Starter Potassium for Wheat and Barley on High Potassium Soils

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Crop responses to nutrient applications are normally obtained as a result of a nutrient deficiency. Identification of nutrient deficiency is heavily dependent on either soil and/or plant tissue testing. Both tools can statistically provide an index of the nutrient status of a soil with great success. However, there are instances when a response to a nutrient is obtained on soils where the nutrient's soil test levels are far above what is considered as a critical or deficient level.

Westco Fertilizers of Calgary, Alberta, has had an extensive prairie-wide research program to assess responses of common cereal crops to seed-placed K in soils containing "available" K levels above what is considered optimum.

> Small grain response to potassium (K) and chloride (Cl) was inconsistent in this study. Researchers did not show a relationship between Cl application and disease suppression, soil type, cropping history, climate, and regional conditions. However, there was a strong relationship between frequency of response and the disease-susceptible barley varieties.

What Do We Mean by High Potassium Levels?

Research has been carried out in western Canada in order to calibrate soil tests against the yield of common crops. This work was successful, both in identifying K deficient soils on the Canadian prairies and deriving a critical level below which K deficiency occurs. A level of 125 parts per million (ppm) in the top six inches of soils, determined by ammonium acetate, is generally considered as the critical level. The majority of prairie soils test in excess of 300 ppm in the top 6 inches.

Why Is Potash Being Used in Soil with High Potassium Levels?

Application of small amounts (10 to 25 lb K_2O/A) of potassium chloride (KCl) in the seed-row is becoming an increasingly common practice in the western Canada prairies. This practice has been adopted in response to reported benefits from the Cl portion of the fertilizer. Yield responses to Cl have been attributed to disease suppression, especially in winter wheat. Sometimes, however, a yield increase due to Cl application is observed without any connection to disease suppression. Other potential benefits of placing small amounts of K with the seed include responses to K due to proximity of seedling roots to readily available K in cool springs, reduction in lodging, and promotion of early maturity.

What Is the Frequency of Crop Responses to Potash on High Potassium Soils in Western Canada?

During a 10-year period (1989-1998) more than 200 experiments with seed-placed K fertilizer on high testing soils were conducted in the three Prairie provinces (Alberta, Manitoba and Saskatchewan). **Table 1** contrasts the frequency and amount of response to a seed-placed application of 13 or 25 lb K_2O/A in the western Canadian prairies for spring cereals, 50 lb K_2O/A broadcast on winter wheat, and a

TABLE 1. Frequency of response and average grain yield increase from K application to spring and winter crops in western Canada and Montana.

Crop	Frequency of response, %		Average yield increase, bu/A	
	Montana	Prairies	Montana	Prairies
Barley	40	40	3.7	4.6
Spring wheat	25	20	4.2	3.3
Winter wheat	50	N/A[1]	3.9	1.8[2]

[1]Not available.
[2]PPI/PPIC/FAR sponsored research from Dr. D.B. Fowler, University of Saskatchewan.

broadcast application rate of 25 lb K_2O/A on all cereal crops in Montana.

Results indicate that barley had the highest probability of giving a yield response to added K in western Canada, with 15 percent of trials showing a 5 to 10 bu/A yield response, and 40 percent of trials having at least a 2 to 5 bu/A response. The frequency of response for spring wheat was lower, with 20 percent of trials having a 2 to 5 bu/A yield increase. The results from Montana indicate that the frequency of response with winter wheat is even higher than spring cereals. This reflects in part the role of Cl in reducing the incidence of physiological leaf spot, a non-disease leaf spotting symptom associated with certain winter wheat varieties. The trials measured kernel plumpness of barley and days-to-maturity and protein of both barley and wheat. However, none of these variables showed any response to the K application.

Why the Benefits from Seed-Row K Application on Soils with High Potassium Levels?

Our work and the work of other scientists have not fully explained this behavior. We tried to relate apparent yield increases to disease suppression by the Cl portion of the fertilizer, soil type, previous crop, and climatic or regional conditions, but could not come up with either a consistent trend or sometimes any trend at all. However, we could establish a very strong relationship between frequency of response to KCl and barley variety. This provided us with an indirect link between response and disease resistance. Varieties with lower disease resistance, such as Harrington, showed a 2 to 5 bu/A yield increase 50 percent of the time and a 5 to 10 bu/A increase 20 percent of the time. However, varieties with superior disease resistance, such as Leduc, Stander or Manley, did not respond as frequently.

Conclusion

Certain barley varieties grown on western Canadian prairie soils containing high available K levels do respond to seed-row applied KCl every two to three years out of five. We were unable to associate this response with soil Cl levels, root rot infection, climatic conditions, soil type, or previous crop. This type of response was less likely with hard red spring wheat (less than two out of five years). We are also unable to establish a benefit of seed-row KCl placement on decreasing days to maturity and grain protein or increasing plumpness of malting type barley. However, from both agronomic and economic perspectives and because we still cannot fully explain this behavior, K applications on soils containing high levels of available K are strongly recommended only with barley varieties that appear to be susceptible to disease. BC

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