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DEGRADATION AND PERSISTENCE OF ATRAZINE IN SOILS

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Laterite soil had the highest persistence of Atrazine followed by black and red soils in the decreasing order. Among black soils, soil which had alkaline reaction (pH) exhibited longer persistence. The inhibition of soil microbes at high pH might be the reason for lower rate of Atrazine degradation. The faster rate of Atrazine degradation was due to low clay and organic matter contents. Laterite soils which had 4.29% of organic matter recorded the highest persistence of Atrazine. Because of higher absorption and low rate of desorption, the amount of Atrazine available for chemical and microbial degradation would be much less in laterite soil resulting in longer persistence. The present study also revealed that under field conditions Atrazine persisted in a black clay loam soil for a period of 2 months.

Once a herbicide reached the soil, it is subjected to various reactions with soil and environmental factors. Interactions of a herbicide with soil and environmental factors determine its immediate phytotoxicity and subsequent degradation and hence its persistence of activity, in the soil. Ideally, a given, herbicide should persist just long enough to control the target weeds and then be rapidly degraded to their constituent atoms. If the period of persistence is too long, injury to susceptible plants planted subsequently can occur or long term environmental pollution problem could arise. This paper summarises the investigation made on the degradation and the resulting persistence of Atrazine in soils.

MATERIALS AND METHODS

Six different types of soils viz. Red, black and laterite with different textural make up and soil reaction were selected for the study. Twenty g of each soil sample was transferred into a series of 100 ml ca. test tubes. The soil samples were treated with Atrazine 50 µg/g of soil. After mixing the insecticide well, the solvent was allowed to evaporate. The tubes were then moistened to field capacity moisture and incubated at 25° C±1 C. The treatments were replicated thrice. Analysis of soil samples was carried out 10 days intervals upto 80 days. The entire soil in the test tubes were utilised for the estimation of Atrazine residues (Anon, 1964). The sample was extracted with chloroform and hydrolysed with 50 % H_2SO_4. The sample absorbance was measured in an UV spectrophotometer at 225, 240 and 255 nm, The readings at 225 nm, were used for background correction.

A field experiment was also conducted to study the peristence of Atrazine in a black clay loam soil under a cover crop of sorghum. Atrazine was applied to soil @ 0.25 kg ai/ha as a pre emergent application. Soil sample was drawn at 10 days interval upto 60 days and analysed for the content of Atrazine residues in soil.

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Table 1. Physical and chemical properties of soils used for the study

Properties	Red-1	Red-2	Black-1	Black-2	Black-3	Laterite
1. Clay %	6.23	19.35	53.00	41.00	25.47	22.43
2. Sand %	78.60	68.40	20.20	36.20	49.90	58.41
3. Texture	Sandy	Sandy clay	Clayey	Sandy clay	Clay loam	Sandy clay loam
4. pH	8.30	5.22	8.20	8.30	9.50	4.80
5. E. C. (m.mohs/cm²)	0.82	0.32	0.85	0.42	0.75	0.12
6. O. M. Content (%)	0.46	0.32	0.72	0.65	0.42	4.29

Table 2 : Values of degradation reaction rate constant (K) half-life ($t\frac{1}{2}$) and equation describing loss of Atrazine in soils under field capacity moisture condition.

Soil	K x 10^{-3}	$t\frac{1}{2}$ (days)	Equations describing loss
1. Red-1	5.29	13.08	$C = 50e^{-0.0526}$
2. Red-2	4.81	14.00	$C = 50e^{-0.04181}$
3. Black-1	4.46	15.51	$C = 50e^{-0.0446}$
4. Black-2	3.89	17.81	$C = 50e^{-0.0389}$
5. Black-3	3.84	18.02	$C = 50e^{-0.0384}$
6. Laterite	2.71	25.51	$C = 50e^{-0.0271}$

RESULTS AND DISCUSSION

Table 1 provides the important physical and chemical properties of soils used in the investigation. Among the red soils used, one was sandy in texture and the another with acid sandy loam type. Black soils differed between clay and sandy clay. Among the three Black-3 was alkaline with pH 9.5. Lateriate soil was acidic with sandy clay loam in texture. The organic matter content was also differed, having highest (4.29%) in laterite soil and least in Red soil No. 2

Quantities of Atrazine remaining in all the 6 soils incubated and sampled at different intervals under field capacity moisture level showed that with advancement of time there was an exponential decrease in the concentration of Atrazine whose dose at initial application was 50 ppm and the same residue values when plotted as a function against days, a straight line characteristic of first order rate reaction was obtained. Therefore, the data were plotted as a straightline on semi-log scale as C= Coe-kt.

Where C — Concentration of Atrazine (ppm) remaining at time 't' days.

Co = initial concentration added (50 ppm)

K = degradation re-action rate constant (day-1)

The values of 'k' were calculated by dividing the slope of the straightline by 0.4343. The half-life values were ($t\frac{1}{2}$) calculated using Hoskins (1961) formula. The degradation reaction rate constant 'k', half-life ($t\frac{1}{2}$) period and equations describing the losses of Atrazine for the 6 soils are presented in table 2.

The values of degradation reaction rate constant were high for red soils followed by black and laterite soils in the decreasing order. On the contrary the t 1/2 values were low for red soils followed by black and laterite soils in the increasing order. This clearly indicated that Atrazine was degraded faster in red soils than black or laterite soils. In other words laterite soils had the highest persistence followed by black and red soils in the decreasing order. Among red soils, sandy red soil had a faster degradation than acid sandy clay type. The faster degradation Atrazine in sandy red soil might be due to the low clay and higher sand contents. The slightly longer persistence of Red-2 (Sandy clay) soils might be due to the higher clay content (19.35%) as against 6.23 in Red-1 soil. Among the three black soils, the alkaline (Black 3) soil had the highest ($t\frac{1}{2}$) value. The longer persistence of Atrazine in the alkaline soil might be due to inhibition of microbes at high soil reaction which otherwise would have degraded Atrazine effectively. In general, black soils recorded a longer persistence of Atrazine than red soils, possibly due to larger percentage of clay contents in black soils. Laterite soil had recorded the least 'k' value among the soils and this indicated a very low rate of Atrazine degradation. As evidenced by its half-life value (25.51 days) the persistence of Atrazine in laterite soil was very high. This might be due to the high organic matter content (4.29) and possibly because of higher absorption and low rate of desorption, the amount of Atrazine available fo chemical and microbial degradation would be much less in laterite soil resulting in higher persistence. The possible reason that low pH of soil might have contributed higher persistence of Atrazine, would loose its claim since the acid red soil (Red-2) did not exhibit such behaviour.

Table 3 showed the quantities of Atrazine that remained in a black clay loam soil at different intervals after a pre-emergent application in sorghum field. Atrazine was applied at the rate of 0.15 kg ai/ha and the content of Atrazine in soil after 10 days was 0.650 ppm and the Atrazine residues were detected upto 50 days after application. An amount of 0.032 ppm was recorded 50 days after application. Rohde *et al.* (1981) observed that Atrazine persistence in coastal plain of Southern USA, was 4 months, with 4.48 and 2.24 kg ai/ha applications. They further reported that persistence did not vary significantly with application rates. The present study revealed that under tropical conditions, Atrazine persistence in a black soil for a 25 kg ai/ha dose, was upto 2 months only.

Table 3 : Persistence of Atrazine in black soil

Days after application	Dose kg/ai/ha	Quantity of Atrazine remained in soil (ppm)
10	0.25 kg ai/ha	0.650
20	"	0.520
30	"	0.261
40	"	0.080
50	"	0.032
60	"	ND

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PHENOTYPIC STABILITY FOR CANE YIELD IN SUGARCANE

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Thirteen varieties of sugarcane including four released varieties (Co 1148, Co 1158, Co 7717 and Co 7314) were investigated for G x E interaction for cane yield during three successive years (1979 through 1982). The mean squares due to genotype, environment and G x E interaction were found highly significant. Co 7314 was the highest yielder in each year. On the basis of regression coefficient and deviation from regression, Co 1148 was found the most desirable variety. This variety was also second highest cane yielder over the years.

Before releasing a variety for general cultivation, it has to be grown in a wide range of environments, so as to ensure the stability of its performance. The performance of the genotypes differs in various environments due to genotype and environmental interaction (G x E). To determine the stability of a variety various parameters like mean (x) regression coefficient (b) and deviation from regression ($\bar{s}d^2$) have been used by different workers (Finley and wilkinson, 1963; Eberhart and Russel, 1966; Perkins and Jinks, 1968; Freeman and Perkins, 1971). Present study was carried out to identify high yielding and stable genotypes in the present sugarcane germplasm.

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