Impact of soil pH on waterlogging tolerance

Background

Trial work on KI in 2010 showed that liming increased redox potential by increasing soil pH. Redox potential is a measure of the oxidative capacity of the soil. Higher redox potential provides better conditions for plant growth under waterlogged conditions. This is because under waterlogged conditions the availability of oxygen is low and hence the oxidative capacity is low. If lime increases redox potential it could potentially alleviate some of the effects of waterlogging.

What was done

A trial was set up at Mills's 'Cliffords' Block on Birchmore Rd investigating the impact of lime sand application on wheat yield under waterlogged conditions. The site selected was wet and waterlogged for approximately 8 weeks. The area has a 525mm average rainfall, but 675mm was received for 2011. The soil was a fertile duplex lateritic loam over clay with a Colwell P of 54mg/kg, Potassium of 419mg/kg and Sulphur of 21mg/kg. The original soil pH of the trial was an acidic 4.8 in $CaCl_2$.

The trial was a completely randomised blocked design with 4 replicates. This means that each lime treatment appeared 4 times in the trial, once in each of the four blocks. Each plot was 8m long by 3m wide.

Lime was applied at 3 different rates per ha; 2.5t/ha (standard 1 tonne per acre) 5.0t/ha and 7.5t/ha. The lime was evenly broadcast by hand and then lightly incorporated at sowing in an effort to preserve soil structure.

Results

During sowing there was some burst seed across the trial site. This most likely contributed to the variability in the results seen in table 1 below.

TABLE 1: **below shows the yields in t/ha of the different treatments.**

Treatment	**Average yield (t/ha)**
Control	0.99
Lime 2.5t/ha	0.69
Lime 5t	1.13
Lime 7.5t	0.87

Note LSD 95% equals 0.52 t/ha

Due to the high variation and associated standard error the results are not statistically significant. There is too much variation in the above yield results to draw any conclusions from the results.

TABLE 2: **– the effect of Lime sand application rate on soil pH at 0-10cm and 10-20cm depth**

	Soil pH ($CaCl_2$)	
Lime rate (t/ha)	**0-10cm**	**10-20cm**
0	4.8	4.9
2.5	5.0	5.0
5	4.8	4.9
7.5	5.2	5.0

Table 2 above shows the impact of lime sand on soil pH. This data is the average of soil taken from all 4 reps for each lime treatment. It can be seen that there is little difference between the treatments. The raw data shows large variation in the results. This, combined with the small differences between treatments, indicates that there is unlikely to be any significant differences between the lime rates. It is interesting to note that the control (zero lime treatment) has the same pH as the 5t/ha treatment, most likely due to the variability of the results.

The trial has been GPS marked will be monitored to investigate the long term effect of lime on crop yields and soil pH under waterlogged conditions. We anticipate greater increases in pH over time.

Further information contact

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Take home messages

- Results too variable to determine effect of pH/lime on waterlogging
- Trial will be continually monitored with greater changes in pH expected

Sponsors and contributors

- GRDC funding administered by AgKI
- Mills family for providing land and spraying and sowing the trial