Effect of Stubble Height on Crop Growth

Aim: To check whether higher stubble affected crop growth.

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Location: Maya-Coorow Rd, Maya

Background: This was one grower site for 3 yr (2003-2005) GRDC project WAN00003 **"**Developing Innovative and Sustainable High Residue No-Till Farming Systems". Residue was cut at three heights by the grower with his harvester at 2003 harvest and sown to lupins with his seeder in 2004.

Cutting stubble low to enable the seeder to get through it has a cost in harvester hours and a greater proportion of the straw to be spread, an operation that tends to concentrate material to the swath centre. More recently built seeders have a greater capacity to sow through higher stubble loads compared to older machines but this advantage may not be realised. Crops may respond positively (eg, greater lower pod height from tall residue, better mulching from low residue) or negatively (greater N lockup from low cut residue, but this is not a factor with lupins) to straw cut height.

A group of paticipating growers was formed in 2003 and at a meeting in October that year, agreed to conduct this trial on their properties. Of a group of 25, 21 managed to do this, four sites being sown to lupins. The amount of information collected varied from site to site, depending on site eveness and the differences that became apparent. This site was generally a good one (in being even) but yield data was not taken.

Trial Details:

Plot size and replication	5 plots @ 2 seeder widths: medium height, high, medium, low, medium.
Soil type	Yellow sandplain
Sowing date	10th May
Conditions at sowing	Moist
Machinery	DBS bar and John Deere box, DBS points Number of rows: 48
Seeding rate	45 kg/ha Belara
Fertiliser	45 kg/ha Summit 'Legume' mix
Herbicides and Insecticides	500mL roundup PSPE, 1 L/ha simazine + 50 mL/ha PSPE, grass selective was Fusion at label rates, crop top with 800 mL/ha of paraquat
Paddock History	2003 = wheat, 2002 = BM lupins, 2001= barley

Results:

Plant height. Observations on the 16th June suggested that the plants in the high-cut stubble were taller than those in the lower stubble (all rows ran in a N-S direction). This lead to the following actions:

1. The plant population was sampled, one at every second metre down the row (40m = 20 plants). Four rows were sampled for each height, giving 4 replications.
   The height of each plant was measured (the greatest extent of the longest leaf).
2. The samples were bulked up to give the 4 replications of the 3 treatment heights, dried and weighed.

Table 1: Effect of stubble height on lupin growth

Stubble treatment	Stubble height, cm	Plant weight (dry), g	Plant height, cm
Tall	51.9	0.19	17.0
Medium	29.2	0.18	14.8
Short	20.5	0.18	13.4
Mean	-	0.18	15.1
Probability	-	0.61	<.001
l.s.d.	-	0.04	1.0

Temperature. The above results suggested that there was a combination of light (drawing the plants upward, due to partial shading) and higher temperatures (due to greater shelter as this site is rather windswept) causing better growth. Moisture was not likely to have been a limitation at this site at this time. A data-logger and 12 thermocouples were used to measure temperatures, with 3 pairs in short stubble (at 1 cm and 10 cm above ground) and 3 pairs in tall stubble.

The data shows similar mean temperatures from the four positions, but with a greater diurnal range at ground level with the low stubble. Light is more likely to be affecting plant height but no measurements were taken. No data was taken of soil moisture to check the mulching effect but there was a variation in stubble loads across the site that did not show a pattern supporting the idea that mulching was a factor in plant growth.

Plant height and lowest pod height (1st September):

Straw length:	short	medium	tall	Mean	std deviation
Mean plant height (10 plants per sample)	55.5 cm	58.1	61.9	58.5	5.0
Mean lowest pod height	36.2	37.0	45.5	39.6	5.7

Similar results were found at the Lewis site (between Kellerberrin and Bruce Rock), but again, no biomass or yield data was taken. At Fulwood site (North Meenar, near Northam), the lupin crop was sown at right angles to the previous cereal crop and old stubble was rarely close enough to the lupin plants to have any effect on the light getting to the plants. At the fourth site, poor seeder performance, with excessive clumping, over-rode any other factors.

Once the lowest flower/pod height is above the stubble height, there seems to be no effect from the stubble on this.

Summary:

- Stubble height would appear to have a statistically significant effect on early lupin plant height.
- This effect, although trending towards a higher lower pod height on those plants, is not statistically significant in this trial (possibly due to the small sample taken).
- This trial had insufficient measurements taken to determine the mechanism that caused the plants growing in tall residue to grow taller and have a higher first pod, and whether that led to an increase in yield.

Technically reviewed by: Dr Bill Bowden, DAWA, Northam