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Soil Moisture Conservation in Dry Land Agriculture

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Abstract:- In the current agricultural environment, the emphasis is on maximizing the water productivity within the land use in order to feed the growing population soil moisture conservation is a key component of raising water productivity. the preservation of soil moisture particularly in rainfed and dry land agriculture is a crucial component to prevent moisture deficiency in soil. Although the rainfall in arid and semi-arid areas is sufficient for crop growth, dry spells with unusual rainfall distribution during the crop's critical growth stages can reduce the yield by 50% to 60%. Therefore, some efficient soil moisture conservation techniques like mulching, deep tillage, compartmental bunding, and basin listing are to be adopted for successful crop production in order to prevent yield loss and maintain crop stands with the maximum yield. These methods for conserving soil moisture can also enhance soil qualities and lessen soil erosion and degradation.

Keywords:- *Conservation Of Soil Moisture, Tillage, Rotation, Agricultural Systems, Rainfed.*

I. INTRODUCTION

Out of the 143 million ha net cultivated area, dry land and rainfed agriculture account for about 108 million ha (or 75% of it). Despite significant advancements in irrigation technology since the 1950s, rain-fed agriculture still accounts for the cultivation of 64.7% of cotton, 83.8% of pulses, 42% of rice, 74.1% of oilseeds, and 85.6% of coarse cereals. 40% of food grains are produced by dry land and rainfed agriculture, which also feeds two-thirds of the cattle and 50% of the human population. According to Patil et al. (2014), dry land farming is characterized by low crop production and high yield variability from year to year due to a variety of factors, including water availability. India's population is growing, and there is more intersectoral competition for fresh water as a result Agriculture is under pressure to consume less water (Zaman et al., 2017; Maitra and Pine, 2020). Urban residents' needs for water are likewise growing daily. In these conditions, conserving soil moisture is one of the key strategies for raising agricultural productivity (Namirembe et al., 2015). More can be done to save soil moisture.

Characterized as a technique to achieve high agricultural yield by preventing moisture loss from the soil. Reducing the amount of water lost from plants through transpiration and from the soil through evaporation or combined evapotranspiration is the main objective of soil moisture conservation (FAO, 2003). The key strategy for lowering crop irrigation needs and preserving the necessary water for agricultural output is soil moisture conservation (FAO, 2003).

In order to reduce crop irrigation needs and so preserve the necessary water for agricultural output, soil moisture conservation is the major strategy (FAO, 2003). Following some soil moisture conservation measures, which are further described in the topic, was advised in order to increase the soil's availability of moisture and the rate of water infiltration. Numerous agronomic practices, such as the System of Rice Intensification (SRI), Direct Seeded Rice (DSR), Aerobic Rice, and others are encouraged in addition to various soil moisture conservation measures (Mohanta et al., 2021; Midya et al., 1021a, b).

II. METHODOLOGY

❖ *The Techniques Used By The Farmers For Soil Moisture Conservation*

In our nearby area the farmers are using various methods and techniques to conserve soil moisture like deep tillage, compartmental bunding, mulching, strip cropping, crop rotation etc.

➢ *Deep Tillage*

In order to maximize water infiltration into the deeper layers of the soil and reduce runoffs and nutrient loss while increasing crop productivity, tillage is one of the key conservation practices (Das et al., 2010). To break the hard pan and further enhance the physical qualities of heavy soils, deep tillage is frequently used. Deep tillage is typically performed every two to three years at a depth of 25 to 30 cm. When the soil is left fallow during the off-season and summer, it becomes harder, which is important for dry land and rainfed agriculture. In this case, the presence of rain might worsen surface runoffs and cause soil erosion.

➢ *Compartmental Bunding*

According to Chaudhry et al. (2004), this technique is one of the most affordable methods for conserving rainwater in rainfed vertosols with a slope of less than 1%. To prevent soil erosion and hold rainwater where it falls, the entire field has been partitioned into small compartments of specified sizes.

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➢ *Mulching*

By controlling weeds, preserving soil moisture, lowering water evaporation, changing the physical environment of the soil, and enhancing soil fertility, mulching is one of the crucial agronomic practices that directly affects the hydro-thermal regimes of soils (Leong et al., 2003). It is a method that encourages the growth of plants, and Sai Manoj Kumar et al. By improving moisture conservation, modifying the soil temperature, and boosting nutrient availability, development can be facilitated (Kher et al., 2010). Organic mulches, such as peat, wood chips, and straw.

➢ *Strip Cropping*

To stop soil erosion and moisture loss, different crops are grown in alternate strips in this farming technique. Runoff is slowed down and soil particles that are rinsed off the ground are filtered by the infertile rows of close-growing segments. Another agronomical technique called strip cropping involves planting common crops in relatively small strips across a land slope. These strips are set up so that there should always be strips of closely spaced, erosion-resistant crops between the strip crops.

➢ *Crop Rotation*

Crop rotation is the process of cultivating several crops on the same piece of land progressively over the course of a year. Legumes can help cereal crops by reducing soil erosion, restoring soil fertility, and preserving soil moisture. It reduces weed and insect infestation, improves soil nutrient content, and fosters soil health. Utilizing the soil moisture at various depths can be accomplished by rotating shallow-rooted and deep-rooted crops in a cropping sequence (Agri info, 2015).

III. DATA ANALYSIS

❖ (*Based on the survey conducted we got responses for farmers on soil moisture conservation which have been explained).*

➢ *How to measure a seasonal dry period?*

A distinction between RAW (Readily Available Water) and TAW (Total Available Water) must be made based on the moisture content at field capacity and moisture content at wilting point. Take RAW = 0.5TAW.

➢ *How to distinguish between soil moisture restriction and coniferous heat stress?*

All years saw above-average annual precipitation totals of 1000 mm or more, with summer precipitation (May to August) never falling below 300 mm. Likewise, we see a definite drop-in growth rate during summers with high air temperatures (at least a few days with Ta > 30C), and a noticeable increase in growth rate during cooler years (not more than 2-3 days with Ta > 30 o C). Precipitation in the summer is sluggishly (and favourably) associated with temperature. In the summer, the soil moisture varied from 30 to 25 to 10 to 20 percent by volume.

➢ *How the farmers measuring the soil moisture?*

There are two ways to evaluate soil moisture: directly and indirectly. Direct methods include measuring the amount of moisture in the soil, whereas indirect methods estimate the amount of water by using the characteristics of the water in the soil. Through oven drying or the volumetric method, moisture is thermo-gravimetrically determined in direct approaches.

➢ *I wish to employ black polythene soil mulch for a nine-month turmeric crop. What are the potential production scenarios?*

During kharif and the summer, the temperature inside the black plastic mulch may soar. So, avoid practising in vast spaces. In the first year, conduct a preliminary study on a modest scale while keeping an eye on the weather and productivity. if the temperature rises significantly. You can deliver speeches on plastic or create side-opening slides.

➢ *Is there is any disadvantages of using mulching sheet?*

Yes there are some disadvantages of mulching sheet as we all know that plastic is non- biodegradable so using large amount of polythene may effect environment its not a eco-friendly and hard to dispose of and it also release excessive heat and moisture which may harm the crop.

IV. LITERATURE REVIEW

❖ *P Sai Manoj Kumar, Masina Sairam, Sagar Maitra centurion university of technology and management M.S Swaminathan professor of agriculture December 2021 Indian journal of natural science*

P Sai Manoj, Masina Sairam, Sagar Maitra (2021) article explore the terms about the soil moisture conservation in dry land agriculture. That how the farmers use different techniques to maintain the soil moisture in dry land.

➢ *Introduction*

Soil moisture is a crucial factor in the productivity and sustainability of dryland and rainfed agriculture. In recent years, changes in weather patterns and growing populations have put increased pressure on agricultural systems to conserve soil moisture. Various soil moisture conservation techniques have been developed and used to improve crop yields and soil health. In this article, P Sai Manoj Kumar provides a review of different soil moisture conservation techniques for dryland and rainfed agriculture.

➢ *Conservation Tillage*

Conservation tillage is a widely used soil moisture conservation technique in dryland agriculture. It involves leaving crop residues on the soil surface to reduce water evaporation and increase soil organic matter. The use of conservation tillage can increase soil moisture content, reduce soil erosion, and increase crop yields. However, the success of conservation tillage depends on soil type, crop type, and management practices.

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- *Mulching*

Mulching is another widely used soil moisture conservation technique that involves covering the soil surface with a layer of organic or inorganic material. Mulching can reduce soil temperature, evaporation, and weed growth, while improving soil moisture content and nutrient availability. The success of mulching depends on the type and amount of mulch used, as well as the climate, soil type, and crop type.

- *Rainwater Harvesting*

Rainwater harvesting is a technique used to capture and store rainwater for later use. This technique can be used to improve soil moisture content and reduce runoff in dryland and rainfed agriculture. Different rainwater harvesting techniques, such as roof-top rainwater harvesting, ponding, and contour bunding, have been developed and used in different regions. The success of rainwater harvesting depends on the amount and timing of rainfall, the size and type of catchment area, and the storage capacity.

- *Crop Rotation*

Crop rotation is a soil moisture conservation technique that involves alternating crops in a sequence to improve soil health and moisture content. Crop rotation can reduce soil erosion, increase soil organic matter, and improve soil structure, leading to increased soil moisture content and crop yields. However, the success of crop rotation depends on the crop type, soil type, and management practices.

- *Conclusion*

Soil moisture conservation techniques are important for dryland and rainfed agriculture. Different techniques, such as conservation tillage, mulching, rainwater harvesting, and crop rotation, have been developed and used to improve soil moisture content and crop yields. However, the success of these techniques depends on various factors, such as soil type, crop type, climate, and management practices. Further research is needed to identify the most effective soil moisture conservation techniques for different regions and conditions.

V. RESEARCH GAP

There can be wide variations of moisture shortage both within and between seasons. a drought year whose total rain is well below the long-term average may still include periods of excessive rain and flooding, while a high rainfall season may include periods of drought. This makes the choice of method difficult, because the desired objective may change from one season to another.

Thus, the moisture conservation methods need to be evaluated using scientific principles.

VI. LIMITATIONS

Some regions use crop wastes as animal feed, which adds to the cost for soil conservation. Measures to conserve soil moisture may not be applied in all areas since non-mechanized agriculture can be difficult to produce new crops using mulch or other agricultural wastes (Gosai et al., 2009). Crop leftovers cannot be used to preserve in-situ soil moisture because of residue burning in the crop field. Certain moisture-conservation strategies, such as plastic mulching and strip cropping, are not suitable for all types of crops. For small-scale farmers, high mechanisation methods are not cost-effective. Another significant obstacle to putting moisture conservation practises into practise is the lack of understanding of these practises among many farmers.

VII. RESULT

Technologies for preserving soil moisture have both benefits and drawbacks. Low agricultural output is a result of water stress in plants, which is mostly caused by loss of soil porosity. Adoption of soil and water conservation technology is required for the restoration of degraded soils in order to address water stress issues in ASALs. Agronomic measures like plant/soil cover, conservation farming methods, and contour farming; vegetative methods like vegetative strips, live fences, and wind breaks; structural methods like terraces, bunds, cut-off drains, and barriers; and management measures like selective clearing and area closures were all categorised by as being used to conserve soil and water in Kenya. Agronomic and structural measures are the most widely utilised technologies in drylands, according to the metadata.

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Table 1 Technology Advantages & Disadvantages

Category	Technology	Advantages	Disadvantages
Agronomy	Conservation farming	It increases infiltration and soil moisture content. Increases soil organic. Matter content Lessens the need for labour it improves crop yields. Contribution to erosion control reduces the requirement for workforce and mechanisation which lowers the cost of production.	A rise in the likelihood of illnesses and insect pests. the decomposition of crop wastes may result in the temporary immobilisation of nitrogen. A rise in weed pressure.
	Trash lines	Reduces runoff and erosion. Enhances infiltration and soil moisture content. Enhances the amount of organic Matter in the soil. Enhances the structure of the soil.	Frequent upkeep necessary.
	Mulching	Maintain soil moisture Enhancing soil nutrients using organic mulch 92% lessens the prevalence of weed. Straw mulch can cut runoff by up to 43% 86–97% lessens soil erosion The increase in agricultural yields is between 34.5 and 4 Decreases evaporation by 35 – 88% Enhances soil structure by incorporating organic matter Mulch made of stone and gravel increased tree growth by 70%	Incidences of pests are rising During decomposition, woody mulch may cause nitrogen to become immobilised Time-consuming Plastic mulch production costs could go up.
	Terraces	Decreases sediments and runoff by up to 52%.	High labour requirement.

VIII. CONCLUSION/DISCUSSION

Techniques for conserving soil moisture are required to maintain the soil's physical, chemical, and biological qualities as well as its optimal soil moisture, which is important to feed the agricultural plants with the necessary amount of water and nutrients. In each region, a different approach is used. The soil, topography, climate, and the farmer's preferences all influence the best technique to use. In dry land and rainfed farming systems, these methods can also aid in achieving agriculture sustainability. All methods for storing moisture, however, have some benefits and disadvantages. The combination of many soil moisture conservation approaches is a superior strategy than adhering to a single technique, according to certain experimental data.

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