

A Confounding Effect of Ammonium Toxicity on Bioassay Detection of Thien carbazole in Soil

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Introduction

Generally plant response measured in a bioassay is not specific to one source. The lack of specificity may be desirable because the presence of all herbicide residues that detrimentally affect the same plant parameter are detected. However, other soil applied chemicals apart from herbicides may also alter the parameter measured in a bioassay.

Thien carbazole, an ALS-inhibiting herbicide is used post-emergent (POST) for control of certain annual grass and broadleaf weeds in wheat at a rate of 5 g ai ha⁻¹.

Typically, ALS-inhibiting herbicides are detected in soil using root inhibition of susceptible plant species (Jourdan et al. 1998; Szmigielski et al. 2008).

Objectives

The objectives were (1) to use oriental mustard root length bioassay for detection of thien carbazole residues in soil, (2) to examine the effect of ammonium on inhibition of oriental mustard roots, and (3) to use canaryseed plants for detection of root inhibition associated with ammonium toxicity.

Materials and Methods

Root length bioassay was performed in 2-oz WhirlPak™ bags (Szmigielski et al. 2008). Oriental mustard (*Brassica juncea* L. 'Cutlass') was grown for 3 d while canaryseed (*Phalaris canariensis* L. 'CDC Togo') was grown for 5 d (Fig. 1).

Effect of thien carbazole on root length of oriental mustard and canaryseed was determined in the concentration range from 0 to 3.9 µg ai kg⁻¹ soil.

Effect of ammonium on root length of oriental mustard and canaryseed was assessed using ammonium nitrate in the concentration range from 0 to 400 µg N g⁻¹ soil.



Fig. 1. Plant bioassay performed in WhirlPak™ bags.

Results and Discussion

Oriental mustard root response is sensitive to thiencazuron (Fig. 2a). However root length of oriental mustard plants is also reduced by ammonium (Fig. 2b). Therefore mustard root inhibition due to ammonium toxicity may be misinterpreted as root reduction due to thiencazuron.

Canaryseed root response to ammonium nitrate is similar to the response of oriental mustard roots (Fig. 2b) but canaryseed root length inhibition due to thiencazuron is very small (Fig. 2a). Therefore canaryseed root length bioassay can be helpful in identifying inhibition caused by ammonium.

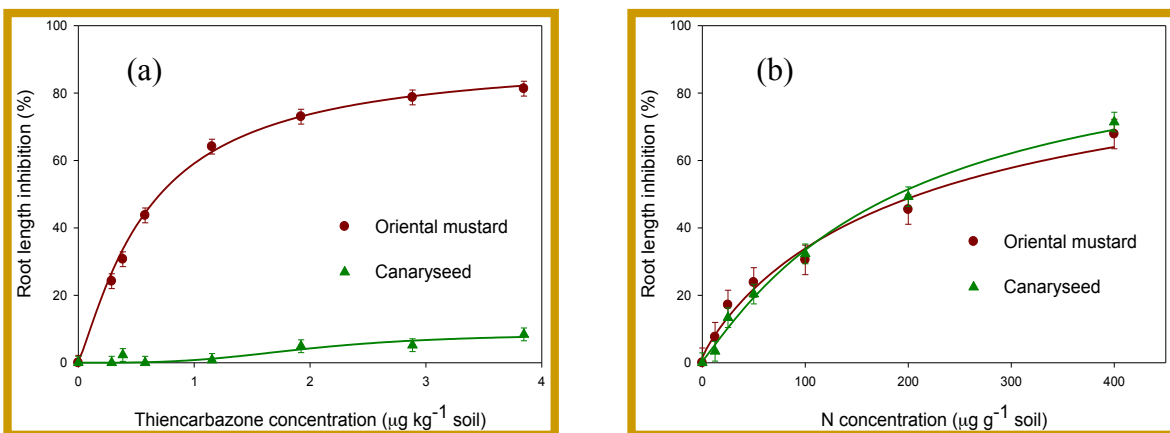


Fig. 2. Root length inhibition of oriental mustard and canaryseed plants in response to (a) thiencazuron and (b) ammonium nitrate.

Practical Considerations

Since ammonium toxicity has a confounding effect on detection of thien carbazon by the oriental mustard bioassay, ammonium from N-fertilization may cause false positive results.

Because canaryseed root bioassay is effective in detecting ammonium in soil, use of oriental mustard and canaryseed root length bioassays together may aid in interpreting results from the oriental mustard bioassay for residual thien carbazon (Table 1).

No reduction of oriental mustard and canaryseed root length indicates that there is no detectable thien carbazon residue and no ammonium in soil

Reduction of oriental mustard but no reduction of canaryseed root length indicates that there is a detectable thien carbazon residue and no ammonium in soil.

Reduction of both oriental mustard and canaryseed root length indicates that thien carbazon residue could be present but because of ammonium, thien carbazon detection is not conclusive.

Table 1. Summary of the results for the oriental mustard root length and canaryseed root length bioassay in soil.

| Oriental mustard root length | Canaryseed root length | Thien carbazon in soil | Ammonium in soil |
|---------------------------------|---------------------------|---------------------------|---------------------|
| ————— cm ————— | | | |
| 7 ± 1 | 8 ± 1 | No | No |
| < 6 | 8 ± 1 | Yes | No |
| < 6 | < 7 | ? ^a | Yes |

^a not conclusive as oriental mustard root reduction may be due to ammonium alone or a combination of ammonium and thien carbazon

References

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