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Rainfed Agriculture – Present scenario in India

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Introduction

The Indian economy is primarily agrarian which contributes 21 percent of country's GDP and 60% of the employment. Rainfed agriculture is vital to country's economy and food security since it contributes to about 40% of the total food grain production, supports two third of livestock and 40% of human population. Rainfed agriculture also influences livelihoods of 80% of small and marginal farmers. In view of the growing demand for food grains in the country, there is a need to increase the productivity of rainfed areas in future and for that optimize use of natural resources in the form of Rainfall, land and water is up most important. The country will have to feed about 1.3 billion people requiring 5-6 MT of additional food grain every year. Over 70 percent of the Indian population which is pre dominantly rural do not have proper access to food and non-food commodities due to poor employment and infrastructure facility. Rainfed agriculture accounts to about 51.12% of the net sown area of the country and major areas of crops includes coarse cereal (85%) , pulses (83%) , oilseeds(70%) and cotton(65%).Even if full irrigation potential is created, still 40% of net cultivated area will remain as rainfed agriculture which would continue to be a major food grain production domain.

The quality of natural resources in the rainfed ecosytem is gradually declinig due to over exploitation. Rainfed areas suffer from bio-physical and socio economic constraints affecting the productivity of crops and livestock. Rainfed agriculture is typically characterised with diverse agro-topo-climates and production systems, drought proneness, poor soil and land quality, scarcity of water and diverse socio econmic settings. All these factors coupled with climate change/variability impacts are evident on crop production, productivity and stability of rainfed rainfed production systems. These factors are causing wider gap in rainfed crops of the country and the yield gap-I (Potential yield –Attainable yield) and Yield gap-II (Attainable yield-Farmers yield) in rainfed crops is still a challenge. These challenges have to be addressed through climate resilient agronomic interventions and continuous efforts are being made through National Agricultural Research and Extension system to bridge the yield gaps in rainfed production system.

The drought of the mid-sixties catalysed the Government of India to invest on Dryland research significantly. By realising the drought impact on agriculture, poor development and socio economic conditions in Dryland areas, Government of India (GOI) during Fourth Plan (1969-74) emphasized on a comprehensive network research programme in Dryland agriculture. In1969, the then Prime Minister Mrs. Indira Gandhi put keen interest in Dryland research and developmental programmes. Subsequently AICRP on Dryland Agriculture (AICRPDA) was launched in 1970 by Indian Council of Agricultural Research in collaboration with the Government of Canada through Canadian International Development Agency (CIDA) with Co-coordinating cell at Hyderabad. The AICRPDA has several unique features that is the only project to have started with a multidisciplinary team with Agronomy, soil physics, soil and water conservation engineering, plant breeding besides testing technology in farmers field. Integrated Dryland Development Pilot Projects were started simultaneously. As on 2022, AICRPDA network has 31 centres (19 main centre, 3 sub centres and 9 voluntary centres) located in 18 states all over India across diverse agroecological settings.

Research Focus: An Overview

During Indo-Canadian Dryland research at AICRPDA centres In the first Phase (1970-75) location specificity of technology was emphasised mainly like low monetary input, time of seeding and plant population geometry, crop substitution and intercropping system, contingent crop planning, weather aberrations etc. During second phase (1976-1982) focus was given on life saving irrigation, in-situ moisture conservation by tillage, efficient crops and cropping systems, crop husbandry for weather aberrations and alternate or multiple land use system. During third phase (1982-1987) the research continued on intercropping and double cropping, identification of genotypes, manipulation of sowing and harvesting dates and plant population, fertiliser use, off season tillage, lifesaving irrigation with harvested rain water, network research on alternate land use systems. During 1987-2008, the research focus was on location specific problems considering agro-ecological characteristics, pre dominant rainfed production systems, rain water management, evaluation of crops/varieties, cropping/farming system, crop planning as per soil-site suitability and contingency planning, INM, tillage and farm machinery and alternate land use systems. During 2000s, more focus was given on real time contingency measures, crop diversification, crop tree animal integrated farming systems, tillage and nutrient management, balanced nutrition, conservation agriculture, farm mechanization and alternate land use system. Besides these, AICRPDA centres have been involved in many collaborative research programmers with CRIDA under ACIAR (Australian Centre for International Agricultural Research) NATP (National Agricultural Technology project), NAIP (National Agricultural Innovation project) NICRA (national innovations on climate resilient Agriculture) and also with ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) national, state and SAUs funded dryland research and development programmes/schemes.

Central Research Institute for Dryland Agriculture (CRIDA) was established in 1985 by upgrading AICRPDA, Hyderabad to work on development of suitable technologies to enhance the productivity of rainfed areas. It is a constituent organization of ICAR, an autonomous body of Ministry of Agriculture, Government of India. The institute is currently is a nodal officer for coordination of research on Dryland Agriculture, Agro meteorology and climate change.

Challenges of Rainfed agriculture

Climatel: With diverse climate, India has a high spatial and temporal variability in rainfall and temperature. Thus, rainfed farming systems are practiced in regions of strong climate contrasts.

Frequent Droughts: Droughts and famines are the general features of rainfed agriculture in India. Conceptually, drought is indicative of situation of limited rainfall that is below the "normal" amount for the area. The perception of drought varies from one region to another depending upon normal climatic conditions, available water resources, agricultural practices, and the specific socioeconomic activities of the region.

Cropping Patterns: Predominant rainfed crops grown in India include: coarse cereals (85%), pulses (83%), oilseeds (70%), and cotton (65%). In arid regions, single crop system involving a long fallow period (October to June) is a rule rather than an exception. Mixed or intercropping is common as a means of insurance and risk minimization. A large proportion of Vertisols in the semiarid region are left fallow during the rainy season due to water logging and drainage problem.

Soil Management: Soils hold the key for enhancing productivity and improving resilience against harsh climate in rainfed agriculture in India. Loss of fertile soil by erosion, depletion of SOM, emerging deficiencies of secondary and micronutrients, high soil compaction, surface crusting, loss of soil biodiversity are among strong limiting factors to productivity enhancement of rainfed agriculture in India.

Strategies for Sustain Food Production in Rainfed Region

Rain water management: Rain water is the key input in rainfed Agriculture. The success of rainfed agriculture lies in the wide use of natural resources particularly rain water. Since rainfed agriculture in India is largely monsoon dependent, often encounter extreme variation in rainfall both in time and space. Rain water management assumes vital importance in reducing risks and stabilizing crop production.

Crop management: Rainfed Agriculture is risk prone due to weather aberrations such as delayed onset of monsoon and in-season drought/ long dry spells. Adoption of location-specific improved crop management practices is essential for drought mitigation and enhanced productivity. Some of the important practices are Time of sowing, Sowing /planting methods, Seed treatment, Plant population and geometry, Efficient crops and varieties, Cropping systems (Inter cropping, Double cropping etc.) and Antitranspirants.

Interculture/weed management: In rainfed areas weeds cause reduction in yields by 30-80%. The loss may be still higher during drought due to competition for moisture by the weeds. If not controlled, weeds can compete and uptake 30% moisture and nutrient affecting crop performance and yield. Therefore Integrated and cost effective weed control measures need to be employed for effective weed management. Off season tillage helps to minimize weed problem in kharif crops in light soils. Planning suitable crop rotation s helps to avoid crops associated and parasitic weeds.

Nutrient management: Soils in drought prone regions are generally deficient in nitrogen. Most of them are also deficient in available phosphorus, sulphur and some micro nutrients (mainly Fe and Zn).Integrated Nutrient management (INM), Soil carbon Management, Crop residue recycling, Site specific nutrient management, Foliar nutrition of crops etc.

Farm mechanization: Farm mechanization in rainfed agriculture plays a vital role in reducing cost of crop production, drudgery and increase in cropping intensity. Farm machineries are used nowadays extensively in tillage and seed bed preparation, sowing operations, weeding and intercultural operations, plant protection, irrigation, harvest and post-harvest operations of crops throughout the country based on the availability of the equipments.

Alternate land use/Agroforestry systems: When a land is put under an alternative production system in order to match its capability more appropriately to the new land use and achieve more sustainable biological and economic productivity on long term, it is known as alternative land use. Agroforestry is a land use system that includes combination of agriculture, agrostology, forestry, horticulture and animal husbandry. Integration of trees/woody perennials is the main objectives of reducing risk and increasing total productivity. Agri-silviclture, Agri-horticulture/Agri-silvi-horticulture, Silvi-pastoral systems, Horti-pastoral systems, alley cropping, Live hedges etc are some of the agro-forestry systems that can be practiced in rainfed production system.

Real time Contingency Planning (RTCP) for weather aberrations: Under National innovations in Climate Resilient Agriculture (NICRA), All India Coordinated Research Project on Dryland Agriculture (AICRPDA), CRIDA, Hyderabad conceptualized Real time Contingency Planning(RTCP) as "Any contingency measure either technology related or policy based which is implemented based on real time weather pattern in any crop growing season" since 2011.RTCP is implemented in two approach i.e preparedness and real time measures. The main objectives of RTCP is to establish a crop with optimum plant population during delayed onset of monsoon and better crop performance during seasonal drought occurred due to delayed onset of monsoon, early season drought, mid-season drought, terminal drought as well as in extreme events.

The importance of rainfed agriculture varies regionally, but rainfed areas produce most food for poor communities in developing countries. Although irrigated production has made a higher contribution to Indian food production especially during the Green Revolution, rainfed agriculture still produces about 60% of total cereals and plays an important role. In this context, it is imperative to focus on rainfed agriculture in order to make the agriculture sector sustainable and resistant to climate change.