

Chapter – 1: Production and Management of Crops

- Early men – food gatherers – depend on wild plants, animals – food
- Slowly – they learnt – grow plants – obtain food – led to cultivation
- Today – 70 % Indian population – agriculture

Agriculture

- Most common occupation – now – known as industry
- This industry – increased rapidly – new techniques – increase in crop production
- Classified into –
 - Agronomy –
 - Study and develop techniques – improve agriculture
 - Horticulture –
 - Cultivation – fruits, vegetables, ornamental plants
 - Animal husbandry –
 - Rearing – domestic animals

Crop Plants

- Crops – plants – cultivated at one place – large scale
- Grown in fields – for food – cereals – rice, wheat, etc – maximum percentage
- These food grains – provide vital (required) nutrients – carbohydrates, proteins, vitamins, minerals, fibres
- 30 major crop plants – used by humans – throughout world
 - Cereal crops – rice, wheat, maize, barley, ragi
 - Pulses – grams, peas, beans
 - Oilseeds – mustard, groundnut, sunflower
 - Root crops – sweet potato
 - Sugar crops – sugarcane, beetroot

Steps Involved in Crop Production

- Modern agriculture – stepwise, scientific approach
- Requires knowledge – nature of soil, nutrients, methods of ploughing, sowing, irrigation, pest control, etc

Preparation of soil

- Process – soil – made suitable – sowing of seeds
- Following steps –
 - Ploughing / tilling –
 - Process – turning, loosening of soil – better percolation – water, air
 - Done – help of plough (tractor) – OR – by animals (oxen)
 - Advantages –
 - Loose soil – allow roots – grow deeper – support plants

- Aerates the soil – allow roots – breathe easily
- Nutrient-rich soil – comes on top – plants use these nutrients
- Manure, fertilizer – mix better
- Loosened soil – help earthworms, microbes – grow better – increase fertility
- Loose soil – sunlight – reach deeper – kill harmful microbes

■ Tools used for ploughing –



- Plough –
 - Driven by tractor – OR – by pair of bulls
 - Made of iron or wood – one end – strong triangle iron strip – ploughshare – connected to long wood – plough shaft
 - One end of shaft – handle attached – another end – attached to beam – placed on animal's neck
- Hoe –
 - Simple implement – pulled by animals – used for weeding
 - Made of long wood or iron rod – connected to strong, bent plate – like a blade
- Cultivator –
 - Traditional plough, hoe – replaced by cultivator
 - Use of machines – save time and labour

○ Levelling –

- Ploughed soil may contain – big lumps – crumbs
- Crushing of lumps – pressing the soil with wooden or iron leveler – levelling
- Advantages –
 - Prevent soil erosion
 - Uniform irrigation
 - Uniform mixing – fertilisers, manure
 - Lesser loss of moisture - evaporation

Manuring

- Before sowing seeds – manures, fertilisers – added to soil – increase fertility
- Addition of manure – soil spongy – helps in holding air, water
 - Manures –
 - Organic substance – supply nutrients – required by plants
 - Made from – dead, decaying matter
 - Different types –
 - Compost –
 - Farm waste – livestock excreta, vegetable waste, domestic waste, weeds, straw, etc – decomposed in pits
 - Compost – rich in organic matter, nutrients
 - Vermicompost –
 - Prepared using earthworms – faster process – decomposition of animal, plant waste
 - Farmyard –
 - Prepared from cattle dung, leaves, straw, etc
 - Green –

- Before sowing – some leguminous plants – sun hemp, guar – grown and then mixed into soil – while ploughing
- These green plants – turn into green manure – increase nitrogen, phosphorus
- Fertilisers –
 - Chemicals – contain nutrients – plant growth
 - Man-made – produced as salts – inside factories
 - Most common – NPK fertilisers – contain Nitrogen, Phosphorus, Potassium
 - Organic component of soil – slowly decreasing – now – sulphur also added
 - Disadvantages –
 - Excessive use – damage soil – making it too acidic, too basic
 - Source – water pollution – excess fertilisers – washed away by rainwater – crop fields to water bodies – harm aquatic life
 - Excess fertilisers – harm useful microbes in soil
- Advantages of manure over fertilisers –
 - Manure – increase water holding capacity
 - Soil – become porous – exchange of gases – made easy
 - Improves – texture of soil
 - Increases – number of friendly microbes

Sowing

- Process – putting seeds – into soil – sowing
- Before sowing – precautions to take –
 - Seeds – good quality, healthy, disease resistant, pest free
 - Seeds – sterilized – fungicides, antibiotics, etc
 - Proper spacing – between seeds – avoid competition – space, oxygen, water, nutrients, light – during germination
 - Seeds – sown at appropriate depths – too deep – do not germinate – too close to surface – easily eaten by birds, insects
- Methods of sowing seeds –
 - Broadcasting –



- Traditional method – seeds scattered by hand
- Disadvantage – seeds – not grown – proper distances and depths – wastage, reduced crop yield (produce)

- Traditional tool –



- Comprises of – funnel – connected to 2-3 tubes – sharp end
- Seeds – put into funnel – travel to tubes – sharp ends penetrate into soil – seeds at proper depths
- This tool – ensure – seeds at proper distance
- Better than broadcasting – BUT – more time, labour

- Seed drill –



- Mechanism – similar to traditional tool – BUT – more efficiency
- Seed drill – connected to tractor – many tubes leading to plough
- This method – saves time, labour – more efficient

- Transplantation –

- Plants – tomato, rice, chillies, etc – seeds – not sown directly – BUT – sown in seedbeds in nurseries
- Seedlings – selected and transplanted (transferred)
- Advantages of seed drill over traditional tool –
 - Seeds at proper depths, distances
 - Seeds – not eaten by birds, insects
 - Seedlings – do not compete – air, space, nutrients, light
 - Saves – time, labour
- Advantages – transplantation –
 - Healthy seedlings – transferred to field
 - Better root, shoot development
 - Sowing of plants – proper distances, depths

Irrigation

- Process – supplying water to crops – through canals, reservoirs, tube wells, etc – irrigation
- Early India – farmers – dependent only on rains
- Rainfall – uncertain – new methods – developed
- New methods – use of tanks, dams, lakes, wells, etc
- Amount of water – depends on crops and season
- Rice seedlings – transplanted – nurseries to water-logged fields – need constant supply of water
- Wheat – needs more water – time of sowing, flowering, development of grains
 - Traditional methods –
 - Taking water – wells, lakes, canals – using cattle or human labour
 - This water – taken to fields – irrigation
 - Nowadays – pumps also used – run by diesel, biogas, electricity, solar energy
 - Traditional methods – cheaper – BUT – not very efficient
 - Modern methods –
 - Sprinkler system –
 - Used in places – land is uneven – soil is sandy
 - Network of vertical pipes – rotating nozzles on top
 - Main pipe turned on – pressurized water – flows through nozzles
 - Nozzles – sprinkle water evenly
 - Drip irrigation –
 - Useful technique – areas with water shortage
 - System of pipes and tubes – supply water – drop-by-drop – minimizing wastage
- Irrigation – essential for crop production – BUT – excessive irrigation – harmful
- Excess water – collected in fields – cut off air supply to crop roots



Crop protection

- Growing crop – needs to be protected – other plants, animals
- Crop protection includes –
 - Weeding –
 - Removal of seeds
 - Sometimes – unwanted plants – weeds – grow with crops
 - Weeds – compete with main crop – nutrients, space, air, light, water – decrease yield

- Different crops – different season – different weeds
- Methods – control weeds –
 - Mechanical control –
 - Pulled by hand, trowel (*khurpa*), harrow
 - Chemical control –
 - Chemicals – 2,4-dihydroxi diphenyl methane, dalapon, metachlor, etc – kill weeds
 - These chemicals – weedicides or herbicides
 - Sprayed before flower, seeds produced
 - These – do not harm crops
 - Many weedicides – non-biodegradable – affect soil fertility
 - Biological control –
 - Some organisms – feed on weeds – introduced into fields
 - These organisms – eat weeds – do not harm crops
 - Cochineal insects – control (kill) opuntia
 - Some crop plants – barley, soyabean, sunflower, etc – produce toxic substances – growth of weeds – not allowed
- Pest control –
 - Crops – may be attacked by pests – affects production
 - Pests include – fungi, bacteria, viruses, rodents (rats, etc), insects (termites, etc)
 - Fungi – cause diseases – smut, rust of wheat, blight of potato
 - Bacteria – cause disease – blight of rice
 - Methods – controlling pests –
 - Chemicals –
 - Pesticides – kill pests
 - 3 types –
 - Insecticides –
 - Kill insects – locusts, termites, etc
 - Fungicides –
 - Destroy fungi
 - Rodenticides –
 - Kill rodents
 - Disadvantages –
 - May kill – useful insects – butterflies, honeybees
 - Mostly non-biodegradable – harm environment
 - Mix with soil – absorbed by crops – consumed by humans – cause harm
 - Biological control –
 - Products – biological origin – biocides – very effective – no pollution
 - Hormones – female insects – trap male insects
 - Birds – scared away – scarecrows
 - Some organisms – eat insects – not crops – used to control pests

Harvesting

- Process – collecting, gathering – matured crops
- India – harvesting – 2 times per year – especially cereal crops

- 2 main crop seasons – our country – kharif and rabi
- Kharif season – rainy season – June to September – paddy, maize, groundnut
- Rabi season – winter season – October to March – wheat, gram, pea
- Another seasonal crop – zaid / zayad – some vegetables, low grade cereals
- After maturing – crops are harvested – methods –
 - Threshing –
 - After cutting – grains separated – threshing on stone – OR – walking cattle over it
 - These days – machines also used – threshers
 - Some machines – combines – do both things – harvesting and threshing
 - Winnowing –
 - Grains – collected after threshing – contain some chaff
 - This chaff – removed by winnowing
 - This process – grains – dropped from a height
 - Heavier grains – fall at the same place – lighter grains – blown away – collected at some distance
- After harvest – crop sticks – burnt by farmers
- Better option – let them be their – increase organic matter, return nutrients, decrease erosion, increase water holding capacity, control growth of weeds

Storage and distribution

- Crop produce – vary – season to season – grains – stored for future use
- Buffer (extra) stocks – maintained – supply of grains – sufficient – when crop fails
- Crops – wheat, rice – harvested – contain high moisture content – should be dried before storing
- Afterwards – grains – packed in gunny (jute) bags – stored in silos, godowns, granaries
- Stored grains – checked regularly

Increasing Crop Production

- Several methods – increase crop production
- Crop rotation –
 - Some plants – wheat, rice – consume lots of nitrogen
 - After harvest – soil depleted of nitrogen – not suitable for plants requiring more nitrogen
 - Farmers – grow leguminous plants – peas, soyabean, groundnut – crop rotation
 - Leguminous plants – use atmospheric nitrogen – release nitrates into soil – rhizobium bacteria – root nodules
 - Soil gains nitrogen – ready for next crop
- Mixed cropping –
 - 2 or more crops – same field – same time
 - Cotton and groundnut, wheat and chick-pea, wheat and mustard
 - Waste product – one crop – used by another
- Field fallow –
 - Natural method – improvement of field – no crop grown – 1 or more seasons
 - Grasses, herbs – grow on field – animals graze here
 - Excreta of animals, crop remains, leftover grass – form humus – replace nutrients
 - This method – not used anymore – better, faster methods available
- High-yielding varieties (HYV) –

- Crop plants – specific properties – increase crop production
 - Resistant to diseases and drought
 - Give higher yield
- These characteristics – gained with help of scientists – plant breeders
- Process – hybridization – experiments with different plant varieties – produce plants – specific properties
- Method of hybridization –
 - 2 plants – required properties – selected
 - 1 plant – high yield – BUT – easily affected by diseases
 - Other plant – resistant to diseases
 - Bisexual flowers – anthers of one variety – removed – emasculation – prevent self fertilisation
 - Pollens – from other plants – transferred to stigma emasculated flowers
 - Seeds obtained – after fertilisation – sown – this process – repeated for generations – get required characters – called stock

Green revolution

- Dr. Norman E. Borlaug – tremendous increase – wheat production – Mexico – hybridization – 1960s
- Indian agriculturists – imported high-yielding varieties – cross-breed with Indian varieties
- Result – tremendous increase – wheat production – known as green revolution
- Afterwards – hybridization – done for other crops as well

Animal Husbandry

- Early men – dependent on animals for food
- Later – used animals – get wool, hide (skin), leather, honey, etc – domestication of animals
- Domestication – taming (controlling) of animals – specific purpose
- Dog – 1st animal – domesticated – tamed for companionship
- Domesticated animals – called livestock – breeding, rearing, caring – animal husbandry
- Domesticated animals and their uses –
 - Cattle –
 - Cows, buffaloes, bullocks – known as cattle – imp. category
 - Cows, buffaloes – provide milk, dairy products – known as milch animals
 - Bullocks – used in agriculture – ploughing
 - Hide (skin) – used for leather production
 - Sheep, goat –
 - Sheep – reared – wool, meat, skin – Goats – reared – meat, milk, hair, skin
 - Poultry –
 - Poultry farming, rearing – hen, ducks, chicken, etc – meat, eggs
 - Fishery –
 - Breeding, rearing – fish – large scale – pisciculture (fish farming)
 - Fish – rich source of protein – easily digestible – helps in growth
 - Oils from some fishes – rich source – Vitamin A, D
 - Apiculture –
 - Honeybees – provide – honey, wax
 - Honey – thick, sweet fluid – nectar of flowers – used in ayurvedic medicines