POTENTIAL OF THE HERBICIDE FLUAZIFOP-BUTYL TO CONTAMINATE GROUNDWATER IN SUBTROPICAL AREA

Jui-Hung Yen, Wey-Shin Sheu and Yei-Shung Wang

Department of Agricultural Chemistry, National Taiwan University, Taipei, Taiwan

The possible contamination of groundwater by the herbicide fluazifop-butyl was assessed using the behavior assessment model (BAM) and the groundwater pollution-potential model (GWP). The dissipation coefficients of the fluazifop-butyl in soils at different moisture contents (30, 60 and 90% of soil field capacity) and soil temperatures (10, 25 and 40℃) were studied by determining the degradation and adsorption of fluazifop-butyl in the soils. Residues of fluazifop-butyl in soils were extracted by acetonitrile and detected with HPLC. Adsorption of fluazifop-butyl on soils were performed by adding 1 g air day soil to the water containing 0, 0.3, 0.4, 0.5, 0.6 and 0.7 mg/L of fluazifop-butyl, separately, and shaking for 4 hrs under 25 and 37℃, separately. The supernatant was extracted by dichloromethane + *n*-hexane (1:1), and fluazifop-butyl was analyzed by HPLC. The movement of fluazifop-butyl in the soil column was accomplished by leaching the surface-applied herbicide through an acrylic column (40×7 cm i.d.) packed with six tea garden soils, separately, at room temperature (25±2℃).

Adsorption of fluazifop-butyl on soil seems not relative to the soil temperature. Adsorption coefficient (K_d) of fluazifop-butyl on six soils were found from 281 to 3677 μg/g (25℃) and 287 to 3885 μg/g (37℃). (Table 1) Fluazifop-butyl showed a very fast degradation in the soils, even in the low temperature of 10℃. About 50% of original fluazifop-butyl was degraded after 4 days incubation in all soils at 10℃. However 50% of fluazifop-butyl was degraded after 1 day and was not detectable after 4 days incubation at room temperature or higher. In the various soil temperatures and water contents, the half-lives were found from 1 to 14 days at 10℃, but less than one day at 25 and 40℃. (Table 2) In the experiment on the movement of fluazifop-butyl in the soil column, the chemicals could not be detected in the leachate from column until the seventh day of the leaching period. After slicing the soil column and analyzing the content of fluazifop-butyl, only a trace amount of herbicide was detected at 0 to 3 cm depth in all soil columns. (Fig 1) No herbicide was found at the depth greater than 3 cm. Simulation by the behavior assessment model after leaching for 7 days and the relative concentration of fluazifop-butyl in six soils. (Fig 2 & 3) The results showed this herbicide may not lead to contamination of groundwater under normal conditions.

Table 1. The Kd values of fluazifop-butyl in soils at 25 and 37℃

	25℃		37℃	
	K_d	R-square	K_d	R-square
Ttk-ta	3166	0.992	3421	0.993
Ttk-tb	2632	0.985	3230	0.996
Ttk-fa	2204	0.995	2498	0.981
Ttk-fb	714	0.998	775	0.985
Ske	281	0.949	287	0.960
Pc	3677	0.998	3885	0.984

Table 2. The half-life of fluazifop-butyl in soils at different conditions

Soil	Temperature	WHC(%)	μ	R	$T_{1/2}$ (day)
Ttk-ta	40	90	1.417	0.865	0.49
		60	3.000	0.996	0.23
		30	1.464	0.913	0.47
	25	90	1.511	0.997	0.46
		60	1.537	0.990	0.45
		30	1.555	0.983	0.45
	10	90	0.051	0.959	13.50
		60	0.174	0.968	3.99
		30	0.149	0.972	4.64
Ttk-tb	40	90	1.474	0.992	0.47
		60	1.487	0.991	0.47
		30	1.517	0.980	0.46
	25	90	0.726	0.991	0.95
		60	1.556	0.971	0.45
		30	1.600	0.959	0.43
	10	90	0.137	0.986	5.07
		60	0.142	0.997	4.88
		30	0.113	0.988	6.15

Soil	Temperature(℃)	WHC (%)	μ	R	$T_{1/2}$ (day)
Ttk-fa	40	90	1.467	0.969	0.47
		60	1.481	0.983	0.47
		30	1.490	0.960	0.47
	25	90	0.365	0.842	1.90
		60	0.346	0.903	2.00
		30	0.441	0.966	1.57
	10	90	0.054	0.987	12.94
		60	0.055	0.994	12.55
Ttk-fb	40	90	0.056	0.997	12.42
		60	1.479	0.990	0.47
		30	1.526	0.997	0.45
	25	90	0.739	0.980	0.94
		60	1.529	0.933	0.45
		30	1.545	0.959	0.45
	10	90	0.328	0.979	2.11
		60	0.052	0.913	13.41
		30	0.053	0.935	13.00

Soil	Temperature(℃)	WHC(%)	μ	R	$T_{1/2}$ (day)
Ske	40	90	1.394	0.908	0.50
		60	3.000	1.000	0.23
		30	3.000	0.979	0.23
	25	90	3.000	0.956	0.23
		60	3.000	0.941	0.23
		30	3.000	0.883	0.23
	10	90	0.654	0.982	1.06
		60	0.584	0.988	1.19
		30	0.405	0.992	1.71
Pc	40	90	3.000	0.966	0.23
		60	3.000	0.978	0.23
		30	3.000	0.999	0.23
	25	90	3.000	0.976	0.23
		60	3.000	0.978	0.23
		30	3.000	0.896	0.23
	10	90	1.553	0.946	0.45
		60	1.495	0.945	0.46
		30	3.000	0.870	0.23

Fig 1. Distribution of fluazifop-butyl in various soil columns for 30 day.

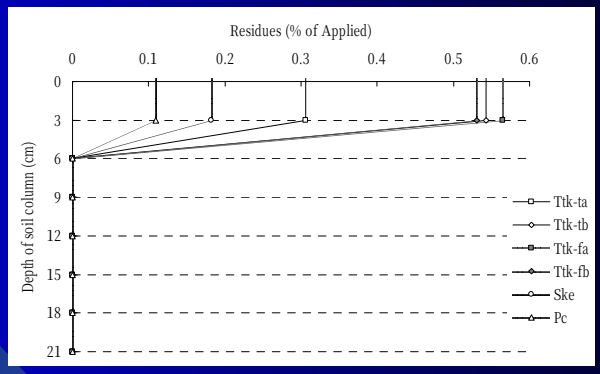

Fig 2. The distribution of fluazifop-butyl in the soil profile simulated by BAM model at 30 day after application

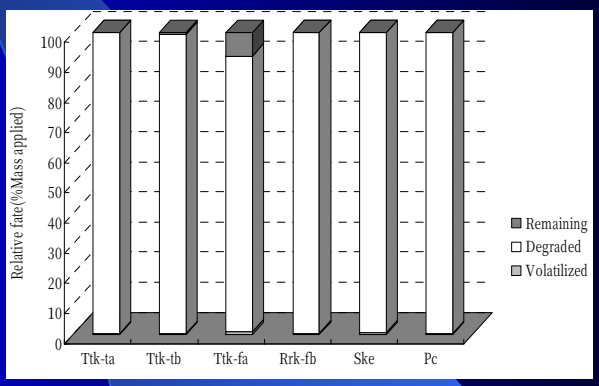

Fig 3. The relative fate of fluazifop-butyl in the environment simulated by BAM model at 30 day after application