Water Resources & Water Budget of Pakistan

By:

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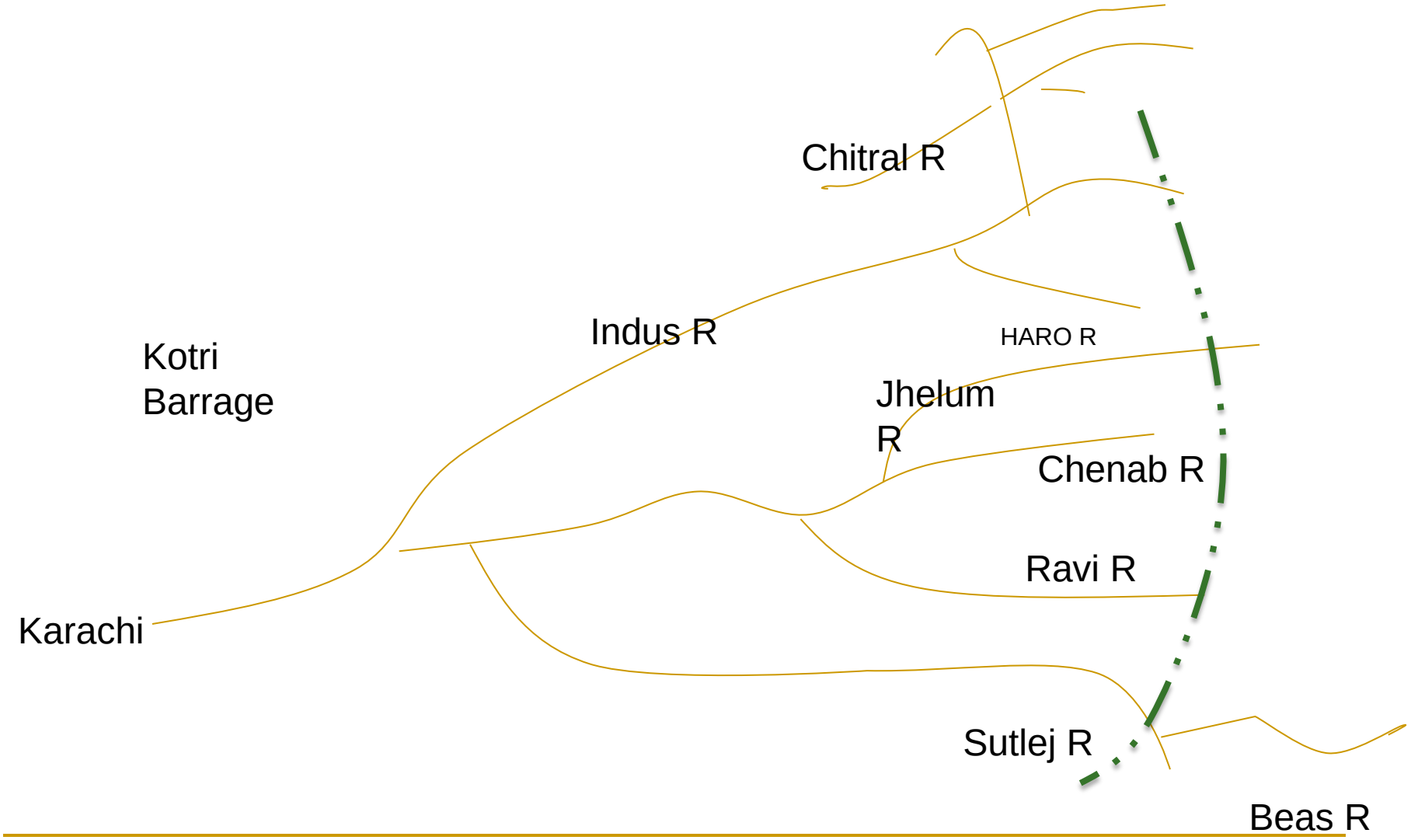
INTRODUCTION

SURFACE WATER RESOURCES

- Average volume Water received annually from rain fall in Indus plain: Annual rain fall over indus plain and Peshawar valley (80,000 sq.ft) is 40 maf.---25 maf supplied to CCA (cultivable command area). This corresponds to Avg. depth of about 9". This water is insufficient for irrigation. It is not possible for satisfactory crop production.
- Therefore, Dependency on surface & G.W is necessary.

MAJOR RIVERS OF PAKISAN



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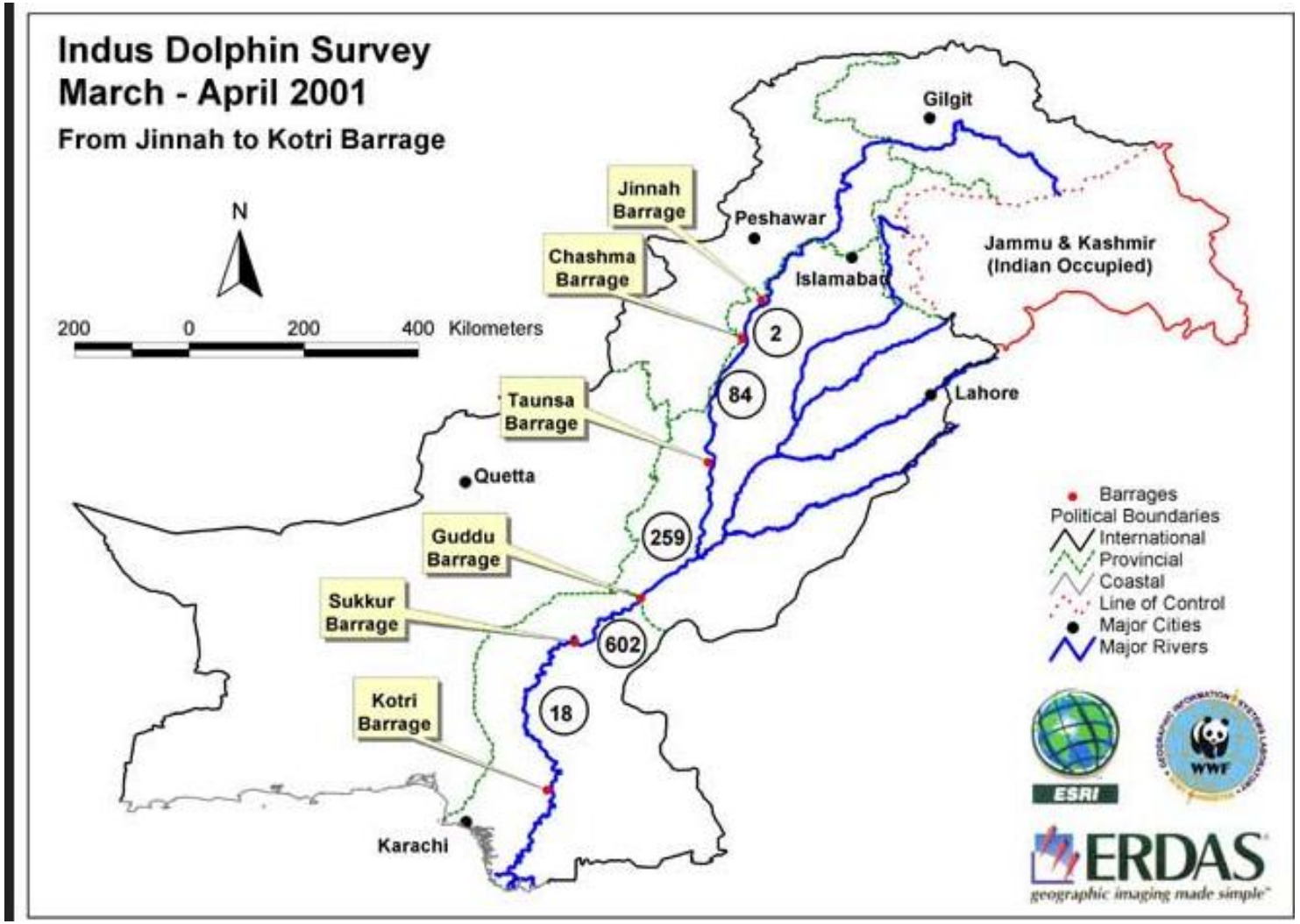


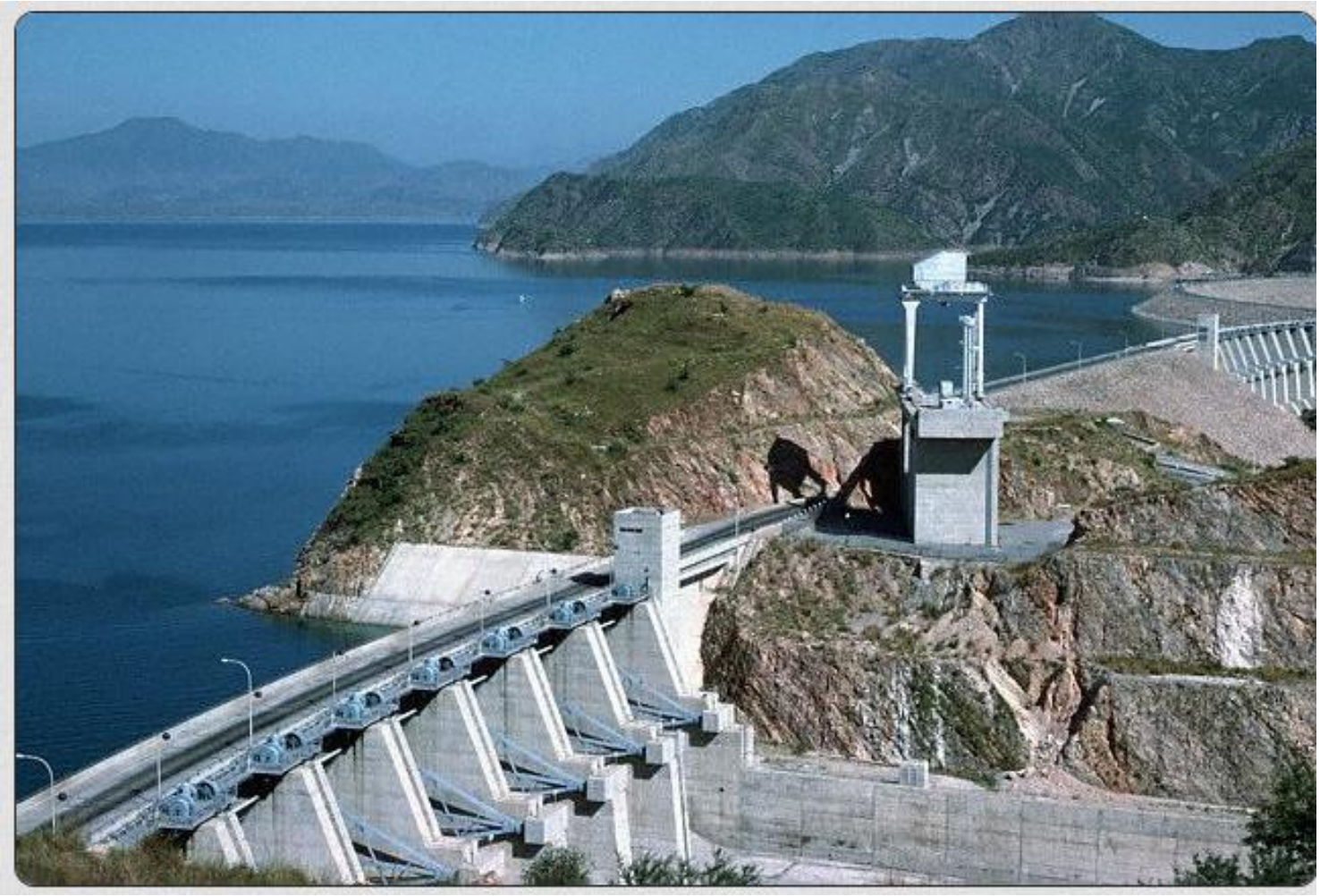
INDUS RIVER

- Eastern side of Indus; (5 rivers): Jhelum, Chenab, Ravi, Beas and Sutlej
- Kabul River-Tributaries: Swat, Punjklora,, Kunar, Kurram, Gomal, Kohat, Tai, Tank also join the right side of Indus

Annual Flow in Main Rivers

Discharge is recordable at suitable sites called rim stations
above these sides most of flow of tributaries occurs.

Tarbela Dam



Tarbela Dam, along the Indus River, rises 148 meters high and is 2743 meters in length. Completed in 1977, the embankment contains 126,151,570 cubic meters of earth and rock, the largest volume ever used in a structure of its kind. Pakistan.

Mangla Dam

Mangla Dam is the sixteenth largest dam in the world. It was constructed from 1961 to 1967 across the Jhelum River, about 67 miles (108 km) south-east of the Pakistani capital, Islamabad in Mirpur District of Azad Kashmir, Pakistan. The main structures of the dam include 4 embankment dams, 2 spillways, 5 power-cum-irrigation tunnels and a 1,000 MW power station

Mean annual flow of Indus & its tributaries

River	Rim STN	Catchments Area(sq.m)	Annual Flow MAF
Indus	Attock	65,180	93
Jhelum	Mangla	12,900	23
Chenab	Marla	11,400	26
total			142

The Average Annual Flow of 3 rivers: Indus,
jhelum Chenab (called wester rivers) as a result of Indus water treaty (1960) with India pass an overage annual flow of 142 MAF.

The flow of Ravi, Beas and Sutlej, the water rights of which has been taken over under the treaty by India is 34 maf.

the avg. annual flow of Indus at Tarbela in 67 maf the

Kabul river contributes 26 maf

which makes the total flow above Attock is 93 maf.

Total Mean Annual River Q(discharge) annum is 133 maf of this about 32 maf is discharged into sea, some is lost in evaporation and infiltration to GW reservoir.

The entire Culturable command area (CCA) of the Indus plain is 39.6 million acres.

which would require a perennial water supply of about 202 maf out of the CCA's 39.6 Million acres, only 25 million acre are being supplied with surface water , the rest classified as Culturable waste.

GROUND WATER

- In Hilly Areas
  - springs
  - Artesian wells

In Dry & Sandy Areas
- Infiltration galleries
- Underground tunnels

Intercepting ground water table (karez)

Perrenial River System
- Open wells
- Tube wells

Indus plains composed of deep alluvial deposits which from extensive G.W aquifer of 40 million acres

→Recharge before construction of canal system/=10 maf annum

→recharge after construction of canal system/=41.9 maf

GROUND WATER WITH DRAWLS

Type of tube well	Fresh ground water pumped in maf per annum
Public sector tube wells	0.6
Private tube wells	26.3
Scrap tube wells	9.4
Open wells, Persian wells outside the Indus plain	1.0
Total delivery	37.3

Definition and Necessity of Irrigation

DEF: Irrigation is defined as the science of artificial application of water in accordance with the crop requirements, throughout their growth period, for full fledged nourishment of the crop

ADVANTAGE OF IRRIGATION

1. Increase in food production
2. Optimum Benefits- optimum utilization of water yields maximum crop yield
3. Elimination of Mixed Cropping- Mixed Cropping means sowing together more crops
4. General Prosperity- Revenue returns are quite high and helps in development of country

5- Generation of Hydroelectric Power- Cheaper power generation from dams, canal falls etc.
6- domestic water supply
7- facilities of communication
8- Inland Navigation
9- Afforestation- Trees are generally grown on the banks of canals

GROUND WATER POLLUTION:

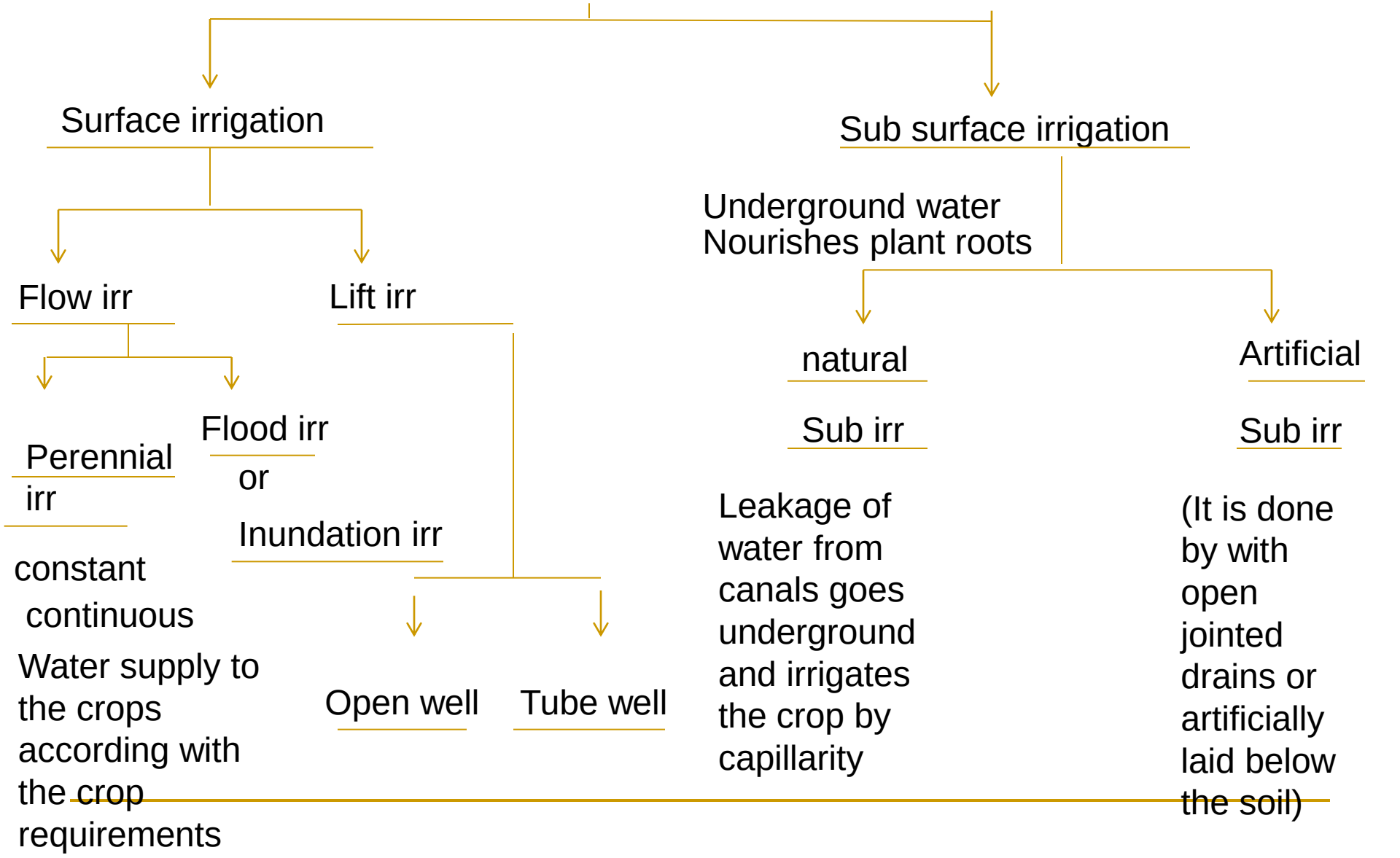
Nitrate pollution causes diseases such as Anemia.

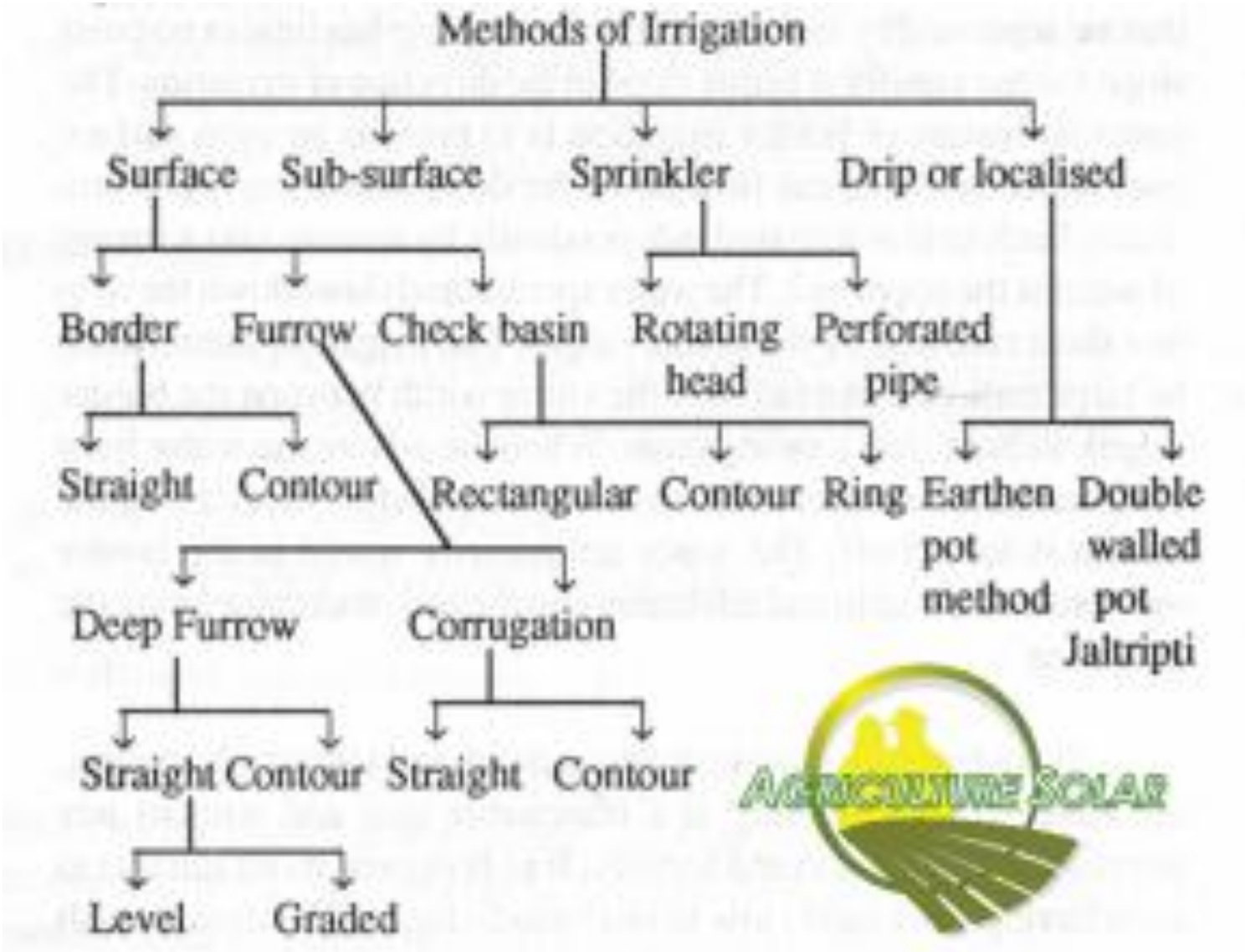
Irrigation May Result: in colder and damper climate causing outbreak of diseases like Malaria.

Over and intensive irrigation may lead to water logging and reduce crop yields

irrigation is a complex and expensive .

TYPES OF IRRIGATION:




Methods of Irrigation
Surface
Sub-surface
Sprinkler
Drip or localised
Border
Furrow
Check basin
Rotating head
Perforated pipe
Straight
Contour
Rectangular
Contour
Ring
Earthen pot method
Double walled pot Jaltripti
Deep Furrow
Corrugation
Straight
Contour
Straight
Contour
Level
Graded

Techniques of Water Distribution in the Farm

1- Free flooding
2- Border flooding
3- Check flooding
4- Basin flooding
5- Furrow irrigation method
6- Porous hose method
7- Spray method

1-Free flooding or ordinary flooding

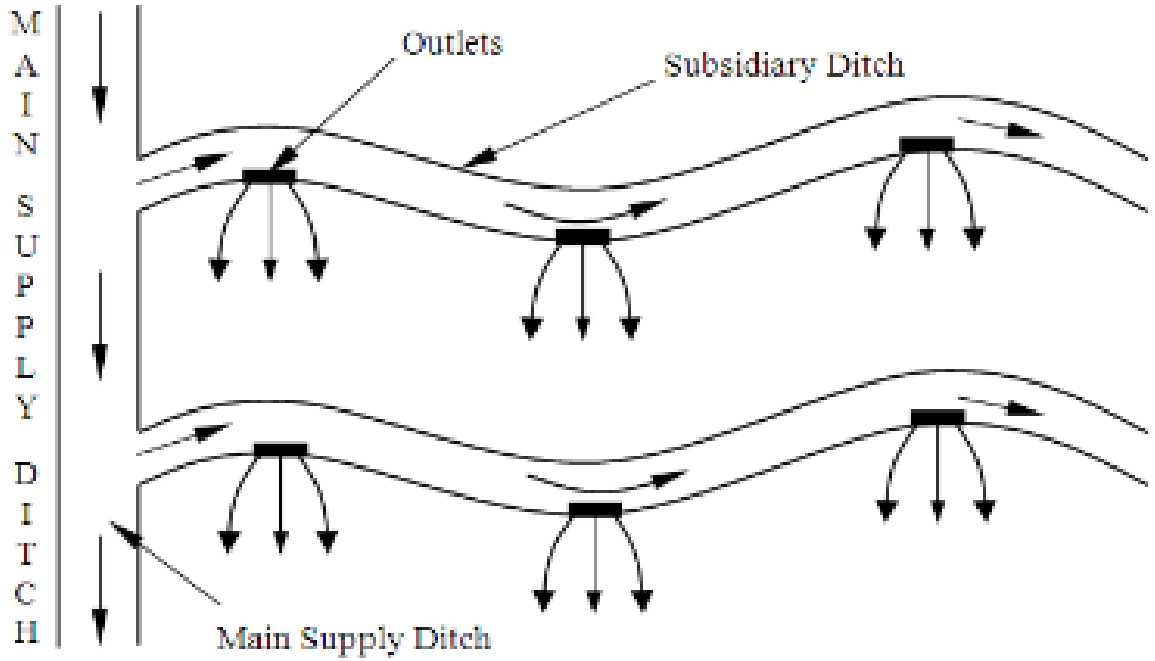


Fig: Free flooding (plan view)

Ditches excavated in the field either on the contour or up and down the slope. Water from these ditches flows across the field. Contour ditches called lateral or subsidiary ditches spaced at about 20-50 m apart depending upon slope of soil crop

1-Free flooding or ordinary flooding

2. Border Flooding

Land is divided in to number of strips, separated by low levees called borders. The land area confined in each step is of the order of 10-20m in width and 100-400 m in length. Ridges b/w borders should be sufficiently high to prevent overtopping.

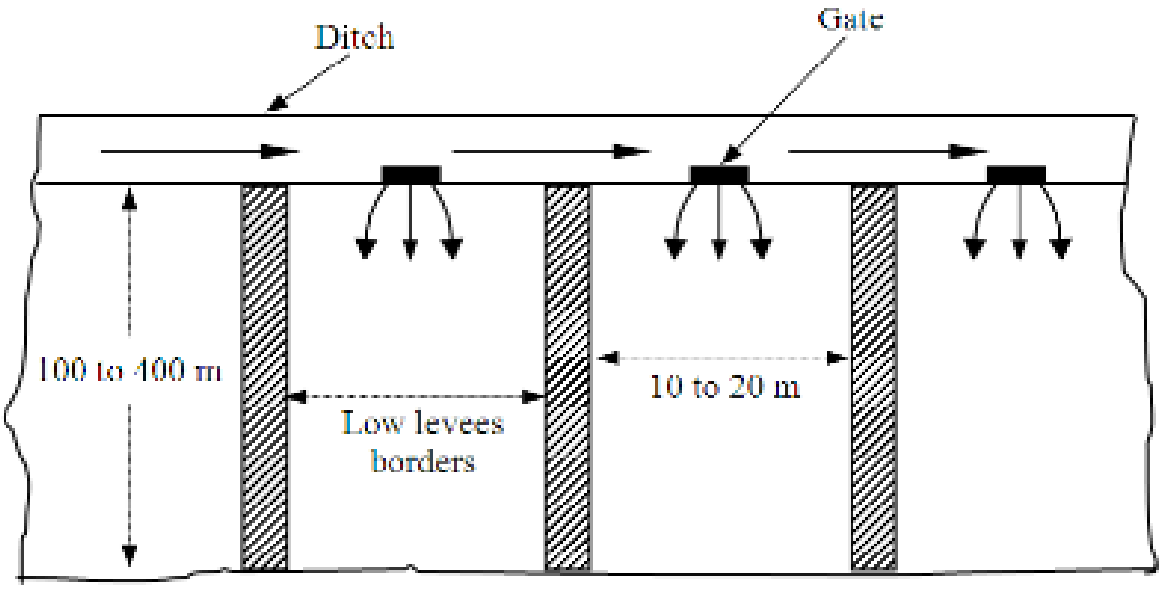


Fig: Border flooding (Plan view)

Border Flooding

3- Check Flooding

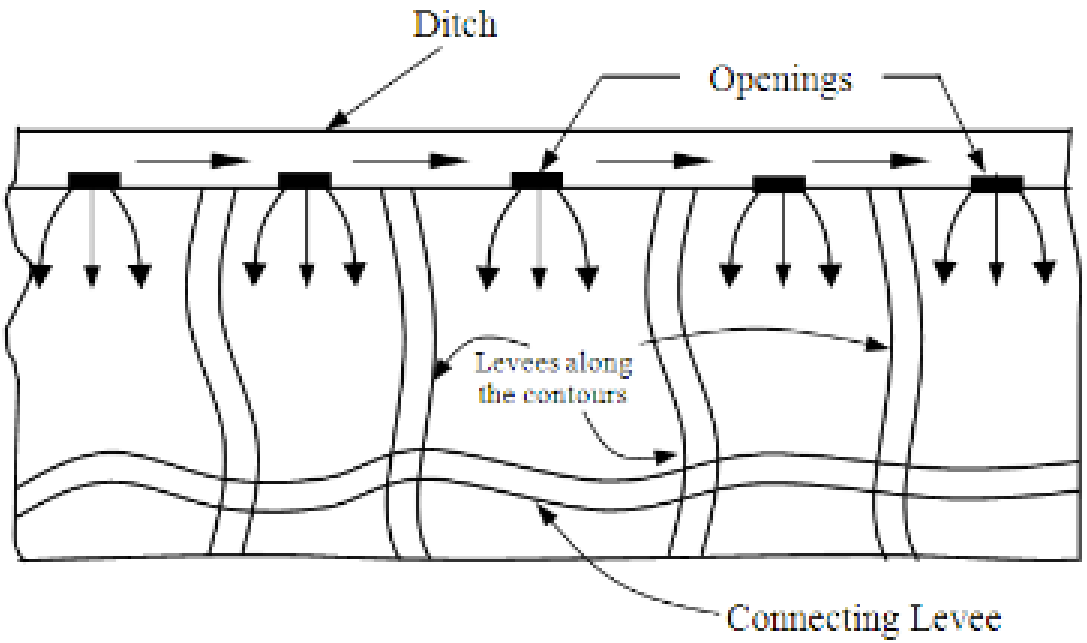
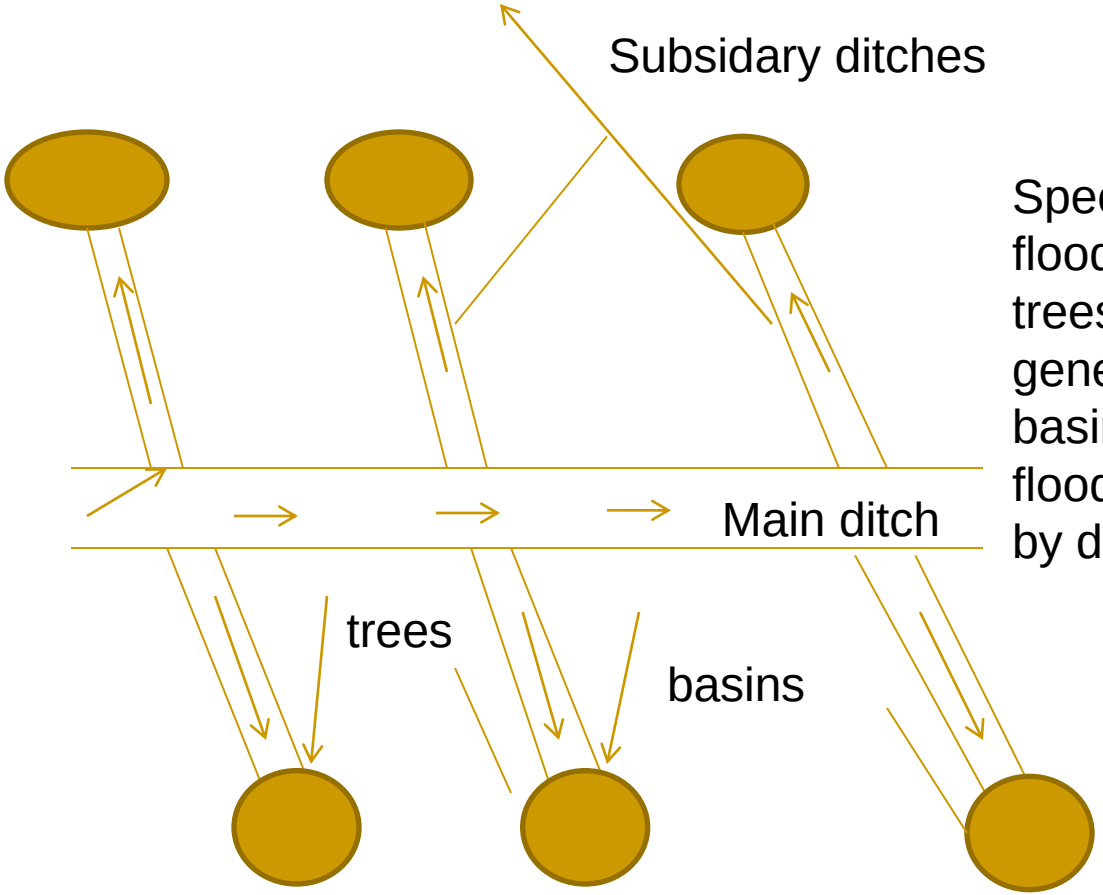


Fig: Check flooding (Plan view)

It is similar to ordinary flooding except that the water is controlled by surrounding the check area with low and flat levees are constructed along the contours having the vertical interval of about 5-10 m. These levees are connected with cross levees. The confined plot area varies from 0.2-0.8 ha. The check is filled with water at fairly high rate and allowed to stand until the water infiltrates. It is suitable for more permeable and less permeable soils.

3- Check Flooding

Basin Flooding

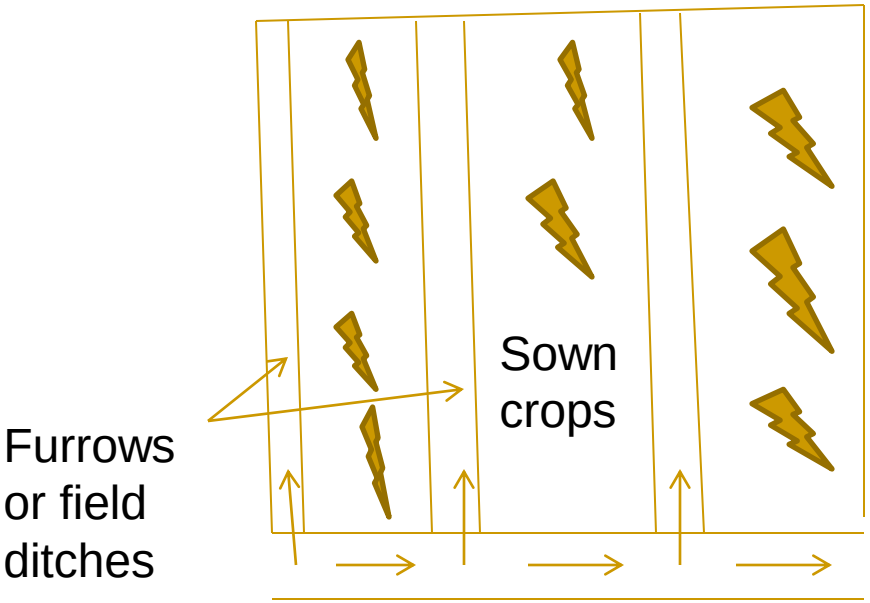


Entry of water through bank hole or by a hose syphon

Special types of check flooding for orchard trees.One or more trees are generally placed in the basin, The surface is flooded as in check method by ditch water.

Furrow Irrigation Method

In flooding method water covers the entire surface while in furrow method, only 1/5 to ½ of land surface is wetted by water. Causes less evaporation and permits sooner cultivation depth:8-30 cm length: 400m.



Entry of water through a bank or by a hose syphon

Furrow Irrigation Method

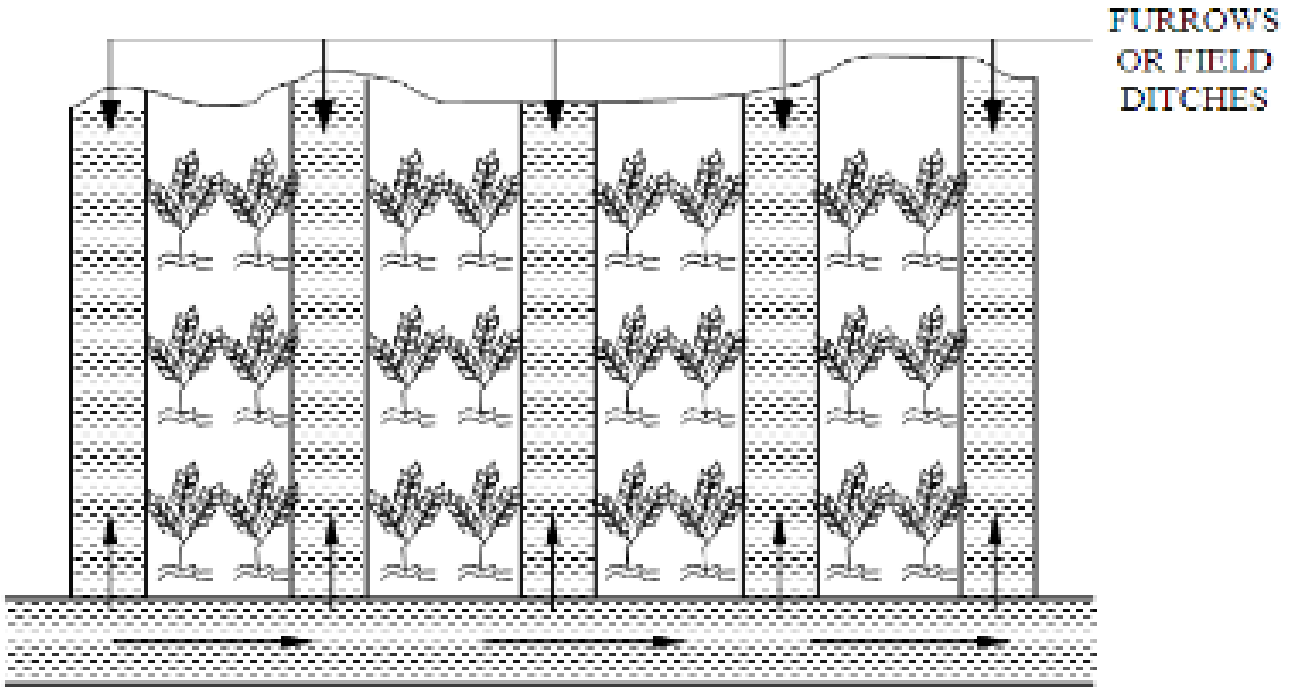
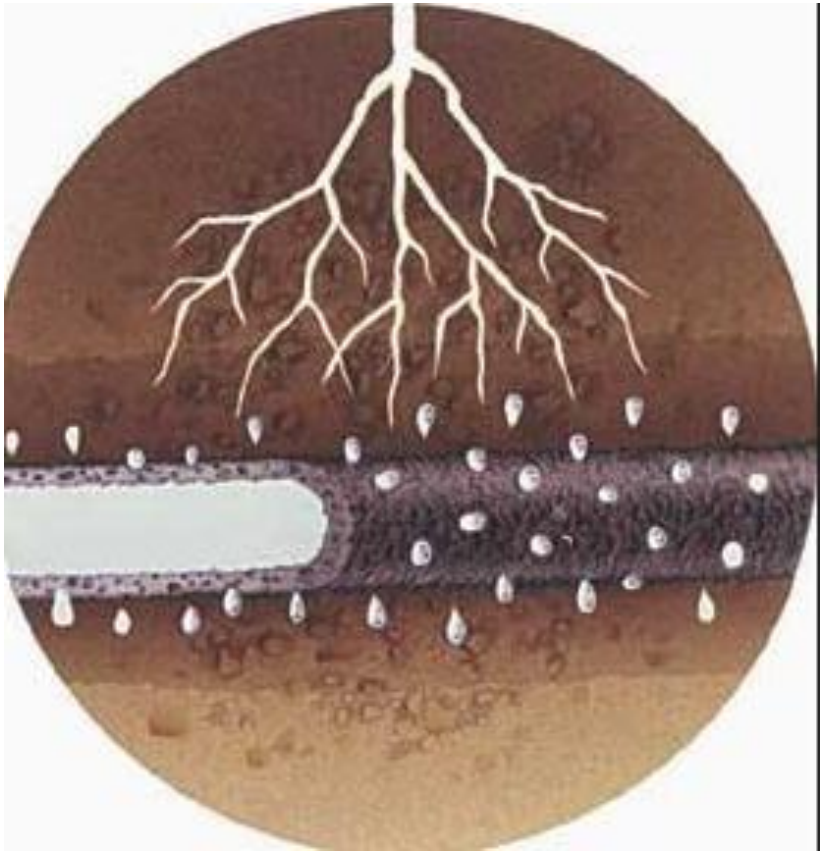


Fig: Plan view (Furrow irrigation method)

Furrow Irrigation Method

6. Porous Hose Irrigation Method (Ozo irrigation Method)

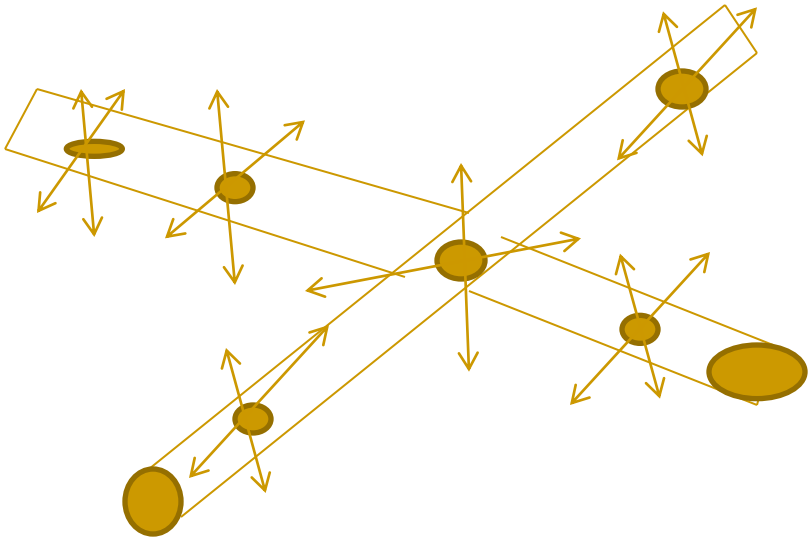
•A porous hose canvas is used for throwing water over the land.
•Water is pumped in to the hose, it oozes through the canvas walls and falls freely on the ground.
•This is used where there scarcity of water.
•It is a cheep method but the draw back is that the porous pipe lasts for a shorter life (2 – 3 years)



Porous Hose Irrigation Method

7. Spray irrigation Method

Water is applied to the soil in the form of a spray through a network of Pipes and pumps , it is a costly process and widely used in USA . It can be used for all types of soils and for different topographies and slopes. This method is used in desert areas where other types of surface or subsurface irrigation are very different.



Spray irrigation Method

Spray irrigation Method

Spray irrigation Method

Spray irrigation Method

Thank You!