

STUDIES ON EFFECT OF TRICKLE IRRIGATION SYSTEM IN ORCHARD

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ABSTRACT : Trickle irrigation system was introduced mainly for irrigating orchard crops in canal command area of south-west Punjab. In this study, efforts have been made to evaluate the impact of trickle irrigation system in orchard at farmer's field. Exhaustive surveys were conducted to collect the information regarding performance of this technology. Based on this study it was found that timely and frequent watering reduced kinnow fruit dropping $5\pm 1\%$. Results of the study also revealed 23% more yield for trickle irrigated kinnow orchard. Water use efficiency 5.59 q/cm was found with trickle irrigation as compared to 3.29 q/cm of surface irrigated orchard. It was also found that trickle irrigation system utilized 33% less fertilizer as compare to conventionally managed orchard. The 41% additional area cultivated due to adoption of trickle irrigation system. Early fruiting observed in guava orchard where trickle irrigated system was installed from very beginning. Trickle irrigated guava orchard produced Rs. 15000/- ha even at the age of 3-years only while surface irrigated orchard of same age was not in position to take fruiting. Besides the numerous advantages with trickle irrigation system, the technical and managerial problem noticed at farmer's level in canal irrigated areas.

Key Words : Trickle irrigation, guava orchard.

South-West part of Punjab is characterized as semi-arid agro-climatic zone predominantly occupied by light textured soil with higher concentration of salts. Ground water is salting and agriculture is totally dependent on canal water supply. Cotton-wheat and orchards are the main crops of this region. Due to higher water demand of cotton wheat generally orchards experience water scarcity during critical stages results heavy fruit dropping specially in kinnow orchard.

Trickle irrigation system has been recognized as an answer to meet the increasing demands of water especially of orchard crops with available limited water supply. This method has about 95% water application efficiency. Due to the obvious advantage of providing high irrigation efficiencies, trickle irrigation is becoming more popular day by day. There has been a significant increase in the area under trickle irrigation in the country. From a mere 1500 ha in 1985, the area under trickle irrigation has grown to 2,59,500 ha at present (Alam and Kumar, 2001; Dhillon and Singh, 1965). Through field survey, impacts of installation of trickle irrigation in orchard

crop were studied. The specific objective of the study was to evaluate the performance of trickle and conventional methods of irrigation for orchard crops.

MATERIALS AND METHODS

The data regarding the system and their performance at farmer's field were collected from the farmers through questionnaire, face to face discussion, personal inspection and measurements. The field observation includes the type of orchards, age of orchards, source of water supply, construction feature of storage tank, irrigation system detail, crop detail including cost of cultivation, yield and cost of produce. Trickle system details in different orchard crops are given in Table-1.

RESULTS AND DISCUSSION

The comparative performance of trickle and conventional methods of irrigation are studied under following heads—

Yield

The frequent and timely meeting of water demand of the plant resulted better yield and quality of the fruit. Trickle irrigation system also reduced kinnow fruit dropping by $5\pm 1\%$ (Table-2) with mitigating

Table-1 : System and crop details of orchard crops.

Crop	Details	Crop	Details
Kinnow	a. Farm farm size - 15 ha age of the tree - 16 year plant spacing - 6 × 6. m no. of plants - 278/ha Water Supply water storage tank tank size-60 m × 60 m × 6 m construction material - lime + cement surkhi Irrigation system irrigation system-trickle no. of emitters per plant-6 emitters discharge-8 lph operating hour/day-4 total days of irrigation in a year -221 Source of power supply-electricity	Guava	(a) Field farm size - 1.0 ha age of tree - 3.0 year spacing - 6 × 6 m no. of plants - 278/ha (b) Water supply (l) water storage tank tank size - 53 × 45 × 2.7m construction material - surkhi + lime + cement Irrigation system irrigation system-trickle no. of emitters per plant-4 emitters discharge-8 lph operating hour - 3 hr/day total days of irrigation in a year -240 Source of power supply-Solar

water stress during adverse climatic conditions (Table-2) also reveals higher kinnow yield 240 kg/plant under trickle irrigation over 200 kg/plant for surface method. The higher return Rs. 93,000/ ha recorded for trickle irrigated orchard over Rs. 60,000/ha of surface irrigated kinnow.

Early fruiting in guava observed due to better growth of plant of trickle irrigation system. Trickle irrigated guava orchard produced Rs. 15000/ha even at the age of 3 years while only 50% fruiting allowed due to the early age of plant for fruiting. The same aged flood irrigated guava orchard was not in position to give fruiting.

Irrigation water saving

It is now well established fact that trickle irrigation system utilizes the water most efficiently other than any methods of irrigation for irrigating

widely spaced crop i.e. orchards. This saved water could be used for irrigating another crops resulting into more area under irrigation which otherwise was rainfed or uncultivated. The saving in irrigation water was worked out as additional area irrigated due to installation of trickle irrigation for irrigating the fruit crops. With the use of trickle irrigation, an increase in area under cultivation could be increased upto 34 ha (16 ha orchard + 16 ha cotton-wheat, bengal gram, mustard) from 24 ha of cultivated area with the same amount of available canal water supply (Table-2). This shows the indirect benefits of the system by increasing the cultivated land which otherwise was kept fallow.

Saving of Labour and Energy

Trickle irrigation leads to a considerable

Table-2 : Summary of the results obtained from the study.

Parameter	Without trickle irrigation	With trickle irrigation
Irrigation water saving (in term of additional area irrigated)	Total 24 ha area under irrigation 16 ha-cotton-wheat, mustard, Bengal gram 08 ha-orchard	Total 32 ha area under irrigation 16 ha-cotton-wheat, mustard, Bengal gram 16 ha-Orchard
Energy saving	Interculture- 14±1 times/year	Interculture- 8±1 times per year
Labour charge	15 spray	10 spray only
Insecticide & pesticide		
Fertilizer saving	300 g/plant, 4 times in a year	200 g/plant 4 times in a year
Yield and Quality	Kinnow 195±10 kg fruits/plant More dropping of fruit 1100±100 fruit/plant non uniform size (≥ 4 grades) Auction price - Rs. 60,000 - 65,000 per ha	240±10 kg/plant 5±1% fruit ropping 1150±100 fruit/plant uniform size (≥ 3 grade only) Auction price - Rs. 93,000 - 100,000 per ha
	Guava (i) some plant damaged due to water scarcity (ii) no fruiting-	Due to frequent nature of watering very few plant damage occurred 80±10 fruit/plant 20±5 kg/plant Auction price Rs. 15,000/ha

saving in labour and energy. With trickle irrigation, a single man can irrigate a large area as well as provides fertilizer through irrigation water frequently as per need of the plant. Trickle irrigation also leads to less weed growth because of localized watering. Thus, a considerable labour and energy saving observed in trickle irrigated orchard. The results of the study depicted saving in labour requirement about 43% for interculture, training and pruning, fertilization etc. with trickle irrigation (Table 2). Similarly, Guatal *et.al.*, (1989) found a saving of labour charges upto 25% in trickle system compared to conventional method. Results of the study also depict that about 33% less fertilizer was applied through fertigation in trickle irrigated orchard as compared to surface irrigated. Urea was used only for fertigating orchard. Similarly, Bar Yosef (1977) found urea to be best source of fertigation through trickle irrigation.

In this study it was also found that trickle irrigated orchard experienced very less pest and disease attack as compare to conventionally irrigated kinnow. Over 40% less fungicide sprays were down in trickle irrigated orchard.

Constraints in adoption of trickle irrigation

The advantages of trickle irrigation have been scientifically proven, even though the adoption level is not satisfactory of this technology. The feed back about the constraints in promoting the technology was taken from the farmers and found that high initial investment involved in installation is a major constraint in promoting the system. They also pointed out that they face a lot of difficulties in getting subsidy offered by the government towards promotion of the system. Since, in this region canal water is being used as source of water supply for the system, which is having a lot of impurities, caused clogging problem for the emitters. Unsatisfactory service after

sale by the manufacture/companies was also noticed. Besides these, problems relating to the technology viz. non availability of information about water requirement for the horticultural/orchards crops depending on soil texture, age of the tree and climatic conditions was experienced. The study also pointed out that there is a dire need to educate/train farmers for smooth operation and maintenance of the system at their own level. (Padma Kumari and Sivanapan, 1979; Srinivas, 1999; Sudha Kar, 1993).

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