Bachelor of Biosystems Technology
Faculty of Technology
South Eastern University of Sri Lanka

BSE 11042 Principles of Irrigation

Furrow Irrigation

Running water in small channels (furrows)
Water infiltration from bottom and sides
Water diverted to furrow from open ditches or pipes
Siphons
Gated pipes
Multiple outlet rises

Suitable Crops:

Row crops, orchards and vineyards
Small furrows or corrugations - grains, pasture

- Optimum length of furrows determined by intake rate &stream size
- Corrugation - available stream is small
  - lands with uneven topography

Furrow Types:

1. Level Furrow:
- Level lengthwise / dike at end to pond water & minimize tail end losses.
- Large stream sizes desired to achieve high uniformity.
- Suited for fine textured, very slowly permeable soils on relatively flat land

2. Contour Furrow:
- Curved to fit topography of field
- Have gentle slope along length
- Fields up to 15 % slope can be irrigated

3. Graded Furrow:
- Straight channels down the prevailing slope
- Land smoothing required
- Low efficiency, erosion, poor uniformity could be seen when slope is more than 2 % or in loose textured soil.

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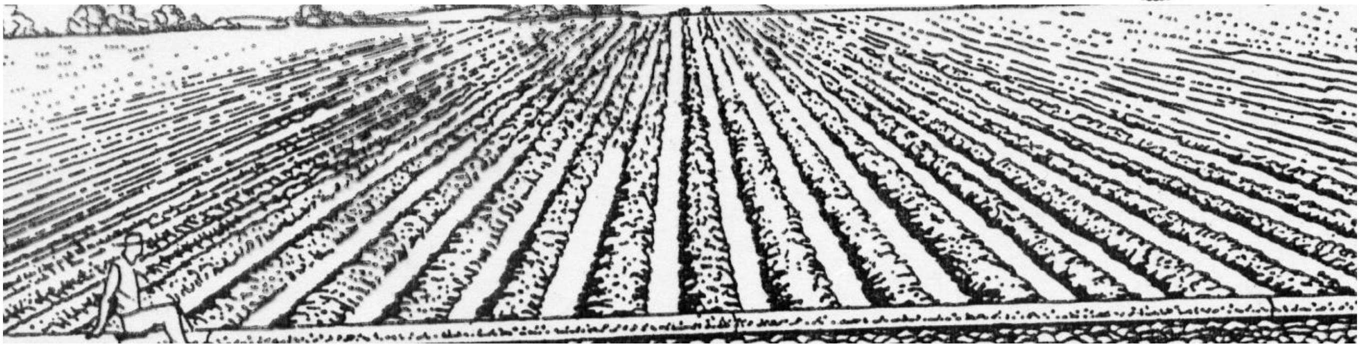
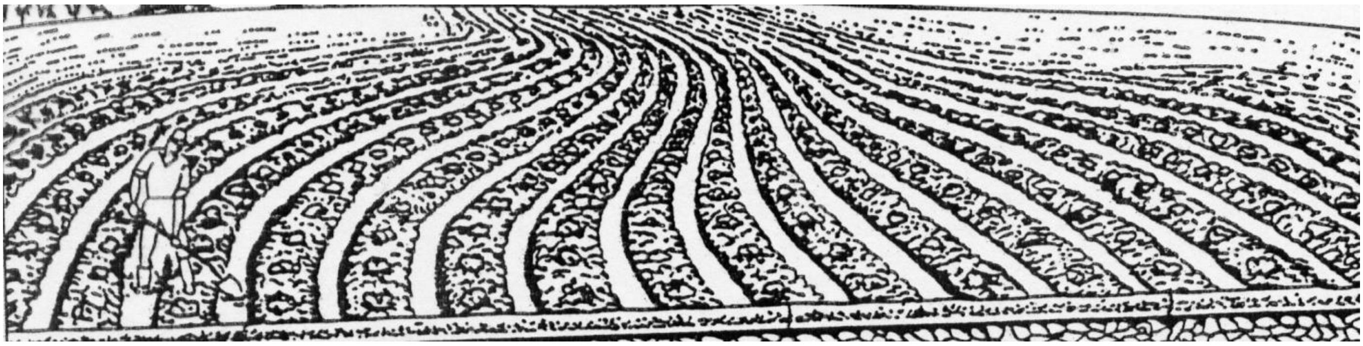
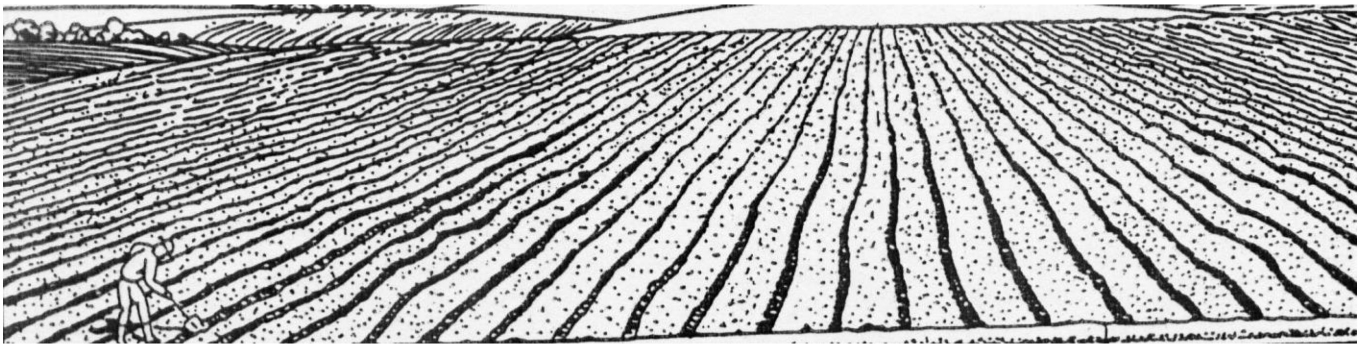


Graded or level furrow



Contour furrow



Corrugated form of a furrow

Furrow layout designing needs;

1. Shape & spacing of furrow

- ❖ Height of ridge & land slope determine water carrying capacity
  (Too low ridges overtop, too high ridges require large volume of water)
- ❖ High ridges - high rainfall areas - Flooding prevention and use of rainwater.
- ❖ Spacing depend on optimum spacing

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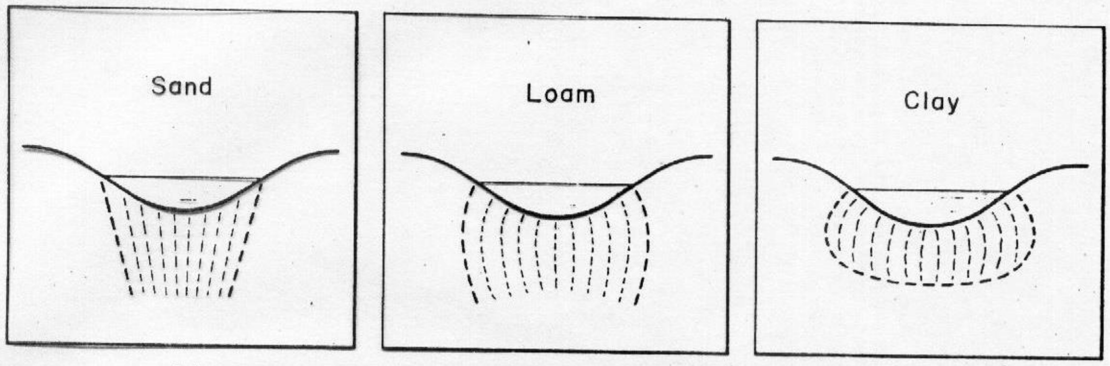
- Sandy soils - closer furrows than in clay soils
  Ridge size 0.15 m – 0.4 m
  Furrow spacing 0.3m - 1.8m
- Larger the slopes broader the furrows
- Shape - on soil stability.



Wetting patterns in furrows of differing soil types

2. Selection of advance furrow stream

- Non erosive flow should be used

  $Q_{max} = 0.6 / S$ in L/s (S is % slope)

3. Selection of main irrigation stream

- Large number of cut backs used to reduce tail end runoff
- 1 or 2 cut back desired
- Achieved by removing 1 or 2 siphon or regulating orifice opening

4. Slope of the field

Erosion problem during rainfall - so slope could be limited.

Soil type	Maximum slope %
Sand	0.25
Sandy loam	0.40
Fine sandy loam	0.50
Clay	2.50
Loam	6.25

To prevent deep percolation losses – Slopes in sandy soils should be greater than clays.

5. Furrow length

Deep percolation losses influence the length

Have to determine by field test
Rough guides – use tabulated values

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Stream should reach end of furrow within a time T/4 (T - time required to infiltrate required depth D)

Average depth of water applied during irrigation

$$d = \frac{360\,q\,t}{WL}$$

d – average depth (cm)
q – Flow (L/s)
t – duration of irrigation (h)
W – furrow spacing (m)
L – furrow length (m)

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Advantages of furrows

1. Suitable for crops that are subjected to injury if water covers crown or stem
2. With runoff return systems, furrows can be a highly uniform and efficient method.
3. Provide better on-farm water management capabilities.
4. Provide operational flexibility to achieve high efficiency
5. A smaller wetted area can reduce evaporative losses on widely spaced crops.
6. Low capital cost
7. Less wastage of land on field ditches
8. Provides good field drainage
9. No crust formation
10. Allows irrigation on sloping land
11. no partial submergence
12. Wets half to one third of land surface

Disadvantages of furrows

1. High labour requirements (greater than other surface methods)
2. Experience needed to divert water to furrows
3. Mismanagement can severely degrade system performance
4. Potential salinity hazards between furrows
5. Greater possibility of tail water runoff (when end dikes are not used)
6. Limited machine movement across field.
7. Need one extra tillage practices (furrow making)
8. Increased erosion potential
9. More difficult to automate
10. Poor lateral water spreading in sandy soils
11. Land leveling needed for uniform furrow slope

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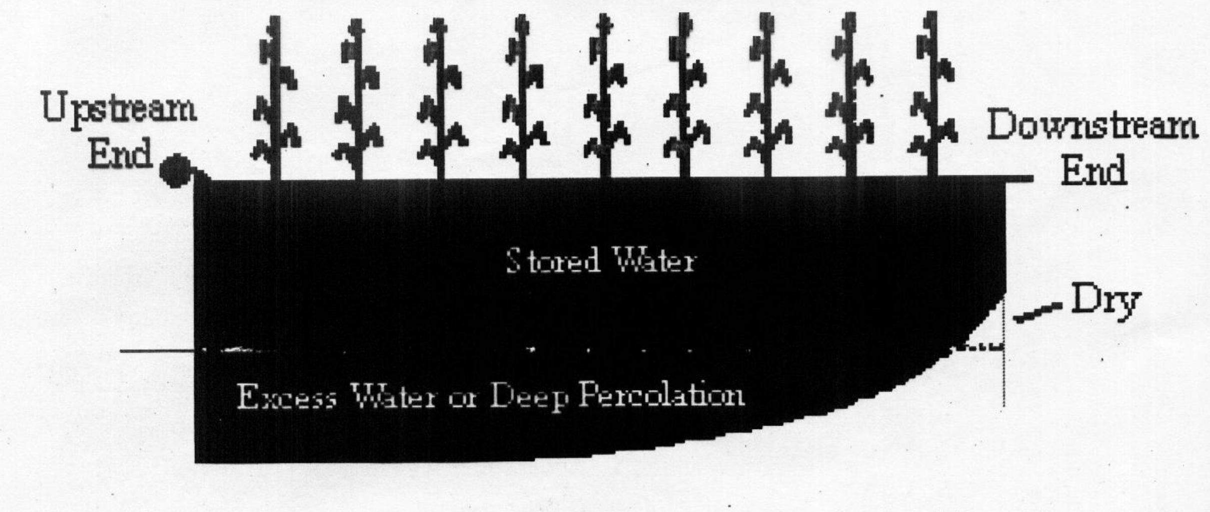
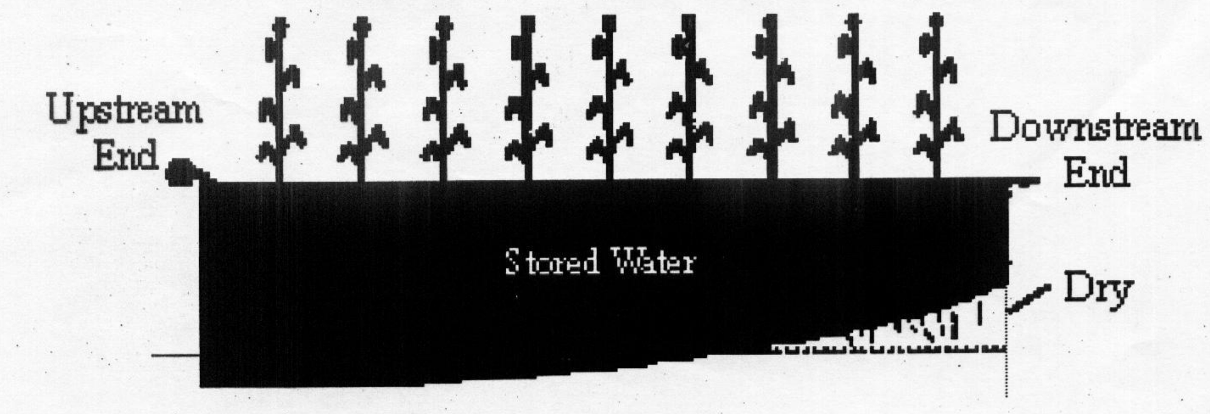


1a. Poor uniformity - adjust stream size and set time.



1b. Ideal infiltration pattern.

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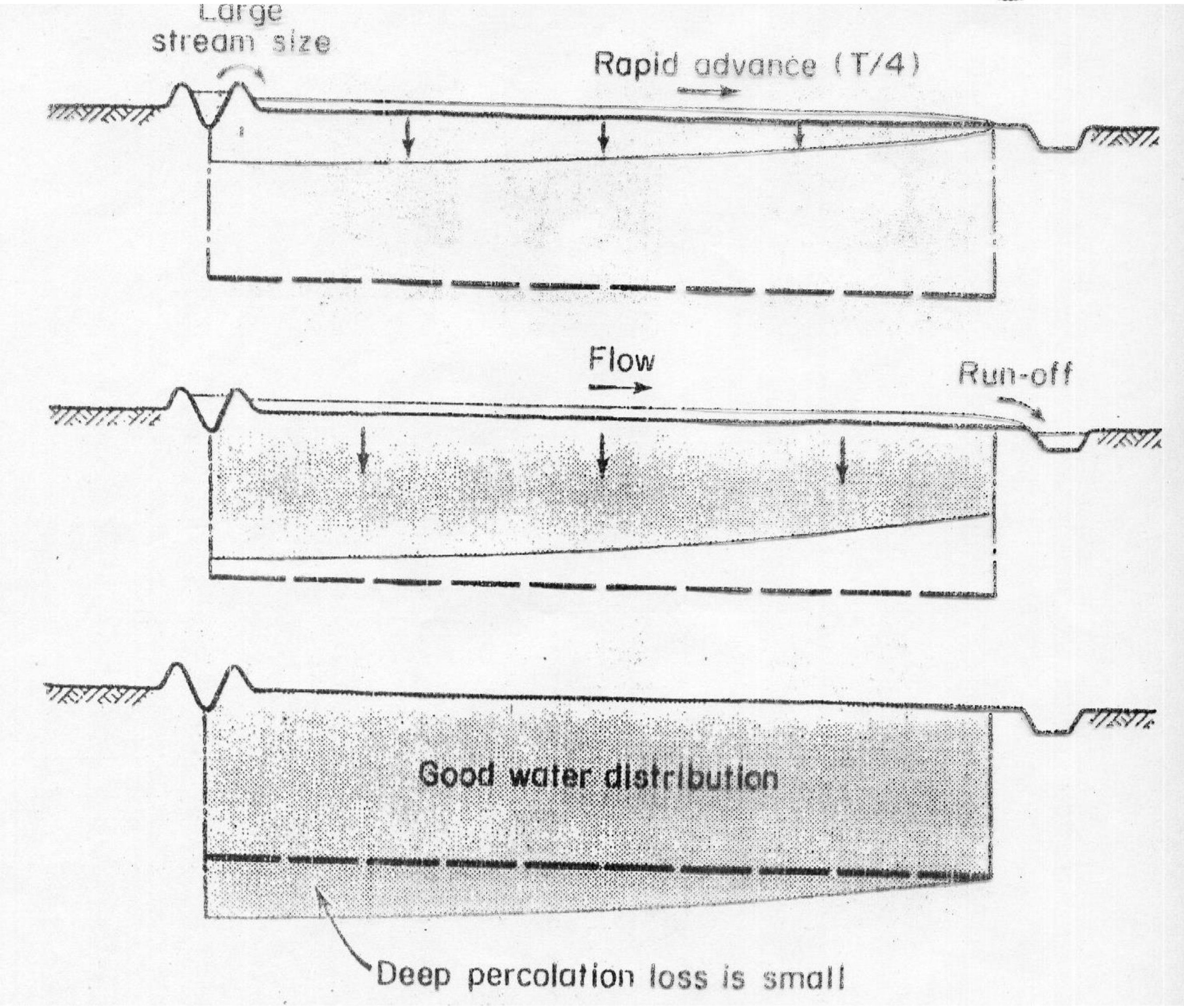

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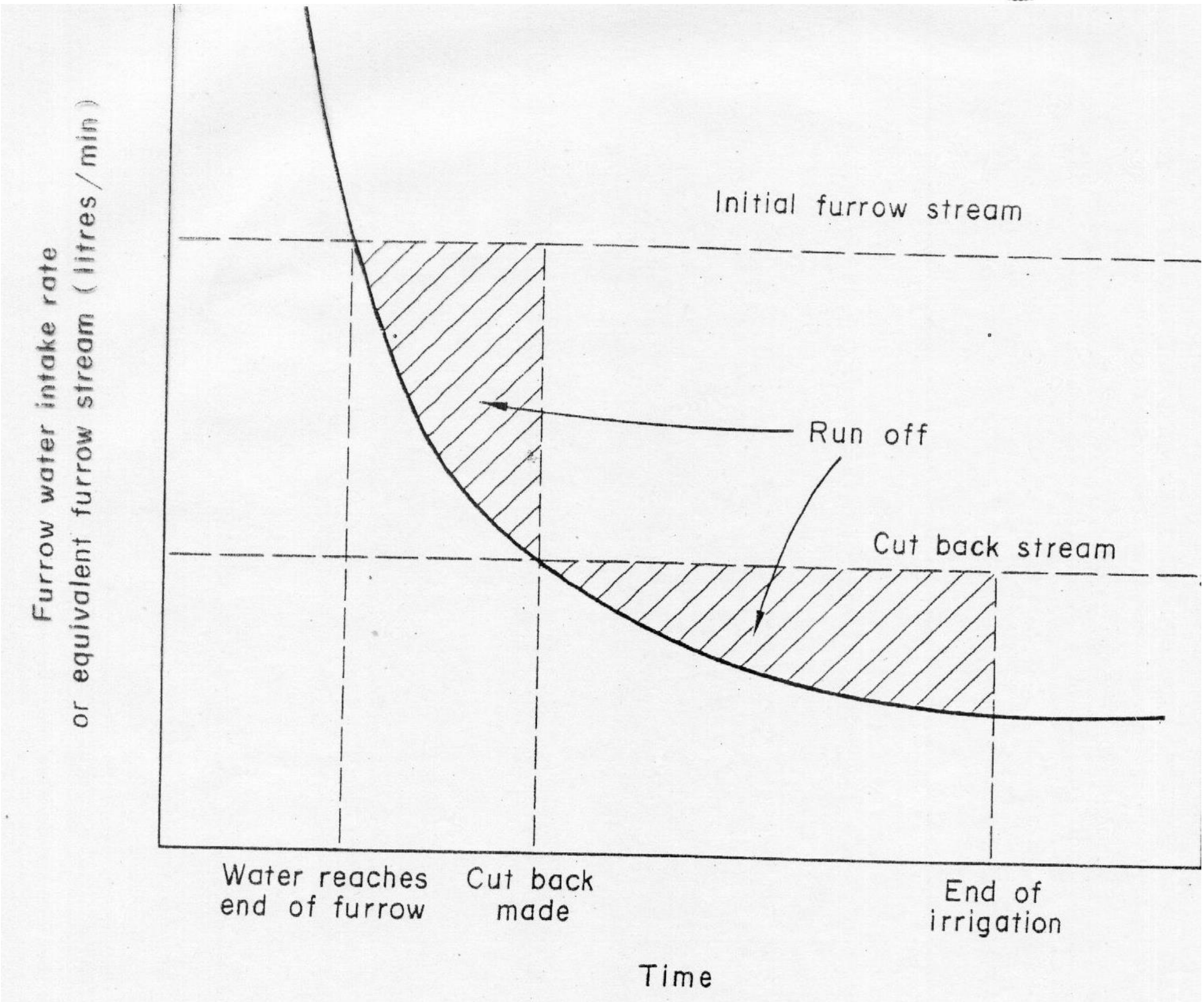

Discharge into a furrow with cut-back stream

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