Phosphorus Fertilizer Boosts Yields in Fallow Wheat Production

By Stewart A. Brandt

Phosphorus fertilizer addition over a 72-year period increased crop yields from 19 to 29% depending on the environmental conditions in each year.

The role that fertilizer has played in crop production has been reviewed in a number of past publications, and recently summarized by Stewart et al., 2005. The general consensus is that fertilizers contribute from 30 to 50% of crop production in most intensively cropped environments. However, the question is often asked: "What is the impact of fertilizer in less intensive environments?"

On the northern Great Plains, fallow remains a component of dryland cropping systems (Zentner and Campbell, 1988). While not very efficient, the fallow period contributes to soil moisture conservation which allows for substantial increases in crop yields under very dry environments. When grown on fallow, most crops in this region respond to fertilizer P additions. These responses are due to low soil P in most of these calcareous soils, and cool soil temperatures at seeding.

A long-term fallow/wheat/wheat rotation study was conducted at Scott, Saskatchewan, to monitor year-to-year crop yields, and to evaluate soil quality changes. After 72 years of cropping (1930 to 2002) in a fallow/wheat/wheat rotation, the yields on fallow were evaluated based on growing season precipitation. The 24 driest years (May-July precipitation averaging 4.25 in.), 24 near normal years (May-July precipitation averaged 6.25 in.), and the 24 wettest years (May-July precipitation averaged 8.36 in.) were compared for the response of spring wheat to P fertilizer additions of 30 lb P_2O_5/A.

The largest percentage gain in yield was achieved during dry years, declining slightly for both near normal and wet seasons (**Table 1**). Given the mineralization of N during the fallow period on these soils, no fertilizer N was applied and no response to N was expected. The grain yield response to fertilizer P additions, ranging from 19 to 29%, is less than that reported in earlier publications and reflects on this mineralized soil N. While farmers often consider reducing inputs during dry years, these results suggest that fertilizer P may be an exception. Adequate P from fertilizer may be essential for efficient water use during dry seasons. BC

Phosphorus was applied to the area at left in this photo showing wheat response.

Table 1. Crop yield response to fertilizer P addition to wheat grown on fallow.

Treatment	Check, bu/A	P added, bu/A	Gain, bu/A	Gain, %
24 driest years	18.7	24.1	5.4	29
24 average years	24.1	28.6	4.5	19
24 wettest years	31.2	38.7	7.5	24

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Abbreviations and notes for this article: P = phosphorus; N = nitrogen.

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