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A REVIEW OF THE CAUSES, EFFECTS AND WAY OUT OF SOIL EROSION ON AGRICULTURAL LANDS

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ABSTRACT

The paper herein is an overview of the factors responsible for erosion on agricultural land, some of the factors are: overgrazing, heavy tillage operations, deforestation, poor soil conservation practices, etc. This occurs as a result of the erosive forces of wind and water on agricultural lands. It also explains the effects of soil erosion on the productivity of the land and strategies of controlling and reducing these effects on the land. Strategies such as proper soil, crop and vegetation management are considered. Also the use of mechanical methods such as terracing, bunding, filling and treatment of gullies are also described as means of controlling erosion on agricultural lands.

Keywords: Soil Erosion, Causes, Effects, Soil Management, Crop Management, Terracing

INTRODUCTION

Soil erosion is a natural process, occurring over geological time, and may be caused by water or wind. The occurrence of soil erosion involves all the processes which strips soil and weathered rock from the earth's surface, making the

fragments available for transport by wind, water or ice until they are deposited as fresh sediment somewhere else (Morgan, 1996). This process is described as geologic erosion, while soil erosion that occurs in excess of this geologic erosion is described as accelerated erosion, which arises majorly as a result of man activities on the earth surface. This explains that process of erosion is a natural one but is often intensified by human land use practices. Soil erosion is one form of soil degradation along with soil compaction, low organic matter and loss of soil structure, poor internal drainage, salinization, and soil acidity problems, and these other forms of soil degradation, serious in themselves; usually contribute to accelerated soil erosion. The process of soil erosion may be a slow process that continues relatively unnoticed, or it may occur at an alarming rate causing serious loss of topsoil, carrying plant nutrients and organic matter, leading to reduction of productivity on agricultural lands. The loss of soil from farmland may be reflected in reduced crop production potential, lower surface water quality and damaged drainage networks. The three processes that are involved in soil erosion are; detachment of soil particles, plant nutrients, and organic matter from the top soil, transportation of these materials either through water, wind, glaciers or gravity from their original location to another, and the final deposition of these materials in other areas.

Soil erosion is a hazard traditionally associated with agriculture in tropical and semi-arid areas and is important for its long term effects on soil productivity and sustainable agriculture (Morgan, 1996). The process of soil erosion involves both the physical and gradual deterioration in physical properties of the soil, hence leading to low

productivity on agricultural lands. This affects agriculture greatly because of the huge dependence of crop cultivation practices on the top soil, which is eroded off by soil erosion. The loss of soil on the land surface which may occur either by wind or water erosion, has been identified as a major constraint in generating enough food to feed the world's escalating population. Soil erosion has been a major threat to soil quality since the beginning of agriculture (Louis, 2011), as various practices such as excessive tillage, overgrazing, deforestation, poor land use systems, etc. has contributed immensely to the deteriorating effects of the soil structure and washing off of the top soil and organic matter constituents of the soil.

The way forward in controlling these effects on agricultural lands is to adopt proper tillage practices, cultivating and carrying out farm operations such as cropping, tilling and harvesting on contours. Also mechanical methods such as terracing of slopes, implementation of grassed water ways, and the use of bunding, re-vegetation and diversion channels in the treatment of gullies.

SOMECAUSES SOIL EROSION ON AGRICULTURAL LANDS

Erosion occurs when soil is left exposed to rainfall or wind energy. Raindrops hits exposed surface with great force and as a result dislodges soil particles from the surface. Asides the impact of rainfall and wind, other factors that influences the actuation of soil erosion on agricultural lands includes;

a. Agricultural Practices and Land Use: Although world agricultural production accounts for about three-quarters of the soil erosion worldwide, erosion also

occurs whenever humans remove vegetative cover (Lal and Stewart, 1990).

b. Topography: The topography of a given landscape can cause increase in erosion rates.
c. Removal of Vegetative Covers: Land areas covered by both living and dead plant biomass, are more protected and experience relatively little soil erosion because raindrop and wind energy are dissipated by the biomass layer and the top soil is held by the biomass.
d. Soil Structure: Soil structure influences the ease with which it can be eroded. Soils with medium to fine texture, low organic content, and weak structural development are most easily eroded (Bajracharya and Lal, 1992).

EFFECTS OF SOIL EROSION ON AGRICULTURAL LANDS

The effects of soil erosion can be sub-divided into on-farm and off-farm impacts. On-site impacts are predominantly borne by the farmer and are essentially related to loss of production capacity. As soil erosion takes place, the ability for cereal crops and grass to flourish is reduced which, in turn, has a direct impact on the productivity of the land.

a. **On-site effects:** The implications of soil erosion by water on farmlands extend beyond the removal of valuable topsoil. Crop emergence, growth and yield are directly affected by the loss of natural nutrients and applied fertilizers. Seeds and plants can be disturbed or completely removed by the erosion. Organic matter from the soil, residues and any applied manure, is relatively lightweight and can be readily transported off the field, particularly during spring thaw conditions.

b. **Off-site effects:** The off-site impacts of soil erosion by water are not always as apparent as the on-site effects. Eroded soil, deposited down slope, inhibits or delays the emergence of seeds, buries small seedlings and necessitates replanting in the affected areas. Soil eroded from agricultural lands will often find its way into a main river channel from where it can be transported downstream as far as the sea.

STRATEGIES FOR CONTROLLING ON AGRICULTURAL LANDS

The process of soil erosion on agricultural lands requires optimal attention and study, in other to determine the most suitable practice to adopt for erosion control. This is to ensure that erosion and its effect is reduced drastically, hence promoting crop production and reduction in loss of top soil and soil nutrients. The only way forward in achieving this is adopting the best and most environmental friendly strategies in controlling and managing erosion on the farmland. These strategies of erosion control may include both mechanical and agronomical methods in controlling the effect of soil erosion on the farmland. Effective erosion controls are important methods and systems put in place to reduce water pollution, soil degradation and soil loss.

Crop and Vegetation Management

This process of soil erosion control involves the use and proper management of crops and vegetation to minimize the effect of erosion on farmlands. Agronomic measures for soil conservation utilize the protective effects of plant covers to reduce erosion. This method of erosion control is less expensive compare to the mechanical form of erosion control

and it is easily adopted by peasant farmers. This method includes:

i. Dense Planting: High density planting is used to reduce the area of the soil that is exposed to the impact of rain and wind.
ii. Crop Rotation: When the same types of crops are grown in the field every year, the soil becomes depleted in certain minerals. Crop rotation is an important method for checking erosion and maintaining soil productivity.
iii. Cover Crops: Planting of cover crops like centrocema, rye, Austrian winter peas, crimson clover, peuraria, etc. are used to cover the lands not immediately needed for other uses.
iv. Multiple Cropping: The practice of multiple cropping is a process used to increase the productivity of the land whilst providing protection for the soil against erosion.
v. Forestry Management: This practice involves the management of forest vegetation and its products. Practices such as afforestation, revegetation, agro forestry etc. are encouraged in other to reduce the effects of erosion on the land.
vi. Grazing Land Management: Overgrazing is a major factor that increases the rate of erosion on agricultural lands, therefore proper range and grazing area management is required to reduce this effect.

Soil Management Practices

This involves employing proper soil conservation practices that would help maintain the fertility and structure of the soil, thus promoting proper aggregation of soil particles and overall reduction in soil erosion losses. They include;

i. **Contour Farming**: This involves tilling and planting across the slope, following the contour of the land. This means soil cultivation and planting are carried out along the contour purposely to prevent water runoff down-slope and encourage infiltration of water into the soil.
ii. **Strip Cropping**: this process involves cultivating a field partitioned into long, narrow strips which are alternated with different crops. It is majorly used when the slope of the farm land is too steep. Strips are placed cross-wise to the prevailing wind direction to reduce the effect of wind erosion.
iii. **Mulching**: This involves covering the soil surface with straw, leaves or grasses. Mulches of different kinds keep soil erosion in check; increases soil fertility and also minimize evaporation losses from the top soils.
iv. **Retiring The Land**: Areas subjected to heavy soil erosion should be put under thick cover of grasses and left for a given duration. This helps the soil in regaining its stability and structure over time. This process is also similar to shifting cultivation, where soil erosion is being reduced by rotating the cultivation on a given piece of land.
v. **Minimum Tillage**: Minimum tillage or reduced tillage refers to practices using chisel or disc plough to prepare the soil whilst retaining 15 to 25 percent residue cover. In the planting of wheat near Pisa, Italy, runoff increased over that from conventional tillage. Despite the higher runoff, annual soil loss was lower under minimum tillage at 1.6 t/ha compared with 4.1 t/ha from conventional tillage (Chisci and Zanchi, 1981).

Mechanical Methods

In recent years, soil erosion problems have received attention of engineers. The mechanical practice of soil conservation involves the use of various engineering techniques and structures which are adopted to supplement the other methods and practices, when the latter is not sufficiently effective. These methods of erosion control and soil conservation includes;

i. **Basin Leaching**: This method involves a number of small basins (water reservoirs) made along the contour by means of an implement called basin blister. Basins collect and retain rain water for long period, making it possible to also catch and stabilize downwardly moving soils on the slopes.
ii. **Pan Breaking**: In areas were soils become impervious to water and are less productive because of formation of hard sheet of clay a few feet below the surface. Such areas can be made productive and permeable to water by breaking hard clay pans through the use of pan breaker on contour at a depth of about 5 feet.
iii. **Sub-Soiling**: This method involves the breaking of the hard subsoil by means of an implement called subsoiler. This process increases rainwater absorption into the soil and makes the soil looser, thus giving room for luxuriant growth of vegetation.
iv. **Terracing**: Terraces break long slopes into shorter ones. They generally follow the contour. As water makes its way down a hill, terraces serve as small dams that intercept and guide the water to an outlet.

ECONOMICS OF EROSION CONTROL

It will be extremely difficult to justify erosion control by traditional approaches. This is because erosion processes causes damages to many branches of the national economy and much of this damage, namely its social consequences, is difficult to express in numerical values. The evaluation of social losses resulting from damage caused to the basic natural resources is lacking. Erosion control should therefore be preceded by economic evaluation of the enumerable losses caused by erosion.

The evaluation of the economic effectiveness of erosion control measures with regards to agricultural production should not only consider the current interests of agricultural enterprises but should take into account the interest of the society manifested in the effort to conserve the soil for future generations and to protect the environment. Environmental control and soil conservation will enforce the introduction of erosion control measures in areas where traditional methods have shown them to be economically inefficient and have been an obstacle to their implementation. The effectiveness of erosion control measures is significantly related to their effect on water resources.

CONCLUSION

From the foregoing review, it can be concluded that erosion adversely affects agricultural lands, contributing majorly to soil loss, reduction in soil fertility, poor aggregation of soil particles, and overall soil degradation. This occurs majorly as a result of poor soil conservation practices and full exposure of the land to the erosive effects of wind and water, through deforestation and poor agricultural practices.

RECOMMENDATION

It is quite impossible to completely stop erosion as water and wind will always move soil and that's all there is to it. But with effective planning and effort the extent of erosion can be minimized.

Thus to reduce the effect of erosion certain practices must be avoided. Practices such as;

a. Cultivating under extreme cold or dry conditions i.e. The slow growth of germinating seeds means that the top layer of soil is exposed to the environment
b. Cultivating on steep slopes.
c. Heavy grazing on sown pastureland.
d. Burning of stubble after harvest.

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