

A Sustainable Dryland Community Achieved Through Proactive Research on Effective Management of the Soil Resource (Liebe Group Soil Health Project)

Aim: To establish if the current wheat yield could reach potential yield by extra N fertilisation and to identify potential constraints of 8 Satellite Sites throughout the Liebe area

Research Officer: David Scholz
Company: Liebe Group

Farmer: Paul Sutherland
Location: Dalwallinu



Background: Eight Satellite Sites were established in 2003 for the Liebe Soil Health Project. The focus for the trials and information from the Soil Health Project so that it is applicable to the Coorow, Dalwallinu and Perenjori Shires. These sites were chosen mostly as the poorer yielding paddocks, or areas of paddocks, of the Satellite Site farmers. Soil type, farmer management and rainfall of these sites are quite variable. The objective of these trials was to a) firstly determine if nitrogen is limiting yield and b) identify potential constraints to yield within the soil resource. If nitrogen is limiting yield that must first be addressed. Trials and demonstrations will be developed in consultation with researchers and Satellite farmers to ameliorate primary soil constraints to yield.

Trial Details:

Plot size and replication	10 x 10 m * 3 replicates. Randomised block design
Soil type	Sand over clay to loamy clay
Sowing date	28 th May 2003
Conditions at sowing	Moist
Machinery	Bourgalt
Seeding rate	50 kg/ha of Calingiri
Fertiliser	
Treatment 1: Basal fertiliser	60 kg/ha DAP (all plots –farmer applied); 60 kg/ha Urea (all plots – farmer applied)
Treatment 2: Basal plus additional N fertiliser	As above, plus additional N – topdressed as Urea @ 55kg Urea (– DS applied on 24 th July)
Herbicides and Insecticides	Glyphosate 1.2 L/ha, Treflan 1.0 L/ha, Diuron 350 mL/ha, MCPA 450 mL/ha
Paddock History	2002 = Wheat, 2001 = Wheat, 2000 = Lupins

Results:

Paul Sutherland's site was the highest yielding of all the Satellite Sites. It benefited from an extremely wet August in which 93.5 mm fell. Yield was 4.03 tonne (Table 1) for the control and extra N (plus N treatment) did not make a significant difference. Hand harvest measurements so tend to give higher yields than expected therefore be wary of these yields.

Protein was not significantly affected by extra fertiliser nor was harvest index. The harvest index was low for both treatments, indicating low efficiency of the conversion of biomass resources into grain.

Table 1: Grain yield, protein and harvest index for the plus N treatment and basal treatments. The plus N treatment treatment was the topdressing of 55 kg/ha urea 24th July.

Treatment	Grain Yield (t/ha)	Protein (%)	Harvest Index (%)
basal	4.03	10.43	38.61
plus N	3.92	11.57	34.43
LSD (5%)	n.s	n.s.	n.s

Potential yield, as defined by French and Schultz, has been exceeded for this site (Table 2). This takes into account the water that the crop used (growing season rainfall – evaporation) multiplied by an expected water use efficiency of 20 kg/ha/mm. The water use efficiency in this case is 26.96 kg/ha/mm, hence the higher yield.

Table 2: Actual yield vs. potential yield and water use efficiency based on growing season rainfall (French-Schultz equation).

Rainfall (mm, 28th March - 30th October)	Site Yield (t/ha)	Potential Yield (t/ha)	Water Use Efficiency (kg/ha/mm)
259.5	4.03	2.99	26.96

The addition of N fertiliser (plus N treatment) did not significantly affect plant biomass, the N in the plant or N uptake at anthesis (Table 3). However, compared to the other Satellite Sites, the amount of N taken into the plant was high. Comparing the high %N uptake with the harvest index (Table 1) indicates that an excess of N is probably the cause of the low harvest indices. The plants produced large amounts of biomass (Table 3), which took up a large amount of nitrogen.

Table 3: Biomass and Nitrogen content of the leaf and stem at anthesis, total N in topsoil (soil N measured at seeding + applied N in top 10 cm), the N translocated into the plant at anthesis and the %N taken into the plant.

Treatment	Biomass at anthesis (t/ha)	%N at anthesis	Total N in top 0-10cm (kg/ha)	N in biomass at anthesis (kg/ha)	%N uptake
basal	7.04	0.99	83.31	69.08	82.91
plus N	7.31	1.12	108.38	85.78	79.15
LSD (5%)	n.s.	n.s.		n.s.	n.s.

The moisture down the profile shows that there is excess moisture below depth of 60 cm (Figure 1). The top 10 cm was the only zone significantly dried out. Roots were found the whole way down the profile, even down to 120 cm. This shows that the roots are not accessing the moisture efficiently.

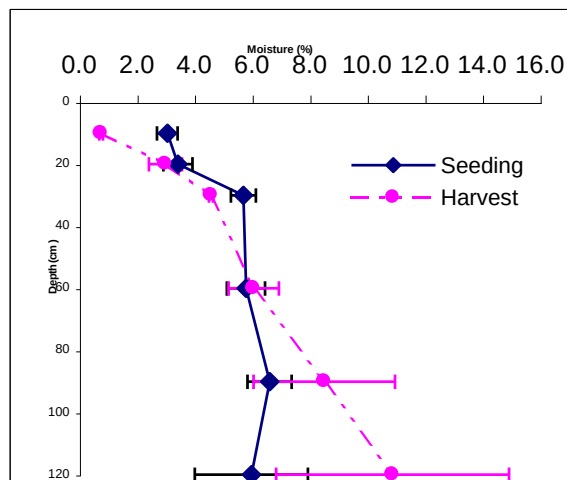


Figure 1: Gravimetric moisture content (%) of Soil measured to depth.

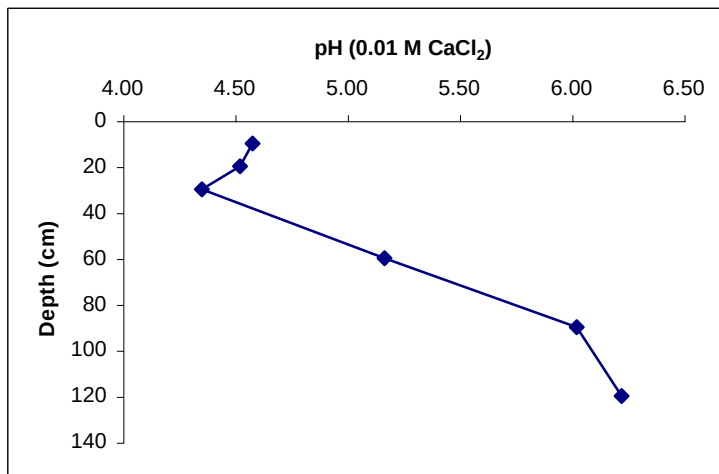


Figure 2: pH, measured in calcium chloride, down to depth.

The pH in the 20-30 cm zone is 4.35 indicating that acidity may be a problem within this root zone, but not through the whole soil profile.

Summary:

- This was the highest yielding Satellite Site with the basal treatment (the farmer's fertiliser regime) yielding 4.03 t/ha. Adding extra N didn't significantly affect yield. N was probably in excess causing a low harvest index.

- Potential yield was reached, however from the excess moisture in the profile at harvest and the low harvest indices it seems that this crop could have yielded higher.
- PH may be a constraint at depth 20 – 30cm.
- Trials in 2004 will aim to achieve this.