

DISCUSSION



Discussions on “water saving and increase in yield of rice crop through on-farm reservoir: a case study” by Deepak Kumar Soni and K.K. Singh

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The paper highlights the use of ‘on-farm reservoir’ (OFR) for improving yield of rice crop and saving of water. Perhaps, the area referred to in the paper lies in the command area of some canal network in Haryana where irrigation supply do not reach because of lavish water consumption by farmers at the head reach of the canal i.e. by the head enders. As rightly observed by the authors, the tail enders in most of the surface irrigation schemes in India suffer due to overuse of irrigation water by the head enders in the gravity flow system. In our country, there is no volumetric method of charging irrigation water. Irrigation rates are usually determined by area-crop-season basis. As a result, the head enders always over draw water resulting in losses and consequent fall in overall efficiency of irrigation. Overall efficiency, also called project efficiency of most of the surface irrigation schemes, which consumes about 80% of our utilizable water resources of the country, must be improved to save water and ensure productivity of agricultural land per unit of area, unit of water and unit of time. At present, overall efficiency of surface irrigation schemes in India is about 30–35% (INCID-1998) which is too low when compared with the figures of 75% in Japan and 55% in China. The average project efficiency in three major river-valley projects determined by the discussor was found to vary from 18.6% to 38.8% (Mazumder, 1984). Most of the irrigation water was found to be lost in conveyance and field application and extremely poor management of water at the farm level [Mazumder (1986), Bharat Singh (1991)]. Zimermann (1966) examined several drawbacks of protective type extensive irrigation practice being followed in India, where available water is spread over vast areas through a widely spaced unlined canal

networks. Most of the water in such a system is lost in conveyance and most of the remaining water is lost because of inefficient irrigation management (IWRS 2007). Even a marginal increase in irrigation efficiency will cause substantial savings of water which can be either diverted for other uses or more agricultural land can be brought under irrigation with the same amount of available water. Different steps for improving overall efficiency of irrigation have been suggested by Mazumder (2007).

Unlike other commodities like electricity, drinking water, etc. water for irrigation is currently distributed almost free of cost. The present irrigation water rates are extremely low and the revenue collection is also very poor. Whereas during the British days, 87% of the overhead and maintenance costs of irrigation schemes used to be realized from irrigation revenue, today the revenue receipt is so low that it can hardly meet 15% of maintenance cost of the projects as shown in Figure 1 (Mohile et al. 1994). The cost of operation and maintenance, administrative and depreciation cost and the interest on borrowed capital are being subsidized by the government. Many of the surface irrigation projects which were our national assets are soon going to be our national liabilities if the present situation continues. Some of the early storage projects are fast losing their live storage capacity due to siltation (CBIP 1994) requiring dredging at enormous cost.

Using 2011 census figures, the population of India in 2025 is being projected as 1394 million when average per capita availability of water will fall to just 1394 m³ in an average year which is quite low compared to some other countries in the world (Table 1).

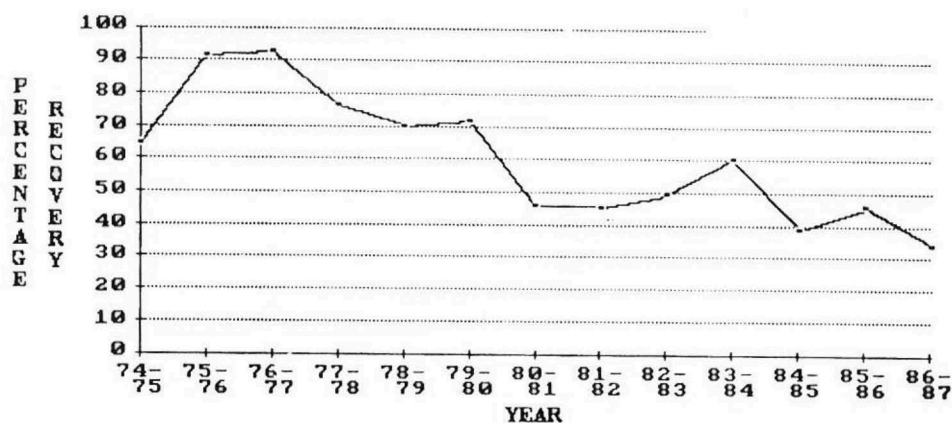


Figure 1. Average year-wise percentage recovery of working expenses for 15 states in India

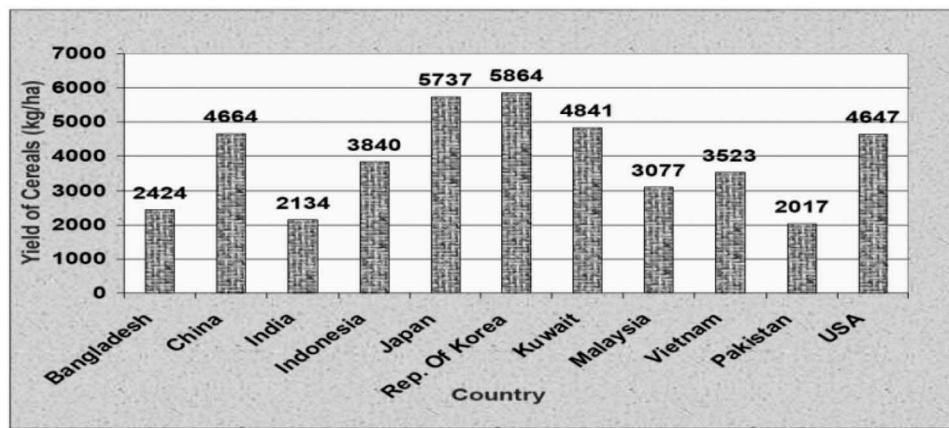


Figure 2. Yield of cereals in India and other neighboring countries.

Table 1. Per capita water availability (in m^3) in different countries in the world as on 2011.

USSR	USA	China	Australia	India
19,500	9900	5000	2420	1545

Principal source of India's water resources is monsoon rainfall which varies from place to place and year to year. While some parts of our country are devastated by floods, some others suffer from acute droughts. Solution lies in water storage – both surface and subsurface – and scientific management of water for agriculture which alone consumes about 80% of available water resources of India. At present, India has a meager storage capacity of 300 BCM, mostly in surface reservoirs. It is inadequate to fight drought like situations arising occasionally in different parts of the country. Loss of live storage due to silting of reservoir is estimated as 53 BCM by 2050 (CWC 1991). NASA has identified more than 30 hotspots in India where freshwater is in particular danger (IAHR 2018). The situation is going to aggravate further due to uncontrolled pollution of both surface and ground water. *Without strong action by government to preserve water and manage the scarcity, the situation is likely to worsen further in the coming days.*

In the above context, the paper is a significant contribution in irrigation engineering/management. Tables 5 and 6 give the irrigation schedule for the years 2013 and 2015, respectively. Table 7 gives the increase in rice yield and water saving in sub-farm B (with OFR) compared to that in sub-farm A (without OFR). While yields of sub-farm A are 906 and 876 kg in the years 2013 and 2015, respectively, the corresponding values in sub-farm B are 967 and 921 kg, respectively. The total irrigation requirements for rice, based on actual evapotranspiration and effective rainfall, are found to be 317.7 and 517.6 mm in the years 2013 and 2015, respectively. The difference is due to variation of rainfall. It appears that the same irrigation schedule was followed for both farms A and B since the crops and the rainfall were the same in adjoining farms. The difference in yield of rice in the two farms is marginal since the irrigation schedule adopted (at 10 days frequency) was the same. Considering the higher one i.e. 967 kg in farm B of one-fourth acre equivalent to 9 T/ha. Figure 2 shows yield of cereals in India and other neighboring countries. India, Pakistan and Bangladesh, which were once united before 1947, follow similar type surface flooding irrigation for rice crops. They have more or less similar yield (2–2.4 T/ha)

which is substantially lower than 9 T/ha obtained in the present study where controlled and scientific irrigation as per consumptive requirement were adopted by the authors.

Unlike wheat, rice is a water loving crop and it requires submergence irrigation since rice is found to have highest growth rate at soil moisture equal to field capacity requiring submergence irrigation causing huge quantity of percolation losses. In the case of conventional irrigation supply through canal networks, gross delta for rice, as stated by the authors, varies from 1200 to 1400 mm. Taking a mean value of 1300 mm, the water requirement in conventional canal irrigation system is 1300 T/ha. As stated in Table 7, the volumes of water actually used in sub-farm A are 338 and 306 tons in the years 2013 and 2015, respectively. Taking the mean as 322 mm, it corresponds to an amount of water equal to 448 T/ha. Had the same amount of water been supplied from conventional canal supply system, the overall efficiency would have been 31% ($=448/1300$) only. Rice cultivation by canal irrigation system should be discouraged in rainfall deficit areas like Rajasthan.

As regard use of OFR for storing runoff/canal water for reuse, it is a very useful method of improving irrigation efficiency and is widely used in Israel where rainfall is scanty. It is also called service tanks which stores rain/canal water in long distance canals. There are occasions where canal water released from distant reservoir may not be drawn by the farmers due to rainfall or other reasons and the canal water can be diverted to these service tanks. Besides the benefits of OFR pointed out by the author in their paper, OFR helps in conservation of canal/rain water and offers some flexibility of operation by farmers to apply irrigation at their convenience. Their location, storage capacity, inflow and outflow control devices are to be very carefully designed (Zimmerman 1966). Other benefits of such FOR/service tanks are:

- They act as sediment trap and help in controlling water pollution.
- They help in fish culture and survival of flora and fauna.
- They can be used for domestic purposes and for drinking water for animals.
- They offer recreation opportunities for local/rural people living around the service tanks.

Authors may kindly note that the title of column 6 in Tables 5 and 6 should have been rainfall instead of effective

rainfall which is that part of the rainfall which meets the consumptive requirement of crops (Yii-Hsung Tsao 1972).

Disclosure statement

No potential conflict of interest was reported by the author.

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