Agri. Res. J. Kerala, 1976 *14* (1) 68—74

INFLUENCE OF CLAY, ORGANIC MATTER AND SOME OF THE INDUSTRIAL WASTES IN REDUCING THE WATER AND NUTRIENT LOSSES IN THE LEACHATE OF A HIGHLY PERMEABLE SOIL

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The ability of the soil to produce crops depends not only on the proper supply of nutrients, but also upon soil air-water regimes which govern the maximum utilization of available nutrients. The water and nutrients applied are carried down to deeper layers and are not available to plant growth. It has been calculated that in a period of about $2\frac{1}{2}$ years, the nutrient leached in an arable sandy soil amounts to 60 kg. N, 65 kg. K, 200 kg. Ca, and 16 kg. Mg. per hectare (Weise 1970).

Sandy soils are encountered in above 2 lakhs hectares in Tamil Nadu comprising costal areas of South Arcot, Tanjore, Chinglepet, Ramnad and Thirunelveli districts. The loss of applied water and nutrients is a major problem in the management of this type of soils. Hence a study was undertaken to find out the effect of clay, organic matter and some of the industrial wastes on the water and nutrient losses in the highly permeable sandy soils.

Materials and Methods

The influence of clay, organic matter and some of the industrial wastes on nutrient losses in the leachate were studied in a pot-culture experiment with CO-10 Finger millet as the crop in a completely Randomised Block Design with three replications. The soil used for the study was red sandy loam con" taining 0.018 per cent total nitrogen, 0.071 per cent total P_2O_5, 0.51 per cent total K_2O, 0.31 per cent total calcium and 0.18 per cent total magnesium. The pH of the soil was 7.2 and the electrical conductivity was 0.2 m. mhos/cm.

The treatments consisted three levels each of clay (as black soil), organic matter (as F Y M) and industrial wastes (Fly, ash, Flue dust and Cement dust) along with clay and organic matter applied in combination and the performance of these were compared with that of the control (Table 1).

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The leachate was collected by fixing a tube at the bottom of the pot, at three stages of the crop growth and analysed for N, P, K, Ca and Mg contents. Nitrogen was estimated by adding 2-3 g. of Devardas alloy and 10-15 ml. of 30 per cent NaOH to a known volume of aliquot and the contents were distilled. The evolving ammonia was collected in 2 per cent boric acid usiug Methyl red-Bromocresol greeen double indicator. The phosphorus content was estimated by Olsen's method (Olsen, *et ai* 1954). Calcium and magnesium were estimated by Versente titration method (Jackson, 1967). The potassium content in the leachate was estimated by directly feeding the leachate to the 'EEL' Flame Photometer.

Results and Discussion

I. Water loss:

It is seen that the quantity of leachate was less in organic matter applied treatments (Table 1), which could be attributed to the improvement in the water holding capacity. The results of the work carried out on similar soils by Werke (1968), Balev *et al* (1969) and Morizet and Millet (1972) also confirm these findings.

II. Nutrient loss:

Nitrogen: The loss of nitrogen was more in initial stages and thereafter it decreased (Table 2), understandably, because of the removal of nitrogen by crop. Loss of nitrogen was less in organic matter applied pots and was more in all the pots treated with industrial wastes. This is in agreement with the findings of Broadbent and Ott (1957) and Vyas and Motiramani (1971). More loss was recorded in the treatments containing industrial wastes.

Phosphorus: The phosphorus content was more or less constant in all the three stages (Table 2). All the industrial waste applied pots registered less loss of phosphorus in the leachate the maximum being in fly ash applied ones. More phosphorus loss was noticed in organic matter applied pots.

Potassium: The loss of potassium content was in decreasing order as the crop growth advanced (Table 2). Less loss of potassium was registered in the flue dust applied treatments. More loss was noticed in clay plus organic matter applied treatments.

Calcium: Not much variation was observed in the calcium content in all the three stages (Table 3). The loss of calcium was minimum under organic matter applied treatments. In the case of industrial wastes, the cement dust applied treatments recorded lower amount of calcium loss. As in the case

Table 1

Influence of the treatments on leachate collection

cc/5 minutes

Treatments	Leachate I	Leachate II	Leachate III	Mean
Control	331	253	360	314
C_1	233	278	246	252
C_2	333	318	326	325
C_3	295	283	267	281
O_1	231	237	243	237
O_2	257	258	266	260
O_3	181	171	234	202
C_1O_3	249	238	338	275
C_2O_2	267	239	276	260
C_3O_1	294	171	351	280
FA_1	289	352	292	308
FA_2	281	265	277	274
FA_3	330	307	313	316
FD_1	325	250	346	307
FD_2	323	247	293	287
FD_3	323	277	292	326
CD_1	267	223	383	291
CD_2	280	237	338	285
CD_3	329	269	345	314

C = Clay as black soil @ 60, 120 & 180 tons/ha FA = Fly ash @ 7, 12 & 19 tons/ha.
FD = Flue dust @ 7, 12 & 19 tons/ha. CD = Cement dust @ 7, 12 & 19 tons/ha.
O = Organic matter as FYM @ 12, 24 & 36 tons/ha.

Table 2

Influence of the treatments on the Nitrogen, Phosphorus and Potassium content in the leachate

(in ppm)

Treatments	Nitrogen			Phosphorus			Potassium		
	Stage I	Stage II	Stage III	Stage I	Stage II	Stage III	Stage I	Stage II	Stage III
Control	44	44	13	3.3	22	1.5	26.3	14.8	14.5
C_1	98	16	12	1.2	2.5	1.8	26-7	8.2	12 3
C_2	188	18	10	1.0	1.3	1.3	30.7	13.0	14 3
C_3	205	14	10	1.3	1.3	1.3	26.7	12.2	16.7
O_1	83	18	12	10.0	10.2	8.3	51.0	28.0	27.5
O_2	113	[2	12	24.1	26.7	16.4	55.7	40.7	42.5
O_3	48	13	12	29.8	37.2	26.0	50.7	56.2	46.2
C_1O_3	132	12	13	23.8	26.3	22.3	81.3	66.8	61.8
C_2O_2	109	9	17	12.0	19.0	11.4	65.0	30 5	27.2
C_3O_1	145	11	10	2.3	5.5	3.3	48.3	24.7	26.2
FA_1	171	11	11	0.5	1.7	1.5	39.3	13.8	14.8
FA_2	203	10	10	0.5	1.7	1.1	28.0	13.7	12.8
FA_3	179	JO	10	0.5	0.6	2.5	30.7	14.0	11.3
FD_1	90	10	1 !	1.5	2.7	1.7	26.7	10.5	14.3
FD_2	174	If)	11	1.8	1.5	2.4	32.0	9.2	9.7
FD_3	146	8	10	1.7	1.6	1.8	39.0	12.2	12.8
CD_1	86	10	11	.1.9	2.5	3.1	32.3	11 0	14.7
CD_2	199	9	10	1.6	3.0	1.6	32.0	8.0	12.7
CD_3	196	9	11	3.1	2.9	2.0	28.7	14.2	14.3
SE_D	8.515	NS	NS	1.843	0.826	0.814	3.372	2.602	0.793
CD	17.21			3.74	1.67	1.65	6.82	5.26	1.60

SE_D = Standard error of mean difference.

CD = Critical difference at P — 0.05.

NS = Not significant.

Table 3

Influence of the treatments on the Calcium and Magnesium contents in the leachate (in ppm)

Treatments	Calcium			Magnesium		
	Stage I	Stage II	Stage III	Stage I	Stage II	Stage III
Control	263	236	130	184	371	70
C_1	379	347	160	154	422	86
C_2	777	347	137	219	745	64
C_3	887	485	309	231	872	142
O_1	417	283	207	175	623	77
O_2	431	263	189	212	203	135
O_3	383	282	122	158	520	77
C_1O_2	702	512	197	257	497	198
C_2O_2	727	284	151	248	613	109
C_3O_1	847	283	145	242	519	85
FA_1	714	443	161	223	586	78
FA_2	465	341	152	241	228	84
FA_3	893	440	292	187	371	132
FD_1	485	332	177	160	588	132
FD_2	620	401	144	204	235	66
FD_3	593	289	183	181	561	83
CD_1	385	309	198	153	621	134
CD_2	692	359	315	178	836	172
CD_3	387	235	161	147	732	63
SE_D	35.643	25.806	15.668	9.816	18.28	3.55
CD	72.03	52.15	31.67	19.84	36.96	

SE_D = Standard error of mean difference

CD Critical difference at P = 0.05

of nitrogen, phosphorus, potassium, etc. the loss of calcium decreased from the initial stage to the later stages. This can be explained as due to crop removal as it advanced in growth.

Magnesium: The loss of Magnesium in the leachate water was singificantly influenced by the treatments. In general, the industrial wastes applied treatments recorded less loss of magnesium. More loss was registered under clay plus organic matter applied treatments.

Summary

A pot culture experiment with CO-10 Finger millet *Eleusine coracana*. (Gaertn) was conducted to study the influence of clay, organic matter and some of the industrial wastes on the water and nutrient losses in a highly permeable soil (sandy loam) with a view to increasing the fertilizer use efficiency. It was found out that the water and nitrogen losses were reduced by the application of organic matter. In general, the industrial wastes reduced the loss of phosphorus, nitrogen, potassium, calcium and magnesium in the leachate water.

Acknowledgement

The authors express their sincere gratitude to the Tamil Nadu Agricultural University for permitting the publication.

സംഗ്രഹം

പരുക്കൻ മണൽ കൂടിയ മണ്ണിനങ്ങളിൽ വളപ്രയോഗത്തിന്റെ പ്രവർത്തനക്ഷമത വർ ദ്ധിപ്പിക്കുന്നതിനു് ചെളി, ജൈവപദാർത്ഥങ്ങളും, വ്യാവസായികാവശിഷ്ടങ്ങളും എന്നിവ ഉപയോഗിച്ചു് നടത്തിയ ഒരു പരീക്ഷണത്തിൽ നിന്നും, ജൈവപദാർത്ഥങ്ങളും ചേർക്കുന്നതു് വഴി മണ്ണിലൂടെയുണ്ടാകുന്ന ജലാംശത്തിന്റെയും, നൈട്രജന്റെയും നഷ്ടം കാര്യമായി കുറയ്ക്കാമെന്നു് തെളിഞ്ഞു. വ്യാവസായികാവശിഷ്ടങ്ങളും ചേർക്കുന്നതു മൂലം ഫോസ്ഫറസ്സു്, നൈട്രജൻ, പൊട്ടാഷ്യം, കാൽഷ്യം, മഗ്നീഷ്യം എന്നിവയുടെ rarogaj നിർഗ്ഗമനം ജലത്തിൽ കാര്യമായി കുറയുകയുണ്ടായി.

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(M. S. *received:* 21-7-1976)