How a participatory research approach has improved the viability of lupin crops in Western Australia.

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Abstract

Lupin crops are recognised by growers in the central wheatbelt of Western Australia as having a greater risk of failure than that of their mainstay cereal crops - wheat and barley. In order to minimise the risk of crop failure in lupins growers in the Kellerberrin district tackled a number of crop establishment issues to best ensure crop success in their environment. Developments in tillage technology over the last decade have enabled growers to examine crop row spacing and seeding rate interactions with greater precision. Crop architecture as impacted by seeding rate and row spacing may influence crop performance.

The results of a number of on farm research (OFR) activities conducted by members of the group in 2001 to 2003 are outlined to show how growers best tackled the issue of reducing total crop failure in lupins. These found that where lupin yield potential was lowered, as in the case of a poor season, wider than normal row spacings employed at seeding improve the chances of crop success. Likewise in such an environment growers were able to refine current small scale research developments through OFR to determine the optimum seeding rate of these crops. Results are indicating adopting lower seeding rates than those determined through the intensive research studies of agronomists. The influence of row orientation in lupins is less conclusive in its findings through similar OFR activities and there is an indication that this may be influenced by crop yield potential.

Key Words

Lupins, seeding rate, risky crops, crop establishment, row orientation.

Introduction

The production of lupins in low rainfall environments has been a recent development in the final decades of the twentieth century. While now established, lupin crops are seen by growers as of greater risk for failure than wheat, which underpins broadacre farming in this environment. Lupins are grown as they are seen as important options in crop sequences for the control of disease and weeds.

In order to minimise the risk of crop failure in lupins, growers in the Kellerberrin district investigated crop establishment issues to best insure crop success with lupins. Developments in tillage technology such as the increased use of ‘no till’ and ‘zero til’ have enabled growers to examine crop rowspacing and seeding rates with a greater degree of precision in seed and fertiliser placement and crop orientation effects.

Methods

A series of OFR activities following “Test As You Grow” principles ‘Bulls eye’ level 3 design (Russell, 2001) were implemented during 2001 to 2003 to compare a number of agronomic practices. These included: **1.** Row spacing of a double spacing to their ‘normal’ row spacing of between 22 to 27cm.

2. Seeding rates of 45, 83 and 123 kg/ha were set for three separate runs around the paddock.

3. Crop orientation, set out on three corners of the paddock at 90^0 to each other set away from the paddock headlands. Eleven replicated comparisons were conducted at 2 sites in 2002 and 3 sites in 2003.

Plant density counts were taken and observations of pod density and pod height were also taken in some activities. Grain yield was determined by machine harvesting 3 replicates of each treatment in plots exceeding 100m length. Genstat V5 (1997) was used to conduct general ANOVA and linear regression analysis.

Results and Discussion

Rowspacing

The wider or double row spacing treatment showed a positive benefit to lupin yield (Fig 1). The results show that where yields are lower the response to wide row spacings is even more beneficial to yield giving up to 30% yield increase in 2001. This pattern was also seen in 2003 but not quite to the same extent.

These results suggest that there is an advantage in sowing lupins on wide row spacings and this is more pronounced when seasonal circumstances lead to a low yield potential than if there is a higher yield potential. This is further evidenced by similar work reported in other areas of the state (Crabtree et al, 2002).

Seeding rate

The OFR activity indicated that seeding rates may need to be lowered to achieve optimum plant densities in low rainfall environments (data not presented). Improvements in seeding methods through the adoption of improved tillage equipment have resulted in more plants becoming established due to better seed/soil contact. In normal years, rates of about 80 - 85 kg/ha at wider row spacings rather than the 100 kg/ha as suggested from earlier agronomic studies, 40-45 plants per square meter may suffice where yields of 1 to 1.5 t/ha are likely to occur. Later separate studies to this (French 2006) have concluded there to be no difference in optimum seeding rate between narrow and wide rows.

Orientation

The orientation results are contradictory and may very well reflect paddock and site variability. In five of the eleven comparisons, the N-S orientation had superior yields to the E-W orientation but only one set was significantly ($p<0.05$) greater (Fig 2). Of the six E-W orientations that had greater yields to paired N-S orientations, four of these comparisons showed significantly ($p<0.05$) greater yields to their corresponding N-S orientation.

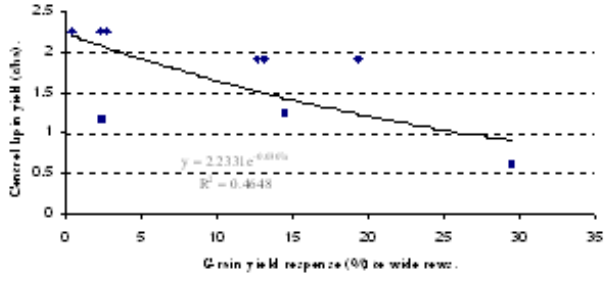

Figure 1. Response of lupin yields to increasing row spacing based on the OFR by growers at Kellerberrin in 2001 (■) and 2003 (♦).

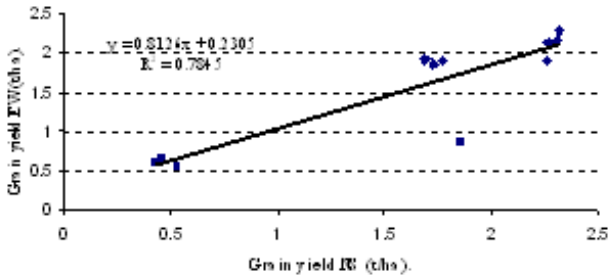

Figure 2. The relationship comparing yields of lupins grown in a NS direction to corresponding lupins grown in an EW direction based on OFR activities in 2002 (■) and 2003 (♦).

Conclusions

The adoption of suitable row spacings and seeding rates for lupins at the beginning of the season now means that there is improved buffering of the crop yield should the season turn out to be drier than expected. In this situation appropriate row spacing and seeding rate gives an improved chance of having a harvestable crop at the end of it. The extension of these results through farmer groups like WANTFA and the agribusiness consultant network has shown that these practices are becoming normal principles in lupin management and have now generated a number of GRDC funded research projects in the last few years. Further investigations are continuing into row orientation as yield potential may be an influencing factor. It may well mean that sowing around the paddock may be the best alternative. In many cases the orientation of tramlines may be dictated greatly by soil type and topography of a paddock.

References

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