Crop Rotations To Complement Winter Wheat

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INTRODUCTION

Dryland crop production in Montana is dominated by a winter wheat – fallow crop sequence due in large part to limited annual precipitation that ranges from 250 to 400 mm. The majority of these 830 thousand hectares are annually established under no-tillage conditions. It is likely that increased diversity in crop selection could improve crop management aspects such as weed control, and water and nutrient use efficiency. Improved conditions could lead to better economic return. Increased acreage of pulse crops such as dry pea and lentil in the region have provided an opportunity to include these crops in the traditional system. Additionally an oilseed crop, camelina sativa has shown promise as an alternative crop for dryland production.

Figure 1. Spring peas following winter wheat, June 2014.

MATERIALS AND METHODS

In 2008 a field study was established at Huntley, MT to evaluate inclusion of pulse and oilseed crops in traditional dryland winter wheat cropping systems. Grain yield and and economic return were evaluated. The only treatment was crop rotation, arranged in a randomized complete block with four replications. Treatments are listed in Table 1.

Table 1. Crop Sequence Treatments

Rotation	Year 1	Year 2	Year 3	Year 4
1	Winter wheat	Fallow		
2	Winter wheat	Spring Wheat	Fallow	
3	Winter wheat	Spring pea	Fallow	
4	Spring pea	Winter Wheat	Fallow	
5	Winter wheat	Spring wheat	Lentil (cover crop)	
6	Winter wheat	Spring wheat	Lentil	
7	Winter wheat	Spring wheat	Camelina	
8	Winter wheat	Lentil	Spring wheat	Camelina

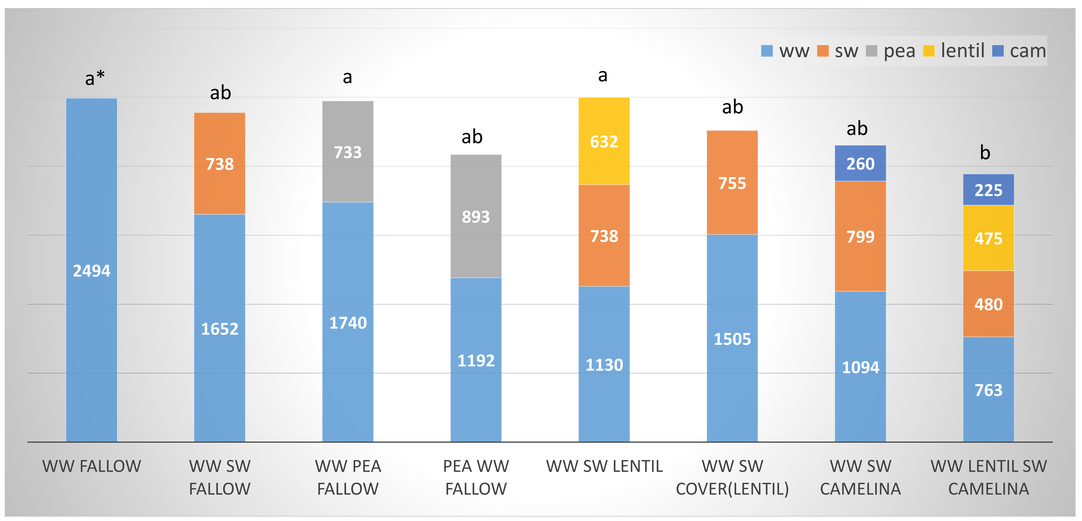
All crops were established in no-till conditions using a John Deere 752 drill with all phases present each year. Weed control was by use of herbicides only. Variety choice varied, but primarily consisted of Yellowstone (ww), Vida (sw), Sustainable Oils SO-30 (cam), Admiral (pea), and Crimson (lentil). Yield was determined using one pass of a plot combine, and corrected for moisture. Fertilizer was applied based on yield goals determined from average yields of the preceding three years. Analysis of variance was performed using SAS mixed model procedures. Means separation was done utilizing and F-protected LSD test.

Figure 2. Camelina following spring wheat, June 2014.

RESULTS AND DISCUSSION

Years 2009 – 2011 were wetter than normal, followed by drier than normal years for 2012-2013. Total annualized grain yield averaged over the five years of the study was not significantly different in 7 of the 8 rotations (Figure 3). Economic analysis using only input costs and revenue, followed a similar trend, as grain yield (Table 2). Winter wheat – fallow dominates as a practice for dryland producers in Montana because it provides stable grain yields and top income. But this study shows that alternate crop choices and rotations can be viable if rotation is warranted for reasons other than bottom-line economics.

Figure 3. Average annualized grain yield (kg ha^{-1}) in dryland rotation study, 2009-2013, Huntley, MT.



*Column totals with same letter are not different using Fisher's LSD(.05).

Table 2. Annualized returns per hectare for various crop sequences, 2009-2014, Huntley, MT.

	Sequence	2009	2010	2011	2012	2013	Mean	CV
1	ww/F	$ 405 a	$ 605 ab	$ 699 a	$ 603 a	$ 395 d	$ 516 a	24.9
2	ww/sw/F	$ 363 a	$ 674 a	$ 709 a	$ 390 b	$ 375 d	$ 477 ab	34.5
3	ww/p/F	$ 388 a	$ 548 b	$ 499 b	$ 437 b	$ 657 ab	$ 482 ab	20.6
4	p/ww/F	$ 279 b	$ 561 b	$ 417 b	$ 114 c	$ 531 c	$ 358 ab	48.8
5	ww/sw/cov(L)	$ 371 a	$ 647 a	$ 701 a	$ 296 c	$ 269 e	$ 425 ab	44.4
6	ww/sw/L	$ 395 a	$ 684 ab	$ 785 a	$ 35 b	$ 694 a	$ 489 a	59.3
7	ww/sw/C	$ 262 bc	$ 615 ab	$ 719 a	$ 79 c	$ 348 de	$ 373 ab	64.5
8*	ww/L/sw/C	$ 237 c	$ 435 c	$ 304 c	$ 82 c	$ 576 bc	$ 299 b	57.8
	Different letters within a column indicate significant difference at 5% probability level. Abbreviations are as follows: Winter wheat is ww, spring wheat is sw, spring pea is p, lentil is L, camelina is C, fallow is F, and cover crop is cov. *Rotation 8 was modified to this sequence starting in 2012.							