UNIT 16 DROUGHT AND CROP MANAGEMENT IN RAINFED FARMING

Structure

16.1 INTRODUCTION

Two-third of the cultivated area in India is under rainfed situation where dry farming is practised. It supports 40 per cent of our human population and two-third of livestock. About 50 per cent of cultivated area of the country will continue to remain rainfed in future even after full utilisation of irrigation potential. Presently rainfed farming comprises about 91 per cent area of coarse cereals (pearl millet, sorghum, maize & finger millet) and pulses (chickpea and pigeonpea), 80 per cent of oilseeds (groundnut, rapeseed, mustard and soyabean) and 65 per cent of cotton. About 50 per cent area of rice and 19 per cent area of wheat is rainfed.

Rainfed area is mostly found in arid, semi-arid and sub-humid regions where frequent occurrence of drought cause partial or complete crop failure. Conventional classification of rainfed agro-ecosystem is based on mean annual rainfall and moisture index (Table 16.1). Drought can occur anywhere in India depending upon rainfall distribution and its occurrence all over the area in consecutive years may bring national calamity. A drought is defined as a lack of rainfall so great and long continued as to affect injuriously the plant and animal of a place depleting water supply. The term drought refers to period of unusually low water supply. According to the Indian Meteorological department droughts occur over an area where the annual rainfall is less than 75 per cent of the normal. The areas receiving less than 50 per cent of annual rainfall is called severe drought area. Droughts may be local, confined to a single

Table 16.1: Conventional Classification of Rainfed Agro-ecosystem

Climate Zone	Annual Rainfall (mm)	Moisture Index (%)
Arid	< 500	– 67 to 80
Semi-arid (dry)	501 – 700	– 51 to – 60
Semi-arid (wet)	701 – 1000	– 34 to – 50
Sub-humid (dry)	1001 - 1600	0 to – 33

watershed or they may be widespread extending over many states. Farmers consider drought as a shortage of water for their crops; economists define drought as a water shortage affecting the established economy of a region. Prolonged drought affects all segments of society within the region, and often its effects extend to other far areas.

Rainfed farming has number of constraints. Farmers are resource poor, soils are degraded and nutrient deficient and rainfall is erratic in time and space resulting low and unstable crop yield. The success of rainfed crop production mainly depends on improved crop management practices. Rainwater and land managements, which will be discussed in the next unit, are pre-requisites for improved crop management in rainfed farming. Selection of crops, varieties and cropping system according to climate and soil type and adoption of improved agronomic practices like optimal sowing time, plant population, fertilizer use, tillage, cultural practices etc. are very essential to increase and stabilize crop yield. Crop management practices should be in conjunction with land and rainwater management practices for optimal utilization of both the natural resources, i.e., rainwater and soil. Major operations of rainfed crop management practices require planning on individual farmers basis involving farmers and input supply agencies.

At present, package of improved crop management practices are available for almost all rainfed regions. The State Department of Agriculture is involved in dissemination of these packages recommendations in rainfed areas through effective demonstrations and supply of inputs on subsidy. Improved crop management practices involve mainly low monetary inputs except fertilizers and chemicals. In recent years there has been observed an increasing trend in rainfed crop yields because of adoption of crop management practices particularly improved crop varieties and fertilizer use.

Objectives

After studying this unit, you should be able to

- define droughts and list problems of rainfed farming,
- state strength and weaknesses of traditional rainfed farming practices,
- discuss improved crop management practices in rainfed farming, and
- plan and manage crops on a rainfed farm.

16.2 DROUGHT MANAGEMENT

Drought can be defined according to meteorological, agricultural and hydrological criteria. Indian Meteorological Department defines meteorological drought when average seasonal rainfall in a region is less than 75 per cent of the normal. Agricultural drought occurs when extended dry period results insufficient moisture in the root zone of the soil carrying adverse effects on crops. Hydrological drought is extended dry period leading to substantial depletion of surface and ground water consequently drying up of reservoirs, lakes, streams and fall in ground water level.

Agricultural droughts occur when the actual evaporation (AE)/potential evaporation (PE) is < 0.25 at the critical stages of crops. Droughts may be of short duration or long duration. It may occur in a crop season or may extend to two crop seasons. The frequency of drought occurrence varies with regions. Drought prone areas are recognized in our country for planning rainfed farming systems (Figure 16.1). In many developed countries forecasting of drought is being done to manage available water.

Droughts are based on rainfall and availability of soil water. An agricultural drought considers "effective rainfall" as being that portion of the rain that was retained in the root zone while in hydrological drought "effective rainfall" is the portion which does not enter or remain in the root zone. Now-a-days many indices are used to measure drought.

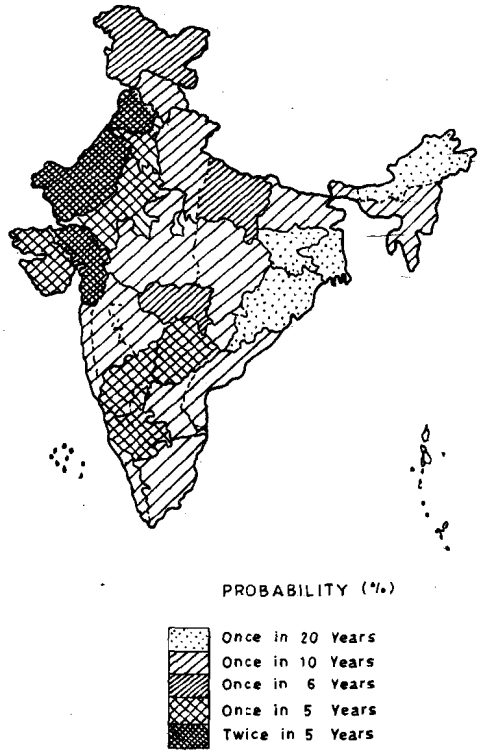

Figure 16.1: Probability of Drought in India (Source:Appa Rao et al)

16.3 MITIGATION OF AGRICULTURAL DROUGHT

Risks involved in raising successful crop depend on nature of drought, probable duration and periodicity of occurrence within the season. In the arid regions (rainfall < 500 mm) drought is almost inevitable during most of the years. In semi-arid areas (rainfall 500-700 mm) drought occurs in 40-60 per cent of years due to deficient seasonal rainfall and inadequate soil moisture availability. Even dry sub-humid regions (rainfall 750-1200 mm) experience drought situations due to dry spells during monsoon.

Early season drought occurs either due to delayed onset or due to prolong dry spell soon after onset of monsoon. This may result in resowing or poor crop stand and seedling growth. In this situation water availability for crop growth gets reduced due to delayed start and crops suffer from moisture stress during reproductive stage due to early withdrawal of monsoon.

Inadequate soil moisture availability between two successive rainfall events during crop growth period is termed mid-season drought. Its effect varies with crop stage, duration and intensity of the dry spell. Late season or terminal drought occurs as a result of early withdrawal of monsoon. It is more critical as the grain yield is strongly related to water availability during reproductive stages. Rainfed rice and maize are often subjected to such drought due to failure of September rains.

Chronic droughts occurs in extreme arid areas when rainfall and stored soil moisture are inadequate to meet the water demand of the crops during most of the years and assured growing period is hardly 6-7 weeks.

Alternate crops for different periods of sowings that match with the delay in sowing have been recommended to mitigate the effect of drought. Creating soil mulch and minimizing weed population reduce evaporative losses which extend the life of standing crops under drought. Mitigation of agricultural drought is possible to some extent through alternate crop strategy, reduction in evaporative losses and better crop husbandry. Harvesting and storage of more rainwater in situ and in tanks can help in mitigation of drought. Life saving irrigation from stored water under drought condition can save rainfed crops.

Self Check

i) How to define a drought? What is agricultural drought?

ii) What is effective rainfall for considering hydrological drought?

iii) How to mitigate drought in rainfed farming?

16.4 TRADITIONAL RAINFED FARMING

Traditional rainfed farming has very poor management of land, soil, rainwater and crops. Certain rainfed crops are grown more for convenience or by convention because farmers first priority is to produce food for his family and fodder for his animals. It has been a subsistence type of farming where every farmer tries to produce everything he needs. There has been indiscriminate land use due to increasing demand of food and fodder. In this process, marginal lands, not suitable for agriculture has also been put to crop cultivation resulting very poor yield and crop failure. Traditional rainfed farming requires very low investment. Rainfed farmers simply use their local seed and tools and never use costly inputs like fertilizers and chemicals. Local varieties are of long duration which invariably suffer from moisture stress after monsoon recession. Rainfed farmers generally use local plough (Desi plough) for all tillage and seeding operations. Traditional rainfed farming is risky and utilizes only a fraction of rainwater and soil potential.

16.5 IMPROVED CROP MANAGEMENT PRACTICES

Crops and Varieties

The duration of cropping season for a particular region is determined by rainfall pattern. The crop grown in a rainfed region is to be tailored to the length of growing season. By and large, the duration of rainfed crops varies from 75 to 150 days depending upon regions and type of crops. The local genotypes of traditional crops which are cultivated because of economic and social reasons, are of longer duration facing more chances of moisture stress. Crop substitution in such cases are advantageous. Selecting suitable crops and varieties can increase yield of single crop and help increase cropping intensity. There are many criteria set out for selecting rainfed crop and variety, however, the capacity to produce a fairly good yield under limited soil moisture condition is the most desirable. The rainfed crop should be of short duration, high yielding and drought resistant. More productive crops for some rainfed regions are given in Table 16.2.

Table 16.2: Yield of Crops in Rainfed Area

Region	Traditional		High Yielding	
	Crop	Yield (q/ha)	Crops	Yield (q/ha)
Agra	Wheat	10.3	Mustard	20.4
Bellary	Cotton	2.0	Sorghum	26.7
Bijapur	Wheat	9.4	Safflower	18.5
Varanasi	Wheat	8.6	Chickpea	28.6

Selection of rainfed crop also depends on soil depth. Millets do much better than sorghum on light and shallow soils. In the areas having compact sub-soils, root penetration of castor or pigeonpea is better than millets or sorghum. Rainfed farmers generally prefer cereals.

Legumes and oilseeds improve the economic condition of rainfed farmers and also serve the nation's need.

Cropping Intensity

Depending upon the rainfall, soil depth and crop management aspects, a large portion of rainfed areas can be put under intensive cropping using improved technology on rainwater management, crops and agronomic practices. This could be achieved through mixed or inter-cropping and sequential cropping systems. The potential cropping systems in relation to rainfall and soil type are given in Table 16.3.

Table 16.3: Potential Cropping Systems in Relation to Rainfall and Soils

Rainfall (mm)	Soil Type	Effective Growing Season (weeks)	Cropping System
320 - 600	Red and shallow black soil	20	Single kharif cropping
350 - 600	Deep sierozemes and alluviums	20	Single cropping in either kharif or rabi
350 - 600	Deep black soil	20	Single rabi cropping
600 - 750	Red, black and alluvium soils	20-30	Intercropping
750 - 900	Alluvium, deep black, deep red and sub-montane soils	> 30	Double cropping with monitoring
> 900	Alluvium, deep black, deep red and sub-montane soils	> 30	Double cropping

Mixed or Inter-cropping

In mixed or inter-cropping two or more crops are sown at the same time. These crops may differ in its duration, rooting depth, water and nutrient uptake etc. In the rainfed area, receiving rainfall between 500 to 700 mm with a distinct period of moisture surplus, mixed or inter-cropping should be used for improved crop production and higher returns to the farmers. Now-a-days, more emphasis is laid on inter-cropping of legume crop with main cereal crop. Examples are: Sorghum + pigeonpea; Sorghum + greengram; pearlmillet + pigeonpea; sorghum + soybean and foxtail millet + pigeonpea. Even in the higher rainfall (750 to 1200 mm) areas inter-cropping facilitates growing cereal + legume or legume + legume system of different maturity. Important inter-cropping are cereal + legumes, and cereal + oilseed. Some important intercropping tested at different research centres are given in Table 16.4.

Table 16.4: Important Inter-cropping Systems in Rainfed Farming

Region	Crops	Grain Yield (q/ha)		
		Main Crop	Inter Crop	Total Yield
Agra	Mustard alone	14.6		14.6
	Mustard + chickpea	12.8	4.7	17.5
Bhubaneshwar	Maize alone	13.2		13.2
	Maize + pigeonpea	8.9	5.4	14.3
Dehradun	Maize alone	28.0		28.0
	Maize + Soyabean	22.8	10.8	33.6
Hoshiarpur	Wheat alone	29.0		29.0
	Wheat + Mustard	26.7	2.9	29.6

Region	Crops	Grain Yield (q/ha)		
		Main Crop	Inter Crop	Total Yield
Indore	Maize alone	28.5		28.5
	Maize + Soyabean	24.0	6.2	30.2
Jhansi	Sorghum alone	18.1		18.1
	Sorghum + pigeonpea	14.1	5.1	19.2
Ranchi	Chickpea alone	4.9		4.9
	Chickpea + Mustard	2.2	8.7	10.9
Rewa	Sorghum alone	40.1		40.1
	Sorghum + pigeonpea	34.0	9.0	43.0
Varanasi	Pearl millet alone	13.8		13.8
	Pearl millet + Black gram	10.4	4.7	15.1

Sequence Cropping

The rainfed area receiving more than 800 mm rainfall and high (> 200 mm) available water holding capacity of root zone soil is suitable for sequence (double cropping. The main objective of sequence cropping is to maximise the return. The sequence cropping in rainfed farming depends on soil fertility, growing season, need of cereals, pulse and oilseed, and integrated insect-pest management. Some sequence cropping are given in Table 16.5.

Table 16.5: Production from Single and Double Cropping

Region	Crop Yield (q/ha)			
	Rainy Season		Post-rainy Season	
Akola	Fallow	–	Safflower	10.2
	Green gram	6.1	Safflower	13.5
Bijapur	Fallow	–	Safflower	12.4
	Green gram	7.6	Safflower	12.9
Dehradun	Fallow	–	Chickpea	16.8
	Maize	35.1	Chickpea	15.4
Hoshiarpur	Fallow	–	Wheat	27.6
	Maize	31.9	Wheat	20.9
Indore	Fallow	–	Wheat	21.8
	Soybean	29.0	Wheat	19.4
Solapur	Fallow	–	Chickpea	14.9
	Sorghum	37.2	Chickpea	8.4

Suggested double cropping systems for different rainfed regions in the country are given below:

Region	Crops
Submontane north-west region	Rice-wheat
	Rice-chickpea
	Maize-chickpea
	Soybean-wheat
Bundelkhand of Madhya Pradesh	Rice-wheat
	Rice-chickpea
	Sorghum-chickpea
	Green gram-wheat
Plain of eastern Uttar Pradesh	Rice-chickpea
Sub-humid soils of Chotanagpur	Rice-linseed
	Maize-safflower
Sub-humid red soils of Orissa	Rice-horse gram
Sub-montane soils of North-East	Maize-mustard
Punjab	Maize-chickpea
Sub-montane soils of Jammu region	Maize-mustard
Malwa plateau of Madhya Pradesh	Maize-safflower
	Sorghum-safflower
	Sorghum-chickpea
	Soybean-safflower
Vidarbha region of Maharashtra	Green gram-safflower
Bundelkhand region of Uttar Pradesh	Cowpea (fodder)-mustard
	Sorghum (fodder)-chickpea

Fertiliser Use

Rainfed crops not only suffer from moisture stress but also from nutrient deficiency. Supply of required nutrients to rainfed crops is low, hence also resulting in very poor yield. There is a great scope of increasing rainfed crop yields by proper nutrient supply through following ways:

1) Use of farmyard manures (FYM) and compost
2) Use of crop residues
3) Growing legume crops
4) Green manuring
5) Use of inorganic fertilizers

The rainfed farmers are using only organic manures, particularly FYM, at some places. It is now well recognised that inorganic fertilizer use has a key role in increasing rainfed crop

yields. The consumption of fertilisers in rainfed area continues to be very low. The doze of fertiliser supplying major nutrients, i.e. nitrogen (N), phosphorus (P) and potassium (K) in rainfed farming depends on soil type, crop and available water. The yield response to added nutrients, changes with a change in water supply. It is known that initial fertiliser application to rainfed crop increases crop vigour and more vigorously growing crops develop deeper root system extracting more water from lower soil layers. Efficient use of fertilisers can only be made if they are applied on soil test basis. There is widespread deficiency of N and P in rainfed areas. Deficiency of K is limited to light textured soils.

The efficiency of fertilisers application also depends upon the method of application. Drilling of fertilizers is found better than broadcast and foliar application especially for post-rainy season rainfed crop. In rainy season N should be applied in 2-3 split applications.

The fertilizer requirements of rainfed crops are less than that of irrigated crops. The package of fertilizer recommendations are developed for different crops and cropping sequences.

SAQ 2

i) What are the weaknesses of traditional rainfed farming?

ii) What is the duration of rainfed crops?

iii) What are main criteria for selecting rainfed crop and variety?

iv) How to increase cropping intensity in rainfed farming?

v) How can you supply more nutrient to rainfed crop?

16.6 TILLAGE AND SEEDING PRACTICES

Tillage and seeding practices are very important farm operations in rainfed farming. Tillage facilitates moisture intake and its storage in the soil profiles and conditions soil for accepting the seed into seed-bed for its proper emergence and growth. Deep tillage (25-30 cm) has been found highly beneficial under alluvials and red soils for increasing water intake and storage; breaking hard pan and helping tap rooted crop. Medium (15 to 20 cm) and shallow (5-15 cm) tillage help incorporation of FYM and phosphate fertilizers, seedbed preparation, making dust mulching, earthing and weed management.

Country (Desi) plough, made of wood, is the primary tool of rainfed farmers all over India. It is used for summer ploughing, seed-bed preparation, fallowing, earthing and incorporation of FYM and fertilizers. It makes a V-shaped furrow. Other tillage implements used in rainfed farming are as follows:

1) Tractor drawn Mould Board plough and chiseller for deep ploughing.

2) Tractor drawn chisel plough, disc plough, cultivators and harrows for medium and shallow tillage.

3) Bullock drawn iron plough, cultivator and disc harrow for shallow tillage.

4) Bullock drawn bladed harrows for primary shallow tillage.

Traditionally, seeding of rainfed crops is done by broadcasting, placement of seed behind country plough (KERA) and drilling of seed with funnel attached to country plough (PORA). Some rainfed crops sown by these traditional methods have poor germination and plant stand. Seeds are required to be put in moist seed-bed in optimum quantity and covered with desirable soil cover. Crop geometry, seed rate, line sowing and proper

placement of fertilizer while seeding are also important. These functions are performed better when improved seeding devices are used. The success of seeding machinery in rainfed condition depends on its occuracy of seed and fertilizer metering, placing seed in moist zone, ability to inter crop, rapidity of ridge or farrow seeding or both and area coverage.

At some places simple seeding devices having 2 to 4 furrow openers and hand filled funnel with tubing are being used. The seeds are placed by plough man into the funnel which is distributed equally to tubes placing seed below furrow openers. Now-a-days many seed drills and seed-cum-fertilizer drills are available for different rainfed areas. These drills are pulled by bullocks. They have metering devices for seed and fertilizer to adjust seed and fertilizer rate. These drills have flexibilites to adjust depth of seed and fertilizer placement and spacing. The furrow openers of such seed drills are designed in such a way that adequate soil cover is maintained over drilled seed while deep seeding in dry condition, leaving open furrows. These drills can cover 2 to 5 times more area in a day depending on number of the furrow openers, as compared to single row seed drilling with local plough. Tractor drawn seed-cum-fertilizer drills are also available for rainfed areas but their use is limited due to small holding and lack of tractor power in rainfed areas.

Self metering seed-cum-fertilizer drills having many furrow openers are not easily adopted by rainfed farmers because of their high cost, complex mechanism, poor repair facilities in villages, poor bullock power, small and fragmented holdings, lack of cooperation and poor economic conditions of farmers. Rainfed seeding device should be cheap, simple, easily repairable and versatile.

SAQ 3

i) What is the main traditional implement used in rainfed farming?

ii) What are the main requirements of a good seed-cum-fertilizer drill in rainfed farming?

iii) What are the traditional method of rainfed crop sowing?

16.7 FORAGE CROPS, AGRO-FORESTRY AND AGRO-HORTICULTURE

Forage Crops and Pasture

Feeding of livestock with nutritious fodder is one of the biggest problems of rainfed areas. Grazing animals on a well developed and maintained grassland is an efficient method of feeding livestock but there are many impediments for maintaining grasslands at a highly productive level in our country. Fodder shortage in the rainfed areas can be reduced by adopting suitable agronomic practices, introduction of fodder crops particularly legumes, multiple and inter-cropping and development of pastures.

The important non-leguminous fodder crops cultivated in rainfed areas are maize, sorghum and pearl millet. Legumes are the cheapest, dependable and best source of nutrition in the animal feeding as they are rich in proteins and vitamins A and D. The important rainfed forage and pasture legumes with their yields and habitats are given in Table 16.6.

Table 16.6: Important Rainfed Forage and Pasture Legumes

	Name of Crops	Habitat	Green Fodder (q/ha)
a)	**Cultivated Legumes**		
1	*Vigna sinensis* (Cowpea)	Sandy to sandy loam soils with good drainage, annual	200
2	*Cyamopsis tetragonolobus* (Cluster beans)	Sandy to sandy loam soils with good drainage, with medium fertility, annual	175
3	*Stizolobium deeringianum* (Velvet bean)	Sandy to sandy loam well drained soils, annual	225
4	*Dolichos lablab var. lignosus* (field beans)	Sandy to sandy loam well drained soils, perennial	200
5	*Phaseolus aconitifolius* (Moth)	Sandy to sandy loam soils with medium fertility, annual	150
6	*Dolichos biflorus* (Horse-gram)	Sandy to sandy loam and gravely red soils, annual	100
7	*Phaseolus trilobus* (Phillipesara)	Sandy loam to clay black soils, annual	75
b)	**Pasture Legumes**		
1	*Macroptilium atropur-poreum* (Siratro)	Sandy loam to red loamy soils, perennial	125
2	*Atylosia scarbaeoides* (Bankulthi)	Sandy to red gravely soils perennial	55
3	*Macrotilium lateyroides* (Phasemy bean)	Sandy loam to loamy soils, perennial	85
4	*Stylosanthes guyanensis* (Brazilian stylo)	Sandy surfaced soils underlying heavy soils, perennial	250
5	*Stylosanthes humulis* (Townsville stylo)	Sandy surfaces soils in areas with rainfall upto 60 cm, annual	225
6	*Stylosanthes hamata* (Carri bean stylo)	Sandy soils with low rainfall, perennial	275
7	*Stylosanthes scabra* (Seca)	Sandy soils with extremely low rainfall areas, perennial.	300

The important cultivated legumes giving 75 to 250 q/ha of green fodder are cowpea, velvet beans, cluster beans, horse gram, moth, field beans etc. These legumes also add 30 to 50 kg N/ha/year in the soil. Pasture legumes like stylos, siratro, phasemy beans etc. are used as green fodder. The pasture legumes are either grazed by the live-stock in-situ or cut and fed. The mixed cropping of cereals like pearl millet and sorghum and legumes like cluster beans, cowpea and moth are very useful in rainfed farming for fodder needs. Some legumes like cowpea, cluster beans, green beans etc. can be intercropped with cereals and oilseed crops and cut after 30 to 40 days for fodder use without affecting the yield of cereal or oilseed. Application of N and P fertilisers increases fodder yields by 100 per cent.

Agro-forestry Systems

Agro-forestry is a land management system which increases overall production combining agricultural crops, tree and forest plants simulaneously or sequentially. In this system

selection of tree species, crops, geometry and row direction are important consideration. Some suitable tree and forage species and crops for different rainfed regions are given in Table 16.7.

Table 16.7 : Suitable tree, forage species and crops for agro-forestry systems

Regions	Tree Species	Grass/Legume Species	Crops
1) Alluvial soil region (Agra) Rainfall 710 mm	*E. teretecornis* *E. comaldulensis* *A. Nilotica* *A. lebbek* *L. leucocephala*	*C. setigerus* *C. setigerus* *C. fulvus*	Pearl millet Pigeon pea Wheat, Barley Cowpea Mustard
2) Rainy Black soil region (Akola, Kovil patti) rainfall 730-830 mm	*E. viridis* *A. nilotica* *L. leucocephala*	*P. antidotale* *M. Purpureum,* *C. ciliaris* *S. hamata*	Sorghum Pigeonpea Pearl millet Green gram
3) Post-rainy black soil region (Bellary, Bijapur, Solapur) rainfall 510-760 mm	*E. hybrid* *A. nilotica* *A. auriculiformis* *L. leucocephala*	*C. ciliaris* *D. annulatum* *S. hamata* *P. lathyroides*	Sorghum Safflower Cotton
4) Rainy & Post-rainy black soil region (Indore, Udaipur) rainfall 680-900 mm	*A. indica* *L. leucocephala* *C. siamea*	*S. nervosum* *D. annulatum* *S. hamata* *S. scabra*	Sorghum Pearl millet Cow pea Pigeon pea Wheat Mustard Safflower Chickpea
5) Red and lateritic soil region (Hyderabad, Anantapur, Bangalore) rainfall 570-830 mm	*L. leucocephala* *E. camaldulensis* *A. auriculiformis* *A. nilotica* *S. grandiflora* *C. equisetifolia*	*C. ciliaris* *S. hamata* *S. scabra* *M. purpureum*	Sorghum Peal millet Finger millet Castor Pigeonpea Groundnut
6) Red and black soil region (Jhansi) rainfall 990 mm	*S. egyptica* *S. grandiflora* *L. leucacephala* *A. tortilis*	*C. ciliaris* *D. varagatus* *S. nervosum*	Pearl millet Pigeonpea Cowpea Sorghum Wheat Mustard
7) Sierozems (Jodhpur, Hissar, Rajkot) rainfall 380-700 mm	*P. cinararia* *A. nilotica* *A. Lebbek* *L. leucocephala*	*C. ciliaris* *P. antidotale* *D. annulatum* *S. hamata* *S. scabra*	Pearl millet Clusterbean Cowpea Moth Green gram

Farm Forestry System

In farm forestry system, fuel and fodder yielding trees are planted on farmers field boundaries, bunds and near the farm ponds and farm building as shelter belt, windbreak and tree belt. These trees modify the environmental factors and increase crop yield besides fuel and fodder production. Acecia, Albizzia, Casuarina Zizyphus, Dalbergia, Eucalyptus, Leucaena, Mango, Neem, and Tamarindus can be planted under farm forestry system.

Agro-horticultural System

Agro-horticultural system is similar to agroforestry. In this system trees planted gives fruits in addition to fuel wood. Fruit trees of *Emblica officinalis*, *Psidium guava*, *Mangi*

fera indica, *Taramindus indica* and *Zizyphus* species can be integrated with crops and grasses.

16.8 WEED MANAGEMENT

Weed infestations are a major limiting factor to increasing crop yield in rainfed areas. This problem is intensified under improved rainfed farming practices such as high soil fertility and moisture conservation. Weeds compete directly with crop for water nutrients, sunlight etc. Some weeds exude toxic matters from roots, foliage and plant residues which reduce crop growth. Weed control can be achieved by the following methods:

Preventive Methods

This method prevents the spreading of weed seeds. It involves practices like sowing of clean (weed seeds free) seed, controlling weeds on bunds, ditch, fence etc., removing seeds of weeds from farm machinery before changing fields, preventing soil erosion, spreading completely rotten farm yard manure etc. Preventive method is the first step in weed management in rainfed farming.

Mechanical Methods

It involves physically removing the weeds by hand pulling, hand hoeing, or with mechanical devices drawn by animals or tractors. Machines or tools for weed control are designed to remove weeds between and within crop rows, before sowing, after harvesting and during fallowing. Mechanical methods are simple and require little skills. Often they are time consuming and expensive. Other disadvantages are low availability of labour at peak period and difficulty of entering the field when soils are wet and sticky. Ploughing and harrowing are used for weed control during non-crop period. Khurpi, triphali and hoes are used during cropping season. Bullock and tractor drawn tools are available for weed control but its adoption in rainfed farming is low.

Chemical Methods

Selective weed control herbicides can be used in rainfed farming. It has not been widely used in Indian rainfed area because of availability of labour at low wages, high cost, sophisticated technique of herbicide use and mixed cropping involving both dicotyledonous and monocotyledonous crops requiring different herbicides. Chemical weed control may become more popular in rainfed area because of labour cost rise and availability of herbicides and low cost sprayers. To maintain good soil health only recommended herbicides should be used for weed control.

Biological Methods

In many foreign countries the use of insects, plant diseases and animals as agents for weed control has attracted attention in recent years. Almost complete eradication of opuntia Spp (Prickly pea) by Cactoblatis Cactoran in Australia and Hypericum Perfartum (Klameth weed) by Chrisolina hyperia in USA has been found. There is no effective biological method available in India for rainfed areas.

16.9 MID-SEASON CORRECTIONS

Rainfall aberration may damage a crop or cropping system resulting very poor yields or crop failure. If there is considerable delay in onset of monsoon late sowing of Kharif crop may give poor yield and may adversely affect next Rabi crop. Under such situation a short duration crop and variety should be sown instead of normal kharif crop.

There could be severe moisture stress after crop sowing resulting poor plant stand. If an early rain is received the same crop may be resown or an other shorter duration crop may be resown for adequate plant stand. On other hand, if crop experiences moisture stress at early growth stages, thinning may be done to reduce plant population and mitigate the moisture stress.

There may be complete crop failure due to severe drought in the middle of growing seasons having no possibility of its revival. Under such situations the plants should be

harvested for fodder and soil moisture should be conserved through tillage practices for next crop.

Strategies are developed for different rainfed areas to meet the weather aberration. The rainfed farmers should have alternate crop strategy and watch their crops critically to adopt mid-season corrections promptly and timely.

SAQ 4

i) What is agro-forestry system of rainfed farming?

ii) What is biological method of controlling weeds?

iii) What to do when a rainfed crop has withered due to prolonged drought during mid-season and there is no chance of its revival after receiving rains?

16.10 SUMMARY

This unit has attempted to explain traditional and improved rainfed crop management practices for different rainfed areas. It has also attempted to familiarise you with forage crops, agro-forestry and agro-horticulture for rainfed farming. It has also tried to explain different tillage and seeding practices, weed control measures and mid-season corrections in rainfed farming.

16.11 KEY WORDS

Intercropping : Growing two or more crops in a field at the same time.

Cropping Sequence : Growing two or more crops in a field in sequence during a year.

Green Manuring : Growing and incorporating legume crop in soil for its decomposition giving nutrients to the following crop.

Agro-forestry : A land management system growing crops, trees and forest plants in a field simultaneously or sequentially.

Agro-horticulture : A land management system growing crops and fruit trees in a field simultaneously or sequentially.

16.12 ANSWER TO SAQs

SAQ 1

i) Drought is defined according to meteorological, agricultural and hydrological criteria. Agricultural drought occurs when extended dry period results insufficient moisture in the root zone of the soil causing adverse effects on crop.

ii) In case of hydrological drought the effective rainfall is the portion of rainfall which does not enter or remain in the root zone.

iii) Drought can be mitigated by sowing alternate crops & varieties of suitable sowing time. Dust mulching and reducing weed population also mitigate drought by reducing evaporation losses. Water harvesting for life saving irrigation is also suggested to mitigate drought in rainfed crops.

SAQ 2

i) a) Poor management of land, soil, rainwater and crop,

b) Subsistence farming,

c) Low investment, and

d) Use of local seed and traditional equipments and tools.

ii) Rainfed crop duration varies from 75 to 150 days depending upon regions and crops.

iii) Rainfed crop should be of short duration, high yielding and drought resistant. It should have capacity to produce good yield under limited moisture conditions.

iv) Cropping intensity in rainfed farming can be increased by using improved technology of rainwater and crop management through mixed/intercropping and sequential cropping.

v) Followings are the ways to supply more nutrient to rainfed crops:

a) Use of FYM and compost,

b) Use of crop residue,

c) Growing legume crop,

d) Green manuring, and

e) Use of inorganic fertiliser.

SAQ 3

i) Country (Desi) plough made of wood is the main implement used by rainfed farmers for summer ploughing, seed bed preparation, sowing, fallowing, earthing FYM incorporation etc.

ii) Placing seed & fertilizer at proper (moist) depth and space in proper quantity, more area coverage, ability to intercrop etc.

iii) Broadcasting, placement of seed behind plough and drilling seed with funnel attachment of country plough.

SAQ 4

1) In agro-forestry system of rainfed farming crops and forest trees/plants are grown simultaneously or sequentially.

2) Use of insects, plant diseases and animals as agents are used for controlling weeds, under biological weed control methods

iii) Harvest the crop for fodder and prepare field conserving moisture for sowing next short duration crop or early sowing of next crop.