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Pencycuron Dissipation in Waterlogged Rice Soil*

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Abstract: Pencycuron dissipation in soils of waterlogged rice field was investigated at Field Rate (FR), 2FR and 10FR with and without Decomposed Cow Manure (DCM) for two consecutive years. Pencycuron dissipated at all treatment combinations following first order kinetics and the half-lives ranged between 4.9 to 5.8 days. DCM amendment has significantly accelerated the pencycuron dissipation.

Key words: Pencycuron, dissipation, half-life, waterlogged soil, *Rhizoctonia solani*

Introduction

Pencycuron [1-(4-chlorobenzyl)-1-cyclopentyl-3-phenylurea] is a non-systemic protective fungicide for controlling sheath blight (*Rhizoctonia solani*) of rice (Tomlin, 1997). Dissipation of pencycuron in soil under laboratory condition (Pal *et al.*, 2005a, c) and in rice plant under field has been reported (Pal *et al.*, 2005b). However, information on the dissipation of pencycuron in soil under actual field condition is lacking. Laboratory results do not necessarily reflect the actual field condition because in field multiple forces simultaneously works (Racke *et al.*, 1997). In addition unrealistic pesticide concentrations not relevant to agricultural management practices may be useful for assessing the environmental risk due to monocultural practices or accidental spills (Perucci *et al.*, 1999). Tropical soils are deficient in organic matter content. Therefore, it is necessary to apply organic supplements to soil on a sustained basis. Rice is the principal crop grown in the tropics, under waterlogged condition during monsoon season. Therefore, field study under rice cultivation was conducted to determine the dissipation of pencycuron in soil.

Materials and Methods

Field experiments were conducted for two consecutive years in the wet seasons (June-October) of 2002 and 2003 at the Agriculture Experimental Farm, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (located at 22° 52' N latitude and 88° 30' E longitude), West Bengal, India with rice (cv. IET 1444). The soil had no history of receiving any pesticide treatment 6 months prior to this study and the field was monocropped with rice only. DCM was applied at the rate of 10 t ha⁻¹. The physico-chemical properties of soil and DCM have been reported (Pal *et al.*, 2005a).

Pencycuron (Monceren 250 SC) obtained from Bayer Crop Science India Ltd., Calcutta was applied at FR (187.5 g a.i. ha⁻¹), 2FR and 10FR. The 1st and 2nd spray of pencycuron were given at

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35 and 50 (in 2002) and 34 and 48 (in 2003) day after transplanting, respectively. Five soil samples (0-15 cm depth) were collected from each of the replicated plots under different treatments at 1, 7, 15 and 30 day after the 2nd spray of pencycuron and composited. Pencycuron was quantified using high performance liquid chromatography (Pal *et al.*, 2005a).

Treatments were replicated three times in a Randomized Complete Block Design (RCBD). IRRISTAT statistical package developed by International Rice Research Institute, Philippines was used for the statistical analysis of the data. Bartlett's homogeneity test was carried out with the two years data. Data observed to be homogeneous for the two years were subjected to combined ANOVA.

Results and Discussion

Pencycuron dissipation in waterlogged rice field soil followed first order kinetics ($r^2 > 0.86$) and the half-life values were obtained between 4.9 to 5.8 days (Table 1) irrespective of pencycuron application rate, DCM amendment and year of experimentation. The half-lives ranged from 5.5 to 5.8 and 5.1 to 5.7 days in DCM unamended and amended soils respectively in the 1st year while the same were 5.2 to 5.5 and 4.9 to 5.5 days in the 2nd year. Thus there was a statistically significant ($p < 0.05$) decrease (Table 2) in half-lives in the 2nd year. Decrease in half-lives might have resulted from greater root mass and exudates of the crop, which stimulated the proliferation of microorganisms (Bhattacharyya *et al.*, 2005) and/or some kind of adaptation in the degrading microflora (Topp *et al.*, 1997) as the field was monocropped with rice. The effect of pencycuron application rate on the half-life values was statistically nonsignificant. Significant acceleration ($p < 0.05$) of pencycuron dissipation due to addition of DCM resulted either from large microbial biomass in DCM capable of degrading pencycuron faster or from the cometabolic effect of DCM on indigenous soil microbial populations (Pal *et al.*, 2005a, c). The half-life values of pencycuron in soil under field were much lower compared

Table 1: Regression equation, dissipation rate constant (k), correlation coefficient (r^2) and half life values of pencycuron in field soil

Treatment	Regression equation	k (day ⁻¹)	r ²	t _{1/2} (day)
1st year (2002)				
Pencycuron Fr ^a	y = 1.571-0.0518x	0.0518	0.94	5.8
Pencycuron 2FR	y = 1.869-0.0513x	0.0513	0.93	5.8
Pencycuron 10FR	y = 2.429-0.0551x	0.0551	0.86	5.5
Pencycuron FR + DCM ^b	y = 1.556-0.0554x	0.0554	0.94	5.4
Pencycuron 2FR + DCM	y = 1.852-0.0526x	0.0526	0.94	5.7
Pencycuron 10FR + DCM	y = 2.432-0.0595x	0.0595	0.89	5.1
2nd year (2003)				
Pencycuron FR	y = 1.575-0.0556x	0.0556	0.93	5.4
Pencycuron 2FR	y = 1.863-0.0549x	0.0549	0.93	5.5
Pencycuron 10FR	y = 2.452-0.0579x	0.0579	0.89	5.2
Pencycuron FR + DCM	y = 1.564-0.0612x	0.0612	0.93	4.9
Pencycuron 2FR + DCM	y = 1.852-0.0592x	0.0592	0.94	5.1
Pencycuron 10FR + DCM	y = 2.437-0.0542x	0.0542	0.88	5.5

^a Field rate ^b Decomposed cow manure

Table 2: Effect of application rate and organic matter on half-life value of pencycuron

LSD ^a	Year (Y)	Pesticide (P)	DCM (D)	P x D	Y x P	Y x D	Y x P x D
(p = 0.05)	0.17	ns	0.17	ns	0.30	ns	ns

^aLeast significant difference

to the laboratory incubated condition. In same soil under laboratory condition, half-lives of 10.7 to 15.9 days at 60% water holding capacity of soil and 14.8 to 17.3 days under waterlogged condition have been reported in our earlier study (Pal *et al.*, 2005c). The observed decrease in the half-life values of penycuron might be attributed to the interplay of multiple forces simultaneously at work under actual field condition (Racke *et al.*, 1997).

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