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Research Article

BENEFIT COST RATIO AS INFLUENCED BY DIFFERENT IRRIGATION AND FERTIGATION LEVELS ON GUAVA CV. VNR BHIHI

B. CHENNAKESAVULU*[1], G. RAVI BABU[2], A. MANI[3], D.V. SWAMI[4] AND K. UMAKRISHNA[5]

1Department of Agricultural Engineering, College of Horticulture, Dr Y.S.R. Horticultural University, Venkataramannagudem, 534 101, Andhra Pradesh, India
2Department of Soil and Water Conservation Engineering, College of Agricultural Engineering, Madakasira, 515301, Acharya N.G. Ranga Agricultural University, Lam, Guntur, 522 034, India
3Department of Soil and Water Conservation Engineering, Dr N.T.R.College of Agricultural Engineering, Bapatla, 522101, Acharya N.G. Ranga Agricultural University, Lam, Guntur, 522 034, India
4Department of Post Harvest Technology, Dr Y.S.R. Horticultural University, Venkataramannagudem, 534 101, Andhra Pradesh, India
5Department of Agricultural Statitics, College of Horticulture, Dr Y.S.R. Horticultural University, Venkataramannagudem, 534 101, Andhra Pradesh, India
*Corresponding Author: Email - chennakesavulub7@gmail.com

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Abstract: A research experiment was conducted during kharif and rabi seasons of 2018 -2019 to study the influence of irrigation and fertigation scheduling on yield and benefit cost ratio 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 three replication. The highest benefit cost ratio 4.31 was recorded in I2F1 (irrigation at 100 % of ET + 288, 192, 192 g of NPK water soluble fertilizers) treatment while lowest benefit cost ratio 2.15 was observed in I4F4 treatment (irrigation at 60 % of ET irrigation + 30, 10, 10 g NPK water soluble fertilizers). Similarly, Lowest payback period 23 months was recorded in I2F1 (irrigation at 100 % of ET + 288, 192, 192 g of NPK water soluble fertilizers) treatment while highest payback period 38 months was noticed in I4F4 treatment (irrigation at 60 % of ET irrigation + 30, 10, 10 g NPK water soluble fertilizers).

Keywords: *Drip irrigation, Fertigation, Benefit cost ratio and Yield*

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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 [1]. 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.

Guava is considered as one of the major fruit crops in terms of area and production after mango, banana and citrus. It is also called as poor man's apple in India. 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 [2-4].

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°63'120"N latitude and 81°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 (I1) at 120 % of ET, (I2) at 100 % of ET, (I3) at 80 % of ET and (I4) at 60 % of ET. There were four levels of fertigation namely F1 120% of recommended dose of fertilizer (288,192,192 g of NPK/ plant/ year), F2 100% of recommended dose of fertilizer (240,160,160 g of NPK/ plant/ year), F3 80% of recommended dose of fertilizer (192,128,128 g of NPK/ plant/ year) and F4 60% of recommended dose of fertilizer (144,96,96 g of NPK/ plant/ year).

Irrigation scheduling was done on very alternate day. The drip irrigation was scheduled as suggested by Mane *et al*. (2006).

Table-1 *Benefit cost ratio and payback period for 1 ha of guava crop under drip irrigation during 2018-19 (Two season pooled data)*

Treatment	Total yield, t/ha	Fixed cost, Rs./ha	Operating cost, Rs./ha	Total cost, Rs./ha	Gross income, Rs./ha	Net income,Rs./ha	BCR	Payback period (Months)
I1F1	186.02	23505.9	896.69	24402.5	88372.8	63970.2	2.62	33
I1F2	191.33	22704.4	896.69	23601	90895.5	67294.4	2.85	31
I1F3	199.35	21902.8	896.69	22799.5	94702.6	71903.1	3.16	29
I1F4	206.25	21101.3	896.69	21998	97980.1	75982	3.46	27
I2F1	270.40	23505.9	667.92	24173.8	128443	104269	4.31	23
I2F2	250.08	22704.4	667.92	23372.3	118803	95431.1	4.08	24
I2F3	207.69	21902.8	667.92	22570.8	98666.6	76095.9	3.37	28
I2F4	236.98	21101.3	667.92	21769.3	112582	90812.3	4.17	23
I3F1	219.86	23505.9	439.16	23945	104448	80503.5	3.36	28
I3F2	219.13	22704.4	439.16	23143.5	104100	80956.6	3.5	27
I3F3	213.13	21902.8	439.16	22342	101250	78907.9	3.53	27
I3F4	183.77	21101.3	439.16	21540.5	87301.2	65760.7	3.05	30
I4F1	182.67	23505.9	210.40	23716.3	86782.4	63066.2	2.66	33
I4F2	167.13	22704.4	210.40	22914.8	79400.1	56485.4	2.47	35
I4F3	157.27	21902.8	210.40	22113.2	74715.4	52602.2	2.38	36
I4F4	141.45	21101.3	210.40	21311.7	67185.2	45873.5	2.15	38

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.

Economic Analysis

In this study, BCR was calculated to analyse the return of the production system of high-density planting guava crop under drip irrigation system. Following assumptions were made for estimating the components of BCR which include capital cost of the drip irrigation system and gross and net return under high density planting:

Area of field is 1 ha

Land is flat and

Water source is located at the corner of the field.

The number of emitters, length of laterals and main pipe, filters and pump were constant in all cases. However, their fixed cost and annual costs were worked out separately. The cost of all the materials was estimated based on the prevailing market prices. The interest rate considered was 12% per annum. The capital cost and operating cost of the system were calculated for each treatment. Subsequently, gross return and net return per hectare were estimated based on crop yield data..

Results and Discussion

The net return, gross income per hectare and benefit cost ratio for two seasons pooled data are presented in [Table-1]. The cost of fertilizers varied from Rs. 4293.79to Rs. 2,146.90 depending upon the type and quantity of fertilizers used. The cost of fertilizer was highest with F1 (288, 192, 192 g of NPK/plant/year) followed byF2(240,160,160 g of NPK/plant/year). The cost of fertilizers was least for F4(144, 96, 96 g of NPK/plant/year). From [Table-1] it is observed that the total cost of cultivation varied from Rs. 24,402.54 to Rs. 21,311.73. Based on pooled data the cost of cultivation was highest in treatment I1F1during crop period. Similarly, lowest cost of cultivation was observed in treatment I4F4 during investigation period. Maximum estimated yield per hectare was recorded 270.40 tons in I2F1 (irrigation at 100 % of ET + 288, 192, 192 g of NPK water soluble fertilizers) treatment while lowest estimated yield per hectare was observed 141.45 tons in I4F4 treatment (irrigation at 60 % of ET irrigation + 30, 10, 10 g NPK water soluble fertilizers). The highest benefit cost ratio 4.31 was recorded in I2F1 (irrigation at 100 % of ET + 288, 192, 192 g of NPK water soluble fertilizers) treatment while lowest benefit cost ratio 2.15 was observed in I4F4 treatment (irrigation at 60 % of ET irrigation + 30, 10, 10 g NPK water soluble fertilizers). Similarly, Lowest payback period 23 months was recorded in I2F1 (irrigation at 100 % of ET + 288, 192, 192 g of NPK water soluble fertilizers) treatment while highest payback period 38 months was noticed in I4F4 treatment (irrigation at 60 % of ET irrigation + 30, 10, 10 g NPK water soluble fertilizers). Present results in respect of benefit cost ratio are supported by the findings of Harendrakumar *et al.* (2015) [2] and Mahadevan *et al*. (2019) [3] in respect of guava and Jeyakumar *et al.* (2017) [4] in coconut.

Conclusion

The highest benefit cost ratio 4.31 was recorded in I2F1 (irrigation at 100 % of ET + 288, 192, 192 g of NPK water soluble fertilizers) treatment while lowest benefit cost ratio 2.15 was observed in I4F4 treatment (irrigation at 60 % of ET irrigation + 30, 10, 10 g NPK water soluble fertilizers).

Research Category: Irrigation and Fertigation

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****Principal Investigator or Chairperson of research: B. Chennakesavulu**

University: Dr Y.S.R. Horticultural University, Venkataramannagudem, 534 101, Andhra Pradesh, India

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Study area / Sample Collection: West Godavari district of Andhra Pradesh

Cultivar / Variety / Breed name: Guava (*Psidium guajava* L.).

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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