Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 06 (NOV-DEC, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Soil Conservation through Agronomic Measures

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Soil is natural dynamic body which supports many organisms, acts as a reservoir of carbon and supply nutrients for food production which supports the human as well as livestock lives on earth. In recent years, this natural entity is facing problems of erosion and deterioration due to indiscriminate exploitation by human. Soil erosion removes topsoil layer containing organic matter, nutrients and microorganisms required for plant growth. This emphasis on the need of soil conservation.

Definition of soil conservation: Soil conservation is the prevention of loss of the top most layer of the soil from erosion or prevention of reduced fertility caused by over usage, Acidification, salinization or other chemical soil contamination. According to WOCAT (World Overview of Conservation Approaches and Technologies) soil conservation are the activities at the local level which maintain or enhance the productive capacity of the land in areas affected by or prone to degradation.

Importance of soil conservation:

- Boosts earth quality and productivity.
- Promotes water infiltration and increases its storage.
- Aids air and water purification.
- Gives food and shelter for wildlife.

Soil conservation strategies rely on three basic steps:

1. Obtaining proper knowledge of the land resource use.
2. Monitoring fields and detecting critical zones.
3. Controlling and estimating the efficiency of applied soil conservation technique

Agronomic Measures of Soil Conservaion

These measures are suited for areas with for areas with less than 2 % slopes.

A. Contour Cultivation:

1. Line joining the places of equal elevation is known as contour.
2. All the cultural practices such as ploughing, sowing, intercultivation etc. carried out along the contour and across the slope.
3. The major idea behind this kind of activity is to reduce the loss of soil and water by erosion.

Mechanism

1. By ploughing and sowing across the slope, each ridge of plough furrow and each row of crop act as obstruction to runoff.
2. It provides more time for the water to penetrate the soil leading to reduced soil and water loss.

Benefits:

1. Contour cropping can reduce soil erosion as much as 50%.
2. By reducing sediments and runoff and increasing water infiltration it promotes better water availability.

Importance/Uses

1. It has been practiced over centuries in areas where irrigation farming is important.
2. Contour farming has been proved to reduce fertilizer loss, power and time consumption and wear on machines as well as to increase crop yield and reduce erosion.
3. Contour cropping is most effective when used in conjunction with strip cropping, bench terracing etc.

B. Strip Cropping

Strip cropping is a practice of growing field crops in narrow strips either at right angles to the direction of the prevailing wind, or following the natural contours of the terrain to prevent wind and water erosion of the soil.

2. Cultivation of crops in alternative strips to prevent soil erosion.

Purpose

1. Basically, strip cropping agriculture is used either to improve soil health, support primary crop growth and reduce soil erosion.
2. It is basically a practice of growing erosion permitting and erosion resting crops in alternate strips.

Types

1. Contour strip cropping

a. Crop bands are aligned according to the relief contour.
b. The practice is particularly efficient on slopes.
c. It protects soil from rill formation and sedimentation by slowing runoffs down.

2. Field Strip Cropping

a. Crop bands are arranged in parallel lines across the field without following the contours.
b. This method is suitable for both flat & gentle slopes, and also used if soil is not too prone to erosion.

3. Buffer Strip Farming

a. Buffer planting is implemented on steep hilly slopes where typical contouring is complicated.
b. Buffers (e.g., bushes, grasses, or legumes) grow between contour bands alternatively and can be either permanent (often native vegetation) or temporary.
c. The practice is particularly winning on erosion prone terrains when buffer vegetation holds the soil in place.

4. Wind Strip Cropping

a. In this case, protecting plants perpendicularly face the prevailing winds, so their position does not depend on the slope contour.
b. They serve as a shield and mitigate the wind damage on yields and soils.

C. Conservation Tillage

a. This is an umbrella term that includes reduced tillage, minimum tillage, no-till, direct drill, mulch tillage, stubble-mulch farming, trash farming, strip tillage, plough-plant.
b. Conservation tillage is any tillage practice that builds up crop residues on the soil surface to minimize the impact of water and wind erosion.
c. The 30% residue is the benchmark for water erosion and 1000 pounds per acre or 454 kg per acre benchmark for wind erosion are minimum requirements.

Advantages:

a. Conservation tillage will reduce the soil erosion.

b. Soil health will be improved.
c. Water conservation will increase.
d. Improvement in the Air quality.
e. Wildlife Habitat will be safeguarded to some extent
f. Production costs will be lowered.
g. Improved crop yields & Revenue opportunities

Disadvantages:

a. There are some disadvantages which hinder the application of conservation tillage in semi-arid conditions like;
b. Dense plant covers may be incompatible with the well-tested strategy of using low plant populations to suit low moisture availability.
c. Crop residues may be of value as feed for livestock.
d. Planting through surface mulches is not easy for ox-drawn planters although there may be no problem with hand job planters.
e. And farmers acceptance to new technology will be the main problem

D. Mulching

a. Surface mulches are used to prevent soil from blowing and being washed away, to reduce evaporation, to increase infiltration, to keep down, to improve soil structure and eventually to increase crop yields.
b. Inter-culture kills weeds and produces five or seven cm thick soil mulch which helps to reduce evaporation from the top soil.
c. It also breaks the surface crust which forms after each downpour.
d. Mulches will be available in various types like Plastic, Stubble, Pebble, Dust, Straw and various vegetative mulches.

Advantages of Mulching

a. Mulching will reduce the direct impact intensity of Rain and Wind on the soil.
b. It will reduce the water evaporation
c. Decrease the weed invasion and weed population in the field
d. Maintains the soil structure, porosity and overall soil physical properties were stabilized.
e. Improves the soil biota, so organic matter will increase.

E. Growing of cover crops

a. Cultivated legumes, in general, furnish a better cover and hence better protection to cultivated land against erosion than ordinary cultivated crops.
b. The crops and the cropping systems will naturally vary from region to region, depending on the soil and climatic conditions.
c. The mostly preferred cover crops are green gram, black gram, cowpea, groundnut etc.

Advantages of cover crops

a. Cover crops decreases the barren land area as row spaces of main crop will also used for cultivation. b. It increases the infiltration rate of the soil.
c. Slows the direct impact velocity of rain water on the soil.
d. Supply nutrients and supress weeds.
e. Breaks the pest cycles and decrease the pest incidence.
f. Improves soil physical and biological properties

F. Mixed cropping

a. Mixed cropping is the growing of 2 or more crops simultaneously in the same field without any definite row pattern. This is done by mixing their seeds.
b. Important objectives of mixed cropping are a better and continuous cover of the land, good protection against the beating action of the rain, almost a complete protection against soil erosion and the assurance of one or more crops to the farmer.

Advantages of Mixed cropping:

a. Exposure of soil to water and wind will be minimized

b. The risk of total crop failure is reduced

c. Farmers tend to harvest a variety of produce such as cereal, pulses or vegetables or fodder to meet the various requirements of family or of an agricultural farm.

d. Due to complementary effect of component crops, yield of both crops is increased. e.g., wheat and gram.

e. Fertility of the soil is improved by growing two crops simultaneously.

f. Chances of pest infestation are greatly reduced.

G. Conservation farming

a. It includes any farming practice which improves yield, or reliability, or decreases the inputs of labour or fertilizer, or anything else leading towards improved land husbandry, which we have defined as the foundation of good soil conservation.

b. It includes strip cropping, crop rotations, alternate cropping, mixed cropping and interplanting, surface and mulching, organic mulches, deep planting of varieties, dry seeding etc.

Benefits of Conservation agriculture

Environmental benefits that protect the soil and make agriculture more sustainable:

a. Reduction in soil erosion, and thus of road, dam and hydroelectric power plant maintenance cost

b. Improvement of water quality.

c. Improvement of air quality.

d. Biodiversity increase.

e. Carbon sequestration.

Economic benefits that improve production efficiency

Three major economic benefits can result from CA adoption:

a. Time saving and thus reduction in labour requirement.

b. Reduction of costs, e.g., fuel, machinery operating costs and maintenance, as well as a reduced labour cost.

c. Higher efficiency in the sense of more output for a lower input.

Agronomic benefits that improve soil productivity

a. Adopting conservation agriculture leads to improvement of soil productivity.

b. Organic matter increase.

c. In-soil water conservation.

d. Improvement of soil structure, and thus rooting zone.

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