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## **A cost benefit analysis of crop production with various irrigation systems**

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### **Abstract**

India has the largest irrigation network in the world yet the irrigation efficiency is not been more than 40 per cent. In absence of new irrigation projects, bringing more area under irrigation would mostly rely on the efficient use of water. In this context, micro irrigation could play a key role in higher productivity and increased water use efficiency (WUE) besides fulfilling sustainability mandates with economy in use and higher crop productivity. Adoption of this might help in raising the irrigated area; productivity of crops and WUE. Drip-fustigation, where fertilizer is applied through an efficient irrigation system (drip method), nutrient use efficiency could be as high as 90 per cent compared to 40-60 per cent in conventional methods.

**Keywords:** India, new irrigation projects, Drip-fustigation

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### **Introduction**

India has the largest irrigation network in the world yet the irrigation efficiency is not been more than 40 per cent. In absence of new irrigation projects, bringing more area under irrigation would mostly rely on the efficient use of water. In this context, micro irrigation could play a key role in higher productivity and increased water use efficiency (WUE) besides fulfilling sustainability mandates with economy in use and higher crop productivity. Adoption of this might help in raising the irrigated area; productivity of crops and WUE. Drip-fustigation, where fertilizer is applied through an efficient irrigation system (drip method), nutrient use efficiency could be as high as 90 per cent compared to 40-60 per cent in conventional methods. Although drip irrigation is an acceptable technology by the Indians farmers, its rate of adoption is sluggish in annual crops due to involvement of initial high capital cost. Nevertheless, the area under drip irrigation has increased manifolds from 1500 ha (1989) to 2 mha (2010), However, this is extremely miniscule when compared to the potential of 69 mha. While devising appropriate reason for this poor growth of this technology, high initial cost is one of the major constraints hindering its rapid adoption in annual crops including cotton. Adoption of drip system per hectare land of cotton is estimated at Rs 65,000 to Rs 75, 000 and the initial investment is high. For successful adoption, a technically feasible irrigation method should also be economically easier for adoption. Hence, two low cost drip systems of micro tube drip (39.4%) and poly-tube based drip (57.8%) were developed through rigorous testing procedures for optimum efficiency at CICR, Coimbatore. The bulletin is prepared by including emphasis for reducing system cost, principles of irrigation in cotton and justification in promoting and following the low cost systems. Performance of low cost systems with respect to growth characters, yield, quality, input use efficiency, and economics are assessed and included. Thus, the bulletin is very much useful in promoting low cost drip system for an efficient on farm irrigation scheduling in Bt cotton.

Cotton (*Gossypium hirsutum* L.) being the most important commercial crop of India (10.3 m ha with a production of 29.5 Million bales of lint in 2009-10) contributes to around 60 per cent of the raw material to the textile industry and provides employment to nearly 60 million people with productivity of 494 kg/ha. Further impetus to cotton productivity i.e., to the world average of 725 kg/ha is possible through efficient and optimal use of precious on farm inputs i.e., water and nutrient. Management of water and nutrients plays a key role in breaking of the undesired tempo in productivity plateau reached after major enhancement by introduction of Bt cotton which occupies more than 85% area under Cotton. Good quality water is having multifarious application such as for irrigation, industrial use, power generation, livestock use, and domestic use both in urban and rural areas. Due to increasing cost of irrigation projects and limited supply of good quality water, water becomes a high value commodity and is known as liquid gold. As quoted by Sir. C. V. Raman, water is the ELIXIR of life that makes wonders in earth if it is used properly, efficiently, optimally, equitably and judiciously. For this, the best known technique is micro-irrigation that is proven for its efficiency, water & input saving. Since indiscriminate use of water through conventional type with 60 per cent application efficiency is causing serious threat to available ground water resources on the other hand drip-fustigation, where fertilizer is also applied through an efficient (drip) irrigation system, Nutrients Use Efficiency could reach as high as 90 per cent besides achieving > 95 per cent application efficiency. Therefore, the amount of fertilizer lost through leaching could be as low as 10% in drip fustigation as compared to 50% in the traditional one. A study on drip fustigation in Israel indicated that realization of highest yield of seed cotton (6.3 t ha<sup>-1</sup>) was possible, and the projected area of drip irrigation in India would be about 10 m ha by 2025.

### Principles of water management

- Cotton seeds will not germinate until they absorb half their weight of water
- Which is considerable A planned moisture regime that will restrain vegetative growth without
- Adversely affecting yield is essential. Desirable that the plant completes most of its vegetative growth before the
- Flowers appear and this is the best achieved by moisture regime that promotes regular and rapid but not excessive development of the young plant. During early part of the season, less water is used by the plant and more water
- Is lost by evaporation than transpiration. The peak is reached when the plant is loaded with bolls and water consumption
- Then begins to decline. Ample moisture during flowering and boll formation is essential.
- Moisture stress during these periods' results in flower drop, boll shedding, poor
- Development of bolls, low ginning percentage and ultimately low yield of fiber.

### Potential advantages of Drip Irrigation

#### Enhanced water utility

Irrigation water requirements can be reduced with drip irrigation over traditional one although the water savings, of course, depend on the crop, soil, environmental conditions and the attainable on-farm irrigation efficiency. Primary reasons for water savings include precision irrigation, decreased surface evaporation, reduced irrigation-runoff from the field and controlled deep percolation losses below the crop root zone

#### Better crop growth and yield

Under drip irrigation system, soil water content in the active portion of the plant root zone remains fairly constant because irrigation water can be supplied slowly and frequently at a predetermined rate. Here, the total soil water potential increases (soil water suction decreased) with elimination of the wide fluctuations in the soil water content. Proven results revealed that the benefits of drip irrigation includes frequent irrigation to crop as far as practicable, free from irrigation induced soil aeration, less plant disease and restricted plant root growth.

#### Superior fiber quality

The influence of irrigation water on fiber quality is less pronounced compared to its effect on seed cotton yield. The extreme regime of either excess water or prolonged dryness could reduce the fiber length. But, limited irrigation has no influence on ginning percentage, fiber length and bundle strength although limited moisture increased the fibre staple length

#### Reduced salinity

Evidences suggest that waters of higher salinity can be used in drip irrigation without greatly reducing crop yields. Minimizing the salinity hazard to plants by drip irrigation can be attributed to dilution of the salt concentration in soil solution following irrigation to maintain high soil water status in the root zone and movement of salts beyond the active plant root zone. Drip system suitable to use saline water has

### Conclusion

For successful adoption, a technically feasible irrigation method should also be economically easier for adoption. Thus, low cost polytube drip system performed higher in terms of crop growth characters, yield attributes & seed cotton yield and in optimum efficiency through water use efficiency, uniformity coefficient, nutrient use efficiency and economics of nutrient use efficiency. Thus, the bulletin showed the suitability and viability of low cost polytube drip system for an efficient on farm irrigation scheduling in BT cotton.

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