

STUDIES ON GROWTH AND YIELD PARAMETERS OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. L-49 THROUGH DRIP IRRIGATION AND MULCHING UNDER AGRO-CLIMATIC CONDITION OF CHHATTISGARH PLAINS

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Abstract: The experiment was carried out during the year 2009-2010 in Randomized Block Design (RBD) with five replications and eight treatments allocating mulching with different irrigation levels viz., 100%, 80% and 60% of water through drip and flood irrigation. The guava variety L-49 was taken with the objectives to study scheduling of irrigation under drip irrigation system, to work out the water requirement of guava and to assess the effect of black plastic mulch on growth and yield parameters of guava. The use of 80 per cent water through drip irrigation with plastic mulch was found effective for guava plants. The plants in respect of canopy spread, number of fruits per plant, fruit yield per plant and per hectare, days to 50 % flowering (minimum), days to fruit maturity (minimum) were found superior under 80 per cent water through drip with plastic mulch. While, highest plant girth and more number of primary branches were observed under 100 per cent of water through irrigation by flood system. The maximum number of leaves and twigs was observed with the treatment 60 % of water through drip irrigation.

Keywords : Drip irrigation, mulching, guava, growth and yield

INTRODUCTION

Guava (*Psidium guajava* L.) belonging to family "Myrtaceae" is an important and commercial fruit crop of tropical and subtropical region of India. The area under guava in our country is 181.7 thousand ha and production is 1823.3 thousand metric tonnes with a productivity of 10.03 t/ha, whereas in Chhattisgarh, the area and production is 10814 ha and 85863 metric tonnes, respectively with a productivity of 8t/ha, which is not encouraging (Anon., 2008).

Water stress during the critical stages of fruit growth and development is the main reason for low productivity. Majority of guava orchards in Chhattisgarh are rainfed, low-yielding and produce fruit of sub-standard quality. In such situation, water and weed management especially during the period between fruit set to maturity plays an important role in improving the yield. For efficient water and weed management under such situation, drip irrigation alongwith mulching is the best option which saves 25-30 per cent irrigation water. The scheduling of irrigation adopted in orchard influences the availability of soil moisture to the plant as well as its distribution in the soil profile and thus improves yield and quality in bearing trees. The advantageous effects of drip irrigation have been proved by many workers viz., Nath and Pathak (2006), Pathak *et al.* (2002) and Sen and Deshmukh (2000) in guava and aonla, but the actual requirement of water varies in different agro-climatic conditions. The beneficial effect of plastic mulch in guava production has been widely discussed by several workers such as Bhattacharya and Bortharkar (1992), Debnath *et al.* (2004) and Maji and Das (2008).

Hence, the present studies were conducted with the objective to work out the water requirement of guava under drip irrigation system and also to assess the effect of black plastic mulch on growth and yield parameters of cv. L-49 under agro-climatic condition of Chhattisgarh plains.

MATERIAL AND METHOD

Field experiment was carried out during the year 2009-10 in winter season at research field of Precision Farming Development Centre (PFDC), Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The treatment details are given below:

- T₁ : 1.0V of water (irrigation by drip system)
- T₂ : 1.0V of water (irrigation by drip system) + Black plastic mulch (50 micron)
- T₃ : 0.8V of water (irrigation by drip system)
- T₄ : 0.8V of water (irrigation by drip system) + Black plastic mulch (50 micron)
- T₅ : 0.6V of water (irrigation by drip system)
- T₆ : 0.6V of water (irrigation by drip system) + Black plastic mulch (50 micron)
- T₇ : 1.0V of water (irrigation by flood system)
- T₈ : 1.0V of water (irrigation by flood system) + Black plastic mulch (50 micron)

The plant height (m), plant canopy height (m), canopy spread (m), plant girth (cm), number of primary branches per plant, number of leaves per m², number of twigs per m², number of fruits per plant, fruit yield per plant (kg), fruit yield per hectare (tonnes), days to 50% flowering and days to fruit maturity were recorded during the experimentation for each plant at four directions randomly north, south, east and west for studying various growth, flowering, yield and quality characters. The plant

height of guava trees was measured from the ground level to the tip of the tree canopy by using measuring tape and average was calculated. First, the trunk height was measured, then the plant canopy height was calculated by deducting the trunk height from the total height of the plant and average was calculated. The canopy of plant from North-South and East-West were recorded in metres with the help of the measuring tape and it was averaged separately for N-S and E-W. Trunk girth of plant was measured 10 cm above the ground level with the help of measuring tape and it was averaged. The number of primary branches was counted on each plant emerging from the trunk and average was worked out. Number of leaves per m² was counted from each plant at four directions randomly and average were calculated. Number of twigs per m² was counted from each plant at four directions randomly by the help of quadrat and the data were averaged. The total number of fruits was counted from north, south, east and west directions for each randomly tagged plants and were averaged. Total yield per plant was calculated by weighing the fruits after harvesting and mean was calculated. The fruits were weighed separately from each plant and the total yield was worked out by multiplying the number of plants and then per hectare yield of fruit was calculated in t ha⁻¹. Days to 50% flowering was calculated by counting the days from initial flowering to the days taken for 50% flowering. Days to fruit maturity were calculated by counting the number of days between the initial fruit set to the number of days required to fruit maturity for each plant.

RESULT AND DISCUSSION

Data recorded on the effect of different levels of irrigation and mulching on various growth, flowering and yield characters viz., plant height, canopy height, canopy spread, plant girth, number of primary branches per plant, number of leaves per m², number of twigs per m², number of fruits per plant, fruit yield per plant and per ha, days taken to 50% flowering and days to fruit maturity of guava are presented in Table 1.

Plant height: It is apparent from the table that significantly maximum plant height was found in T₃ (4.47 m) followed by T₇ (4.36 m) and T₁ (4.32 m). While, significantly minimum plant height was obtained in T₆ (3.50 m). In view of the above finding, similar results were obtained by Nath and Pathak (2006) in guava. The taller plant height with 80% water through drip irrigation might be due to the optimum availability of moisture which facilitated for production of better root biomass resulting better nutrient uptake from the soil.

Plant canopy height & spread: Significantly maximum canopy height of plants was recorded in T₃ (3.09 m) followed by T₁ (3.07 m) and T₇ (2.90 m). Whereas, minimum canopy height was observed in

T₆ (2.15 m). Similar results have been reported by Patil and Patil (2001) in guava. The plant canopy spread ranged from 6.66 m to 5.29 m and 6.52 m to 5.10 m for N-S and E-W directions, respectively. Looking to both N-S and E-W direction, T₄ (6.66 m N-S to 6.52 m E-W) had significantly larger canopy spread followed by T₆ (6.46 m N-S to 6.48 m E-W) and T₂ (6.28 m N-S to 6.25 m E-W). Significantly minimum canopy spread was observed in T₇ (5.29 m N-S to 5.10 m E-W). This was probably due to greater CO₂ concentration as well as soil temperature due to plastic mulch which enhanced the vegetative growth of plants leading to more plant spreads. Obminskaya (1991) reported that black poly mulch improved soil temperature, moisture and nutritional regimes thereby stimulating the plant growth in mango. The above findings are in accordance with the report of present investigation.

Plant girth: Maximum plant girth was found in T₇ (86.00 cm) followed by T₈ (74.20 cm) and T₃ (72.40 cm). Whereas, minimum plant girth was recorded in T₄ (63.40 cm).

Number of primary branches per plant: Number of primary branches were influenced significantly by irrigation levels and mulching. The maximum number of primary branches per plant was recorded in T₇ (4.00) followed by T₁ (3.40) and T₈ (3.20). While, minimum number of primary branches per plant was obtained in T₂ (2.20).

Number of leaves: Significantly maximum number of leaves per m² was recorded in T₅ (779.20) followed by T₆ (653.00) and T₃ (626.00). While, the minimum number of leaves per m² was found in T₇ (542.20). Drip irrigation with 60% water and mulching produced more leaves as compared to control. This might be due to availability of more photosynthetic area and better distribution of reflected light, which could help in more photosynthetic activity. Secondly, higher plant metabolism and more biosynthesis of auxins might be responsible for overall growth of the plant. The maximum number of leaves per plant provided large photosynthetic area which ultimately helped the plant to produce higher amount of carbohydrates, which could enhance overall growth of the plant. The lower canopy growth and number of leaves may be due to the result of short supply of water and higher evaporation rate.

Number of twigs: Maximum number of twigs per m² was recorded in T₅ (95.20) followed by T₆ (91.40) and T₁ (85.80). While, significantly minimum number of twigs per m² was found in T₂ (69.80). This might be due to greater CO₂ concentration and improved soil temperature enhancing the vegetative growth of plants. The results are in conformity with the finding of Lareau *et al.* (1991) in mango crop.

Number of fruits: Significantly maximum number of fruits were found in T₄ (250.40) followed by T₂ (246.44) and T₆ (237.31). While, minimum number of fruits per plant was recorded in T₇ (181.52). The

maximum number of fruits per plant might be due to the higher fruit set which increased the number of fruits per plant. The above results are in good agreement with the finding of Maji and Das (2008) in guava.

Fruit yield: The fruit yield ranged from 47.63 kg to 32.42 kg per plant. Significantly maximum number of fruit yield per plant was recorded in T₄ (47.63 kg) followed by T₂ (46.13 kg) and T₆ (44.83 kg), whereas, minimum fruit yield per plant was obtained in T₇ (32.42 kg). Drip irrigation provides appropriate moisture at field capacity, better root development in terms of number and spread of roots, which facilitated luxuriant growth of plant due to better nutrient uptake resulting better fruit growth and development, ultimately achieving higher yield. Higher yield with mulching could be ascribed due to difference in plant light environment among the treatments under the field condition. In conformity of this, similar findings have been reported by Maji and Das (2008) in guava crop. The fruit yield per hectare ranged from 13.28 to 9.05 tonnes. Significantly maximum fruit yield per hectare was found in T₄ (13.28 t/ha) followed by T₂ (12.78 t/ha) and T₆ (12.31 t/ha). While, minimum fruit yield per hectare was obtained in T₇ (9.05 t/ha). The results are directly correlated with fruit yield per plant and are in close

conformity with the finding of Borthakur *et al.* (1988) in guava.

Days taken to 50% flowering: Maximum days were taken to 50% flowering under the treatment T₇ (39.75) followed by T₈ (37.75) and T₁ (36.21). Significantly minimum days were taken to 50% flowering under the treatment T₄ (32.57). The temperature plays a key role in flower growth, development and fruit set in guava. Drip irrigation alongwith the mulch affect the temperature of micro climate around the plants. The greater influence of temperature and increased photosynthesis might have influenced to the initiation of first flowering, 50% flowering, number of flowers per plant, fruit set percentage due to different levels of drip irrigation and mulching. Similar results were corroborated with the findings of Patil and Patil (2001) and Patra *et al.* (2003) in guava crop.

Days to fruit maturity: Significantly maximum days to fruit maturity was noted under the treatment T₇ (78.77) followed by T₈ (77.65) and T₁ (74.76). While, minimum days to fruit maturity was counted under the treatment T₄ (65.70). An earlier maturity in T₄ may be due to higher soil temperature due to plastic mulch enhancing the rates of physiological functioning. The findings are in line with the result of Obminskaya (1991).

Table 1: Effect of different levels of irrigation and black polyethylene mulches on growth, flowering, fruit maturity and yield parameters of guava cv. L-49

Treatments	Plant height (m)	Plant canopy height (m)	Plant canopy spread (m)		Plant girth (cm)	No. of primary branches / plant	Number of twigs / m ²	Number of leaves/ m ²	Number of fruits / plant	Fruit yield/ plant (kg)	Fruit yield/ha (t/ha)	Days to 50% flowering	Days to fruit maturity
			N-S	E-W									
T ₁	4.32	3.07	5.64	5.37	66.00	3.40	85.80	619.60	215.28	39.97	11.04	36.21	74.76
T ₂	3.95	2.46	6.28	6.25	68.00	2.20	69.80	587.80	246.44	46.13	12.78	33.13	68.15
T ₃	4.47	3.09	6.17	6.05	72.40	2.40	81.80	626.00	228.67	42.30	11.81	34.45	68.95
T ₄	3.51	2.20	6.66	6.52	63.40	2.60	71.20	613.40	250.40	47.63	13.28	32.57	65.70
T ₅	4.02	2.80	5.92	5.47	66.00	2.80	95.20	779.20	200.10	37.59	10.49	35.47	71.76
T ₆	3.50	2.15	6.46	6.48	67.20	3.00	91.40	653.00	237.31	44.83	12.31	32.93	67.94
T ₇	4.36	2.90	5.29	5.10	86.00	4.00	76.60	542.20	181.52	32.42	9.05	39.75	78.77
T ₈	4.18	2.67	5.40	5.24	74.20	3.20	76.60	610.20	195.12	35.93	9.90	37.75	77.65
SEm	0.09	0.10	0.06	0.04	2.38	0.09	1.72	18.34	2.01	1.43	0.35	0.66	0.66
CD at 5% level	0.27	0.29	0.17	0.12	6.88	0.25	4.99	53.12	5.81	4.13	1.01	1.92	1.92

T₁ : 1.0V of water (irrigation by drip system); T₂ : 1.0V of water (irrigation by drip system) + Black plastic mulch (50 micron)

T₃ : 0.8V of water (irrigation by drip system); T₄ : 0.8V of water (irrigation by drip system) + Black plastic mulch (50 micron)

T₅ : 0.6V of water (irrigation by drip system); T₆ : 0.6V of water (irrigation by drip system) + Black plastic mulch (50 micron)

T₇ : 1.0V of water (irrigation by flood system); T₈ : 1.0V of water (irrigation by flood system) + Black plastic mulch (50 micron)

CONCLUSION

The following conclusion can be drawn from the experiment. The treatment T₄= 0.8V of water + Black plastic mulch (50 micron) performed better as compare to other treatment followed by treatment T₆= 0.6V of water + Black plastic mulch (50 micron).

It can be deduced that 0.8V of water along with Black plastic mulch (50 micron) gives an increased and early yield. These early yield contribute to the increase in overall yield under the treatment T₄. Besides earliness in fruiting it also results in greater fruit numbers contributing to greater yields. Hence, their use in guava cultivation is recommended.

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