TRIAL SUMMARIES

Lentils

L1. Lentil Sowing Time x Stubble Management, Mid North (Pinery), South Australia 2010--2012

This report was published in the Southern Pulse Agronomy Research Snapshot 2012 and the Crop Science Society Newsletter published in May 2012. It includes the results from 2012 summarised along with the key findings from similar experiments held in 2010 and 2011.

Aim

To maximise yield of new lentil varieties through the identification of optimum sowing dates and stubble management strategies.

Treatments

Varieties:	8 varieties per season including Boomer, Nipper, Nugget, PBA Blitz and PBA Flash
Sowing dates:	Break of season, and 2-3 weekly intervals thereafter
Stubble:	1.8-2.2t/ha of barley or wheat stubble (30-35cm standing height)
Treatments:	Removed - cut at ground height and raked bare just prior to sowing
	Slashed - cut at ground height to leave 20-30cm length straw
	Standing - 30cm high
Fertiliser:	MAP + Zn @ 75kg/ha

Background

The benefits of early sowing and stubble retention have been widely discussed in seasons and environments characterised by low growing season rainfall, and/or short, sharp finishes. However the importance of sowing time and stubble retention in relation to increased grain yield has been less evident in recent favourable growing seasons. However this research shows that retained stubble can be important in lentil under both favourable and less favourable growing season conditions.

Lentil sowing date by stubble management trials were set up between 2010 and 2012 in the Mallala district of the lower Mid North of SA in response to poor crop yields in previous low rainfall seasons. The trials aimed to determine whether yield of lentils could be improved by sowing inter-row into standing stubble, compared with retained but slashed stubble or situations where stubble was removed altogether (burnt). Each trial contained eight lentil varieties, three stubble management practices (Removed/burnt stubble, Slashed stubble and Standing stubble) and three sowing dates (break of season and 2-3 weekly intervals thereafter). Stubbles amounts ranged between 1.8-2.2t/ha of barley or wheat stubble, with a 30-35cm standing height.

Summarised Results and Interpretation 2010-2012

- Grain yield – A significant grain yield response was generated from stubble management in each season. Significant two-way (Sowing date x Stubble management and Variety x Stubble management) interactions were generated for yield in 2010, while significant three-way (Sowing date x Variety x Stubble management) responses were generated in 2011 and 2012. A summary of these results is shown in Table 1.

  Results with complex three-way treatment interactions complicate interpretation of the yield data, however trends are apparent across the three years of experiments. Firstly, yields of retained stubble treatments (Slashed and Standing) across all varieties were equal or greater than those from Removed stubble treatments. Secondly, there was generally a greater yield response from the Standing treatment than the Slashed treatment. Thirdly, there was generally a greater yield response from stubble retention at the Late sowing date than the Early or Mid sowing dates. Finally, variety interactions with sowing date and stubble management treatment were apparent but appeared to be seasonally dependent and most significant in 2012 where growing season rainfall was low.

- Varieties: PBA Blitz showed the highest yield response from retained stubble. This may be due to its erect growth habit, which often fails to cover the inter-row soil space with its canopy. It tends to have low amounts of vegetative growth once flowering is initiated unlike other varieties such as Boomer, Nugget or PBA Ace which generally continue to accumulate biomass during flowering and early podding and completely cover the inter-row space. This feature in PBA Blitz may lead to increased soil moisture loss in unprotected (i.e. Removed stubble) treatments and hence a greater benefit is achieved from retaining stubble in this variety. In some seasons, PBA Blitz may also benefit from the delayed maturity which occurs in retained stubble systems by being able to respond to late rains which would normally only be of benefit to later maturing varieties.
  By contrast Boomer showed the least response from stubble management. It is thought that it's higher and more vigorous biomass production allows it to close the inter-row earlier and more regularly than other varieties thus aiding it in conserving moisture, regardless of the presence of stubble. Further to this Boomer is more indeterminate in its flowering pattern than other varieties and often has the latest maturity date of the varieties tested.
- Lodging – A significant stubble treatment response was generated for lodging in two of the three seasons (Table 2). In 2010 lodging increased in standing and slashed stubble treatments compared to the removed stubble treatment. In 2012 lodging was higher in the Slashed stubble treatment compared with the Removed and Standing stubble treatments. There was no significant response in 2011.
- Maturity – A significant stubble treatment response was generated for maturity in all three seasons (Table 3). In all three seasons maturity was delayed in the Standing stubble treatment compared to the Removed treatment, while in two of the three seasons (2010 and 2011) maturity was delayed in the Slashed stubble treatment compared to the Removed treatment. In two of the three seasons (2010 and 2012) maturity was also delayed in the Standing stubble treatment compared to the Slashed stubble treatment.
- Soil moisture – Soil moisture was measured in September in the 2010 trial (data not shown), and Slashed and Standing stubble treatments showed increases in soil moisture by 3 and 12% respectively compared to the Removed treatment. This result was also evident through a delay in plant maturity timing in retained stubble treatments compared to Removed treatments in this year (Table 3).
- Pre-harvest grain loss – trials were scored for shattering and pod loss prior to harvest. Due to timely harvest practice pre-harvest losses were generally minimal, and there were no treatment responses observed.

Table 1: Summary of grain yield improvement (% of Removed stubble yield) from Slashed and Standing stubble treatments compared to the Removed treatment for six varieties and three sowing dates across three seasons in the Mallala region.

Variety	Variety Characteristics	2010		2011		2012	
		Slashed	Standing	Slashed	Standing	Slashed	Standing
Boomer	Late, high EV, high BM, prostrate	0	0	0-16% (M)	0-27% (L)	0-16% (E, L)	0-29% (E, L)
Nipper	Mid-Late, erect, low BM	11	12	0%	0%	0%	13-34% (E, M, **L**)
Nugget	Late, industry standard	17	11	0%	0-21% (M)	0-33% (M)	0-38% (M, **L**)
PBA Blitz	Early, erect, low BM	12	**22**	0%	0-36% (**E**, L)	0-33% (M)	0-28% (E, M)
PBA Bounty	Mid-Late, prostrate	0	11	0%	0-20% (**E, M**)	n/a	n/a
PBA Flash	Early-Mid, erect	9	9	0-34% (M)	0-26% (E, M)	0%	0-30% (E, L)
Average stubble treatment response (all sowing dates and varieties) P<0.05		7	**10**	8	**11**	11	**18**
Season summary		Average start Wet finish		Wet start Average finish		Average start Dry finish	
Site mean yield (t/ha)		3.8		2.0		1.4	

Bracketed treatments denote which sowing date (Early (E), Mid (M) or Late (L)) yielded higher than the Removed stubble treatment.
Bolded treatments denote the sowing date (E, M or L) where the Standing stubble treatment yielded higher than the Slashed stubble treatment.

Table 2: effect of stubble management on lodging (1-9 score) of lentil, Mallala Region 2010-2012.

Stubble treatment	Removed	Slashed	Standing	LSD (P<0.05)
2010	6.1 [a]	5.7 [b]	5.8 [b]	0.30
2011	5.4	5.3	5.5	ns
2012	7.8 [S]	7.3 [T]	7.8 [S]	0.34

Lodging score: 1= prostrate, 9 = erect

Table 3: effect of stubble management on maturity (1-9 score) of lentil, Mallala Region 2010-2012.

Stubble treatment	Removed	Slashed	Standing	LSD (P<0.05)
2010	3.0 [a]	3.22 [b]	3.56 [c]	0.30
2011	3.0 [l]	4.0 [m]	4.0 [m]	ns
2012	5.06 [S]	5.13 [S]	5.75 [T]	0.34

Maturity score: 1 = dead, 9 = healthy

Key Findings and Comments

- Average grain yields across all varieties in retained stubble treatments (Slashed and Standing) were equal or greater than Removed stubble treatments in all years of testing.
- There was generally a greater yield response from the Standing treatment than the Slashed treatment.
- The yield response from stubble retention was generally the greatest at the Late sowing date.
- Several possible reasons may explain why Standing stubbles generated the greatest yield increase:
    - Soil moisture retention: differences in soil moisture were measured in 2010 and evident in the form of delayed maturity in all three seasons.
    - Altering the micro-climate: previous research conducted in Canada has attributed changes in the "microclimate" at the plant level in standing stubble systems to increased soil moisture and subsequent yield. Soil temperature, solar radiation and wind speed

were all reduced in standing stubble systems, which was thought to reduce evapotranspiration during the lifecycle of the crop (Cutforth et al, 2002).
    - Wind protection: protection from buffeting winds afforded by standing stubbles means that plants are able to divert more carbohydrates into the photosynthetic development and flower production, rather than into stem development for wind resistance. The costs of stem development in response to stimuli like wind (a process called thigmomorphogenesis) has been documented in a number of plants (eg Jaffe, 1993; Cipollini, 1999).
- Stubble management has produced a varied response to lodging across seasons. Retained stubble systems consistently showed equal or greater lodging than Removed stubble, likely due to the increased biomass levels that occur in these treatments.
- These results show that stubble management improves yield stability in lentil across seasons varying in rainfall and length. However a larger yield response was observed from retained stubbles in the driest season (2012). The importance of conserving soil moisture, even in favourable seasons, is significant and the advent of modern farming systems such as minimum tillage and GPS guidance will facilitate this practice. However, growers looking to implement this practice should also be aware of the potential negative issues associated with stubble retention in their particular farming system e.g. seed placement, herbicide and pest management issues. Stubble management may also be more important in lentils than in other break crops due to their smaller canopy size.

References

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