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Role of soil and water conservation for sustainable fruit production

Khalasi* D. N., Pandey A. K. and Pooja Naik

ASPEE College of Horticulture and Forestry,
Navsari Agricultural University,
Navsari-396 450, Gujarat

**Corresponding Author: khalasidevang64@gmail.com*

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ABSTRACT

Soil and water are the more valuable natural resources on earth surface consider as a basic needs of food, feed and fibre for human beings. Land is the basic unit of all agricultural production. To be used very judiciously to meet the need of growing population for sustained quality of human life and also agricultural development. Water is one of most important inputs for raising fruit plant successfully. After soil, water is perhaps the second important resource required by the plants. Thus it is considered as one of the most limiting factors for plant growth and development. Land provides food, fuel, fodder and shelter besides supporting secondary and other economic life supporting system. However there has been a continuous depletion of land resources and the quality of land is deteriorating due to various factors like soil erosion caused mainly due to shifting cultivation, high rainfall, large scale deforestation, overgrazing, general mismanagement, *etc.* There for, best way to protect natural resources (Soil and Water) against deterioration in quality or erosion is 'Conservation'. Different physical(Contour bunds, Bench terracing, Grass waterways, Half moon terrace and Water harvesting ponds), agronomical(Mix cropping, Intercropping, Mulching, Strip cropping and Agroforestry) and biological measures(Vegetative strip, Protective bush land, Live fences and Reforestation) are adopted to protect natural resources from this types of calamities. Choice & Design of Soil & Water Conservation measures depend on soil, rainfall, land slope and wind character of the area.

Keywords: Natural resources, Soil, Water, Conservation and fruit production

INTRODUCTION

Conservation is the protecting the Natural Resources (Soil & Water) against deterioration in quality or erosion due to any agent. Enhancing the capability of the resources to produce better through management practices. Land and water natural essential resources for the existence of life and provides food, fuel, fodder and shelters besides supporting secondary and other economic life supporting system for which management has become most essential (Yadav *et al*., 2004). Indian agriculture accounts for 90% water use due to fast track ground water depletion and poor irrigation management systems (Vibha Dhavan, 2017). Soil and water are more valuable natural resources for raising fruit plant successfully. So shortage in any of these factors limit growth and development of crop species.

Water and wind are two natural factors that cause soil erosion which can be reduce by adopting physical, agronomical and biological measures. Mulches also play an important role in reducing soil erosion, improving soil structure, organic matter, microbial flora, soil aeration, regulating soil temperature, conserving moisture in-situ, controlling weeds and reducing nutrient removal by weeds.

Soil and water conservation measures are predominantly applied for the following purposes:

- To control runoff and thus prevent loss of soil by soil erosion
- To improve soil fertility
- To conserve water
- To harvest (excess) water

ROLE OF CONSERVATION IN SOME FRUITS CROPS

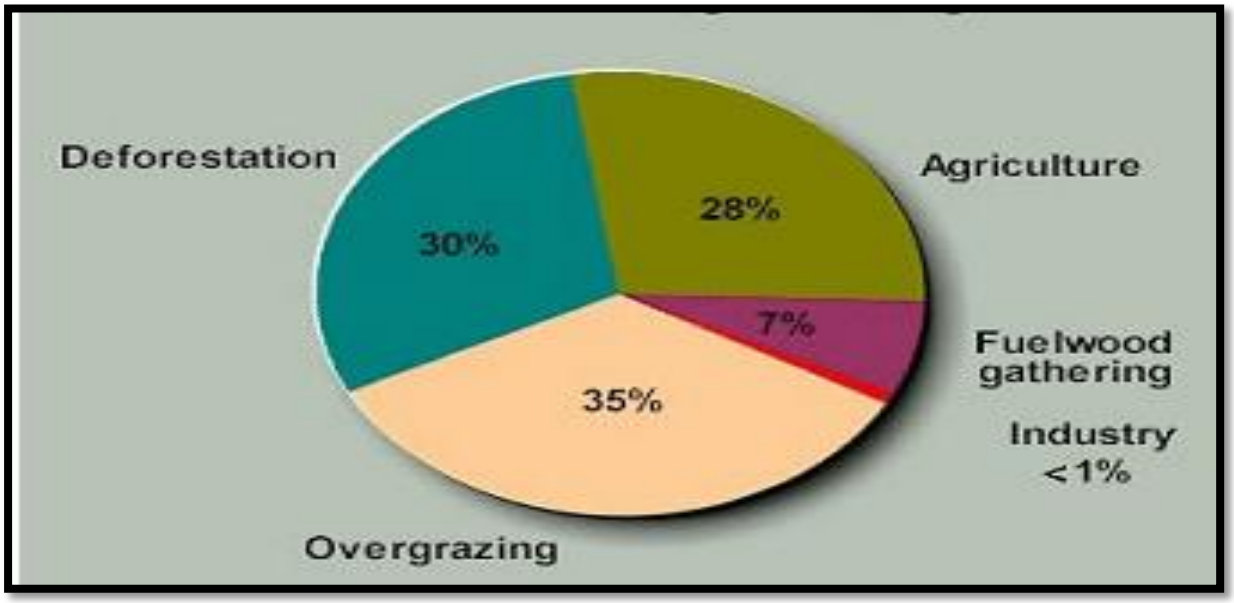
Acid lime:- The low productivity of acid lime is attributed to low water availability in the soil profile at flowering and fruit growth stages during post monsoon period.

Mango :- In recent years, because of the low and erratic rainfall, productivity has been drastically reduced due to low moisture in soil profile during flowering and fruit development.

Apple:- Water deficit interferes with cell division and elongation during fruit growth, hence reduce fruit size and quality.

Guava:- Guava suffers in terms of growth and production under rain-fed conditions due to low water availability in the soil profile during February to May.

Ber :- In arid and semi arid areas, moisture is one of the important limiting factor for successful fruit production, hence, conservation of soil moisture becomes an essential cultural practices.



Source: http://www.information.org/images/graph_soil degradation.jpg

Figure : 1 Human activities causing soil degradation

Different human activity causes soil degradation and water erosion such as deforestation, fuel wood gathering, overgraging and some agriculture activities like improper management during crop production.

Principle of Soil & Water Conservation

[1] Blocking concentrated overland water flow through

- Vegetative means
- Mechanical / structural means

[2] Enhancing in-situ water storage by enhancing opportunity time for infiltration

[3] Enhancing surface water storage – for off season irrigation, Ground water Recharge, and other uses.

Soil and Water Erosion (Safdar *et al*., 2018)

Soil erosion:-

- Detachment and transportation of soil mass from one place to another through action of wind, water in motion or by the beating action of rain drops.

Water erosion:-

- It is the removal of soil from the land surface by water, including runoff from melted snow and ice and is the major cause of soil degradation.
- **There are the two natural factors that cause soil erosion**

[1] Water erosion and [2] Wind erosion

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Water erosion : Intense rains that have not been captured within the landscape can create torrents of water which erode soils

Wind erosion : This type of erosion often worse when the soil are dry and barren and wind speeds are high

Water erosion is occur by various forms

- **Sheet erosion:-** Removal of thin layer of soil from a land area.
- **Rill erosion:-** A series of small channels on a slope curved by running water
- **Gully erosion :-** Large, wide channels curved by running water and it cannot be smoothed out with conventional tillage equipment
- **Splash erosion:-** Scattering of detached soil particle by the impact of rain drop

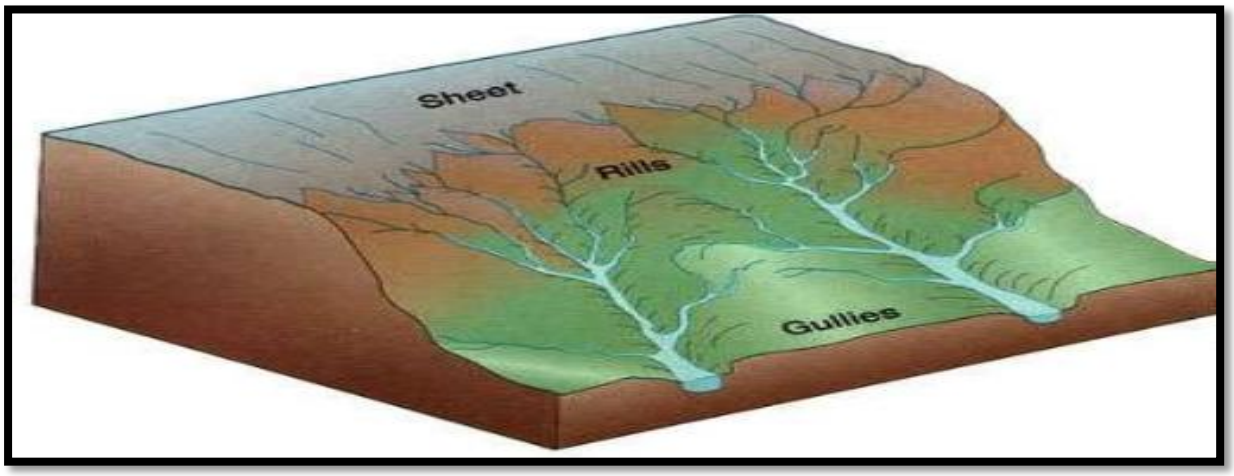

Figure : 2 different forms of water erosion

Form of wind erosion

- **Creeping :** Coarse and very coarse sand grain rolled on ground surface
- **Saltation :** Lifting and bouncing of particles
- **Suspension :** Lifting of silt and clay size particles high into the air and thus carried out long distances

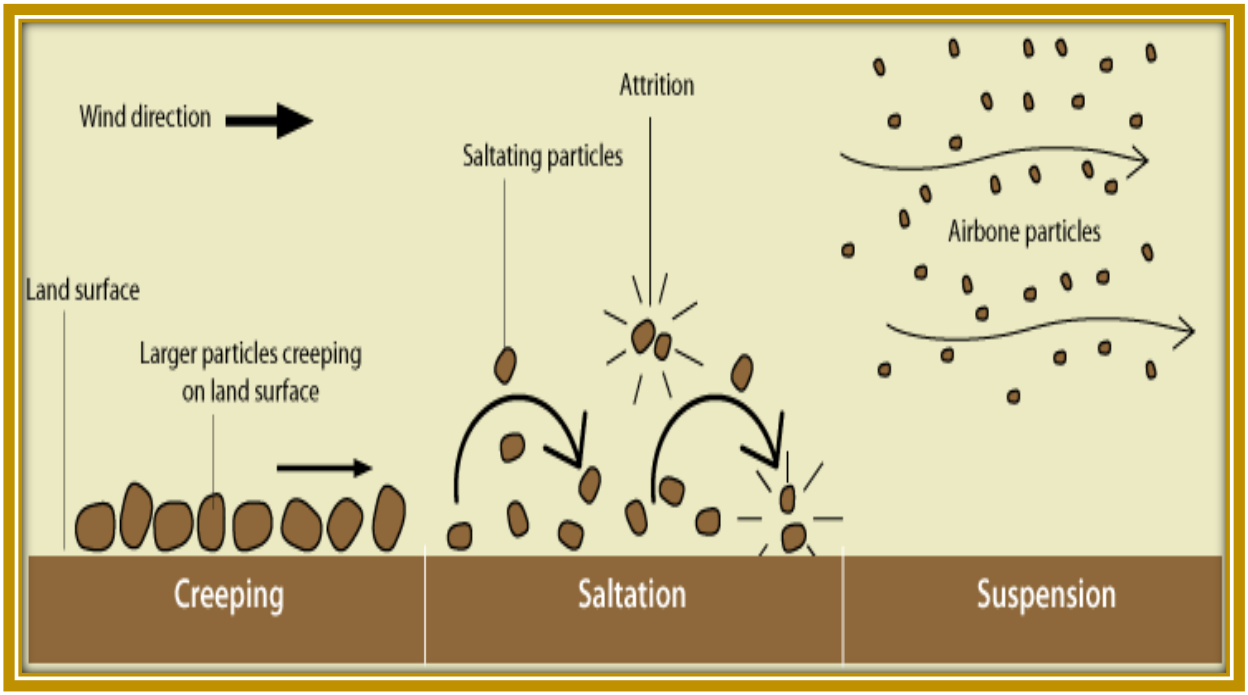

Figure 3: Forms of wind erosion

Classification of soil and water conservation measures

[1] Agronomical

•**Mix cropping :** It is a growing of two or more crops simultaneously in the same field at same time without any definite row pattern. This is done by mixing their seeds.

•**Inter cropping :** It involve cultivation of two or more crops simultaneously in the same field in a definite row pattern.

•**Mulching :** Covering top of the soil with loose extraneous matter is known as mulching. It is of two types : organic and inorganic. The grass clippings, crop stump, straw, bark chips, compost, manure, saw dust, cotton burs, wooden pieces, rice husk, bran, onion and garlic scales, leaf litter, cinders, paper, latex etc. are some important organic mulches, whereas, plastic film, metal foil, sand, gravel, stone etc. constitute inorganic mulches. It prevents evaporation of moisture from the surface.

➢ **Purpose of mulching**

1] Conservation of soil moisture
2] Regulation of soil temperature
3] Suppression of weed growth
4] Prevention of soil erosion
5] Control of pest and disease

•**Strip cropping :** Strip cropping consists of establishing alternate strips of vegetation with high and low wind protective ability. Practice of growing crop in alternate strip of row crop. It break slopping landscape in wide segments with diverse vegetative cover which intercept runoff and promote water infiltration and reduce runoff.

•**Agroforestry :** Growing of multipurpose tree species along with agricultural crops is beneficial to reduce soil erosion as well as generating income of farmers.

[2] Physical

•**Contour bunds :** Bunds are either mechanical or vegetative barrier created across the slope. The purpose is to divert the excess runoff during rain to the waterways and retain erode soil. This measure can be created with the use of local resources.
•**Bench terracing :** It is the flat beds constructed across the slope, and vertical interval of such terrace should not increase more than 1 m.
•**Grass waterways :** This are the channel laid out preferably on natural drainage line in the watershed. As far as possible natural resources should be used without much distance for draining out excess water.
•**Half Moon Terraces :** These are level circular beds having 1-1.5 m dimeter cut into halfmoon shape. These beds are used for planting and maintaining sapling of fruit and fodder tree in the in horticulture/agroforestry land use.
•**Water harvesting pond :** Water harvesting pond can be used for creating seasonal and perennial pond for irrigation and fish farming purpose.

[3] Biological

•Vegetative strips : trap crop residue and sediments moving off field.
•Protective bush land
•Natural drainage way protected by a permanent grass cover (live fences) e. g. Vetiver grass
•Reforestation

Choice & Design of S & W Conservation measures depend on:

- Soil
- Land Slope
- Rainfall
- Wind characteristic of the Area

Soil conservation practices

- **Contour Farming :** The practice of tilling, planting and performing all cultural operation following the contour line of the field slope.
- **Terrace Farming :** It is a type of farming consist of different steps or terrace that were develop in various place around world. It is built in side of hills.
- **Zero-Till Farming :** No-till is a conservation effective strategy to reduce wind because it leaves most of the residues and maintain an undistributed soil surface.
- **Organic Farming :** It involve use of organic fertilizers like FYM , Green manure, biofertilizer for crop production and avoid use of synthetically compound fertilizer.
- **Windbreaks :** Wind break must be planted across the direction of the predominant wind. It prevent soil erosion by stabilizing the slope.

Water conservation practices

- Plant wind break: e.g. Eucalyptus, Casurina, Karonda and Polyalthia *etc*.
- Keep crop residue on the field shade the soil resulting reduce soil temperature

- Choosing water conserving species like low water requirement crop and drought resistant crop
- Adopt suitable crop rotation: grown high water requirement crop in monsoon and low water requirement after monsoon.
- Adopt suitable irrigation method such as drip irrigation, sprinkler and hand watering

Figure 4: Water Harvesting Structures

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