PULSES INCREASE PROFITABILITY OF WINTER CROP ROTATIONS IN SOUTHERN NSW

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Abstract

This paper views pulse crops as both cash crops in their own right and as valuable components of winter cropping rotations in southern Australia. Accordingly, their gross margins are based not only on their direct grain returns but also flow-on benefits to following cereals. Using this overall rotation concept, lupin, pea and faba bean become more profitable than continuous wheat production - with or without nitrogen. While these pulses were often less profitable than cereals in their first year, this was more than compensated for by their boost to profit in the following cereal. The results of long-term trials covering 14 years at Wagga showed that on average a lupin/wheat sequence was 197%, 108%, and 20% more profitable than wheat (N0)/wheat (N0), wheat (N100)/wheat (N100) and sub clover/wheat (N0) sequences, respectively. On low fertility soils, sequences using canola, linseed and faba bean as the break-crop were generally less profitable than sequences using lupin or field pea as the break-crop, although these studies were more limited in number.

Key words: Pulses, rotations, economic analysis, profit, gross margins.

Winter pulses (lupin, field pea, faba bean and chickpea) and oilseeds (canola and linseed) have been introduced over the last two decades as 'break crops' in wheat/clover rotations in southern Australia (2). Pulses are strategically introduced after several cereal crops when soil N fertility is low, while oilseeds are usually grown at the end of a pasture phase and prior to the first cereal crop when soil N fertility is high. Besides being cash crops, other major benefits include disrupting disease cycles of cereals, contributing biologically fixed N (pulses), spreading sowing and harvest windows and providing more flexible weed control programs. Ultimately wheat yields increase and the diversity of income widens. While many growers were quick to acknowledge such rotational benefits in their farming systems, they often did not appreciate or found it too difficult to calculate the full financial benefits which incorporated the enhanced productivity of a following cereal. Rather, choice of crop was more focused on comparisons of projected gross margin of individual crops each year, this approach often placing pulses at a disadvantage.? Their adoption therefore has been erratic and slower than originally projected.

This paper adopts the view that pulses are components of a total cropping rotation targeted at stages when soil N fertility is declining. We therefore used two-phase sequences based on field data to calculate their gross margins. In the first phase of these sequences, profitability of cereals, lupins, peas, canola and subclover were compared, and in the second, additional benefits to following wheat added.

Table 1. Gross margins ($/ha/year) for different broadleaf and cereal crops grown in two-phase sequences at four environments in southern NSW.

Sequence		Environment 1 (Eugowra)			Environment 2 (Cowra/Manildra)		
Phase 1	Phase 2	Phase 1	Phase 2	Average	Phase 1	Phase 2	Average
W* (0N)	W (0N)	84	-39	22	271	259	265
W (0N)	W (40N)	84	10	47	271	324	297
W (0N)	W (80N)	84	29	57	271	355	313
L (0N)	W (0N)	77	177	127	211	435	323
P (0N)	W (0N)	20	220	120	279	418	349
F (0N)	W (0N)	33	180	107	164	419	291
		Environment 3 (Wagga)			Environment 4 (Wagga)		
Phase 1	Phase 2	Phase 1	Phase 2	Average	Phase 1	Phase 2	Average
W (0N)	W (0N)	201	61	131	-	-	-
B (0N)	W (0N)	-	-	-	220	139	180
L (0N)	W (0N)	90	375	232	226	575	401
P (0N)	W (0N)	-	-	-	268	474	371
C (50N)	W (50N)	-	-	-	365	404	385
LS (50N)	W (50N)	-	-	-	227	421	324

* W wheat, L lupin, P field pea, F faba bean, B barley, C canola, LS linseed.

Methods and materials

Data was collected from several studies conducted over different time periods and over several locations in southern NSW (1, 3). These together represented four different environments, *viz*: 1 - Eugowra, a high cropping intensity and lower rainfall environment (1983-86); 2 - Cowra/Manildra, a low cropping intensity and higher rainfall environment (1983-85); 3 - Wagga, a high cropping intensity and higher rainfall environment (1983-85); and 4 - Wagga, a high cropping intensity site but at a different period of time (1989-93). Sites were selected in paddocks that had previously supported one or more cereal crops, thus these two-phase sequences commenced at the "N fertility decline" stage of a crop rotation.

In another long-term (1983-96) rotational study at Wagga (5), further economic comparisons were made between wheat (N0)/wheat (N0), wheat (N100)/wheat (N100), lupin (N0)/wheat (N0) and subclover/wheat (N0) sequences which had run continuously for 14 years. Here, each years data was presented as a moving mean (based on three years data using the preceding, present and following year) to minimise seasonal fluctuations. Break-even analysis was also undertaken to compare by how much the price of lupin had to decrease, or the prices of other crops (or stocking rate) had to increase before these rotations become equal to the lupin-wheat sequence (Table 2).

Assumptions under-lying the economic analysis were that experimental data represented commercial situations and the prices and costs used related to the year 1997. Costs are based on the NSW Agriculture farm budgets for southern NSW, but varied according to additional N inputs to the tune of $0.93/kg plus $10/ha for application. On-farm prices per tonne for the commodities were wheat $145, lupin $190, peas $210, canola and linseed $300 and barley $125.

Grazing values of stubbles were also added to the gross margins, based on their estimated carrying capacity in dry sheep equivalents (DSE): canola and linseed (0.2 DSE), wheat 0N (0.3 DSE), wheat 40N (0.4 DSE), wheat 50-100N (0.5 DSE), and lupin, peas, faba bean, and chickpea (1 DSE). In the third study environment (Wagga), subclover pastures were compared with the pulse break crops, assuming a carrying capacity of 10 DSE. Sheep gross margins were $17.62/ DSE, based on merino wethers producing 21 micron wool at a price of 490c/kg greasy equivalent.

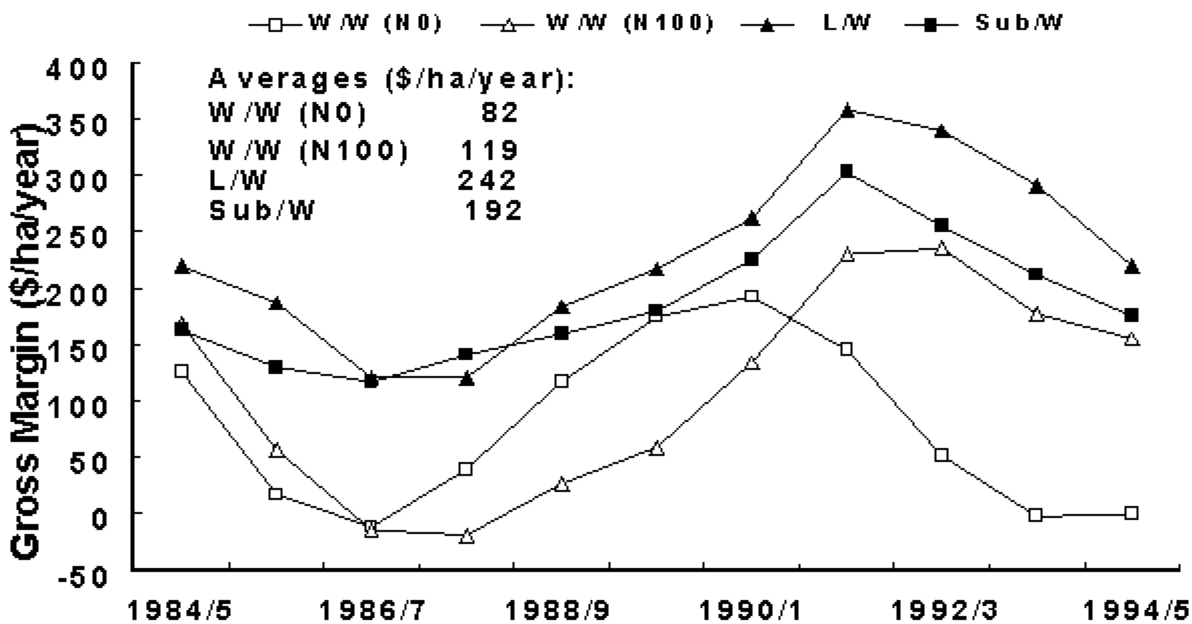

Figure 1

Results and discussion

Incorporating lupin or field pea substantially lifted profitability of the overall rotation when compared to continuous wheat production in all situations, even when liberal amounts of N fertiliser has been targeted to the latter option only (Table 1). These results also confirm farmer findings that in many cases, pulse crops when viewed in isolation are less profitable than cereals. But when viewed as components of an overall rotation, they indeed become more profitable due to the substantial boost in profit of the following wheat crop. The results of long-term trials covering 14 years at Wagga (Fig. 1) also showed that on average a lupin/wheat sequence was 197%, 108%, and 20% more profitable than wheat (N0)/wheat (N0), wheat (N100)/wheat (N100) and subclover/wheat (N0) sequences respectively. Sequences incorporating canola, linseed and faba bean as the break-crop were generally less profitable than using lupin or field pea as the break-crop, although these studies were more limited in number.

Table 2. Break-even prices of other commodities required to equal the profitability of lupin/wheat sequences at Wagga in southern NSW. In option 1, prices of wheat, canola or peas and the stocking rate of sub clover increases. In option 2, prices of lupin decreases.

Sequence	Option 1		Option 2	
	Crop/ Activity	Price* ($/t)/ Stocking Rate	Crop	Price* ($/t)
Environment 3				
Sub Clover/Wheat	DSE	15	Lupin	153
Wheat/Wheat 100 N	Wheat	230	Lupin	86
Environment 4				
Canola/Wheat	Canola	315	Lupin	185
Pea/Wheat	Pea	233	Lupin	165

*For gross margin analysis, a stocking rate of 10 DSE was assumed and prices of $145 for wheat, $190 for lupin, $210 for pea, $300 for canola was used.

In the long-term rotation study at Wagga (5), the lupin/wheat sequence in the vast majority of occasions produced greater gross margins than wheat (N0)/wheat (N0), wheat (N100)/wheat (N100) and subclover/wheat (N0) over the period 1979-95 (Fig. 1). This effect was mostly attributed to enhanced wheat grain yields following lupin (5). While the gross margin analysis showed that lupin and subclover had relatively low cash returns as an opening "break-crop", this was more than compensated for by the substantial effect these legumes had on boosting production in the following wheat crop. Low and sometimes negative gross margins during 1986-88 were associated with low wheat yields due to a build up of the disease eyespot lodging. This was subsequently controlled using foliar applied fungicides. The low returns from wheat/wheat (N0) since 1990 were due to the declining soil N supply.? Other data (4) also shows the acidifying affect of these legumes to be substantially less than that from continually using fertiliser N. This benefit needs to be considered also when analysing long term cropping data.

Break-even analysis (Table 2) suggests stocking rates have to increase by up to 50% or wheat prices by up to 60% for subclover/wheat or wheat/wheat sequences to become equally profitable to lupin/wheat sequences.? On the other hand, canola and pea prices would only have to increase marginally (by 5 and 11%, respectively), or lupin prices decrease marginally (by 3 and 13%, respectively) for a canola/wheat and a pea/wheat sequence to become equally profitable to a lupin/wheat sequence.

Conclusions

When planning crop rotations, farmers need to consider both the projected gross margin of the individual crops as well as their projected benefits to the crops that follow. Gross margins of pulses may not always be as attractive as other options when viewed in isolation, but when account is taken of their benefits to following cereal crops, they do enhance the overall profitability of the rotation. It is logical to place pulses later a crop rotation where soil N levels are low and when other non-leguminous alternatives will require considerable inputs of fertiliser nitrogen.

All pulses in this study enhanced the profitability of rotations by similar magnitudes. Therefore, the ultimate choice of pulse should depend largely on its adaptation to the local environment and on projected marketing advantages over other contenders, and not on any perceived differences in responses in following cereal crops. Fertiliser N is not as profitable an option as the strategic incorporation of pulses into a cereal rotation and can be more environmentally degrading if high rates are continually used.

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