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**Original Article****Rainwater Management Strategies for Enhancing Productivity in Rainfed Agriculture****P.V. Ramesh Babu<sup>1</sup>, B. Sahadeva Reddy<sup>2</sup>, V. Roja<sup>3</sup>, N. Veronica<sup>4</sup> and Ch. Sreenivas<sup>5</sup>**<sup>1</sup>Scientist (Agronomy)RARS, Maruteru, West Godavari (Dist), Andhra Pradesh.<sup>2</sup>Principal Scientist (Agronomy)RARS, Maruteru, West Godavari (Dist), Andhra Pradesh.<sup>3</sup>Scientist (Plant breeding) RARS, Maruteru, West Godavari (Dist), Andhra Pradesh.<sup>4</sup>Scientist (Crop Physiology) RARS, Maruteru, West Godavari (Dist), Andhra Pradesh.<sup>5</sup>Associate Director of Research, RARS, Maruteru, West Godavari (Dist), Andhra Pradesh.

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**ABSTRACT**

Rainfed agriculture constitutes a major component of agricultural production systems in India, particularly in semi-arid and sub-humid regions. In Andhra Pradesh, nearly 58–60% of the cultivated area depends solely on rainfall. Variability in rainfall distribution, declining groundwater resources, soil erosion, and low soil moisture availability are major constraints affecting crop productivity in rainfed ecosystems. Efficient rainwater management practices can substantially improve soil moisture conservation, groundwater recharge, nutrient-use efficiency, and crop yields. This article reviews practical and scientifically proven approaches for harvesting, conserving, and utilizing rainwater in rainfed farming systems. The adoption of watershed-based interventions, in-situ moisture conservation techniques, farm ponds, contour cultivation, sub-soiling, compartmental bunding, mulching, and supplemental irrigation can significantly enhance agricultural sustainability and resilience to climate variability.

**Keywords:** Rainfed Agriculture, rainwater harvesting, soil moisture conservation, farm ponds.**INTRODUCTION:**

Rainfed agriculture plays a vital role in ensuring food security and rural livelihoods in India. In Andhra Pradesh, approximately 39 million hectares of agricultural land depend on rainfall for crop production. Climate change has altered rainfall patterns, resulting in erratic precipitation, prolonged dry spells, and occasional high-intensity rainfall events. Such variability often leads to moisture stress during critical crop growth stages and excessive runoff during periods of heavy rainfall.

A substantial proportion of rainfall received in rainfed areas is lost through surface runoff. Red soils may lose nearly 25% of rainfall as runoff, while black soils lose around 10%. Consequently, only a

small fraction of rainfall is effectively stored within the soil profile for crop use. Runoff not only results in water loss but also accelerates soil erosion and nutrient depletion, leading to long-term declines in soil productivity. Therefore, scientific rainwater management practices are essential for improving water-use efficiency, conserving soil resources, and stabilizing crop yields under rainfed conditions.

**CHALLENGES IN RAINFED AGRICULTURE:** The major constraints affecting rainfed crop production include:

- Uneven distribution of seasonal rainfall.
- Frequent occurrence of drought spells during crop growth.
- Low soil organic matter content.
- Limited infiltration and poor water-holding capacity of soils.
- Surface runoff and soil erosion.
- Nutrient losses associated with eroded topsoil.
- Declining groundwater recharge.

These challenges necessitate integrated soil and water conservation measures for sustainable crop production.

**RAINWATER MANAGEMENT PRACTICES BEFORE SOWING:** In case of rainfed farming soil moisture can be conserved by different practices clearly mentioned here under:

**1. Mechanical measures for moisture conservation:**

**a. Desiltation of Water Bodies:** Regular desiltation of check dams, drainage channels, village tanks, and feeder streams improves water storage capacity and facilitates groundwater recharge. Enhanced storage ensures greater water availability for agriculture and domestic use.

**b. Construction of Trenches and Field Bunds:** In red soils with moderate slopes, contour trenches and field bunds should be constructed at appropriate intervals to intercept runoff and increase infiltration. These structures reduce water loss and promote soil moisture conservation. **C.**

**c. Deep Tillage:** Deep tillage using disc ploughs or chisel ploughs after the onset of pre-monsoon rains improves soil porosity and infiltration. Deep ploughing breaks compacted layers, facilitates root penetration, and enhances soil water storage.

**d. Sub-soiling:** Sub-soiling to a depth of 45–60 cm at intervals of two to three years helps break hardpans and improves water movement within the soil profile. This practice enhances root development and increases crop tolerance to drought.

**e. Contour Cultivation:** Ploughing, sowing, and intercultural operations across the slope significantly reduce runoff velocity, increase infiltration, and minimize soil erosion.

## 2. Cropping Strategies for Moisture Conservation:

- a. **Intercropping Systems:** Intercropping erosion-resistant crops such as pigeonpea, castor, and pearl millet with spreading legumes like groundnut, cowpea, greengram, blackgram, and horsegram reduces runoff and improves soil cover.
- b. **Organic Matter Addition:** Application of farmyard manure, compost, crop residues, and tank silt improves soil structure, increases water-holding capacity, and enhances nutrient availability.
- c. **Mulching:** Surface mulching with crop residues, rice husk, or groundnut shells reduces evaporation losses, suppresses weed growth, and conserves soil moisture for extended periods.
- d. **Vegetative Barriers:** Planting grasses such as vetiver and other perennial species along contour bunds acts as a biological barrier to runoff and soil erosion while increasing water infiltration.

## 3. Soil and Water Conservation in Black Soils:

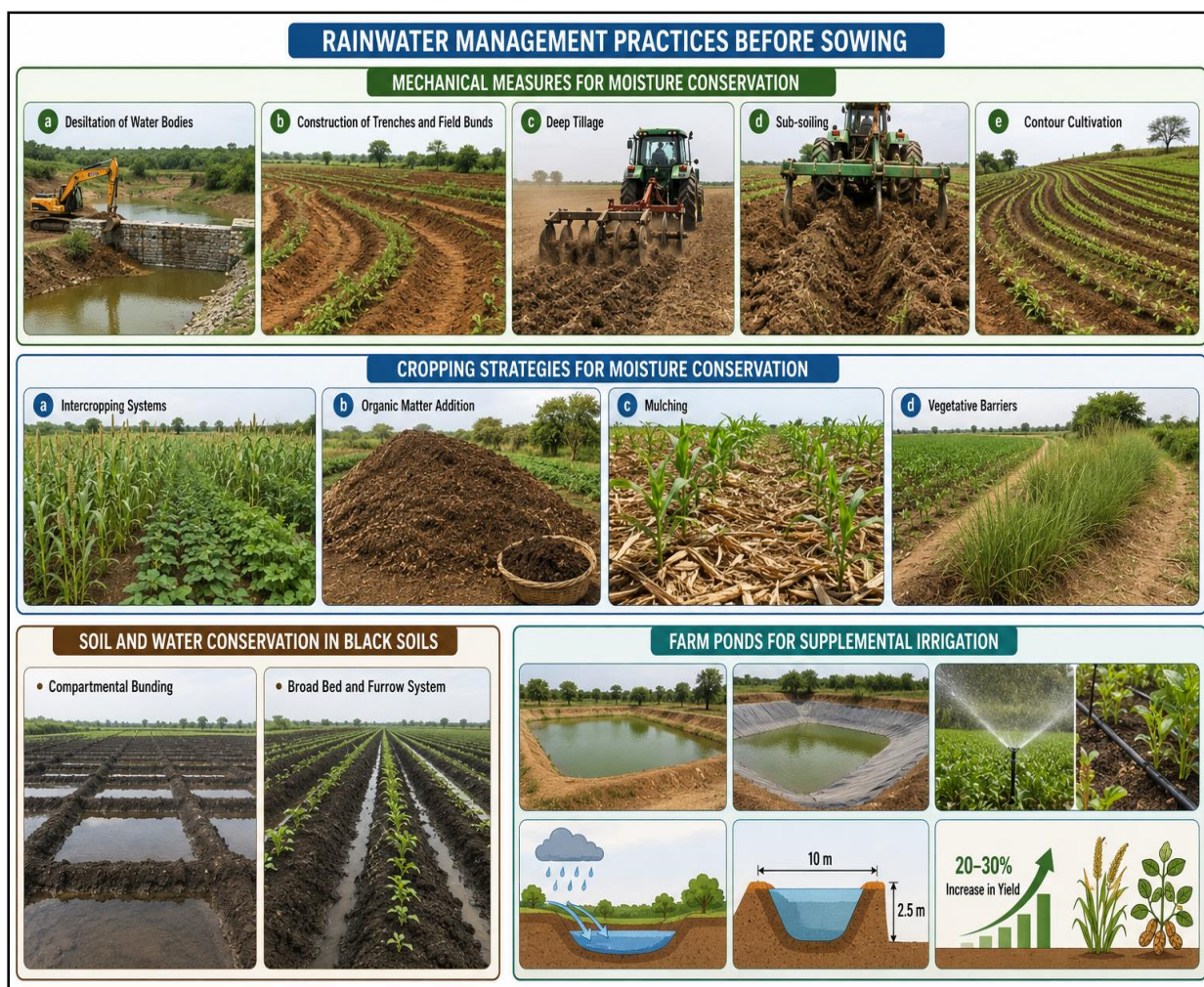
- **Compartmental Bunding:** Formation of small square compartments (approximately 5 × 5 m) in black soils helps retain rainwater and improve moisture storage for subsequent crops.
- **Broad Bed and Furrow System:** The broad bed and furrow (BBF) system facilitates drainage during excess rainfall and improves water availability during dry periods. This system is particularly beneficial for crops grown on heavy clay soils.

## 4. Farm Ponds for Supplemental Irrigation:

Farm ponds are effective structures for storing excess runoff generated during intense rainfall events. Stored water can be utilized as supplemental irrigation during dry spells occurring within the cropping season.

Typically, farm ponds measuring approximately 10 m × 10 m × 2.5 m are suitable for rainfed red soil regions. Pond lining using soil-cement mixtures can reduce seepage losses and improve water retention.

Supplemental irrigation through sprinklers or drip systems during critical crop growth stages can increase crop yields by 20–30% in rainfed regions. Efficient utilization of stored water enhances water productivity and reduces crop failure risks.



**Fig: Showing the rainwater management before sowing of the crop**

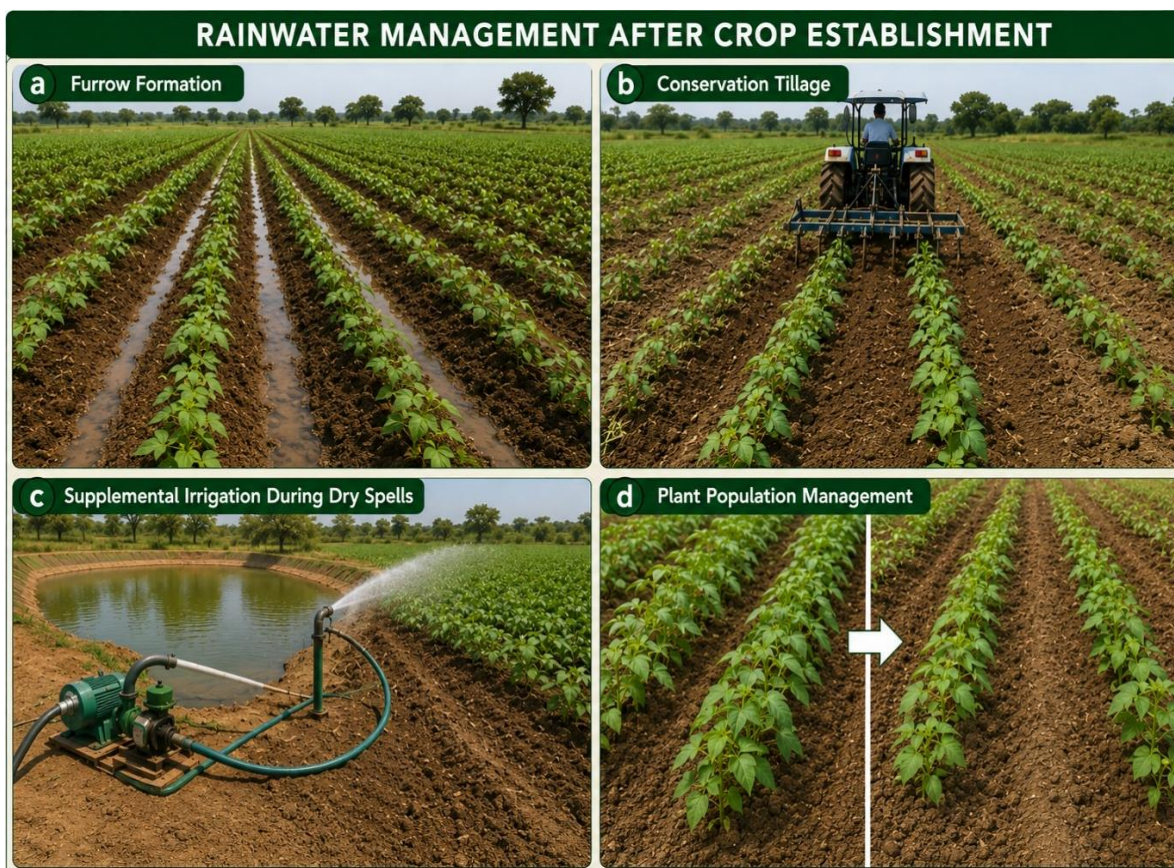
**RAINWATER MANAGEMENT AFTER CROP ESTABLISHMENT**

**a. Furrow Formation:** Creation of furrows between crop rows 20–25 days after sowing improves rainwater infiltration and reduces runoff. Furrows facilitate moisture storage within the root zone and improve crop growth.

**b. Conservation Tillage:** Timely intercultivation using suitable implements controls weeds while conserving soil moisture by breaking surface crusts.

**c. Supplemental Irrigation During Dry Spells:** When rainfall deficits persist beyond 10 days in red soils and 15 days in black soils, supplemental irrigation from farm ponds can prevent moisture stress and maintain crop productivity.

**d. Plant Population Management:** Thinning excess plants in crops such as pigeonpea and castor ensures optimum spacing, reducing competition for moisture and nutrients under limited water conditions



**Fig: Showing the rainwater management after crop establishment**

**BENEFITS OF RAINWATER MANAGEMENT:** Adoption of integrated rainwater management practices offers multiple benefits:

- Increased rainwater infiltration and groundwater recharge.
- Reduced runoff and soil erosion.
- Improved soil fertility and nutrient retention.
- Enhanced soil moisture availability.
- Greater resilience to drought and climate variability.
- Increased water-use efficiency.
- Improved crop productivity and farm profitability.
- Sustainable management of natural resources.

#### **CONCLUSION**

Rainwater management is a critical component of sustainable rainfed agriculture. Efficient harvesting, storage, and utilization of rainfall can substantially improve soil moisture availability, reduce erosion losses, and stabilize crop production under variable climatic conditions. Practices

such as contour cultivation, deep tillage, sub-soiling, vegetative barriers, farm ponds, mulching, compartmental bunding, and supplemental irrigation provide practical solutions for enhancing productivity in rainfed ecosystems. Widespread adoption of these technologies can improve agricultural resilience, increase farmer income, and contribute to long-term sustainability of rainfed farming systems.

## **REFERENCES**

- Central Research Institute for Dryland Agriculture (CRIDA). Dryland Farming Technologies for Sustainable Agriculture. Hyderabad, India.
- FAO. Water Harvesting and Supplemental Irrigation for Improved Crop Production. Food and Agriculture Organization of the United Nations, Rome.
- Indian Council of Agricultural Research (ICAR). Handbook of Agriculture. ICAR, New Delhi.
- Pathak, P., Wani, S.P., and Sudi, R. Watershed Development and Rainwater Management in Semi-Arid Regions. ICRISAT Publications.
- Rao, C.S., Venkateswarlu, B., Lal, R., Singh, A.K., and Kundu, S. Rainfed Agriculture in India: Challenges and Opportunities. ICAR Publications, New Delhi.
- Singh, R.P. Soil and Water Conservation Engineering. Kalyani Publishers, New Delhi.
- Wani, S.P., Rockström, J., and Oweis, T. Rainwater Harvesting and Management for Improving Agricultural Productivity. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad.