

Table 3. Initial deposit, degradation constant and half lives of CMC in soil and water

Sample	Dose ($\mu\text{g g}^{-1}$)	Initial deposit (a)	Degradation constant (b)	T $\frac{1}{2}$ (days)	Prediction equation
Soil	50	42.36	-0.0214	14.01	$Y = 42.36 - 0.0214 X$
	100	80.16	-0.0201	14.40	$Y = 8.16 - 0.0201 X$
	200	160.3	-0.0212	14.17	$Y = 160.32 - 0.0212 X$
Water	50	37.40	-0.0552	5.452	$Y = 37.40 - 0.0482 X$
	100	72.11	-0.0566	5.317	$Y = 72.11 - 0.0513 X$
	200	138.0	-0.0596	5.048	$Y = 138.03 - 0.0596 X$

CMC in soil and water followed first order function. The half life period for CMC in soil and water followed the same trend of results wherein least number of days (5.0-5.4) were required for CMC to degrade to its 50 per cent in water and for soil was 14.0-14.6 days.

References

- Hoskins, W.M. (1961). Mathematical treatment of loss of pesticide residues. *Pl. Prot. Bull. (FAO)* 9: 163-168.
- McCall, P.J., Verona, S.A. and Kelley, S.S. (1979). Soil degradation and metabolism of uniformly ^{14}C ting labeled 2,4,5-T and 2,4-D. Abstr. The 178th National meeting of the American Chemical Society, p.58.
- Nigg, H.N. and Stamper, J.H. (1980). Persistence of phenthoate (Cidal) and phenthoate oxan on fruit, leaf and soil surface and in air in Florida citrus, *Chemosphere*, 9: 343-350.
- Timme, G. and Freshse, H. (1980). Statistical interpretation and graphic representation of the degradation behaviour of pesticide residue, *Pflanzenschutz. Nachrichten. Bayer*, 33: 47-60.

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Research Notes

Bioassay studies on the residual effect of herbicides applied to rainfed maize on succeeding cucumber

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Herbicides are applied to control wide range of weed flora in various field crops which apart from controlling target weeds, part of the applied herbicide slowly gets degraded, leaving certain amount in the soil for some period which may get translocated into plant produce and seepage into water bodies in course of time. The residues of soil applied herbicides are estimated qualitatively as well as quantitatively by both instrument and bioassay technique. By using bioassay technique, an attempt was made

to study the residual effect of herbicides applied to rainfed maize on the growth of succeeding cucumber and residues of herbicides was quantitatively determined (Sankaran *et al.* 1993).

Composite soil sample was collected at two stages of maize crop growth (30 DAS and at harvest) from each plot applied with herbicides (atrazine 0.25, metolachlor 1.0, anilofos 0.40 and pendimethalin 1.0 kg ha⁻¹) by two methods (pre-emergence 3 DAS and early post

Table 1. Residual effect of herbicides applied to rainfed maize on growth characteristics of succeeding cucumber (mean of three replications)

Sl. No.	Treatments	30 th day soil sample				Harvest stage soil sample		
		Germination (%)	Plant ht.(cm)	Root length (cm)	Fresh biomass (g/pot)	Plant ht.(cm)	Root length (cm)	Fresh biomass (g/pot)
Pre-emergence application								
1.	Atrazine 0.25 kg ha ⁻¹	80	8.90 (16.0)	4.8 (7.60)	6.74 (14.8)	10.6	5.0	8.05
2.	Metolachlor 1.0 kg ha ⁻¹	90	9.70 (8.50)	4.6 (11.5)	7.71 (2.60)	11.4	5.1	8.52
3.	Anilofos 0.4 kg ha ⁻¹	90	9.30 (12.3)	4.8 (7.70)	6.95 (12.1)	11.9	5.4	8.33
4.	Pendimethalin 1.0 kg ha ⁻¹	95	8.80 (17.0)	4.6 (11.5)	6.23 (21.2)	10.8	5.3	8.90
Early post emergence application								
5.	Atrazine 0.25 kg ha ⁻¹	80	8.85 (16.5)	4.7 (9.60)	7.31 (7.60)	10.2	5.1	8.10
6.	Metolachlor 1.0 kg ha ⁻¹	100	9.20 (13.2)	4.8 (7.70)	7.85 (2.80)	11.6	5.2	8.61
7.	Anilofos 0.4 kg ha ⁻¹	95	9.50 (10.4)	4.8 (7.70)	7.10 (10.2)	11.8	5.0	8.13
8.	Pendimethalin 1.0 kg ha ⁻¹	95	9.40 (11.3)	4.9 (5.80)	7.70 (2.70)	11.1	5.2	8.81
9.	Hand weeding twice (20 & 40 DAS)	100	10.60	5.20	7.91	11.0	5.2	8.75
	CD (0.05)		1.13	1.00	1.00	NS	NS	0.95

Numbers in parenthesis indicate the percentage reduction in biometric characters of cucumber.

Table 2. Exponential growth equation and persistence of herbicide residue on 30th day

Herbicides	Exponential growth equation	Persistence of herbicide residue (ppm)	R ²
Metolachlor	$Y = 8.1219 e^{-0.8913 x}$	0.058	0.92
Pendimethalin	$Y = 8.1233 e^{-0.8057 x}$	0.039	0.94
Anilofos	$Y = 6.7492 e^{-0.7469 x}$	0.035	0.91
Atrazine	$Y = 4.7565 e^{-1.6936 x}$	-0.205	0.97

Y = Fresh biomass

X = Concentration of herbicide

emergence 12 DAS) to rainfed sorghum, grown during *rabi* 1999. The soil samples collected from nine treatments including control plot were used for pot culture experiment using cucumber (sensitive crop) as test crop.

Representative soil sample weighing 2.5 kg was transferred to plastic pots. Each treatment was replicated thrice. In each pot, ten cucumber seeds (local variety) were sown and regular

watering was done. Germination was recorded on 7th day and thinning was done to maintain 2 plants in each pot. After 30 days, plants were pulled out and plant height, root length and fresh weight were recorded. Similarly, soil samples were collected from adjacent field when herbicides were not applied, for developing standard growth curve. As did for herbicide treated soils, known concentration of respective herbicides (0.0, 0.05, 0.1, 0.2, 0.4 and

0.8 ppm) were prepared, added into the pots, stirred well and sown with cucumber seeds. The growth parameters like plant height, root length and weight of fresh biomass were recorded on 30th day and thus data obtained were fit into exponential growth model and growth equations were developed. Based on the highest R^2 values of exponential growth equation obtained for three parameters, the R^2 value derived by using fresh biomass was considered for working out persistence of herbicide residue.

The germination of cucumber seed did not differ under different treatments. Analysis of data on plant height, root length and fresh biomass of succeeding cucumber (Table 1) revealed that residual effect of herbicides (atrazine, metolachlor, anilofos and pendimethalin) applied either as pre-emergence or early post emergence to previous crop (maize) resulted in significant reduction in plant biometric characteristics of cucumber grown in the soil samples collected on 30th day. The reduction in plant height varied from 8.5 to 17.9% for various treatments. The biomass production was reduced up to 21.2% due to residual effect of pendimethalin followed by 14.8% reduction with atrazine residue, as compared to herbicide checkpots. The residual effect of herbicides also resulted in the significant reduction in root length of cucumber which ranged from 7.6% for atrazine and anilofos to 11.5% for metolachlor and pendimethalin. This is inline with the findings of Janardhan *et al.* (1999) who reported that residual effect of pendimethalin applied @ 2.0 kg ha⁻¹ to previous rice crop caused reduction in root length of cucumber. Though there was significant difference in the weight of fresh biomass above that of values recorded in the standard curve, suggesting residues of herbicide were almost nil in the post harvest soil samples.

The data recorded on fresh biomass of cucumber grown in two sets of soil samples

for various treatments were fit into exponential growth equation and persistence of herbicide residue were worked out (Table 2). The herbicides applied as pre-emergence to rainfed maize were found to have persistence on 30th day and they were in the descending order; metolachlor (0.058 ppm) > pendimethalin (0.045 ppm) > anilofos (0.035 ppm). This is in agreement with findings of Jayakumar *et al.* (1990) who found persistence of pendimethalin upto 90 days. The negative impact of atrazine was observed on the growth of cucumber even at lower dose among the herbicides tried, but it could not be determined through bioassay as the quantity of residue might have been low in the soil while no herbicides residue was found in the soil samples collected at harvest stage.

It is inferred that the residue of herbicides were observed in various proportions to the quantity of herbicides applied in the main field upto thirty days after application. The persistence of the residue was found higher for metolachlor (0.058 ppm) followed by pendimethalin (0.039 ppm) and anilophos (0.035 ppm).

References

- Jayakumar, R., Kempuchetty, N. and Sankaran, S. (1990). Persistence of pendimethalin in different soils. In: Abstr. of papers, Biennial Conf., ISWS, Jabalpur.
- Janardhan, G., Muniyappa, T.V., Ramachandra, C., Bhaskar, S. and Krishnamurthy, N. (1999). Residual effect of pre-emergence herbicides applied to transplanted rice on succeeding crops. *Curr. Res.* 28: 12-14.
- Sankaran, S., Jayakumar, R. and Kempuchetty, N. (1993). Herbicide residue, Gandhi Book House, Coimbatore.

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