Chapter 38: Cropping Pattern

Introduction

In hydrology and water resources engineering, the term **cropping pattern** refers to the yearly sequence and spatial arrangement of crops grown by farmers on a given area of land. It is influenced by factors such as climate, soil type, water availability, irrigation infrastructure, socio-economic conditions, and government policies. Understanding cropping patterns is crucial for efficient **water resources planning and management**, particularly in regions dependent on irrigation systems.

Proper planning of water distribution, reservoir operation, and command area development heavily relies on the cropping pattern adopted in a region. This chapter explores cropping patterns in detail, their classifications, factors affecting them, and implications for hydrologic and irrigation system design.

38.1 Definition of Cropping Pattern

- **Cropping Pattern** is the proportion of area under different crops at a given point in time in a specific region.
- It provides an overview of:
  - The type of crops being grown.
  - The seasonal variation in crop cultivation.
  - Water demand of different crops.

  Cropping pattern is **dynamic**, not static, and often changes based on environmental, technological, and economic considerations.

38.2 Types of Cropping Patterns

38.2.1 Mono-Cropping

- Growing the **same crop year after year** on the same piece of land.
- Example: Wheat or Paddy cultivation in northern India.
- Risk of soil nutrient depletion and pest build-up.

38.2.2 Multiple Cropping

- Growing **more than one crop** on the same land during a year.
- Types include:

  - **Double Cropping**: Two crops in a year (e.g., rice followed by wheat).
  - **Triple Cropping**: Three crops (e.g., rice–rice–pulse rotation in Kerala).

38.2.3 Mixed Cropping

- **Simultaneous cultivation** of two or more crops on the same field without any definite row pattern.
- Aims at **risk minimization** (e.g., growing millets with legumes).

38.2.4 Intercropping

- **Row-wise growing** of two or more crops in proximity.
- Enhances productivity and land use efficiency.
- Example: Sugarcane intercropped with onion or pulses.

38.2.5 Crop Rotation

- **Sequential cultivation** of different crops in a planned rotation on the same field.
- Helps in maintaining **soil fertility** and **pest control**.
- Example: Rice–Mustard–Fallow; Maize–Wheat–Legumes.

38.3 Factors Affecting Cropping Patterns

38.3.1 Climatic Conditions

- **Rainfall**, **temperature**, **humidity**, and **sunshine** influence crop selection.
- Example: Paddy is suited for high-rainfall areas, wheat for temperate zones.

38.3.2 Soil Type

- Fertility, texture, and **drainage capacity** dictate what crops can be grown.
- Sandy soils favor pulses; clayey soils are good for paddy.

38.3.3 Water Availability

- Regions with **assured irrigation** can adopt **water-intensive crops**.
- In rainfed areas, drought-resistant or short-duration crops are preferred.

38.3.4 Irrigation Infrastructure

- Existence of **canals, tube wells, tanks, and drip/sprinkler systems** influences cropping intensity and choice.

38.3.5 Economic Factors

- **Market demand**, **minimum support price (MSP)**, **input costs**, and **profit margins** drive cropping decisions.

38.3.6 Socio-political Influences

- Government subsidies, agricultural policies, and food security concerns.
- Cultural preferences and local traditions.

38.4 Cropping Seasons in India

India has three primary cropping seasons:

38.4.1 Kharif (June to October)

- Sown at the beginning of the monsoon.
- Crops: Rice, Maize, Cotton, Jowar, Bajra, Groundnut.

38.4.2 Rabi (October to March)

- Sown after monsoon withdrawal.
- Crops: Wheat, Barley, Mustard, Gram.

38.4.3 Zaid (March to June)

- Summer season crops.
- Crops: Watermelon, Cucumber, Muskmelon, Fodder.

38.5 Command Area and Cropping Pattern Relationship

- The **command area** of an irrigation project directly influences the **cropping pattern**.
- Cropping patterns must be compatible with **water availability**, soil properties, and infrastructure design.
- Irrigation scheduling and **canal capacity** depend on peak water demands of crops grown during different seasons.

38.6 Duty, Delta, and Cropping Pattern

- **Duty** (area irrigated per unit discharge) and **Delta** (depth of water required by crop) are affected by cropping pattern.

- Water-intensive crops like sugarcane and paddy have **high delta** and **low duty**, needing **careful planning** in canal command areas.
- The **crop calendar** helps determine seasonal water allocation and rotation.

38.7 Impact of Cropping Pattern on Water Resource Planning

- A well-planned cropping pattern:
  - Prevents **over-exploitation** of groundwater.
  - Supports **equitable distribution** of water.
  - Optimizes **reservoir operation schedules**.
- Cropping pattern changes necessitate **revisions in water budgeting** and **irrigation strategies**.

38.8 Water Requirements of Major Crops (Indicative Values)

Crop	Total Water Requirement (mm)
Paddy	1200 – 1500
Wheat	450 – 600
Sugarcane	1500 – 2500
Cotton	700 – 1200
Maize	500 – 800
Pulses	300 – 400

These values vary with **region, climate, and variety**.

38.9 Modern Trends in Cropping Patterns

- **Shift toward cash crops** due to higher returns.
- Adoption of **high-yielding varieties (HYVs)** and **genetically modified crops**.
- **Drip and sprinkler irrigation** allowing diversification in water-scarce regions.
- Use of **remote sensing and GIS** for cropping pattern analysis and prediction.
- Emphasis on **climate-resilient crops** due to changing weather patterns.

38.10 Importance of Cropping Pattern in Civil Engineering

- Essential for:
  - **Irrigation project planning**.
  - Designing **water distribution networks**.
  - Calculating **crop water requirements**.
  - Ensuring **sustainable water use**.
- Directly related to **hydrological modeling**, **reservoir operations**, and **flood control planning**.
