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FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES

Rainfed Agriculture and Watershed Management

Lecture -3

PROBLEMS OF CROP PRODUCTION IN DRYLANDS

The land degradation in rainfed areas has resulted from climatic variations and unplanned over-exploitation of natural resources by human activities, and increasing pressure of human and livestock population. It has become unavoidable to cultivate even the marginal lands. The pasturelands are degraded due to overgrazing caused by both increase in livestock population and decrease in area under grazing due to encroachment for cultivation and urbanization.

As a result, more and more forests are being used for grazing purpose. At present nearly 70% of rainfed area is affected by wind erosion and sand deposition. Out of an estimated 142 million ha net cultivated area, about 86 million ha (60%) is rainfed. Even after reaching the full irrigation potential, nearly 50% of the cultivated area will remain rainfed.

At present about 60% of India's population as also 60% of livestock depends on agriculture. By 2025 AD, it is likely to reduce to 40% due to continued migration of rural people to semi urban/urban areas out of the projected population of 1.5 billion. The average land holding is likely to be 0.08 ha from the present 0.15 ha, which would be uneconomical for farming. Rainfed farmers are economically weak with little ability to withstand risk. Out of the 97 million farm holdings, 76 per cent are small.

- Most of the cropping in the arid and semiarid regions continues to be under rainfed conditions.
- A majority of the farmers are small farmers with meagre resources.
- The poor resource base permits only low input subsistence farming with low and unstable crop yields.
- The low productivity of agriculture in dry farming regions is due to the cumulative effect of many constraints for crop production.
- The constraints can be broadly grouped in to
 - Climatic constraints,
 - Soil related constraints,
 - Traditional cultivation practices
 - Heavy weed problem
 - Lack of suitable varieties and
 - Socio economic constraints.

Climatic constraints:

Rainfall characteristics: Among the different climatic parameters' rainfall is an important factor influencing the crop production in dry regions are:

1. Variable rainfall: Rain fall varies both in time and space dimension. Annual rainfall varies greatly from year to year and naturally its coefficient of variation is very high. Generally, higher the rainfall less is the coefficient of variation. In other words, crop failures due to uncertain rains are more frequent in regions with lesser rainfall. The average annual rainfall of India is 1192 mm where as in Andhra Pradesh it is 890mm. Based on the average annual rainfall, the India can be divided into four zones. More than one third of total geographical area in India receive rainfall less than 750 mm

2. Intensity and distribution:

In general, more than 50 per cent of total rainfall is usually received in 3 to 5 rainy days. Such intensive rainfall results in substantial loss of water due to surface runoff. This process also accelerates soil erosion. Distribution of rainfall during the crop growing season is more important than total rainfall in dryland agriculture.

iii) Aberrations or variations in monsoon behavior:

Late onset of monsoon: If the onset of monsoon is delayed, crops/varieties recommended to the region cannot be sown in time. Delayed sowing led to uneconomical crop yields.

Early withdrawal of monsoon: This situation is equally or more dangerous than late onset of monsoon. Rainy season crops will be subjected to terminal stress leading to poor yields. Similarly, post-rainy season crops fail due to inadequate available soil moisture, especially during reproductive and maturity phases.

Prolonged dry spells: Breaks of monsoon for 7-10 days may not be a serious concern. Breaks of more than 15 days duration especially at critical stages for soil moisture stress leads to reduction in yield. Drought due to break in monsoon may adversely affect the crops in shallow soils than in deep soils.

iv) **High atmospheric temperature:** Because of high atmospheric temperature the atmospheric demand for moisture increases causing high evapo-transpiration losses resulting in moisture stress.

v) **Low relative humidity:** Low relative humidity results in high ET losses causing moisture stress whenever moisture is limiting.

vi) **Hot dry winds:** Hot dry winds causes desiccation of leaves resulting in moisture stress. High turbulent winds especially during summer months cause soil erosion resulting in dust storms and loss of fertile soil.

vii) **High atmospheric water demand:** Due to high atmospheric water demand the potential evapotranspiration (PET) exceed the precipitation during most part of the year.

3.1 Soil related Constraints:

The different soil groups encountered in dryland areas are black soils, red soils and alluvial soils. The constraints for crop production are different in different soil groups. The predominant soil group is alluvial where the problems for crop production are not so acute as in red and black soils. The different soil constraints for crop production are

Inadequate soil moisture availability: The moisture holding capacity of soils in dry regions is low due to shallow depth especially in alfisols (red soils), low rainfall and low organic matter content.

Poor organic matter content: The organic matter content in most of the soils under dryland conditions is very low (< 1%) due to high temperature and low addition of organic manures. Poor organic matter content adversely affects soil physical properties related to moisture storage.

Poor soil fertility: Due to low accumulation of organic matter and loss of fertile top soil by soil erosion the dry land soils are poor in fertility status. Most of the dry land soils are deficient in nitrogen and zinc.

Soil deterioration due to erosion (wind, water): In India nearly **175 m.ha** of land is subjected to different land degradations, among them the soil erosion is very predominant. The erosion causes loss of top fertile soil leaving poor sub soil for crop cultivation.

Soil crust problem: In case of red soils, the formation of hard surface soil layers hinders the emergence of seedlings which ultimately affect the plant population. Crusting of soil surface after rainfall reduces infiltration and storage of rainfall, due to high run off. **Presence of hard layers and deep cracks:** Presence of hard layers (pans) in soil and deep cracks affect the crop production especially in case of black soils.

3.2 Cultivation practices

The existing management practices adopted by the farmers are evolved based on long term experience by the farmers.

- The traditional management practices are Ploughing along the slope
- Broadcasting seeds/ sowing behind the country plough leading to poor as well as uneven plant stand
- Monsoon sowing

- Choice of crops based on rainfall
- Application FYM in limited quantity
- Hand weeding
- Mixed cropping
- Use of conventional system of harvesting
- Traditional storage system

3.3 Heavy weed infestation: This is the most serious problem in dryland areas. Unfortunately, the environment congenial for crop growth is also congenial for weed growth. Weed seeds germinate earlier than crop seeds and try to suppress the crop growth. The weed problem is high in rainfed areas because of continuous rains and acute shortage of labour. The weed suppression in the early stage of crop growth is required to reduce the decrease in crop yields.

3.4 Lack of suitable varieties: Most of the crop varieties available for cultivation in dry lands are meant for irrigated agriculture. There are no any special varieties exclusively meant for dryland areas. Hence still more efforts are required to develop varieties in different crops exclusively meant for dryland agriculture.

3.5 Socio-economic constraints: The economic condition of the dryland farmers is very poor because

- a. Less access to inputs
- b. Non availability of credit in time
- c. The risk bearing capacity of dryland farmer is very low. Hence the dryland farmers resort to low input agriculture which results in poor yields.

Management of Natural Resources:

- The natural resources that are to be managed on sustainable basis are soil, water, vegetation and climate. India is blessed with vast natural resources of land, water, vegetation and climate but with poor quality of life. They can be managed by
- Characterization and development of sustainable land use plans for each agro ecological region in the country
 - a) Soil and moisture conservation
 - b) Integrated soil fertility management
 - c) Inter basin transfer of surface flow which is otherwise going as waste for seas and oceans
 - d) Creation of live storage of water by constructing reservoirs
 - e) Integrated water management of surface and ground water sources
 - f) On farm irrigation water management to enhance water use efficiency