Clay application rates and degree of clay incorporation

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Purpose:	To demonstrate what clay rate is required for claying to be successful and to look at how this is affected by the degree of clay incorporation.
Location:	Badgingarra Research Station
Soil Type:	Pale deep sand
Rotation:	Lupins 2008; Oats 200;7 Lupins 2006
GSR:	447 mm (DAFWA BRS weather station)

BACKGROUND SUMMARY

What is the right rate of clay to apply? This continues to be a common question for growers considering claying water repellent sands. A small clay rate demonstration site was established at the Badgingarra Research Station by several growers to look at the impact of various rates of clay ranging from 50-450 t/ha.

TRIAL DESIGN

Clay was applied at rates of 0, 50, 100, 360 and 450 t/ha in strips 60 m long. At one end of these strips the clay was incorporated with two passes of a set of offset discs (shallow incorporation) to a depth of 10-15cm while at the other end (up-slope) the rotary spader (deep incorporation) was used to incorporate the clay to depth of 25-30cm. Each strip was sown to Calingiri wheat with a combine on 28 May 2009 at 90 kg/ha with Agstar Extra at 80 kg/ha.

RESULTS

Table 1. *Analyses of clay rich subsoil spread at Badgingarra Research Station in 2009.*

pH_{Ca}	pH_w	mg/kg				EC	Particle size %		
		K	S	P	B	mS/m	Sand	Silt	Clay
5.8	6.4	54	20	2	1	20	64	5	31

Table 2. *Yield response of Calingiri wheat in 2009 to application of clay rich subsoil spread at various rates in 2009 and incorporated with either offset discs (shallow incorporation) or a rotary spader (deep incorporation).*

Clay rate	Incorporation method			
	Offset discs (2 passes)		Rotary spader (1 pass)	
	% Clay increase in top 10cm*	Grain yield (t/ha)	% Clay increase in top 25cm*	Grain yield (t/ha)
0t clay/ha (cultivation only)	0	2.67	0	3.65
50t clay/ha	1.0	3.15	0.4	3.42
103t clay/ha	2.1	3.09	0.8	3.23
360t clay/ha	7.3	2.74	2.9	3.86
450t clay/ha	9.1	2.81	3.7	4.14

** calculated % clay increase based on measured clay content of spread subsoil of 31%, 5% gravel, estimated bulk density of 1.6 and the rate of clay application and assumes even clay incorporation to a depth of 10 cm for offset discs and 25 cm for the rotary spader.*

Please note: It is not relevant to directly compare between the two incorporation methods because the rotary spaded section of the trial sat higher on the slope in soil which contained more gravel and was a higher yielding soil type while the offset discs section was on poorer yielding pale deep sand soil at the bottom of the slope.

DISCUSSION

- As the clay rate increased with shallow incorporation using offset discs the yield benefit tends to decline (Table 1), with essentially no difference in yields at the two highest rates of 360 and 450 t clay/ha.
- At the higher clay rates, surface crusting of the clay was clearly visible where the clay had been only partially incorporated with offset discs. Had the clay been evenly incorporated through the top 10cm of soil with the offset discs 450 t/ha clay would have increased the clay content of the topsoil to >10% sufficient to cause problems with surface crusting (Table 1). High clay contents at the soil surface due to shallow incorporation can result in more water being held at the surface resulting in higher evaporation losses and clay may absorb much of water from small rainfall events leaving little water for uptake by crop roots.
- The yield trend with clay rate is reversed for the spader however which incorporates more thoroughly to depth with yields tending to increase with clay rate (Table 1).
- With deep incorporation using the spader it is likely that the low rates the clay are so diluted through the top 30cm that it is ineffective but at higher rates the deeper incorporation of clay through more of the soil is an advantage.
- Trial confirms expectation that the degree of incorporation needs to be commensurate with the rate of clay applied - determining this relationship based on the clay content of the subsoil being spread and the level of incorporation to be used is likely to be the key to more reliable claying success. Subsoils used for clay spreading should be analysed for clay content, % gravel, pH and nutrient content prior to spreading and the rate applied sufficient to increase the clay content of the non-wetting topsoil to 3-6%.

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