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Dryland Agriculture: Problems and Solutions

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Dryland farming is a special case of rainfed agriculture practiced in arid and semiarid regions in which annual precipitation is about 20–35% of potential evapotranspiration. Management objectives center on preserving precipitation on the land, lowering soil surface evaporation to enhance the amount of evapotranspiration needed for transpiration, and adopting drought-tolerant plants that bloom when precipitation patterns are most favorable. Dry regions are those with insufficient irrigation systems and little or no reliable rainfall. Desert agriculture is important to the economy since it is used to grow the majority of the coarse grain crops, pulses, oilseeds, and raw cotton. Crops created for dry farming can either survive or avoid drought. Crops that can withstand drought, such as sorghum, have the ability to reduce transpiration (the emission of moisture). In fact, they may even practically cease growing when there is a lack of moisture, resuming up growth again when the conditions are favorable. The conversation is limited to topics involving agricultural technology and research. In addition to pressures on traditional farming systems, the future and stagnation of dryland crops and the growing scarcity of natural resources are the main factors aggravating the situation of dryland agriculture. Although these objectives have not changed for millennia, new technologies are emerging to enhance food productivity in these disadvantaged places. Crops that are adapted to dry farming typically require more land and mature more quickly than crops cultivated in humid environments.

Introduction

Dryland Agriculture refers to growing of crops entirely under rainfed conditions. In India, about 70% of arable land depends entirely on rainfall for crop production and the practices of agriculture here is called dryland farming. Drylands constitute the land both on steep slope and flat valley plains where water resources (surface and ground water) are not sufficed and hence, agriculture depends on rainfall. As per the encyclopedia Britannica, “dryland farming consists of

making the best use of a limited water supply by storing in the soil as much of the rainfall as possible and by growing suitable crop plants by method that make the best use of this moisture". The fourth five-year plan document of India defines dry farming areas as those, which receive as annual rainfall ranging from 375 to 1125mm and with very limited irrigation facilities. Areas, which receive less than 375 mm of average rainfall, are considered as absolutely arid or desert areas, which require special treatment. Dryland agriculture is a system of crop farming under situations where water becomes a major limiting factor for production with no provision of any planned irrigation. Crop production is solely dependent on rainfall. Rainfall farming is the practice of growing crops, entirely depending on rainfall as a source of moisture where the mean annual rainfall is around 750 mm. the quantity of rainfall should be adequate/sufficient to meet the crop demand. Dryland farming technology refers to cropping pattern/rotation, varieties and agronomic practices adjusted and adopted to the moisture regime of the region.

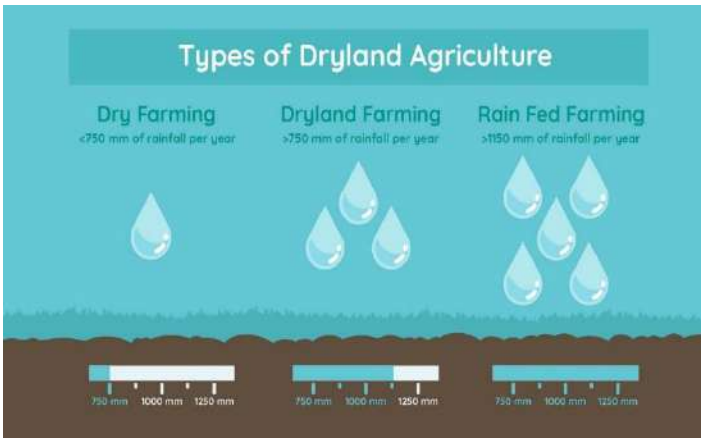
History of Dry Farming

First systematic scientific approach to tackle the problems of dry farming areas was initiated by Tamhane in 1923 on small plots of Manjari farm near Pune and the work passes on to Kanitkar in 1926. A comprehensive scheme of research was drawn up by Kanitkar with financial support from ICAR. Realising the importance, the ICAR launched a comprehensive project on dryland farming in five centres: Sholapur and Bijapur in 1933. Hagari and Raichur in 1934 and Rohtak in 1935. A decade of work upto 1943-44 mainly on rainfall analysis, physico-chemical properties of soils, physiological studies in millets and on agronomic aspects resulted in series of dry farming practices commonly known as the Bombay dry farming practices. Hydrabad dry farming practices and Madras dry farming practices. These practices stressed the need for contour bunding, deep ploughing, application of FYM, low seed rate with wide spacing, mixed cropping and crop rotation. These recommendations could not motivate the farmers to adopt them as the yield advantage was about 15-20 per cent over a base yield of 200- 400 kg ha^{-1} By the mid1950s, importance of soil management was realised for improving the productivity of drylands and the ICAR established eight Soil Conservation Research Centres in 1954. However, yield improvement was not more than 15-20 per cent over the basic yield of 200-400 kg ha^{-1}. importance of short duration cultivars maturing within adequate soil moisture available period (crop growing period) was recognised during 1960s. The place of high yielding varieties and hybrids for yield advantage in dryland agriculture was realised in mid – 1960s. With the establishment of All India Coordinated Research Project for Dryland Agriculture (AICRPDA) IN 1970, emphasis was shifted to multi-disciplinary approach to tackle the problem from several angles. Similar efforts were initiated at ICRISAT, Hyderabad in 1972. The ICAR selected 23 dryland agricultural centres all over the country on basis of the moisture deficit, soil type and rainfall characteristics.

Climate Resilient Smart Agriculture: Approaches & Techniques

Crops that are adapted to dry farming are typically smaller and mature faster than those grown in more

humid environments, and they are typically given more room. India is recognized as the leading agricultural nation in terms of both area and produce value. 70% of the world's poor reside in rural regions and rely heavily on irrigation provided by rainfall for their agricultural activities (Sharma et al., 2005). The country's rain-fed regions cover roughly 31.7 million hectares of land, of which 41.5% is arable and 19% is cultural wasteland. The North-West and Southern parts of the country are where you'll find the majority of the rainfed regions. Western Rajasthan (19.62 million hectares), North-western Gujarat (6.2 million hectares), South-western Punjab (1.45 million hectares), South-western Haryana (1.28 million hectares), Andhra Pradesh (2.16 million hectares), Karnataka (0.86 million hectares), and Maharastra (0.13 million hectares) are the main regions of the country that experience hot, arid conditions (Meena et al. 2009). These areas of the nation are distinguished by an unstable eco-system and a harsh agro-climate. The dry land areas are characterized by an annual rainfall between 100 and 500 mm with a coefficient of variation (CV) ranging from 40 to 70 percent; low relative humidity; high potential evapo transpiration value ranging from 1600 mm in the eastern part to 1800 mm in the western part of the region (Yadava and Soni 2008).



Dry Farming

Cultivation of crops in areas where annual rainfall is less than 750mm and crop failures due to prolonged dry spells during crop period are most common. In arid areas, dry farming is carried out with the aid of moisture-conservation techniques. In this area, a different land use system is advised.

Dry Land Farming

Cultivation of crops in areas where annual rainfall is more than 750 mm but less than 1150 mm is called Dry land farming. For dryland farming methods in semi-arid climates, soil and moisture conservation measures are crucial. A drainage system can be necessary, particularly in dark soils.

Rainfed Farming

Means cultivation of crops in regions where annual rainfall is more than 1150mm. There is less chances of crop failures due to dry spells. There is adequate rainfall and drainage becomes the important problem in rainfed farming.

Only a very large volume could possibly cover the entire subject because the methodologies are so different. The application of agronomic approaches, the adoption of water collection concepts, and the usage of resistant crop varieties that may be advantageous in such locations are then advised. Vegetable crops use a variety of moisture conservation techniques, including ridges and furrows, ridges and furrows plus mulch, and farmers' practices (Flatbed method). The vigor of the vegetable crops was improved by ridge and furrows, mulch, and better plant height, leaf area, and dry matter production (Allolli et al., 2008).

At present, the major arid vegetables being grown by the farmers on small scale (0.10 ha) to large scale (2.50 ha) in different cropping systems during Kharif and Rabi seasons are Citrullus lanatus, Snapmelon, Brinjal, Okra, Bottlegourd, Ridge gourds, Clusterbean, Round melon, Tomato, Chilli, Pea, Cauliflower, Cabbage, Spinach, Fenugreek (leaves), Coriander (green), Carrot, Radish,, Green Onion, Garlic, Mustard leaves, Moringa pods, etc. (Meena et al .2009).

Dry Farming - Constraints

Rainfall is the primary and most important factor affecting productivity in drylands and the occurrence of rainfall is the most uncertain and erratic. About 40% of cereals, 70% of finger millet and cotton, 90% pulses and oil seeds and almost 100% of millets are grown on rainfed lands. Drylands are generally poor in productivity. Most of the crop and varieties grows in drylands are subsistence oriented with low yields. The cultivars are of longer duration, photosensitive and have a low harvest index with low response to inputs such as fertilizers. Deforestation, overgrazing and unlimited cultivation on sloping lands have increased the run-off, reduced the recharge of the soil profile and ground water and caused severe soil erosion. Crop production in such area is highly marginal.

The major constraints of dry farming may be classified as follows:

- Basic resource constraints
- Socio-economic constraints
- Technological constraints

Basic Resource Constraints

Drylands farms have, for centuries been the scene of frequent droughts floods and others forms of human tragedy due to erratic rainfall pattern and others natural hazards. More than 80% of the dryland farmers own less than 2 hac of land per capita. The drylands are characterized by uncertain and aberrant weather. Uncertainty and variability of rains, of both space and time, is the biggest constraints affecting agricultural production in rainfed farming, Drylands are generally low in soil fertility. The soils are universally deficient in nitrogen and frequently in phosphorus. Potash in adequate in many cases except in light textured soil or in soils under continual high production. Problem such as soil salinity or alkalinity further aggravate the situation. The average consumption of fertilizers in cropped area of drylands is less than 10 kg/ha in the 114 predominantly non-irrigated semi- arid tropical districts. In rainfed agriculture, drought stress can occur at any time during crop growth.

Socio- Economical Constraints

Most of the dryland farmers are poor and have very little cash reserve available. The total operation is of the subsistence type and the farmer's concern is to grow staple crops for home consumption. Dryland farmer are not able to utilize the credit facilities provided by the co- operatives and banks in areas where they exist because of their ignorance/ low literacy rates.

Technological Constraints

Lack of suitable genotypes capable of giving high and stable yields under rainfed conditions is a major constraint. Many farmers are unable to use inputs like fertilizers, herbicide and pesticides due to lack of adequate moisture.

Dry Farming Techniques

Dry farming techniques is highly site- specific and will vary from region to region, depending on the type of

soil and rainfall patterns in the area. The following approaches and practices may help in boosting crop production in drylands:

1. Determination of the effective growing season
2. Selection of suitable genotypes to match the rainfall pattern
3. Selecting an intercropping system to ensure sustainability of production and income
4. Creation of a local, cheap water source like a farm pond or a dug well
5. Using improved agricultural implements for timeliness and precision of operations
6. Use of moderate amounts of nutrients to starve of nutrients stress
7. Harvesting water and recycling it in the events of drought.
8. Maintaining a vigil on yield reduces like diseases, pests and weeds and controlling them effectively.
9. Harvesting the crop at physiological maturity stage.

Conclusion

Dryland farming plays a crucial role in agricultural practices in regions with limited water availability. There is no one solution for the dryland farming to make it more productive. By utilizing appropriate crop selection, water conservation techniques, and traditional knowledge, farmers can successfully cultivate crops and achieve sustainable agricultural practices. Each dry environment is distinct in its own; solutions developed should be based on the basic needs of the local conditions prevailing in that region. Soil, water and all the natural resources are never taken for granted, these resources when utilized in a judicious manner gives maximum output. Green revolution of the 1960s was oriented on growing improved varieties and the present-day emphasis should be a sustained development of agriculture especially in dryland areas.

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