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EFFECT OF LEVELS OF ORGANIC CARBON ON THE PERSISTENCY OF DIURON (3-(3,4-DICHLOROPHENYL)-1-1-DIMETHYL UREA) IN AN ACID SANDY SOIL

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The persistency of diuron in soils with different levels of organic C was studied in a laboratory incubation experiment. It was found that diuron incorporated with higher organic C levels in soil persisted over a longer period than with lower organic C levels.

INTRODUCTION

Chemical weed control is a routine operation in tea plantations done commonly during (a) the first two years after planting tea and (b) soon after pruning until the canopy regenerates and covers the ground.

During these periods, both pre-emergent and post-emergent herbicides are used to control the weed populations. There is much concern that repeated use of persistent herbicides might cause harmful effects on soil micro flora and hence on soil fertility. In addition, the high cost of herbicides also limits its use to some extent. There is evidence to show that persistency of herbicides depend on the organic matter status of the soil and hence frequency and dosage of application could be varied (Rahman, 1977).

Even though, some studies on this aspect has been done elsewhere only little work has been done in Sri Lanka. The following investigation was undertaken to study the persistency of a most commonly used pre-emergent herbicide in relation to the organic matter content of the soil.

MATERIALS AND METHODS

The soil used for this study was obtained from a depth of 0-10 cm from Field No.1 of St.Joachim Estate, Ratnapura (60 m amsl; 6° 44'N; 80° 21'E) and was air dried and passed through a 2 mm sieve. Some soil properties of this soil are given in Table 1.

TABLE 1 – *Soil properties*

Sand (%)	Silt (%)	Clay (%)	C(%)	pH
89.0	1.0	10.0	1.9	4.6

Four lots each of 15 kg portions of this soil was thoroughly mixed with varying amounts of powdered cow dung (organic C = 15.6 %) to give different levels of organic

C content (1.9 %, 2.3 %, 2.7 % and 3.5 % on a dry weight basis). The soil was then brought to field capacity (20 % w/w moisture content).

This soil in 5 kg portions was transferred into polythene bags and kept at room temperature (30 - 35°C) for equilibration for 4 weeks and then was spread out on a clean polythene and the following treatments were imposed in January 1988. The experimental design was of the completely randomized type.

Treatments

1. T1 – Control
2. T2 – Diuron (3-(3,4-dichlorophenyl)-1,1- dimethyl urea), active ingredient 80 % w/w at 1.2 kg in 560 l of water per ha sprayed onto soil.

There were two main treatments (control and diuron) with 4 sub treatments (levels of organic carbon). Altogether there were 8 treatments replicated 3 times. After imposition of treatments the soils were transferred back to polythene bags and incubated at room temperature (30 - 35°C). The soil moisture was maintained at field capacity (20 % w/w moisture content) throughout the experimental period.

Bioassay technique used

The degree of persistency of herbicides in soil was evaluated at monthly intervals from June (i.e. 6 months after the treatments were imposed) up to December except in the months of September and November. The soil moisture was maintained at field capacity throughout the entire 6 months period before the bioassay was started. It was preferred to use a small seeded annual as the indicator species (Torstensson and Aamisepp, 1977). For this purpose, seeds of *Oryza sativa* of the same size and appearance were soaked in water and kept overnight and later placed in a moist filter paper in the dark for one day. Seeds that had germinated were selected for the bioassay. These seedlings were planted in pots with soil drawn from the incubated polythene bags. The shoot length was measured 3 weeks after planting. There were 5 seedlings and the treatments were replicated 3 times.

RESULTS AND DISCUSSION

The measurement of shoot growth of the plants is given in Table 2. In all the control treatments the shoot length was high compared with the diuron herbicide treatments. Among them the soil with the highest organic carbon content had the maximum shoot length. This is mainly due to the improved fertility of the soil as a result of increased organic C content of the soil (Russel, 1950). Among the herbicides treated soil there is a definite pattern of shoot growth. At a given organic C level the shoot length of *Oryza sativa* in soils treated with diuron was less than that of the control. This was attributed to limited post emergent action of diuron in addition to its pre-emergent action (Zur, Dar and Apt, 1967; Anderson, 1984).

TABLE 2 – *Shoot length (cm) of Oryza sativa*

Treatments	Months after imposition of treatments				
	6	7	8	10	12
3.5 % Org. C + Diuron	13.6	13.4	11.0	8.4	9.4
3.5 % Org. C only	20.1	21.7	20.0	21.0	18.5
2.7 % Org. C + Diuron	8.1	9.1	13.1	11.9	10.9
2.7 % Org. C only	17.6	17.7	20.4	20.1	18.3
2.3 % Org. C + Diuron	4.4	5.1	5.9	11.5	15.0
2.3 % Org. C only	17.0	16.8	19.0	18.7	18.8
1.9 % Org. C + Diuron	4.5	6.4	6.5	10.0	15.7
1.9 % Org. C only	13.7	14.9	14.7	18.7	18.2
LSD (P=0.05)	2.50	2.49	2.25	2.77	2.69

Among the herbicide treated soils, the effect of diuron with higher C levels (3.5 % and 2.7 % C) compared to those with lower C levels (1.9 % and 2.3 % C) is clearly evident towards the end of the experiment as shoot growth becomes progressively reduced. But by this time the effect of diuron with lower C levels has largely disappeared. It is to be noted that in the first 3 months (6th, 7th and 8th months after the treatments were imposed) the effect of diuron with lower C levels effectively controlled the growth of *Oryza sativa* compared to those with higher C levels. This may be due to adsorption of the herbicide into organic matter and its slow release. At the higher organic C levels, the adsorption of herbicides into organic matter may be higher since the rate of adsorption depends on the availability of organic matter. By the 10th month the effect of diuron with all the organic C levels were almost the same while by the 12th month, the herbicide effect of the lower C levels has largely disappeared. However, the herbicide effect at the higher organic C levels still persisted. This may be due to the slow release of the adsorbed herbicide with time. Anderson (1984) reported that soil persistence of urea herbicides is from a few months to an year or more. This indicates that organic C may be an important factor in determining the persistence of diuron in soil.

This preliminary study opens up the possibility of deciding upon the dosage of diuron depending on the organic C levels of the soil. Further studies on this aspect is necessary to evaluate the dosage of diuron according to the organic C content of soils which will no doubt result in the usage of less diuron for effective control of weeds in tea plantations.

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