Spring Pea, Lentil, and Chickpea Response to Phosphorus Fertilizer

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Fertilizer Facts

Fertilizer √off

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Introduction

Growing pea, lentil, and chickpea in rotation with cereal crops provides many benefits to cereal-dominated cropping systems. The benefits include: 1) biologically fixing nitrogen (N) and making it available to the crop and subsequent crops, 2) interruption of pest cycles, 3) conservation of soil water for subsequent cereal crops because of the shallow rooting depths of pea and lentil, and 4) providing commodity and economic diversification.

Phosphorus (P) is deficient in many Montana soils. Fertilizer P has been reported to improve seedling vigor and seed quality of dry peas in Canada (Henry et al., 1995). The objectives of this study were to investigate spring dry pea, lentil and chickpea yield response to fertilizer P application in Central and North-central Montana.

Methods

A 2-year experiment was conducted at the Central Agricultural Research Center (CARC) near Moccasin and on a producer's field near Cut Bank, MT (maintained by staff from the Western Triangle Agricultural Research Center) from 2003-2004. The soil Olsen P content was about 12 ppm at CARC and 8 ppm at Cut Bank. Three commercially available spring dry pea, lentil, and chickpea cultivars were direct-seeded (no-till) into spring wheat stubble.

Triple super phosphate (0-45-0) was applied with the seed at planting at four P fertilizer levels (0, 15, 30, and 45 lbs P_2O_5/a). An additional 30 lbs KCl/a was applied at the Cut Bank site. The experiment was a randomized complete block design with four replicates (separate randomized blocks for each species). Plots were planted with a no-till nursery planter having 12 in. row spacing. Plot dimensions were 5 ft x 20 ft and 6 ft x 25 ft at CARC and Cut Bank, respectively.

At CARC, a pre-planting application of glyphosate (Roundup Ultramax, Monsanto) herbicide was used and grassy weeds were controlled with quizalofop p-ethyl (Assure II, DuPont) herbicide. At Cut Bank, sulfentrazone (Spartan 4DF, FMC Ag) herbicide was applied pre-plant on the dry pea and chickpea plots while pendimethalin (Prowl 3.3EC, BASF Ag) herbicide was incorporated with a harrow in the lentil plots. Grassy weeds were controlled with sethoxydim (Poast, Micro Flo) herbicide. Plots were planted in mid- to late-April and harvested in late-July using a plot-scale harvester.

Results

Due to drought conditions in 2003, dry pea, lentil, and chickpea yields were lower than normal at both CARC and Cut Bank (Figure 1). Crop yields at CARC were near normal in 2004, but were still low at the Cut Bank site. In both years, the average dry pea and lentil grain yields were greater at CARC than at Cut Bank. However, chickpea production was approximately 200 lbs/a more at Cut Bank in 2003 than at CARC. Due to severe late summer drought conditions, the chickpea trial at Cut Bank was abandoned in 2004.

Dry pea varieties Delta, Majoret, and CDC Mozart yields were similar to each other over both years and sites, and no yield differences were observed for the lentil varieties Brewer, CDC Richlea, and CDC Vantage. The large seed-sized, Kabuli-type chickpea (CDC Yuma), produced lower yields than the small seed-sized, Desi-type and small Kabuli-type chickpeas, Myles and CDC Chico, respectively (data not shown).

The application of 30 lbs P_2O_5/a increased pea and lentil yield at CARC in 2004 by more than 10% compared to the control plots with no P. Application of P at CARC in 2003 increased pea and chickpea yields slightly, but apparently did not affect the lentil yield. In addition, P did not increase yields at Cut Bank in either year, despite having lower initial Olsen P levels. It is likely that water, more than P, limited crop yield in both study years.

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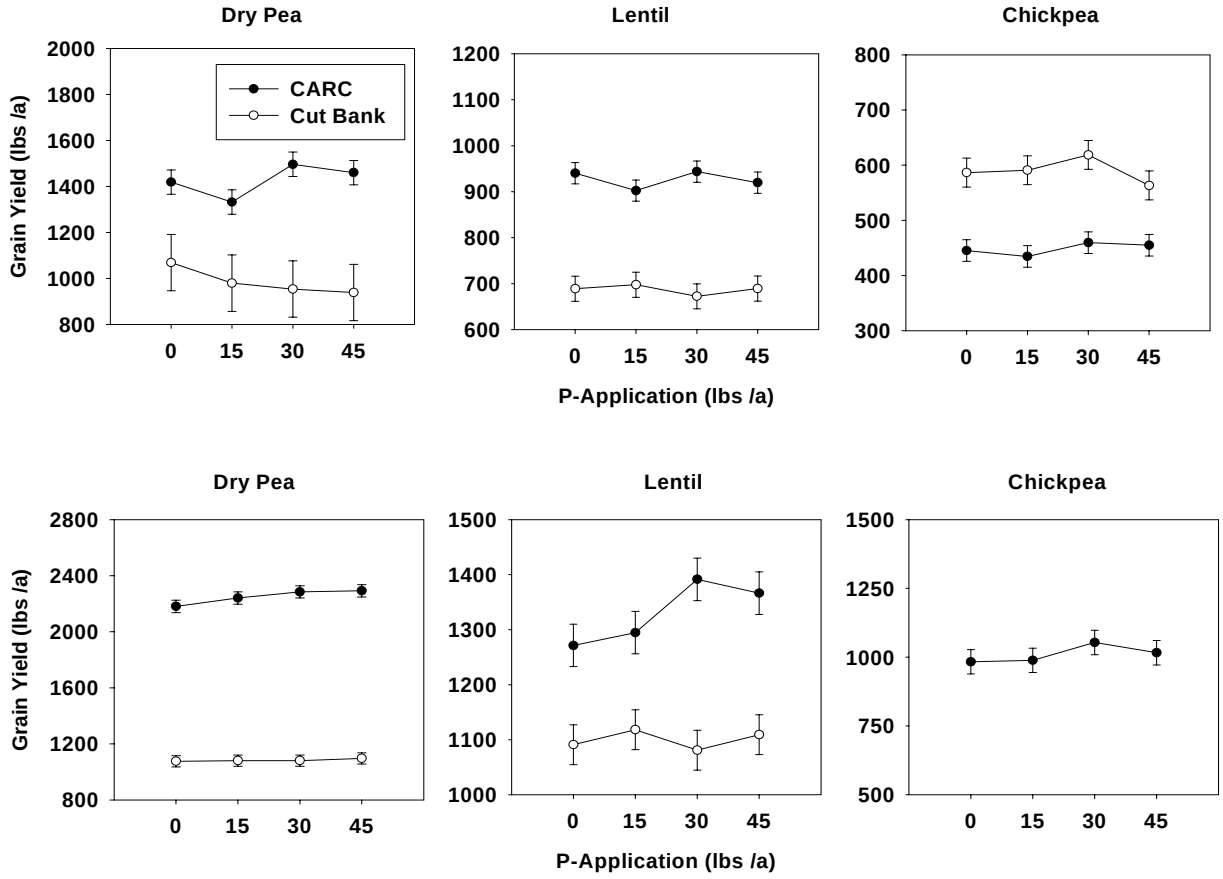

Figure 1. Grain yield of dry pea, lentil, and chickpea response to phosphorus application in 2003 (top) and 2004 (bottom) at Central Agricultural Research Center (CARC) and Cut Bank. Yields are averages of three cultivars.

Summary

Introducing pulse crops into a rotation with cereal crops provides many benefits. Dry pea, lentil, and chickpea have demonstrated great potential for acclimation into Central Montana environments. As a result, production acreage has increased rapidly in recent years. Pulse crops require minimal fertilizer inputs because of their ability to biologically fix N; however, adding 30 lbs P_2O_5/a could improve grain yields in low Olsen P soils (≤12 ppm) at some sites, especially in wetter years.

Fertilizer Facts:

- Pea, lentil, and chickpea are annual legumes that fix N from the atmosphere; therefore, they need minimal nitrogen input.
- Annual legumes provide many benefits to subsequent crops.
- In low Olsen P soils (≤12 ppm), application of 30 lbs P_2O_5/a may improve annual legume grain yields, especially if other resources, such as water, are not limiting.

Reference

Henry, J.L., A.E. Slinkard, T.J. Hogg. 1995. The effect of phosphorus fertilizer on establishment, yield and quality of pea, lentil and faba bean. Can. J. Plant Sci. 75:395-398.

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