



Characteristics of Dryland Farming and Cropping Systems/Patterns in Dryland Agriculture

*Desika R

School of Agricultural Sciences, Dhanalakshmi Srinivasan University, India

*Corresponding Author's email: desikadevimdr@gmail.com

Dryland farming refers to crop production practiced in regions receive low and erratic rainfall, typically less than 750 mm annually, without access to irrigation. Nearly 70% of India's cultivated area falls under rainfed/dryland conditions, contributing significantly to the production of coarse cereals, pulses, and oilseeds. Since crop growth in these regions depends entirely on conserved soil moisture and rainfall, farmers must adopt specific practices and cropping patterns suited to moisture-scarce environments. This article discusses the key characteristics of dryland farming and the cropping systems and patterns commonly followed in such regions.

Characteristics of Dryland Farming

- 1. Low and Erratic Rainfall** Dryland areas receive rainfall ranging from 400–750 mm annually, often concentrated in a short period (3–4 months) and highly variable in distribution, both spatially and temporally.
- 2. High Risk and Uncertainty** Due to unpredictable onset, distribution, and cessation of rainfall, crop failure risk is high. Farmers face frequent dry spells even within the cropping season.
- 3. Poor and Shallow Soils** Soils in dryland tracts are often shallow, low in organic matter, and have limited water-holding capacity, which further restricts moisture availability to crops.
- 4. Limited Cropping Intensity** Due to moisture constraints, only one crop is generally grown per year (mono-cropping), though double cropping is possible in areas with assured rainfall or better soil moisture retention.
- 5. Dependence on Soil Moisture Conservation** Since irrigation is largely absent, the entire crop production strategy revolves around conserving rainwater in the soil profile and using it efficiently.
- 6. Small Farm Holdings and Low Input Use** Dryland farmers, particularly in developing regions, generally operate small and fragmented holdings with limited access to inputs like fertilizers, quality seeds, and credit.
- 7. Predominance of Hardy Crops** Crops grown are typically drought-tolerant and short-duration, such as sorghum, pearl millet, finger millet, chickpea, pigeon pea, groundnut, and various minor millets.
- 8. High Wind Velocity and Evapotranspiration** Dryland regions often experience high temperatures and wind speeds, leading to greater evapotranspiration losses and moisture stress.
- 9. Vulnerability to Land Degradation** Continuous cultivation without adequate conservation measures makes these lands prone to erosion, nutrient depletion, and desertification.

10. Need for Location-Specific Technology Because rainfall, soil type, and topography vary widely across dryland tracts, farming technologies and cropping patterns must be tailored to local agro-climatic conditions.

Cropping Systems in Dryland Farming

A cropping system refers to the overall pattern and sequence of crops adopted in a given area over time, integrated with resource management practices. In dryland regions, cropping systems are designed primarily to minimize risk and maximize the efficient use of limited moisture. Common systems include:

- **Mono-cropping:** Growing a single crop per year, suited to areas with very low and short-duration rainfall (e.g., pearl millet or sorghum as sole crop).
- **Intercropping:** Growing two or more crops simultaneously in a definite row arrangement to reduce risk and make efficient use of resources (e.g., sorghum + pigeon pea, groundnut + pigeon pea).
- **Mixed cropping:** Growing two or more crops together without a distinct row pattern, mainly as an insurance against crop failure.
- **Sequential cropping:** Growing two crops in sequence within the same year when residual moisture or a short growing window permits (e.g., short-duration pulse after an early-maturing cereal).
- **Relay cropping:** Sowing the succeeding crop before harvesting the standing crop, to utilize residual soil moisture effectively.
- **Alley cropping/Agroforestry-based systems:** Integrating trees or shrubs with field crops to provide additional income, fodder, and soil conservation benefits.

Cropping Patterns in Dryland Farming

Cropping pattern refers to the proportion of area under various crops at a given point in time in a region. In dryland areas, cropping patterns are shaped by rainfall duration, soil depth, and moisture availability:

1. **Sole Cropping Pattern:** Practiced in low rainfall zones (less than 500 mm) where only one hardy crop such as pearl millet, sorghum, or moth bean is grown.
2. **Intercropping Pattern:** Common in medium rainfall zones (500–750 mm), combining a cereal with a legume (e.g., sorghum + green gram, pearl millet + cluster bean) to ensure at least partial yield even under moisture stress, while improving soil fertility through nitrogen fixation.
3. **Double Cropping Pattern:** Followed in areas with relatively assured rainfall (above 750 mm) or good moisture-retentive soils, allowing a short-duration kharif crop followed by a rabi crop grown on residual moisture (e.g., greengram/blackgram followed by chickpea or safflower).
4. **Contingency Cropping Pattern:** Alternative crop plans kept ready to counter delayed onset, mid-season, or terminal drought situations, involving quick-maturing or drought-escaping varieties.
5. **Strip Cropping Pattern:** Crops grown in alternating strips across the slope to reduce soil erosion and conserve moisture, especially on undulating dryland terrain.

Importance of Suitable Cropping Systems and Patterns

Adopting the right combination of cropping systems and patterns in dryland areas helps to:

- Reduce the risk of total crop failure due to erratic rainfall
- Improve overall land and moisture use efficiency
- Enhance soil fertility through legume inclusion
- Provide better economic returns and food security to farmers
- Promote sustainable use of natural resources and reduce land degradation

Conclusion

Dryland farming is characterized by moisture scarcity, high production risk, and dependence on soil and rainfall management rather than irrigation. Selecting appropriate cropping systems and patterns — such as intercropping, sequential cropping, and contingency planning — is central to stabilizing yields and improving farmer livelihoods in these challenging environments. With continued research and extension support, dryland regions can achieve sustainable productivity while conserving their fragile natural resource base.

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