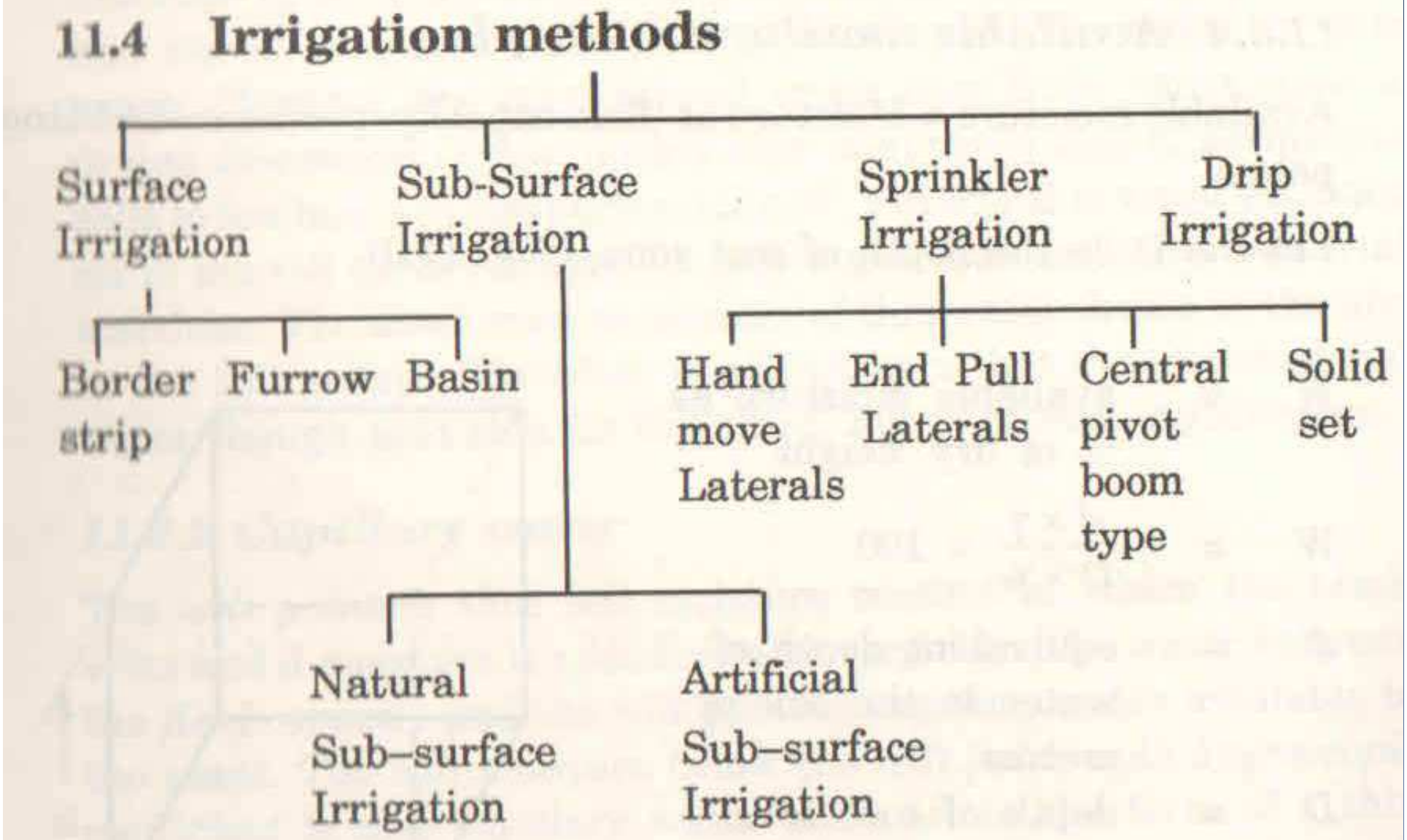
Methods of Irrigation

Methods of Irrigation



Surface Irrigation

- Where water is applied from field ditches without any levees to guide its flow, the method is designated uncontrolled or wild flooding.
- It is practiced largely where irrigation water is abundant and inexpensive.

Surface Irrigation

Surface Irrigation

- The land is divided into suitable size plots, each plot is practically level. Water is admitted at the U/S end of the plot and when water reaches down stream end, supply of water is cut off.
- If the water is made to flow on the surface too quickly, an insufficient amount will percolate into the soil on the other hand.
- If water is kept on the soil surface too long, waste will result from percolation beyond root size.
- It is therefore difficult to apply water efficiently by flooding methods.

Surface Irrigation

- In uncontrolled flooding, the smoothness of land surface, the attention and skill of the labour are also important.
- Water is brought to the field in permanent supply ditches and then distributed.
- The spacing of the ditches is determined by the grade of the land, the texture and depth of the soil, the size of stream, and nature of the crop.

Border Strip or Controlled Flooding

- Where land, water or labour is expensive, it is generally advisable to prepare for controlled flooding in border strips.
- Land is leveled and divided by 6" strips into a number of about 30ft to 70 ft wide.
- Water is allowed at the upper end of each strip and flows down along the strip to the lower end of the land.

Border Strip or Controlled Flooding

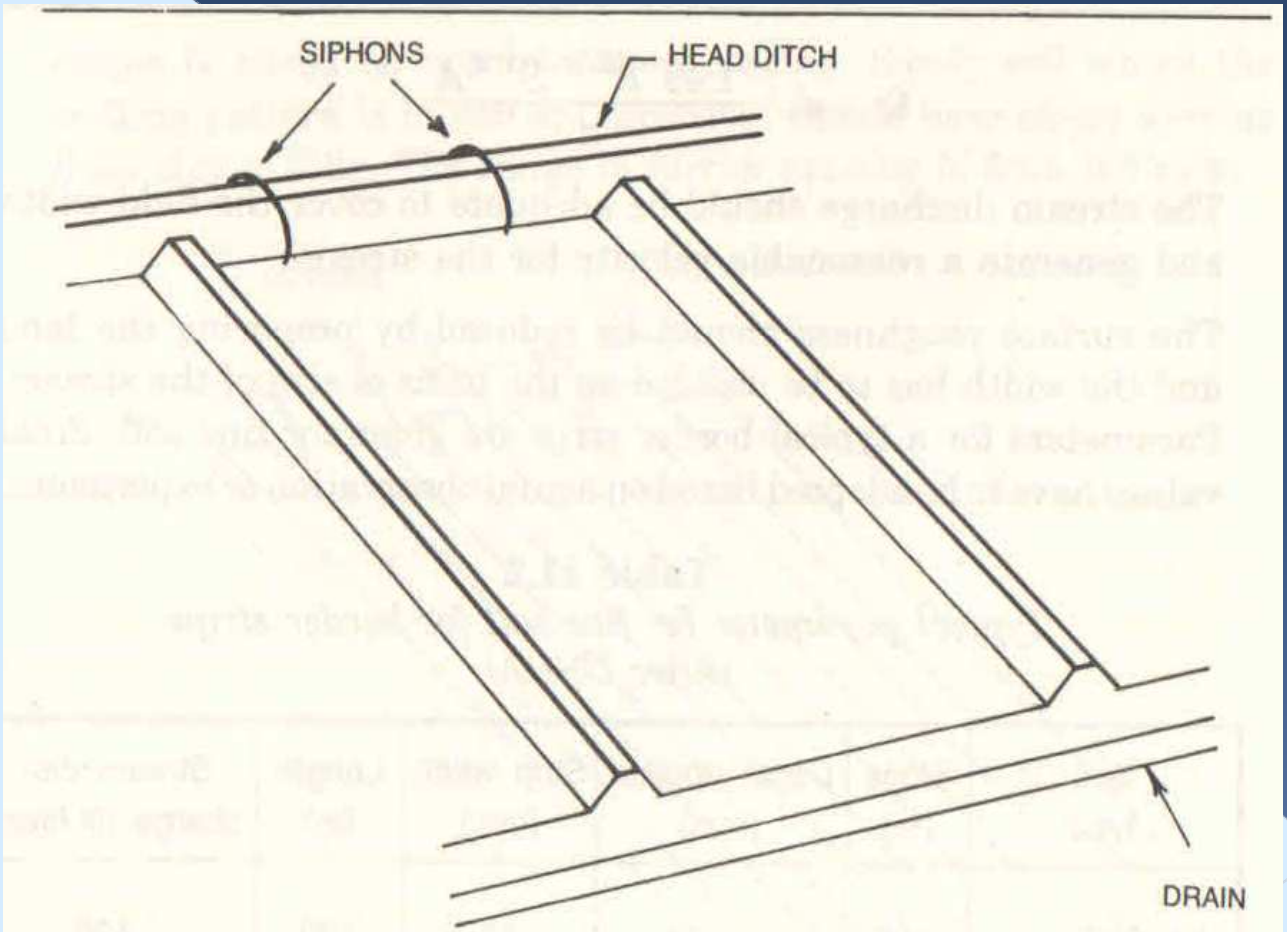


Fig. 11.4 A border strip system

Border Strip or Controlled Flooding

Table 11.2

Typical parameter for fine soil for border strips (After USDA)

Soil type	Slope (%)	Depth applied (mm)	Strip width (mm)	Length (m)	Stream discharge (lit./sec)
Fine soil (Fine sand Silty soil and alluvium)	0.25	50	15	400	120
		100	15	400	70
		150	15	400	40
	1.00	50	12	400	70
		100	12	400	35
		150	12	400	20
	2.00	50	10	320	30
		100	10	400	30
		150	10	400	20

Border Strip or Controlled Flooding

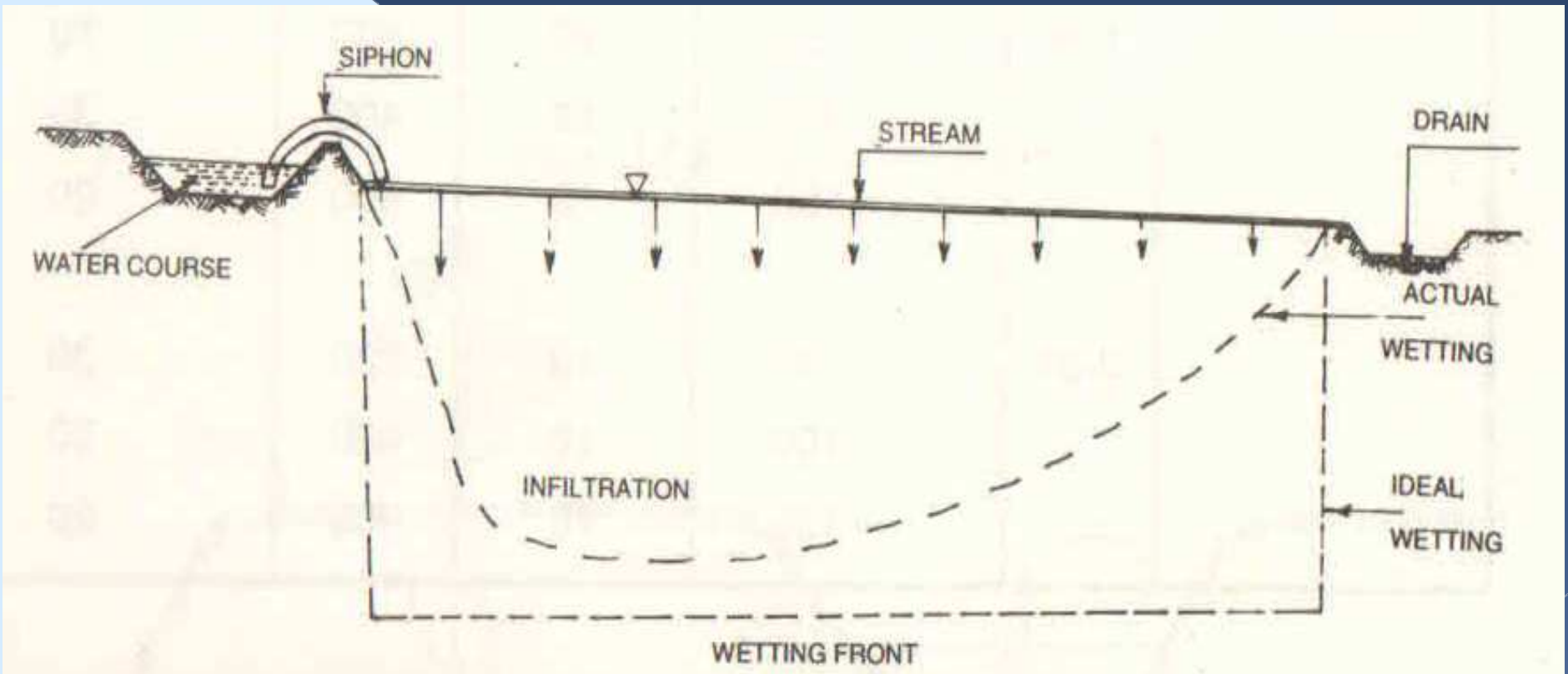


Fig. 11.5 Cross–section of border strip

Border Strip or Controlled Flooding

- In practical, it is best to make the border slope from 2-4 per 1000 ft, but slopes as low as 1ft. per 1000 ft can be used.

Border Strip or Controlled Flooding

- The border method is suitable to silts of wide variation in texture. It is important to study the physical soil properties in advance of preparing land for border irrigation.
- At the head of each border strip a gate is placed in the supply ditch for convenience in turnings water into and out of the strip borders.

Furrow Irrigation

- This method is usually useful for crops which are planted in rows such as sugarcane, potatoes and corn etc.
- The land is divided alternately into furrows, separated by ridges to plant the crops.
- Water is run into the furrows thus supplying water to the root zone through seepage.

Furrow Irrigation

- The height of ridges may vary from 0.15m to 0.4m and the distance between the furrows is based on the optimum crop spacing.

Furrow Irrigation

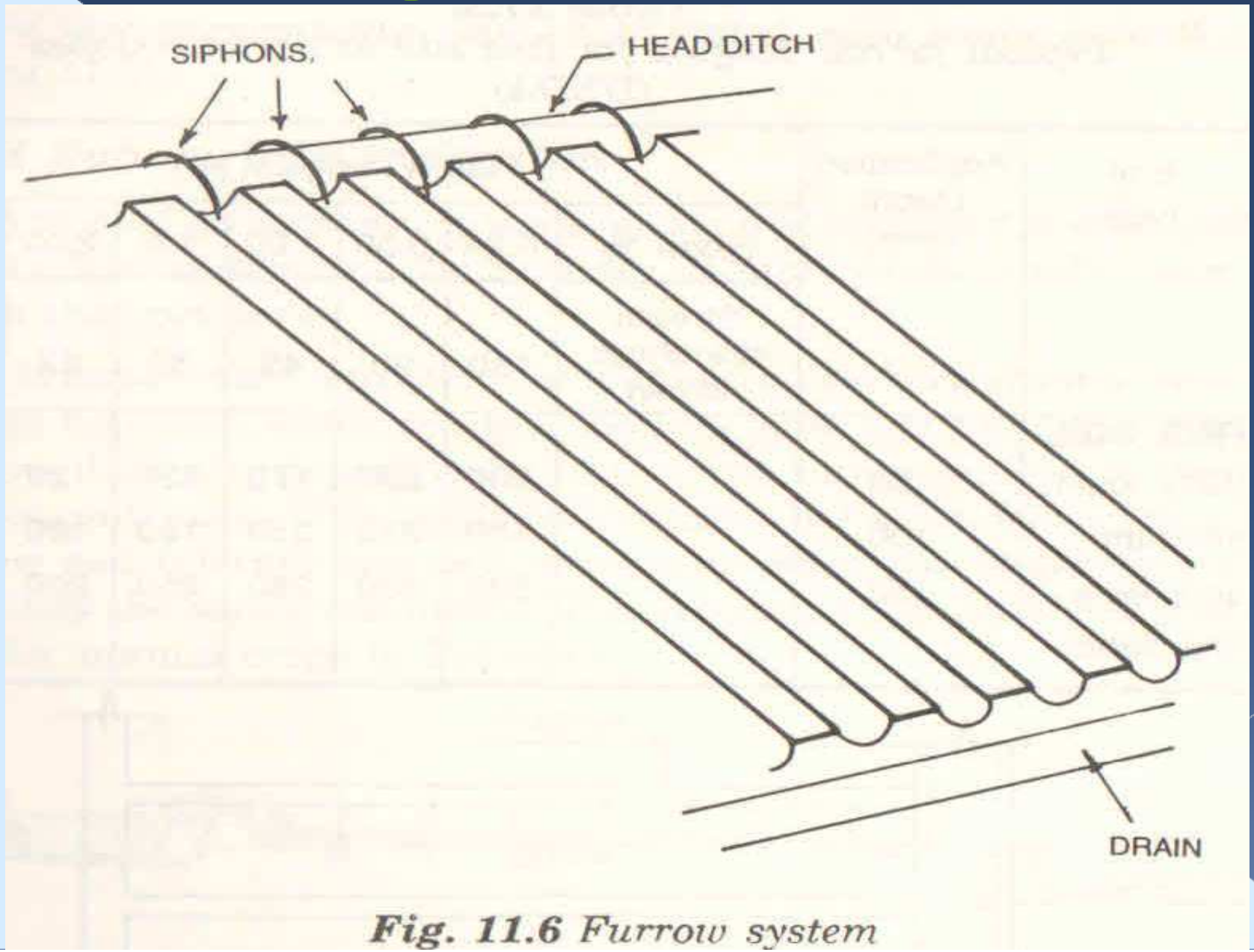


Fig. 11.6 Furrow system

Surface Irrigation

University of Arizona. Credit: John C. Palumbo

Furrows

Table 11.3:

Typical furrow lengths for fine soil at various slopes (USDA)

Soil type	Application Depth (mm)	Furrow lengths (m)						
		Slope %	0.25	0.50	1.00	1.5	2.00	3.00
		Stream discahrge lit/min	180	90	45	30	22	15
FINE SOIL (Silty loam, alluvium and, very find sand)	50		300	220	170	130	120	90
	100		450	310	250	190	160	130
	150		530	380	280	250	200	160

Furrow Irrigation

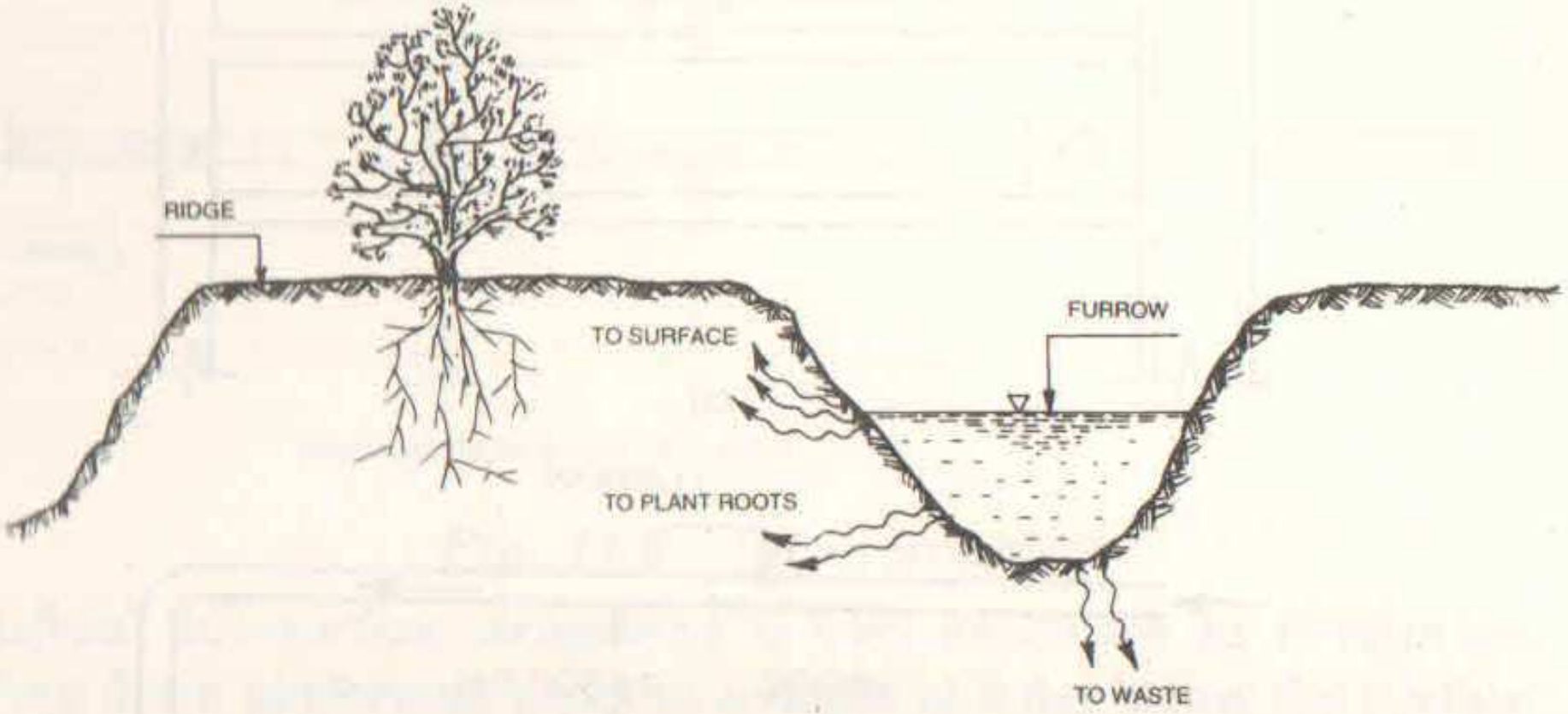
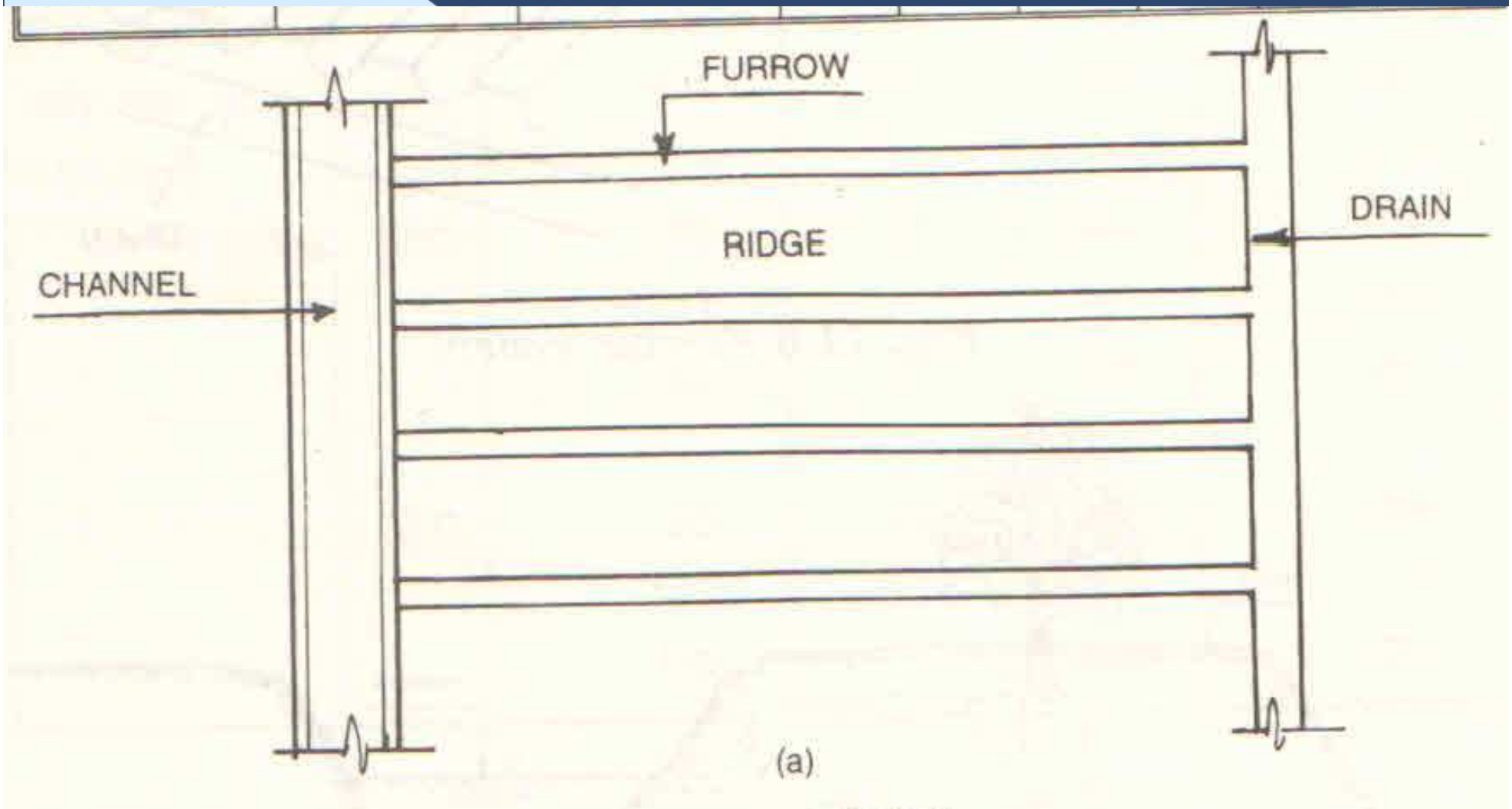


Fig. 11.7 Furrow irrigation (cross-section)

Furrows



Spacing of Furrows

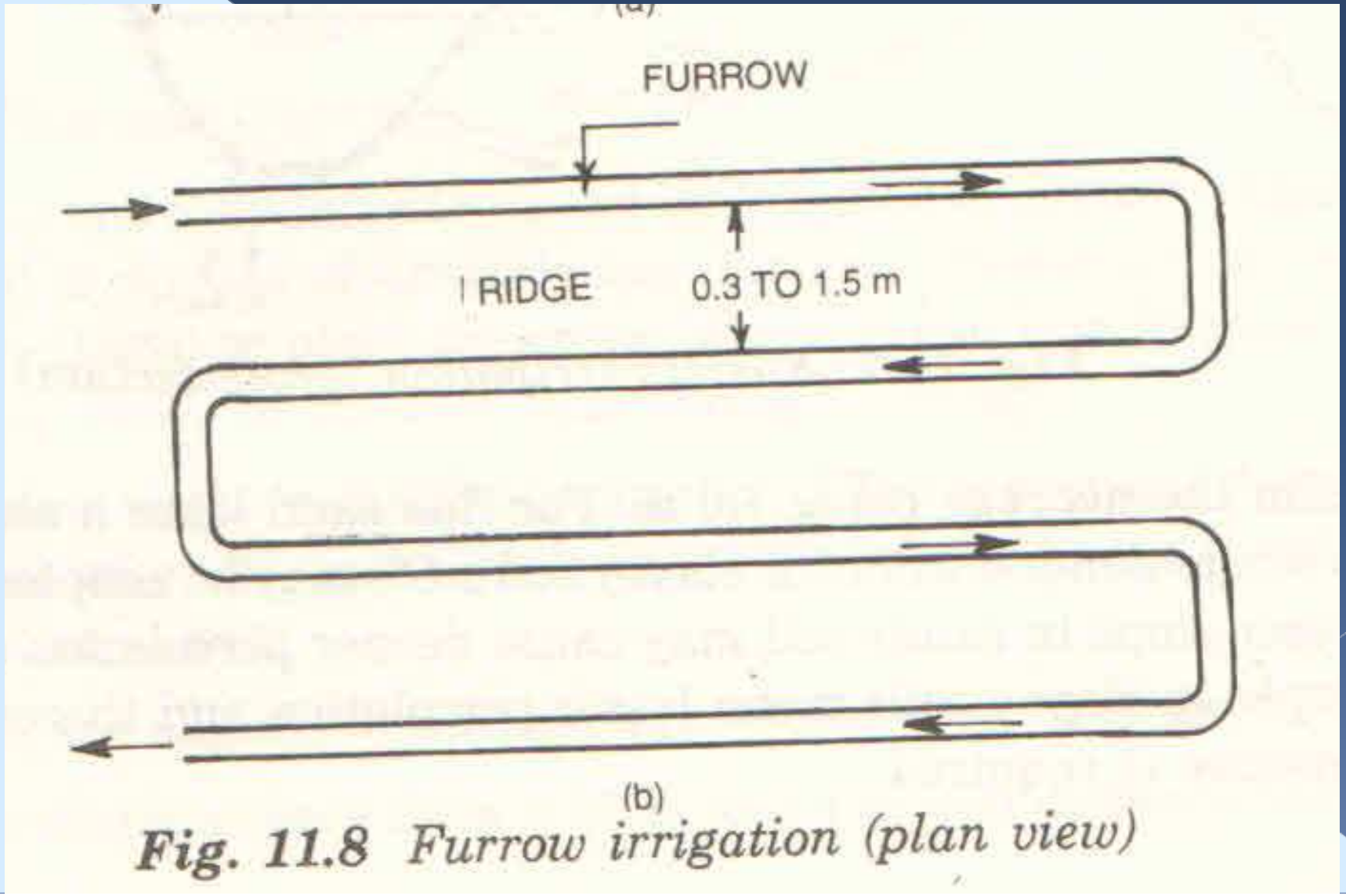


Fig. 11.8 Furrow irrigation (plan view)

Spacing of Furrows

- The range of furrow spacing is from 0.3m to 1.8m the average being 1.0m.
- For fine sand loam a slope of 0.5% is recommended.
- For clayey soil 2.5% can be adopted.

Basin Irrigation

- Basin irrigation is practiced for the individual trees in the orchards. Also small piece of flat land surrounded by checks or levees is called a basin.
- A flat land having a slope less than 0.1% and soils of low permeability, can be irrigated with basin irrigation

Basin Irrigation

Basin Irrigation

Basin Irrigation

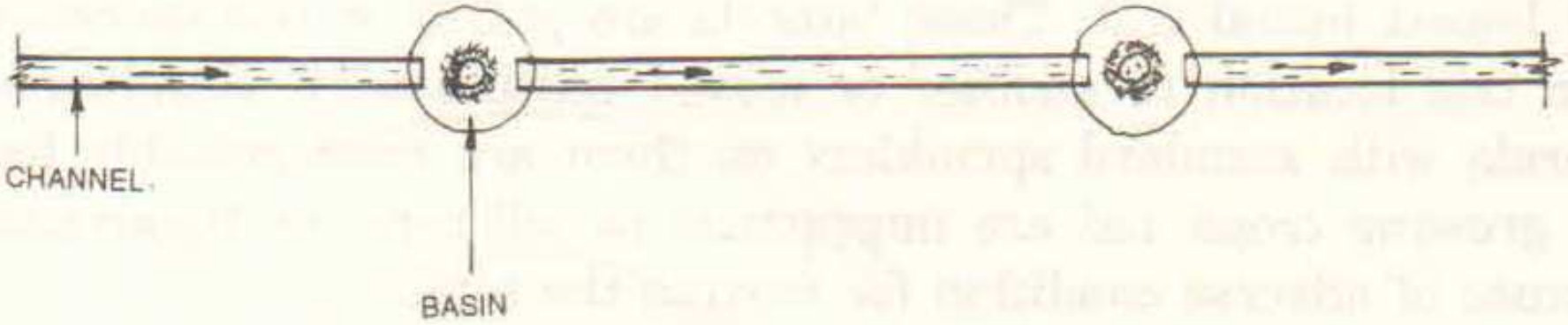


Fig. 11.9 Basin irrigation

2. Sub-Surface Irrigation

- Natural sub-surface irrigation can be practiced where the ground water table is high and water reaches the root zone by capillary action.
- However, this also deposits salts in the root zone resulting in their high concentration. This method of irrigation in Pakistan is practiced in grow salt tolerant and salt consuming grass like "kalar grass" to remedy the saline conditions.
- This system is not practiced for normal crops in Pakistan

2. Sub-Surface Irrigation

- Artificial sub-surface irrigation is very expensive as it requires laying down perforated pipes at a depth of 0.5m below the surface and 0.5m spacing.
- This can be used in such soils having higher permeability horizontally and low permeability vertically.
- The advantage is higher irrigation efficiency
- This system has been replaced by drip irrigation

Sprinkler Systems

3. Sprinkler Irrigation

- The method of applying water to the surface of the land in the form of a spray, some what like ordinary rain, is known as sprinkling.
- This method of irrigation was started about 1900. Before 1920 sprinkling was limited to truck crops, nurseries and orchards.
- It is used in damp climate regions as a supplement method of irrigation.

3. Sprinkler Irrigation

- These systems were expensive to install but often fairly inexpensive to operate.
- Portable sprinkler systems developed with the introduction of light weight materials early by 1930.
- Sprinklers have been used on all soil types. Water is spread over the soil through nozzle from the pipes that bring water under pressure.
- It may be used for sandy soil and also for steep and hilly land.

CONDITIONS FAVOURING SPRINKLER IRRIGATION

- Some of conditions which favour sprinkler irrigation are as follow:-
- 1. Soils too porous for good distribution by surface method.
- 2. Shallow soils, the topography of which prevent proper leveling for surface irrigation methods.
- 3. Land having sleep slopes and easily erodible soils.
- 4. Irrigation system too small to distribute water evidently by surface irrigation.

CONDITIONS FAVOURING SPRINKLER IRRIGATION

- 5. Undulating land too costly to level sufficiently for good surface irrigation.
- 6. Labour available for irrigation is either not experienced in surface methods of irrigation or is unreliable.
- 7. Land needs to be brought into top production quickly. Sprinkler system can be designed and installed quickly.

Sprinkler Systems

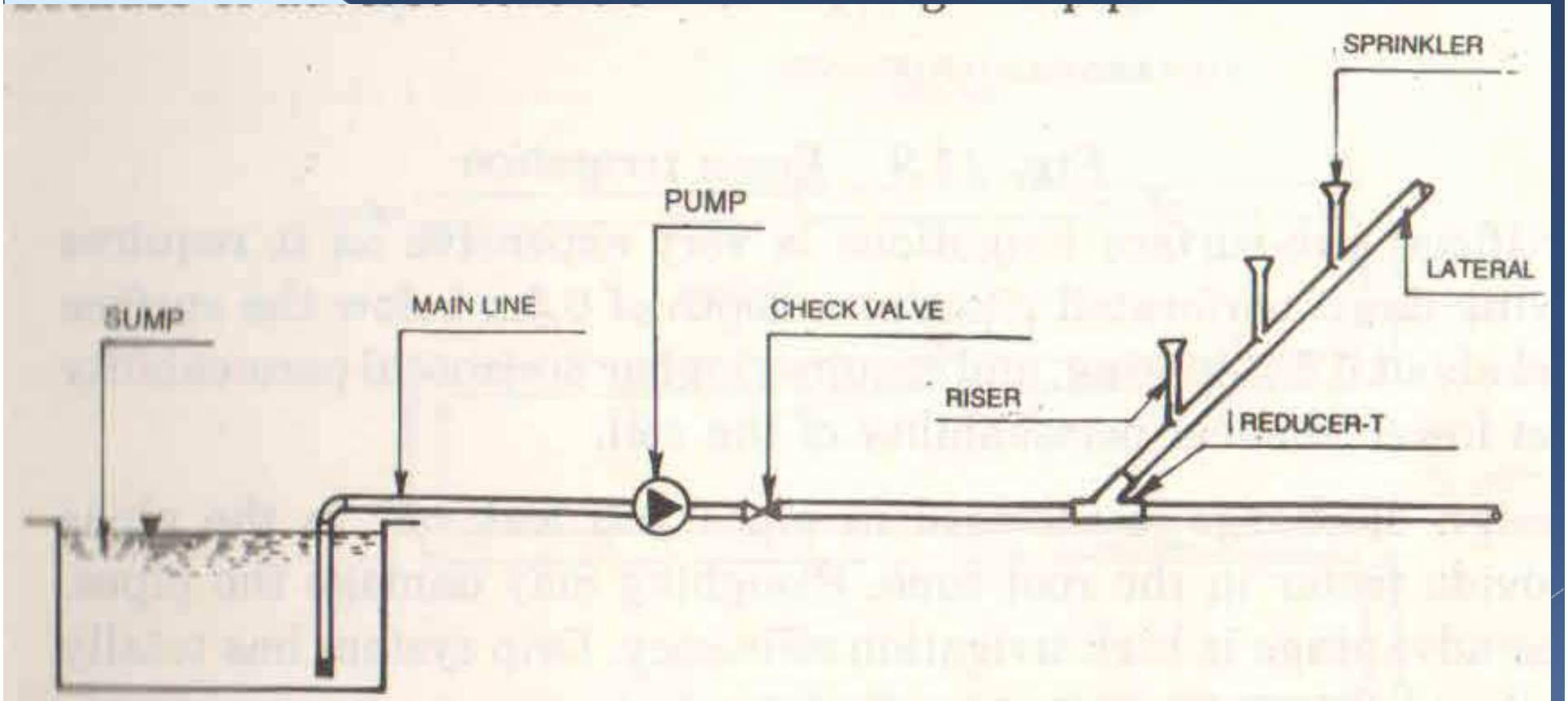


Fig. 11.10 Sprinkler irrigation solid system

Sprinkler Systems

Sprinkler Systems

Sprinkler Systems

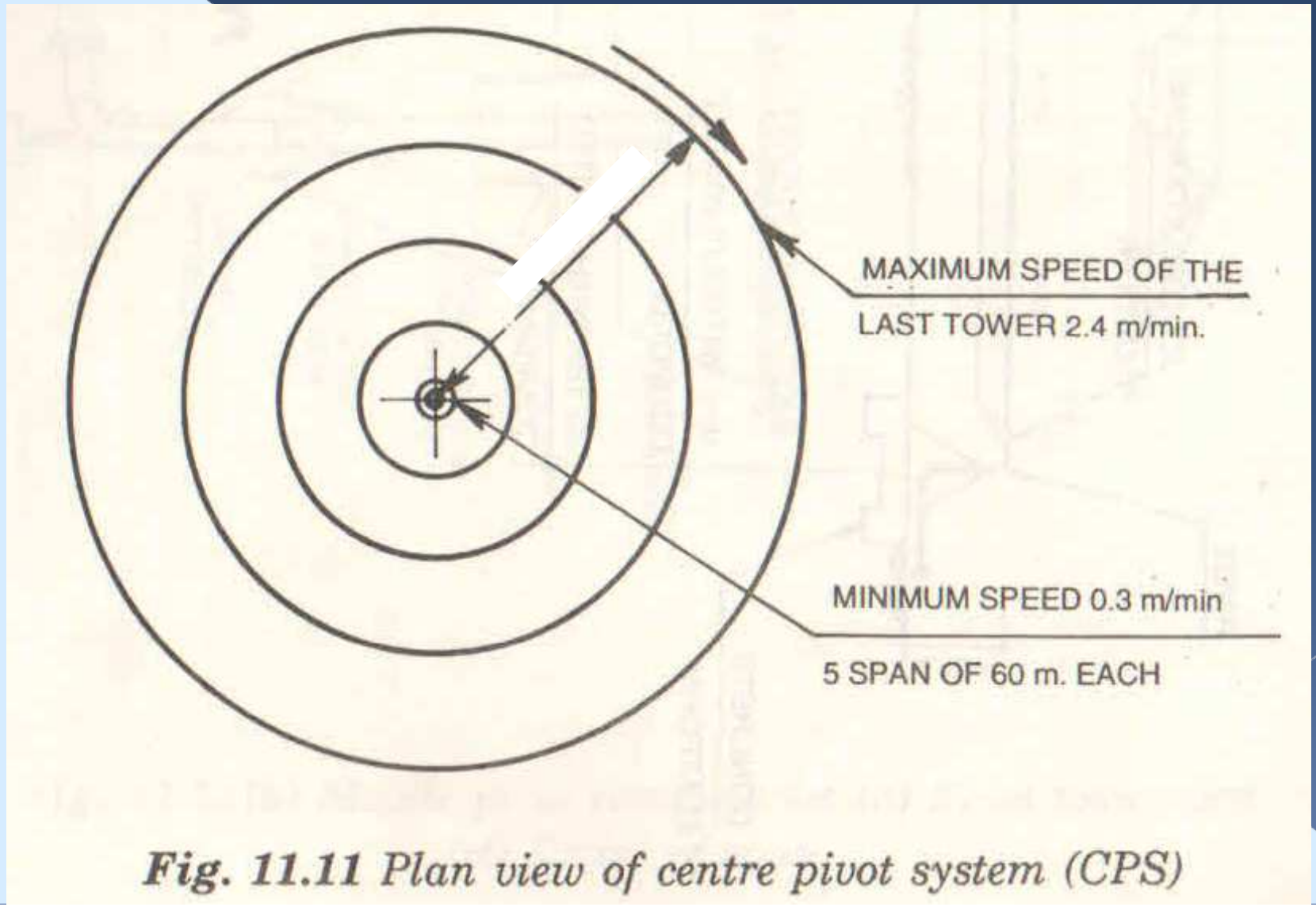
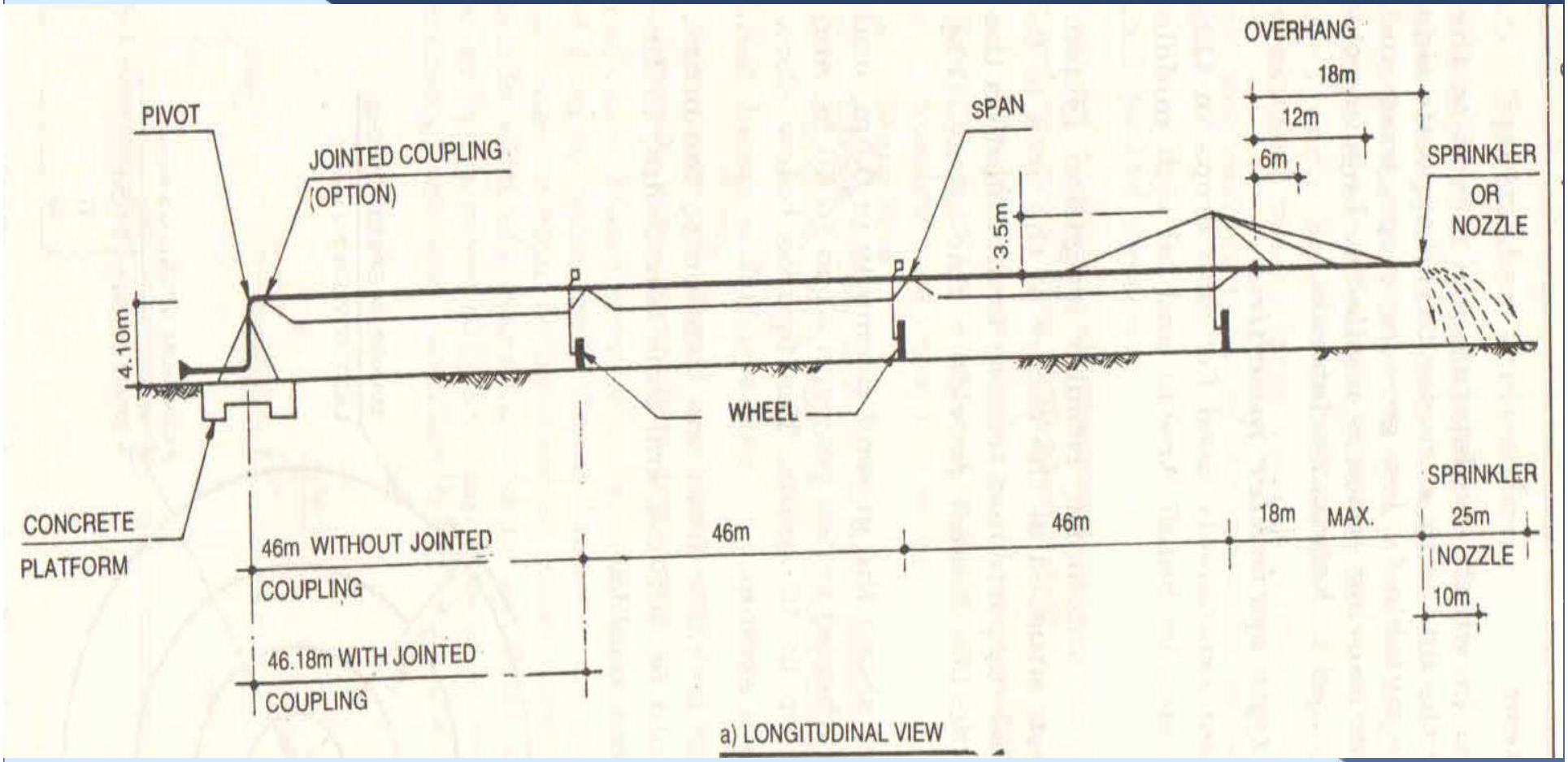


Fig. 11.11 Plan view of centre pivot system (CPS)

Sprinkler Systems

Sprinkler Systems



Comparing Sprinkler Systems to Surface Irrigation System

- The following points should also be considered when comparing sprinkler and surface methods of irrigation.
- 1. Water measurement is easier with sprinkler than with surface method.
- 2. Sprinkler system can be designed so that less interference with cultivation and other forming operation occurs and less land is taken out of production than with surface methods.

Comparing Sprinkler Systems to Surface Irrigation System

- 3. Higher water application efficiency can normally be obtained by sprinkler irrigation.
- 4. When water is already being pumped to the point of use the pressure needed for sprinkler can be obtained with a minimum of additional capital investment.
- 5. When domestic and irrigation water comes from the same source, a common distribution line can frequently be use.

Comparing Sprinkler Systems to Surface Irrigation System

- 6. For areas requiring infrequent irrigation sprinkler irrigation can be provided at a lower capital investment.
- 7. When ever water can be delivered to the field under gravity pressure, sprinkler irrigation is particularly attractive.
- 8. Frequent and small application of water can be applied readily by sprinkler system.

OTHER USES OF SPRINKLER SYSTEMS

- Sprinkler system has several secondary agriculture uses which are important in addition to the primary use for distributing irrigation water to be stored in the soil.

- 1. Frost protection

- Frost protection can be provided by sprinklers. Crops have been save in temperature as low as 20°F by sprinkler irrigation.

OTHER USES OF SPRINKLER SYSTEMS

- 2. Fertilizer application
-
- Several fertilizers and soil amendments can be applied quickly, economically, easily and effectively through sprinkler system spraying.
- Fertilizers and amendments materials can be injected into the water in several ways.

4. Drip Irrigation System

- Drip or trickle irrigation system is slow frequent, precise application of water directly to the plant through devices known as emitters.
- Emitters are placed on the soil, or just below the surface of the soil.
- This wets the ground around the plant and inspite of the fact that irrigation field gives a dry look, it is most efficient of all the irrigation systems and result in highest yield as compared to other systems.

4. Drip Irrigation System

Subsurface drip irrigation (SDI)

2. Sub-Surface Irrigation

4. Drip Irrigation System

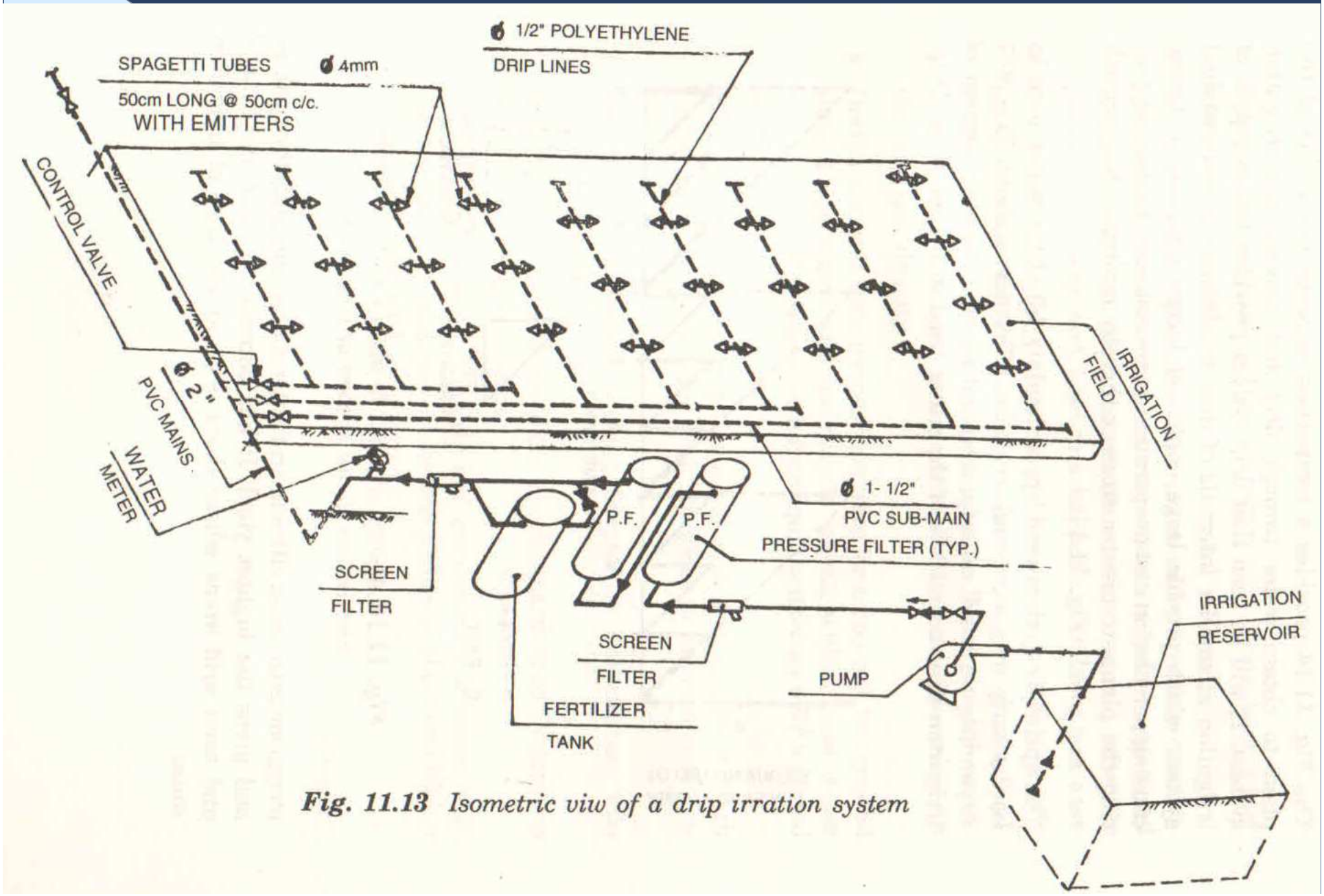
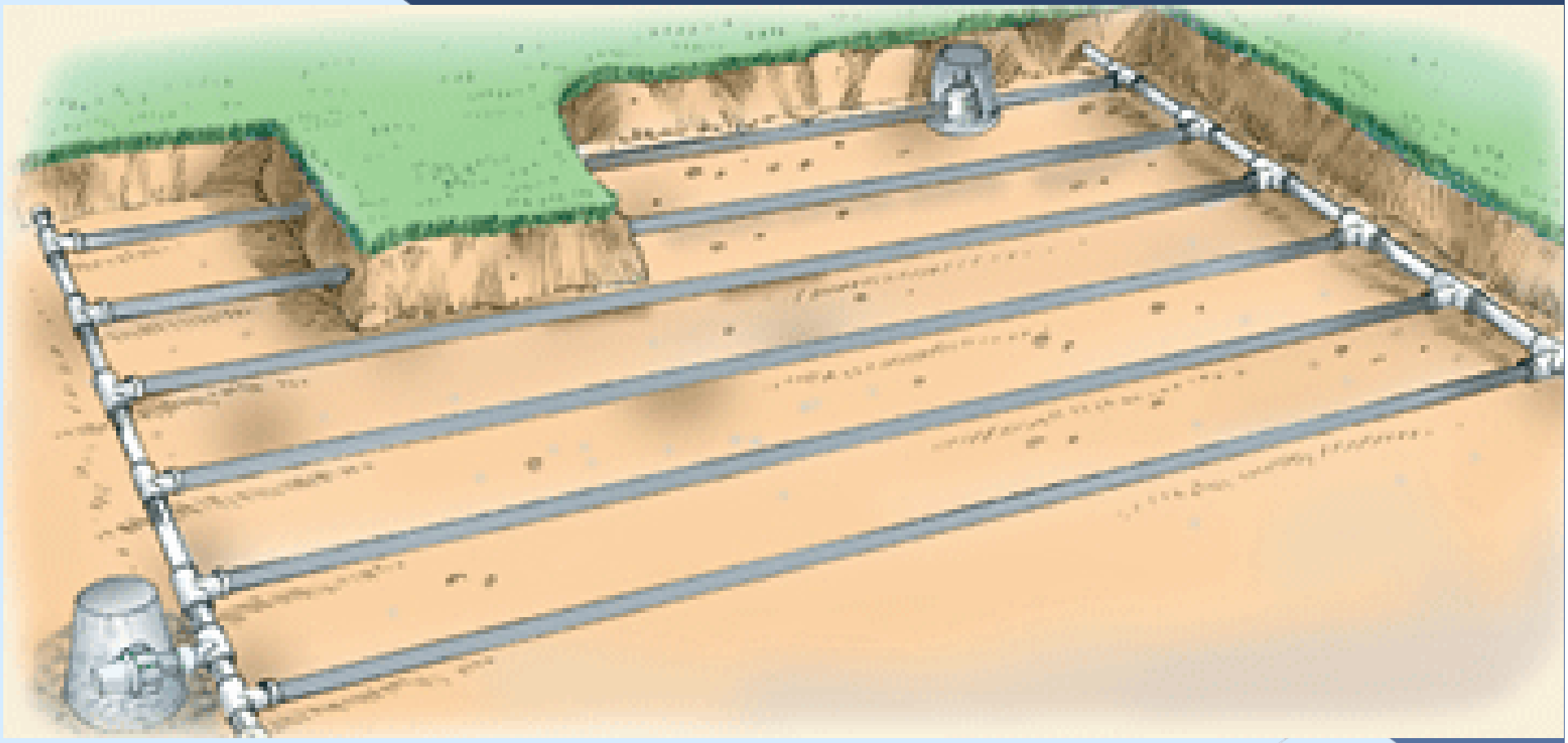
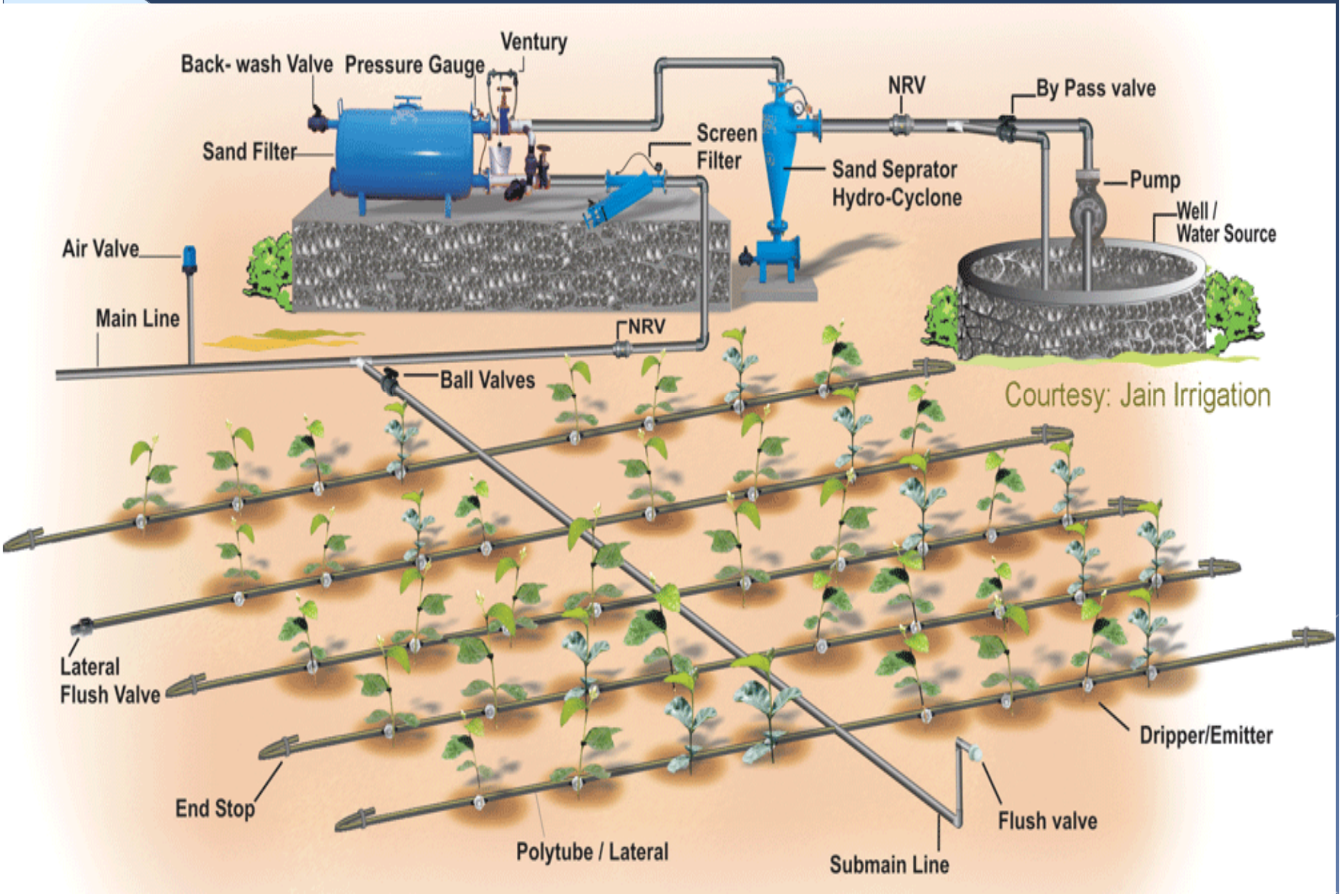


Fig. 11.13 Isometric viw of a drip irration system

2. Sub-Surface Irrigation



4. Drip Irrigation System



NOTE

- All the important details and the specifications regarding the methods and systems for irrigation should be thoroughly read by Iqbal Ali Book.