

Water Resource Management

The Problem

Royalaseema region (rain-shadow zone) in Andhra Pradesh state is a hot and dry region experiencing frequent meteorological droughts. This region has only about 30% of the cropped area irrigated, and rest of it is dependent on rain-fed cultivation, which is susceptible to the vagaries of monsoon. The region is socio-economically relatively backward and has poor water security. Tanks are an important source of water for the rural economy in the region. But explosion of well irrigation in the catchment and commands for crop cultivation, which reduce the surface runoff into these tanks, has driven tanks into disuse. The biggest victims of this tragedy are the poor, small and marginal farmers, who depend on tanks for providing supplementary irrigation for their kharif crop.

Apart from the changes in the hydrological regime of the tanks and their catchments resulting from several socio-economic processes which adversely affect the inflows and therefore their performance, climatic variability has a huge impact on tanks. The Royalaseema region experiences high variability in rainfall and other climatic parameters, and due to this, the performance of tanks shows high variation across the years.

Solutions

Interventions	BCR	Benefits (crore INR)	Costs (crore INR)
Water Saving through Drip and Mulching of 30,000 ha land	5.07	818.5	161.3
Irrigation Expansion of 65,000 ha land through Water Transfer	3.68	159.2	43.2

Total costs and benefits 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.appriorities.com/agriculture-and-food-security.

Irrigation Expansion through Water Transfer from a Surplus Region to Augment Existing Irrigation Sources (Tanks)

The Problem

Most of the Royalaseema region falls in the Pennar river basin. Some areas in Kurnool and Chittoor districts also fall in Krishna and Palar river basins respectively. The region has high inter-annual variability of rainfall in the range of 24% to 35%. Hence even a small variation in rainfall causes meteorological drought-like situations in the region (IRAP, 2017).

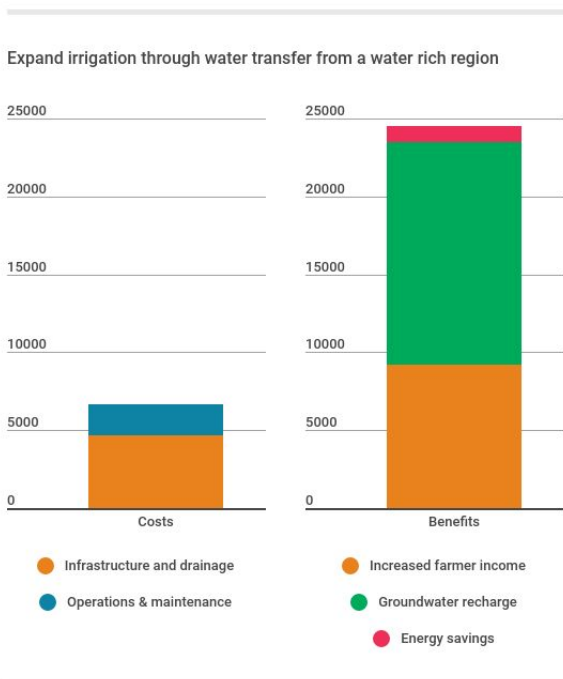
Tanks are the major source of irrigation in the region. Overall, there are about 12,900 tanks in the region (GoAP, 2016). However, areas irrigated by tanks show high inter annual variability due to significant dependence of tank inflows on the rainfall in the region. In fact, the area irrigated by tanks has shown a declining trend in all the four districts of the region (IRAP, 2017).

One of the major reasons for decline in tank irrigation is growth in well irrigation in the region. With increase in the numbers of well, intensive use of groundwater for irrigation in such areas has resulted in lowering of water table. This phenomenon reduces the base flows and has had a major negative influence on the tank irrigated area.

The Solution

In order to provide a reliable source of irrigation in the Rayalaseema region, there is a need to transfer water from exogenous sources (which are comparatively water rich) to rejuvenate tanks. This would also enable farmers to take up crop production during years in which the tanks do not receive inflows from their local catchments. As per one estimate, the additional storage space available in the tanks in the region during a drought year is about 1,700 MCM. Already some major water transfer projects are under implementation in the region.

Annual costs and benefits INR/ha



Costs

The annualized cost of transfer of surplus water from the donor basins, which involves the cost of conveyance infrastructure and drainage works is estimated to be INR 4,653 per ha. This is considering a system life of 25 years and a discount rate of 5%. Additionally, INR 2,000 will be required for annual operation and maintenance of the system. Assuming that the additional water will be used to irrigate land mostly under paddy cultivated during

winters (around 65,000 ha), the overall annualized cost will be INR 43.2 crore.

Benefits

The annual incremental net return for farmers from availability of additional water from tanks is estimated to be INR 9,236 per ha. The indirect benefits (annual) in the form of positive externalities include INR 14,229 per ha from groundwater recharge from the tanks and INR 1,020 per ha due to energy saving on account of reduced groundwater pumping. Overall, annual incremental returns and indirect benefits will be INR 159.2 crore.

Water Saving through Drip Irrigation and Mulching in High Value Crops

The Problem

In the Rayalaseema region, water saving through adoption of efficient irrigation technologies and practices is both desirable and necessary to boost agricultural productivity and reduce poverty.

On one side, the region is reeling under water scarcity due to highly variable rainfall and on another side large farmers are over-abstracting limited groundwater resources for growing high value crops such as tomato, sapota, papaya, grapes, guava and citrus, at the cost of small and marginal farmers, as their excessive water use results in drying up of the shallow wells.

The Solution

As per one estimate for erstwhile Andhra Pradesh that includes present day Telangana, about 1265 thousand hectares of irrigated area can be brought under water saving technologies, with almost 70% under drip irrigation alone.

Along with the practice of mulching which reduces evaporation from the bare soil surface thus retaining moisture in the soil, and suppresses weed growth, this can lead to significant water saving at the field scale or increase in area under irrigation using the saved water.

The intervention suggests benefits of relying on micro-irrigation technologies (mainly drip irrigation)

along with on-farm water management practices (such as mulches) which can be useful as they reduce water demand at field level by reducing non-beneficial evaporation and non-recoverable deep percolation.

Costs

The annualized capital cost of drip installation and plastic mulch coverage is INR 53,782 per ha of cropped area. This is considering a system life of 10 years for drip, one season for mulch and a discount rate of 5%. On an average, about 30,000 ha of land per annum have been covered under drip in the region during the last 11 years (2003-04 to 2015-16). Considering the same pattern, the overall annualized cost will be INR 161.3 crore for the systems installed during 2016-17.

Benefits

The annual incremental net return per ha of land covered by the technology (drip plus mulch) is INR 2,51,140. The economic value of indirect benefits (annual) in the form of positive externalities include INR 19,288 per ha for water saving benefit and INR 2,411 per ha for energy saving on account of reduced groundwater pumping. Overall, annual

incremental returns and indirect benefits will be INR 818.5 crore.

Annual costs and benefits INR/ha

Drip Irrigation and Mulching in High Value Crops

