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Soil Erosion
and its management

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Introduction

Soil is a dynamic complex of minerals and organic matter supporting plants or having capacity to support plant growth. Soil formation is slow process which is the result of interaction of parent material, climate, biotic, slope and time factors. Soil is the most significant resource and provides base for life on earth. The United Nations Convention to Combat Desertification-Global Land Outlook (UNCCD) reported that up to 40% of land is now degraded. Soil erosion is one of the most critical hazards adversely affecting both environment and economy. Soil erosion by water is the most widespread form of soil degradation worldwide and it is considered one of the major threats to soil ecosystem services. In general, 80% the total land degradation is due to problem of erosion, and probably 80 to 85 % of erosion is done by water.

Soil erosion: Definition and Responsible Agent

Soil erosion generally means the displacement of the upper layer of soil. It is a form of soil degradation by the action of natural phenomena. Soil erosion may be a slow process that continues relatively unnoticed, or it may occur at an alarming rate causing a severe topsoil loss. The process is associated with geomorphic processes or agents such as running water, winds, coastal waves and glaciers. Therefore, it is occurring since time immemorial. But it has become a serious problem due to increased anthropogenic interferences over the period of time. Soil erosion is the process of soil particles detachment and their transportation by runoff water and deposits to a new place.

Water and winds are the main agents of soil erosion. In our country, about more than 80% of total soil erosion is caused by water alone. In the case of erosion by water, soil particles are either detached by the impact of raindrops or run-off water that is moving over soil surface. The high striking velocities (up to 9 m/sec) and large number of drops generate intense hydro-dynamic force to detach huge amount of soil particles. The detachment by raindrops is

widespread and by run-off generally confined to small definable channels. The rate of detachment varies with the variations in rainfall, run-off, soil characteristics, topography, and cover conditions.

Soil erosion as a problem in India

According to the data furnished by National Bureau of Soil Survey and Land Use Planning (NBSS&LUP, 2004), ICAR on soil degradation on 1: 250,000 scale for different state of country, it had been found that about 45% of the total geographical area of the country is degraded due to different agents. It was also reported that more than 65% of the land degradation is due to the combined action of water and wind. In India the rate of soil erosion varies from 3 to 80 ton/ha on an average of 16.35ton/ha. So we can say that around 5000 MT (5334MT) of top soil is eroded annually in our country, out of which 61% is dislocated from one place to another. It is also reported that about 29% of the eroded material is permanently lost to the sea and 10% is deposited in the reservoirs, resulting in loss of storage capacity by 1-2% per annum.

Soil Erosion Control Techniques (SECTs)

The loss of soil from farmland can result in reduced crop production potential, lower surface water quality and damaged drainage networks. Although soil erosion cannot be totally prevented, it can be reduced to a maximum acceptable level, or soil loss tolerance can be developed. For the purpose, many soil conservation techniques (SCTs) have been explored and widely used around the world to alter soil and water processes which includes conservation tillage, check dam, mulch, and vegetation restoration etc. The design and application of soil erosion control techniques (SECTs) must consider the requirements related to the effectiveness of erosion control, relative stakeholders within the region, and their temporal and spatial applicability.

Various SECTS can be classified into different type i.e. Cropping techniques, biological techniques and engineering techniques.

1. **Cropping techniques-** They refer to the use of farming techniques and practices, implying management of crop residue, tillage, nutrients, etc., to control erosion. They are also known as soil control techniques (SCTs). They are mostly applicable where soil having slope up to 2º. The common cropping techniques include No-tillage, mulch, and so on.
2. **Biological techniques-** They refer to the use of natural ground cover, especially vegetation cover, to prevent raindrops from striking the soil surface directly. These techniques also helpful in conserving soil moisture and optimum temperature for proper growth and development of crop plant. The most common biological Technique is vegetation Restoration.
3. **Engineering techniques** – These techniques deal with physical structures to intercept runoff velocity, pond runoff water, trap sediments, and then prevent soil loss., These techniques have been widely used in the mountainous and hilly areas. The common engineering techniques include check dam, terrace, etc.

Limitations

- Slope gradient, Slope length, soil characteristics and rainfall intensity can strongly affect runoff and soil loss, which in turn affects SECTs efficiency.
- The effectiveness of some techniques such as no-tillage and terraces changes over time after consecutive years of application.
- The limited use of SECTs can also be attributed to a low education level and the precarious economic context of farmers who are afraid to invest in soil conservation.

Conclusion

Management of soil erosion is critical. Though there are several conventional soil erosion control techniques but new improvements are necessary with the accelerated soil erosion caused by human activities. Proper SECTs can effectively reduce erosion, but successful implementation is really a challenging task. The effectiveness of any new technology is limited by many factors such as climate, soil properties, topography, land use, cultural practices, demography and socio-economic status but there is a need to explore effective soil erosion management techniques that can be sustained and applicable at mass scale.