

Optimal seeding rates for organic production of field peas and lentils

Julia M. Baird¹, Fran L. Walley¹ and Steven J. Shirliffe²

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

Introduction

The province of Saskatchewan supports the largest number of certified organic farms in Canada, making up approximately half of the farms in the country producing organic field crops (Statistics Canada 2001). Organic farming differs from other production systems in that no synthetic fertilizers or chemical inputs are used. Organic producers, therefore, must rely on other methods to suppress weeds and maintain soil fertility. Common practices in organic systems are to use summerfallow and green manure ploughdown. These practices reduce weed populations and can increase soil fertility, but can increase soil erosion and do not yield a cash crop. There is also evidence to suggest that soil microbial populations decrease when land is bare during the growing season. Partial replacement of summerfallow and green manure ploughdown may be possible with pulse crops grown as a cash crop. Pulse crops can be effective in weed suppression, nitrogen fixation, and formation of associations between plant roots and arbuscular mycorrhizal fungi (AMF) which increase plant uptake of phosphorus, a nutrient that is commonly deficient in organic systems. Seeding rates for organic pulse production, however, have not been established and organic producers must use seeding rates determined for conventional production as their guideline. These rates may not be optimal given that weed management strategies differ greatly between conventional and organic production systems.

Objective

To determine the optimal seeding rate 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 and 2006 growing seasons near Vonda, Delisle and Vanscoy, SK on certified organic farmland. Seeding rates were 10, 25, 62, 156 and 250 seeds m⁻² for field peas and 15, 38, 94, 235 and 375 seeds m⁻² for lentils. Summerfallow and green manure ploughdown treatments were included to assess differences in soil nutrient concentrations and water storage post-harvest. In-crop harrowing for all seeding rates was performed approximately one month after planting. Weed and crop biomass were collected at physiological maturity. Seed yield was collected by hand harvest of a 1m² area and a mechanical harvest of a 1.5m by 6m area was performed as well.

Analysis of economic optimal seeding rate was determined by return based on seeding rate. Selling price used was the average certified organic price for each crop in 2005 (University of Saskatchewan 2006). The seed price paid by the farmer was an average price obtained from Marysburg Organic Producers Inc. (Personal communication). Return was calculated by subtracting the price obtained for each crop density

(yield*selling price) from seed cost (seeding rate [assuming 70% emergence]*seed cost). The resulting values were graphed and a hyperbolic curve was fitted to the data.

Results and Discussion

Actual plant densities achieved were much lower than the targets; field pea densities ranged from approximately 5 to 160 plants m⁻², while lentil densities ranged from approximately 10 to 250 plants m⁻².

The highest return for field peas was achieved with the second-highest seeding rate with an average crop density of ~100 plants m⁻². This density yielded a mean of 1385 kg ha⁻¹ in both years. Returns ranged from \$170 to \$205 ha⁻¹. The mean return was higher for the second-highest seeding rate than the highest in both sites for both years despite increased seed yields at the highest seeding rate.

Lentils provided the greatest return at the highest seeding rate in all cases except Vonda in 2006. The crop density and seed yield varied greatly between 2005 and 2006. Returns in 2005 were much higher than in 2006; ranging from \$1000 to \$1865 ha⁻¹ in Delisle and Vonda, respectively. The crop density for these two sites was 240 plants m⁻². The mean highest return in 2006 in Vonda and Vanscoy was \$930 ha⁻¹ with a crop density of 140 plants m⁻². The lentil trials in 2006 had lower emergence rates and substantially lower yields than in 2005, likely due in part to climatic conditions.

Preliminary Conclusions

The potential for increased returns tends to rise as seeding rate increases for lentils. The seeding rate recommended for conventional production of lentils, 130 plants m⁻² (Saskatchewan Pulse Growers 2000) is likely too low for organic production. The same is not true for field peas; a seeding rate of approximately 100 plants m⁻² resulted in the highest return for this study. This rate is similar to the seeding rate of 88 plants m⁻² recommended for conventional production of field peas (Saskatchewan Pulse Growers 2000).

Further study will determine the effect of seeding rate on soil nutrients, specifically phosphorus and nitrogen. In addition, the effect of seeding rate on plant colonization by AMF will be assessed for both crops. Weed suppression as crop density increases will also be addressed.

References

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