

## Drip Fertigation Technology for Enhancing Water and Nutrient Use Efficiency in Arid Agro-ecosystem of Irrigated North-Western Rajasthan

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**Abstract:** Field experiments were conducted from 2002 to 2012 in AICRP on IWM at Agricultural Research Station, Sriganganagar to find out optimum crop geometry under drip system, optimum drip irrigation schedule and optimum fertigation schedule for American cotton (hybrid *hirsutum* cotton), Bt cotton, sugarcane and brinjal. The pooled results of the trials revealed that paired planting in Bt cotton, sugarcane and brinjal was found cost effective without any yield loss. In American cotton paired planting gave significantly higher seed cotton yield over single row planting. Drip irrigation schedule at 1.0 ET<sub>c</sub>, 1.0 ET<sub>c</sub>, 80% PE and 1.0 ET<sub>c</sub> was found optimum for American cotton, Bt cotton, sugarcane and brinjal, respectively. The increase in yield of respective crops was 24.2, 31.0, 26.4 and 30.9% and saving of water was 13.3, 32.9, 17.1 and 29.6% over conventional practice. Drip irrigation also improved the quality of produce by increasing fibre length and fineness in cotton lint and commercial cane sugar to the extent of 35.8% over conventional practice. Drip irrigation also suppressed the pest population in cotton. The fertigation schedule 150 kg N and 20 kg K<sub>2</sub>O ha<sup>-1</sup> (40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as basal) in 6 equal splits at an interval of 15 days for American cotton, 120 kg N, 32 kg P<sub>2</sub>O<sub>5</sub> and 16 kg K<sub>2</sub>O ha<sup>-1</sup> in 6 equal splits at an interval of 15 days and 2% foliar spray of KNO<sub>3</sub> at 90 and 105 days after sowing for Bt cotton, 112.5 kg N and 30 K<sub>2</sub>O ha<sup>-1</sup> (40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as basal) in 9 equal splits at an interval of 20 days for sugarcane and 96 kg N and 48 K<sub>2</sub>O ha<sup>-1</sup> (80 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as basal) in 12 equal splits at an interval of 10 days for brinjal was found optimum. The increase in yield of respective crops due to optimum fertigation schedule was 49.8, 15.6, 20.7 and 30.6% and water saving was 13.3, 24.3, 25.0 and 29.6% and fertilizer saving was 0, 20, 25 and 20% over conventional practice of irrigation and fertilizer application. In both drip irrigation and fertigation water expense efficiency increased by 43.3 to 85.9% over that of conventional practice. Thus, drip irrigation with fertigation was found a better option to increase water and nutrient use efficiency in arid agro-ecosystem of Irrigated North Western Rajasthan.

**Key word:** American cotton, brinjal, Bt cotton, crop geometry, drip irrigation, fertigation, quality, sugarcane, yield, water expense efficiency.

Irrigated North-Western Plain Zone of Rajasthan, comprising of Sriganganagar and Hanumangarh districts, is a part of the vast arid tract of Thar Desert. The geographical area and net cultivable area of the zone is 2.06 and 1.71 m ha, respectively. Most of the soils in the region come under *Torrismments* and *Torrifluvents* groups. These soils are light textured having low organic carbon and poor water holding capacity. The climate of the area is hostile. The rainfall is very low and erratic. The average annual rainfall varies from 250 to 350 mm. During summer maximum temperature goes as high as 46 to 48°C and

during winters the minimum temperature goes as low as 1 to 2°C. Humidity remains low throughout the year except during rainy season. The mean annual pan evaporation is 1825 mm. There is wide gap between rainfall and pan evaporation throughout the year. The ground water in general is brackish. Thus, the crop production is mainly dependant on canal irrigation. The water availability in canal (Gang, Bhakra and Indira Gandhi) command is inadequate and uncertain. There is no match of water availability with crop water requirements. The farmers also face the inequitable distribution of water when canal is closed without completing its cycle due to one or other reason. The requirement of warabandi,

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