Water Resource Management

The Problem

Rajasthan is characterized by low to very low rainfall and excessively high aridity due to high temperatures affecting large parts of the state. The arid region of Western Rajasthan has vast amounts of arable land, probably the highest in India in per capita terms. The very low rainfall with high inter-annual variability and extreme aridity increase the demand for water for crop production.

Expansion of irrigation in the desert region of western Rajasthan through lifting canal water into diggies (small pond to store the canal water supply that addresses the reliability issue) and using it for irrigation through sprinkler system and selection of crops that are less water-intensive enables farmers to take up crop production even in undulating land, having saline groundwater, thereby reducing irrigation water application requirements.

The other intervention discussed is about Khadins which are runoff-harvesting systems which store water from the rocky catchments in the soil profile of the reservoir bed, for later use in crop production.

Solutions

Interventions	BCR	Benefits (INR)	Costs (INR)
Expansion of Irrigation	2.92	48,886 per year and ha	16,747 per ha year
Renovation of Khadins	2.68	19,74,785 over 15 years per avg. khadin	7,35,875 over 15 years per avg. khadin

Total costs and benefits at 2017 prices discounted or annualized at 5%

The full paper by Dr **Dinesh Kumar**, Executive Director of the Institute for Resource Analysis and Policy (IRAP) is available on www.rajasthanpriorities.com/agriculture-and-food-security.

Expansion of Irrigation

The Problem

Rajasthan has one of the lowest per capita renewable water resources in the world with an average annual per capita renewable freshwater availability of 532 cubic meters which is only slightly more than the international minimum of 500 cubic meters needed to avert what is referred to as a condition of absolute water scarcity.

In Rajasthan about 58% cultivable land is under rain fed agriculture. Crops cannot grow well in this region without external water inputs.

The Solution

The intervention proposed is irrigation expansion through water use efficiency improvement in the command area and the potential area of intervention is western Rajasthan. It is assumed that farmers would adopt micro sprinklers with more water allocation to efficient crops and optimal dosage of farm inputs, to bring about high water use efficiency.

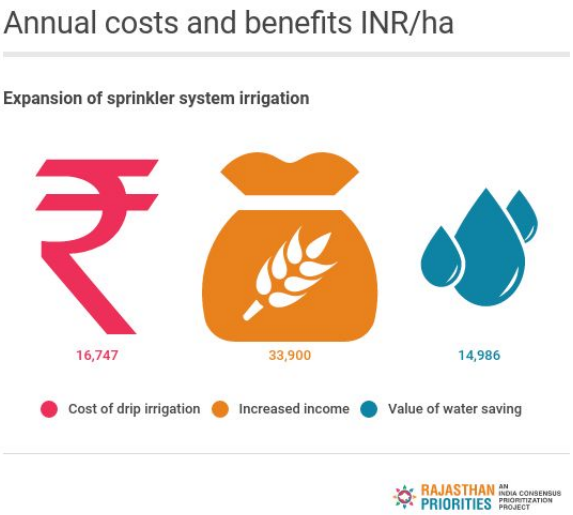
Expansion of irrigation in the desert region of western Rajasthan through lifting canal water into diggies and using it for irrigation through sprinkler system and selection of crops that are less water-intensive enables farmers to take up crop production even in undulating land, having saline groundwater, thereby reducing irrigation water application requirements.

Costs

The annualized private capital cost discounted at a rate of 5% and assuming the life of the system to be 10 years, is Rs 15,069. Annualized Capital Cost (economic) with the initial capital investment (without the subsidy component) amortized using discounting techniques is Rs 16,747 per ha.

Benefits

Incremental income with sprinklers per ha of irrigated crop is Rs 33,900. Positive externality brought about by water saving of 816 m3 per ha is Rs 14,986. Considering a discount rate of 5% social benefit which is the sum of private benefit and positive externality is Rs 48,886 and the social benefit-cost ratio is 2.92.



Renovation of Traditional Water Harvesting Systems

The Problem

Khadins (one of the traditional water harvesting system of Rajasthan) are runoff-harvesting systems that store water from rocky catchments in the soil profile of the reservoir bed, for later use in crop production. Western Rajasthan, especially Pali and Nagaur districts, have thousands of traditional water-harvesting systems including Khadins.

Renovation of Khadins for runoff harvesting is expected to increase crop production particularly in the non-rainy season.

The Solution

The intervention seeks renovating Khadins for runoff harvesting for crop production in the non-rainy season. The average command area of the Khadin is 41 ha.

Costs

Capital cost for renovation of a Khadin is Rs 5,39,894. The life of the system is assumed to be 15 years and the capital cost was annualized considering a discount rate of 5%. The maintenance cost for these 15 years, which is undertaken 5 times i.e. every three years, is Rs 53,989. The net present worth of the costs is Rs 7,35,875.

Benefits

Incremental income from crop production in the command area of the Khadin over irrigated cultivation is Rs 5,17,311 per ha. The Net Present Worth of the Private Benefits, which are accrued once in three years, considering a discount rate of 5% is Rs 18,79,888. The positive externality as a result of saving in cost of energy for pumping groundwater is Rs 29,257, which is also accrued once in three years. Net Present Worth of the Indirect Benefits is Rs 94,897. Social benefit, which is the sum of the private benefit and positive externality, is Rs 19,74,785. For a discount rate of 5%, the private benefit-cost ratio is 2.55 and the social benefit-cost ratio is 2.68.