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Short communication

Leaching behavior of oxyfluorfen in FYM amended and un-amended sandy clay loam soil

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Herbicides are most successful weed control technology ever developed as they are selective, fairly easy to apply and offer flexibility in application time. Herbicides have come as big boon to farmers in areas where labour is limited and wages are high. But along with many advantages, there are some inadvertent disadvantages like shift in weed flora, herbicide resistance and herbicide residues in food chain and ground water. The potential of herbicides in contaminating the ground water have gained considerable attention in recent years.

Oxyfluorfen (Chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifloromethyl) benzene), belonging to diphenyl ether group, is a selective pre- and post-emergence herbicide used to control many annual broad-leaf and grassy weeds in vegetables, fruits, cotton, ornamentals and on non-crop areas. It acts by destroying cell membranes and causing rapid desiccation of the plant. Adsorption of pesticides by soils, that influence the movement of herbicides, has frequently been found to be correlated with organic matter and clay contents. The soil of northern Madhya Pradesh is low in organic matter. Therefore the present study was undertaken to study the mobility of oxyfluorfen in FYM amended and un-amended sandy clay loam soil of Gwalior (Madhya Pradesh).

Soil (0-15 cm depth) was collected from surrounding area of Research farm, College of Agriculture, Gwalior. The soil collection site was never treated with any herbicide. The soil was sandy clay loam in texture with sand 55.2%, silt 19.4% and clay 25.4%. The portion of soil was amended with FYM 20 t/ha, moistened with water and kept for 15 days, air dried and passed through a 2 mm sieve. The experiment was done at ambient temperature in a completely randomized design with three replications. Polyvinyl chloride (PVC) columns (10 cm internal diameter and 60 cm long) were cut vertically into two and joined together using adhesive tape. Muslin cloth was tied to one end to hold the soil. PVC columns were filled with soil (6 kg/column) and packed by gentle tapping the columns. The surface of each column was then covered with sand (3 cm) to maintain uniformity of the column surface during water application. One day before the herbicide application, 500 ml water was added from the top to pre condition soil. Oxyfluorfen was added directly to column after dilution with 10 ml water at doses equivalent to 230 and 460 g/ha. Sufficient quantity of water (200 ml per day) was added 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. The presence of herbicides at different soil depths was determined through bioassay using maize as sensitive crop by following the standard procedure. Plant height, fresh weight and dry weight of maize plant as affected by oxyfluorfen were recorded on 21 days after sowing (**Table 1**).

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Leaching behaviour

The pH of the soil was 7.9 and 7.8, electrical conductivity 0.11 and 0.14 dS/m, and organic carbon 0.20 and 0.33% for non-amended soil and FYM amended soil, respectively. The leaching of oxyfluorfen was affected by concentration of herbicide as well as amendment of FYM as depicted by the growth of maize plant at different depth. Plant height and fresh weight of maize were reduced up to 30-35 cm and 35-40 cm at 230 and 460 g/ha oxyfluorfen, respectively in un-amended soil. In soil amended with FYM the oxyfluorfen leached down to 20-25 cm at 230 g/ha and 30-35 cm at 460 g/ha dose as evident by decrease in maize growth (**Table 1**). The presence of organic matter constitutes an impediment for oxyfluorfen movement because of its high adsorption capacity (Sondhia 2008). Ram Prakash *et al.* (2015) recorded 10 and 15 cm leaching of oxyflourfen in black and red soil of Hyderabad, respectively. Gustafson (1995) revealed that mobility of herbicide in soil is inversely related to its degree of

Table 1. Effect of oxyfluorfen on growth of maize at different depths in FYM amended and un-amended soil

Soil depth (cm)	230 g/ha						460 g/ha					
	Un-amended soil			FYM amended soil			Un-amended soil			FYM amended soil		
	Plant height (cm)	Fresh wt. (g/plant)	Dry wt. (mg/pl.)	Plant height (cm)	Fresh wt. (g/pl.)	Dry wt. (mg/pl.)	Plant height (cm)	Fresh wt. (g/pl.)	Dry wt. (mg/pl.)	Plant height (cm)	Fresh wt. (g/pl.)	Dry wt. (mg/pl.)
0 - 5	20.78	0.773	89	17.74	0.600	67	18.39	0.710	83	17.22	0.613	82
5 -10	20.77	0.717	78	17.91	0.659	77	18.78	0.611	73	16.23	0.604	76
10-15	22.24	0.823	83	17.25	0.648	68	17.52	0.732	83	17.07	0.636	63
15-20	21.66	0.809	78	18.54	0.793	88	21.22	0.766	83	17.05	0.737	67
20-25	23.72	0.840	86	17.44	0.748	80	21.75	0.707	88	20.22	0.830	68
25-30	24.27	0.961	99	28.11	1.250	133	21.11	0.836	97	24.66	0.746	81
30-35	26.55	1.121	124	27.22	1.275	109	26.00	0.926	104	25.22	0.865	109
35-40	31.44	1.533	160	29.72	1.203	128	26.33	0.903	107	27.16	1.118	131
40-45	30.24	1.474	165	28.99	1.056	133	28.00	1.287	122	30.22	1.056	125
45-50	30.66	1.519	135	30.50	1.210	123	30.22	1.286	111	31.26	1.210	136
Control	29.83	1.301	122	26.92	1.249	108	29.83	1.301	122	26.92	1.249	108

sorption to soil surface. The leaching of oxyfluorfen in amended soil up to less depth as compared to un-amended soil may be due to higher organic matter in amended soil resulting in higher absorptive capacity of the soil constituents for herbicide. Sondhia (2008) reported that oxyfluorfen may move up to 90 cm in soil profile under continuous and high rainfall conditions (850 mm natural rainfall) and thus may have potential to contaminate ground water. Janaki *et al.* (2012) reported that oxyfluorfen at recommended and double recommended level leached up to 60 cm in different textured soil, while Mishra *et al*. (2012) recorded leaching of this herbicide up to 15 cm only irrespective of concentrations in sandy clay loam soil. Yen *et al.* (2003) reported that oxyfluorfen was not very mobile in soil and may not contaminate ground water under normal conditions. But in soil of extremely low organic carbon content and coarse texture, oxyfluorfen has the potential to contaminate groundwater less than 3 m deep (Ying and Williams 2000).

SUMMARY

Leaching behavior of oxyfluorfen herbicide was evaluated under laboratory conditions in FYM amended (20 t/ha) and un-amended sandy clay loam soil. Oxyfluorfen at recommended and double the recommended level was applied in soil in PVC columns (10 cm diameter and 60 cm long). After seven days, the presence of herbicides at different soil depths was determined through bioassay by using maize as sensitive crop. The study revealed that oxyfluorfen leaches up to 30 to 40 cm in sandy clay loam soil and the leaching decreases to 20 to 35 cm by amendment of FYM indicating that organic carbon content is an important factor that influence the leaching of oxyfluorfen.

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