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Nutrient losses in soil due to erosion

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Abstract

The nutrient loss is closely related to erosion. The amount of individual nutrient deteriorates from soil by any factor this nutrient loss use full for plant and crop and affect the water bodies. Soil nutrient lost mainly through the runoff many nutrients are dissolving in rain water or lost. The rate of soil loss is 16.4tonnes/hectare every year, (CSWCTRI), Dehradun. Mainly N₂, Ca, P, Mg, K and organic matter can be lost from agriculture land through soil erosion. Manure and fertilizer can help to protect against nutrient loss low through erosion or runoff. These losses are affected by soil type, vegetative cover and land slope or fertility. Where soil are highly erodible, conservation tillage can reduce soil erosion and runoff, resulting in less surface loss of nitrogen. Soil erosion means detachment, transformation and deposition. Erosion is detachment of soil particle from one place to another place by the action of wind and water. Nutrient loss due to erosion is very harmful effect for crop production reducing regularly or arable land convert in barren land. Annual soil loss of India is 16 ton's/hectare when permissible limit is 12ton's/hectare. Water and wind eroded area in India is 93.68 Mha and 9.48 Mha (NBSS & LUP). Active soil erosion occurs due to floods over 140mha of land resulting loss of 6000 MT of fertile soils containing 5.5MT of NPK. Mainly two type of erosion wind and water erosion. Wind erosion mainly found in North-west part of India and water erosion mostly in hilly areas of country. Wind erosion is mainly three type's saltation, suspension, or surface creep in witch suspension is more hazards. Water erosion types are splash, sheet, gully erosion in which sheet erosion is more hazards in which fine clay partials and soluble nutrients are remove with water.

Keywords: soil erosion, nutrient loss, conservation, rainfall

Introduction

After a heavy rain even farmers question what has happened to the nutrients in their soils. This is important but it is not easy to assess how much nutrient has been lost because there are many variables to consider. We must be think about; the crop and the stage it is at; the applied fertilizer and the way it was put on; the soil, its texture and water holding characteristics. The intensity and duration of the rainfall even.

Nutrient can be lost in a number of ways. Soluble nutrients like nitrate and potassium can be lost in run off and drainage water, whereas less soluble nutrients like phosphorus are more likely to be lost with sediments moving in eroding soil and run-off water. Negligible loss by wind erosion so organic matter, clay partials or soil in sand, silt, clay ratio is disturbed with reduce fertility. The Revised Universal Soil Loss Equation (RUSLE) lists the main factors that contribute to soil erosion. An understanding of these factors and how they affect soil erosion helps with the design of sound strategies to control runoff. The Universal Soil Loss Equation (USLE) was developed in the United States in the mid 1960's, and was revised (RUSLE) for Canadian conditions in the 1990's to estimate soil losses due to surface runoff:

$$A = R \times K \times L \times S \times C \times P$$

Where,

A = soil erosion loss in tonnes/hectares

R = rainfall factor

K = soil erodibility factor

L = length of slope factor

S = slope factor

C = cropping system/ground cover factor

P = management practices factor

The loss of nutrients by water erosion in crop field include in soil degradation.

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Table 1: Different classes of soil erosion by water in India

S. No	Soil erosion rate rang (Mg/ha/yr)	Soil erosion class
1	0 – 5	Slight
2	5 – 10	Moderate
3	10 – 20	High
4	20 – 40	Very high
5	40 – 80	Severe
6	More than 80	Very severe

Most 17 essential nutrients are required for plant growth and lifecycle. N and P are the main nutrients that restore soil fertility, and together with Ca, Mg, K and organic matter, are losses by water erosion (Bertol & Miquelluti, 1993) [1]. It is impossible to stop all erosion completely, but can be minimised, techniques to control erosion usually result in maintaining or increasing soil productivity. Productive soil transport or reduce productivity due to erosion. Eroded soil carries away large quantity of plant nutrients such as nitrogen, phosphorus, potassium, and calcium. Typically eroding soil about three time more nutrient s than are left in the remaining soil. A ton of fertile surface soil averages 1-6kg of nitrogen, 1-3kg of phosphorus, and 2-30kg of potassium, whereas the soil on eroded land has average nitrogen levels of 0.1-0.5kg per tons.

All the three primary nutrient total N, P, K, loss kg/ha values were plotted agents the corresponding loss of annual total P was 5kg/ha reported by (Rai and Sharma, 1998) [5] the average annual nutrient loss according to (Mandal *et al.* 2012) [3] were 10.2kg/ha/yr for total N, 1.0kg/ha/yr total P and 20.07 kg/ha/yr total K.

Nutrient loss in maize field by runoff (Lal & Mishra, 2015) [2]

Maize crop field	Total soil loss(t/ha)	Total N loss Kg/ha	Total P loss Kg/ha	Total K loss Kg/ha
5% slope	1.54	0.15	8.843	5.64
3% slope	1	0.28	7.27	7.37
1% slope	1.59	0.65	7.27	7.53

Highly soluble nutrients like nitrate and potassium are prone to leaching. leaching phenomena when the soil is saturated and cannot be hold any more water and drainage occurs. The drainage water dilutes and transformation of the nutrients downs the root zone. Deep are rooting crops like maze can access nitrate from as deep as 180 cm, but once nutrients are below the rooting zone, they are no longer accessible.

The following equation gives a rough estimate of how far N will move in the profile N movement (cm) = rainfall (mm) x 10 / Soil field capacity%.

Eroded soil carries away vital plant nutrients such as nitrogen, phosphorus, potassium, and calcium. Typically, the eroded soil contains about three times more nutrients per unit weight than are left in the remaining soil. A ton of fertile topsoil averages 1 to 6 kg of nitrogen, 1 to 3 kg of phosphorus, and 2 to 30 kg of potassium, whereas the topsoil on the eroded land has an average nitrogen content of only 0.1 to 0.5 kg per ton. To offset the nutrient losses inflicted by crop production, large quantities of fertilizers are often applied. (Troeh *et al.* 2004) [6] estimate that lost soil nutrients cost U.S. agriculture several billion dollars annually. If the soil base is relatively deep, about 300 mm, and if only from 10 to 20 tons of soil is lost per hectare per year, the lost nutrients can be replaced with the application of commercial fertilizers and/or livestock manure. However, the replacement strategy is expensive for the farmer and nation and usually poor farmers cannot afford

fertilizer. Not only are the fertilizer inputs fossil-energy dependent, these chemicals can harm human health and pollute the soil, water and air (Pinentel and Burgess, 2013) [4]. The loss of nutrients by water erosion in crop field contributes to soil degradation, especially under conventional tillage N, P are the main nutrients that restore soil fertility, and together with Ca, Mg, K and organic matter are subject to loss by water erosion (Bertol & Miquelluti, 1993) [1].

Seasonal rainfall, runoff and soil loss from different land configuration, broad-bed and furrow (BBF) and flat on grade (FOG) (Mandal *et al.*, 2015) [3]

Year	Rainfall (mm)	Runoff (mm) Soil loss (ton ha ⁻¹)			
		BBF	FOG	BBF	FOG
2003	1058	163.0(15.4%)	214.9(20.33)	2.0	2.9
2004	798.2	124(15.5%)	183.3(23%)	0.7	1.5
2005	946	177(18.7%)	246(26.1%)	1.43.1	
2006	1513	502(33.2%)	873(57.7%)	3.5	6.4

Conservation methods

Soil conservation mines agents work on soil transformation or reducing maximum nutrient loss in crop land. Techniques for improved soil conservation include crop rotation, cover crop, conservation tillage and planted windbreaks and affect both erosion and fertility. When plants, especially trees, die, they decay and become part of the soil. Many methods are applied according to land condition and available opportunity.

Soil conservation methods are three types.

1. Biological method
2. Mechanical method
3. Other method

Afforestation

The best way to conserve soil to increase are under forest. Indiscriminate felling of tree should be stopped and efforts should to plant trees in new areas. A minimum area of forest land for the whole country that is considered healthy for soil and water conservation is between 20 to 25% but it was raised to 33% in five year plan. The recommended proportion of forest area in plain area is 20% while for hilly and mountainous regions it is 60%.

Checking overgrazing

Overgrazing of forest and grassland by animals especially by goats and sheep, should be properly checked. Vegetation is generally reduced erosion intensity of water and wind. Plants roots are tightly bind with soil partials and increase stability.

Perimeter runoff control

This is the practice of planting trees, shrubs and ground cover around the perimeter of your farmland which impedes surface flows and keeps nutrients in the farm soil. Using the grass way is a specialized way of handing perimeter run off that uses surface friction to channel and dissipate runoff.

Wind breaks

Rows of tall trees are used in dense patterns around the farmland or prevent wind erosion. every green trees can provide year round protection but deciduous trees can be adequate as long as foliage is apparent during the seasons when the soil is bare.

Terrace farming

Terracing is a method of curving multiple, flat levelled areas

in to hills stapes are formed by the terraces which are surrounded by a mud wall to prevent run off and hold the soil nutrients in the beds.

Cover crops/ crop rotation

Cover crops such as turnips and radishes are rotated with case crops in order to blanket the soil all year round and produces green manure the replenishes nitrogen and other critical nutrients. Using cover crops can also suppress weeds.

Contour Ploughing

It is a very effective way for farmland on slopes to prevent run off.in which ploughing agent the slope and reducing intercity of water flow.

Conclusion

The physical forces like wind and water are causing detachment and removal of surface soil, the most fertile part of the soil mass. The process is technically called as erosion. The nutrient are adsorbed over the soil particle, especially present in top portion, and the top soil is eroded and carried away in water bodies hence the nutrients are also lost with the soil particles according to an estimate about 600million tones of surface soil is eroded every year resulting into a nutrient loss worth Rs700 crores annually. this loss is gradually increasing because of faulty crop planning, deforestation etc. Thus there is a drastic depletion in soil fertility.

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