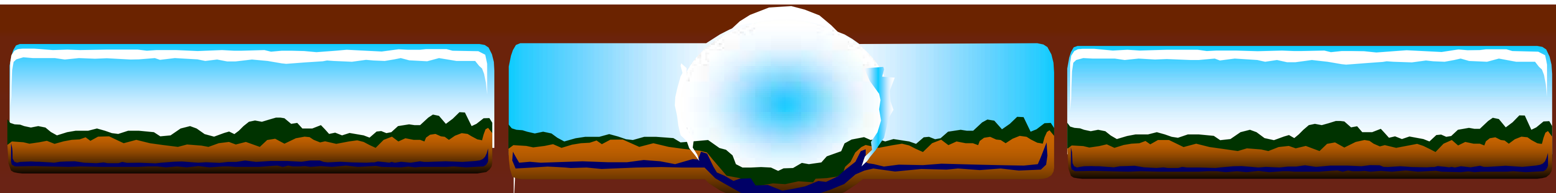

DISSIPATION OF ANILINE HERBICIDE PENDIMETHALIN AND ORYZALIN IN SOILS

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Trifluralin and benfluralin are widely used aniline herbicides in Taiwan. These herbicides are immobile and easily to accumulate in soil because they are very slightly solubility in water and lower vapor pressure. When soil condition changes greatly, the herbicides may contaminate the environment by mass flow or high concentration desorption. It is of important to study the fate and behavior of the herbicides in the soil environment after they were applied. In this study, the experiments were performed by studying: (1) dissipation of two herbicides in three soils, (2) isotherm sorption of both herbicides on soils, (3) movement in the soil columns and (4) the possibility of groundwater contamination by these herbicides by assessing with the behavior assessment model (BAM) and groundwater pollution-potential model (GWP).

The adsorption isotherms for trifluralin and benfluralin under 25 and 37℃ in three soils (Yangmin mountain loam, Tauyuan clay loam and Lukuo sandy clay loam) were found to agree with Freundlich equation.(fig. 1) The distribution coefficients (K_d) of two herbicides in Yangmin mountain loam soil were higher than in other soils. The results indicated that higher organic carbon contains (9.53%) involve the distribution coefficients. The K_d values of trifluralin in three soils were higher than benfluralin.(Table 1) The dissipation rates of herbicides in Yangmin mountain loam soil were more quickly than the other soils. Increasing temperature and soil water content showed to increase the herbicides' dissipation rate ($t_{1/2}$).(Table 2 & 3) After leaching for 42 days in soil columns, no herbicide residues can be detected from the leachate.(fig. 2) For BAM modeling, the mobility of benfluralin was faster than trifluralin.(fig. 3) In the GWP model assessment, the residue of trifluralin was found at 1m depth of groundwater of Lukuo sandy clay loam after leaching for 337 day. But the residue of benfluralin was also found at the 1m depth of groundwater of Lukuo sandy clay loam only after leaching for 173 days.

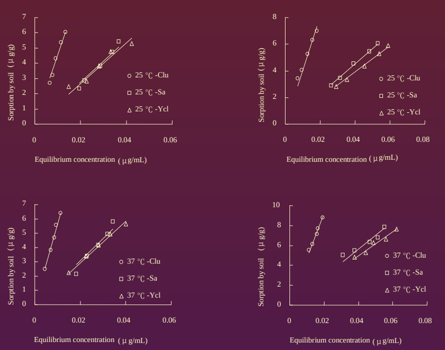

Fig. 1. Equilibrium sorption isotherms of trifluralin and benfluralin at 25 and 37℃

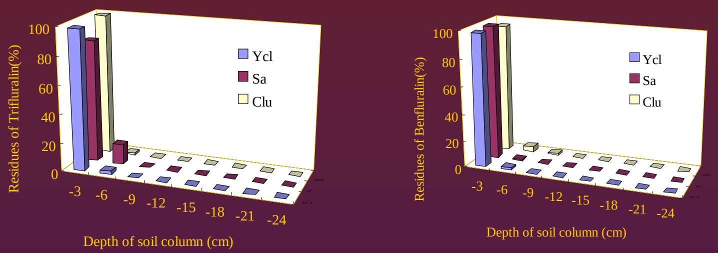

Fig 2. Distribution of trifluralin and benfluralin in three soil columns for 42day

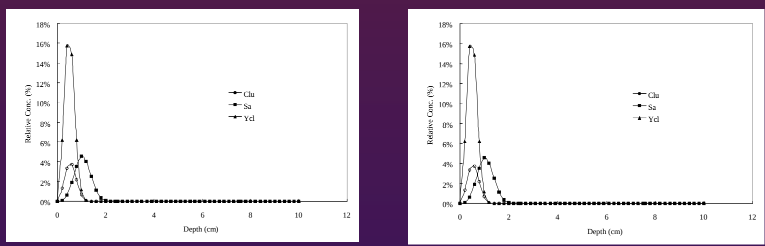

Fig 3. The distribution of trifluralin and benfluralin in the soil profile simulated by BAM at 42 days after application

Table 1. The Kd values of trifluralin and benfluralin in three soils at 25 and 37℃

Temp.(℃)	Trifluralin			Benfluralin		
	Clu	Sa	Ycl	Clu	Sa	Ycl
25	447.8	138.1	133.2	402.4	113.1	97.8
37	558.2	135.6	145.5	462.6	140.0	123.0

Table 2. Dissipation coefficient (K) and half-life ($t_{1/2}$) of trifluralin in the soils under different conditions

T.	Moisture	Clu			Sa			Ycl		
(°C)	%WHC	K(day^{-1})	$t_{1/2}$(day)	R^2	K(day^{-1})	$t_{1/2}$(day)	R^2	K(day^{-1})	$t_{1/2}$(day)	R^2
10	90	0.00200	150.4	0.189	0.00098	307.4	0.726	0.00179	167.9	0.589
25	30	0.00459	56.8	0.702	0.00545	55.2	0.837	0.00339	88.9	0.719
25	60	0.00604	49.9	0.485	0.00907	33.2	0.829	0.00443	67.9	0.874
25	90	0.02334	12.9	0.885	0.01904	15.8	0.969	0.00616	48.9	0.908
40	90	0.02623	11.5	0.741	0.02311	13.0	0.782	0.00462	65.2	0.864

Table 3. Dissipation coefficient (K) and half-life ($t_{1/2}$) of benfluralin in the soils under different conditions

T.	Moisture	Clu			Sa			Ycl		
(°C)	%WHC	K(day^{-1})	$t_{1/2}$(day)	R^2	K(day^{-1})	$t_{1/2}$(day)	R^2	K(day^{-1})	$t_{1/2}$(day)	R^2
10	90	0.00263	114.7	0.379	0.0021	146.2	0.417	0.0020	153.9	0.009
25	30	0.00423	71.1	0.931	0.0084	35.8	0.913	0.0047	63.5	0.855
25	60	0.00442	68.0	0.881	0.0068	44.6	0.838	0.0060	50.2	0.574
25	90	0.00100	30.4	0.880	0.0016	37.2	0.578	0.0069	44.0	0.791
40	90	0.02246	13.4	0.987	0.0186	16.21	0.939	0.0166	18.15	0.901