

Characteristic best practices leading to profitable crop production.



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Characteristic Features: i. Farming dependent solely on rainfall ii. Potential evapotranspiration is more than precipitation. iii. Soil moisture storage is often inadequate for crop growth.

Differences between Dry Farming and Rainfed Farming: Dry Farming Rainfed Farming Rainfall is less than 750 mm. Rain fall more than 750 mm. Rainfall distribution is erratic. Rainfall is well distributed. PET exceeds rainfall.

Rainfall is more than Potential Evapo Transpiration (PET). Arid and semiarid climate. Humid and temperate climate.

Crops are subjected to severe moisture stress Crops do not face moisture stress. Soil moisture conservation is important. Runoff and erosion control are important. a. Cropping is confined to short seasons only.

b. Droughts are frequent. c.

Crop yields are not stable and fluctuate widely from year to year. d. Farming is mostly of the subsistence type.

#### **Soil Moisture Conservation:**

It is a method of using and managing land based on the capabilities of the land itself, involving the application of the best practices leading to profitable crop production. Prerequisites for soil moisture conservation are— 1.

Physiographic. 2. Rainfall. 3. Flood, Drought. Needs/Objectives: 1.

Efficient collection of rain water. 2. Reducing percolation losses and Evaporation losses. 3. Preventing soil erosion. 4.

Water harvesting at the time of availability. 5. Efficient use of stored moisture. 6.

Absence of supplementary irrigation source. 1. Agronomical/Cultural a.

Mulching b. Crop Management c. Conservation tillage (I) Mulching: i.

Covering the soil surface with any material.

ii. Materials- crop stubble, straw, coir pith, groundnut shell, husk. Types of Mulching — 1. Vertical-Trench - 40 x 15 cm at 2-4 m interval across slope - filled with organic matter. 2. Live mulch: Plant can grow by inter cropping. e.

g. - sorghum and cowpea. Sorghum + Sword bean. 3.

Stover mulch/straw mulch. i. Cumbu, sorghum straw, sugar cane trash.

4. Stubble mulch. i. Stirring of soil - Crop residues protect from erosion by minimum disturbance. ii.

Even up to 3% slopes. 6. Pebble mulch. i. Useful in dry land fruit tree culture on base of tree increase infiltration, reduce runoff loss. (II) Crop

Management: a. Multiple cropping b. Agroforestry c.

Crop alternation d. Strip cropping 1. Multiple cropping: i. Avoiding fallow ii.

Crop rotation iii. Smothering crop mixture iv.

Mix with shallow and deep rooted crop (e. g.) maize + Red gram 2.

Agroforestry: i. Agri Silvi culture ii. Silvi pastoral iii. Agro silvipastural 3.

Crop alternation: i. Shallow rooted crops with deep rooted crops 4. Strip

cropping: i. Crops are planted in narrow strips across the slope altered with strips of erosion resistant crops and erosion permissible crops.

ii. 2 types (i) Contour strip cropping: a. Inter tilled row crop + growing erosion resistant crop – right angle to flow of water (ii) Field strip cropping: a. Uniform strip against slope but without contour. (III) Conservation tillage: 1. Off season/summer tillage 2. Contour ploughing/contour tillage 3. Minimum tillage 2.

Mechanical Measures: (a) Basin listing (b) Bunding (c) Ridges and furrows (d) Broad bed Furrows (e) Terracing I. Basin Listing: i. Small depressions of 10-15 cm depth at vegetative interval by basin listing. ii. Usually before sowing. II. Bunding: i.

across slope at suitable interval? III. Ridges and Furrows: i. 30-40 cm width, 15-20 cm ht – across the slope ii. suitable for medium to deep black and red soil iii. Wide spaced crops grown i. e. maize, cotton, tomato IV.

Broad bed Furrow: i. Beds with 1.5 m width, 15 cm height ii. Furrows of 30 cm height iii. Suitable for heavy black soil iv. Slope upto 0.6% Advantages — i. Accomodate wide range of crops ii.

Suitable for intercropping iii. Runoff reduced iv. Sowing can be done by seed drill V. Terracing: (a) Bench terracing i.

16-33% slope ii. series of level strips (or) plat forms across slope iii. intensive cropping possible (b) Zing terracing i. 3-10% slope ii.

Medium to deep soil of heavy rainfall areas iii. Field divided -2: 1 [donor; receiving area] 3. Agrostological/Biological: (i) Pasture/Grass land (ii) Strip cropping with grasses (iii) Ley farming a. Fodder grass + legume in rotation 4. Chemical: Soil Moisture Conservation measures for Non cultivable lands 1. Agroforestry 2. Pasture 3. Vegetative barriers 5.

Mechanical measures a. Bunding b. Terracing Advantages — a. Prevent direct ' splash' erosion by raindrop b.

Increase infiltration c. Fit easily in any farming system d. Less expensive e. Less management Disadvantages — a. Identification very difficult b. High initial cost Reduction of Loss of Stored Soil Moisture: Rainfall infiltrates into the soil and permits downward and laterally gets stored in soil profile. Part of it percolates down to ground water.

Stored water is absorbed by plants and weeds. It is lost from the soil surface as evaporation and from crop and weed canopy as transpiration. Reduction of Evaporation Loss: Evaporation happens to maintain soil thermal regime and is governed by i. Soil moisture content ii.

Vegetative cover on surface iii. Soil type iv. Temperature gradient between soil and atmosphere Measures to control evaporation loss: i. Shallow surface tillage ii. Mulching iii. Use of anti evaporant chemicals The rate of transpiration is governed by: i.

Soil moisture potential ii. Atmospheric water demand iii. Plant canopy characters such as leaf area, stomatal resistance

**Drought Management Technique for Dryland Development:**

Dry farming; — Farming practiced in rainfall areas of 400-700 mm/annum. i. Source of water only Rainfall. Rainfed farming; > 700 mm Rainfall per annum.

Impact of Drought: (i) Shortage of food production— failure of crop. (ii) Shortage of fodder (iii) Shortage of drinking water leads to migration. (iv) Shortage of fuel for cooking leads to deforestation.

(v) Death of cattle & Humans Management of Drought 1. Low monetary system: i. Moisture conservation — intercropping. ii. Choice of crops & varieties — Early maturity, deep root, dwarf shoot, thick leaves, more number of grain per pod. iii. Optimum plant population — Reduction in evaporation.

iv. Pest management v. Mulching of plant material 2. High cost inputs: i. Fertilizer use — for maximise the fertilizer use efficiency. ii.

Use of tractor power — improve infiltration & better root development. 3.

Water harvesting: Farm ponds, percolation ponds, checkdams, retaining wall etc. Benefits — (i) Ground water available through percolation ponds. (ii) It creates droughtless condition.

(iii) Less cost. (iv) Involvement of community participation. 4. Transfer of Technology: Lab to land programmes through K. V. K. 5.

Miscellaneous Efforts: i. Financial assistance in the form of subsidy. ii. Low interest loans for the constructing of farm ponds. iii.

Improving the socio-economic status of poor by Govt. iv. Small scale & cottage industries in the rural areas. v. More emphasis on meteorological research (computer & satellites) vi. Comprehensive price policy by Govt. Infrastructure Requirement to Meet Drought: (i) Seed banks – facility to the farmers. (ii) Fodder banks (iii) Farm ponds.

### **Integrated Dry Land Technology:**

A single technology in isolation will not give desired results. Adoption of all related technologies as an integrated dryland technology alone will provide a synergistic effect and improve the crop productivity on dry regions. The various components of such an integrated dry land technology are the following: i. In situ soil moisture conservation ii. Choice of suitable crops and crop substitution. iii.

Selection of high yielding drought tolerant varieties iv. Tillage to conserve moisture v. Establishment of optimum population vi. Soil fertility management vii. Crop protection against weeds, pests and diseases Transpiration loss can be reduced by the use of antitranspirants and by some cultural methods. Antitranspirants: Antitranspirants are substances or chemicals applied on plant foliage to control rate of transpiration. Based on their mechanism of action, antitranspirants are classified into various types.

i. Stomatal closing type e. g.

phenyl mercury acetate ii. Film forming type e. g. paraffin and wax emulsions iii. Reflectant type e.

g. kaolinite iv. Growth retardant type e. g. cycocel (CCC) Cultural methods of transpiration control: i. Weed control ii. Shelter belts iii.

Alley cropping

#### **Alternative Land Use Systems for Dry Lands:**

Uncertain rainfall, poor soil conditions and low level of management has made annual cropping of field crops a non-remunerative enterprise in many pockets of drylands. Sometime, cropping has been given up altogether and lands remain fallow and become wastelands overgrown with unwanted vegetation. To arrest this trend and to bring back the land under economically useful vegetation, alternate land use systems such as grasslands/pastures, agroforestry and horticulture are recommended. This has become necessary for the following reasons. (a) Annual field crop production is nonviable and uneconomical in many years. (b) Yield of field crops is low and fluctuate. (c) Continued use of the eroded and degraded lands, under the present system of annual cropping may ecologically degrade the lands.

(d) Alternate land use systems such as grasslands-and tree culture are less risky, more productive and remunerative in these marginal lands. The choice of an alternate land use system depends on the land capability. Most of the lands under dry farming tracts come under the land capability classes of III and above. Land Capability Class Alternate Land Use Recommended: Class II Dry land horticulture Class III & IV Agroforestry or lay farming Class V Pastures or Silvipasture or tree farming Class VI Range lands/ wood lots Ley farming offers the following advantages: Ley farming is an agricultural

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system where the field is alternately seeded for grain and left fallow other name of the method is alternate husbandry.

In this method, field is alternately used for grain or other cash crops for a number of years and laid down to ley i. e. left fallow, used for growing hay or used for pasture for another number of years. After that period it is again ploughed and used for cash crops. i.

Fodder for cattle ii. Low risk system iii. Soil moisture conservation iv.

Enrichment of soil fertility v. Control of Perennial weeds Choice of trees for drylands: Trees suitable for drylands have the following characters — i.

Multipurpose tree species ii. Adaptable to wide variations in soil and climate iii. Withstand severe pruning iv. Rapid growth e.

g. Black soil – Azadirachta indica Red soil – Albizzia lebeck, Acacia nilotica

Dryland Agriculture: The criteria for selection of fruit trees for drylands are: i.

Drought tolerance ii. Adaptability to varying soil conditions iii.

Quick regeneration after pruning iv. Rapid recovery after stress is removed

e. g. Black soil – Ber, Sapota, Jamun, Amla Red soil – Mango, Pomegranate,

Amla Silviculture System for Drylands: i. Staggered planting – Trees are

grown scattered in the field with annual crops E. g.

neem + pulses/sorghum ii. Border trees – Trees can be grown along farm boundaries, e. g. neem, tamarind iii.

Agrisilviculture Alley Cropping: Annual field crops are grown in alleys formed by hedge rows of trees and shrubs, e. g. Leucaena as hedge with sorghum,

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maize as intercrop. Benefits i. Green fodder from hedge rows during dry season and dry fodder from annual crops during rainy season. ii.

Hedge rows check runoff and erosion when formed along contour or across slope. iii. Pruning from hedgerows can be used as fodder, fuel wood or for mulching.

### **Water Shed:**

Water shed is a manageable hydrological unit that makes a harmonious use of the prevailing climate, soils, water, locally available material and human resources towards stepping up crop yields. It is also referred as catchment area or drainage basin.

Size of Water Shed: i. Micro ii. Mini iii. Macro Principles of Water Shed

Management: 1. Utilizing the land based on its capability.

2. Minimizing silting up of tanks, reservoirs and lower fertile lands. 3.

Conservation of rainwater. 4. Safe diversion of surface runoff to storage structures. 5.

Water harvesting for supplemented irrigation. Objectives: 1. Production of food, fodder, fuel, fruit, fish combine on a sustained basis. 2.

Over exploitation of resources to be maintained. 3. Water storage at convenient locations for different purposes. 4. Erosion control, eco system safety, economic stability. 5. Recharge of ground water.

6. Reduction of drought. Steps in Water Shed Management: 1.

Basic information: i. Statistics of population and livestock. ii. Pattern of land ownership. iii. Topography, cropping system and yield and land capability for farming.

iv. Data on rainfall, erosion problems and ground water. v.

Information on existing water sources like tanks, well etc. vi. Service facilities like schools, market, health and veterinary facilities.

2. Developmental components: i. Soil conservation measures ii. Run off harvest in storage structures and its recycling for protective irrigation iii. Ground water recharge and development iv. Efficient use of available water through proper field layouts, land shaping, leveling, lining of water courses and life saving Main Components of Watershed: Management Programme: 1.

Soil and water conservation – i. Permanent measures-Bunds, Terrace ii.

Semi permanent measures-Inter bunds Treatment iii. Temporary measures-Vegetative barrier 2. Water harvesting.

3. Crop management – i. Optimum seeding time ii. Fertilizers schedules and balanced use of plant nutrients iii. Weed management and package of practices for aberrant weather iv.

Contingent crop planning Benefits of Water Shed Management: 1. Increased soil health 2. Decrease in silting 3. Increase in natural resource