



Risk Management Strategies in Rainfed Farming: Building Resilience Against Climatic and Production Uncertainties

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Rainfed agriculture supports a major share of cultivated land in India and remains highly vulnerable to erratic rainfall, drought, dry spells, and other climatic and market-related uncertainties. This article reviews the principal sources of risk in rainfed farming systems, drought, moisture stress, pest and disease outbreaks, price volatility, and resource constraints, and examines management strategies developed to reduce vulnerability and stabilize farm income. Key approaches discussed include contingency crop planning, soil and water conservation, crop diversification, integrated pest management, weather-based advisories, and institutional risk-sharing mechanisms such as crop insurance under the Pradhan Mantri Fasal Bima Yojana (PMFBY). Drawing on national programmes including the National Innovations in Climate Resilient Agriculture (NICRA) and contingency planning frameworks developed by ICAR-CRIDA, the article highlights an integrated, multi-pronged approach combining agronomic, technological, and policy interventions as essential to building long-term resilience in rainfed cropping systems.

Introduction

Rainfed farming accounts for nearly two-thirds of India's net sown area and contributes significantly to national food grain production, particularly coarse cereals, pulses, and oilseeds. Unlike irrigated systems, rainfed agriculture depends almost entirely on the timing, distribution, and quantity of monsoon rainfall, making it inherently risk-prone. Year-to-year variability in onset, withdrawal, and intensity of rainfall, combined with frequent dry spells and occasional floods, exposes farmers to substantial production risk. Beyond climatic uncertainty, rainfed farmers also face price volatility, limited access to credit and inputs, degraded soil resources, and inadequate irrigation infrastructure. These compounding risks often trap smallholders in a cycle of low investment and low productivity. Climate change projections suggest increasing frequency of extreme weather events, further intensifying the vulnerability of rainfed systems. In this context, systematic risk management, anticipating, mitigating, and coping with production and income risks, has become central to sustaining rainfed agriculture and safeguarding farmer livelihoods.

Contents

1. Major Sources of Risk in Rainfed Farming

Rainfed cropping systems face several interlinked categories of risk. Climatic risk arises from delayed monsoon onset, prolonged dry spells, and erratic rainfall distribution, all of which directly affect sowing windows and crop establishment. Biotic risk stems from pest and disease outbreaks that are often aggravated by moisture stress and weakened plant vigour. Market risk includes price fluctuations and lack of assured procurement, which undermine income stability even when yields are adequate. Resource and institutional risk reflects limited access to quality seed, credit, extension advisory, and post-harvest infrastructure, particularly among smallholder and marginal farmers.

2. Contingency Crop Planning

Contingency planning involves preparing alternative crop and variety options in advance for situations such as delayed onset of monsoon, prolonged mid-season dry spells, or early withdrawal of rains. ICAR-CRIDA, in collaboration with State Agricultural Universities, has developed district-level contingency plans specifying short-duration varieties, alternate crops, and revised sowing windows suited to different rainfall scenarios. Adoption of such location-specific contingency measures helps farmers minimise crop failure and maintain a basic level of productivity even under adverse seasonal conditions.

3. Soil and Water Conservation Measures

In situ moisture conservation practices, including contour bunding, ridge-furrow systems, mulching, and conservation tillage, improve rainwater infiltration and reduce runoff losses. Water harvesting structures such as farm ponds, percolation tanks, and check dams capture excess monsoon runoff for supplemental irrigation during critical crop growth stages. These measures, central to watershed development programmes, reduce dependence on a single rainfall event and provide a buffer against intermittent dry spells.

4. Crop and Enterprise Diversification

Diversifying from mono-cropping toward intercropping, mixed cropping, and integration of livestock, horticulture, or agroforestry components spreads production risk across multiple enterprises. If one component is affected by adverse weather, returns from others can partially offset losses. Diversification also improves input-use efficiency, nutrient cycling, and overall farm resilience, while offering more stable and diversified income streams across the cropping season.

5. Integrated Pest and Nutrient Management

Moisture-stressed rainfed crops are particularly susceptible to pest and disease pressure. Integrated Pest Management (IPM), combining resistant varieties, timely monitoring, biological control agents, and judicious need-based pesticide use, reduces crop losses while limiting input costs. Similarly, balanced and need-based nutrient management, informed by soil testing, improves crop vigour and resilience to moisture stress, reducing the compounded risk of biotic stress under climatic uncertainty.

6. Weather-Based Advisory and Climate-Resilient Technologies

Agromet advisory services provide farmers with location-specific weather forecasts and corresponding crop management recommendations, enabling timely decisions on sowing, irrigation, and plant protection. The National Innovations in Climate Resilient Agriculture (NICRA) programme has promoted climate-resilient technologies, including drought-tolerant varieties, custom hiring centres for farm machinery, and village-level climate risk management committees, across vulnerable rainfed districts, strengthening farmers' adaptive capacity at the local level.

7. Institutional and Financial Risk-Sharing Mechanisms

Crop insurance schemes, notably the Pradhan Mantri Fasal Bima Yojana (PMFBY), provide a financial safety net by compensating farmers for yield losses due to natural calamities, pests, and diseases at a relatively low premium. Complementary mechanisms such as weather-based crop insurance, minimum support price (MSP) procurement, and institutional credit further help cushion income shocks. Strengthening farmer awareness and timely claim settlement remain important areas for improving the effectiveness of these schemes.

Conclusion

Risk in rainfed farming arises from the interaction of climatic variability, biotic stresses, market fluctuations, and resource constraints, requiring a multi-pronged management approach rather than any single intervention. Contingency crop planning, soil and water conservation, diversification, integrated pest and nutrient management, weather-based advisories, and institutional risk-sharing mechanisms such as PMFBY together form a comprehensive risk management framework. Continued investment in climate-resilient technologies under programmes like NICRA, supported by strong extension outreach and farmer awareness, will

be essential to sustaining productivity and stabilising livelihoods in India's rainfed agricultural regions amid increasing climatic uncertainty.

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