# 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

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**Company:** Liebe Group

**Farmer:** Colin McGregor
**Location:** East Maya

**Background:** Eight Satellite Sites were established in 2003 for the Liebe Soil Health Project. The focus for these sites is to spread the trials and information 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 | Deep acidic sand |
| Sowing date | 26th May 2003 |
| Conditions at sowing | Moist |
| Machinery | Concord bar |
| Seeding rate | 50 kg/ha of Arrino |
| Fertiliser<br>Treatment 1: Basal fertiliser<br><br><br>Treatment 2: Basal plus additional N fertiliser | <br>67 kg/ha DAP (all plots –farmer applied)<br>33 kg/ha Urea (all plots – farmer applied)<br><br>As above, plus additional N = topdressed as Urea at a rate of 55 kg/ha (DS applied on 24th July 2003) |
| Herbicides and Insecticides | 0.7 L/ha Roundup, 0.3 L/ha Ester & 1.5 L/ha Treflan, 0.5 L/ha Real |
| Paddock History | 2002 = Pasture, 2001 = Pasture. |

**Results:**
This site was also used for a fertiliser trial using Colin's machine (see pg 72), hence the basal fertiliser was 100 kg/ha of a 2/3 DAP: 1/3 urea mix. Colin only used 75 kg/ha for the rest of the paddock.
The basal yield was 75% of potential yield (Table 1). Rainfall was relatively low (225 mm) compared with the other Satellite Sites.

**Table 1:** Actual yield vs. potential yield and water use efficiency based on growing season rainfall (French-Schultz equation).

| Rainfall (mm, 28th March - 30th October) | Basal Yield (T/ha) | Potential Yield (T/ha) | Water Use Efficiency (kg/ha/mm) |
|---|---|---|---|
| 225 | 1.70 | 2.26 | 15.04 |

The plus N treatment did not significantly increase yield for this site, nor did it significantly increase protein or the harvest index (Table 2). Therefore the N is not limiting yield in this season for this site.

**Table 2:** Grain yield, protein and harvest index for the plus N fertiliser and basal fertiliser treatments. The plus N fertiliser treatment was the topdressing of 55 kg/ha urea 24th July.

| Treatment | Grain Yield (t/ha) | Protein (%) | Harvest Index (%) |
|---|---|---|---|
| basal | 1.81 | 12.90 | 41.38 |
| plus N | 1.70 | 14.70 | 38.29 |
| **LSD (5%)** | n.s | n.s. | n.s |

There is a large amount of N in the profile for the plant to access. Table 3 shows a very high level of N in the top 0-10cm of soil for both treatments. The plus N treatment did not significantly increase the N taken into the plant or the biomass. % N uptake was not significantly different with the plus N treatment and was quite low compared to the other satellite sites, again indicating that N is not limiting the plant.

***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 0-10cm (kg/ha) | N in biomass at anthesis (kg/ha) | %N uptake |
|---|---|---|---|---|---|
| basal | 1.89 | 1.82 | 121.87 | 34.09 | 27.97 |
| plus N | 1.93 | 1.97 | 146.94 | 37.57 | 25.57 |
| **LSD (5%)** | n.s | n.s. | | n.s. | n.s |

The gravimetric moisture content of the soil (Figure 1) showed a dry profile at harvest time down to 30 cm, however moisture was in excess below 60 cm in the profile. Root matter was observed from the 30-60 cm zone at harvest time. After this depth, moisture content increased indicating that the plant is not efficiently removing resources from below 60cm. This moisture could benefit the plant yield especially if it is accessed during grain filling.

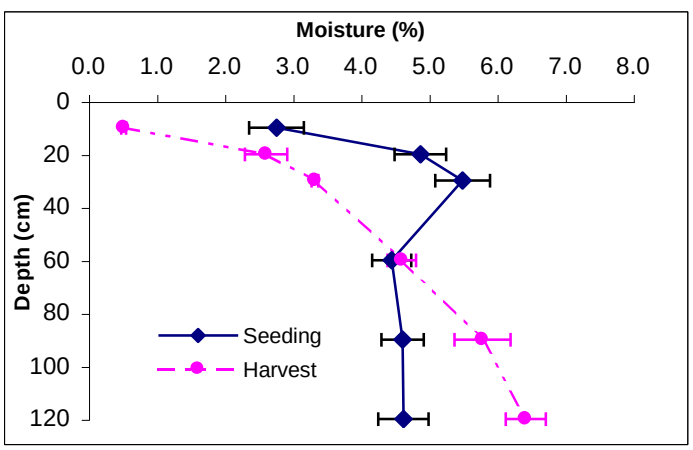


**Figure 1:** Gravimetric moisture content (%) measured to depth

The pH is adequate at the surface (4.90), but decreases rapidly to be 3.96 at 10-20 cm and 3.77 at 20-30 cm. There is a consistent decline down to 120 cm where the pH is 3.70 (severely acidic). Below 10 cm, this soil would most likely be subject to aluminium deficiency and nutrient deficiencies. This would be a major constraint to root growth. The plant would not be able to access the moisture efficiently in a severely acidic environment if at all. This is the most acidic subsoil of the satellite sites.

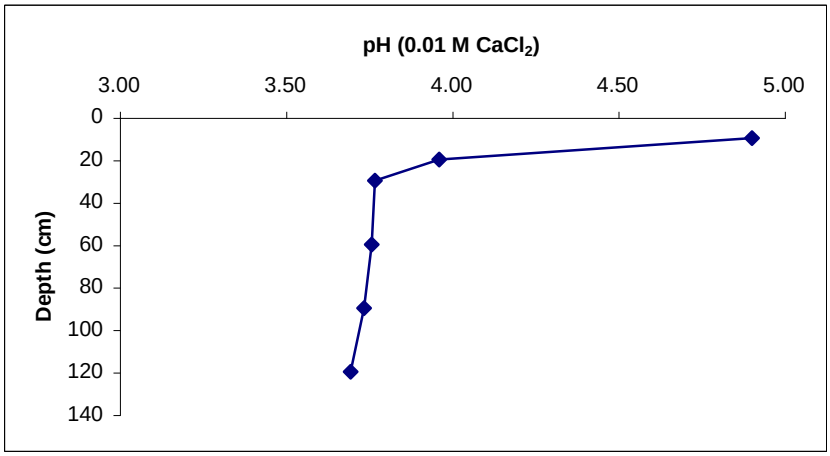


**Figure 2:** Soil pH, in calcium chloride, measured down to depth 120cm

**Summary:**

- Basal yield reached 75% of potential yield at this site.
- The plus N treatment did not significantly affect yield, and N was not a limiting factor.
- Moisture was in excess below 60 cm soil depth.
- Severe acidity is most likely a primary constraint to root penetration and therefore, wheat yield.
- Trials will continue to ameliorate this constraint in 2004 and 2005.