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A NOTE ON THE RUN OFF LOSSES OF MAJOR PLANT NUTRIENTS IN WATER-LOGGED RICE SOILS

Information on the optimum time for dewatering rice fields after fans-planting to minimise nutrient losses by surface run off is lacking. A quantitative assessment of the nutrient losses by surface run off is therefore highly essential to make the rice cultivators aware of the losses if dewatering is done on a particular day after fertilizer application and also to help them to make good the losses after heavy rains. A preliminary experiment was, therefore, conducted at the Kerala Agricultural University campus at Vellayani during the Khariff season of 1975 - 76 using a lateritic clay loam soil collected from the Vellayani area of Trivandrum District. The experiment was carried out in 10 kg pots in a 9 × 4 randomized block design. The pots were filled with air-dried soil and a basal application of N, P_2O_5 and K_2O at the rate of 45-45-45 kg/ha in the form of urea, superphosphate and muriate of potash was given. Water was added to each pot in quantities sufficient to puddle the soil and to stand to a height of 5 cm above the surface of the soil. Twenty day old rice seedlings (Variety Jaya) were then planted in each pot at the rate of two plants per pot. The treatments consisted of removing the surface water by the run off method after 0 (within six hours of application), 1, *2, 3,* 5, 7, 9, 11 and 13 days of fertilizer application and planting and no dewatering. The volume of water removed from each pot was measured and samples analysed for N, P and K. The total nutrients removed were computed from the volume of surface water removed by surface run off.

The percentage nutrient losses when surface water was removed at different intervals of time is given in Table 1 and represented graphically in Fig 1. The results are found to be statistically significant at the 5% level for nitrogen and at 1% level for phosphorus and potassium.

It was observed that about 70% of the applied N was lost when water was removed by run off method on the same day of manuring. The loss was reduced to 44% after 48 hours and it became negligible after the fifth day of fertilizer application. Although urea nitrogen is held weakly by soil it gets hydrolysed to NH_4 ions and is either absorbed as exchangeable ion or gets itself fixed by clay colloids within 4 to 5 days. The observed reduction in N losses with time is obviously due to this phenomenon.

As far as P is concerned the losses are negligible when compared to nitrogen and potassium. However the maximum loss of about *2* per cent occurred on the third day of fertilizer application. The observed reduction in solubility

Table 1

Percentage losses of nutrients by rurface sun off at different intervals after planting

Nutrients '	No. of days 0	1	2	3	5	7	9	11	13	CD
Nitrogen(N)	69.500	44.100	20.700	16.700	11.900	8.000	6.700	6.70	6.70	x 20.27
Phosphorus (P)	1.160	0.696	1.045	2.040	1.280	1.045	1.045	0.93	0.93	xx 0.28
Potassium (K)	26.000	14.500	10.200	5.900	5.400	5.900	5.100	3.30	3.00	xx 3.91

and consequent reduction in loss might be due to precipitation by soluble Fe and Al or by their hydroxides which are abundant in water-logged soils, (Pearsall, 1950; ponnamperuma, 1972). The iron and aluminium phosphates release phosphate as the pH increases on water-logging either by hydrolysis, anion exchange by the reduction of Fe^{+++} to Fe^{++} with the liberation of sorbed or chemically bonded P (Stunn and Morgan, 1970). The observed increase in loss after 24 hours of planting might be due to any one or more of the above reactions. The loss of P was reduced after the third day of application. The phosphate ion released by these reactions might be resorbed by clay or the hydrous oxides of Fe and Al or might diffuse to the upper oxidised zone and get reprecipitated (Hynes and Greib, 1970).

Twenty six per cent of the applied K was lost when dewatering was done on the same day. Maximum losses occurred during the first two days and was negligible thereafter. Like the NH_4^+ ions, K^+ ions are also held adsorbed on the clay complex and those in excess of adsorption and fixation are free to move in the soil water.

The dry weights of grain and straw after harvest were recorded, the data statistically analysed and the results are given in Table 2. Drastic reduction of both grain and straw yields were observed when the surface water was drained on the same day of fertilizer application. Grain yield was 37% of the control whereas it was 50% of the control in the case of the straw. With increasing periods of dewatering the decrease got reduced and became negligible after the fifth day of fertilizer application. The decrease in yield obtained due to dewatering might be due to the cumulative effect of the losses of the major nutrients.

The results showed that the maximum run off loss of 70 per cent of applied N and 26 per cent of applied K occur on the same day of fertilizer application. The losses are considerably reduced after 48 hours and are negligible

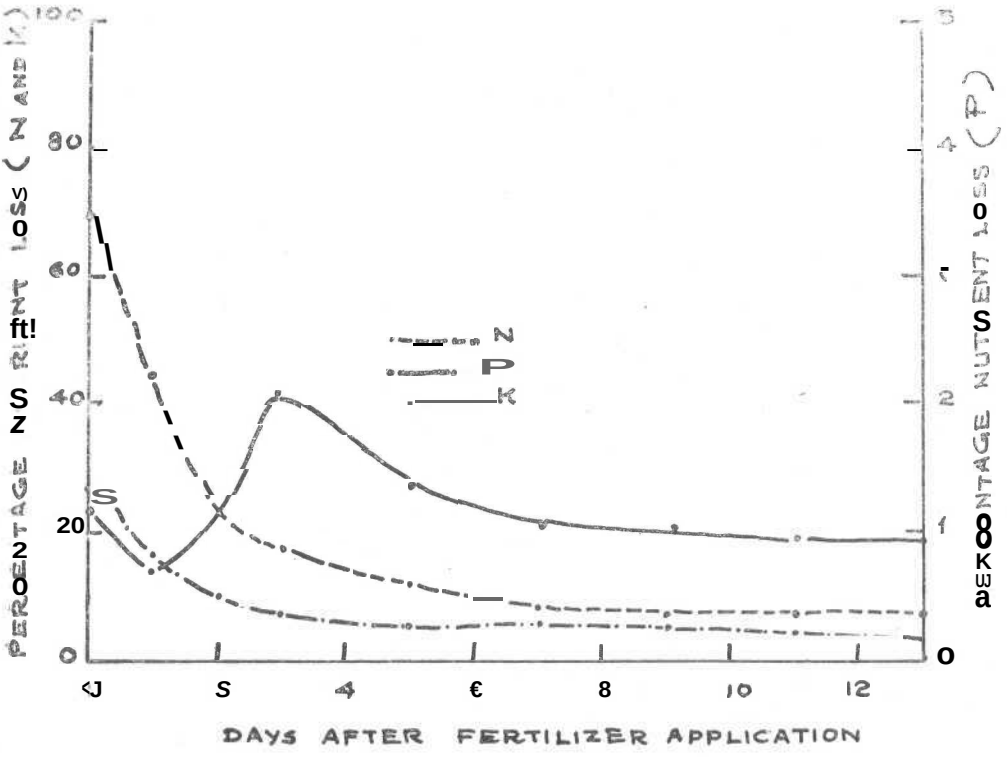

Fig. 1. PERCENTAGE NUTRIENT LOSS BY RUN OFF

Table 2

Grain and straw yield as affected by run off losses

Days after Planting	0	1	2	3	5	7	9	11	13	CD
Grain yield in g/pot	13.0	21.4	26.9	31.4	33.0	32.8	35.6	34.8	34.8	x 15.4
Straw yield in g/pot	14.0	22.1	26.7	26.7	27.3	27.1	27.2	27.1	27.5	xx 3.91

after the 5th and 2nd day of application for N and K respectively. These observations have to be repeated using other common nitrogenous fertilizers and are to be verified by field trials.

സംഗ്രഹം

കേരള കാർഷിക സ്വ്കലാശാലയുടെ വെള്ളായണി കാമ്പസ്സിൽ നടത്തിയ ഒരു പരീക്ഷണത്തിൽ നിന്ന്, ഉപരിതലജലം ചേർത്ത അതേ ദിവസം തന്നെ വാർന്നു പോകയോ വാത്ത കളയുകയോ ചെയ്താൽ രാസവള രൂപത്തിൽ നൽകിയ നൈടജ നെറ 70 ശതമാനവും **26** ശതമാനവും നഷ്ടപ്പെട്ട പോകുന്നതായും അതു മൂലം നെൽ വിളവിനെറ **63** ശതമാനവും വൈക്കോലിനെറ 50 ശതമാനവും കുറയുന്നതായും കണ്ടു. നൈടജനെറയും പൊട്ടാസിയത്തിനെയും നഷ്ടം, വളം ചേർത്തതിനെറയും വാത്തു കളയുന്നതിനെറയും ഇടയിലുള്ള സമയ ദൈർഘ്യം കൂട്ടുന്നതോടെ, കുറയുകയും നൈടജനെറ അഞ്ചും പൊട്ടാസിയത്തിനെറ rosr^o ദിവസങ്ങൾക്കു ശേഷം നാമമാത്രമാകയും ചെയ്യുന്നു. ഫോസ്ഫേറ്റ് വളങ്ങൾ ഉപരിതല ജല പ്രവാഹത്താൽ കാര്യമായി നഷ്ടപ്പെട്ട പോകുന്നില്ല.

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