Pilot low cost irrigation scheduling

Punjab, India

water scarcity impact

Reduced withdrawal	●
Reduced consumption	
Improved water quality	
Increased productivity	●
Net basin benefit	●

volumetric impact

216 000 m^3/yr

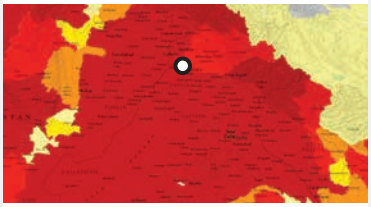
programme cost

$660 835

estimated unit cost of water

30 ¢/m^3

Water Stress
Punjab, India



Arid & low water use
Low (<10%)
Low to med (10-20%)
Med to high (20-40%)
High (40-80%)
Extremely high (>80%)
No data available

Water Stress Map:
Gassert, F., M. Landis, M. Luck, P. Reig, and T. Shiao. 2013. "Aqueduct Global Maps 2.0."

Confidence level
Low Medium High

Water Scarcity Impact Key
Main Minor

Credits
We would like to acknowledge the input of Shama Perveen, Director at Columbia Water Centre for her contribution to this case study.

Project overview

Punjab, a state located in the northwest of India, produces 20% of the nation's wheat, 11% of its rice and 11% of its cotton from only 1.5% of its geographical area. Since 1970, Punjab has seen growth in its agricultural production, however, this growth has been dependent on increasing exploitation of groundwater for irrigation. The over exploitation of groundwater has resulted in a drop in the water table by almost 80%. The abstraction is perceived to be threatening national food security.

Punjab is a major source of rice and wheat for the national food and procurement distribution system. A flat rate per unit of power for irrigation was offered by the state government leading to excessive volumes of water being used in rice irrigation. The Columbia Water Centre and Punjab Agricultural University have researched how to save water in rice cultivation. The investigation was undertaken with the intention to find a solution that farmers could implement into their farming methods in order to reduce water consumption and then, in the future, to seek a scaling up of that strategy. Tensiometers were trialled and made attractive to farmers through a structured field test. 5 306 farmers have participated in the trial from 2010 to 2013 tensiometer over the last three years. The results of the trials could then be used to predict water savings on a much larger scale.

Key Elements

- Use of tensiometers to measure soil moisture content and guide irrigation scheduling.
- The project was funded by the PepsiCo Foundation as part of a multi-country initiative.

Key Outcomes

- 5 306 farmers have participated in the trials from 2010 to 2013.
- 2 795 farmers (53%) carried through to the end of the trials.
- Water usage by participated farmers was reduced from 3 448 000m^3 to 2 800 000m^3 over 3 years.
- 19% reduction in withdrawals which also led to a 24% mean reduction in energy use per acre.

Punjab, India

Intervention Features

- Irrigation scheduling
- Soil moisture content monitoring

Project Levers

(1) Installation of technology:

Tensiometers are designed to give estimates of soil moisture content and indicate when irrigation is required to maintain crop growth. The aim is to eliminate any 'guess work' for when the crop needs to be watered and therefore reducing the volume of irrigation water that is used and promoting better crop health.

Tensiometers consist of a sealed, water-filled tube with a ceramic porous cup and vacuum gauge at the top. The water level in the tube goes down as the moisture content of the soil decreases. Irrigation is required when the moisture level reaches a specific point depending upon the crop that is being grown.

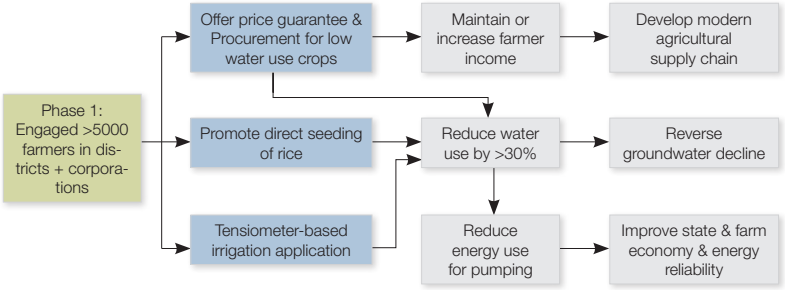
One acre of land per farmer was used for the test where half the land was devoted to the test and the other half used existing practices. Flood irrigation was the most common practice in the region which takes place when the electricity is on. The results were determined from the comparison of crop yield. One tensiometer was required per acre of land at a cost of 300 rupees ($6). These tensiometers were developed by the Punjab Agricultural University whereby the gauge had three bands, red, yellow and green to indicate the moisture content. They were calibrated for specific crops, in this case rice. Standard tensiometers ranged in cost from $40-$200. Frequency and duration of irrigation was recorded by each farmer as well as the rice yield from their trial plots.

Outcomes and Challenges

Due to energy costs for irrigation being subsidised there is little incentive for farmers to save water. This is however changing due to increasing cost of groundwater abstraction as a result of the falling water table. Farmers are aware of the impacts of climate change and the decrease in the water table and saw the need to use water more efficiently. 34% of the trialing farmers followed through to the end of the trials. Initially, this was mainly due to technical difficulties with the tensiometers, however, these problems were soon rectified. There was also a spell of excess rainfall which meant some farmers did not see the need to trial the tensiometers and in a few cases, tensiometers were stolen from the farms meaning the trial could not be completed. Adopted irrigation scheduling guided by these simple and affordable tensiometers would reduce the application of irrigation water of 1 050m^3 of water per hectare per year.

The opportunities for up scaling this study and demonstrably addressing the falling groundwater table need to be investigated further and the impact of reduced return flows considered. The project demonstrated that the provision of a simple affordable tool can aid irrigation scheduling. However its full effectiveness will depend upon parallel development of options that create either a legislative environment that prevents overexploitation of water resources through enforced allocations or opportunities to increase the attractiveness of other less water intensive crops. Some of the options identified by the study are shown below.

Above: Tensiometer use in Punjab
(© Columbia Water Center, NY)



Above: Pepsico Foundation & Columbia Water Centre proposals for future development
(© Columbia Water Center, NY)