EFFECT OF ENVIRONMENTAL FACTORS ON HERBICIDAL ACTIVITY OF DIPHENAMID

By

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Diphenamid (N,N-dimethyl-2,2-diphenylacetamide) in an aqueous solution in plastic bottles was partially detoxified when exposed to sunlight for 1 week. Varying spray volumes from 300 to 1,800 l/ha did not have an appreciable effect on the phytotoxicity of diphenamid, sprayed on a coarse or fine soil surface. The marked dissipation of diphenamid which occurred from the soil surface was attributed to photodecomposition and volatilization. Diphenamid phytotoxicity was greater when the first irrigation after spraying was applied in four increments of 100 m³/ha or two increments of 200 m³/ha than when it was applied in a single 400 m³/ha watering: the latter caused more leaching of the herbicide. The diphenamid fraction leached out of a 4-cm soil layer increased as the organic matter content in the soil decreased, from 25% in peat (22.3% o.m.) to >88% in sandy loam (0.9% o.m.). The herbicidal activity remaining after leaching was lower in sandy loam and in peat than in soil with medium organic matter content (11.6% and 6.2%). Diphenamid degradation rate in soil at 50% field capacity moisture level, increased when temperature was increased from 10°C to 30°C. After 4 months of incubation at 10°C, 40–50% of the original herbicide was detoxified, while at 20°C and 30°C the loss exceeded 90%. Within the range of day-temperatures of 10°C to 40°C in soil and of 10°C to 35°C in nutrient solution, diphenamid phytotoxicity to tomato seedlings increased with temperature.

KEY WORDS: Diphenamid; detoxification; phytotoxicity; degradation; soil; temperature; tomato.

INTRODUCTION

Diphenamid (N,N-dimethyl-2,2-diphenylacetamide) is effective in pre-emergence applications for controlling annual grasses and various broadleaved weeds, and is tolerated by several solanaceous crops. It is a valuable herbicide for tomatoes, but erratic results, including crop damage or insufficient weed control, have been reported in Israel.

The behavior of diphenamid in soil appears to be governed by its relatively high water solubility (260 ppm) and its great mobility with water.
in the soil (7, 9, 14, 15, 18). Diphenamid was reported to resist breakdown by exposure to sunlight (1), but in solution or mixed with soil the herbicide was detoxified by gamma radiation (17). Applied to fields in the U.S.A. at normal doses, diphenamid persisted for up to 10 months (19, 24); in Israel, however, its herbicidal activity remained appreciable for much shorter periods.

Different types of damage caused by diphenamid have been observed on solanaceous species. Increased damping-off has been recorded on pepper treated with diphenamid, and the interaction of the herbicide with soil-borne pathogens was discussed by Eshel and Katan (11). Diphenamid injured tomatoes grown in the greenhouse in the winter, apparently due to low light intensity (21).

The present study deals with the effect of several factors related to application and to environment on the performance of diphenamid. The purpose was to understand better the behavior of diphenamid under various conditions simulating practical situations, and to improve accordingly the application techniques. The following factors were investigated, using only bioassays to assess the herbicidal activity: losses in aqueous solution in dark and sunlight, influence of spray volume, dissipation from soil surface, influence of watering and soil organic matter on leaching, and effects of temperature on persistence and on phytotoxicity.

**EXPERIMENTAL AND RESULTS**

Commercially formulated diphenamid (80% W.P.) was used in all experiments. Its herbicidal activity was assessed by various bioassays based on oat (*Avena sterilis* L. cv. Mulga), sorghum (*Sorghum vulgare* L. cv. Hazera Hybrid 6078), or tomato (*Lycopersicon esculentum* Mill. cv. Eilon). The assessed parameters of treated plants were expressed as percentage of the corresponding control. Except when otherwise stated, the soil used in tests was Newe Ya’ar clay. Herbicide concentrations in soil, obtained by thoroughly mixing 20 ml of a given aqueous herbicidal solution with 1 kg of air-dry soil, were expressed in ppm w/w. All containers for plant growth had drainage holes at the bottom.

*Loss of diphenamid toxicity in aqueous solution*

In two experiments, aqueous solutions of diphenamid in closed polyethylene half-liter bottles, were exposed to sunlight or stored in the dark.

In one experiment, bottles with solutions of 0, 0.5, 1 or 2 ppm of diphenamid were either exposed to outdoor sunlight, or kept in the dark in closed cartons. also placed outdoors. The experiment was carried out in