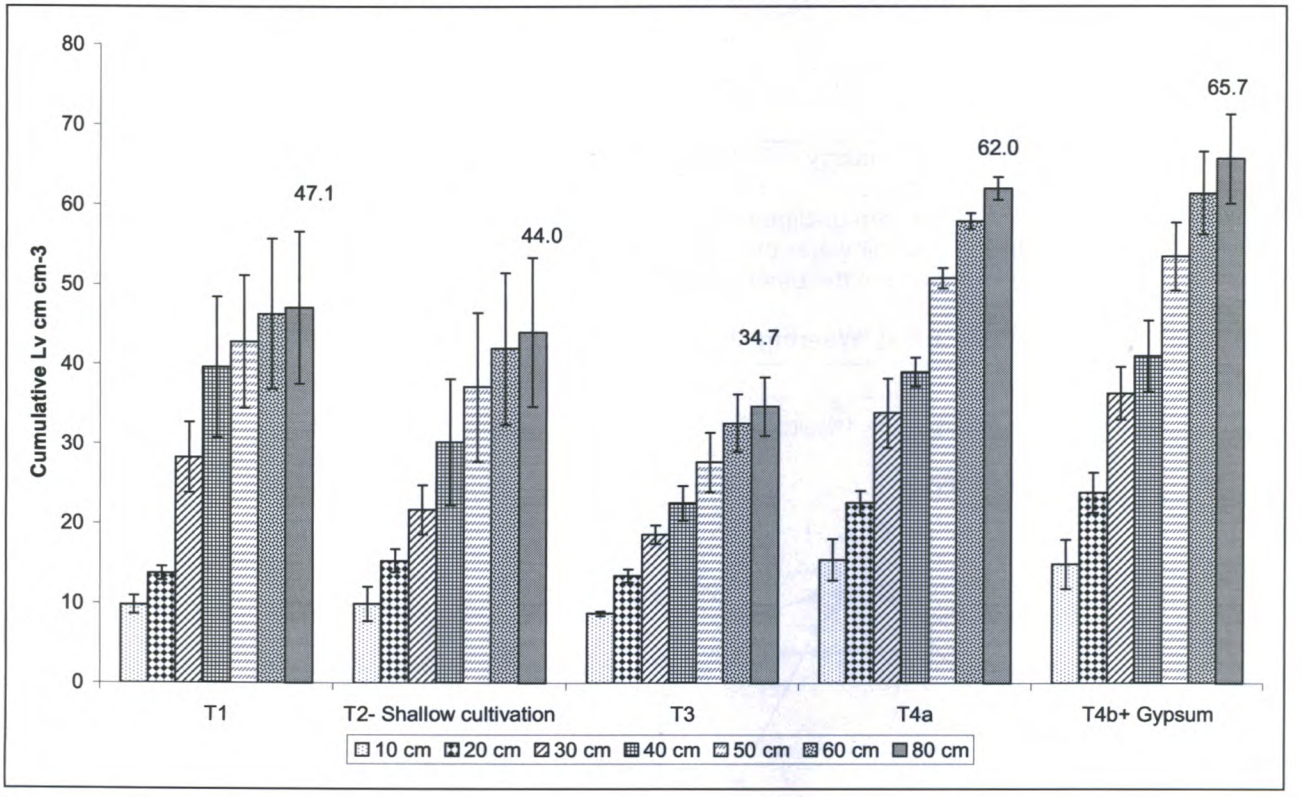
Treatment	T 1	T 2- Deep Rip	T 3	T 4a	T 4b
ET_{Total}	402.4	422.7	402.5	407.5	394.0

Root Length Density for the 'Weering' wheat crop 2002

Figure 21 shows the root length density for the wheat crop at Weering in 2002. There was a significant difference ($p<0.01$) between the density for both the deep rip and gypsum treatments (T4a and T4b) and the other treatments at the 20 cm depth.

In addition T4b was significantly different ($p<0.05$) to Deep rip (T3) at the 30 and 80 cm levels. It appears that the use of gypsum has a positive benefit when using deep ripping. There is a penalty for deep rip without gypsum addition, as T3 had the lowest root density.

Figure 21: Cumulative Root Length Densities, Lv, for Wheat Crop 'Weering' 2002



Site 2, Gnarwarre, the eastern end of the Wilson block at the SFS site.

Table 108: Summary of Treatments at Gnarwarre and Gnarwarre Rainfall 2003

Year	Treatment No	Treatment Description
2002	1	Shallow Cultivation (20 cm)
	2	Shallow Cultivation (20 cm)
	3	Deep Rip (40 cm)
	4	Deep Rip (40 cm) + Gypsum (5 t/ha)
2003	1	Direct Drill
	2	Shallow Cultivation (20 cm)
	3	Direct Drill
	4(a)	Direct Drill
	4(b)	Deep Rip + Gypsum (2.5 t/ha)

Month	mm
April	47.5
May	14.5
June	20.0
July	65.0
August	71.3
September	45.5
October	108.0
November	16.0
Total	387.8

Long Term Average (Geelong)
April – November: 383 mm

Table 109: Agronomic details at Gnarwarre 2003

Year 2003	Gnarwarre
Planting Date	28/05/03
Variety	Grace Canola
Sowing Rate	5 kg/ha
Fertiliser	MAP 100 kg/ha, Urea 108 kg/ha 9/09/03
Herbicide	Gesarin 1.7L/ha Gesatop 1.7L/ha Telstar 125 mL/ha 2/06/03, Select 250 mL/ha 1/09/03.
Harvest Date	4/12/03

Table 110: Harvest Yield of Canola at Gnarwarre 2003

	Treatment	Yield t/ha	Harvest Index
1	Direct Drill	3.05	0.41
2	Shallow Cultivation	2.16	0.37
3	Direct Drill	2.20	0.48
4a	Direct Drill	2.37	0.42
4b	Deep Rip + Gypsum	2.06	0.41
LSD 5%		**1.01**	**0.17**

The highest yield was achieved by the direct drill treatment which was only slightly less than significantly different (at 5% level) than the deep rip and gypsum plots. There was no advantage in cultivation, with the lowest yield (T4b deep rip and gypsum) and lowest harvest index (T2 shallow cultivation).

Figure 22: Harvest Yield of Canola at Gnarwarre 2003

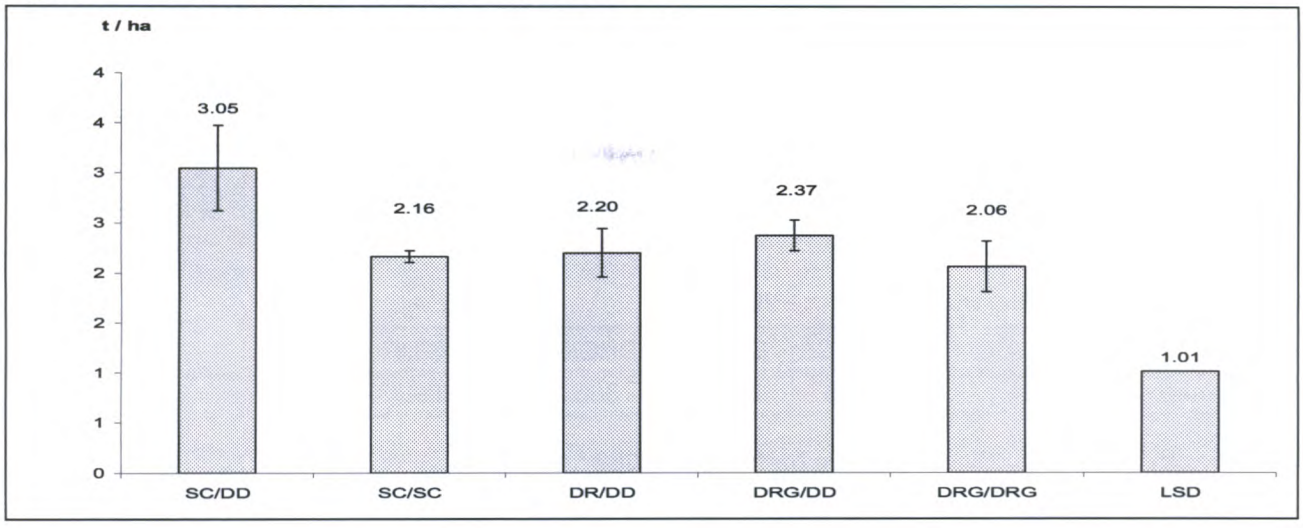
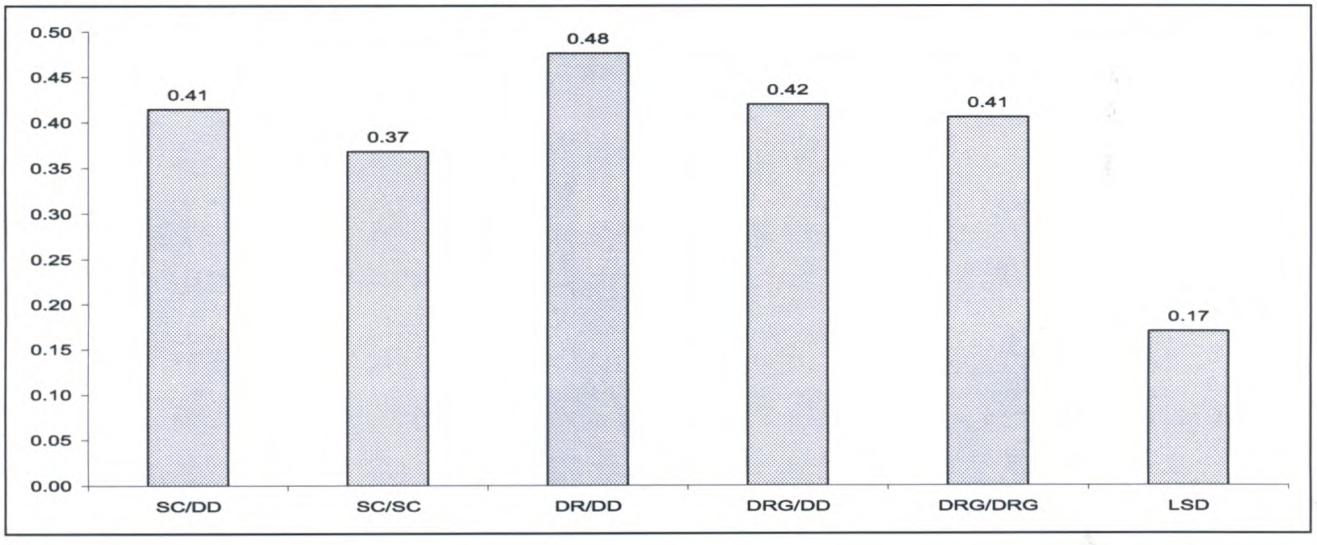


Figure 23: Harvest Index at Gnarwarre 2003



Soil Water

Soil water measurements were taken from every plot with a neutron probe.

Figure 24: Soil Water (0-60 cm) at Gnarwarre 2003

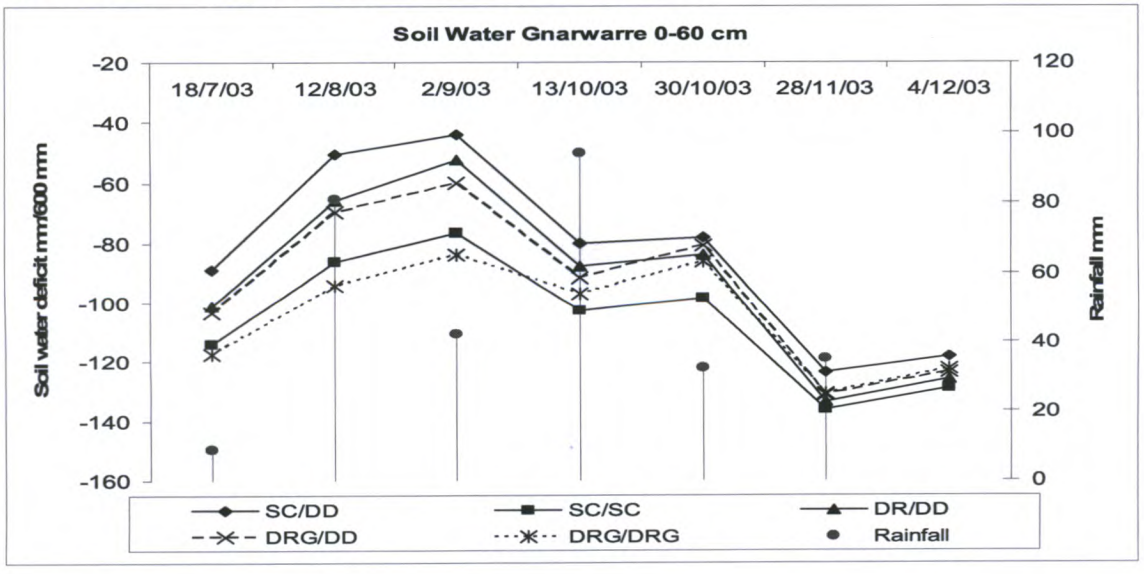


Figure 24 shows the soil water for all treatments. Measurements commenced after sowing took place, hence the cultivated plots show the lowest soil water at the beginning of the chart. The direct drill had the greatest soil water in the profile throughout the season, and also used the greatest amount of soil water through the season (Table 111).

Direct drill appeared to conserve the soil water and have more plant available water for use by the crop resulting in the highest grain yield. Table 111 shows that the SC/DD treatment had the greatest soil water use, while the cultivated treatments, SC/SC and DRG/DRG had the least water use. There appears to be no distinct advantage in the use of gypsum at the Gnarwarre site.

Table 111: Soil Water Balance Gnarwarre 2003

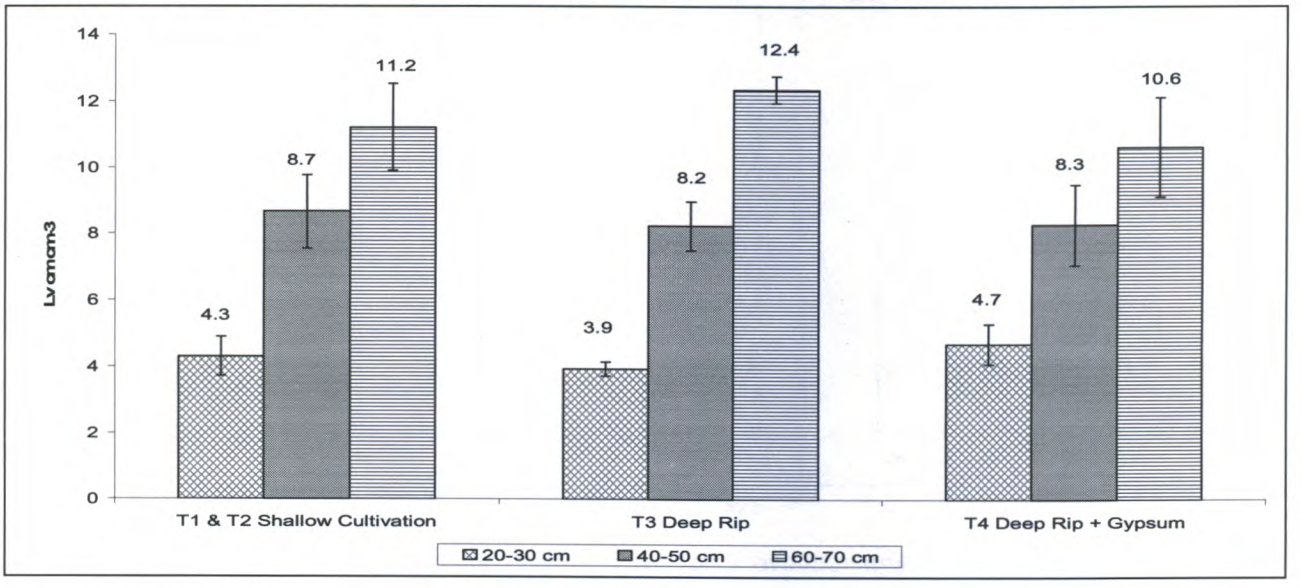
Treatment	SC/DD	SC/SC	DR/DD	DRG/DD	DRG/DRG
ET_{Total} (mm)	314.5	299.8	309.7	305.1	289.7

Root Length Density for the Gnarwarre barley crop 2002

Figure 25 shows the root length density of the crop at Gnarwarre in 2002. There were no significant interactions at all depths.

It should be noted that all of the plots received cultivation in 2002.

Figure 25: Cumulative Root Length Densities, Lv, of Barley Crop at Gnarwarre in 2002



Conclusion:

The use of cultivation, whether deep or shallow, in 2003, shows no advantage in increasing the grain yield. In fact there may be a penalty in the loss of soil water, particularly at the surface, if the cultivation is performed in a dry autumn, as was the case in 2003. This drying surface soil is critical to rapid and thorough germination. The depleted surface soil water at Gnarwarre contributed to very sporadic emergence of the canola.

Thus timing of cultivation with rainfall is critical, so as not to deplete soil water, or otherwise to allow rapid replenishment.

Root density measurements at Cressy indicated that the use of deep ripping should be used with the addition of gypsum in the sodic soils typical of the high rainfall cropping zone.