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DISSOLUTION RATE OF UREA AND MURIATE OF POTASH PACKED IN PERFORATED POLYBAGS

Ensuring slow release of fertilizers is one of the methods to improve their efficiency by reducing loss from soif in solution and gaseous forms. Several types of slow release fertilizers are suggested to improve the efficiency of applied fertilizers . Salonius (1978) reported that plastic coated urea is more efficient in white spruce plantations in Canada as compared to prilled urea. He also observed that coated urea was released slowly and to a smaller volume of soil and that less of it was immobilised by microbial and chemical action. Sulphur and shellac coated fertilizers have been widely tested in the case of nitrogenous fertilizers (Prasad *et al.* 1971 and Bandyopadhyay and Biswas, 1982). Placement of urea paper packets has been suggested as an alternate low cost technology for improving efficiency of applied N to rice (IRRI, 1974). In Rice Research Station Moncombu, Kerala, placement of N in paper balls was found to be effective in increasing grain yield of rice (Anon. 1980). Mani and Palaniappan (1979) obtained higher yield of paddy by the use of paper packed urea as compared to prilled urea. Experiments at Pattambi, Kerala, showed that sulphur coated urea increased nitrogen response and grain yield in rice (Anon. 1979). The effectiveness of resin and sulphur coated fertilizers in tobacco was investigated by Valentine *et al.* (1978) and they observed that coated K fertilizers were more effective especially in the years of heavy rainfall.

Trials conducted on the laterite soils of FACT Agricultural Research Station, Udyogamandal, Cochin showed that supergranulated urea and urea formaldehyde (ureaform) were better than prilled urea, with respect to N use efficiency in rice (Vijayachandran and Prema Devi, 1982).

Slow rate of availability of fertilizer nutrients is important in plantation crops also, as they require year round availability of fertilizer nutrients. But in high rainfall areas even with two or three split applications, a good percentage of the applied soluble fertilizers will be lost by leaching. Many of the commercially available coated fertilizers are not extensively used because of the high cost. Therefore, an attempt was made to study the effectiveness of perforated polythene packets in reducing the rate of release of urea and muriate of potash (M.O.P.) in rubber plantations. The study was conducted at Kerala Agricultural University, Trichur.

As a preliminary step to study the efficiency of perforated polythene packed fertilizers, observations were taken on the dissolution rate of packed urea and M.O.P. buried in fertilizer trenches of rubber trees during south west monsoon season. The treatments of the trial consisted of combinations of two types of perforated polythene bags (with eight sewing needle holes/cm" and with four sewing needle holes/cm^2) and two fertilizers (urea and M.O.P.). The quantity of fertilizers filled in each bag was 250 g.

These treatment combinations were tested under cropped field conditions during Kharif 1981. The efficiencies of the treatments were tested during summer under simulated rainfall using rose-cans. The dissolution rate of urea and M.O.P. through perforated polythene bags was worked out for the respective investigations.

Polythene bags of size 15cm x 10 cm were needle holed in a sewing machine to get the required number of perforations. The bags were filled with 250 g of urea and M.O.P. separately and sealed. Each bag constituted one plot and the experiment was planned as CRD with three replications.

In the first trial, the packed fertilizers were buried in trenches around rubber trees, 30 cm deep, 1 m apart and 1 m away from the tree, in early June with the onset of south west monsoon. Thirty six bags were buried; six bags around each tree (3 with 4 perforations/cm^2 and 3 with 8 perforations/cm^2) so that three bags could be taken out at random from each set every month. The dug out fertilizer bags were cleaned by using dry cloth, opened with a knife, air dried and were then placed in known weight of distilled water to dissolve the fertilizer in it. The solution was filtered and the quantity of fertilizer left in the solution was estimated gravimetrically. The impurities originally present in urea and M.O.P. were estimated. separately andthis wastaken into consideration while calculating the percentage dissolution.

The same treatments were compared under simulated conditions also. For this, 18 bags were buried in each treatment and 1 m^2 area was marked out around each bag. Rainfall was simulated every day or alternate days by using a rose can Twenty to forty litres of water was applied in every square meter area, twice (morning and evening) daily. The dissolution rate was worked out as in the previous case, by periodically taking out the fertilizer bags.

The data on the percentage release of fertilizers are given in Fig. 1 and and Table 1. The dissolution rate of urea was very high as compared to M.O.P, In both the types of polythene bags, all the packed urea was released within two months and during this period, a total of 920.8 mm rainfall distributed over 37 rainy days was received. At the same time, M. 0. P. took three months for complete dissolution. The rainfall received during these three months aggregated to 1449. 6 mm, with 56 rainy days.

The dissolution rate was influenced by the number of perforations per square centimeter. When the perforations were closer, the release was faster in the case of both the fertilizers. It was observed that 81% of the packed urea was released from the bags with eight perforations per cm^2 whereas from the bags with four perforations per cm^2 only 49 per cent was released after a period of one month. At the same stage of sampling, the quantities of M.O.P. released from the two types of packing were 22 and 12 per cent, respectively. At the time of second sampling (2 months after), only 37 and 21 per cent of M.O.P. was released from the packets with four and eight perforations per cm^2, respectively. Urea was more or less completely released by this time from both types of packets

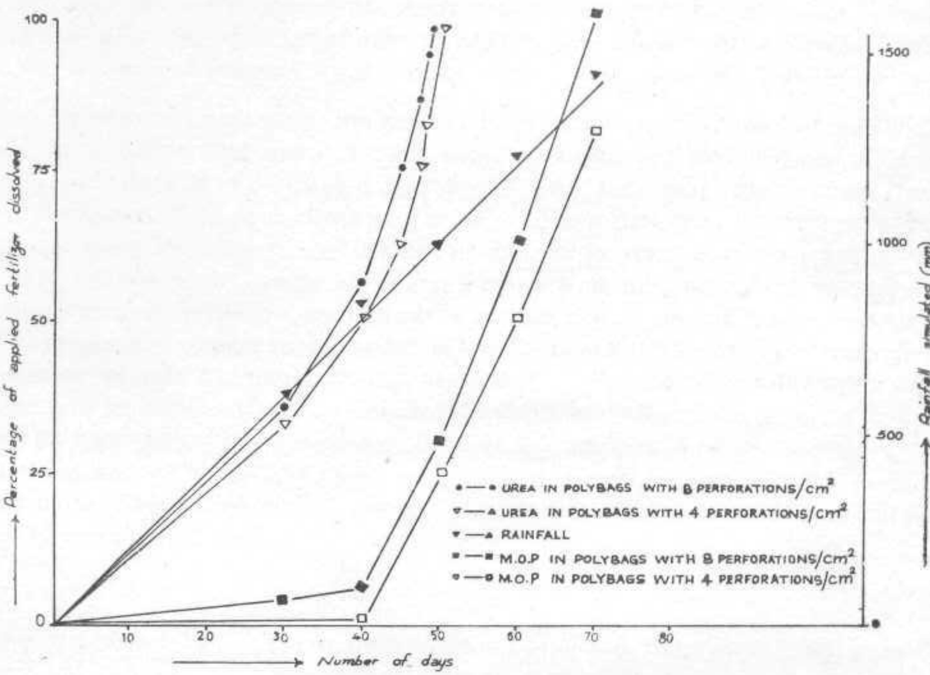

FIG. 1. DISSOLUTION OF UREA AND MURIATE OF POTASH (M.O.P) UNDER SIMULATED CONDITIONS

The dissolution rate recorded under simulated conditions of rainfall (Fig. 1) corroborated the above results. Under simulated conditions, during the initial few days, dissolution rate of urea was negligible. However, about 60% of the urea was released within 42 days and the entire quantity by 50 days. The initial slow release of fertilizers might be due to the tight packing which gave no room for water to enter the bag and stagnate after the release of initial few grams of fertilizer from the bag the packing became loose allowing water to entre and stagnate inside the bag. This resulted in the sudden accelerated release of fertilizers subsequently. The total quantities of water applied during the periods were 840 mm and 1000mm, respectively. As in the case of the study under field conditions, under simulated conditions also the dissolution rate of M.O.P. was slow. After 70 days, with a total of 1440 mm of water, the dissolution was to the extent of 80 to 99%.

It is concluded from the studies both under cropped field conditions and simulated situation that there is substantial retention and slow release of urea and M.O.P. when packed in perforated polybags. The fact that atleast some quantities of fertilizers do remain intact in the bags upto a period of 2-3 months should testify the possible advantage of use of this method for ensuring slow availability in the case of plantation crops in which fertilizers are applied in basins and where the quantities of fertilizers applied per plant are high. In the context, bags with fewer perforations appear to be better as fertilizers are retained upto two months in the case of urea and three months in M.O.P. To suit availability upto varying periods and for different rainfall patterns, further standardisations of porosity of bags would be necessary. Further confirmation of the advantage of the technique would require assessment based on crop response and adoption of it at the farm level would depend on the extent of savings in fertilizers and the additional cost involved in packing the fertilizers.

Table 1

Weight of fertilizer (g)* remaining in the polythene bags at different periods after burial under field conditions

	1 MAB**		2 MAB		3 MAB		Mean
	Urea	M.O.P.	Urea	M.O.P.	Urea	M.O.P.	
T_1	45.5	182.8	0	147	0	0	62.6
T_2	124.6	207.2	12.3	182	0	0	87.7
Mean	85.1	195.0	6.2	164.5	0	0	

C. D. at 5% for interactions 27.9 (SEM±9.3)
 ,, marginal means 19.7 (SEM±6.6)

* Initial weight of fertilizer 250g each

** MAB—Months after burial

T_1—Polythene bags with 8 sewing needle hole/cm²

T_2— ,, 4 ,,

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ചെറു സുഷിരങ്ങളുള്ള പോളിത്തിൻ സഞ്ചികളിൽ 250 ഗ്രാം യൂറിയ, മ്യൂറിയേററ് ഓഫ് പൊട്ടാഷ് എന്നീ വളങ്ങൾ നിറച്ച് സീൽ ചെയ്തു റബറിന്റെ വളച്ചാലുകളിൽ ഇടവപ്പാതിക്കാലത്ത് മണ്ണിട്ടുമൂടി നടത്തിയ പരീക്ഷണങ്ങളിൽ, യൂറിയ മണ്ണിൽ ലയിച്ചുചേരാൻ രണ്ടുമാസവും മ്യൂറിയേററ് ഓഫ് പൊട്ടാഷ് മൂന്നുമാസവുമെടുത്തു.

College of Horticulture
Vellanikkara 680684
Trichur, Kerala

P K. Asokan
R. Vikraman Nair
K. Sudhakara

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