

WRE 451: Hydrology, Irrigation and Flood Management

3.00 Credit, 3 hrs/week

Definition of irrigation:

- Is the artificial means of supplying water to plants for its growth and maturity.

Necessity of Irrigation:

in context of BP.

1. Rainfall < Demand of plant (water requirement for plants)
2. Rainfall is sufficient but distribution (spatial) is not as per requirement
3. Rainfall is sufficient, spatial distribution is also good but temporal distribution is not as per requirement
4. Advanced scientific development:

HYV:

- fertilizer must
- Irrigation must
- Insecticide must.

JII

Objectives of the irrigation:

- i) Ensure enough moisture essential for plant growth.
- ii) Provide crop insurance against short duration drought.
- iii) Cool the soil & atmosphere to provide a suitable surrounding.
- iv) Wash out/dilute harmful salts, chemical in the soil.
- v) Reduce hazards of soil piping.
- vi) Soften the tillage pan.

*crop
cool
dilute*

*Wash harmful salt
Reduce soil piping
Soften tillage pan*

12-13 Advantage of irrigation:

Direct Benefits:

- (1) Increase food production
 - Multiple cropping
 - Growing high yielding varieties
 - Timely agricultural operation
 - Control of weed.
- (2) Modify soils or climatic environment - leaching
- (3) Lessen risk of catastrophic caused by drought.
- (4) Increase income/national cash flow
- (5) Increase labour employment
- (6) Increase standard of living
- (7) Increase value of land
- (8) Domestic & Industrial water supply.
- (9) Improve communication & navigation facilities
- (10) Improvement in the ground water storage
- (11) Development of recreation facilities
- (12) Improve fish culture.

Disadvantages of irrigation:

- 1) Rise of water table
- 2) water logging
- 3) Impaired soil aeration
- 4) Restricted root system
- 5) Toxicity of nutrients:
- 6) Soil erosion
- 7) Production of harmful gases:

domestic & in
food produce
fish culture

Irrigation as a subset of production systems and the environment:

One can not simply start irrigation without also improving other production inputs (which may also be limiting crop production)

Inputs:

- Fertilizers
- Labour availability
- Markets of produce
- Pest control
- Cultivation equipment
- Drainage

Yield-water application interaction:

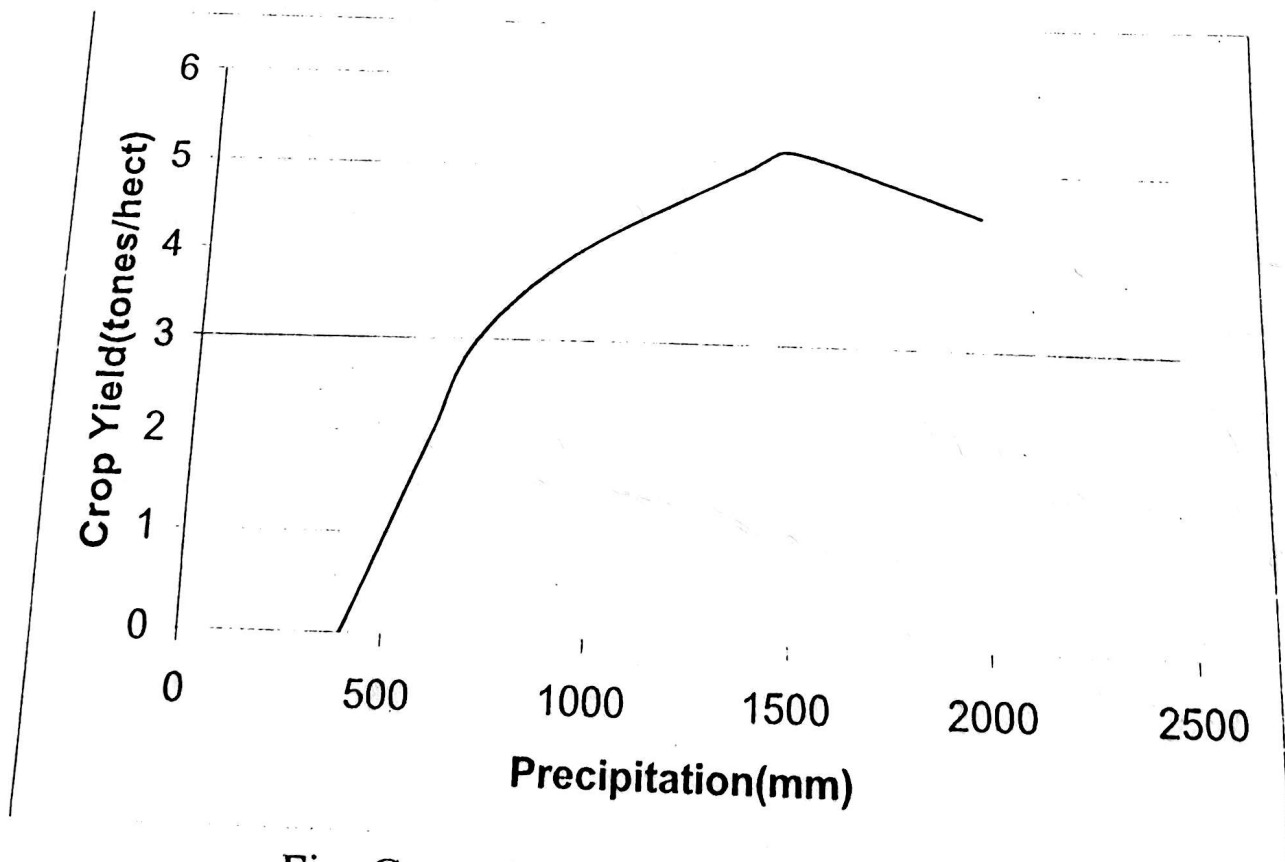


Fig: General crop water production function

The above curve is parochial in nature.

Shape = f (Soil, climate, crop type, fertility, precipitation).

Therefore, it is usually not transferable to other areas.

Irrigation is a part of the hydrologic cycle:

Fig: Hydrologic cycle (Video Clip)

Law of conversion of Mass:

- Water can not be destroyed or created.
- It must be accounted for with in an irrigation system or river basin.
- The only "Consumptive" or consumed portion of diverted water is evapotranspiration, or E_t .

Return flow: The balance of diverted water (diversion - E_t) will either:

- Runoff of the surface
- Percolation below the root zone.
- Seep from canals and reservoirs
- Be spilled from canals

All diverted water in excess of E_t will eventually return to a stream or ground water at a lower elevation where it can be reused by another user.

The portion of diverted water which returns to a water course or ground water is called return flow.

1/3/14
Water rights: In addition to determining the adequacy of a water sources one must also consider the effect of a diversion or change in water use on other users. Many of these users may hold a "Water right."

A water right is a legal deed detailing the ownership of the right to divert and beneficially and consumptively use of water.

A water right usually has 3 parts:

1. Length of the time
2. Maximum rate of diversion
3. Maximum land area which can be irrigated

Unfortunately there is no overall water law, formal system of water rights or regulatory instruments for water use and allocation in Bangladesh.

Followings are available:

1. The irrigation Act (1876)
2. Bangladesh water and power development boards ordinance (1972)
3. Local government ordinance (1983)
4. Irrigation water rate ordinance (1983)

Main thing is that in practical no law is maintained and there is no monitoring.

Irrigation Engineering:

- Is an applied subject dealing with investigation, planning, design, execution, control & servicing of irrigation and allied works.
- Inter disciplinary area

Concept of multipurpose project:

- A multipurpose project is one which serves more than one purpose
- Such as irrigation project can serve the following purposes.
 - Storage, control & utilization of water for irrigation.
 - Development of hydro-electric power.
 - Flood control
 - Silt control in rivers & canals
 - Inland navigation
 - Water supply
 - Fish culture
 - Recreation

- A multipurpose project entails the study of different sciences. Such

as-

- o Engineers
- o Agriculturist
- o Soil Scientists
- o Hydrologist
- o Meteorologist
- o Administrators
- o Planners
- o Farmers. - Beneficiary
- o Economist
- o Sociologist

Administrators
Agriculturist
Soil
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Engineers
Economist
Meteorologist
Hydrologist
Planners
Farmers

1. Economic consideration:

- Cost-benefit ratio < 1
- Cost Involves: Investigation, planning, design, construction, operation, maintenance.
- Benefits: Which can be converted to money.

2. Social & economic consideration of beneficiary:

- Land ownership pattern
- Local availability of labour
- Existing farming practices facilities
- Crop type & calendar
- Transportation, storage & marketing facilities
- banking facilities
- Technical advisory services
- Overall education level/consciousness
- Peoples participation.

3. Environmental consideration:

- EIA: Environmental Impact Assessment.
- Submergence of land & forestry
- Atmospheric pollution for organic decomposition
- Water logging
- Water borne diseases.
- Fish habitats.

Type of Irrigation Development

(A) W.r.t procurement process of water.

1. Storage type
2. Diversion type
3. Combination of storage & diversion
4. River pumping.
5. Ground water pumping
6. Reclamation of wastes & sewage water

SD

SD (+)
G/R Pumping
Reclamation of

12-13

(B) W.r.t are coverage:

1. Major irrigation project: > 10,000 ha,
2. Medium irrigation project (2000-10,000) ha
3. Minor irrigation project < 2000ha

(c) w.r.t purpose of the project:

1. Single purpose
2. Multipurpose.

Irrigation practice in Bangladesh:

Water management in Bangladesh involves a wide range of interventions in the country's land and water regime but two main categories can be distinguished;

- Irrigation
- Flood control and drainage

National water policy:

main objective is to promote agricultural growth through private development of groundwater and where feasible, with surface water development.

There are six main elements in the Government policy.

- Encourage and promote continued development of minor irrigation without affecting drinking water supplies.
- Encourage future ground water development for irrigation by both public and private sectors.
- Improve resources utilization through conjunctive use of all forms of surface water and ground water for irrigation.
- Strengthen crop diversification programs for efficient water utilization.
- Address the problem of agricultural chemicals polluting surface water and ground water.
- Strengthen systems of monitoring water use, water quality and ground water recharge.

Problem: Ground water irrigation conflicts with domestic water supply system when water table drops under the reach of HTW.

Some told that arsenic problem is also found due to over extraction of water from ground.

Categories:

Two Categories of irrigation: minor and major irrigation

- minor irrigation is mostly by farmer-operated and owned tubwells and low lift pumps. and 92% of the total.
- major irrigation is mostly by BWDB surface irrigation project.

- STW irrigation is most developed in NW, NC and SW regions.

Fig: Irrigated land from Shallow tubwells

- Surface water irrigation is mainly in NE, SE and SC regions where there is a higher density of small perennial channels and other water bodies.

Fig: Irrigated land from Surface water

Land resources:

Bangladesh has a total area of 14.7 Mha and a net cultivable land of 8.3 Mha. But at the end of 2025 this will reduce to about 7.7 Mha.

Cropping patterns:

- Kharif I (March to July): Pre-monsoon season. Aus is planted. Jut is other crop.
- Kharif II (July to December): The monsoon. Aman is planted.
- Rabi (November to April): The winter season. Boro is main crop. And others are Wheat, pulses, Oilseeds, Vegetables etc.

Rabi season is the main irrigation season and favorable for high yield. (Why?)

Social and environment aspects of irrigation and FCD:

- Agriculture is the largest sector of the Bangladesh economy
- The largest source of employment
- Of 17 million rural households, 11 million are engaged in farming

- Two types: small holding farmers and medium-holding farmers
- Constraints to productivity and expansion of irrigation among small holders include lack of access to cheap credit, low incentive to invest in inputs and irrigation, insecurity of crops, lack of knowledge etc.
- Require good attention to low interest credit and information packages.
- Main environmental issue is the effects on ponds and stream flows in dry season.
- Use of fertilizer Deteriorated water quality
- Some research shows that arsenic problem may also related with the ground water irrigation
- Irrigation structures reduce fish migration of the river system. Some fish friendly structures reduce this problem. Example: Pilot Fishpass project connecting the manu River and Kawadighi Haor in North East Region.