

## **Dryland agriculture**

**Growing of crops entirely under rainfed condition is known as dryland agriculture. Depending on the amount of rainfall received, dryland agriculture can be divided into three categories:**

### **1. Dry farming:**

- Cultivation of crops in area where rainfall is less than 750mm per annum is called dry farming.**
- Prolonged dry spells during crop period are most common. Crop failures are more frequent under dry land farming condition.**
- Dry farming regions are equivalent to arid region and moisture conservation practices are important in this region.**

## **2. Dryland farming**

- **Cultivation of crops in areas receiving rainfall above 750mm is known as dryland farming.**
- **Dry spells during crop period occur but crop failures are less frequent.**
- **Dryland farming areas are grouped under semiarid regions.**
- **Adoption of soil and moisture conservation practices and also provision of drainage especially in black soils are necessary.**

## **3. Rainfed farming**

- **Cultivation of crops in regions receiving more than 1150 mm rainfall is known as rainfed farming.**
- **It is practiced in humid regions where crop failures are rare and drainage is important problem.**

## **Dryland vs Rainfed farming**

<b>Constituent</b>	<b>Dryland farming</b>	<b>Rainfed farming</b>
<b>Rainfall (mm)</b>	<b>Less than 800</b>	<b>More than 800</b>
<b>Moisture availability</b>	<b>Shortage</b>	<b>Enough</b>
<b>Growing season (days)</b>	<b>Less than 200</b>	<b>More than 200</b>
<b>Growing regions</b>	<b>Arid and semiarid</b>	<b>Humid and sub humid</b>
<b>Cropping system</b>	<b>Single or intercropping</b>	<b>Intercropping or double cropping</b>
<b>Constraints</b>	<b>Wind and water erosion</b>	<b>Water erosion</b>

## **Problems of crop production in dry farming**

**Dry farming areas are characterized by very low and highly variable and uncertain yields. Crop failures are quite common. These are mainly due to following reasons:**

### **1. Inadequate and uneven distribution of rainfall:**

**The rainfall is low and highly variable which results in uncertain crop yields. Besides its uncertainty, the distribution of rainfall during crops period is uneven, receiving high amount of rain when it is not needed and lack of it when crop need it.**

### **2. Late onset of early cessation of rain:**

**When the monsoon sets in late, the sowing of crop are delayed resulting in poor yields. At times, the rains may cease very early in the season exposing the crop to drought during flowering and maturity stages which reduces the crop yield considerably.**

**3.Prolonged dry spells during the crop period:** Long breaks in the rainy season are important features of Indian monsoon. These intervening dry spells when prolonged during crop period reduces crop growth and yield and when unduly prolonged crop fails.

**4.Low moisture retention capacity:** The crop based on red soils, and coarse textured soils suffer due to lack of moisture whenever prolonged dry spell occur due to their low moisture holding capacity. Loss of rain water occurs as run off due to undulating and sloppy land.

**5.Low fertility of soils:** Dryland is not only thirsty, but also hungry. Soil fertility has to be increased but there is limited scope for extensive use of chemical fertilizers due to lack of adequate soil moisture.

## **MOISTURE STRESS**

- **Soil moisture is the most limiting factor in dry land farming and dryland farming situation.**
- **Understanding of the physiological process that occurs during moisture stress is necessary to ameliorate the stress effects either by management practices or by plant improvement.**
- **Stress is the result of action of external factors of an organism. Moisture stress indicates the action lack of or excess of water on plants.**
- **The term moisture stress is generally used for deficit moisture conditions though it is applicable to excess moisture also.**
- **Moisture stress is most prevalent under dryland farming conditions.**

## **Effects of moisture stress**

**It does not affect all the aspects of plant growth and development equally. Some processes is highly susceptible while others are far less effected. The final yield of the crop is the integrated result of these effects of stress on water relations, photosynthesis, respiration, nutrition and growth and development.**

## **Mechanisms to conserve water are:**

- 1. Stomatal mechanism**
- 2. Increase photosynthetic efficiency**
- 3. Liquid deposits on leaves**
- 4. Reduction in leaf area**
- 5. Leaf surface**
- 6. Effects of awns**
- 7. Water storage in plants**

## **Mechanism to improve water uptake**

**Drought avoidance is promoted by well-developed deep root system with high efficiency to extract water from deeper layers of the soil. This mechanism is desirable only if there is sufficient soil moisture in deeper layers for extraction. Water uptake can be improved by several mechanisms such as:**

- 1. Efficient root system**
- 2. Root -shoot ratio**
- 3. Increase in liquid phase**
- 4. Osmotic adjustment**



## **Drought tolerance**

- **Due to different drought avoidance mechanisms, plants are able to maintain favorable water balance and adverse effect of reduced water potential are not felt by the plants.**
- **In drought tolerance, water potential of plant is reduce and it adverse effects are felt.**
- **Drought tolerance can be defined as tolerance of the plants to a level of stress at which 50% of the cells die.**
- **The performance of higher plants depends upon the integrated functions of may cells which is disturbed by drop.**
- **Drought tolerance is either by mitigating stress or by showing high degree of tolerance.**

## **Resource development and utilization:**

**Important natural resources are rainfall, soil and plants. Resource development and their efficient use are two important aspects to achieve good and stable yields under dryland condition. The rainfall received in arid and semiarid regions is to be stored either on the soil or in the soil. Soil resources are developed by:**

- 1. Understanding the soil by proper grouping or classification.**
- 2. Rectifying the defects of the soil either by leveling, application of amendments.**
- 3. Increasing storage capacity of the soil.**

**Plant resources are developed by selecting or breeding drought resistant varieties suitable for arid and semiarid environments.**

## **Water harvesting**

- **Collecting and store water for substituent use is known as water harvesting.**
- **It is the method to induce, collect, store and conserve local surface run off for agriculture in arid and semiarid regions.**
- **In arid regions, the collecting area or catchment area is substantially all higher proportion compared to command area.**
- **The runoff is induced in catchment area in arid lands where as in semiarid regions, runoff is not induced in catchment area, the excess rainfall is collected and stored.**

## **Irrigated agriculture**

**It is an agriculture in which crops grown are irrigated by different means and good yield are obtained. Irrigation is the artificial application of water to the land or soil. It is used to assist the growing of agricultural crops, maintenance of landscapes and re-vegetation of disturbed soils in dry area and during periods of inadequate rainfall. Irrigation also has a few other uses in crop production, which include protecting plants against frost, suppressing weed growth in grain fields and preventing soil consolidation. Irrigation systems are also used for dust suppression, disposal of sewage and in mining. Irrigation is also is often studied together with drainage, which is the natural or artificial removal of surface and subsurface water from a given area.**

## **Types of irrigation:**

Various types of irrigation techniques differ in how the water is obtained from the source and it is distributed within the field. In general, the goal is to supply the entire field uniformly with water, so that each plant has the amount of water it needs, neither too much nor too little.

**1. Surface irrigation:** In surface irrigation systems, water moves across the surface of agricultural land, in order to wet it and in order to filtrate into the soil. Surface irrigation can be subdivide into furrow, border strip or basin irrigation it is often called flood irrigation when the irrigation results in flooding or near flooding of the cultivated land. This has been the most common method of irrigating agricultural land. Where water levels from the irrigation source permit, the levels are controlled by dikes, usually plugged by soil.

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**This is often seen in terraced rice fields, where the method is use to flood or control the level of water in each distinct field. In some cases, the water is pumped or lifted by human or animal power to the level of the land. The field water efficiency of surface irrigation is typically lower than other forms of irrigation but has the potential for efficiencies in the range of 70 -90 % under appropriate management.**

## **2. Localized irrigation:**

**It is a system where water is distributed under low pressure through a piped network, in a pre-determined pattern and applied as a small discharge to each plant or adjacent to it. Drip irrigation, spray or micro sprinkler irrigation and bubbler irrigation belong to this category of irrigation methods.**

### **3. Subsurface textile irrigation**

**It is a technology designed specifically for subsurface irrigation in all soil textures from desert soils to heavy clays. A typical subsurface textile irrigation system has an impermeable base layer (usually polyethylene), a drip line running along that base, a layer of geotextile on top of the drip line and a narrow impermeable layer on top of the geotextile. Unlike standard drip irrigation, the spacing of emitters in the drip pipe is not critical as the geotextile moves water along the fabric up to 2 meter from the dripper.**