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*Short communication*

# Pitcher irrigation for young mango plantation in water scarce hilly tracts of southern Gujarat

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Study on young mango (cv. Kesar) plants was conducted to evaluate the performance of pitcher irrigation on young mango crop. It was found that there was non-significant change in growth amongst the treatments during first four years of the crop. Under pitcher irrigation survival percent of plants was 96% with only 4% mortality was due to mechanical damage and disease. The result analysis shows that treatment $T_1$ which consists of one pitcher of 10 l capacity, filled weekly could save 50% water, with minimum cost and without significantly affecting the plant growth till first four years. The analysis with respect to water saving and cost involved shows that treatment $T_2$, i.e. by placing two pitchers of 7 l capacity filled every 8$^{th}$ day, shows the second best growth in spite of 30% water saving and 30% less cost of irrigation as compared to control.

Mango is one of the major crops of the southern Gujarat and the area has export potential due to nearness to Mumbai port. It is observed that mango requires regular irrigation during first five years and in the subsequent years only three watering are required during the year viz. first at the pea stage; second at marble stage and third at 20 days interval from the second irrigation. For getting higher produce, farmers irrigate by flooding or through check basin method of irrigation or through drip method of irrigation. In check basin and flooding method of irrigation much of water goes as losses. Buried clay pots are not sensitive to clogging as emitters, although they may clog with time (3 or 4 seasons) and required to be reheated. The book Fan Sheng Chich Shu (one of the first agricultural texts) describes the use of buried clay pot in China more than 2000 years ago (Sheng Han 1974). It is likely that, buried clay pot irrigation had been used for many years before the description was published and current practice remains much the same. This ancient method is still practiced today in several countries like India, Iran, Brazil etc. Mondal (3), Reddy and Rao (7), Bainbridge (1), Bainbridge (2) and Rai (6) found that buried clay pot uses as little as 10% of the water used in conventional surface irrigation method.

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The problem in adoption of drip irrigation method are high initial investment, after sales maintenance costs and requirement of electricity at least for few hours during the day which is a rare possibility in villages especially the hilly regions. To cope with this problem, in rain fed areas of the region, pitcher method of irrigation could be helpful. More et al (5) conducted experiment using pitcher irrigation on mango crop and found that 50% water saving can be achieved by this method during the first year of planting.

The study on young mango cv. Kesar plants was conducted at Agricultural Experiment Station, Navsari Agricultural University, Paria, Gujarat, during 2003 - 06. Treatment details are shown in Table 1. The design adopted for analysis was randomized Block Design (RBD). There were four replications and two plants per replication. Plant to plant spacing was kept at 10 m x 10 m. Initial fertility status; pH and EC of different layers of the soil in the plot area are given in Table 2. Half baked pitchers were purchased from local artisans, later 3 mm diameter hole was drilled by a hand tool at 1/7$^{th}$ height of pitcher. Later, 5 cm long wick (cotton cloth) was inserted from the hole, from the inner side the pitcher. The wick was knotted at the end (inside the pitcher) and the other end was kept pointing towards the root. Pit of 60 cm x 60 cm size was prepared and filled with a mixture of farm yard manure and soil in equal proportion. Pitchers, as per treatments, were placed in

**Table 1.** Treatment details for pitcher irrigation in mango.

| Treatment code | No. of pitcher | Capacity of pitcher (L) | Weekly Irrigation frequency | Total volume of water (L/week) |
|---|---|---|---|---|
| $T_1$ | 1 | 10 | 1 | 10 |
| $T_2$ | 2 | 7 | 1 | 14 |
| $T_3$ | 2 | 10 | 1 | 20 |
| $T_4$ | 3 | 7 | 1 | 21 |
| $T_5$ | 2 | 7 | 2 | 28 |
| $T_6$ | 0 | - | 1 | 20 |

**Table 2.** Soil data of experimental plot at different depth.

| Soil Depth (cm) | pH | EC($dSm^{-1}$) | Nitrogen (kg/ha) | $P_2O_5$(kg/ha) | $K_2O$ (Kg/ha) |
|---|---|---|---|---|---|
| 0-15 | 6.57 | 0.24 | 297.9 | 36.31 | 378.0 |
| 15-30 | 6.29 | 0.40 | 269.7 | 38.44 | 364.5 |
| 30-45 | 6.69 | 0.27 | 257.2 | 32.04 | 364.5 |
| 45-60 | 6.80 | 0.24 | 250.8 | 26.70 | 337.5 |
| 60-75 | 6.97 | 0.22 | 250.8 | 27.76 | 351.0 |
| 75-90 | 7.16 | 0.20 | 222.6 | 24.56 | 324.0 |
| 90-105 | 7.19 | 0.19 | 219.5 | 24.56 | 324.0 |
| 105-120 | 7.31 | 0.21 | 216.3 | 25.63 | 297.0 |

pits and later covered with lid and ring around the plant was mulched with paddy straw. Irrigations were applied as per the treatments by manually filing pitchers using buckets, from a water source nearby. Biometric observations were taken each year, before onset of monsoon during the study period.

Total water applied in pitchers during the study period is shown in Fig. 1. Maximum water is applied in $T_5$

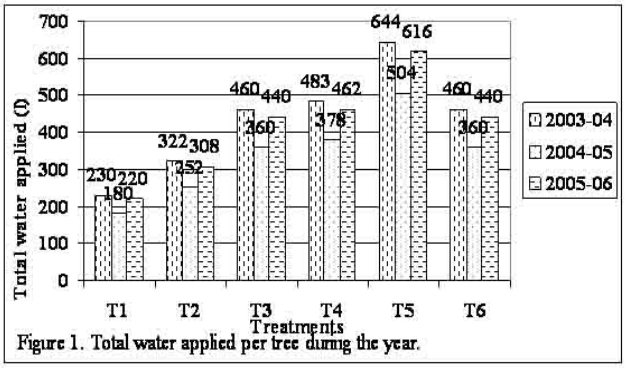

Figure 1. Total water applied per tree during the year.

followed by $T_4$ and $T_3$ and $T_6$, minimum water was applied in $T_1$. There was no significant change in any of the growth parameter during first two years of study or till 3 yr of plant age, in different treatments. However, from the third year (4yr-old-plant) significant changes in height and spread are observed (Table 3). Treatment $T_5$ recorded maximum height and spread but was at par with $T_2$, the reason being water requirement increases with age and roots start penetrating deeper.

The results of present study implies that by placing a pitcher of 10 l capacity filled every week could save 50% water with minimum cost without any significantly adverse effect on plant growth during first three years. From the fourth year of plant age, due to slight increase in water requirement, 2 pitcher of 7 L capacity with 30% water saving are required.

Table 3 shows that the biometric parameters are best in $T_5$ treatment (Two pitchers of 7 L capacity filled every 4th day), followed by $T_2$ (Two pitchers of 7 L capacity

**Table 3.** Mean biometric parameters (cm) during the fourth year of mango plantation.

| Treatment | Girth | Height | Spread | |
|---|---|---|---|---|
| | | | E - W | N - S |
| $T_1$ | 13.3 | 197.3 | 135 | 144 |
| $T_2$ | 13.8 | 245.8 | 191 | 218 |
| $T_3$ | 11.0 | 212.0 | 186 | 184 |
| $T_4$ | 13.0 | 234.5 | 190 | 183 |
| $T_5$ | 13.8 | 277.8 | 234 | 209 |
| $T_6$ | 15.0 | 197.8 | 174 | 166 |
| CD @ 5 % | NS | 33.0 | 35.0 | 38.0 |
| CV % | 18.30 | 9.65 | 12.69 | 13.63 |

filled every 8th day. The cost in treatment $T_2$ is 30% less (Fig. 2) than control treatment, in addition to the water saving of 30% from control treatment and 50% water saving from best treatment $T_5$ (Fig. 1). It is followed by $T_1$ (One pitcher of 10 l capacity filled every 8th day), $T_3$ (Two pitchers of 10 l capacity filled every 8th day) respectively. Whereas $T_4$ (Three pitchers of 7 l capacity filled every 8th day (total 21 l) and $T_6$ treatments (Ring method of irrigation on every 8th day (total 20 l) are more or less equal with an slight edge of $T_6$ treatment, in the observed parameters.

Cost of pitchers was maximum in $T_4$ (4,500 Rs/ha), followed by $T_3$ (4,000 Rs/ha), $T_2$ (3,000 Rs/ha), $T_5$ (3,000

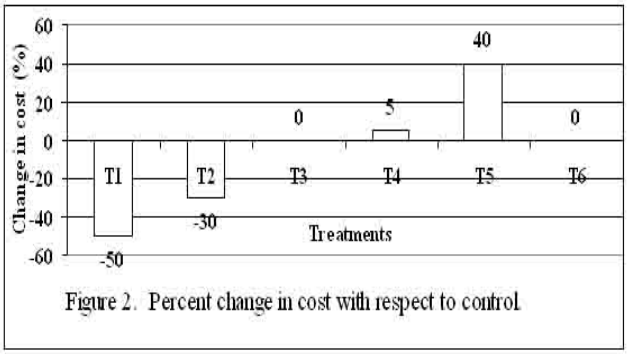

Figure 2. Percent change in cost with respect to control

Rs/ha) and $T_1$ (2,000 Rs/ha) respectively. When considering the cost of labour for filling the pots, there was 50 and 30% saving in treatments $T_1$ and $T_2$ respectively as compared to ring control. The cost of $T_3$ was same as that of control, whereas (Fig. 1), the cost of $T_4$ (50%) and $T_5$ (40%) was higher than control. Farmer of small land holding will himself fill pitchers in rotation as he will have to fill at the most 15 pitchers daily, which will require not more than 40 min., thus saving the high labour cost.

There was non - significant change in growth amongst the treatments during first four years of the crop. Under pitcher irrigation survival percent of plants was 96% with only 4% mortality was due to mechanical damage and disease. The results shows that treatment $T_1$ which consists of one pitcher of 10 l capacity, filled weekly could save 50% water, with minimum cost and without significantly affecting the plant growth till first four years. The analysis with respect to water saving and cost involved shows that treatment $T_2$, i.e. by placing two pitchers of 7 L capacity filled every $8^{th}$ day, shows the second best growth in spite of 30% water saving and 30% less cost of irrigation as compared to control.

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