Testing Root Length Bioassay for Assessment of Herbicide Resistance in Wild Oat (*Avena fatua* L.)

UNIVERSITY OF SASKATCHEWAN

Anna M. Szmigielski[1], Jeff J. Schoenau[1], Hugh Beckie[2]

[1]Dept. of Soil Sci., University of Saskatchewan; [2]Agriculture and Agri-Food Canada

Introduction

Wild oat *(A. fatua* L.*)* is one of the ten worst annual weeds of temperate agricultural regions of the world and occurs in all Canadian provinces. The continual evolution of herbicide-resistant wild oat populations and limited herbicide modes of action for its control threaten sustained annual field crop production in many agricultural areas including the Canadian prairies (1).

Monitoring the distribution and abundance of herbicide-resistant weeds requires effective screening tests that can distinguish between resistant and susceptible weed biotypes.

Objectives

The objectives were to test the use of a rapid and simple root length bioassay for assessment of wild oat susceptibilty - resistance to selected ALS-inhibiting herbicides.

Materials and Methods

● Seeds of eight wild oat biotypes characterized as herbicide-susceptible and –resistant based on pot assays were obtained from AAFC in Saskatoon, SK (Table 1).

● The bioassay was performed in 2-oz WhirlPak™ bags (2). Wild oat was grown for 5 days in the laboratory under fluorescent light (Fig. 1).

Fig. 1. Bioassay performed in WhirlPak™ bags.

● Root length of wild oat was measured in response to soil-incorporated flucarbazone (0 - 600 ppm), pyroxsulam (0 - 138 ppm), imazamox/imazethapyr (0 - 896 ppm), and metsulfuron (0 -128 ppb).

Results

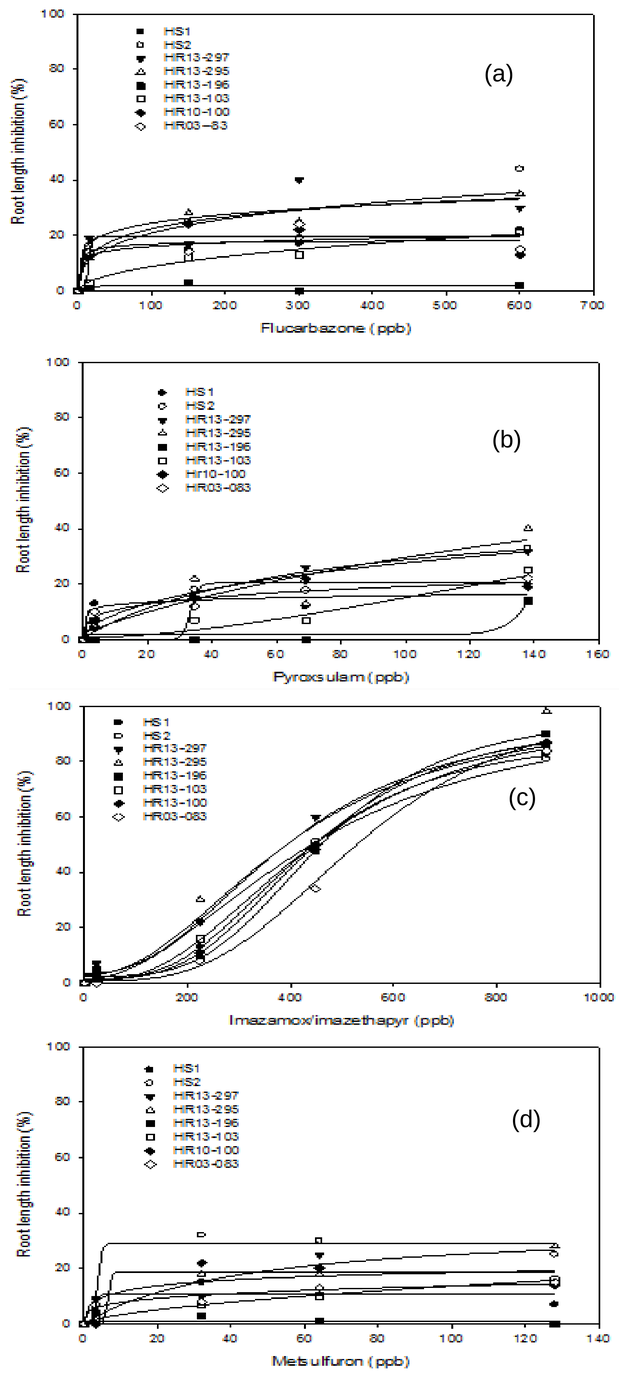

Fig. 2. Root length inhibition of wild oat biotypes in response to increasing concentration of (a) flucarbazone, (b) pyroxsulam, (c) imazamox/imazethapyr, and (d) metsulfuron.

Discussion

● Root length inhibition of the investigated biotypes in a herbicide concentration range from 0 to 40X was low in response to flucarbazone (Fig. 2a), pyroxsulam (Fig. 2b) and metsulfuron (Fig. 2d), and was very high in response to imazamox/imazethapyr (Fig. 2c).

● Based on these results, all of the tested wild oat biotypes would be characterized as resistant to flucarbazone, pyroxsulam, and metsulfuron but highly susceptible to imazamox/imazethapyr.

● There is a disagreement between the results from the root length bioassay and the pot assay (Table 1).

Table 1. Susceptibility/resistance of wild oat biotypes to selected ALS-inhibiting herbicides evaluated in pot assays by AAFC Saskatoon.

Wild oat biotype	Susceptibility/resistance to selected ALS-inhibiting herbicides
HS1	Susceptible (to all classes of ALS-herbicides)
HS2	Susceptible (to all classes of ALS-herbicides)
HR13-297	85% resistant to Everest (flucarbazone)
HR13-295	96% resistant to Everest (flucarbazone)
HR13-196	98% resistant to Pursuit (imazethapyr)
HR13-103	100% resistant to Simplicity (pyroxsulam)
HR10-100	97% resistant to Simplicity (pyroxsulam)
HR03-083	100% resistant to Assert (imazamethabenz)

Conclusions

Because the results from the root length bioassay do not agree with the results from the pot assays, the root length bioassay is considered **not** suitable for assessment of susceptibility/resistance of wild oat to ALS herbicides.

References

(1) Beckie H.J. Heap I.M. Smeda R.J. Hall L. M. (2000) Screening for herbicide resistance in weeds. Weed Technol. 14:428-445.

(2) Szmigielski A.M., Schoenau J.J. and Beckie H.J. (2015). Assessment of Wild Mustard (*Sinapis arvensis* L.) Resistance to ALS-inhibiting Herbicides, Herbicides, Physiology of Action, and Safety, Dr. Andrew Price (Ed.), ISBN: 978-953-51-2217-3, InTech, Available from: http://www.intechopen.com/books/herbicides-physiology-of-action-and-safety/assessment-of-wild-mustard-sinapis-arvensis-l-resistance-to-als-inhibiting-herbicides

Acknowledgements

Financial support of Saskatchewan Agriculture Development Fund, Saskatchewan Pulse Growers and Western Grains Research Foundation is gratefully acknowledged.