

# Optimising fertiliser inputs by soil type: a preliminary trial at Karoonda

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Karoonda SA MSF Site

## Key messages:

- P increased wheat yields but higher N only increased grain protein
- A split higher N application with low N at seeding produced the same yields as all N upfront
- Yields between zones varied by over 100%

## Aims:

- To investigate the response of wheat to different fertiliser rates and split applications across potential paddock zones.
- To collect preliminary soil and yield response data as part of a suite of trials and analyses aimed at identifying strategies to improve water use efficiency on Mallee soils.

## Background:

This preliminary trial at the new Karoonda MSF site was established to investigate the growth and response of wheat across different paddock zones, from a heavy flat (high EM) up a slope to a sandy rise (low EM). Later analysis and future trials will incorporate a range of spatial soil characteristics. It was envisaged that this trial could provide valuable information on crop response to inputs at this new site and aid in future treatment selections for the main Water Use Efficiency (WUE) trials to be established in future seasons. The data will also to be used for calibrating and validating crop models so that the crop response and risk across a long-term range of season-types can be evaluated.

## About the trial:

The trial was located at the Karoonda MSF site and was comprised of three sub trials located on the flat, mid-slope and sand dune. Each sub trial consisted of four treatments x three replicates in a randomized block design. Trial plots were 40 m in length and sown to Wheat var. Axe on 12 June 2009 at 70 kg/ha using narrow points and press wheels at 23 cm spacings. Urea or Triphos was sown below the seed and DAP with the seed for appropriate treatments. Treatments are summarised in Table 1. At harvest each trial was further split into 20 m sections to enable more detailed analysis of crop responses to location in the landscape. Starting mineral N levels on sand, midslope and flats were 40, 65 and >100 kg/ha (0-100 cm) respectively. Starting Colwell P levels on sand, midslope and flats were 25, 30 and 40 mg/kg (0-10 cm) respectively. Growing season rainfall at the site was 224 mm (Decile 5).

**Table 1.** Treatment details 2009

Treatments	Fertiliser	N kg/ha	P kg/ha
Low input	DAP @ 25 kg/ha	4.5	5
Low at sowing + top dress @ GS31	DAP @ 25 kg/ha + Top dress N @ 50 kg/ha	4.5 + 23	5
All N at sowing	DAP @ 25 kg/ha + Urea 50 kg/ha	27.5	5
High P	DAP @ 25 kg/ha + 50 kg Urea and 72 kg Triphos	27.5	20

**Assessments:**

The collection of data at the trial site included:

- EM 38
- Plant Biomass at anthesis
- Grain Yield and Protein
- Rainfall and Temperature (dune and flat)

**Results:**

The crop established well although some areas of crop on the dune were affected by wind damage early in the season contributing to the relatively low yield in that part of the landscape. Statistically analysing each trial separately, the treatments on the flat and mid-slope areas produced similar yields, all of which were substantially higher than on the sand dune (Table 2). On the sand dune, high P increased yield while the different N additions had no impact (Table 2). There were small differences in grain protein in all sub trials, the greatest differences occurring on the sand dune with increases of around 2% protein with the higher N applications. Whilst yield responses to N were not expected on the flats due to high N in the profile, yield on the dunes will often be limited by N. At this part of the landscape, wind damage and a very dry period during August resulted in the poor yields and consequently no N response. Preliminary spatial analysis of treatment effects incorporating all zones (data not shown) indicated that yield under All N at sowing was higher than Low input and Low at sowing + topdress treatments. High P was also higher than all other low P treatments.

In summary, the preliminary results show a significant protein response on all zones to higher N and a yield response to higher P (with higher N), particularly on the dune zone.

**Table 2.** Yield and grain protein of treatments on the flats, midslope and dune

Zone Treatments	Yield (t/ha)			Protein (%)				
	Flat	Mid	Dune	Flat	Mid	Dune		
Low input	1.56	1.46	0.68 b	15.1 b	13.0 c	12.2 c		
Low at sowing + top dress	1.56	1.46	0.73 b	15.4 a	15.2 a	14.6 a		
All N at sowing	1.63	1.62	0.72 b	15.2 ab	14.4 b	14.0 ab		
High P	1.73	1.70	0.90 a	15.3 a	14.1 b	13.8 b		
<i>significance</i>	<i>ns</i>	<i>P=0.059</i>	<i>ns</i>	<i>P=0.098</i>	<i>P&lt;0.05</i>	<i>P&lt;0.05</i>	<i>P&lt;0.01</i>	<i>P&lt;0.001</i>

Note. The same letter within a column indicates no significant difference between those treatments.

### **Future Directions:**

Variable rate P will be investigated further in future trials. The DGT P test developed by Mason et al. at the University of Adelaide will also be used to investigate whether P fertiliser responsiveness can be predicted on these calcareous soils. Only preliminary zoning has been used here. Future work will aim to better define management zones.

### **Who's Involved:**

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### **For more information, please contact**

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