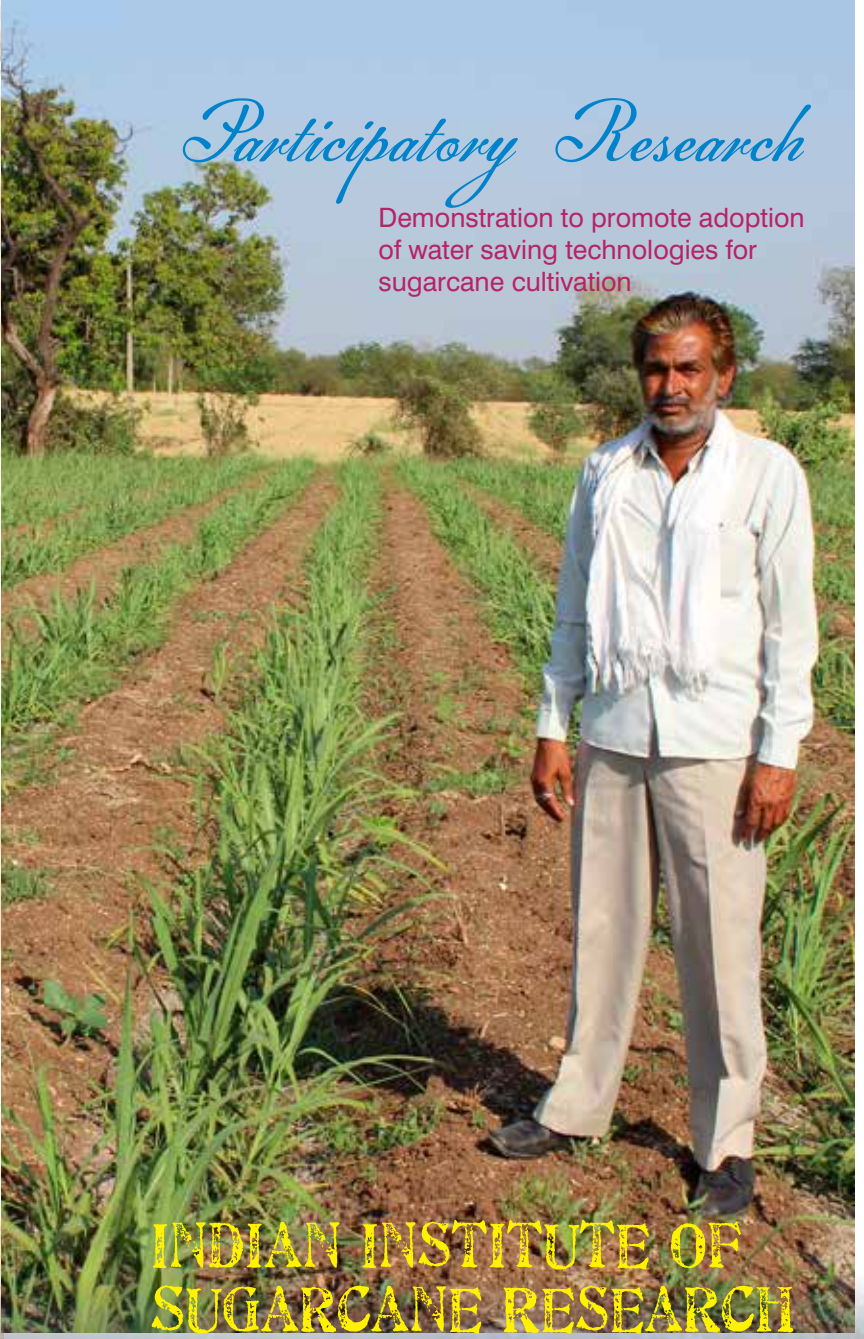
Participatory Research

Demonstration to promote adoption of water saving technologies for sugarcane cultivation



Sugarcane is categorized as one of the crops having high water requirement. The need of the hour is to promote large scale dissemination and adoption of technologies that can enhance water use efficiency and water productivity in agriculture.

Participatory research demonstrations, unique approach to analyze sugarcane cultivation

The Farmer Participatory Research (FPR) is a "learning by doing" approach, which encourages farmers to engage in experiments in their own fields so they can learn and adopt new technologies before sharing it with other farmers. A study was initiated by Rajendra Gupta, T.K. Srivastava, Kamta Prasad, A.K. Sah and K.P. Singh from the Indian Institute of Sugarcane Research, Lucknow in the backward districts of Barabanki and Sitapur in Uttar Pradesh, with the objective of enhancing on-farm irrigation water use efficiency by demonstrating water saving technologies to sugarcane growing farmers; refining technologies as per their need for sustainable adoption and enhancing their profitability and knowledge. A selection of farmers who could be part of the on-farm trials was based on their knowledge about farming and willingness to share their experience. They had to have a minimum of one hectare area under sugarcane cultivation with experience of growing sugarcane for at least 4-5 years.

As many as a hundred participatory research demonstrations on irrigation water saving technologies spread over three cropping seasons (2008-9, 2009-10 and 2010-11) were conducted. These experiments used four water saving technologies: Ring-pit planting, Skip-furrow irrigation, Trash mulching and Irrigation at Critical Growth Stages (ICGS). These were then compared with existing farmer practices.

How the on-farm experiments fared

Sugarcane yield data reveals that yield was considerably higher under demonstrated technologies as compared to that under farmers' practice. Ring-pit system of planting and skip-furrow method of irrigation yielded significantly higher production of sugarcane as compared to the farmers' practice and other demonstrated technologies.

Saving in irrigation water varied from 17.8 to 30.8%. The increase in irrigation water use efficiency (IWUE) was recorded highest in

ring-pit method of planting (142.6%) over the conventional method. Overall, results revealed that the farmers participating in demonstrated technologies registered a significant increase in sugarcane yield, irrigation water saving and irrigation water use efficiency (Table 1).

Effect of demonstrations on knowledge and adoption level of beneficiary farmers

Table 1: Effect of demonstrated technologies on yield, saving in irrigation water and irrigation water use efficiency in sugarcane

Technology	No. of demos 2009-11	Sugarcane Yield (t/ha)	Increase in cane yield over farmers' practice (%)	Irrigation water applied (ha-cm)	Saving in irrigation water over farmers' practice (%)	IWUE (kg cane ha $^{-1}$-mm^{-1})	Increase in IWUE over Farmers' practice (%)
Ring-pit method of planting	16	125.28	96.4	54.56	19.1	236.7	142.6
Skip-furrow method of irrigation	32	88.54	38.8	54.15	17.8	164.8	68.9
Trash mulching	28	80.18	25.7	47.93	27.1	168	72.4
ICGS	24	81.76	28.2	45.41	30.8	180.7	85.2
Farmers' practice		63.8	-	66.01	-	97.6	

Technology and result demonstrations conducted at farmers' field led to increase in knowledge level and support to the farmers in the form of supply of critical inputs culminated in enhanced adoption of sugarcane technologies by the farmers. The demonstrations also helped farmers to get information from different extension agencies related to scientific cultivation of sugarcane, marketing, availability of inputs and subsidies. Highest knowledge enhancement (96%) was observed in ring-pit method of planting. However, the highest adoption (86%) was for skip-furrow method of irrigation. Considerable increase in adoption of water saving technologies clearly indicates farmers' satisfaction with performance of these technologies under their resource conditions (Table 2).

Table 2: Effect of demonstrations on knowledge and adoption

Technology	Increase in knowledge levels from pre to post demonstration (%)	Increase in adoption of technique from pre to post demonstration (%)
Ring-pit method of planting	96	81
Skip-furrow method of irrigation	86	86
Trash mulching	62	47
ICGS	83	85

Joint effort of scientists & farmers creates a model for replication

Feedback from farmers expressed satisfaction with increase in sugarcane yield and savings in water use. The ring-pit planting technique produced higher germination which resulted in higher density of mother shoots but required higher inputs of labor and cane setts. The skip furrow method helped farmers report lesser weed growth and crop lodging.

With trash mulching, farmers observed good bud sprouting when ratoon is initiated during winter months. Farmers were trained in identifying stages of crop growth critical for irrigation, adoption of this technique resulted in saving water without sacrificing yield.

As compared to formal field trials, the farmers' participatory research experiment can improve effectiveness of technology development, raise adoption rates, strengthen farmers' experimental capabilities and increase the payoff to agricultural research. The findings reinforce the fact that the irrigation development alone cannot produce optimal results unless the irrigation system as a whole, from the source of water unto the farm level is well managed.

Different planting/irrigation techniques used as part of the study

Ring-pit planting technique: In this planting technique, the field was marked in squares with side length of 120cm, leaving 1m wide strip along the field's periphery. Pits of 90cm diameter and 45cm depth were made at the centre of each square. In every pit, farm-yard manure, urea, DAP, MoP and zinc sulphate were mixed uniformly before placing the setts for planting. Light irrigation was given soon after planting to accelerate germination. Post 30 days of germination, 2nd dose of urea was applied in pits with half the remainder soil filled back in the pits. At the end of tillering phase, 3rd dose of urea was applied, remaining soil filled back and pits were interconnected with small channels for irrigation.

Skip-furrow method of irrigation: Instead of irrigating all furrows and inter-row spaces, irrigation was given in alternate furrows with sugarcane planted on flat beds.

Trash mulching: After harvesting the plant crop, a thick blanket of sugarcane trash (dried leaves) @10 t/ha was spread in inter-row spaces at ratoon initiation stage. Effectiveness of irrigation is augmented as the evaporation losses from soil surface are considerably reduced.

Irrigation at critical growth stages (ICGS): Critical stages for sugarcane irrigation are emergence, 1st order of tillering, 2nd order of tillering and 3rd order of tillering which is the most critical stage. In areas of limited water supply, ensuring irrigation at critical stages and deferring at somewhat less critical period can improve yield and water use efficiency.

Farmer's practices: Farmers of the selected villages plant sugarcane at 75 cm row to row spacing. They did planking after planting and divided the field in 15 to 20 m wide borders for irrigation. Farmers irrigate the crop as and when their turn for canal water arrives; irrespective of whether the crop needs it or not.

Reflections and Way forward

This study would contribute towards reducing the water footprint for sugarcane which is vital considering India is the second largest producer in the world. The results of the research should be incorporated as part of the Comprehensive District Agriculture Plans (C-DAP) and other Krishi Yojanas to ensure dissemination and implementation at a wider scale. Similar farmers' participatory research studies should be conducted for other water intensive crops such as paddy and wheat.

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