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TOLERANCE OF CILANTRO (Coriandrum sativum) TO POSTEMERGENCE HERBICIDES

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ABSTRACT: Tolerance trials were carried out under greenhouse conditions to determine the tolerance of cilantro to selected postemergence herbicides. Herbicides used were paraquat (1.68 Kg active ingredient/Ha), MSMA (2.24 Kg ai/Ha), 2,4-D (4.26 Kg ai/Ha), bromoxynil (0.28 Kg ai/Ha), atrazine (2.24 Kg ai/Ha), cyanazine (1.12 Kg ai/Ha), metribuzin (0.25 Kg ai/Ha) dimethenamid (1.12 Kg ai/Ha), endothal (0.56 Kg ai/Ha), linuron (0.75 Kg ai/Ha), imazameth (0.067 Kg ai/Ha), imazethapyr (0.028 Kg ai/Ha), acifluorfen (0.28 Kg ai/Ha), lactofen (0.12 Kg ai/Ha), oxyfluorfen (0.03 Kg ai/Ha), and bentazon (1.12 Kg ai/Ha) as well as the untreated control. Herbicides were sprayed when plants reached the two-true leaf stage (approximately 20 days after emergence). No adjuvant was used in herbicide preparations. Linuron, bentazon, oxyfluorfen, acifluorfen, imazethapyr and metribuzin seemed to be have some potential for weed control in cilantro. Other herbicides caused severe phytotoxicity on cilantro leaves.

INTRODUCTION

Cilantro (Coriandrum sativum) is an important seasoning herb in the Caribbean region. This crop is recognized as a weak competitor against weeds, and thus it is recommended that cilantro stands be maintained weed-free during the complete growing season (Morales-Payan 1995). Little information has been published about either the competitive ability cilantro against specific weeds or regarding yield losses in this crop as a result of weed interference.

Weed mixtures caused coriander seed reductions of 40.4% and seed oil losses of 37% in experiments conducted in India (Kothari et al. 1989). In commercial fields in the Dominican Republic, cilantro plant biomass was reduced by nearly 90% due to season-long interference of mixed stands of pigweeds (Amaranthus spp.), hogweed (Boerhavia erecta), spider plant (Cleome viscosa), purple nutsedge (Cyperus rotundus), barnyardgrass (Echinochloa colona), goosegrass (Eleusine indica), bitter weed (Parthenium hysterophorus) and green foxtail (Setaria viridis) (Morales-Payan et al. 1997a). In experiments conducted in the Dominican Republic, cilantro foliar fresh weight was reduced by 60.4% when a population density of purple nutsedge of 50 plants/m^2 was allowed to interfere with the crop during the complete crop season. In that study, as purple nutsedge density increased, cilantro yield decreased (Morales-Payan et al. 1997b).

Traditionally, weed control in cilantro has been done by hand and small cultivation tools. In many cilantro production areas labor availability has sensibly decreased, causing significant increases and/or inconveniences in hand-weeding costs. As a result, the utilization of herbicides as an alternative for weed control in cilantro has become more important. Herbicides reported as selective or satisfactorily safe for use in cilantro include atrazine, DCPA, fuchloralin, linuron, metribuzin, napropamide, oxadiazon, pendimethalin, prometrine, propanil, and trifluralin (Kothari et al. 1989; Zheiljazkov and Zhalnov 1995). Control of most common weeds that occur in cilantro fields, with the notable exception of purple nutsedge, is estimated to be fair to good (over 60% suppression) with the use of these herbicides (Stall et al. 1996). Relatively new herbicides belonging to other chemical families, such as imidazolinones, have not been tested for cilantro tolerance. The objective of this study was to determine the tolerance of young cilantro plants to selected postemergence herbicides.

MATERIALS AND METHODS

Herbicide tolerance trials were conducted during spring and summer 1997 at the University of Florida, Gainesville. Cilantro seeds were planted in multi-cell flats (3 cm^3/cell) filled with a commercial potting medium composed of 50% vermiculite, 30% perlite and 20% spaghnum peat. Once seedlings reached the two-true leaf stage (approximately 10 days after emergence), they were transplanted to 0.5 l plastic containers were filled with the same potting medium previously described. One plant per container was transplanted. Container were sub-superficially irrigated by placing them in trays with water, allowing water to move up through pot bottom-holes. Plants were grown under a 14-hour photoperiod with an average photosynthetic photon flux density of 1800 μmol·m^2·sec with an average day/night temperature of 28/22°C.

Herbicides used were paraquat (1.68 Kg active ingredient/Ha), MSMA (2.24 Kg ai/Ha), 2,4-D (4.26 Kg ai/Ha), bromoxynil (0.28 Kg ai/Ha), atrazine (2.24 Kg ai/Ha), cyanazine (1.12 Kg ai/Ha), metribuzin (0.25 Kg ai/Ha) dimethenamid (1.12 Kg ai/Ha), endothal (0.56 Kg ai/Ha), linuron (0.75 Kg ai/Ha), imazameth (0.067 Kg ai/Ha), imazethapyr (0.028 Kg ai/Ha), acifluorfen (0.28 Kg ai/Ha), lactofen (0.12 Kg ai/Ha), oxyfluorfen (0.03 Kg ai/Ha), and bentazon (1.12 Kg ai/Ha). A non-treated control was also established. Herbicide rates chosen are based on 1X rates used in other crops, such as carrots (Daucus carota), cabbage (Brassica oleracea Capitata group), parsley (Petroselinum crispum), tomato (Lycopersicon esculentum), lettuce (Lactuca sativa), cucumbers (Cucumis sativus), peanuts (Arachis hypogea), cotton (Gossypium hirsutum) and soybeans (Glycine max) (Colvin et al. 1995).

These herbicides were applied to the cilantro foliage in aqueous solution with a manual sprayer calibrated at 300 l/Ha at 20 days after seed emergence (10 days after transplanting). No adjuvant was present in the spaying solutions. Two weeks after application, plants were evaluated for phytotoxicity and harvested for shoot dry weights. A phytotoxicity scale from 0 to 10 was used, where 0 indicates no injury and 10 is total plant death. The effect of the given herbicides on growth was assessed by calculating I_{40} values, which provided the level at which herbicides inhibited 40% of shoot dry matter as compared to the control.

Treatments were organized in a completely randomized design with four replications. Analysis of variance (ANOVA) was performed to test treatment effects at the 5% significance level. If significant differences were found, a Fisher's protected LSD test was carried out to separate treatment means.

RESULTS AND DISCUSSION

Significant differences were found among treatments. As seen in Table 1, linuron at a rate of 0.75 Kg ai/Ha did not differ from the untreated control. Values for I_{40} indicate that along with linuron, bentazon, oxyfluorfen, imazethapyr and acifluorfen at rates of 1.12, 0.03, 0.028 and 0.28 Kg ai/Ha, respectively, did not reduce shoot dry weight in more than 40%. Linuron and bentazon injury symptoms were barely observed even after 3 weeks after treatment (1 in the toxicity scale), whereas oxyfluorfen, imazethapyr and acifluorfen caused a slightly burning in the tips of older leaves (3 in the toxicity scale), from which plants recovered.

Table 1. Tolerance of cilantro to selected postemergence herbicides[1]

Treatment	Rate (Kg ai/Ha)	Shoot biomass (g)	Toxicity (0-10)
control		2.45 a	0
linuron	0.75	2.45 a	1
bentazon	1.12	2.31 b	1
oxyfluorfen	0.03	2.23 b	3
imazethapyr	0.028	1.96 c	3
acifluorfen	0.28	1.91 c	3
cyanazine	1.12	1.61 d	3
imazameth	0.067	1.50 e	6
DCPA	9.00	1.45 e	6
atrazine	2.24	1.34 f	6
dimethenamid	1.12	1.28 fg	6
MSMA	2.24	1.28 fg	6
metribuzin	0.25	1.20 g	2
bromoxynil	0.28	0.52 h	10
paraquat	1.68	0.51 h	10
2, 4-D	4.26	0.51 h	10
endothal	0.56	0.50 h	10
lactofen	0.12	0.50 h	10
		LSD = 0.08	

[1] *Numbers followed by the same letter did not significantly differ (LSD, P=0.05)*

Total plant death was observed with paraquat, 2, 4-D, bromoxynil, endothal and lactofen, while MSMA, atrazine, cyanazine, dimethenamid, imazameth and DCPA caused severe stunting and irreversible leaf burning. However, it is worth to note that metribuzin, even when it stunted plants in the initial stages (2 in the toxicity scale), did not show any visible symptoms and plants somewhat recovered during the latter part of the studies.

Under the conditions of these studies, it can be concluded that DCPA and atrazine showed to be non-selective for cilantro at the rates used, unlike previous reports that suggest otherwise (Kothari et al. 1989; Zheiljazkov and Zhalnov 1995). Further research should look at the effect of different rates of linuron, bentazon, oxyfluorfen, imazethapyr, acifluorfen and metribuzin as well as applications of these herbicides under field conditions to measure efficacy on selected weeds and tolerance on the crop.

REFERENCES

Colvin, D., W. Stall, T. Crocker, L. McCarty, J. Norcini, F. Coale, D. Hall, R. Cromwell, D. Tucker, K. Langeland, G. MacDonald, B. Brecke, J. Dusky, J. Gilreath, D. Jones, A. Meerow, C. Meister, P. Mislevy, M. Singh and E. Whitty. 1995 Florida Weed Control Guide. Gainesville, FL: Univ. of Florida, SP-53. 362 pp.

Kothari, S. K., J. P. Singh and K. Singh. 1989. Chemical weed control in Bulgarian coriander (Coriandrum sativum L.). Trop. Pest Manag. 35 (1):2-5.

Morales-Payan, J. P. 1995. Cultivo de Cilantro, Cilantro Ancho y Perejil. Boletín Técnico No 25. Fundación de Desarrollo Agropecuario. Santo Domingo, Dominican Republic. 26 pp.

Morales-Payan, J. P., B. M. Santos and W. M. Stall. 1997a. Effect of increasing purple nutsedge population densities on cilantro yield. Fla. State Hort. Soc. 1997 Proceedings. Vol. 110 (in press).

Morales-Payan, J. P., B. M. Santos, W. M. Stall and T. A. Bewick. 1997b. Influence of nitrogen fertilization on the competitive interactions of cilantro (Coriandrum sativum) and purple nutsedge (Cyperus rotundus). J. Herbs, Spices and Medic. Plants (in press).

Stall, W. M., J. A. Dusky and J. P. Gilreath. 1996. Estimated effectiveness of recommended herbicides on selected common weeds in Florida vegetables. In: D. Colvin, et al. (eds.), 1996 Florida Weed Control Guide. Gainesville, FL: Univ. of Florida, SP-53. pp. 343-346.

Zheljazkov, V. and I. Zhalnov. 1995. Effect of herbicides on yield and quality of Coriandrum sativum L. J. Essent. Oil. Res. 7(6):633-639.