Lime, Gypsum and Dolomite for Acid Soils

Aim: Investigate the effects of lime, gypsum and dolomite for wheat and lupin production on an acid soil.

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Background: Various soil amendments have been recommended for acid "Wodjil soils" in the North Eastern wheatbelt. This trial was established in 2003 to examine the benefits of lime, gypsum and dolomite on wheat and triticale production. In that favourable year plant growth and yields were improved by about 8% with applications of gypsum in both species. The trial was continued in 2004 with lupins.

Trial Details:

Plot size and replication	2 x 20m, 3 reps
Sowing	3rd May into dry soil with knifepoints + press wheels.
Seeding rate	100 kg/ha Belara lupins
Herbicides and Insecticides	3rd May; knockdown + 1kg Simazine + 400g Atrazine 22nd July; 300g Fusion
Paddock History	2003 = CSBP trial (wheat and triticale)

Soil Analysis	Description	pH	Salt	OC	N(Nit)	N(Amm)	P	Fe	K	S
0-10cm	Brown yellow sandy loam	4.8	0.065	0.74	5	6	4	618	77	12.2

Trt	**2003 Treatments**
1	Wheat - Nil
2	Wheat - 2 t lime
3	Wheat - 2 t gypsum
4	Wheat - 2 t dolomite
5	Wheat - 2 t lime + 2 t gypsum
6	Wheat - 2 t gypsum + 2 t dolomite
7	Triticale - Nil
8	Triticale - 2 t lime
9	Triticale - 2 t gypsum
10	Triticale - 2 t dolomite
11	Triticale - 2 t lime + 2 t gypsum
12	Triticale - 2 t gypsum + 2 t dolomite

Results:
Soil testing in March 2004 showed significant pH increases in the 0-10cm soil which also penetrated to the 10-20cm soil where lime or dolomite had been applied in the previous year. These pH changes also appeared correlated with increases in exchangeable Ca and Mg, and decreases in extractable Al. Where gypsum had been applied the soils had greater electrical conductivity (>0.2dS/m in the 0-10cm) compared to other treatments (<0.1dS/m in the 0-10cm) throughout the 0-30cm soil profile, especially where gypsum was applied with dolomite. These plots also had higher levels of sulphur.

The trial was sown into a dry topsoil in early May following useful rain in March which had left some moisture at depth. Effective rain fell in the rest of May and plant establishment and early growth were good despite the presence of ryegrass. It was noted in July that growth on the plots treated with gypsum was relatively poor due to poor nodulation and this observation was confirmed with the data from plants sampled in August. While K uptake also appeared to be reduced in these plots, the differences were not statistically significant.

Following below average rainfall in August and September, grain yields at the end of the season varied from 1.0 – 1.3 t/ha. Lupin yields were lowest were gypsum had been applied in the previous year but benefited from the application of lime or dolomite. The greatest yield of 1.46 t/ha was produced with the 1 t/ha gypsum plus 1t/ha dolomite plots on the end of the trial but this data needs to be treated with caution as the plots were not part of the formal trial and were only replicated twice at one high yielding end of the trial. Grain protein averaged about 30% in all treatments. The trial will be sown back to wheat and triticale in 2005.

Table 1: Yield and nutrition information for lupins following wheat, triticale and a range of soil amendments. **Key plant measurements taken on the trial.**

Treatment	Species	12-Aug Plt wt. g	12-Aug N %	12-Aug P %	12-Aug K %	12-Aug K mg/plt	Harvest Yield t/ha
Nil	Wht	5.130	3.767	0.199	1.251	64.257	1.161
2t lime	Wht	5.480	3.690	0.196	1.247	67.995	1.313
2t gyp	Wht	4.250	3.810	0.200	1.310	55.567	0.995
2t dolomite	Wht	5.910	3.723	0.203	1.207	71.377	1.281
2t lime+2t gyp	Wht	4.740	3.900	0.204	1.254	59.403	1.089
2t gyp+2t dolomite	Wht	3.780	4.027	0.211	1.289	48.139	1.052
Nil	Trit	5.017	3.480	0.183	1.227	61.510	1.146
2t lime	Trit	4.890	3.627	0.194	1.284	62.930	1.234
2t gyp	Trit	4.087	3.873	0.219	1.422	58.076	1.042
2t dolomite	Trit	5.047	3.730	0.201	1.242	62.861	1.339
2t lime+2t gyp	Trit	4.403	3.910	0.207	1.231	54.556	1.146
2t gyp+2t dolomite	Trit	3.967	3.840	0.223	1.386	54.749	1.208
0.5t gyp+0.5t dolo	Wht	4.680	4.180	0.196	1.191	55.539	1.328
1t gyp+1t dolomite	Wht	4.800	3.980	0.205	1.316	63.212	1.461
	LSD	1.587	0.2447	0.02092	0.1683	nsd	0.227
	Prob	*0.01*	*0.013*	*0.046*	*0.044*	*0.275*	*0.053*

Summary:

- The application of lime or dolomite increased soil pH significantly and increased exchangeable Ca and Mg, while the application of gypsum increased soil conductivity levels.
- The nodulation of the lupins sown on the gypsum plots was impaired probably because of the high salt levels in the soil.
- Following a drier than average season, lupin yields were lowest were gypsum had been applied in the previous year (1.0 t/ha) but benefited from the application of lime or dolomite (1.3 t/ha).

Technically reviewed by: Eddy Pol, CSBP