Are Your Crop Rotations Costing You Money?

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Abstract

Crop rotations under irrigation have focused on limiting the impact of weeds and disease on canola. With the development of canola cultivars with a wide range of herbicide tolerances weed control is no longer a major reasonable rotation. Likewise there is chemical control and genetic resistance to blackleg. This trial was established to determine the degree of yield loss which might be expected in a "high risk" crop rotation vs a "low risk" rotation. The "high risk" (canola-pea) rotation has 7-17% lower yields than the "low risk" (wheat-flax- wheat-canola). At current prices, rotations involving wheat have higher returns. However, at higher canola prices or lower wheat prices the high risk rotation could be more profitable. Cropping decisions need to consider all aspects of risk management and the risk to canola yields from "high risk" crop rotations has not been excessive.

Introduction

Crop rotation is a major method by which a producer attempts to limit the negative impact of price, policy and production risks on his bottom line! Price risks are not controllable to any great extent by the producer but careful scrutiny of the market forecasts may indicate that production of a higher priced crop even if this incurs serious production risks. Policy risks are risks such as changes in tax policy, marketing options and costs of shipping. Policy risks indirectly affects price considerations and may act over several cropping periods. Production risks include diseases, insects, weeds and weather. These factors interact and form the backbone of our "rules of thumb" crop rotation recommendations.

There is significant scientific evidence and practical experience indicating that crop rotation can be an effective method of disease, insect and weed management (Bailey and Duzcek 1996, Kaminski 1996). However, long rotations may be required for rotation to significantly impact the diseases such as common root rot in cereals and sclerotinia in canola and pulses. Extremely long rotations are often not economically viable and the idea of a set rotation is something that generally occurs only in research plots. Under irrigated conditions economic considerations may lead us to shorten crop rotations. We initiated work in 1993 in an attempt to evaluate a 2 year rotation of canola-pea with a recommended rotation of wheat-flax-wheat and canola. This paper outlines the results after one cycle of the 4 year rotation.

Materials and methods

This trial compared pea-canola (high risk) under conventional and direct seeding management with a low production risk, four-year rotation (car&-wheat-flax-wheat). The trial was established on land which had not grown canola or other sclerotinia suspectable crop for 7 years. The pea-canola rotation was conducted under direct seeding and conventional tillage systems. The remaining treatments were direct seeded using a seeder with low disturbance openers. All parts of the four-year and two-year rotations were planted each year. Plots were 6.7 m wide and 12.2 m long with a row spacing of 30.5 cm. Seeding dates were May 15, 1995 and May 28, 1996.

Flax straw was removed by baling to allow the seeding equipment to function. Since the combine was not equipped with a straw chopper all plots were mowed and harrow to distributed straw.

Direct seeded plots were treated with Roundup prior to planting. The seeding rates and other management details for 1995 and 1996 are given below:

Table 1. Planting and herbicide information for the crop rotation trial

	Planting details					Herbicide information		
year	Nitrogen (kg/ha)	P_2O_5 (kg/ha)	crop	cultivar	seeds/m^2	Product applied	rate L/ha	date applied
199s	110	35	Canola	Puantun	80	Fusion #1& #2	1.0 0.43	June 21
		3s	Pea	Carneval	80	Sencor	0.43	June 8
	110	3s	Flax	Linola™ 947	500	Fusion #1& #2 Buctril M	1.0 1.0	June 21
	110	3s	Wheat	AC Taber	250	Stampede CM	2.75	June 8
1996	110	3s	Canola	Puantun	12s	Poast	2	June 25
		3s	Pea	Carneval	55	Poast Basagran	2 2.25	June 25 June 26
	110	35	Flax	Linola™ 947	700	Poast& Buctril M	2 1	June 25
	110	35	Wheat	AC Taber	250	Estaprop& Achieve 40 DG	1.75 0.5	June 25

All plots were harvested separately, samples taken for moisture and after determination of dockage, yields were expressed at the dry moisture level for each crop. Analysis of variance is not done since comparisons between crops are of limited value and violate the assumptions of normality.

From 1994 through 1996 soil samples were taken from the top 30 cm of each plot and analysed for nitrate. Twenty cores were taken from each plot and composited prior to analysis.

Results and Discussion

Canola yields following pea were 15-17% lower than following wheat in 1995 and 7- 9% lower in 1996 (Table 2). This reduction in yield occured despite the lack of sclerotinia or blackleg symptoms. The yields of canola are low and reflect the serious concerns about poor yields throughout the province. The levels of scelerotinia and blackleg infection were too low to be accurately rated. This is due to the high levels of resistance in the cultivar beii grown and the lack of inoculum from previous crop residue. The relatively small size of these plots means that spores can move between plots fairly readily. A second limitation of this trial is that there is no history of blackleg or sclerotinia and thus even 4 seasons of sclerotinia suspectible crops may not increased inoculum levels significantly. Future plans are to split each canola plot and apply chemical sclerotinia control measures to determine if yields can be improved when significant symptoms are not observeable.

Tiige method did not affect yields in any season (Table 2). No tillage improves yields mainly when water is conserved and under centre pivot irrigation water should not be limiting except when the potential transpiration load causes the plant to be stress even when the soil is at field capacity. The tillage system has not affected disease levels at this time.

Under the current pricing assumptions the returns to CPS wheat are significantly greater than to canola even when canola is grown in a 4 year rotation (Table 3). There was a drop in net return of $60-$7O/ha when

canola was grown in a 2 year rotation versus a 4 year rotation. This drop is very significant and is even more significant when land costs are included in the costs of production.

Table 2. Yield of crops in traditional and non traditional rotations

Crop sequence				Till age	Yield 94		Yield 95		Yield 96	
93	94	95	96		kg/ha	SE	kg/ha	SE	kg/ha	SE
pea pea	canola canola	pea pea	canola canol a	conv NT	1300 1317	201 169	--		2031	61
									2095	169
wheat	flax	uheat	canola	NT	1458	112	5239	129	2240	73
canola	pea	canola	pea	conv	3262	202	2153	174	2270	169
canola	pea	canola	pea	NT	3244	340	2077	152	1801	223
wheat	canola	uheat	flax	NT	1458	223	4906	584	1998	241
flax	uheat	canola	wheat	NT	5059	166	2524	115	7833	484
canola	wheat	flax	wheat	NT	4700	191	1885	194	5800	769

Table 3. Yield of crops in traditional and non traditional rotations

Crop sequence				Till age	kernel wt		Test wt		Economics			
93	94	95	96		g/1000	SE	kg/hl	SE	Net $ less land	Net $ with land	kg/ha	$ tonne
pea	canola	pea	canola	conv	2.7	0.1	69	2.3	301	-74	2031	370
pea	canola	pea	canola	NT	2.8	0.1	69	0.6	325	-50	2095	370
uheat	flax	wheat	canola	NT	2.9	0.1	69	0.5	379	4	2240	370
canola	pea	canola	pea	conv	168	3.4	a4	0.9	-17	-392	2270	206
canola	pea	canola	pea	NT	173	4.4	a4	0.3	-79	-454	1801	206
wheat	canola	wheat	flax	NT	5.1	0.1			201	-174	1998	326
flax	wheat	cano1a	i	NT	38	0.2	74	2.7	720	345	7833	150
canola	wheat	flax	wheat	NT	38	0.7	74	4	420	45	5800	150

! Returns after variable costs are removed. Assumptions are that variable costs of production are approximately equal at $450/ha and shipping costs have been deducted from prices assuming Outlook as the delivery point. Land costs are assumed to be $375/ha

Soil ntirate levels were extremely variable but levels were high with all treatments (Table 4). There is a trend for the canola-pea rotation to have greater nitrate levels but it is extremely difficult to attribute higher nitrate levels with either rotation or tillage.

Table 4. Effect of crop rotation on nitrate levels in the top 30 cm of the soil

Crop 1995	Crop 1996	tillage system	Soil test nitrate levels fall 1995		Soil test nitrate levels fall 1996	
			Mean	STD	Mean	STD
pea	canola	Notill	107	30	111	63
pea	canola	Conv	102	35	152	68
canola	pea	Notill	99	50	105	22
canola	pea	Conv	70	20	69	18
canola	wheat	Notill	51	11	73	31
wheat	flax	Notill	55	13	84	36
wheat	canola	Notill	45	6	71	39
flax	wheat	Notill	57	33	81	63

Summary

While canola yields declined in a canola-pea rotation, relative to a wheat-flax-wheat-canola rotation, this decline w s not serious enough to eliminate this as a cropping options if prices indicate that a rotation with a “low production risk has a “high price risk”.

References

Bailey, K. And Duczek, 1996. Principles of crop rotation: wheat and barley. Soils and Crops ‘96 p 336-348.

Kaminski, D., 1996. Principles of crop rotation: oilseeds and pulses. Soils and Crops '96 p 349-354.