Effect of Soil pH on Pyroxasulfone Bioactivity in Soil

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Introduction

Pyroxasulfone herbicide is used for control of most annual grass and small seeded broadleaf weeds in wheat, corn and soybean. Because pyroxasulfone mode of action is distinctly different from the many herbicides to which weeds developed resistance, use of pyroxasulfone in rotation or in combination with other herbicides offers a new alternative in combating the weed resistance problems. Pyroxasulfone has considerable soil activity that varies with organic carbon content (1), but so far the effect of soil pH on pyroxasulfone bioavailability in soils has not been studied.

Objectives

The objective of this study was to investigate the effect of soil pH on pyroxasulfone bioactivity in Canadian prairie soils after altering the natural soil pH.

Materials and Methods

• Bioassay was performed in 2-oz WhirlPak™ bags (2). Sugar beet (*Beta vulgaris* L. 'Beta 1385') was grown for 7 days in soils with pyroxasulfone added from 0 to 184 ppb.

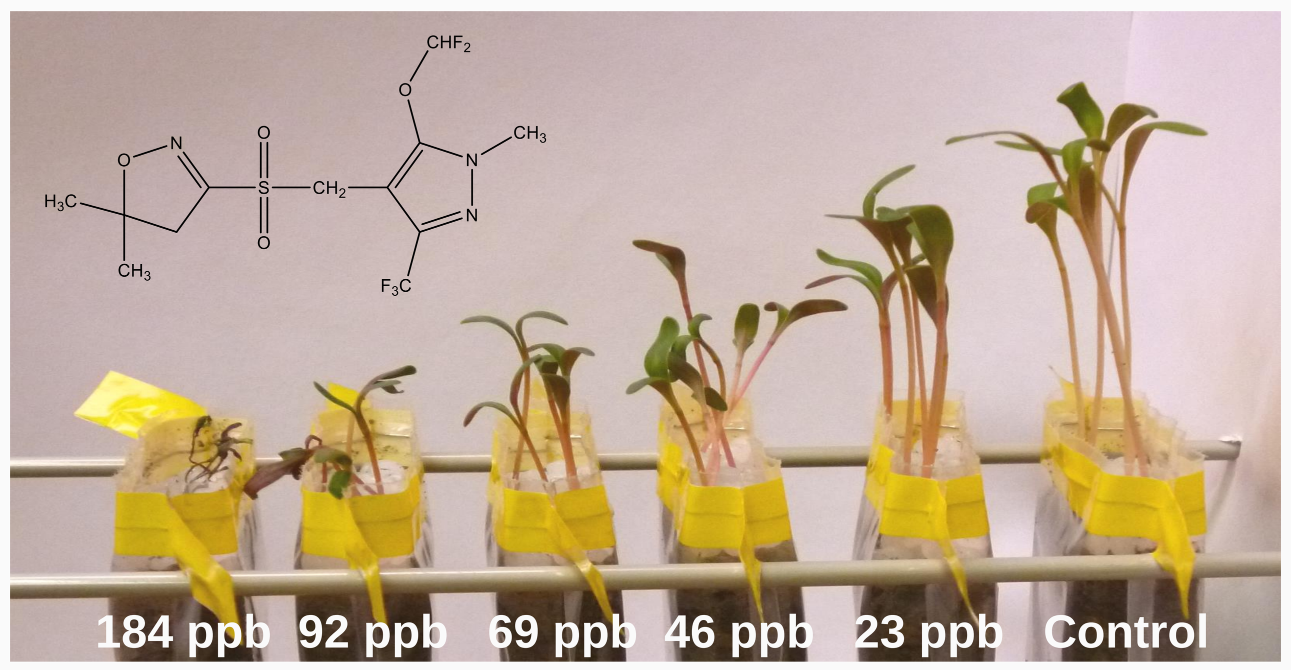

Fig. 1. Sugar beet response to pyroxasulfone in soil.

• Soil pH adjustments in three Saskatchewan soils were accomplished through addition of HCl solution and $CaCO_3$ suspension in water to produce values above and below natural soil pH. After acid and base addition, soils in plastic containers were equilibrated for one week. Soils were air-dried, sieved, and pH was measured.

Results

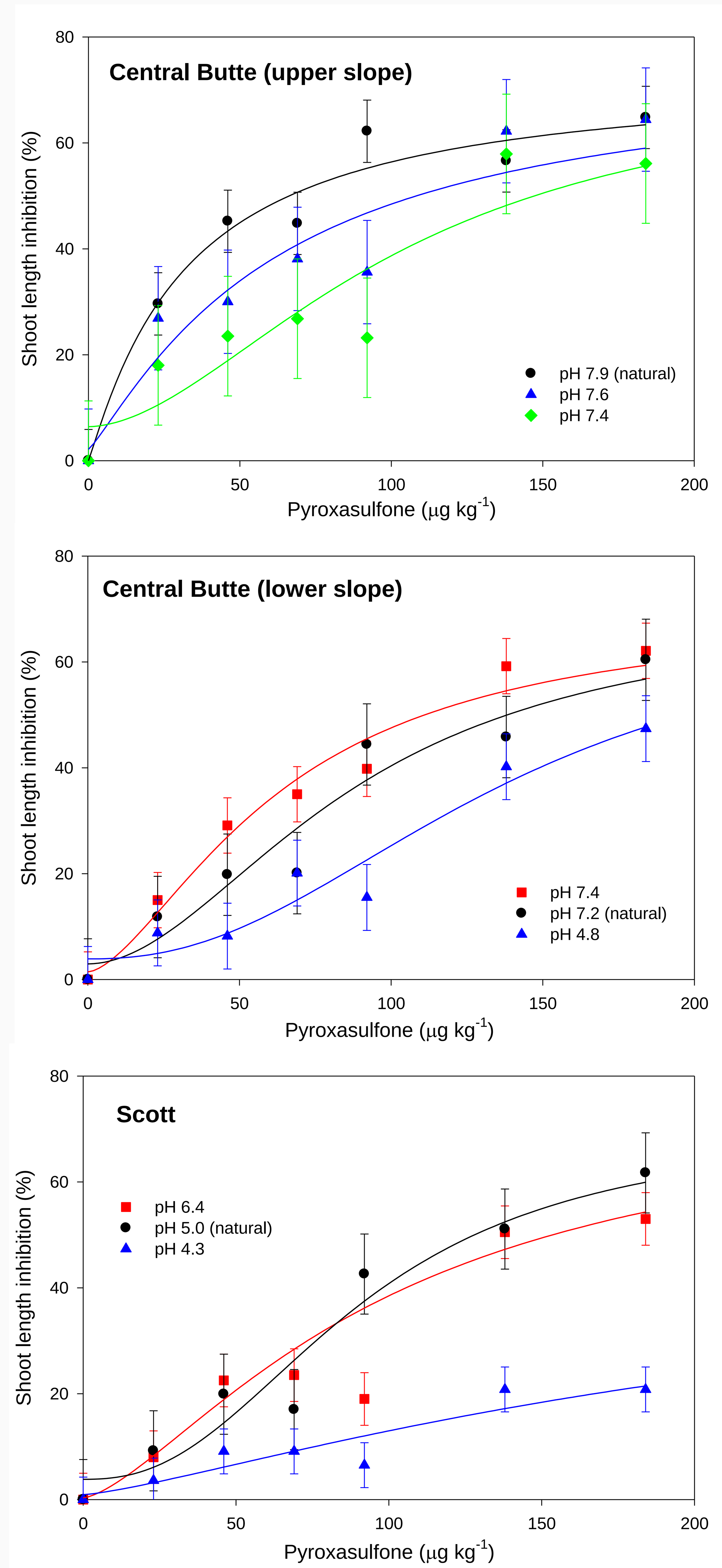

Fig. 2. Effect of soil pH on pyroxsulfone bioactivity in Saskatchewan soils determined by the 7-day sugar beet shoot length bioassay.

Discussion

• Sugar beet shoot length inhibition was reduced in acidified soils (Fig. 2)), demonstrating that pyroxasulfone was less available to plants at lower soil pH.

• Alkalization increased sugar beet shoot length inhibition in the Central Butte (lower slope) soil but did not change sugar beet response in the Scott soil (Fig. 2) indicating that the effect of soil pH on pyroxasulfone bioactivity could vary with soil type.

• The GR_{50} values obtained from the dose-response curves (Fig. 2) were correlated with soil pH in the Central Butte (upper slope) soil (R^2 = 0.96) and in the Central Butte (lower slope) soil (R^2 = 0.93) but not in the Scott soil (R^2 = 0.52). These results demonstrated that pyroxasulfone bioactivity is generally sensitive to changes in soil pH and that pyroxasulfone may be less efficacious in soils of lower pH.

• Usually soil pH affects both the dissociation of herbicide molecules and the charges of the organic matter and clay colloids. Pyroxasulfone molecule is not acidic because it does not contain dissociable hydrogen (Fig. 1). Therefore, the effect of soil pH on pyroxasulfone bioactivity could be primarily related to the change in ionic charges on soil colloids. As soil pH decreases, there are fewer negative charges on organic and clay surfaces. Typically, this leads to greater sorption of herbicides, and subsequently to reduced concentration of bioavailable herbicide in soil solution.

Acknowledgements

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References

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