INTERNATIONAL COMMISSION
ON IRRIGATION AND DRAINAGE

Sixteenth Congress
Cairo 1996

Poster Session
Q.46–P.6

INCORPORATION OF RESERVOIRS INTO IRRIGATION SUPPLY SYSTEMS TO SIMPLIFY FLEXIBLE OPERATIONS

INCORPORER LES RESERVOIRS DANS LES SYSTEMES D'IRRIGATION POUR SIMPLIFIER LES OPERATIONS

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The paper with four case studies[3] emphasizes and illustrates the need to have a flexible supply and distribution system under the control of the farmers. This is in contrast to the common rigid top down rotation schedule which theoretically provides an equal share of water to each farm. However, it is delivered with such rigidity that it cannot be effectively used resulting in low application efficiencies and production.

Effective use requires that the water be made available under control of the irrigator as to frequency, rate and duration, all of which are variables, and that the supply be reliable.

For effective use of the water by the farmer at this outlet and to have negligible inconvenience and inefficient night time irrigation, the supply system must have larger than steady flow capacity. To assure that frequency is modifiable there must be appreciable unused reserve time – low congestion. A rotation schedule with 100% congestion precludes many management procedures. A system able to supply an area by operating only two thirds the days (and not at night), e.g. 67% congestion is good. 50% to 70% is an acceptable range.

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[3] The paper and a report on three more case studies from Pakistan and the USA can be obtained from any of the authors

To obtain the flexible on-farm operation and still have nearly steady canal flow that is necessary to optimum canal operation, requires the use of storage. Some flow variation can be obtained from in-canal storage and canal operations. To obtain the major storage change needed by negligible night irrigation and flow rate and duration variations, larger storage capacity is needed. It can be obtained economically by using a service area reservoir and a Flexible Limited Rate Arranged Schedule. Also needed is an automated only moderately congested distribution system usually involving semi-closed (Harris float valve) pipelines with controls at the farm outlet.

With the flexible schedule and coordinated system operation, the farmer's management capabilities are not restrained by the water supply system. On all projects where such flexibility has been developed, yields have increased 20-40% and farm labor and water usage decreased. These benefits, for which a farmer will gladly pay an increased water charge, justify the small increased investment needed. A comparison of pipe sizes with capacity and cost shows that for 200 mm diameter compared to 250 mm and 300 mm that capacity is doubled and tripled and costs only increase 15% and 40% respectively.

Canals operate best with stable continuous flows while farm usage does best with variable flows and durations. Reservoir storage is essential to economically reconcile the different requirements. Service area reservoirs are located near the middle of the area served by one lateral taking water from the canal. The area below the reservoir must be served an automated semi-closed pipeline system taking water from the reservoir as arranged during the daytime that was essentially the accumulated lateral flow of the previous night.

The area above the reservoir has water distributed by a pipeline system taking water from the upper portion of the lateral. This flow should be slightly in excess of the arranged offtakes. The excess varies as farmers use varies with the excess passing on into the reservoir. The night time flow through the upper lateral will all flow on into the reservoir. The average 24-hour flow rate in the upper portion is that needed to supply the whole service area needs for a day. The upper part of the lateral can be a sloping canal or a specially designed pipeline.

The service area storage capacity could theoretically be only as great as needed to supply the lower portion for one day but this would result in 100% congestion. To provide flexibility and easy canal and scheduling management, its operating capacity should be double the lower area's one day need. The area needed for a reservoir is less than 1% of the service area. Since there must be adequate initial head on the outlet pipeline, there will be appreciable dead storage in the reservoir.