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# MINOR IRRIGATION SYSTEM UNDER THE BRITISH IN DELTA REGION

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*Abstract*

In the southern portion of the Presidency and in the Northern Circars, the only implement in use is the plough which is common to eastern countries. This plough stirs the soil but does not invert it. In some districts containing black-cotton soils, a large plough drawn by six or eight bullocks is used to reclaim land overgrown with weeds. The system of water conservation through field embankments is peculiar to central Indian tracts and is commonly in vogue in the northern Madhya Pradesh, Bundhelkhand region of Uttar- Pradesh and eastern Rajasthan. In the Bundhelkhand region, these works are popularly known as 'bundhies' which consist of earthen embankments thrown across gently sloping ground. During the rainy season water is stored upstream and the land gets submerged. If the land slope, is gradual; often large areas get submerged even by low embankments. Ordinarily, no direct irrigation is carried out and benefit is mostly due to submergence. In nearly all these areas, the soil is generally black which is retentive of moisture. After remaining submerged' under water during the rainy season, the soil retains sufficient moisture to grow good rabi crops. The remaining water is let out and the submerged land released for cultivation.

Keywords: Agriculture, Irrigation, Conservation, Schemes, Sprinkler, Cultivation, Maintenance.

**Introduction**

In the southern portion of the Presidency and in the Northern Circars, the only implement in use is the plough which is common to eastern countries. This plough stirs the soil but does not invert it. In some districts containing black-cotton soils, a large plough drawn by six or eight bullocks is used to reclaim land overgrown with weeds. In the Ceded Districts, the ryots make use of a large scraper called goontaca which performs the services of grubber and barrow; a drill made of three or five bamboo tubes inserted at the top in a hopper into which

the seed is poured and at the bottom into miniature ploughs which form seed-furrows into which the seed falls down the tubes; and a small bullock-hoe for cultivating between the TOWS of growing crops sown with the drill.

Minor Irrigation System

The area, irrigated under various crops during a year, counting the area irrigated under more than one crop during the same year as many times as the number of crops grown and irrigated.

The total gross area proposed to be irrigated under different crops during a year by a scheme. The area proposed to be irrigated under more than one crop during the same year is counted as many times as the number of crops grown and irrigated.

The gross area actually irrigated during reference year out of the gross proposed area to be irrigated by the scheme during the year.

Minor Irrigation (M.I.) Scheme

A scheme having CCA up to 2,000 hectares individually is classified as minor irrigation scheme.

A scheme having CCA more than 2,000 hectares and up to 10,000 hectares individually is a medium irrigation scheme.

A scheme having CCA more than 10,000 hectares is major irrigation scheme.

Dug-well

Dug-well covers ordinary open wells of varying Dug wells are usually excavated with the pick and shovel. The excavated material can be lifted to the surface by the bucket attached to a windless or hoist. The dimension dug or sunk from the ground surface info- water bearing stratum to extract water for irrigation purposes. These are broadly masonry wells, kuchcha wells and dug-cum-bore wells. All such schemes are of private nature belonging to individual cultivator.

Shallow tube-well

Shallow tube-well consists of a bore hole built into ground with the purpose of tapping ground water from porous zones in, sedimentary formations depth of a shallow tube well does not exceed 60-70 metres. These tube wells are either cavity tube-wells- or strainer tube-wells. These are usually drilled by percussion method, using hand boring sets and sometimes percussion rigs. Success and popularity of the scheme depends on how cheap they are. Coir structures formed by binding coir strings over an iron frame are being used as strainer. In shallow water table areas, bamboo frames are also used. Sometimes steel pipe casing are replaced by pipes constructed by rapping bituminized gunny bags over the bamboo frame. These are called bore wells, in which bore-hole

is stable without a lining in the bottom portion and a tube is inserted only in the upper zone. The tube wells are generally operated, for 6 to 8 hours during irrigation season and give yield of 100-300 cubic metre per day, which is roughly 2 to 3 times that of a dug well. As regards ground water the usable amount depends not only on the quality of water available in an area but also its quantity.

Deep tube wells

It usually extends to the depth; of 100 meters and more and is designed to give a discharge of 100 to 200 cubic meters per hour. The deep tubes well are drilled by rotary percussion or rotary cum percussion rigs. These tube wells operate round the clock during the irrigation season, slotted pipes

10 depending upon the availability of power. Their annual out put is roughly 15 times that of an average shallow tube well and are usually constructed as public scheme which are owned and operated by government departments or corporations. A hole is first made piercing the clay layer with the help of anger and the casing pipe is lowered. This is continued till the sand formation is reached.

Surface flow irrigation scheme

These schemes use rainwater for irrigation purposes either by storing it or by diverting it from a stream, nala or river. Some times, permanent diversions are constructed for utilising the flowing water of a stream or river. Temporary diversions are also constructed in many areas which are usually washed away during the rainy season. The small storage tanks are called ponds or bunds his which are mostly community owned. The command areas of such schemes are 20 hectares- or less. The large storage tanks whose command varies from 20 to 2000 hectares are generally constructed by government departments, or local bodies. These are the biggest items of surface minor irrigation works.

Storage schemes

Storage schemes include tanks and reservoirs which impound water of streams and rivers for irrigation purposes. After wells, tanks occupy a very important place under the minor irrigation programme. They provide nearly two-third of the total irrigation from minor sources in the states of Andhra Pradesh, Karnataka, Kerala, Maharashtra, Orissa and Tamilnadu.

Tracts with undulating topography and rocky sub-strata are eminently suitable for tank irrigation. Besides, there exists scope for further construction of tanks in many areas. A large number of existing tanks in southern States have gone into disuse due to long neglect of repairs. Renovation of these tanks so as to restore the lost irrigation potential is being accorded priority under the minor irrigation programme.

The essential features of these schemes are (i) a bund or a dam which is generally of earth, but is also sometimes partly or fully masonry, (ii) anicut and feeder channels to divert water from adjoining catchments (iii) a waste weir to dispose of surplus flood water (iv) sluice or sluices to let out water for irrigation and (v) conveyance and distribution system. The size of the storage is determined by the run-off expected on the basis of dependable monsoon rainfall in the catchment and by the fact whether the rainfall and cropping pattern would permit more than one filling of the tank. The best and direct method to calculate the runoff would be to gauge the stream flow at the proposed site for a number of years. However, as the observed data over a long number of years is normally not available, the run off is computed on the basis of empirical formula found applicable from past experience for the region. When tanks are constructed in a series by bunding up the same valley at several points, some spill very yield from the bunded catchment is also accounted for. In the gross storage provided some percentage provision is allowed for dead storage t6 be consumed by silting in course of time. Uniform distribution of water over the irrigated area is possible with appropriate design and operation of the system.

The irrigable command of the scheme is fixed on the basis of certain standard duties in terms of crop area irrigated per unit of water. The proposed cropping pattern is decided on the basis of past experience in the region. The flood discharge to be escaped over a waste weir is computed by empirical formula which from experience is found to generally hold good for the region. The design of the various component parts of the tank usually requires specialised engineering knowledge.

The tanks fail mainly due to two reasons (i) silting of bed and

(ii) breach due to inadequate surplussing arrangement or bad maintenance

of the bund can irrigate at night. This case the power problems irrigation

can be done at any time. There is power 12 renovation of derelict tanks so as to restore the lost irrigation potential is being accorded priority under

the minor irrigation programme. The work of restoration generally consists of (i) strengthening or raising of bund, (ii) improving the surpassing capacity and (iii) occasional de-silting of bed. De-silting is costly but in some cases

this is being rendered economical by utililsing the excavated earth for reclaiming part of the previously submerged land. The work of restoration is usually carried out by the State Public Works Department. After renovation, irrigation works below a specified acreage are handed over to the panchayats for maintenance. Works having higher irrigation capacity are maintained by the Public Works Department. The new

works are usually taken up as State works by the State Public Works Department.

Diversion Schemes

These schemes aim at providing gravity flow irrigation by mere diversion of stream water supply without creating- any storage. As compared to storage schemes they are economical but their feasibility is dependent on the presence of flow in the stream at the time of actual irrigation requirements. Essentially such schemes consist of (i) an obstruction (weir) or bund constructed across the stream for raising and diverting water; the weir being called anicut in the South, Bandhara in Maharashtra and Gujarat, and Thingal in the Assam region, and (ii) an artificial channel, known as Kul in the hilly areas; Pyne in Chhota Nagpur and Bihar and Dong and Ilhowkong in the Assam region. In case of small schemes which have prominent scope in the hilly tracts and foot hill plains, the wateris usually diverted by constructing temporary bunds across the streams, made up of earth, stones or even bamboos. The discharge handled being of small order, the bund on the head of the channel is not provided with any gated structure for controlling and regulating the flow. Construction of work, is, therefore, simple and cheap and can be handled to a large extent by the people themselves. However, these constructions being temporary, require frequent renovation. The bunds are liable to be washed away by every major flood. The channels also get silted up and scoured frequently. It is essential that whenever' such schemes aim at diverting higher discharges, say more than 5 to 10 cusees, or tackle streams having high intensity of flood discharge, proper regulation structures equipped with suitable types of gates are provided. Weir has to be provided with scouring sluices in order to regulate the flow of silt in the off-taking channels. The construction of masonry weir is comparatively simpler and cheaper where rocky foundation is available beneath the streambed. The design of the weir on permeable and erodable foundation is more complicated and requires specialised engineering knowledge. During low flows the drainages are unable to array their own gilt and flush it into the sea. Instead one can find sand bars getting formed at the mouths affecting their functioning during heavy flows.

The irrigation capacity of the diversion schemes is dependent on the actual flow in the stream at the time the irrigation is required. The cold weather and the hot weather flow, therefore, need to be ascertained carefully before deciding the feasibility and economics of these schemes. This is particularly important in the case of non-snow fed flashy streams that spurt to lift suddenly in the rainy season after, which the discharge in them dwindles down to appreciable quantity. Some diversion schemes are also constructed as kharif or monsoon, channels supplying water only during the monsoon season. Such schemes are-

useful for providing supplemental irrigation for paddy and preliminary watering for sowing of rabi.

In most of the hilly tracts, small irrigation channels called 'kuls' are the only means of irrigation. These channels carry- water diverted from streams by constructing temporary or pucca bunds across the streams. These channels are often constructed in hazardous hilly terrain- under very difficult conditions. To avoid seepage of water and for the sake of stability, these channels are lined in most of the reaches.

Water Conservation-Cum-Ground Water Recharging Schemes

Under this head are included schemes which, serve primarily one or more of the following purposes (i) submerging agricultural land during monsoon for sowing post-monsoon crops, (ii) improving moisture regime of the adjoining fields down stream for raising, of post-monsoon crops without irrigation and replenishing the ground, water. An additional advantage of these schemes is that they help to conserve the soil. When constructed in the head water region serving catchment area of tanks down below, they serve the important purpose of retarding the silting rate of these tanks.

The system of water conservation through field embankments is peculiar to central Indian tracts and is commonly in vogue in the northern Madhya Pradesh, Bundhelkhand region of Uttarpradesh and eastern Rajasthan. In the Bundhelkhand region, these works are popularly known as 'bundhies' which consist of earthen embankments thrown across gently sloping ground. During the rainy season water is stored upstream and the land gets submerged. If the land slope, is gradual; often large areas get submerged even by low embankments. Ordinarily, no direct irrigation is carried out and benefit is mostly due to submergence. In nearly all these areas, the soil is generally black which is retentive of moisture. After remaining submerged' under water during the rainy season, the soil retains sufficient moisture to grow good rabi crops. The remaining water is let out and the submerged land released for cultivation. The other advantage of submerging land in this manner is that the first flood brings a lot of silt which acts as rich manure. By preventing free flow of water across steep gradient, the soil of the land is also conserved.

Ahars in Bihar, which store water for irrigation of paddy fields also function somewhat in a similar manner. Water is let out in October for irrigating the rice fields and the drained out fields in the bed of the ahars are cultivated with rabi crops. The head water tanks popularly in vogue in Orissa have a similar role to perform. These consist of bunds put up across slope at the head of gullies with the objective of impounding and diverting the cumulative run-off into the wider valley area down stream of the bunds by percolation, seepage and surface flow: Surface channels are provided in the flanks to carry floodwater received in excess of the

storage capacity of the bunds during the monsoon season. Large pockets of low lying areas will be there nearer the sea since the delta is all the time in the forming stage and these get water-logged frequently, damaging the crops raised.

Percolation tanks primarily constructed for the purpose of recharging ground water are in vogue in Maharashtra, Tamilnadu, Kerala and Rajasthan. Check-dams or rapats are in vogue in Rajasthan. They consist of bunds constructed across the streams for the purpose of retarding the surface flow and also the sub-surface flow to some extent by making the bed slope of the stream flattened. This results in increased percolation of water in the sub-soil with consequent increase of the ground water supply.

In the case of big embankments impounding large catchments, it is essential that adequate arrangements are made at one or both the flanks or at some other suitable location for passing the floodwater if no such provision is made the embankments are liable to be breached.

Surface Lift Irrigation Scheme

In regions where the topography does not permit direct flow irrigation from rivers and streams, water has to be lifted into the irrigation channels. These works are similar to diversion schemes, but in addition pumps are installed and pump houses constructed. These schemes, being costly in operation, are feasible only in areas where (i) gravity flow irrigation is not possible (ii) there is keen, demand for irrigation and cultivators are enthusiastic, (iii) water is available in the streams for at least about 200 days in a year and (iv) cheap electric power is available. Installation of diesel operated pump sets for lifting water makes the operation and maintenance cost of these schemes exorbitantly high. However, for lifting small order of discharge by individual cultivators, portable diesel engine pump sets are feasible as they provide greater flexibility and mobility for installation at different points of the water source or sources. In some areas Solar Pumps are also used for lifting water.

Sprinkler Irrigation System

Sprinkler Irrigation is a method of applying irrigation water which is similar to rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air entire soil surface through spray heads so that it breaks up into small water drops which fall to the ground.

Advantages of Sprinkler Irrigation

 Considerably improved water utilization over conventional methods so that larger areas are irrigated.

 It generally offers the only method of obtaining adequate distribution of water on certain rolling or hilly kinds where levelling for surface irrigation is not feasible.

 Land is saved as there is no loss for channels and bunds. It eliminates the need for farm ditches and more area is available for crop production.

 The overall irrigation efficiency is from 65 to 80% while that of the surface irrigation ranges between 25 to 60% only.

 It is suitable where depth of the soil is limited by a hardpan 15 or other restricting layers.

 It is suitable on porous soil such as sands, where water penetrates rapidly, giving relatively excessive losses by deep percolation.

 It is adapted to light application of water for shallow rooted crops, in germination of seeds, and during the seedling period.

 Sprinkler irrigation may be designed for smaller flows and is therefore preferred to overcome other methods. It is an economical method of irrigation where the annual requirement is low.

 Run-off and subsequent soil erosion can be eliminated.

 Leaching of salts from soil is effectively done as there are no drainage and salinity problems due to over irrigation.

 One to reduced labour requirement, labour can be used for other productive work on the farm. Mechanization and automation is possible to reduce the labour cost.

 Fixed system can eliminate field labour during irrigation season.

 Better weed control due to elimination of channels and bunds that harbour weeds.

 Fertilizer can be distributed through the system for rapid, effective response.

 Saves fertilizers - surface irrigation washes fertilizer below root zone.

 Can irrigate at night this cases the power problem as irrigation can be done anytime there is power.

Disadvantages of Sprinkler Irrigation

 Sprinkler irrigation is not well, adapted lo soils having low intake rates, less than 4 mm/hour.

 Larger evaporation losses occur because sprinklers wet the entire soil surface as well as the leaves of the plants.

 High and continuous energy requirement for operation.

 Sprinkler water containing, an appreciable amount of salt may result in burn or death of the plant leaves.

 Under certain climatic conditions spread of diseases may be encouraged.

Drip irrigation system

Drip system is a relatively new method of irrigation in which water and other nutrients are delivered directly to the root zone according to plant needs. Thus, making the most efficient use of water compared to conventional methods of irrigation such as furrow, border, basin and even the sprinkler system. The water loss and water use efficiency compared lo other system is very high.

Advantages of Drip Irrigation

 Very high efficiency of water use.

 More crop yield compared to other methods.

 Decreased tillage.

 Better quality produce.

 Improved plant protection and reduced diseases.

 Higher efficiency in use of fertilizers.

 Satisfactory use of poor quality of water.

 Shorter growing season and production of earlier crops.

 Less weed growth and restriction of population of potential hosts.

 Low labour requirement and relatively low operation costs.

 Use in hills terrain and problem soils.

 Improved infiltration in soils of low intake.

 Low pressure requirement: This permits this system to be used even in green houses.

 No tail water loss and soil erosion.

 Ready adjustment to sophisticated automatic control.

 Mechanical operations can be done simultaneously with irrigation

Disadvantages of drip irrigation

 Sensitivity to clogging of dippers.

 Moisture distribution problems.

 High cost compared to conventional methods.

 High skill is required for design installation and operations.

 Clean and filtered water is needed.

 System is liable to damage and theft.

 Rats may eat or damage the drip pipes.

Development of Sprinkler and Drip Irrigation

The area under sprinklers in India was only about 40 hectares in 1958. Between 1958 and 1980, the area increased to 2,20,000 hectares. The high growth rate was essentially due to the adoption of sprinklers by tea and coffee plantation estates. This was done as supplemental irrigation during the non-rainy season. Progressive farmers in Madhya Pradesh had started the use of Sprinkler Irrigation System (SIS) for field crops much earlier, before the State and Central Government prepared the schemes for financing and subsidizing sprinkler irrigation. Due to sustained efforts by the manufacturers and agriculture extension departments, the use spread very rapidly in the states of Haryana, North East, Rajasthan, Maharashtra and Karnataka From 1980 onwards, the use of SIS for field crops started increasing.

Drip Irrigation System (DIS) is the latest method of irrigation. This method is highly beneficial for arid and drought prone areas where water is scarce. Experiments and farm trials have been going on in India for over 14-15 years. In the states of Tamil Nadu, Karnataka, Maharashtra and Andhra Pradesh progressive farmers started the use of this method, in late seventies, without any benefit of subsidy or support from central or slate governments. After sustained efforts by the state and central governments, Agricultural Universities and private manufacturers of the drip irrigation system the use stalled spreading in the drought prone areas of the southern and western parts of India. The use of DIS is mostly for horticultural crops. In states like Maharashtra, Karnataka and Tamil Nadu, it is sometimes used for vegetables and commercial crops.

**Conclusion**

The minor irrigation works under the emergency irrigation drive launched in the year 1948 were continued by the revenue department. Each minor irrigation scheme is expected to benefit 20 acres of lands and give an additional yield of 3.67 tonnes of food grains, according to the formula adopted by the government. The minor works are usually in the charge of the revenue department which looks to their maintenance and repairs, contribution being made by beneficiaries in some cases. Occasional assistance from the public works department is taken in carrying out special repairs or improvements of these works. Soon after independence specially beginning with 1951, the government attached much importance to irrigation, and gave it a high priority in the First Plan itself. Along with agriculture; power and transport emphasis on

irrigation was aimed at, “creating the base for more rapid economic and industrial advance in the future” and within agriculture, for diversifying agriculture and increasing crop yields. The large concern for irrigation was evident from the fact that oh top of Rs. 80 crores of investment in the pre-plan period, the outlay proposed. In the first plan was put at Rs. 376 crores which was about 19 per cent of the total public outlay of around Rs.2000 crores.

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