Short communication

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Leaching behaviour of pendimethelin in sandy-clay loam soil of northern Madhya Pradesh

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Chemical weed control in crop cultivation has become indispensable, particularly due to high cost and acute scarcity of labors during the peak period of demand. As a result, herbicide consumption in the country has shown an increasing trend during the recent years. With the increasing awareness and concern for environmental quality, it is important that we consider not only the effectiveness of a pesticide, but also its persistence and mobility in soil.

The relative vertical movement (leaching) of herbicide in soil influences the weed control effectiveness, carryover and the potential for the environmental problem. Typically, pesticide leaching is of critical concern, when it moves into ground water or another location posing an increased risk to human being and/or the environment. Movement of herbicide in soil depends upon many factors, including chemical properties of herbicide, soil factors as well as intensity and frequency of rainfall or applied water. In general, the mobility of a given class of herbicide is inversely related to their adsorptivity by soil.

Pendimethalin (N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitroaniline) belonging to dinitroaniline group, have proved its effectiveness as herbicide in number of crops. It controls wide spectrum of annual broad leaved weeds and grasses (Tripathi *et al.* 1993). A laboratory column experiment was conducted to understand leaching behaviour of pendimethalin in sandy clay loam soils of Northern Madhya Pradesh,

Surface soil sample (0-15cm) from the surrounding area of the Research Farm College of Agriculture, RVSKVV, Gwalior that was never treated with any herbicide were collected, air-dried and passed through a one mm sieve. The soil was sandy clay loam in texture (sand 55.2%, silt 19.4% and clay 25.4%) with organic carbon 0.30% and pH 7.4. Polyvinyl chloride (PVC) columns (10 cm internal diameter and 60 cm long) were used in experiment and arranged in a completely randomized design with three replications. Columns were cut vertically into two parts and two cut halves were joined together using adhesive tape. The muslin cloth was tied to one end and from the open end processed untreated soil was added into columns. The known amount of soil (6 kg) was packed by gently tapping the columns. One day before the herbicide application, 500 ml water was added from the top to pre condition the soil and allowed to drain naturally. Pendimethalin was added directly to column after dilution with 10 ml water at recommended dose (1.0 kg/ha) and double the recommended dose (2.0 kg/ha). The herbicide required was calculated based on open surface area (surface area of a circle $=\pi r^2$). 200 ml of water was added in two split doses of 100 ml at 8.0 AM and 5.0 PM every day to encourage movement of herbicide. A set of columns was used without herbicide for comparison. At the end of the trial (7 days) adhesive tape was cut and the column was split vertically into two halves by passing metal wire along the joint. The herbicide activity was determined at different depths through bioassay by using maize as sensitive plant by following the standard procedure. Plant height, fresh weight and dry weight of maize plant were recorded 21 days after sowing and presented below (Table 1).

The growth of maize due to pendimethalin was affected in the upper layer of soil up to 5 cm at recommended dose (1.0 kg/ha) and up to 10 cm at double the recommended dose. This reveals that pendimethalin does not leach below 10 cm in soil even at double the recommended dose. Gowda *et al.* (1993) reported that mobility of pendimethalin in the 0-5 cm layer was greater than 5-10 cm depth and very little movement occurred at 10-15 cm depth. Sondhia (2007) reported that approximately 80% of applied pendimethalin was found distributed in 0-12 cm soil depth indicating slow mobility of pendimethalin in clay loam soil. Low leaching potential of pendimethalin may be due to strong absorption of this dinitroanilin herbicide as intrinsic mobility of herbicide in soil in inversely related to its sorption to soil surface (Gustafson 1995). It indicates that under normal conditions of average rainfall the risk of ground water contamination with pendimethalin is negligible.

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Table 1. Effect of pendimethalin on growth of maize plant in soil from different depths

Soil depth (cm)	Recommended dose (1.0 kg/ha)			Double the recommended dose (2.0 kg/ha)		
	Plant height (cm)	Fresh weight (g/plant)	Dry weight (g/plant)	Plant height (cm)	Fresh weight (g/plant)	Dry weight (g/plant)
0 – 5	10.12	0.347	0.043	8.68	0.266	0.038
5 – 10	14.35	0.491	0.057	9.73	0.393	0.044
10 – 15	15.00	0.492	0.064	13.01	0.491	0.054
15 – 20	13.70	0.515	0.060	13.44	0.486	0.059
20 – 25	13.24	0.469	0.060	13.45	0.508	0.062
25 – 30	14.61	0.497	0.065	14.14	0.485	0.063
30 – 35	14.47	0.481	0.061	13.67	0.492	0.060
35 – 40	14.00	0.517	0.059	14.00	0.500	0.059
40 – 45	14.44	0.498	0.061	14.47	0.498	0.060
45 – 50	14.33	0.504	0.062	13.73	0.501	0.062
Control (no herbicide)*	14.14	0.505	0.064	14.14	0.505	0.064

* Mean of all (10) values at different depths

SUMMARY

A laboratory column experiment was conducted to study the leaching behaviour of pendimethalin in sandy clay soil of Madhya Pradesh. Soil sample (0-15cm) was packed in PVC columns and conditioned by adding water one day before the herbicide application. Pendimethalin was added directly to column after dilution with 10 ml water at recommended dose (1.0 kg/ha) and double the recommended dose (2.0 kg/ha). Water was added every day to encourage movement of herbicide. After seven days, the column was split vertically into two halves. The herbicide activity was determined at different depths through bioassay by using maize as sensitive plant. The growth of maize due to pendimethalin was affected in the upper layer of soil up to 5 cm at recommended dose (1.0 kg/ha) and up to 10 cm at double the recommended dose. This reveals that pendimethalin does not leach below 10 cm in soil even at double the recommended dose.

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