

STUDIES ON THE LOSS OF NUTRIENTS BY SEEPAGE AT CENTRAL FARM COIMBATORE *

N. Nadanam and Y. B. Morachan.

Tamil Nadu Agricultural University, Coimbatore

The information on water and nutrient loss by way of percolation and leaching due to excess irrigation and rainfall is meagre in general and in India in particular. Since water application efficiencies are generally very low under irrigation, there are undoubtedly great losses of plant nutrients by leaching from irrigated soils. The amounts of nutrients lost by leaching have been reported by several workers abroad. The leaching losses ranged from as low as 3.8 pounds of nitrogen per acre per year from the nitrogen deficient non-fertilized, mustard cover-cropped soil to 88 pounds, from the treatment of cereal straw and 200 pounds of nitrogen fertilizer (Thorne and Peterson, 1954).

Buckman and Brady (1967) reported that nitrogen is generally leached in the form of nitrate and losses of P due to leaching is generally insignificant. K and Ca losses due to leaching are small compared to the total quantity of these elements in the top soil, these losses may be appreciable when compared to other elements. Donahue (1958) reported that the relative rate of nutrient losses by leaching from the soil are in the order of Ca, Mg, S, K, N and P in the descending order. Hoffman (1967) reported that the losses by seepage ranged from 63 per cent in a light sandy soil to 35 per cent in a heavy loam. Average annual leaching of nitrogen was 10 Kg/ha two-thirds as nitrate and about 60 per cent occurring during the growth period.

Bobritskaya and Alenko (1967) reported that Lysimetric studies showed that nitrogen removed by percolating water from loamy soil under agricultural crops receiving moderate amounts of fertilizers was compensated by nitrogen in atmospheric precipitation. It is reported that in rainy years 23 Kg N, 15 Kg K, 150 Kg Ca, 51 Kg S and 14 Kg, Mg, ha could be leached away from sandy soil. It is evident that excess moisture either through irrigation or rainfall brings about a substantial leaching of nutrients and leaching of nitrogen seems to be more prone to excess moisture.

Materials and Methods

The experiment was conducted in the Central Farm, Agricultural College, Coimbatore during July-October, 1969. The soil is of sandy clay

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loam with 22.5% clay, 10.25% silt, 26.00% fine sand and 29.15% coarse sand. To assess and analyse the water loss in the seepage an apparatus known as Effective Rainfall apparatus was specially fabricated for the experiment as designed by Ramdas (1960). This apparatus is having a funnel with two feet diameter connected to a measuring bottle by a canvas tube ($\frac{1}{2}$ inch diameter). The funnel is covered with a sieve. The whole apparatus is fixed into the soil at two feet depth and the delivery tube is connected with the measuring bottle situated at 6 feet depth cement tank constructed away from the apparatus,

Regular preparatory cultivations were done and the fertilizers were applied at 135.0 Kg N, 67.5 Kg P and 45.0 Kg K per hectare. Nitrogen was applied in two split doses one at sowing and the rest on 30th day after sowing. P_2O_5 and K_2O were applied as basal dose. The crop grown was maize variety, Hi-starch. The soil was maintained at 80 per cent available moisture regime and irrigated whenever needed. The seepage water received by way of excess rainfall or irrigation beyond two feet depth of soil was collected in the funnel and delivered into the measuring bottle. No run-off was allowed, as the field was divided into number of plots by bunds. The seepage water collected in the effective rainfall apparatus in the 90 days period was analysed for N, P, K, Ca, pH and total solids and the well water used for irrigation was also analysed for comparison.

Results and Discussion

It was observed that larger amount of water loss occurred only during the period of rainfall and the loss due to irrigation was nil, since irrigation water was given only in measured quantities to maintain the 80 per cent available moisture regime at one foot depth. The results of the analysis of the well water used and the seepage water collected are presented in the Table 2. The perusal of the data shows that there was larger quantity of nitrogen loss, 4.591 Kg/ha, in the leaching which probably is due to easy solubility and mobility of the nitrogenous fertilizers in the soil. On the other hand, the lesser quantity of leaching of phosphorus and potash, 0.12 and 0.77 Kg/ha respectively, is attributed to the fact that these elements unlike nitrogen, are readily fixed in the soil, thereby rendering less loss in leaching. The leachate was found to contain larger quantities of bicarbonates of calcium, magnesium and sodium and the sulphates and chlorides of sodium. This must be due to the presence of these salts in appreciable quantities in the irrigation water used, naturally these salts being more readily soluble, they accumulate and get collected in the leachate. Russel and Russel (1961) reported that the different rates of removal of constituents depend on the rate of weathering and

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the water percolated. The results obtained in this experiment is an indication of quantum of nutrient loss in the excess rainfall or irrigation. According to Buckman and Brady (3.967) the leaching losses vary with weather conditions, difference in soils, type of management and the Lysimeter used.

Table I. Composition of irrigation water

Particulars of ion	Content in parts per lakh	Computation of salts	
		Particulars	content in parts per lakh
Total soluble salts	388.00	calcium bicarbonate	97.22
calcium	26.40	Magnesium bicarbonate	Nil
Magnesium	1.44	Sodium bicarbonate	Nil
Sodium	89.40	Sodium sulphate	105.10
S.A.R	14.49	Sodium chloride	140.50
Potassium	1.80	calcium Sulphate	8.09
chloride	85.20	Magnesium Sulphate	7.13
Sulphate	82.40		
Bicarbonate	73.20	Total	358.04
R S C.	2.40		
Carbonate	Nil		
Nitrogen	5.60	sodium absorption ration	
Phosphorus	0.13	(SAR) = $\frac{Na^+}{Ca^{2+} + Mg^{2+}}$	
Iron	0.064		
		Residual Sodium Carbonate	
		(RSC) $(Ca + Mg) - (CO_3 + HCO_3)$	
		All ions expressed in M.e /litre	

Table 2. Particulars of nutrients lost by seepage in 90 days period

Particulars of nutrient lost	Parts of per lakh of leachate	Kg/ha
Nitrogen	7.70	4.591
Phosphorus	0.14	0.120
Potassium	2.90	0.770
Iron	0.072	0.062
calcium bicarbonate	32.39	27.758
Magnesium bicarbonate	11.56	3.895
Sodium bicarbonate	3.55	3.039
Sodium sulphate	182.55	156.263
Sodium chloride	228.20	195.339
pH of the Soil	7.9	
pH of the irrigation water	= 6.9	
EC of the irrigation water	= 6.0	Millimhos/Cm.
ph of the Leachate	- 8.5	

Summary

A field experiment was conducted using Effective rainfall apparatus designed by Ramdas (1960) to find out the nutrient loss in seepage by way of excess **irrigation** or rainfall at Central Farm, **Coimbatore**. It was found out that considerable loss of nutrients during crop growth period by seepage is in the following order: 4.59 Kilograms of nitrogen, 27.76 **Kilograms** of calcium bicarbonate, 1563 Kilograms of sodium sulphate and 196.34 Kilograms of sodium chloride per hectare.

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