SURFACE IRRIGATION:

- Surface irrigation is defined as the group of application techniques where water is applied and distributed over the soil surface by gravity.
- It is by far the most common form of irrigation throughout the world and has been practiced in many areas virtually unchanged for thousands of years.

Surface irrigation:

There are four variations under this method viz.

1. Flooding,
2. Bed or border method (Saras and flat beds
3. Basin method (ring and basin) and
4. Furrow method (rides and furrows, broad ridges or raised beds)

Flooding:

- It consist of opening a water channel in a plot or field so that water can flow freely in all directions and cover the surface of the land in a continuous sheet.
- It is the most inefficient method of irrigation as only about 20 percent of the water is actually used by plants. The rest being lost as a runoff, seepage and evaporation.
- Water distribution is very uneven and crop growth is not uniform. It is suitable for uneven land where the cost of leveling is high and where a cheap and abundant supply of water is available.
- It is unsuitable for crops that are sensitive to water logging the method suitable where broadcast crops, particularly pastures, alfalfa, peas and small grains are produced.

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Adaptations:

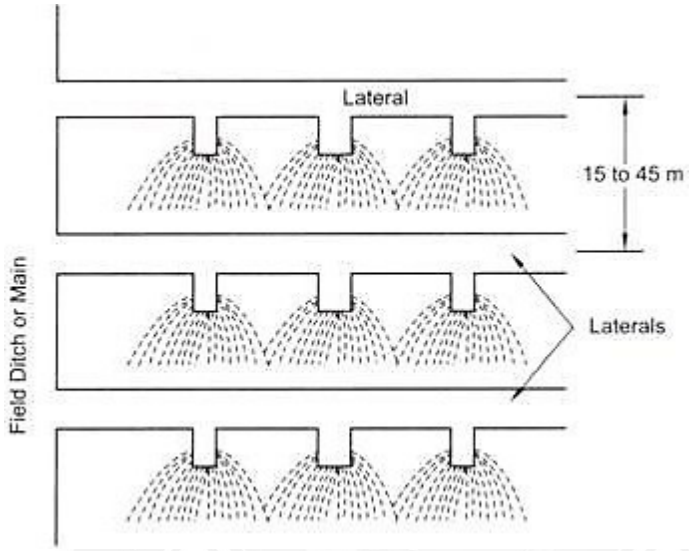
1. An abundant supply of water
2. Close growing crops
3. Soils that do not erode easily
4. Soils that is permeable
5. Irregular topography
6. Areas where water is cheap.

Advantages:

1. Can be used on shallow soils
2. Can be employed where expense of leveling is great
3. Installation and operation costs are low
4. System is not damaged by livestock and does not interfere with use of farm implements.

Disadvantages:

1. Excessive loss of water by run of and deep percolation
2. Excessive soil erosion on step land.
3. Fertilizer and FYM are eroded from the soil.


Lateral
15 to 45 m
Laterals
Field Ditch or Main

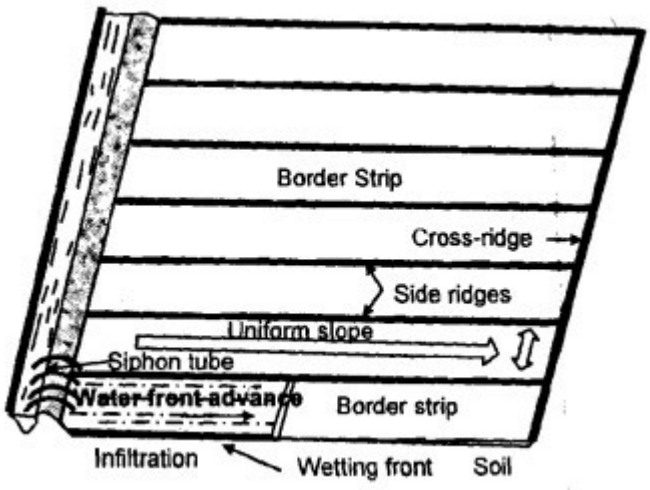
Bed or border method (Sara and Flat beds or check basin):

- In this method the field is leveled and divided into small beds surrounded by bunds of 15 to 30 cm high. Small irrigation channels are provided between two adjacent rows of beds.
- The length of the bed varies from 30 meters for loamy soils to 90 meters for clayey soils.
- The width is so adjusted as to permit the water to flow evenly and wet the land uniformly.
- For high value crops, the beds may be still smaller especially where water is costly and not very abundant.
- This method is adaptable to most soil textures except sandy soils and is suitable for high value crops. It requires leveled land.
- It is more efficient in the use of water and ensures its uniform application. It is suitable for crops plant in lines or sown by broadcast. Through the initial cost is high requires less labour and low maintenance cost.
- This may also be called a sort of sara method followed locally in Maharashtra but the saras to be formed in this method are much longer than broader.

Types of Border Irrigation

Two types of borders are formed :

- Straight Border
- These border are formed along the general slope of the field. These are preferred when fields can be levelled or be given a gentle slope economically.



Contour Border

- These are formed across the general slope of the field and are preferred when land slope exceeds the safe limits.

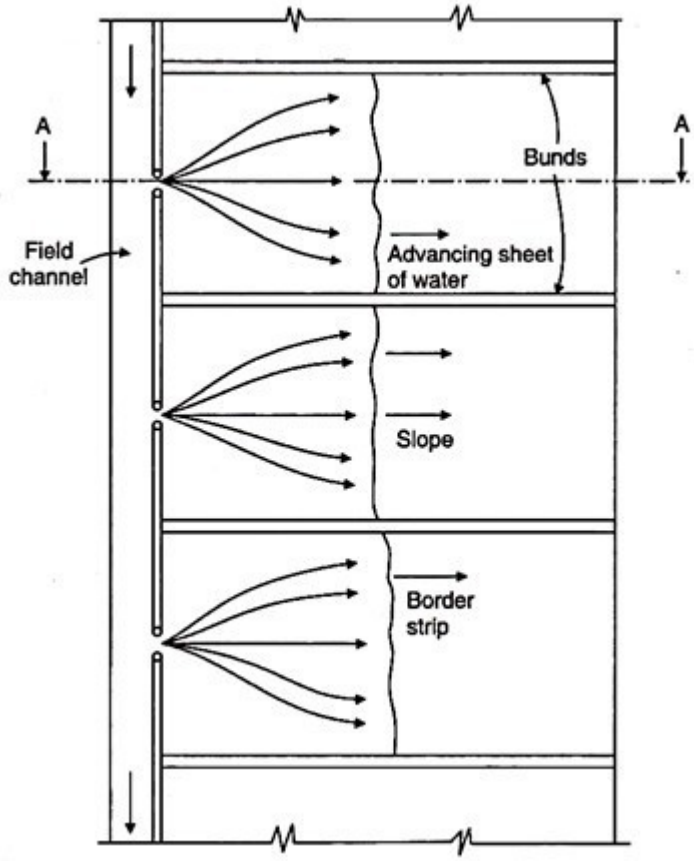
- As fields are undulating and require a lot of earth work to level, economical levelling is not possible. Design criteria for both are not different.

Adaptations:

1. A large supply of water
2. Most soil textures including sandy Loam, loams and clays
3. Soil at least 90 cm deep
4. Suitable for close growing crops.

Advantages:

1. Fairly large supply of water is needed.
2. Land must be leveled
3. Suited only to soils that do not readily disperse.
4. Drainage must be provided



Basin irrigation:

- This method is suitable for orchids and other high value crops where the size of the plot to

be irrigated is very small.

- The basin may be square, rectangular or circular shape. A variation in this method viz. ring and basin is commonly used for irrigating fruit trees.
- A small bund of 15 to 22 cm high is formed around the stump of the tree at a distance of about 30 to 60 cm to keep soil dry.
- The height of the outer bund varies depending upon the depth of water proposed to retain. Basin irrigation also requires leveled land and not suitable for all types of soil. It is also efficient in the use of water but its initial cost is high.
- There are many variations in its use, but all involve dividing the field into smaller unit areas so that each has a nearly level surface. Bunds or ridges are constructed around the areas forming basins within which the irrigation water can be controlled. Check basin types may be rectangular, contour and ring basin.

Types of Check Basins

Based on Size and Shape

The size of check basins may vary from one meters square, used for growing vegetables and other intensive cultivation, to as large as one or two hectares or more, used for growing rice under wet land conditions. While the following points need to be considered :

Rectangular

The basins are rectangular in shape when the land can be graded economically into nearly level fields.

Contour

- The ridges follow the contours of the land surface and the contour ridges are connected by cross ridges at intervals when there is rolling topography.
- The vertical interval between contour ridges usually varies fkom 6 to 12 cm in case of upland irrigated crops like wheat and 15 to 30 cm in case of low land irrigated crops like rice.

Adaptations:

1. Most soil texture
2. High value crops
3. Smooth topography.

4. High water value/ha

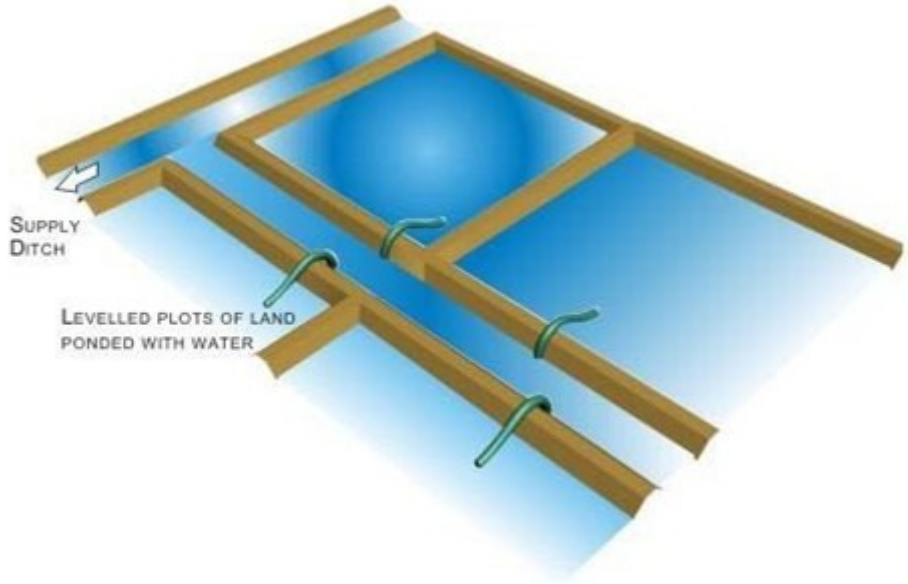
Advantages:

1. Varying supply of water

2. No water loss by run off
3. Rapid irrigation possible
4. No loss of fertilizers and organic manures
5. Satisfactory

Disadvantages:

1. If land is not leveled initial cost may be high
2. Suitable mainly for orchids, rice, jute, etc.
3. Except rice, not suitable for soils that disperse easily and readily from a crust.



Furrow Method

- In this method, irrigation water is useful for row crops. Narrow channels are dug at regular intervals. Water from the main supply is allowed to enter these small channels or furrows.
- Water from the furrows infiltrates into soil and spread laterally to saturate the root zone of the crops.
- It is suitable for row crops like potatoes, sugarcane, tobacco, maize, groundnut, cotton, jowar, etc.
- Row crops such as potatoes, cotton, sugarcane, vegetable etc. can be irrigated by furrow method. Water is allowed to flow in furrow opened in crop rows.
- It is suitable for sloppy lands where the furrows are made along contours. The length of

furrow is determined mostly by soil permeability.

- It varies from 3 to 6 meters. In sandy and clay loams, the length is shorter than in clay and clay loams. Water does not come in contact with the plant stems.
- There is a great economy in use of water. Some times, even in furrow irrigation the field is divided into beds having alternate rides and furrows. On slopes of 1 to 3 percent, furrow irrigation with straight furrows is quite successful.
- But on steeper slopes contour furrows, not only check erosion but ensure uniform water penetration.

Irrigation furrows may be classified into two general types based on their alignment. They are :

(a) straight furrows, and

(b) contour furrows.

Straight Furrows

- They are best suited to sites where the land slope does not exceed 0.75 per cent. In areas of intense rainfall, however, the furrow grade should not exceed 0.5 per cent so as to minimise the erosion hazard.
- The range in furrow slopes for efficient irrigation in different soil types are the same as those recommended for borders.

Contour Furrows

- Contour furrows carry water across a slopping field rather than the slope. Contour furrows are curved to fitthe topography of the land.
- Contour furrow method can be successfully used in nearly all irrigable soils. The limitations of straight furrow are overcome by contouring to include slopping lands. Light soils can be irrigated successfully across slopes up to 5 per cent.

Adaptations:

1. Medium and fine textured soils.
2. Variable water supply
3. Farms with only small amount of equipment.

Advantages:

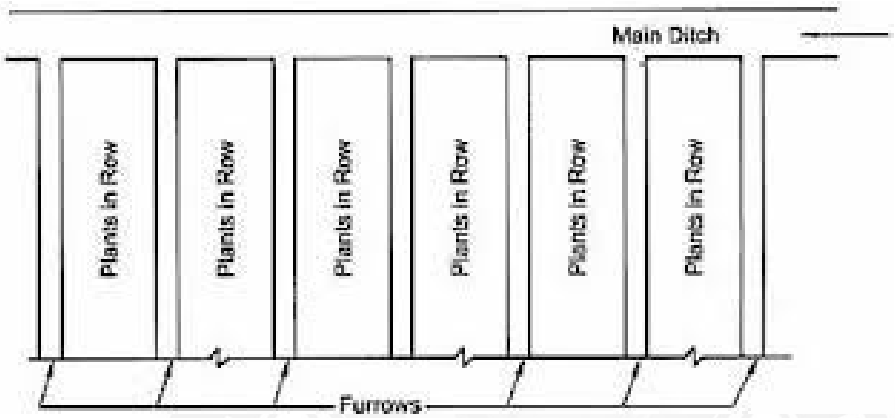
1. High water efficiency
2. Can be used in any row crop

3. Relatively easy in stall
4. Not expensive to maintain

Adapted to most soils.

Disadvantages:

1. Requirement of skilled labour is more
2. A hazard to operation of machinery
3. Drainage must be provided.



Contour farming

- Contour farming involves ploughing, planting and weeding along the contour, i.e, across the slope rather than up and down.
- Contour lines are lines that run across a (hill) slope such that the line stays at the same height and does not run uphill or downhill.
- As contour lines travel across a hillside, they will be close together on the steeper parts of the hill and further apart on the gentle parts of the slope.
- Experiments show that contour farming alone can reduce soil erosion by as much as 50% on moderate slopes.
- However, for slopes steeper than 10%, other measures should be combined with contour farming to enhance its effectiveness.

Benefits :

1. Contouring can reduce soil erosion by as much as 50% from up and down hill farming
2. By reducing sediment and run off and increasing water infiltration
3. Contouring promotes better water quality
4. It gives 10-15% additional yield.

Criteria for Surface Irrigation Method Selection

. The deciding factors for the suitability of any surface irrigation method are natural conditions (slope, soil type), type of crop, required depth of application, level of technology, previous experiences with irrigation, required labour input.

- Moreover the irrigation system for a field must be compatible with the existing farming operations, such as land preparation, cultivation, and harvesting practices.
- The following outline lists a number of factors of the environment which will have a bearing on the evaluation of irrigation system alternates and the selection of a particular system.
- Not all points will be equally significant in each case, but the outline can serve as a useful checklist to prevent overlooking important factors.

Physical Factors

- Crops and cultural practices are of prime importance while selecting an irrigation system.
- Hence, proper knowledge of agronomic practices and irrigation intervals is necessary for proper use of irrigation water and to increase water use efficiency.
- The following physical factors need to be given due consideration.

Crop Parameters

- Tolerance of the crop to soil salinity during development and maturation.
- Magnitude and temporal distribution of water necessary for maximum production.
- Economic value of crop.

Soils Parameters

- Texture and structure;infiltration rate and erosion potential;salinity and internal drainage, bearing strength.
- Sandy soils have a low water storage capacity and a high infiltration rate. Under these circumstances, sprinkler or drip irrigation are more suitable than surface irrigation. Clay soils with low infiltration rates are ideally suited to surface irrigation.
- High intake characteristicrequire higher flow rate to achieve the same uniformity and efficiency.
- Crusting of soil and its effects on infiltration
- Reclamation and salt leaching- basin irrigation
- Spatial variability

Field Topography

- Uniform, mild slopes facilitate surface irrigation.

- Location and relative elevation of water source – water diversion, pumping
- Acreage in each field
- Location of roads, natural gas lines, electricity lines, water lines and other obstructions.
- Shape of field – non rectangular shapes are more difficult to design for
- Field slope – steepness & regularity
- Furrow&borders 2-6% maximum

Climate and Weather Conditions

- Under very windy conditions, drip or surface irrigation methods are preferred.
- Scalding (the disruption of oxygen-carbon dioxide exchange between the atmosphere and the root)& the effect of water temperature on the crop at different stages of growth -risk in basin irrigation.
- Irrigation with cold water early in the spring can delay growth, whereas in the hot periods of the summer, it can cool the environment— both of which can be beneficial or detrimental in somecases.

Water Supply

The following parameters are important:

1. Source and delivery schedule
2. Water quantity available and its reliability
3. Water quality
4. Water table in case of ground water source.
5. Availability and Reliability of Electricity
6. Availability and reliability of energy for pumping of water is of muchimportance.

Economic Considerations

The following points need to be considered while selecting irrigation alternatives.

1. Capital investment required and recurring cost.
2. Credit availability and interest rate.
3. Life of irrigation system, efficiency and cost economics.

Social Considerations

- The education and skill of common farmers and labours available for handling the irrigation system
- Social understanding of handling of cooperative activities and sharing of water resources
- Legal and political considerations, local cooperation and support, availability and skill of labour and level of automatic control

Suitability and Limitations of Surface Irrigation Methods

- Some form of surface irrigation is adaptable to almost any vegetable crop. Basin and border strip irrigation have been successfully used on a wide variety of crops.
- Furrow irrigation is less well adapted to field crops if cultural practices require travel across the furrows. However, it is widely used in vegetables like potato.
- Basin and border strip irrigations flood the soil surface, and will cause some soils to form a crust, which may inhibit the sprouting of seeds.
- Surface irrigation systems perform better when soils are uniform, since the soil controls the intake of water. For basin irrigation, basin size should be appropriate for soil texture and infiltration rate.
- Basin lengths should be limited to 100 m on very coarse textured soils, but may reach 400 m on other soils. Furrow irrigation is possible with all types of soils, but extremely high or low intake rate soils require excessive labor or capital cost adjustments that are seldom economical.
- A major cost in surface irrigation is that of land grading or leveling. The cost is directly related to the volume of earth that must be moved, the area to be finished, and the length and size of farm canals.