A Bioassay for Detection of Group 2 Herbicides

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Introduction

Because of the high plant toxicity of Group 2 herbicides at low concentrations in soil, the residual activity of this group of herbicides is of agronomic concern. The ability to detect the presence of soil residual herbicides is an asset in making sound re-cropping decisions.

Objectives

The objectives of this study were to develop a bioassay as a tool suitable for routine use, and examine its applicability for prediction of crop injury due to flucarbazone residues in soil.

Materials and Methods

A total of 95 soils were examined for flucarbazone residue: 47 soils from farm fields in Western Canada and 48 soils from Arysta LifeScience's experimental fields. Visual evaluation of crop development and/or yields were recorded for sensitive and tolerant crops grown in these fields one year after flucarbazone application. All soil samples were subjected to the chemical analysis for flucarbazone residue and to the mustard root length bioassay.

The mustard root bioassay was performed in small plastic bags (2-oz. Whirl-PakTM bags; Fig. 1). Subsamples of soil (50 g) were wetted to 100% field capacity and the soil in the Whirl-PakTM bag was gently packed to form a layer that was approximately 8 cm deep and 1 cm thick. Six oriental mustard seeds (*Brassica juncea* L. var. Cutlass) were planted. At the end of the three day growth period, plants were harvested after opening the Whirl-PakTM bag and the soil was washed from the roots with a gentle stream of water. The length of roots was measured with a ruler.

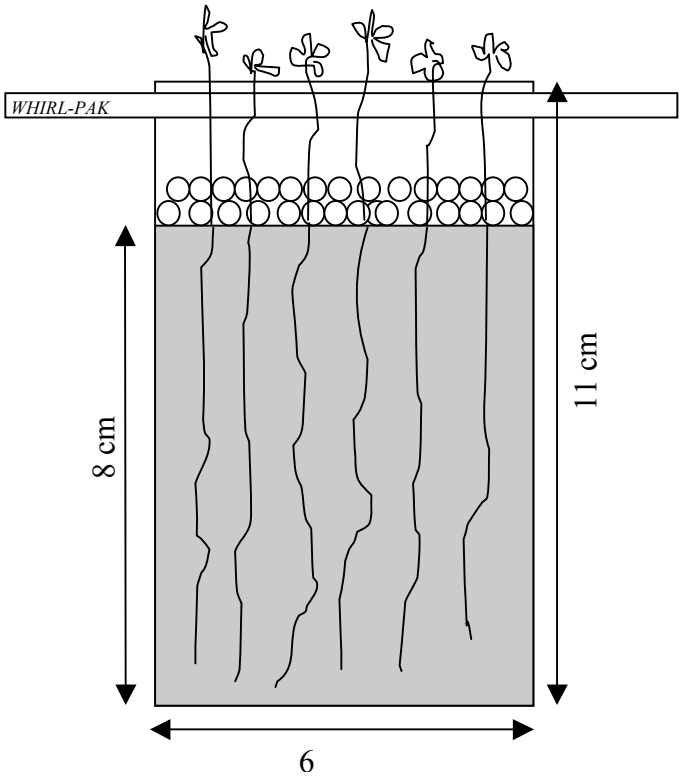

Fig. 1. Diagram of a mustard root bioassay in a Whirl-PakTM bag.

Results and Discussion

The bioassay described in this study is simple, fast, sensitive and reproducible. Only a three day growth and only 200 g of soil are required to complete this bioassay.
The results from the bioassay and the chemical analysis were matched with the field data (crop evaluation and/or yields) and were grouped into three categories:

- corroboration (bioassay or chemical analysis agreed with the field data),
- false positive (bioassay or chemical analysis detected flucarbazone but no injury was observed in the field),
- false negative (bioassay or chemical analysis did not detect flucarbazone but injury was observed in the field).

For the replicated experimental plots (Fig.2), a considerably higher corroboration was obtained between bioassay and crop yields (89%) than between chemical analysis and crop yields (27%). This may be the result of the chemical method detecting total flucarbazone residue while the bioassay detected the bioavailable portion of flucarbazone.

In the farm fields (Fig.2) the percent agreement was slightly lower for the bioassay than for the chemical analysis (70 % and 81%, respectively). Since bioassays are not specific, the presence

of other herbicides especially those applied in the re-cropped fields was most likely measured by the bioassay together with the residual flucarbazone.

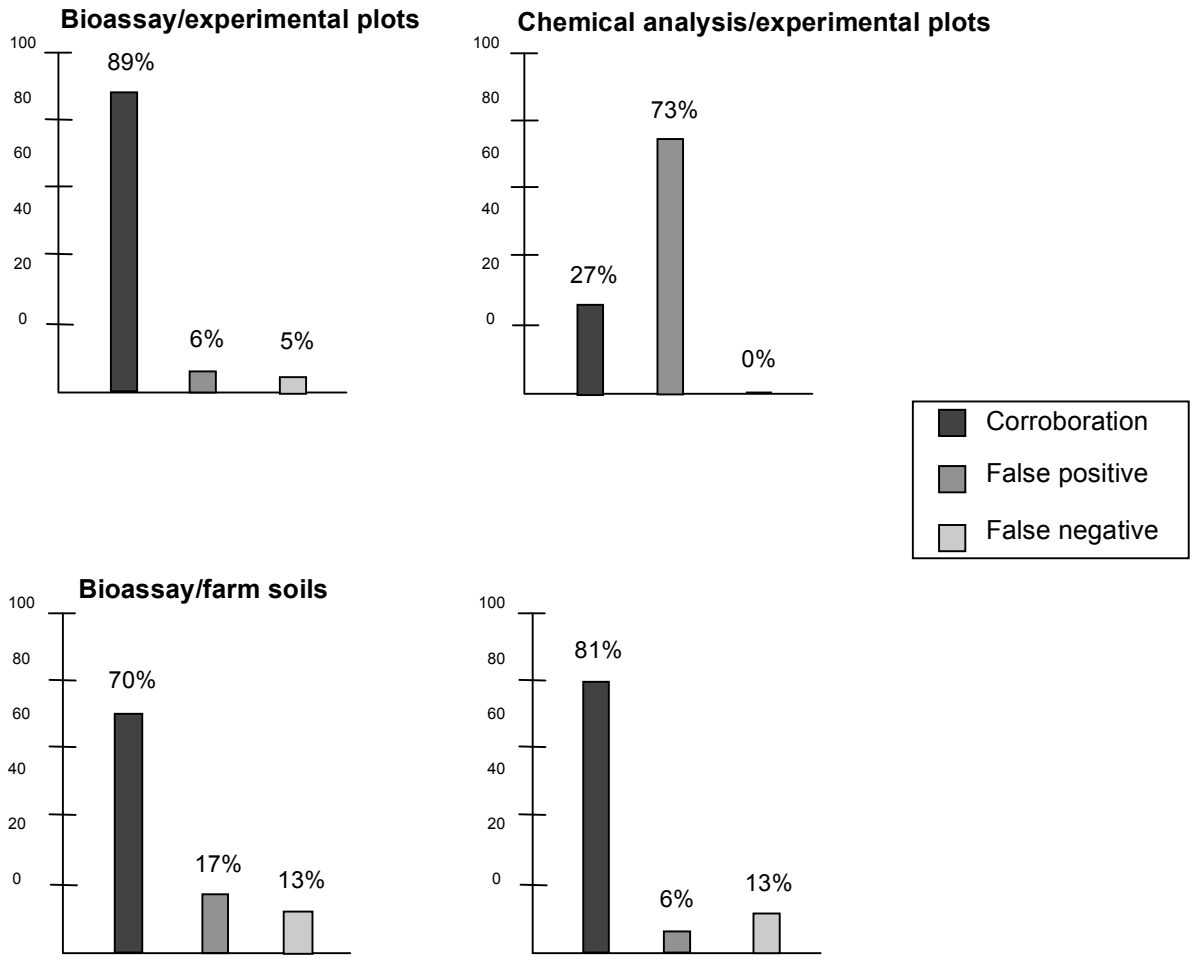

Fig 2. Prediction of crop damage in soils from replicated experimental plots and farm fields using a mustard root bioassay and chemical analysis

Conclusions

This research demonstrates that the mustard root length bioassay provides a potentially high level of accuracy in predicting injury to subsequent crops due to residual Group 2 herbicides. However, other factors such as previous herbicide use, soil properties and weather conditions may influence plant uptake of herbicides and should be considered together with the bioassay when making re-cropping recommendations.

References

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