

After manure

IRRIGATION: "It is defined as the science of artificial application of water to the soil in accordance with the crop requirements throughout the crop period for nourishment of the crops."

### Purposes of irrigation

1. To provide water essential for crop growth.
2. To provide crop insurance against short duration droughts.
3. To cool the soil and atmosphere, thereby making it more and more favourable for plant growth.
4. To wash out or dilute salts in the soil.
5. To reduce the hazard of soil piping.
6. To soften tillage pans.

### IRRIGATION METHODS

Once irrigation water reaches the field supply channels, it is important to apply this water as efficiently as possible. In Pakistan about 25% of the total water available at the field head is usually lost at the stage of field application from the distribution channels, by deep percolation below the crop root zone and runoff.

These are four basic methods of applying water to field

b) Salt affected soils 6.17 M ha

2. Agro-climate of Pakistan is arid to semi-arid and area is 70.00M ha

## → IRRIGATION

It is defined as the artificial application of water to soil for the purpose of supplying water essential to plant growth.

## → OBJECTIVES OR PURPOSES OF IRRIGATION

1. To supplement the water available from rainfall.
2. To contribute to the soil moisture available from ground water.
3. To supply moisture essential for plant growth.
4. To provide crop insurance against short duration droughts.
5. To make nutrients available to plants.
6. To soften the soil for agricultural practices.
7. To leach or dilute salts in the soil.
8. To increase bacterial activities in the soil.
9. To cool the soil and atmosphere, thereby making more favourable environment for plant growth.

## → SOURCES OF IRRIGATION WATER

There are three sources of irrigation water in Pakistan.

### → 1. Precipitation

The source of all water supplies is atmospheric precipitation i.e. rainfall, dew, fog/mist, hail and snow. Amongst those the major source of water available for agriculture is rain. Rainfall should have the following characteristics.

- i. Amounts should be sufficient to replace moisture depleted from the root zone.
- ii. Frequency should be often enough to replenish the soil moisture before plants suffer from lack of moisture.
- iii. Intensity should be low enough so that water can be absorbed by the soil. However, distribution and intensity of rainfall is so erratic that successful crop husbandry is not possible with rain alone.

### → 2. Surface water



## Land utilization in Pakistan

i) Total geographical area of 79.61% Million hectares

Pakistan

ii) Total state owned Forest area 3.58 million hectare  
(5.2% of the total area)

iii) Area not available for cultivation. 24.49 million hectares

*Road, construction channel*

iv) Culturable waste area 8.84 million hectares

*fit for cultivation but not sown*

iv) Cultivated area (current Fallow + Net area sown) 21.60 M.ha

vi) Area sown more than once 5.41 M.ha

vii) Total cropped area (Net area sown + area sown more than once) 22.14 M.ha

viii) Total irrigated area of Pakistan 17.58 M. ha

a) Waterlogged area

i) 0-5 ft depth (water table) 5.246 M.ha

ii) 0-10 ft depth (water table) 9.374 M.ha

The width of a border strip can thus be 10-50 feet. A smaller size is more efficient in water saving.

## → SUITABILITY

It is best suited to:

- ✓ 1. Soils which permit the required land levelling at a reasonable cost.
- ✓ 2. Most suitable to soils having moderately low to moderately high infiltration rates.
- ✓ 3. To irrigate all close-growing crops like wheat, barley, fodder crops and legumes. It is not suitable for rice which requires standing water during most parts of its growing season.
- ✓ 4. Best suited to large, mechanized farms since it is designed to produce long uninterrupted field lengths for ease of machine operations.

## → ADVANTAGES

1. Border ridges can be constructed economically with simple farm implements.
2. Labour requirement is less.
3. Uniform distribution and high water application efficiencies.
4. Large irrigation streams can be efficiently used.

rivers is wholly dependent upon flood water.

### → 3. Ground water

Ground water is lifted to the soil surface through wells and tubewells. Upward movement of ground water by capillarity into the rootzone can be a major source of water for plant growth.

### → METHODS OF IRRIGATION

Method of irrigation to be used is determined by water supply, the type of soil, the topography of land and the crop to be irrigated. Irrigation water may be applied to the crop by following methods.

#### → 1. Surface irrigation

In this method water is applied directly to the soil surface in a form of moving sheet from a channel located at the upper reach of the field. In surface irrigation water may be applied as:

##### ✓ A) Uncontrolled or wild flooding

Water is applied from field ditches (water channels) without any ridges or bands to guide flow of water





+))Q

### SUPPLY CHANNEL

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\* \*channel\*Check \* \*channel\* \*

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Special types of basins are formed for orchards. Usually a separate basin is formed for each tree, located in the centre of basin. Water is supplied to these basins from a supply ditch by flowing through one basin to another. In this case basins are interconnected. In other method small ditches are made between rows of trees and water is turned directly from the ditch into each basin.

### SUITABILITY

Check basin irrigation is suited to:

1. ✓ Smooth gentle and uniform land slopes.
2. ✓ Soils having moderate to slow infiltration rates.
3. ✓ Irrigation of grain and fodder crops in heavy soils where water is absorbed very slowly and is required to stand for a relatively long time to ensure adequate irrigation.
4. ✓ Very permeable soils which must be covered with water supply rapidly to prevent excessive deep percolation losses at the upstream end.
5. ✓ Where leaching is required to remove salts from soil surface.

### → DISADVANTAGES

- ✓ Ridges interfere with the movement of animal-drawn or tractor-drawn implements for interculture or harvesting of crops.



Labour requirements in land preparation and irrigation are much higher.

Labour requirements in land preparation and irrigation are much higher.

### → 3. FURROW IRRIGATION

Furrows are small, parallel channels or ditches which carry irrigation water to the crop. This method is used in the irrigation of row crops. Furrows are developed between the crop rows in the planting and cultivating processes. Crops are usually grown on the ridges between the furrows. The size and shape of the furrow depends on the crop grown, spacing between the crop rows and equipment used. Water is applied by running streams in furrows between the crop rows. Both large and small irrigation streams can be used by adjusting the number of furrows irrigated at any one time to suit the available flow. Water infiltrates into the soil and spread laterally to irrigate the areas between the furrows. Furrows may be straight, like borders laid down on the prevailing land slope, or contoured so that, furrows can carry water across a sloping field rather than down the slope.

#### ✓ SUITABILITY

Furrow irrigation is suitable to irrigate all cultivated crops planted in rows (maize, sorghum, sugarcane, cotton, tobacco, groundnut) and vegetables (potatoes).

#### ✓ ADVANTAGES

- ✓ 1. Water in the furrows contacts only one-half to one-fifth of the land surface, thereby reducing puddling, crusting of the soil, and evaporation losses as compared to other methods where entire land is wetted.
- ✓ 2. Earlier cultivation is possible with a distinct advantage in heavy soils.
- ✓ 3. It is adapted on a wide range of natural slopes without causing erosion.
- ✓ 4. It reduces labour requirements in land preparation and irrigation.
- ✓ 5. There is no wastage of land in field ditches as in check basin method.
- ✓ 6. Large area can be covered with given amount of water.
- ✓ 7. Tends to prevent over irrigation.

#### → DISADVANTAGES

- ✓ 1. Large volumes of water cannot be used in small furrows.
- ✓ 2. It is difficult to add the same quantity of water to each furrow.
- ✓ 3. More difficult to give the same amount of water to the lower portion of the furrow as to the upper.

#### → SUBSURFACE IRRIGATION



roots moving laterally and then vertically through capillaries. Water may be introduced through open ditches or underground pipe lines. The depth of open ditches vary from 30 to 100 cm and they are spaced about 15 to 30m apart.

In artificial sub-irrigation, perforated or porous pipes are laid underground in the vicinity of root zone, and water under pressure is distributed through these pipes. It is useful where there is an impervious sub-soil at a depth of 2 m or more, a highly permeable loam or sandy loam surface soil at uniform level.

#### → SPRINKLER IRRIGATION

In the sprinkler method of irrigation, water is sprayed into the air and allowed to fall on the ground surface somewhat resembling rainfall. The spray is developed by the flow of water under pressure through small nozzles. The pressure is usually obtained by pumping.

#### DRIP OR TRICLE IRRIGATION

It is one of the latest methods of irrigation, and is becoming increasingly popular in areas with water scarcity and salt problems. Drip irrigation involves dripping water into the soil at very low rates from a system of small diameter plastic laterals/ pipes fitted with outlets called emitters or drippers. Water is applied close to the plants so that only part of the soil in which roots grow is wetted, unlike surface and sprinkler irrigation where whole soil profile is wetted.

#### → CANAL SYSTEMS OF PAKISTAN

The partition of India in 1947 struck a heavy blow on our irrigation system as Pakistan was a lower riparian and all the Head waters of the Rivers flowing to Pakistan, fell into the territory of India. Soon after Independence, India interfered in regulation of rivers and canals and stopped supplies. This resulted into a water dispute and ultimately Indus Water Treaty was signed in 1970 between the two countries. River Ravi, Sutlej and Beas i.e. the three Eastern Rivers were assigned to India for the exclusive use of their waters and Western Rivers i.e. River Chenab, Jhelum and Indus were given to Pakistan.

✦ Irrigation system of Pakistan at present is composed of more than 63,213 km of canals which covers a total of 12 m ha.

The irrigation water is diverted to watercourse at the canal outlet (mogha). There are about 89,158 water

### Introduction

- Tillage is the mechanical manipulation of soil aimed to improving its physical condition.
- Tillage is basically an Anglo-Saxon word
- Tilian-mean to plough and prepare soil.
- Teolian-mean to sow and raise crops.

### Primary aims of tillage

- Production of suitable tilth.
- Control of weeds.
- Control of soil moisture.
- Incorporation of organic matters and agrochemicals for weeds and pests.

### Objectives of tillage

- 1-Preparation of seedbed:
- Weeds free soil, which prevents the loss of precious of water and plant nutrients.
- Granular soil structure, which allows close contact of seed and the plant roots with soil.
- Level the soil field to place seed at proper depth and water management also.

- 2-Manage water in soil:

Successfully tillage system and practices have recently been develop especially for proper moisture conservation in rainfed areas of pakistan.

Farmers of rainfed areas normally do 8-10 shallow ploughings with cultivator for moisture conservation.

- 3-Weed control:

With the use of mechanical tillage practices, weeds can be control effectively and economically.

- 4-Soil conservation:

- Tillage prevent soil from air and water erosion particularly in rainfed areas.
- Tillage create the roughness of soil which help to prevent from both air and water erosion.



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- 5-Manipulation of plant residues:
- Increase soil fertility.
- Enhance soil microbial activities.
- Increase infiltration and water holding capacity.

### Types of tillage

- 1-Primary tillage:  
This type of tillage is practiced for root bed preparation.
- 2-Secondary tillage:  
This type of tillage is practiced for seed bed preparation.
- 3-Tertiary tillage:  
This type of tillage is practiced for inter-cultural operations.

### Primary tillage implements

- Disc plough.
- Mould board plough.
- Chisel plough.
- Sub soiler.

### Secondary tillage implements

- Disc harrows.
- Bar harrows.
- Rotavator.
- Tines cultivator.

### Advantages of tillage

#### 1-Soil conservation:

Soil particles bind with water molecules as a result soil is conserved.

#### 2-Water conservation:

As a result of tillage the run off decreases and infiltration increases so water is conserved.

#### 3-soil temperature:

Soil temperature is different by tillage

#### 4-Soil microbial activities:

Appropriate tillage will increase soil structure, texture and favorable temperature, air moisture will also enhance microbial activities.

#### 5-Nutrients uptake:

Nitrogen is most affected by tillage although both P and K are also influenced



Sir:- Ahsan AZIZ

## Seed

①

The seed may be defined as a "fertilized ovule consisting of intact embryo, stored food and seed coat which is viable and has got a capacity to germinate."

"A seed is a unit of reproduction of flowering plants and may be described as a plant embryo in a dormant state, surrounded by a food supply and protective outer skin or seed coat."

This is also called true seed because in some of the crops vegetative parts are used for planting and are also called as seed e.g. potato tubers, Sugarcane stalks. In the eyes of a common man all propagules that are capable of developing into another such plant are seed.

### Functions of Seed

- 1- Seeds serve as a source of plant multiplication.
- 2- Seeds serve as a means by which the plants can survive adverse conditions.
- 3- Seeds give plants the ability to move in space either by means of their special structures or by natural forces such as wind, water, insects, birds and other animals.

In maize and other cereal crops the main food reserves are stored as "endosperm", while in beans they are stored in two cotyledons which later serves as photosynthetic organ

for the young seedlings.

(2)

## TYPES OF SEEDS ON THE BASIS OF COTYLEDON

There are two types of seeds on the basis of cotyledon.

1. Monocotyledonous Seeds:- The seeds which have a single cotyledon are called monocotyledonous or monocot seed e.g. Maize, Wheat, Rice etc.

2. Dicotyledonous Seeds:- Seeds which have two cotyledons are called dicotyledonous or dicot seeds e.g. Gram, peas, Mungbean, Mash bean etc. Cotton, tomatoes, sunflower, apple, Cherry, roses



## Seed Morphology.

(3)

Seed is made up of 1. Embryo 2. Endosperm 3. protective covering consisting of seed coat & testa.

Seed coat (testa) has a marking on its surface which indicates the place of attachment of seed in the fruit and it is called hilum.

In seed coat at one end of the hilum is a small opening called as micropyle.

protective covering of the seed may have two layers, the outer layer which is called testa and the inner layer called tegmen. In most seeds these are fused together.

The function of the protective covering is to protect the seed from drying, mechanical injury and attack by insects & diseases.

Embryo: It is made up of hypocotyl, a plumule and one or two cotyledons. ~~Hypocotyl~~ Hypocotyl is a short <sup>line</sup> axis and it has radicle at its lower end and plumule at its upper end.



Surface and generally turns green and act as first leaves.  
e.g. Beans, cotton, sunflower and castor bean.

2. Hypogeal germination: - Hypo = below/Beneath and geos = earth  
In this type of germination the cotyledon do not come above the  
soil surface. e.g. Wheat, barley, rice, maize, pea, gram.

### Essential Factors for germination

1. Water, 2. Air (oxygen) 3. Temperature 4. Light (For some seeds e.g. tobacco).

## Classification of pure Seed

(5)

According to the Pakistan Seed Act of 1976 there are following four categories of pure seed.

1. Pre-Basic seed 2. Basic seed 3. Certified Seed 4. Approved Seed.

1. Pre-Basic Seed :- It is the seed which is developed by the breeder. It is of high genetic purity. It is directly controlled by the breeder or sponsoring institution. The amount of such seed is too small so it needs multiplication. In order to maintain its genetic purity its multiplication is restricted to specific areas having similar climatic conditions.

The bags of pre-basic seed are identified with a white bag having a diagonal violet line.

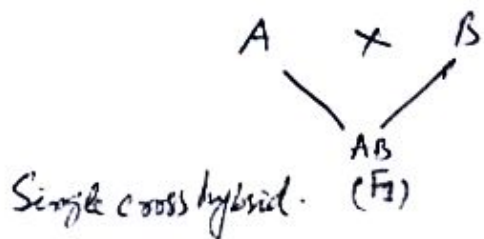
2. Basic Seed :- It is the first multiplication of a pure seed.

# DIFFERENT TYPES OF SEED IN HIGH YIELDING USE

i) IMPROVED SEED :- It is better seed substitute for the one which is inferior in genetic purity and physical quality. It has at least 10-15% more genetic potential and resistant to pests and diseases. It is well adapted to local agroclimatic conditions and more responsive to input application (Fertilizer, water).

ii) HYBRID SEED :- It is produced by crossing two or more homozygous inbred lines to obtain a desirable type having high yield potential. The first generation called  $F_1$  is only recommended for commercial crop production.

If the male is designated as 'A' and the female as 'B' then the single cross is designated as  $A \times B$

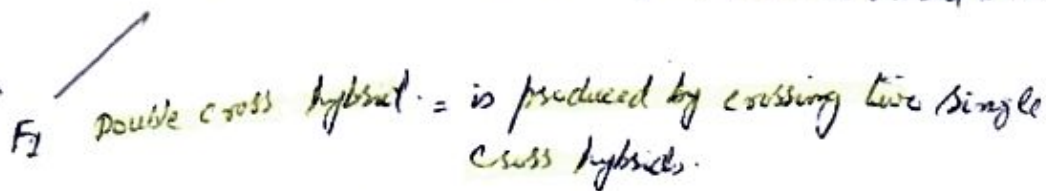


Single cross hybrid X inbred line



It is produced by crossing a single cross hybrid with a inbred line.

AB X CD



iii) COMPOSITE SEED :- It is produced by inter-crossing of a number of selected varieties by making germplasm complexes. Such composites possess the genetic potential for higher production and comparatively more stable than hybrids.



- iv) MUTANT SEED: - These are the seeds produced by mutation breeding. In this technique the genetic make up of the seed is changed by radioactive rays e.g.  $\gamma$ -rays.

### SEED QUALITY

Seed quality is the sum of all characteristics which are related to its performance.

Seed quality is determined by the following characteristics:

- 1- Genetic purity - Should be pure & true to type.
- 2- Physical purity - Should be free from inert matter, other crop seeds etc.
- 3- Viability or germination %age:- Should have good ability to germinate.
- 4- Incidence of seed born diseases:- Should be free from fungal spores.
- 5- Density (weight per unit volume):- Should be large & heavy.
- 6- Vigour (Physiological stamina or health of seed):- Emergence & development of normal seedling under given conditions is called vigour.
- 7- Moisture content:- Should not have high moisture content otherwise deteriorate quality.
- 8- Storability:- Seeds should have high storability. It depends upon the kind of seed. Some seeds deteriorate quickly than others even if kept under ideal conditions of storage. Oil seeds are difficult to store for long.

# Seed Structure

- **Seed Coat:**

- tough protective coating
- Has a scar where it was attached to the ovary

- **Cotyledon:**

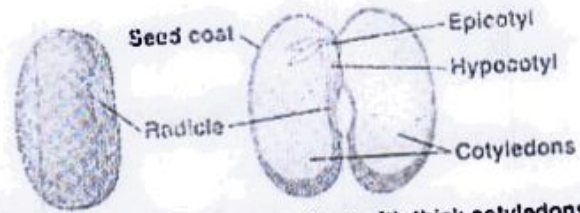
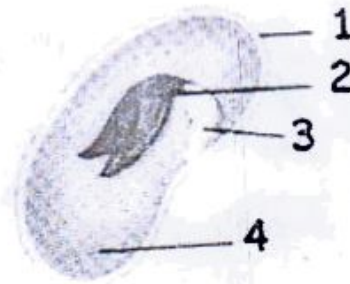
- stores food for early growth of embryo when seed germinates

- **Epicotyl:**

- develops into stems and leaves

- **Hypocotyl:**

- develops into roots



(a) Common garden bean, a eudicot with thick cotyledons



Crop Rotation:- It is a process of growing different crops in succession on a piece of land in a specific period of time with an objective to get maximum profit without impairing the soil fertility. one cycle may take one or more farming years.

In irrigated areas farming year is 12 months.

## CROP ROTATION

It may be defined as "Sequence of raising different crops on the same piece of land for obtaining maximum production without reducing soil fertility."

It is different from the practice of growing the same crop year after year e.g. If we grow wheat in rain season and cotton in Kharif season every year on the same piece of land then it would be a fixed type of farming which is not suitable.

If we rotate wheat with berseem or barseem or gram or lentil in the Rabi season and cotton with maize or sugarcane or Soybean ororghum in the Kharif season then it will be called as crop rotation which will improve soil fertility & crop yields.

### Benefits of Crop rotation

- 1- By rotating crops it is easy to control weeds e.g. Some crops like potato, berseem & lucern when included in the rotation help to control weeds by smothering and inhibiting seed formation.
- 2- By crop rotation it is easy to keep plant diseases and insects under control. Some fungi and insects attack only on particular crops when they are grown on the same land every year e.g. cotton pests.
- 3- By growing crops in a suitable order it is possible to maintain soil fertility. due to
  - a- As different crops remove different plant nutrients in different quantities.
  - b- Differences in root systems of various crops results in variable removal of nutrients from various depths of soil e.g. wheat is a



Shallow rooted crop and cotton is a deep rooted crop.

- c. Leguminous crops such as berseem, gram, lentil, Soybean have the property to fix atmospheric nitrogen with the help of bacteria present in the nodules of their roots. So they improve soil fertility.
- d. Growing different crops with different sowing and harvesting periods it is easy for the farmer to engage his labour force throughout the year. It also helps to generate income throughout the year.
5. Crop yields and quantity are improved e.g. In cereals after a legume protein contents of the grains are improved.

### Principles of Crop Rotation

1. Crops of the same natural order (family) should not follow each other.
2. Crops having same type of root system should not follow each other.
3. Leguminous crops should be included in the rotation.
4. Green manuring and forage crops should be included in the rotation.
5. Crops like potato, sugarcane and seasonal vegetables which require more thorough cultivation should be included in the rotation.
6. Crops susceptible to certain diseases should be rotated with resistant crops.

## CROP NUTRIENTS

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Plants contain small amounts of 90 or more elements, but 16 have been shown to be essential for their growth and development.

These essential elements are: Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulphur, Iron, Manganese, Zinc, Copper, Boron, Molybdenum and Chlorine.

Four more elements such as Cobalt, Vanadium, Sodium and Silicon have been found essential for one plant or other but not required for all plants.

Basic Nutrients: Carbon, H and Oxygen are called basic nutrients and they are primarily absorbed from air and water.

The remaining 13 elements are normally absorbed from the soil by plant roots. These 13 elements are divided into three groups on the basis of their mobility in the plant.



(2)

Secondary Nutrients :- Ca, Mg and S are called secondary nutrients as they are required in less quantity as compared to primary nutrients.

Micro Nutrients :- Micronutrients are those elements which are used by plants in very small amounts. They are as essential for plant growth as the primary & secondary nutrients.

These are Mn, Fe, Zn, Cu, Chlorine (Cl), Mo, ~~B~~ B  
Manganese, Iron, Zinc, Copper, Molybdenum, Boron.

Table:- FORMS OF UPTAKE OF ESSENTIAL NUTRIENTS

Nutrient & Symbol	Principal Form of uptake
<u>Basic Nutrients</u>	
Carbon (C)	$CO_2$
Hydrogen (H)	$H_2O$
Oxygen (O)	$H_2O, O_2$ (Oxygen)
<u>Primary Macro Nutrients</u>	
Nitrogen (N)	$NH_4^+, NO_3^-$
Phosphorus (P)	$H_2PO_4^-, HPO_4^{2-}$
Potassium (K)	$K^+$
<u>Secondary Nutrients</u>	
Calcium (Ca)	$Ca^{++}$
Magnesium (Mg)	$Mg^{++}$
Sulphur (S)	$SO_4^{2-}$ (Sulphate ion), $SO_2$ (Through leaves) Sulphur dioxide
<u>Micro Nutrients</u>	
Iron (Fe)	$Fe^{++}$ (ferrous) or ferrous $Fe^{+++}$
Manganese (Mn)	$Mn^{++}$ (ion)
Boron (B)	$H_2BO_3^-$ or $BO_3^{3-}$ $H_2BO_3$ or $BO_3^{--}$ (borate)

2. Deficiency of the element in question can be corrected by supplying that particular element.
3. The element must extend its effect directly on growth or metabolism.

## FUNCTIONS OF PLANT NUTRIENTS

1. NITROGEN: Nitrogen is utilized to synthesize amino acids which in turn form proteins.
2. Phosphorus: Phosphorus is present in all living plant cells and is utilized to form nucleic acid and energy rich compounds such as ATP and ADP. ATP = Adenosine Tri-phosphate  
ADP = Adenosine Diphosphate



Calcium: It is an essential part of cell wall structure and must be present for the formation of new cells.

Magnesium: It is an essential constituent of chlorophyll and hence important for photosynthesis & sugar production.

Sulphur: Sulphur is constituent of three amino acids namely cysteine, methionine, and cysteine and therefore essential for protein synthesis.

Zinc: It is essential constituent of important enzyme systems in plants. It controls the synthesis of indole acetic acid and important hormone for plant growth.

Iron: It is required for formation of chlorophyll in plant cells. It activates biochemical processes such as respiration, photosynthesis and symbiotic N fixation.

Manganese: It activates several enzymes involved in growth processes.  
Plant enzymes are:-  
Proteases, Amylases, Lipases, Cellulases

Copper: It is an activator of several enzyme systems in plants. It is essential for chlorophyll formation & production of vitamin A.

Boron: It is involved in cell division, protein synthesis, & carbohydrate metabolism, floral initiation & fruit formation.

Molybdenum: Plants can not transform nitrate nitrogen into without molybdenum.

Chlorine:- It is required in photosynthetic reactions in plants to help plants to resist drought stress.

Carbon, H and O are all components of carbohydrates. The major groups of carbohydrates are sugars, starches and cellulose. The sources of C, O, H in plants are derived from  $CO_2$ ,  $O_2$  and water. These elements are not listed included in the listings of <sup>Plant</sup> Fertilizers.

MANURES:- Manures are defined as bulky natural substances which are derived from plant and animal wastes and are applied to soil to fulfill plant nutrient needs for providing plant nutrients.

SOURCES:- The source of ~~soil organic matter~~ <sup>manure</sup> are crop residues, farm yard manure, animal manure, green manure, compost, sewage sludge etc. Dead remains of animals and micro-organisms form the secondary source of organic matter in the soil.

Chemical Composition of Manures (O. matter):-

The chemical composition of soil organic matter is characterized in three major groups

1. polysaccharides    2. Lignins    3. Proteins

Besides these groups, a variety of other substances such as fats and waxes occur in plant residues.

1. polysaccharides are cellulose, hemicellulose, sugars, starches, and peptic substances

2. Lignins are complex substances derived from woody tissues of plants



of organic matter and exists in all life forms.  
These three classes of materials are sources of food  
for soil microorganisms.

## Decomposition of Organic Matter

Organic matter is decomposed by living organisms in  
the soil such as bacteria, fungi and actinomycetes. These  
microorganisms and larger organisms such as earthworm,  
insects ingest organic residue and soil thereby affecting  
the binding bind soil particles into stable aggregates.  
Practically all soil properties are affected by soil organic  
matter.

"The dark coloured organic residue which resists further  
decomposition is called humus."

It improves soil tilth and facilitates aeration and water  
penetration.

The more common simple products that result from the activity  
of soil microorganisms are C, N, S, P and others.

## SOURCES OF MANURES

1. FARMYARD MANURE: Decomposed mixture of dung and urine of farm animals and left over material from fodder fed to the animals.

2. Compost: Composting is the process of reducing vegetable and animal refuse (rural or urban) except dung to a quickly utilizable condition for maintaining soil fertility. Decomposed material is called compost.

The compost prepared from sugarcane trash, rice straw, weeds and other plants etc is called Farm compost.

The compost prepared from town refuse like night soil, kitchen waste is called town compost.

The solid portion in the sewage

of natural or synthetic origin which are added to the soil to supply certain elements essential for the growth of plants."

~~General fertilizer~~ Generally the term fertilizer is used <sup>for</sup> ~~restricted to~~ inorganic artificially produced substances containing one or more nutrients in easily soluble and quickly available form.

The natural organic sources of plant nutrients are called as manures. \*Urea was the first organic compound to be synthesized from inorganic substances.

Table Fertilizers Available in Pakistan

\*Rock phosphate deposits are naturally found in some countries.

<u>Common Name</u>	<u>Grade or Analysis (%)</u>		
	<u>N</u>	<u>P<sub>2</sub>O<sub>5</sub></u>	<u>K<sub>2</sub>O</u>
<u>Nitrogenous Fertilizers</u>			
Urea	46	0	0
Ammonium Sulphate	21	0	0
Ammonium Nitrate	35	0	0
<u>Phosphate Fertilizers</u>			
Single Super phosphate (SSP)	0	18	0
Triple " " (TSP)	0	46	0
Diammonium phosphate (DAP)	18	46	0
Monammonium phosphate (MAP)	11	52	0
<u>Potash Fertilizers</u>			
Sulphate of potash (SOP)	0	0	50
Muriate of potash (MOP)	0	0	50
Complex Fertilizer	0	0	0



## Common Name

### Complex Fertilizers

- i) NPK
- ii) NPK
- iii) NPK

## Grade or Analysis (%)

<u>N</u>	<u>P<sub>2</sub>O<sub>5</sub></u>	<u>K<sub>2</sub>O</u>
15	15	15
10	20	20
13	13	21

## METHODS OF FERTILIZER APPLICATION

Three common methods of Fertilizer application are:

a) Broadcasting:- This is the surface spreading of fertilizer and its incorporation into the soil by ploughing and planking. This is done at or before sowing time.

b) Placement:- In this method fertilizer is placed in bands or rows. (side dressing)

Band placement:- In this method fertilizer is applied in strips or bands 5 to 7 cm to the side and 3 to 5 cm below the rows of seed.

Row placement:- It is also called side dressing. In standing crop In this method fertilizer is placed along the side of each row of standing crop and is then mixed in the soil by hoeing. Side dressing is followed by irrigation.

\* Band placement and side dressing is preferable for phosphate fertilizer. Less soil is in contact with phosphate which reduces its fixation in the soil.

c) Top Dressing:- This method involves scattering of fertilizer by hand or air-craft on the top of standing crop. The field is

NOTE:- Fertilizers can also be applied as foliar spray but this method is not common in Pakistan.



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①  
HARVESTING: Removal of entire plants or economic parts after maturity is called harvesting.

The portion of the stem left in the field is called stubble. The economic product may be grain, seed, leaf, root or entire plant.

TIME OF HARVEST: If the crop is harvested early, the produce contains high moisture and immature grains. The yield will be low due to unfilled grains. It is difficult to store the produce as shrivelled grains with high moisture are easily attacked by pests in the store. Late harvesting results in shattering of grains, germination even before harvest during rainy season and breakage during processing. Harvesting at correct time is essential to get good quality grain and higher yield.

Crop can be harvested at physiological maturity or at harvest maturity.

1. Physiological Maturity: - A developmental stage after which no further increase in dry matter occurs in the economic part of the crop.

2. Harvest Maturity: - Harvest maturity generally occurs 7 days after physiological maturity. The important process during this period is the loss of moisture from the plants. The general symptoms of harvest maturity are yellowing of leaves, drying of grains & pods. It is advisable to harvest crops at harvest maturity.



Table: Harvest maturity symptoms of some important crops.

Crops	Symptoms
Rice	Hard and yellow coloured grains
Wheat	Yellowing of spikelets
Sorghum	Yellow coloured ears with hard grains
Pearl millet	Compact ears, on pressing hard seeds come out.
Pulses	Brown coloured pods with hard seeds inside pods.
Groundnut	Pods turn dark from light colour. Dark coloured patches inside the shell, kernels red to pink
Sugarcane	Leaves turn yellow, Sucrose content more than 10% and brix reading more than 18 percent.
Tobacco	Leaves slightly yellow in colour,

### Method of Harvesting

There are two methods of harvesting

- i) Manual: It is done by sickle. The other tool used for harvesting is knife.
- ii) Mechanical Harvesting: Reapers and combine harvester.

Reaper only cut the crop while combine harvesters cut, separate the grains from the straw, clean it and transport the grains to the storage tank.

## STORAGE

The market value of the produce is generally low at harvesting time. It is therefore, necessary to store the produce for different periods.

### FACTORS AFFECTING STORAGE

The most important factor determining the storability of the produce is moisture content of grains.

Higher the moisture content of grain shorter will be the life storage life.

Moisture content for safe storage of grains of most crops is about 14%.

Among the climatic factors temperature, light and relative humidity are important factors influencing storage of food grains. Insect development is generally limited below 10°C and above 45°C.

30-35% relative humidity is safe to storage of

## CROP PROTECTION

(1)

Crop protection is the science of managing plant diseases, weeds and other pests that damage agricultural crops and forestry.

Pest: A pest is an organism that at any given time or place is undesirable.

Disease: It is any condition of a plant that interferes with its normal structure, and functions or economic value.

pests and diseases have been grouped together and redivided into two new groups.

### Parasitic pests and Diseases

- Insects
- Snails (Shelled gastropods)
- Vertebrate pests (Birds, mammals, reptiles, Rabbits, Foxes, wild dog etc.)
- Nematode diseases (Root knot nematode galls)
- Virus diseases
- Bacterial diseases
- Fungal diseases
- Parasitic flowering plants (Cuscuta sp.)

### Non-Parasitic pests and Diseases

- Living agents (plants & animals) which damage plants mechanically



on plants e.g

Insects: leafcutting bees, Soldier beetle.

Fungi: Lichens, (colony nests)

Animals: cats, dogs, earthworms and humans

Weeds: Weeds also come within this group but because of their importance and number are studied as separate group.

### Non-living agents

Non-living agents are the largest group, non-parasitic pests which are infinite in number and type. These include:

- Environmental agents e.g heat/cold, drought, waterlogging etc.
- Nutrient deficiencies and toxicities.
- Acid soils
- Salinity
- pollution or pesticide injury.
- Mechanical injuries
- Genetic abnormalities.

### CONTROL METHODS

Indirect Control Measures

③  
of pest e.g. Flea beetle, fruit fly. Early planting of Broccoli advances plant maturity before flight peaks.

### 3. Cultivation

Ploughing exposes pests such as caterpillars which are then eaten by birds.

4. Encouragement of plant growth: Good quality seed should be used which will germinate quickly & evenly. A poor growing crop is more vulnerable to pest attack than a quick growing crop.

5. Clean Farming / Removal of alternate host  
Weeds are alternate host to a great variety of insects and these sources of infestation should be eradicated.

### DIRECT CONTROL METHODS

This means chemical control of insect, pests and diseases with the use of inorganic chemicals that are toxic to certain categories of pests.

### Biological Control

In this method a parasite or predator is used to control the pest.



Q.R: Sumaira Anwar / 1 Semester Sec A  
Problem Soils / Problems of Land Resources of Pakistan  
Q.1 A) Salt affected soils. Sir. Akse Aziz

In these soils, the soluble salts accumulate in such proportions that they affect crop production ability of soils.  
In Pakistan 7.617 mha land is saline

Salt affected soils are of three types  
Cations = Na, Ca, Mg      Anions: Cl<sup>-</sup>, Sulphate & bicarbonate  
1- Saline Soils: - lowe = potassium, nitrate & carbonate

These soils contain excessive quantities of soluble salts which show up on the surface of the soil as white crust. Salts from the lower soil depths move to the surface with the upward movement of water. These soils are called white alkali soils or Kallar soils, thar or shor soils

pH is less than 8.5

EC = 4 m mhos/cm or more

ESP = Exchangeable sodium percentage = less than 15

2- Saline-Sodic Soils.

These soils contain soluble salts and exchangeable sodium in excessive quantities which interfere with the growth of most crop plants.

ESP = 15 or more

EC = less than 4 m mhos/cm

pH = less than 8.5

Sodic soils instead of normal soils.

## Sodic Soils

In these soils the proportion of sodium ions associated with the surface of fine clay particles exceeds 15 percent. Locally these soils may be called "Borr soils" or Rakkar Soils. The presence of sodium on clay particles breaks up the aggregation of soil particles. Thus the soil loses its tilth and becomes very sticky when wet & hard when dry

- Difficult to reclaim
- water stands on soil for long time after rain
- pH = 8.5 to 10.5

EC = less than 4 mmhos/cm

ESP =  $> 15$

organic matter may disperse and may move to surface of soil with water imparting a dark colour to the soil. Such soils are also termed as black alkali soils.

## Water logged Soils.

These are the soils in which water reaches within 0 to 1.5 m depth of soil. or Water table came close to the surface of soil create water logged conditions that adversely affect agricultural productivity.



→ Greater evaporation from high water table soil result in accumulation of salts in the root zone of the crop.

The seepage of water from the unlined canals causes waterlogging

- This also cause salinization of the soil  
Deterioration of soil structure, poor aeration, warmer temperature  
reduced nutrient uptake, low organic matter content

- ① Seepage drain ② Lining ③ Canal closure ④ planting trees  
⑤ Drainage.

Soil Erosion :- It is the detachment and transportation of surface soil material with water or wind. As top 12-22 cm soil layer is the principal feeding zone of most of the agricultural crops, its removal makes the soil less productive

Two main agents of Erosion

- i) Water erosion
- ii) Wind erosion

Water erosion is common in northern uplands of the country

Wind erosion is common in arid and semi-arid areas in the South.

About 1.4 m ha are affected by erosion in Punjab alone.

Protective measures 1. Contour Farming 2. Strip cropping 3- Keep the ground covered for major part of the year.

## Chapter 11

# Agro-Industries in Pakistan

Hammad Badar, Abdul Ghafoor and Adnan Adeel\*

### Abstract

Agriculture in Pakistan is gradually being commercialised because of technological modifications, innovations and changes in consumer demand. Agriculture is no more confined to the production of raw agricultural commodities. Greater emphasis is being laid on production of value added agricultural products. As result, the number of agro-industries is rapidly growing. Currently, a wide range of agro-industries are operating in Pakistan to produce numerous food, fiber and other value added products to consumers and other industries for further processing. In addition to serving domestic needs, many of these industries are also exporting products to other countries. In addition to small scale agro-industries mostly operating in rural areas, several large national and multinational firms have invested in various agro-industries in Pakistan. This chapter presents the importance, production/processing capability and market potential of Pakistan's various agro industries such as cotton and textiles, sugar, wheat, rice, fruit processing, dairy, poultry, seed, fertilizers etc. Besides this, development opportunities with its implications and future challenges are also discussed.

**Keywords:** Agro-industries, wheat, sugar, rice, dairy, poultry, seed, fertilizers, cotton and textiles.

### 11.1. Introduction

Pakistan's agribusiness sector is experiencing a transformation from subsistence to commercial and market oriented sector because of rising consumer demand for value

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products are exported to other countries. GDP of the country is sizeable. According to Agricultural Statistics of 2013, the total number of agro-based industries in 2005-06 was 4242.

Broadly, these industries may be categorized into small and large scale industries. Small scale industries operate at smaller scale and may be of two types. Village based small units which are owned and controlled by rural households. They require use of physical labour. For example, pickles industry and chips industry. Other type requires medium-level investment and use of semi-automatic techniques. For example, edible oil and raw rice processing mills. Large scale industries require heavy investment, advanced technology and modern management skills. For example, sugar, food processing and textile industries. Following section briefly gives an overview of major agro-industries in Pakistan.

## 11.2. Cotton and Textile Industry

Textiles industry is the largest industry in terms of investment in Pakistan. It contributes one fourth to industrial value added and employs around 40 per cent of industrial labour force in the country. Pakistan is a major exporting country of textile products from Asian region and more than half of the country's exports comprise of cotton and textile products. Around 30 to 40% cotton production is consumed locally and remaining is exported in raw or finished form. The share of Pakistan in world exports of textiles and clothing is 1.8%.)

Local availability of basic raw material is a key factor for the success of any industry because it substantially contributes in lowering down the cost of doing business. (Pakistan's textile industry has the inherent advantage of being one of the major cotton producing country. The production of cotton was 13.983 million bales with a contribution of around 1.5 percent to GDP and 7.1% in agricultural value addition in 2014-15. The industry comprises of 1221 ginning factories, 549 spinning factories, more than 400 textile mills, over 275000 looms, 700 knitting units, 4000 sewing units, 650 dyeing and 300 oil expellers and more than 18000 small scale oil expellers (kohlus). These units are mostly located in Punjab and Sindh provinces of Pakistan.

The textile industry value chain is quite long involving a number of stages such as cotton production and picking, ginning, spinning, weaving, dyeing, finishing and

Although cotton and textile industries are major contributors in industrial growth, numerous factors hinder the realization of full potential of the industry. Some of these factors include inconsistent production of cotton, fluctuation in cotton prices and quality, energy crisis, unskilled labour, lack of modernization of machines, low value addition.

### 11.3. Wheat Flour Industry

- a. Wheat is the staple food and a major component of diet in Pakistan. From food security viewpoint, wheat is accorded high priority in agricultural related policies and plans. In 2014-15, it contributed 10 percent in agricultural value added and 2.1 percent to GDP. Annual domestic wheat production averages around 24 to 25 million tonnes which is mostly consumed locally. In case of surplus, Pakistan also exports wheat flour mostly to Afghanistan.
- b. For consumption, wheat grains are grinded in whole meal flour traditionally known as "Atta". Wheat flour is used for making bread or "Chapati", cakes and several other bakery products. (Wheat milling takes place in private sector and is carried out by small flour mills (traditional *chakkis*) and modern grinding plants. Small flour mills generally have daily capacity of grinding wheat up to five tonnes. Around 8000 small flour mills are operating in rural areas) In many parts of urban areas also, they provide wheat flour to urban consumers who prefer to have their own wheat milled individually. (The modern grinding plants in the form of flour mills operate at large scale and are located near to major cities for providing wheat flour mostly to urban consumers. According to estimate, around 950 commercial flour mills are operating in Pakistan.)

*value added is the net output of a sector.*

Although the flour industry is privately owned and operated, government regulates flour milling activities by issuing licenses under the Flour Mills (Control) Order of 1959, allocating domestic flour milling quotas and controlling wheat flour sale price. Flour mills procure their wheat supplies from government agencies such as Pakistan Agricultural Storage and Services Corporation (PASSCO) and provincial food departments at fixed release price as per the fixed quota based on their milling capacity. This supply is ensured in months other than harvesting months of wheat. Flour mills also purchase wheat from private traders often at higher price than the price of government wheat. However, flour mills may have to incur addition costs in case of government wheat in the form of uncertain quality and obligation to sell flour at regulated price. (The major challenges faced by flour industry include energy shortage, low quality of wheat and limited storage capacity.)

### 11.4. Rice Industry

Rice is the second staple food widely consumed after wheat in Pakistan. It is the second largest foreign exchange earner after cotton in Pakistan. It contributed around 0.7% to GDP and 3.2% to agricultural value added in 2014-15. Two varieties of rice i.e. long grain "Basmati" and coarse rice "IR" are commonly grown in Pakistan and are famous all over the world due to their excellent taste and aroma. Because of



rice to several countries with various brand names such as Guard Rice, Flora Rice, Roberts Rice and Sun Rice. The main export destination of Pakistani rice are UAE, Saudi Arab, Iran, Kenya and Afghanistan. Rice is mainly grown in Punjab and Sindh provinces.)

Rice industry is growing during the last three decades with increasing demand of basmati rice in local as well as export markets. More than 70% share of export of basmati rice goes to Middle East. More than 50% of rice industries in Pakistan are utilizing the combined facility of husking and polishing. Major rice processing units are located in rice producing areas of Punjab. The cluster of rice processing mills is present in major rice producing belt such as Lahore, Gujranwala, Sialkot and Hafizabad districts of Punjab. (Currently, more than 315 rice milling plants are working in Pakistan.)

(Rice milling generates several products including rice hulls or husk, rice bran, brewer's rice, rice bran oil, flour and starch and ash from hulls. These by-products are used for different purposes: The outer husk layer generated in the first stage of rice milling may be used as fuel in power plants, mulch and abrasives and packing material for protecting fragile cargo during shipping. Rice bran is produced from the outer layer of the brown rice grain and is used in cereals, vitamin contents and mixes. Brewer's rice is used mostly in the processing of fermented products. Rice bran oil is considered effective in lowering blood cholesterol level and may be used as cooking oil because of its high quality and delicate taste. Rice flour is gluten free and non-allergic and used in producing rice pasta, cereals, crisps and snacks. Rice starch is used as thickener in desserts and sauces and for making rice syrup. Ash from Hulls is used for cleaning discolored teeth and making cellulose products such as rayon and rice fuel. Broken Rice Pieces of rice kernels may also be used for manufacturing various products including rice flour and pet foods.

Pakistani rice industry is facing difficulties in reaching to its full potential. One major reason is the low price in international markets which may be attributed to lack of grading, branding and proper packing. Other challenges include non-availability of certified seeds, use of unskilled labour in rice transplantation from nursery, poor post-harvest techniques, higher input prices and lack of modern marketing skills.

## 11.5. Sugar Industry

In Pakistan, sugar industry is a prominent industry which has witnessed substantial growth. Overtime Pakistan's sugar industry has witnessed sizeable growth and currently, 86 sugar mills are operating in Pakistan. Of these, 46 are located in Punjab, 33 in Sindh and 7 in KPK. Sugar cane and sugar beet are the main sources of raw material for sugar mills (Table 11.1.)

Sugarcane is the main source of raw material for sugar mills. Sugarcane is the cash crop of Pakistan which is primarily grown for obtaining sugar. In 2014-15, the contribution of sugarcane to agricultural value addition and GDP was 3.1 and 0.6 percent respectively. Sugarcane production is

Husk:

- 1- Fuel
- 2- Mulch
- 3- packing material

Rice bran

- i) used in cereals
- ii) Vitamin content

Rice Flour:

- 1) Rice pasta
- 2) Snacks

Problems



Table 11.1 Sugar Production in Pakistan

Province	Mills (no.)	Cane Production (million tonnes)	Cane Crushed (million tonnes)	Sugar Produced (000 tonnes)	Recovery %age from cane
Punjab	46	36.04	27.69	2585	9.23
Sindh	33	13.46	13.60	1299	9.42
KPK	7	4.51	3.04	262	8.64
Baluchistan	0	0.04	0.00	0	0.00
Total	86	54.05	44.33	4146	9.24

Source: Govt. of Pakistan, 2013: Agricultural Statistics of Pakistan 2012-13

Although sugar is the main product, the industry produces several other commercial by-products which include molasses, bagasse and press mud. Molasses is a dark brown syrup which is drained during the processing. It plays an essential role in the manufacture of alcohol, rum, yeast and fertilizers. Bagasse is crushed sugarcane obtained after the extraction of juice. It is used for several purposes such as feed for animals, fuel for mills, manufacturing of organic fertilizers, making of hard boards, cartons, chip boards and pulp. The best source of organic fertilizer is the press mud that increases the micronutrients in the soil. It is also sold to the sugarcane growers at a nominal cost that is very useful for fertile soils.

تجیباں

Problem.

The sugar industry is facing several challenges that need the attention of public and private stakeholders for improving the industry profitability. Some of these challenges include underutilization of capacity, low rate of sucrose recovery, political intervention, inadequate credit facility and lack of research and development.

## 11.6. Maize Processing Industry

Maize is an important food grain crop after wheat and rice in Pakistan. In 2014-15, its contribution to GDP was 0.4% and 2.1% to agricultural value added and its production was 4.695 million tonnes. The maize production is mostly concentrated in Punjab and Khyber Pakhtunkhwa. Maize and its byproducts are used as input by several industries such as human food, poultry and wet milling industries.

Maize as grain provides sufficient starch, vitamins, proteins and minerals. It is an alternative source of food when wheat and rice are not easily available. Baked, roasted boiled maize has mild flavor that can also be used as thickening agent in foods such as jellies and custards. Popcorn is the best example of fluffy kernel that are eaten as snack. The syrup extracted from maize contains high contents of fructose that act as sweetener. Starch extracted is mostly used in confectionery and noodles. Edible oil is also extracted from maize seeds. "Levulinic Acid" derived from maize is used as ingredient in antifreeze process. Ethanol as biomass fuel is also obtained from maize. Stigmas of maize female plants are used as herbal supplements. Maize straw is used as energy source at homes. Maize is also used as animal feed and forage.

Kernels are soaked in water with or without  $SO_2$  to soften the seed in order to soften separate various components of seed.



### 11.7. Pulses Industry

Legumes commonly known as pulses are the main source of vegetables protein and are component of food in tropical and subtropical regions. Chickpea, lentil, mung bean, black gram and mash are the major pulses grown in various regions of Pakistan. Among legumes, chickpea is the major winter crop that covers 73% of the total pulses under cultivation and mung bean is the major summer crop that covers 18 percent area. Black gram and lentil is grown on 5 percent area of total pulses area.

Both rich and poor communities prefer to enjoy delicate taste of pulses worldwide. The demand for pulses is continuously rising because of tremendous population growth in Pakistan. (The country is deficient in pulses production. That is why, during last decade, 0.336 to 0.52 million metric tonnes of legumes was imported and the imports are continuously increasing.

(Pulses processing industry is poorly developed because it is in hand of few monopolists. High prices are mostly set due to deficient marketing system. Another reason is the increasing focus of government on four major crops and pulses are not accorded significant importance in policies relating to agriculture.

### 11.8. Fruit Processing Industry

A wide range of fruits such as citrus, mango, dates, apple, guava and banana are grown in various climatic regions of Pakistan. While some of these fruits such as citrus and mangoes are exported, the others are sold in local fruits markets for consumption as fresh or further processing into value added products. The fruit processing industry produces various value added products such as juices, squashes, pulp and jams. Fruit processing industry is one of the largest industries in Pakistan that significantly contributes to agricultural value added. The industry exports premium quality fresh fruits as well and the leading fruit exporters have installed their own processing units for export purposes.)

More than 25 fruit processing industries located in Karachi, Lahore and Peshawar are producing different products including fruit juices, jams, jellies, squashes, pickles, canned fruits and carbonated beverages. The most important feature of this industry is to preserve these products that can be stored at proper time and place for distribution throughout the local and nationwide markets. In Pakistan, production of preserved fruits products is estimated at 15000 tonnes, out of which, 2000 tonnes of jams, jellies and marmalades, 10000 tonnes of pickles and chutneys, 18 million bottles of squashes are preserved.

Existing potential of fruit processing industry is not in match with other industrial developments. (The perishable nature of fruits and vegetables, lack of controlled atmosphere containers, poor transportation facilities, ineffective storage and packaging facilities are the major reasons for this under development of industry.) Share of fruits' export from Pakistan in the world markets is increasing annually that shows that the industry needs to improve the working capacity of already existing

Legum mungo

It is a type  
of bean. Also  
called wood bean

Problems

### 11.9. Vegetable Ghee and Oil Industry

Vegetable ghee and cooking oil industry stands among the major agro-based industries in the country. Since independence, the industry has substantially grown. An estimated production of 1.54 million tonnes of edible oil was recorded in 2014-15. Edible oil including vegetable ghee and oil is the essential source of food which is extracted from the oil seeds. In Pakistan, edible oil is extracted from conventional and non-convention oilseed crops. Conventional oilseed crops include cotton, rapeseed, mustard, groundnut and sesame whereas sunflower, soybean and sesame are non-conventional crops introduced in the country to meet the consumers' needs. Since domestic production of edible oil is insufficient, therefore more than three-fourth of the country's requirement are met through imports of mainly palm oil and soybean.)

**Table 11.2** Production of Vegetable Ghee and Cooking Oil (000 Tonnes)

Year	Vegetable Ghee	Cooking Oil	Total
2010-11	1,092	312	1,124
2011-12	1,103	323	1,426
2012-13	1,139	363	1,502
2013-14	1,185	375	1,560
2014-15	1,176	368	1,544

Source: State Bank of Pakistan (2015).

The vegetable ghee and oil industry began its journey in the private sector. In 1973, under the nationalization policy, 23 of 26 factories were placed under the control of Ghee Corporation of Pakistan (GCP). However, the industry is now once again operating in private sector because of the privatization policy of the government and is estimated to be comprised of around 160 units which are located in all four provinces of the country.

Various techniques are utilized by the oil industry in Pakistan that bifurcate this industry into three broad groups. Ghani (also known as *chekhu* or *kol*) is the main technology for expelling oil in the villages. Different oil seeds are used in different areas. Factories using intermediate level of technology are located in towns. Oil seeds used are region specific. Large scale sophisticated mills are located in big cities and are oriented towards bigger markets. They also procure oil seeds from a much larger area.

**Table 11.3** Import of Edible Oils

Year	Quantity ('000' tonnes)				Value (Million Rs.)			
	Soybean	Palm oil	Other	Total	Soybean	Palm oil	Other	Total
2010-11	66.4	1951.1	158.5	2176.0	5722.2	172702.0	8730.6	187154.8
2011-12	39.5	2108.0	135.6	2283.8	4560.5	211826.2	9309.3	225696.1
2012-13	60.3	2163.8	97.8	2321.9	7157.9	189618.0	6240.4	207660.1

Source: Govt. of Pakistan (2013)



oilseed crops and higher dependency on imported edible. Due to this, the performance of industry is negatively affected. Since edible oil imports mainly comprise of palm oil which is the lowest in quality among various edible oils. Often higher international prices also result in higher local prices of edible oil. As a results, consumers have to consume high priced and low quality edible oil products.

### 11.10. Dairy Industry

Dairy farming in recent year has emerged as a major agro-based activity and buffaloes and cows are growingly raised in an organized manner for milk production for commercial purposes. Pakistan stands among major milk producing countries of the world with a production of 52632 thousand tonnes in 2014-15.

Milk is consumed in various ways such as for making tea, yogurt, butter, desi ghee, khoya and various sweets, in addition to be consumed as fresh. Milk processing companies transform raw milk into pasteurized milk, UHT milk, milk powder, condensed and skimmed milk. A wide range of value added products including ice-cream, creams, drinks, cheese, and desserts are also made using milk as basic ingredient.

*Ultra High temperature processing.*

Urban areas are the major markets for the sale of milk because of changing consumer preferences. Although sale of fresh milk still dominates, the demand for processed milk is gradually growing. This growing demand has attracted many national and international companies to invest in this sector and supply good quality processed milk in markets. Currently Nestle, Engro, Haleeb, Gourmet and Adams are some of the major milk companies in Pakistan

Currently, more than 17 milk processing plants including UHT and pasteurization units are operating in the country with huge potential for growth. Unfortunately, all these dairy units are working below their production capacity. Low animal productivity, poor animal hygiene, lack of water availability, poor animal breeding techniques, smaller herd size, unbalanced animal feed and seasonal milk supply are the major hindrances in dairy industry.

Consumer preferences and taste are some factors affecting growth of processed milk market in the country. In spite of many complaints on quality of fresh milk, most of the consumer still prefer to consume fresh milk as compared to processed one. Another issue is the availability of processed milk only in big cities of the country. Perhaps the most important hurdle in adoption of processed milk is the price difference between processed and fresh milk. On an average there exists a price difference of around 40 Rs/liter between the two types of milk. So majority of the consumers do not afford such high price. Considering the demand for quality milk in the country there is dire need to introduce more...



### 11.11. Poultry Industry

Poultry industry has emerged as a prominent and vibrant industry in Pakistan because of 8-10 percent annual growth in the recent past. It is considered one of the organized agro-industries with a current investment of more than Rs. 200 billion. In 2014-15, poultry industry contributed 1.3 percent to GDP and 6.3 percent and 11.2 percent to agriculture and livestock value added. The industry directly and indirectly provides employment to 1.5 million people. )

In Pakistan, the development of poultry industry on commercial basis started in 1960s when government realized the white meat needs of rising population. The first commercial farm was setup in 1962 by Canada's Messers Shaver's with the help of PIA (Pakistan International Airline), resulting in PIA Shaver. The poultry industry witnessed a period of stability in the late 1990s when producers started earning profit. In the last few years, the poultry industry attracted sizeable investment and the industry is gradually shifting from traditional open houses to semi and completely automated and controlled poultry houses. Currently, there are around 28,000 commercial poultry farms and 150 feed mills with the capacity to produce 2.821 million tonnes of compounds feed per annum are operating in the country.

Though it is now fairly spread around the country, the poultry industry is mainly concentrated around the major cities of Punjab and Sindh provinces. In Sindh, poultry farm are mainly located in Mirpurkhas, Sukkur, Nawabshah and in some other small cities. In Punjab, the poultry farms are based on Lahore, Faisalabad, Rawalpindi, Multan, Rahim Yar Khan, Bhawalpur and Mianwali.

Due to relatively limited supply of mutton and its high prices, there is fair margin for the promotion of poultry meat in the country. The contribution of poultry meat in total meat production is 28 percent in the country. One phenomenal factor in the supply chain of poultry meat is the existence of fluctuating trend in supply and prices which mainly is driven by demand forces. Sometimes the prices shoot up due to limited supply whereas prices depressed to lowest at some other times. Such fluctuations have caused many investors to leave their businesses.

Now a days, poultry industry has experienced a positive change in the form of Environment Controlled Poultry Sheds. Some big companies have entered in this business which have controlled supply and mainly determine the prices in the country. This initiative has pushed many small investors out of this business. At the same time some big companies like K & N, MENU, SUFI etc. have developed their own supply chains which ends up with value added products like processed meat, semi-cooked and cooked poultry meat products. These companies are selling through retailers and also have established their own outlets in big cities of the country. This industry faces some challenges like outbreak of bird flu and related changes in consumer food preferences which results in drastic reduction in poultry meat consumption.



enough raw material for leather industry (53 million number of skins and 15 million number hides). Leather exports stand at number three after textiles and rice in Pakistan. Overall, in 2015 leather exports declined in spite of increase in the prices. Exports of tanned leather remained 408 million dollars whereas leather garments exports were 498 million dollars in 2015. Pakistani leather exports are valued reasonably well in international markets. /

Leather industry is divided into six sub-sectors which include tanning, leather foot wear, leather garments, leather gloves, leather shoes uppers and leather goods. Availability of skins and hides is an added advantage in Pakistan which other countries especially developed ones do not enjoy. As such exports from developed countries are declining and providing a fair chance for increasing exports of leather products from Pakistan.

Over the years, Pakistan's export performance in leather exports has improved but still there is need to improve the quality especially in view of stringent international requirements and standards. One famous allegation on leather industry is the damage this industry is causing to environment. In addition lack of export promotion is another factor causing challenges to leather industry in Pakistan. Trade Development Authority of Pakistan should come ahead and arrange fairs and exhibition showing rest of the world quality and variety of leather products. One important step which needs to be implemented in this regard is the research and development on critical issues facing the leather industry in the country to find out the solutions.

Leather industry in Pakistan is facing many challenges as well. Quality of skins and hides is an issue which needs to be addressed. Traditional system of slaughtering causes cuts and bruises and poor system of storage causes fungus contamination. At the same time availability of skilled labour is another issue for leather industry. Some other major obstacles include lack of modern technology and market research, complex system of export, energy crisis and lack of promotional activities. 2/2/18

### 11.13. Tobacco Industry

Tobacco industry covers mainly three products viz. hukkah tobacco, cigarettes and naswar (Snuff or chewed). However from the market point of view, major share comes from cigarette tobacco. Different types of tobacco such as flue-cured, light air-cured are used in manufacturing of cigarettes, while, light sun-cured is primarily used in hukkahs. Dark air-cured, semi-oriental and dark sun-cured are utilized in the production of biri, cigarettes, chewing and naswar. Tobacco as cash crop is cultivated in Multan, Lahore, Bahawalpur, Khairpur, Peshawar and Baluchistan. Primary production of tobacco crop is followed by secondary operations i.e. curing (graded tobacco) in kilns, storing, aging, blending, casing, cutting and flavouring. Afterwards, cigarettes are filled in paper through advance technology, packed and distributed to local and distant markets. Currently, capacity of 123 billion pieces of cigarettes is produced in Pakistan.

## 11 Agro-Industries in Pakistan

In Pakistan, tobacco processing started in 1951. Since then, two main companies Pakistan Tobacco Company (PTC) and Phillip Morris (PM) Tobacco Company and many small and medium enterprises are involved in the growth and development of industry. Pakistan Tobacco Board (PTB) is the regulatory authority of its production, marketing and pricing mechanism. Contractual agreement is signed between PTC and PM and large growers on the fixed price supported by PTB. Small growers don't follow such type of agreement and sale their produce directly to local buyers or contractors. Without any contractual agreement, few exporters purchase tobacco directly from growers on cash or credit basis.

Heavy taxes such as Central Excise Duty (CED) and General Sales Tax (GST) are imposed on tobacco industry as such this is a good source of revenue for government. Specific financial provisions are absent to meet the needs of key stakeholders who are directly or indirectly involved in its crucial operations i.e. production, curing, transportation, storage, processing, packaging and marketing. Therefore, there is dire need to formalize the formal credit system in this industry. Trend of landless production is the major constraint in this financial system, because people use rented land for its production and mostly rely on illegal financial sources. Market risk is also another hindrance due to natural hazards such as hailstorm that underpin the supply of tobacco.

### 11.14. Tea Industry

In Pakistan, tea is popular beverage and widely consumed in social and professional gatherings. It is also an integral component of daily meal in Pakistani culture. Currently, in domestic market, two types of tea i.e. branded and unbranded (loose) are available which are mostly imported from Kenya, Bangladesh, Indonesia, Sri Lanka, Uganda and Rwanda. First category is imported in loose packing and the second category is packed and is sold in the market with famous brand names.

Until 1970, Pakistan was a bulk producer and exporter of tea. However, after the separation of eastern wing tea is one of the major import item because all domestic requirement of tea is met from import mostly from Kenya. Pakistan has to spend substantial amount of foreign exchange reserves on import of tea.

The growth of tea industry is not as fast as the population is growing. Since last few decades, per capita consumption of tea is approximately 1 kg that is not increasing. Large blender packers who sell under brand name mainly control tea trade in Pakistan. In addition, there are large number of importers, wholesalers and retailers who provide wide variety of tea to consumers in Pakistan.

### 11.15. Seed Industry

Seed is the basic input that has a key role in improving agricultural productivity. The seed industry in Pakistan comprises of public and national, regional and international public private companies and business associations that are directly or indirectly involved in the production, processing, marketing and distribution of seeds. Mostly



seed processing plants owned by public and private sector are located in Punjab and Sindh provinces.)

Private sector induction in seed business started in the 1980s with formal registration of the first seed company in 1981 followed by another eight seed companies in Punjab in the following years. Formally, the seed business was declared open in 1994 and subsequently, the seed industry attracted lot of foreign direct investment. Several multinational companies entered in seed business. Monsanto started its business in 1984, Pioneer Seeds in 1989, Syngenta in 1991 and ICI Pakistan in 1998. The number of seed companies consistently grew and in 2012 the number of registered companies reached to 963.

Formerly Seed Act of 1976 was the basic legal document to govern the seed production and trade. The Seed Act 1976 law failed to fulfil the requirements of a 'modern seed industry' and therefore new Seed Act 2015 has been introduced. This has made it mandatory for farmers to buy seeds from a licensed company or its agent and that they had to do so every time they cultivate a new crop. Under this law, farmers would be fined and imprisoned for preserving, selling and exchanging seeds, a tradition that has been in vogue for centuries.

Initially, Pakistani seed companies were limited to multiplication of basic seed obtained from seed corporations. Now, they have initiated their own variety development programs and are able to bring a number of new crop varieties in the market. As result of expansion in their operations, these companies have gradually started replacing public sector corporations from the market. Some companies are now lead providers of seed of several crops including cotton, maize, oilseeds, vegetables and fodders. Seed production and marketing activities are also performed by local farmers and traders which is referred as unauthorized or bazaar seed. Majority of seed supply is provided by this sector.

The performance of seed industry in Pakistan is considered low because of malpractices and inefficient policies. Numerous challenges faced both by the public and private sector are the major hurdles in the development of industry. Seed processing capacity is inadequate to meet the requirement. Companies lack adequate modern storage facilities that affect the quality of seeds.

## 11.16. Fertilizer Industry

The fertilizer industry provides the key input fertilizer which contributes 30 to 50 percent in crop production. Currently, 9 urea manufacturing plants, 1 Diammonium Phosphate (DAP), 3 Nitrophos (NP), 3 Single Super Phosphate (SSP), 2 Calcium Ammonium Nitrate (CAN) and 1 plant of blended Nitrogen Phosphorous Potassium (NPK) are operating in Pakistan. The total production capacity of these plants is 8,983 thousand product tonnes per annum. However, the actual production is 25 percent less than the installed capacity which may be attributed to the curtailment of gas to the industry because of energy crisis in the country.)

Fertilizers in Pakistan were introduced in the 1950s through imports. In the early 1960s, the government started building domestic fertilizer industry because of abundant

gas supply to the sector and the import-substituting industrialization policy. As a result, the national supply of fertilizers gradually increased and dependence of fertilizer imports declined. However, the imports of those fertilizer which did not require gas in production process continued. Use of high yielding varieties after 1970 further accelerated the fertilizer use in agriculture.

Currently, the fertilizer industry comprise of several firms including Fauji Fertilizers Company (FFC), Engro Fertilizer Limited, Fatima fertilizer, Pak-Arab, Dawood Hercules and Agri-Tech. These companies are trying to provide required amount of fertilizer in the market but some inherent problems in the marketing system and vested interests of market intermediaries cause shortage and hike up the prices. Farmers often complaint about high prices and shortage of fertilizer at the time of need in farming operations. Quality of these fertilizer is another issue which needs immediate attention of regulatory authorities.

### 11.17. Farm Machinery Industry

Pakistan's farm machinery industry supplies large variety of agricultural implements and machinery including tractors. The industry produces a wide range of farm implements and machinery for various agricultural, horticultural and forestry related operations. Some of these includes ploughs, disc harrows, laser levelers, seeders planters, seeding drills, rotary tillers, harvesting implements and threshing machinery.)

Small enterprises dominate the farm machinery manufacturing. These enterprise operate in the form of small workshops and use locally produced conventional machinery in their operations. The industry is mainly located at Mian Channu (Khanewal), Daska, Gujranwala, Paisalabad, Multan and Rahim Yar Khan.

The industry serves mainly the need of local market. The industry is facing issues which hamper its growth. Some of these include lack of standardization and quality, low skilled labour force, low quality compared with imported machinery, unawareness about modern manufacturing practices and performance standards of equipment produced, untrained and use of old and obsolete technology.

### 11.18. Pesticide Industry

Agrochemicals and pesticides are broadly classified in terms of target pests and type of disease or fungus attack, of which main categories are insecticides, herbicides and fungicides. However amongst these, pesticides share the dominant proportion in total market value of this group. Enterprises of agrochemical (pesticide) industry may be classified into three broad categories that include multinational corporations, well established domestic input companies with diversified marketing network and local traders of the wholesale markets.

Punjab is the leading province in terms of pesticides use followed by Sindh, KPK and Baluchistan (Khan, 2000). Over the time the trend of quantity and value of pesticides use has increased and this is regarded by many scientists as one of the



factors affecting agricultural productivity positively by reducing the chances of pest attack. However another school of thought declared it as ethical offense because intensive pesticide use has also enhanced resistance power amongst pests which has increased the problems for farmer. Same is happening in case of herbicides and fungicides. Cotton is major cash crop which alone shares around 70% of pesticide consumption in the country (Tariq, 2002).

Registration of pesticides is practiced under Agricultural Pesticides Ordinance 1971 which regulates the quality check of pesticides. Punjab assembly has passed the Agricultural Pesticides Act 2012 but its implementation is still awaited. Directorate of Pest Warning and Quality Control of Pesticide under the Ministry of Agriculture in Punjab is the main regulatory body which not only inspect and control the quality of pesticides but also spread awareness about their usage. At present in Punjab, there are 416 registered distributors/companies of pesticides.

In the past, there were various structural barriers which worked as impeding factors to de-motivate the new investors. One of these factors includes lengthy process of companies' ordinance for registration process that took up to three years for issuing of license. This issue was solved up to some extent due to introduction of generic scheme and fast-track registration procedures. This generic policy was announced in 1980's to regulate import and marketing of pesticides through various domestic companies. Various multinational companies also got benefits from this opportunity and established their businesses in Pakistan. Local wholesalers/ distributors of pesticide also contribute in highly competitive environment by marketing of generic products but their operations are limited in small towns or rural markets due to insufficient access of finance. Majority of the companies are importing chemicals and making their products using various combinations but few have established their own manufacturing facility. Limited access in national market, financial barriers and legislative restrictions are some of the reasons for not establishing national manufacturing plants in Pakistan. However, with the passage of time, the importers and multinational companies are able to effectively market their imported pesticide products in the domestic market and reaped the benefits of phenomenal margins from the last decade. This industry is facing many challenges including loose quality control, strict government regulations, increasing number of pesticide companies and enhancing default rate of stakeholders.

## Conclusion

Agro-industries in Pakistan are playing an important role in the development of Pakistan's economy by providing market to producers for their agricultural produce and consumers with their food demands. Overtime, these industries have substantial expansion in terms of number and production/processing capacity. There is dire need of further strengthening of these industries because it is commonly held belief that agriculture nowadays cannot be developed without value addition of agricultural commodities. To this end, the role of agro-industries is very important. In Pakistan, agro-industries are facing several challenges which hinder their growth potential. Both public and private sectors need to pay adequate attention to overcome these challenges.

well developed

developed.

2. Hairy stem & leaf margins

Phalaris minor / little canary grass / Dumbi Sili.

1. No. auricles
2. Red sap at the end of root tips
3. pale, broad & soft leaves



Human activities directly or indirectly affect the environment. They add a lot of suspended particulate matter and noise into the atmosphere. They emit from their tail pipes oxides of nitrogen, sulphur dioxide, carbon monoxide and a complex mixture of unburnt hydrocarbons and black soot which pollute the atmosphere. Domestic sewage and run off from agricultural fields, laden with pesticides and fertilizers, pollute water bodies. Effluents from tanneries contain many harmful chemicals and emit foul smell. These are only a few examples which show how human activities pollute the environment. Pollution may be defined as addition of undesirable material into the environment as a result of human activities. The agents which cause environmental pollution are called pollutants. A pollutant may be defined as a physical, chemical or biological substance unintentionally released into the environment which is directly or indirectly harmful to humans and other living organisms.

## Types of Pollution and health hazards

There are many different kinds of pollution and all of them have different effects on the environment and human health. Here is a brief introduction to the different kinds of pollution.

### Air Pollution

Air pollution is the contamination of the air when harmful contaminants are released into the air. One of the biggest effects of air pollution is global warming. It also causes other problems like acid rain, ozone layer depletion, etc. As a result of this, people are being exposed to more harmful UV rays that have increased the occurrence of cancer among people. In the long run, it can also make people get lung cancer, skin cancer etc. Some of the biggest causes of air pollution are cars, motorized vehicles, industries, etc.

Air pollution may cause damage in blood vessels

### Water pollution



## Light pollution

Light pollution is the pollution caused due to use of too much light, especially in urban areas. Light pollution is not something that seems like one of the types of pollution that would affect people, but that is not true. We have seen how animals do require the stars, the moon etc. for migrating and travelling during the night time.

They also need the dark for hunting and also to sleep well. In fact, one of the most harmful effects of pollution is the fact that it affects human sleep patterns. Humans need the dark to sleep properly and rest completely. As long as there are lights around, the brain would not completely rest. As a result of this, people will fall prey to problems like restlessness, fatigue, headache etc. In the extreme levels, it can even become insomnia.

## Noise pollution

Noise pollution is one of the kinds of pollution caused mostly due to urbanization and industrialization. The diseases caused by pollution includes fatigue, irritation, insomnia etc. Noise pollution can cause all of the above. In fact, it is a well known cause for migraines. It can also cause loss of hearing at a really young age for a lot of people. Noise pollution, since it renders people incapable of sleeping and resting completely, can also cause insomnia in the long run, which would have a lot of health repercussions as well.

## Soil Pollution

Soil pollution is contamination of the soil that is caused due to over dumping, over utilization of soil and excess chemicals being injected into the soil. Poor disposal systems, excessive use of fertilizers and pesticides in agriculture, etc. cause soil pollution, especially in agricultural areas. The plants would absorb all the harmful chemicals from the soil, thereby spoiling or even poisoning the person's food. Groundwater sources can also become contaminated due to soil pollution, which would cause water shortage problems as well.

There are many other forms of pollution that have also proven to be harmful for human health, such as thermal pollution (which is the pollution that causes the temperature level to rise in the country).