View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by University of Saskatchewan's Research Archive

Optimizing productivity in organic farming systems through variation of seeding density for field peas and lentils

Julia M. Baird[1], Fran L. Walley[1] and Steven J. Shirtliffe[2]

[1]Dept. of Soil Science, University of Saskatchewan, Saskatoon, SK., julia.baird@usask.ca; [2]Dept. of Plant Sciences, University of Saskatchewan, Saskatoon, SK

Introduction

Seeding rates for organic pulse production have not been established and organic producers must rely on seeding rates determined for conventional production. These rates may not be optimal given that weed management strategies for organic production rely heavily on the competitive ability of the crop for weed suppression.

Objective

To determine the optimal seeding rates for organic field peas and lentils considering a number of factors including crop yield and weed suppression.

Materials and Methods

Randomized complete block trials were conducted during the 2005 growing season and will continue in 2006 near Vonda and Delisle, SK on certified organic farmland. Both sites have been cropped continuously for at least three years. Separate experiments were conducted for lentil and pea. Seeding rates ranged from 10 to 250 plants m^{-2} for peas and 15 to 375 plants m^{-2} for lentils (Table 1). Green manure ploughdown and summerfallow treatments were included for each crop. In-crop harrowing was conducted approximately one month after planting. Weed counts and identification were performed after in-crop harrowing. Weed biomass was collected prior to the green manure ploughdown and at physiological maturity. Crop biomass was collected simultaneously, and an additional sampling time occurred at final harvest. Seed yield and harvest index were determined by threshing the crop biomass collected at final harvest (Table 2).

Results and Discussion

Both crops showed a general trend of decreasing weed biomass with increasing seeding density (Fig. 1). Preliminary data indicate that increased lentil seeding density increased crop biomass at all rates, whereas field pea crop biomass reached a maximum at an intermediate seeding rate around 97 plants m^{-2} in Delisle but continued to increase in Vonda.

Pea seed yields reached 1550 kg ha^{-1} (23 bu ac^{-1}) in Delisle, while Vonda yielded up to 1840 kg ha^{-1} (27.3 bu ac^{-1}) (Table 2). The recommended seeding rate for conventional field pea production in western Canada is 88 plants m^{-2} (Saskatchewan Pulse Growers, 2000), which closely corresponds to our findings.

Lentil seed yield increased up to 1150 kg ha^{-1} (17 bu ac^{-1}) at the highest density in Delisle, while Vonda showed a seed yield of 1962 kg ha^{-1} (29 bu ac^{-1}) at the highest plant density (Table 2) with comparable crop plant populations between sites. The current recommended seeding rate for conventional lentils in western Canada is 130 plants m^{-2}

Table 1. Actual and target seeding rates for organic lentils and field peas in 2005

	Target rates		Actual mean densities	
	Both sites		*Delisle*	*Vonda*
	plants m^{-2}	bu. $acre^{-1}$	plants m^{-2}	plants m^{-2}
Lentil				
	15	0.15†	9	14
	38	0.37	25	36
	94	0.91	75	78
	235	2.27	179	168
	375	3.63	254	234
Field pea				
	10	0.31	6	5
	25	0.78	13	10
	62	1.95	36	31
	156	4.90	85	91
	250	7.85	124	145

†Lentil seeding rates in bu. $acre^{-1}$ were calculated from the Saskatchewan Seed Growers Association Seed Guide (2006).

(Saskatchewan Pulse Growers, 2000). Our findings are similar to those of Ball et al. (1997) in herbicide-free trials as well as a mechanical weed control study conducted by Paolini et al (2003) where increased lentil seeding rates were recommended. Based on the data collected in 2005, organic producers may benefit from increased yields and some reduction in weed biomass by increasing lentil seeding rates. Seed cost may limit the degree by which seeding rates may be increased.

Further investigation will address possible differences between treatments on the nutrient and available water status of the soil for both crops.

Table 2. Mean yield and harvest index for organic field peas and lentils in 2005

Target seeding rate	Harvest Index seed: seed + straw		Seed yield ----------kg ha^{-1}----------		Seed yield ----------bu ac^{-1}----------	
	Delisle	*Vonda*	*Delisle*	*Vonda*	*Delisle*	*Vonda*
Lentil						
15	0.45	0.46	263	530	3.86	7.77
38	0.39	0.47	346	758	5.07	11.12
94	0.40	0.45	492	1226	7.22	17.98
235	0.40	0.43	1033	1695	15.15	24.86
375	0.37	0.44	1160	1963	17.01	28.79
Field pea						
10	0.53	0.51	151	416	2.21	6.10
25	0.50	0.50	546	698	8.01	10.24
62	0.51	0.51	1170	1065	17.16	15.62
156	0.49	0.49	1453	1739	21.31	25.51
250	0.47	0.45	1574	1873	23.09	27.47

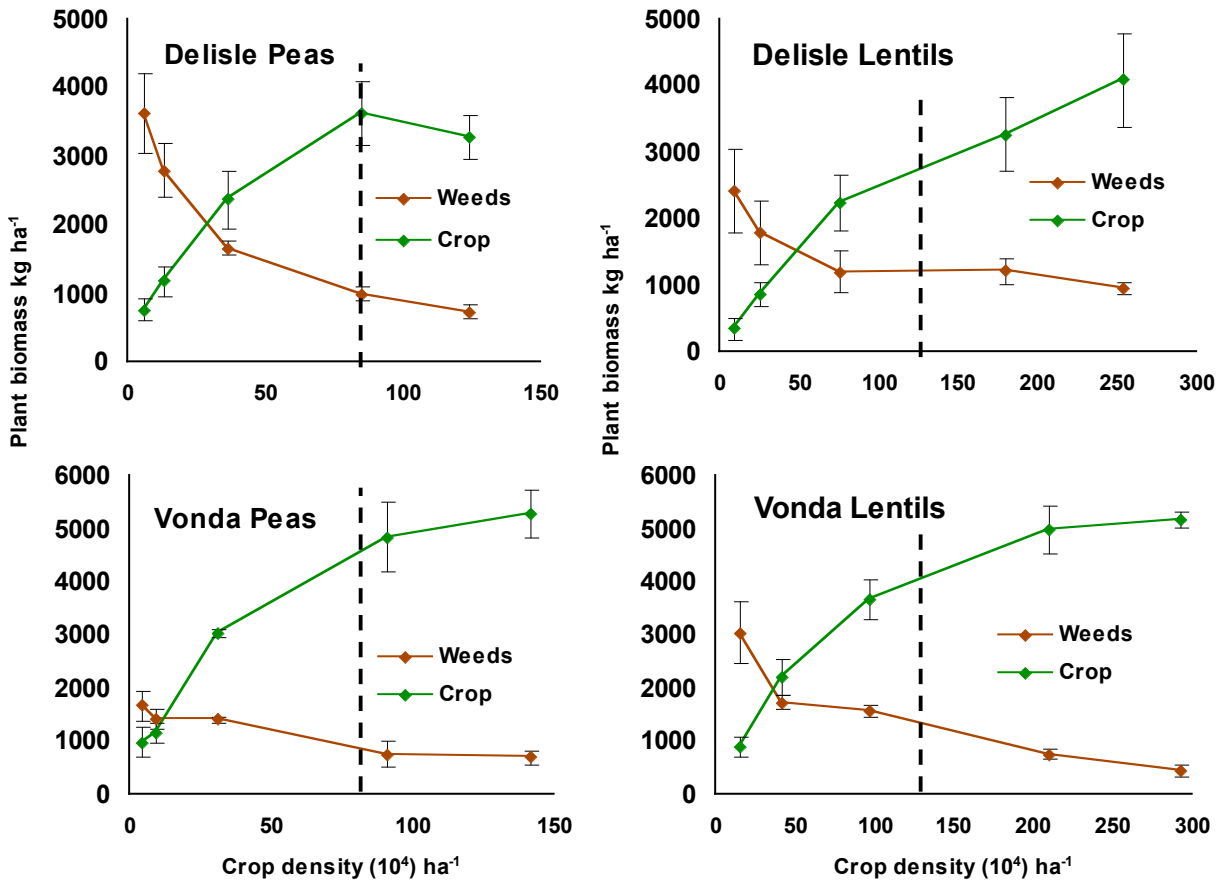

Figure 1. Crop and weed biomass dry weight at physiological maturity for sites at Delisle and Vonda for field peas (left) and lentils (right). Dashed lines indicate biomass yield at recommended conventional seeding rates (Saskatchewan Pulse Growers, 2000).

Summary

Seeding rate recommendations for conventional lentils may be too low for organic production when growers anticipate significant weed pressure; however, conventional seeding rates for field peas may also be appropriate for organic production.

References

Ball, D.A., Ogg, A.G. Jr. and P.M. Chevalier. 1997. The influence of seeding rate on weed control in small-red lentil (*Lens culinaris*). Weed Science. 45(2):296-300.

Paolini, R., Colla, G., Saccardo, F. and E. Campiglia. 2003. The influence of crop plant density on the efficacy of mechanical and reduced-rate chemical weed control in lentil (*Lens culinaris* Medik.) Ital. J. Agron. 7(2):85-94.

Saskatchewan Pulse Growers. 2000. Pulse Production Manual. 2nd Ed. Saskatoon, SK.