Int.J.Curr.Microbiol.App.Sci (2021) *10*(02): 2671-2678

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 10 Number 02 (2021)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2021.1002.293

Effect of Irrigation and Fertigation Scheduling on Vegetative Growth and Yield of Guava cv.VNR Bhihi under High Density Planting System

B. Chennakesavulu[1*], G. Ravi Babu[2], A. Mani[3], D. V. Swami[4] and K. Umakrishna[5]

[1]Department of Agricultural Engineering, College of Horticulture, Dr.Y.S.R. Horticultural University, Venkataramannagudem-534 101, India
[2] Department of Soil and Water Conservation Engineering, College of Agricultural Engineering, Madakasira, Acharya N.G. Ranga Agricultural University, Lam-515301, India
[3] Department of Soil and Water Conservation Engineering, Dr.N.T.R.College of Agricultural Engineering, Bapatla, Acharya N.G. Ranga Agricultural University, Lam-515301, India
[4] Department of Post Harvest Technology, Dr.Y.S.R. Horticultural University, Venkataramannagudem-534 101, India
[5] Department of Agricultural Statitics, College of Horticulture, Dr.Y.S.R Horticultural University, Venkataramannagudem-534 101, India

**Corresponding author*

ABSTRACT

Keywords

Guava, irrigation, Fertigation, High density planting system and yield

Article Info

Accepted:
20 January 2021
Available Online:
10 February 2021

A study was conducted during 2018 -2019 to find out the effect of irrigation and fertigation scheduling on growth and yield of guava (*Psidium guajava* L.). The experiments were laid out in factorial randomized block design with sixteen treatment combinations which included four irrigation levels (120 %, 100 %, 80 % and 60 % of ET) along with four fertigation levels 120 %, 100 %, 80 % and 60 % of RDF(240,160,160 g of NPK/ plant/ year).The nitrogen, phosphorus and potassium (NPK) fertilizers were applied through fertigation as well as soil application to test various attributes of 2 years old guava cv. VNR Bhihi under high density planting system. The investigation indicated that (100% of ET) irrigation (I_2) through drip resulted in maximum plant height (1.80 m), canopy volume (1.48 m^3), plant spread east west and north south 1.47 m, 1.52 m respectively. Interaction effect of irrigation and fertilizer showed maximum plant height (1.84 m), plant volume (1.57 m) and plant spread (1.56 m E-W and 1.60 N-S) in I_2F_1 treatment. Similarly maximum fruit weight (365.88 g), fruit diameter (8.64 cm polar and 7.78 cm equilateral) and fruit yield (16.87 kg) were also recorded in I_2 (100 % of ET) treatment. However, maximum fruit weight (345.76 g), fruit diameter (8.13 cm polar and 7.29 cm equilateral) and fruit yield 15.10 kg) were also recorded in F_1 (120 % of RDF). Interaction effect of irrigation and fertigation levels showed that maximum fruit weight (410.91 g), fruit diameter (9.77 cm polar and 8.74 cm equilateral) and fruit yield (21.22 kg) were also recorded in I_2F_1.

Introduction

The key inputs which directly affect the plant growth and development, yield and quality of produce are irrigation and fertilizer. Application of irrigation water and fertilizers through drip irrigation system is the most effective way of supplying water and nutrients to the plants.

As these are placed near crop root zone, these inputs are effectively utilized by the plants. The best way to obtain better crop production is the application of correct combination of water and fertilizer through drip irrigation system (Hasan and Singh, 2010). Frequent application of fertilizers through drip irrigation system not only saves fertilizers besides it is considered as eco friendly due to leaching of fertilizers is minimized.

In recent years, trickle irrigation has emerged as one of the appropriate water saving technique especially for widely spaced high value fruit, vegetable and plantation crops. This irrigation technique may contribute substantially towards making the best use of water for agriculture and improving irrigation efficiency. It applies water in less quantity drop by drop and at high frequency. Thus, it maintains a near optimal soil moisture environment to the crop. In this system, water is applied more frequently which in turn reduces the moisture stress to the plants and thus enhances the crop growth. The required quantity of water is supplied daily through a network of pipes, thereby reducing the conveyance and evaporation losses to a large extent. This is well suited for undulating terrain, shallow and porous soils and water scarce areas. Water with a certain degree of salinity and brackishness can also be used through the trickle irrigation wherein water is applied daily which keeps the soil moisture tension at the minimum level . At present the area under micro irrigation (drip and sprinkler irrigation) in India is about 9 million ha (Malhotra, 2017).

Fertigation governing factors are type of soil, type of crop, mode of water application, type of fertilizers available, water quality, economic feasibility etc. “Effectiveness of fertigation depends upon understanding of plant growth behaviour including nutrient requirements and rooting patterns, soil chemical factors controlling the solubility and mobility of the nutrients and other factors like pH and salt index of soil.

Guava is considered as one of the major fruit crops in terms of area and production after mango, banana and citrus. The area and production of guava is growing worldwide (0.25 million hectares area and 4.04 million tonnes production) and contributes to 3.9 % of the total fruit production. In India cultivated area of guava is about 2.62 lakh hectares with a production of 36.48 lakh MT. In Andhra Pradesh this crop is being cultivated in an area of about 10,100 hectares and annual production of guava is about 1.508 lakh MT (Anon., 2018).

Materials and Methods

Experimental site and climate

The experimental site was located at College of Horticulture, Dr.Y.S.R Horticultural University, Venkataramannagudem, West Godavari district of Andhra Pradesh. The location falls under Agro-climatic zone-10, humid, east coast plain and hills (Krishna-Godavari zone) and is located at an altitude of 34 m (112 feet) above MSL receiving an average annual rainfall of 900 mm. The geographical situation of experimental site is 16^{o} 63’ 120” N latitude and 81^{o} 27’568” E longitude. It experiences hot humid summer and mild winter. The meteorological data of the past five years as recorded at

Meteorological Observatory, Department of Agronomy, College of Horticulture were used for estimation of evapotranspiration and also in planning and execution of irrigation scheduling.

Treatment Application

The experiment was laid out in a Factorial Randomized Block Design (FRBD) with sixteen treatments and each replicated thrice during 2018-19. The treatments were imposed on uniform two years old VNR Bhihi variety guava plants. Five plants were maintained in each treatment of the experimental plot.

There were four levels of irrigation namely (I_1) at 120 % of ET, (I_2) at 100 % of ET, (I_3) at 80 % of ET and (I_4) at 60 % of ET. There were four levels of fertigation namely F_1 120% of recommended dose of fertilizer (288,192,192 g of NPK/ plant/ year), F_2 100% of recommended dose of fertilizer (240,160,160 g of NPK/ plant/ year), F_3 80% of recommended dose of fertilizer (192,128,128 g of NPK/ plant/ year)and F_4 60% of recommended dose of fertilizer (144,96,96 g of NPK/ plant/ year).

The irrigation was applied to guava plants as per treatments. The drip irrigation was scheduled as suggested by Mane *et al.,* (2006).

The drip irrigation was supplied at an alternate day interval. The daily USDA class A open pan evaporation readings for five years were obtained from meteorological observatory, Department of Agronomy, College of Horticulture, Venkataramannagudem.

Estimation of ET was done by applying average of five years (2013 to 2017) meteorological data of the study site. For rainy days, irrigation requirement was calculated after subtracting corresponding effective rainfall from ET. Treatment wise requirement of fertilizer was calculated based on recommended dose of fertilizer suggested by Technical Bulletin, CISH, Lucknow. Nitrogen was applied in 6 equal splits at bi-monthly intervals (At February, April, June, August, October and December months) during the experimental period.

Treatment wise phosphate and Potassium were applied in two equal splits in the months of June and October as per the treatment. SSP was applied as soil application and MOP was applied through fertigation. Nitrogen was applied as urea, phosphorus as single super phosphate and potassium as muriate of potash. The plants were prunned twice in a year in the months of February and September.

The drip irrigation system was set up with main (75 mm) and sub-mains (50 mm) made up of high density polyethylene and laterals (12 mm) made up to low density polyethylene. The spacing between two adjacent laterals was 2.8 m. Two (8 lph discharge) emitters were used per plant for application. Water soluble fertilizers were injected in drip system through injection pump.

Observations recorded

The data on plant height (m), plant spread from north-south and east-west (m) and girth of primary branches (cm) were recorded using meter scale and vernier caliper. Canopy volume was calculated as the method described by the Samaddar and Chakrabarti (1988) and expressed in (m3).

Fruit diameter, polar and equatorial was taken with the help of Vernier caliper. Average fruit weight was recorded with the help of an electronic balance. Mature fruits were harvested periodically from each treatment separately and the weight was recorded with the help of electronic balance and expressed in kilogram.

Statistical analysis

The data obtained on various characters were subjected to Factorial RBD analysis and interpretation of the data was carried out in accordance to Panse and Sukhatme (1985).

Results and Discussion

Effect of Irrigation and Fertigation Scheduling on Vegetative Growth Characters

The plant vegetative growth characteristics like plant height, plant volume and plant canopy spread (E-W, N-S direction) were used as indicators to evaluate crop growth. The data presented in the Table 1 revealed that irrigation and fertigation scheduling on plant height, plant volume and plant canopy spread (E-W, N-S direction) had significant effect during both the seasons of the field experiment.

The maximum plant height (1.80 m) was recorded in I_2 (at 100 % of ET) and minimum (1.47 m) in I_4 (irrigation 60% of ET). The highest plant height (1.69 m) was recorded in F_1 (288, 192, 192 g of NPK/plant/year) and lowest (1.60 m) in F_4 (144, 96, 96 g of NPK/plant/year). Interaction effect of irrigation and fertigation levels presented in Table 1 showed non- significant effect on plant height.

From Table 1 it is evident that maximum canopy volume (1.48 m^3) was observed in I2 (irrigation at 100 % of ET) as compared to minimum (1.21 m^3) in I4 (irrigation at 60 % of ET). Maximum canopy volume (1.40 m^3) was in F_1 (288, 192, 192 g of NPK/plant/year) as compared to minimum (1.31 m^3) in F_4 (144, 96, 96 g of NPK/plant/year). The interaction effect of irrigation and fertigation levels recorded highest canopy volume 1.32 m^3 in I2F1 (irrigation at 100 % of ET + 288, 192, 192 g of NPK water soluble fertilizers) as compared to minimum (1.09 m^3) in I4F4 (irrigation at 60 % of ET irrigation + 30, 10, 10 g NPK water soluble fertilizers). Ramniwas *et al.*, (2012) found that interaction effect of irrigation and fertigation was significant on plant spread.

This may be due to the fact that the application of drip irrigation during experimentation effectively increased vegetative growth parameters. Subramanian *et al.*, (1997), Bhardwaj *et al.*, (1995) and Maas and Van (1996) reported that vegitative growth of the plants was found to be influenced favorably by uniform distribution of water

The maximum plant spread E-W & N-S (1.47 m, 1.52 m) was observed in I_2 (at 100 % of ET) and minimum (1.20 m, 1.24 m) in I_4 (at 60 % of ET.

The maximum plant spread (E-W & N-S (1.38 m,1.43 m) was observed in F1 and minimum (1.20 m, 1.24 m) in F_4. However, the interaction effect of irrigation and fertigation levels on plant spread showed non-significant influence.

Ramni was *et al.*, (2012) also found that effect of irrigation and fertigation was significant on plant height and plant volume. This may be due to the fact that the application of drip irrigation during experimentation effectively increased vegetative growth parameters.

Subramanian *et al.*, (1997), Bhardwaj *et al.*, (1995) and Maas and Van (1996) reported that vegetative growth of the plants was found to be influenced favourably by uniform distribution of water in the soil through drip irrigation. Similar findings were also observed increased the plant height and plant volume.

Table.1 Effect of drip irrigation and fertigation levels and their interaction on plant Height, plant volume and plant spread

Treatment	Plant height(m)	Plant volume(m^3)	Canopy Spread, m	
			E-W	N-S
I1	1.62	1.34	1.33	1.37
I2	1.80	1.48	1.47	1.52
I3	1.68	1.38	1.37	1.41
I4	1.47	1.21	1.20	1.24
SEm±	0.020	0.020	0.200	0.021
CD at 5%	0.07	0.057	0.058	0.06
P-Value	0.000	0.000	0.000	0.000
F1	1.69	1.40	1.38	1.43
F2	1.67	1.37	1.36	1.41
F3	1.61	1.33	1.32	1.36
F4	1.60	1.31	1.31	1.34
SEm±	0.020	0.020	0.200	0.021
CD at 5%	0.070	0.057	0.058	0.060
P-Value	0.036	0.014	0.042	0.026
I1F1	1.56	1.31	1.29	1.34
I1F2	1.57	1.32	1.31	1.36
I1F3	1.61	1.35	1.34	1.38
I1F4	1.64	1.38	1.36	1.41
I2F1	1.84	1.57	1.56	1.60
I2F2	1.83	1.52	1.5	1.55
I2F3	1.57	1.37	1.36	1.41
I2F4	1.75	1.47	1.46	1.51
I3F1	1.7	1.42	1.41	1.45
I3F2	1.69	1.42	1.4	1.45
I3F3	1.71	1.4	1.39	1.43
I3F4	1.51	1.29	1.28	1.32
I4F1	1.61	1.29	1.28	1.33
I4F2	1.51	1.24	1.22	1.27
I4F3	1.44	1.2	1.19	1.23
I4F4	1.37	1.09	1.13	1.12
SEm±	0.050	0.039	0.04	0.042
CD at 5%	NS	0.114	NS	NS
P-Value	0.051	0.023	0.061	0.072

Table.2 Effect of drip irrigation and fertigation levels and their interaction on fruit weight, fruit yield and fruit diameter

Treatment	Fruit weight g	Fruit yield kg/plant	Fruit diameter, cm	
			Polar	Equilaterl
I1	350.7	15.39	8.25	7.46
I2	388.33	18.96	9.13	8.2
I3	361.74	16.43	8.52	7.7
I4	319.05	12.74	7.53	6.79
SEm±	5.156	0.45	0.124	0.108
CD at 5%	14.891	1.299	0.358	0.312
P-Value	0.000	0.000	0.000	0.000
F1	365.88	16.87	8.64	7.78
F2	359.58	16.27	8.46	7.65
F3	348.6	15.28	8.2	7.43
F4	345.76	15.10	8.13	7.29
SEm±	5.156	0.4497	0.124	0.108
CD at 5%	14.891	1.2988	0.358	0.312
P-Value	0.033	0.0279	0.026	0.013
I1F1	342.01	14.63	8.05	7.28
I1F2	346.74	15.05	8.16	7.38
I1F3	353.96	15.68	8.33	7.53
I1F4	360.08	16.22	8.47	7.66
I2F1	410.91	21.22	9.77	8.74
I2F2	396.58	19.66	9.33	8.44
I2F3	359.91	16.33	8.47	7.72
I2F4	385.91	18.63	8.95	7.91
I3F1	371.8	17.29	8.75	7.91
I3F2	370.74	17.23	8.72	7.89
I3F3	366.08	16.76	8.63	7.79
I3F4	338.35	14.45	7.97	7.2
I4F1	338.79	14.37	7.97	7.21
I4F2	324.25	13.15	7.64	6.9
I4F3	314.47	12.37	7.39	6.69
I4F4	298.69	11.08	7.13	6.38
SEm±	10.312	0.899	0.248	0.216
CD at 5%	29.782	2.598	**NS**	**NS**
P-Value	0.05	0.043	0.061	0.067

Effect of irrigation and fertigation scheduling on yield characters

Different level of irrigation resulted in maximum fruit weight under treatment I_2 (100 % of ET) 388.3 g and minimum 319.05 g in I_4 (60 % of ET). Further, fertigation level resulted maximum fruit weight 365.88 g in F_1 (288, 192, 192 g of NPK/plant/year) and minimum 345.76 g in F_4 (144, 96, 96 g of NPK/plant/year).

The interaction effect of irrigation and fertigation levels recorded highest fruit weight 410.91 g in I2F1 (irrigation at 100 % of ET + 288, 192, 192 g of NPK water soluble fertilizers) as compared to minimum 298.69 g in I4F4 (irrigation at 60 % of ET irrigation + 30, 10, 10 g NPK water soluble fertilizers).

Different level of irrigation resulted in maximum fruit diameter under treatment I_2 (100 % of ET both polar and equatorial 9.13 and 8.20 cm and minimum in I_4 (60 % of ET). Further, in fertigation level F_1 (288, 192, 192 g of NPK/plant/year) resulted maximum fruit diameter 8.64 cm (polar) and 7.78 cm (equatorial) and minimum in F_4 (144, 96, 96 g of NPK/plant/year). However, the interaction of irrigation and fertigation levels was found non- significant (Table 2).

Different level of irrigation resulted in maximum fruit yield under treatment I_2 (100 % of ET) 18.96 kg and minimum 12.74 kg in I_4 (60 % of ET). Further, fertigation level resulted maximum fruit yield 16.87 kg in F_1 (288, 192, 192 g of NPK/plant/year) and minimum 15.10 kg in F_4 (144, 96, 96 g of NPK/plant/year).

The interaction effect of irrigation and fertigation levels recorded highest fruit yield 410.91 g in I2F1 (irrigation at 100 % of ET + 288, 192, 192 g of NPK water soluble fertilizers) as compared to minimum 298.69 g in I4F4 (irrigation at 60 % of ET irrigation + 30, 10, 10 g NPK water soluble fertilizers).

It might be due to increase in vegetative growth with maximum harvest of solar light as discussed earlier in this chapter. Further, per cent fruit set and per cent fruits retention were maximum recorded in I_2 level therefore number of fruits per plant ultimately increased in this treatment. Verma *et al.,* (2017) supported these findings, they observed that maximum number of fruits with irrigation through drip at 100 per cent crop evapotranspiration as compare to 80 per cent in peach cv. Red heaven crop. The present results are also supported by the finding of Sagvekar *et al.*, (2019) in papaya; Rao *et al.*, (2017) and Janaki *et al.*, (2020) in guava.

References

Anonymous. 2018. *National horticulture database*.

Bhardwaj SK, Sharma IP, Bhandari AR, Sharma JC, Tripathi D (1995). Soil water distribution and growth of apple plants under drip irrigation. *J. Ind. Soc. Soil Sci.* 43:323-327.

Hasan, M. and Singh, B. 2010. Fertigation Scheduling for Horticultural Crops. (2)IARI and IFFCO New Delhi.

Janaki, D., Poorniammal, R. and Rajangam, J. 2020. Effect of drip fertigation on yield and quality of guava under ultra high density planting in Tamil Nadu. *International Journal of Chemical Studies.* 8(2): 2720-2722

Kumawat, K. L., Sarolia, D. K. and Kaushik, R. A. 2019. Effect of irrigation and fertigation scheduling on input use efficiency, yield and quality of guava cv. Lalit under intensive orcharding system. *Journal of Soil and Water Conservation.*18(2): 136-143.

Malhotra, S. K. 2017**.** Initiatives and open transition for doubling farmers' income. Plenary lecture presented in National Conference on "Technological changes and innovations in agriculture for enhancing farmer's income. May 28-31,2017 at JAU, Junagarh Gujarat.

Mane MS, Ayare BL, Magar SS (2006). Principles of Drip Irrigation System, Jain Brothers, New Delhi. pp. 24-87.

Maas R, Van Der (1996). Adjust water application to expected fruit size. *Fruitlet* 86:14-15.

Panse VG, Sukhatme, PV (1985). Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi, India.

Ramniwas, Kaushik, R. A., Sarolia, D.K., Pareek, S. and Singh, V. 2012. Effect of irrigation and fertigation scheduling on growth and yield of guava (*Psidium guajava* L.) under meadow orcharding. *African Journal of Agricultural Research*. 7(47): 6350-6356.

Rao, K. V., Gagwar, R., Bajpai, S., Chourasiya, A. and Kumar, S. 2017. Influence of growth, yield and quality of guava (*Psidium guajava* L.) by drip irrigation and fertigation. *Journal of Applied and Natural Science.* 9 (1): 642-645.

Sagvekar, V. V., Chavan, A. P., Shetye, V. N., Malshe, K. V. and Dhonde, M. B. 2019 Effect of drip fertigation on growth and yield of papaya (Carica papaya L.) in semi-arid tropical region of Maharashtra. Journal of the Indian Society of Coastal Agricultural Research. 37: 19-24

Subramanian P, Krishnaswamy S, Devasagayam MM (1997). Study on the evaluation of drip irrigation in comparison with surface irrigation (basin) in coconut. South Ind. Hort. 45:255-258.

Verma, P., Chandel, J. S., Sharma, N. C. and Thakur, Y. 2017. Effect of fertigation on growth, yield, fruit quality and fertilizer use efficiency of peach cv.Redheaven. *Journal of Hill Agriculture*. 8 (2): 181-186.

How to cite this article:

Chennakesavulu, B., G. Ravi Babu, A. Mani, D. V. Swami and Umakrishna, K. 2021. Effect of Irrigation and Fertigation Scheduling on Vegetative Growth and Yield of Guava cv.VNR Bhihi under High Density Planting System. *Int.J.Curr.Microbiol.App.Sci.* 10(02): 2671-2678.
doi: https://doi.org/10.20546/ijcmas.2021.1002.293