

PERFORMANCE OF COATED NITROGEN FERTILIZERS IN COCONUT GROWING SOILS

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ABSTRACT

The effect of slow release fertilizers in coconut growing laterite soil by using different slow release N-carriers was evaluated. The results indicated that the Urea-N was maximum at the first day when fertilized with urea, whereas it was comparatively low for slow release sources. With the progress of time, the concentration of urea-N gradually decreased to a low value by the 15th day in urea, 60th day in neemcake coated urea and urea formaldehyde and 120th day in the case of coir dust coated urea. The ammoniacal-N was maximum for urea followed by coir dust and neemcake-coated urea. Urea formaldehyde treatment had relatively low $\text{NH}_4\text{-N}$ on first day and progressively increased upto 60 days. The $\text{NH}_4\text{-N}$ content showed a gradual decrease in the urea treated soils whereas a gradual increase from 1 to 120 days when treated with neemcake coated urea and coir dust coated urea. The nitrate nitrogen concentration progressively increased upto the 15th day in the case of other treatments. The present study reveals in general, the slow release nature of urea formaldehyde and nitrification inhibition property of neemcake and coir dust.

INTRODUCTION

Under tropical situation considerable amount of nitrogen applied in the soil has been reported to be lost on account of leaching and volatilization (Joshi *et al.*, 1986). Simulated leaching studies revealed this loss to be as high as 70% for the applied nitrogen (Anonymous, 1985). Perennial plantation crops like coconut are cultivated to a large extent in these soils. A possible way to minimise these losses is to use slow release nitrogen sources, which release nitrogen gradually over a period of time. Some of the coated or blended N-fertilizers have already been tried in field crops (Prasad *et al.* 1971; Swezy *et al.* 1962, Rajale and Prasad, 1973). Joshi *et al.* (1986) studied the effect of slow release N-fertilizers in red sandy loam soil which indicated that sulphur coated urea gave less ammoniacal nitrogen, followed by urea formaldehyde and N-lignin. On the other hand, Bopaiah and Biddappa (1987) had shown that urea formaldehyde had low content of ammoniacal nitrogen and less urease activity compared to other coated fertilizers. They also observed that urea formaldehyde persisted in the soil for more than 105 days irrespective of

the soil type. Chemical and biproducts of plant origin like non-edible oil seed cakes viz. neem *Azadiricata indica* and Karanja (*Pongamia glabra*) are known to retard nitrification (Sahrawat and Mukherjee, 1977). The present study was, therefore, undertaken to evaluate the immobility or nitrification inhibiting property of different slow release N-carriers.

MATERIALS AND METHODS

A field experiment with four sources of nitrogen viz. urea, neemcake coated urea, urea formaldehyde and coir dust coated urea, at two levels each (250 g and 500 g N per palm per year) alongwith the recommended dose of P and K on five year old Chowghat Orange Dwarf x West Coast Tall hybrid palms at Nooranad, Alappuzha district, Kerala was conducted. Soil at the experimental site was acid laterite with a pH 5.5 in the 0.50 cm layer and 5.2 in the 50-100 cm layer and contained 0.5% organic carbon, 22.6 ppm Bray I P, 65 ppm available K, 0.4 (Meq/100g) and 0.48 (Meq/100g) of exchangeable Ca and Mg, respectively, in the upper layer.

The fertilizers were applied uniformly to

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the entire basin of the palm (dia . 3 m) and forked in. Soil samples were drawn from the field at 0-50 and 50-100 cm depths on 1st, 15th, 60th and 120th days after the application of fertilizers. The soils were fractionated for urea, ammoniacal and nitrate nitrogen following the procedure of Onkan and Sunderman (1977).

RESULTS AND DISCUSSION

Irrespective of treatments the urea-N content was maximum on the 1st day of application (Table I). The highest (64.7 ppm) value was recorded for the uncoated urea treated plot indicating the influence of indigenous materials in reducing the solubility of urea. Among the slow release materials used urea formaldehyde was found to be most effective in reducing the solubility of urea. The urea-N concentration was found to decrease with progress of time in all the treatments. However, the decrease was much faster in the plot treated with uncoated urea. After the 15th day of application very little urea-N was traceable in this plot, whereas a very gradual decrease in urea-N was observed in other cases. At 120th day maximum urea-N was recorded in the plot treated with urea formaldehyde. This indicates the decreased solubility of the material in the plot. The high

urea-N content in the coated urea treated plots might also be due to inhibition of ammonification and nitrification process by the coating materials. The level of N-content was in tune with the quantity of urea applied in all the treatments. A negative trend in urea-N was observed with depth of sampling (Table I).

An increase in both NH_4N and $\text{NO}_3\text{-N}$ content was noted with the passage of time in all cases (Tables II and III). As is evident from the tables the changes in forms of nitrogen in urea plots were much faster at the 15th day after application indicating the absence of any inhibition agents allowing natural process of ammonification and nitrification, whereas when urea was treated with indigenous material, the above process was taking place at very slow pace resulting in higher concentration of NH_4N and $\text{NO}_3\text{-N}$ after longer periods of time (60th and 120th days after application). The results reported are in agreement with the finding of Joshi *et al.* (1986). The lower conversion of urea blended with coir dust to $\text{NH}_4\text{-N}$ may be due to inhibition of urease activity in soil by dihydric phenols and quinones (Bremner and Douglas, 1971).

Irrespective of treatments all forms of N

Table I. Concentration of urea-N (ppm) in soil (0-50 cm and 50-100 cm) under different slow release N-carriers

Treatments	Period of sampling after treatments							
	1 day		15 days		60 days		120 days	
	0-50	50-100	0-50	50-100	0-50	50-100	0-50	50-100
Urea (250 g N)	60.5	2.0	11.0	0.9	0.8	Tr	Tr	Tr
Urea (500 g N)	64.7	3.7	18.7	2.0	1.34	Tr	Tr	Tr
Neem cake coated urea 250 g	50.5	6.6	16.6	3.4	8.5	Tr	Tr	Tr
Neem cake coated urea 500 g	60.2	10.3	23.3	3.1	9.2	Tr	0.7	Tr
Urea formaldehyde 250 g	19.7	1.7	10.7	3.8	5.7	Tr	2.9	Tr
Urea formaldehyde 500 g	28.3	3.1	12.5	4.4	11.4	Tr	5.1	Tr
Coir dust coated urea 250 g	50.7	4.4	28.9	0.8	14.4	Tr	0.7	Tr
Coir dust coated urea 500 g	55.5	9.4	49.7	0.9	18.6	Tr	1.8	Tr
Control (No Nitrogen)	0.3	Tr	Tr	Tr	Tr	Tr	Tr	Tr
CD (P = 0.05)	6.42	1.73	4.6	0.76	4.6	-	0.5	-

Tr : Trace amount

Table II. Concentration of NH₄N (ppm) in soil (0.50 cm and 50-100 cm) under different slow release N-carriers

Treatments	Period of sampling after treatments							
	1 day		15 days		60 days		120 days	
	0-50	50-100	0-50	50-100	0-50	50-100	0-50	50-100
Urea (250 g N)	177.1	159.6	221.9	102.6	121.6	104.2	112.3	97.5
Urea (500 g N)	340.6	175.3	336.1	142.2	191.0	131.3	171.4	120.5
Neem cake coated urea 250 g	165.0	11.5	184.8	131.5	231.6	136.1	262.1	130.4
Neem cake coated urea 500 g	277.8	124.5	297.7	147.3	276.5	153.3	282.7	142.2
Urea formaldehyde 250 g	153.00	112.5	159.2	118.2	171.3	118.1	172.0	121.2
Urea formaldehyde 500 g	174.6	121.9	211.2	128.5	221.3	130.3	226.1	136.2
Coir dust coated urea 250 g	169.9	147.0	224.9	161.9	238.0	150.8	222.7	148.5
Coir dust coated urea 500 g	218.1	167.4	269.5	175.6	271.9	166.8	257.3	151.9
Control (No Nitrogen)	125.1	96.9	120.2	95.5	109.6	92.9	99.3	89.3
CD (P = 0.05)	10.9	5.7	11.3	5.8	7.1	7.8	12.8	5.7

Table III. Concentration of NO₃-N (ppm) in soil (0.50 and 50-100 cm) under different slow release N-carriers

Treatments	Period of sampling after treatments							
	1 day		15 days		60 days		120 days	
	0-50	50-100	0-50	50-100	0-50	50-100	0-50	50-100
Urea (250 g N)	23.1	15.7	44.1	19.6	33.8	16.8	16.4	13.8
Urea (500 g N)	35.3	24.0	62.9	27.6	53.0	24.9	28.5	20.9
Neem cake coated urea 250 g	11.7	12.4	24.0	13.4	32.2	14.9	45.1	18.6
Neem cake coated urea 500 g	16.8	17.6	36.3	23.3	38.6	25.9	49.2	31.5
Urea formaldehyde 250 g	8.5	9.5	15.4	11.6	20.9	13.2	42.7	23.2
Urea formaldehyde 500 g	11.8	12.0	19.2	17.7	52.0	19.9	65.2	24.6
Coir dust coated urea 250 g	13.4	12.2	20.2	13.0	20.8	11.2	23.4	19.9
Coir dust coated urea 500 g	19.8	14.8	24.4	25.5	37.2	22.2	41.5	32.4
Control (No Nitrogen)	13.1	9.0	12.0	6.9	10.4	5.3	9.9	6.0
CD (P = 0.05)	2.4	2.7	3.1	2.6	2.3	2.8	3.5	4.2

were found to decrease with depth of sampling. This might be attributed to rich microbial activity in the surface soil. From the data it was observed that NO₃-N concentration was (8-19 ppm) on the first day of application in all treatments except urea treatment, whereas in the urea

treated soil it was in the range of 23 to 35 ppm in 0-50 cm depth. The nitrate nitrogen concentration progressively increased upto the 15th day in the case of urea treated soil and only by 120th day in the case of other treatments.

Among slow release materials used neemcake and coirdust were found to have higher inhibition property. Some of the vegetable tannins (Basarha, 1964) quinoles and phenolic compounds (Mishra, *et al.* 1980) are known for their strong nitrification inhibiting properties in the soil.

The results of the present study clearly revealed that all slow release N sources are superior to ordinary untreated urea for the gradual supply of nitrogen to the soil. Similar results are reported by Gorgin (1962) and Gasser (1970). Thus, it is possible to conserve nitrogen in the soil, to some extent, which otherwise gets lost due to denitrification and consequently by leaching and volatilisiation. Hence, there is great scope for economising N use by blending N-fertilizers with indigenous materials like neem cake and coirdust.

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