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Effect of different levels of fertigation through water-soluble fertilizers on growth, yield and quality parameters of papaya (*Carica papaya* L.)

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ABSTRACT: *A field experiment was carried out to study about the effect of different levels of fertigation through water-soluble fertilizers on growth, yield and quality of papaya cv. Red Lady. Application of water-soluble fertilizers through fertigation was quite effective on plant vigour, flowering and fruit set, yield and quality of papaya. Plant height and number of functional leaves were recorded maximum 200.72 cm and 35.50, respectively under 100% RDF through fertigation while different growth and yield parameters i.e. stem girth (51.72 cm), number of fruit per plant (76.27), fruit weight (1.42 kg) and yield (145.23 t/ha) were found maximum under 80% RDF through fertigation. Days required to first flowering and fruiting was recorded minimum under the same treatment. Fruiting characters i.e. length of fruit (30.54 cm), diameter of fruit (34.15 cm) and qualitative parameter total soluble solid (13.38%) was also found maximum under 80% recommended dose of fertilizers through fertigation.*

Key words: *Fertigation, water soluble fertilizers, papaya*

INTRODUCTION

Papaya (*Carica papaya L*) is an important fruit crop in Chhattisgarh region especially in plain regions of Chhattisgarh. Yield and quality attributes of papaya is affected due to inadequate supply of nutrients and irrigation water. With the use of drip irrigation technology water can be applied near to the root zone of the plant by this growth, yield and water use efficiency of plant can be increased. Fertigation is a new technology growing popularity in India. Fertigation includes fertilizer application in combination with irrigation water through drip system of irrigation. It is established fact that drip irrigation recognized as most effective and convenient means of maintaining optimum fertility level as water is supplied to the plants based on evapo-transpiration around active root zone. This fulfills the specific requirement of water as well as nutrients for each crop resulting increase yield of crop with improved quality. Fertigation has been proved successful in a wide range of horticultural crops more particularly in fruit crops (Shirgure *et al*., 1999). The present growing system includes various cultural operations *viz;* manual fertilizer application, irrigation and weeding etc, which are highly, labour intensive and constitute a major portion of the input costs. Adoption of new technology like fertigation for an easy, efficient and cost effective cultivation of papaya with considerably minimum labours involvement for increasing productivity at lesser cost is essential. Papaya is an important fruit of tropics and sub-tropics and climate of the region is well suited for its cultivation. India is the largest producer of papaya in the world therefore it deserves greater attention due to its high nutritive value and protection potentiality. Papaya production needs a shift from the present peasantry farming to new technology. In this present investigation, attempt has been made to find out the optimum fertilizer dose through different fertigation levels for higher growth, yield and quality of papaya cv. Red lady.

MATERIALS AND METHODS

The present experiment was conducted at Precision Farming Development Centre, Horticultural Farm, Department of Horticulture, College of Agriculture, IGKV, Raipur (C.G.) during the year 2012-13 using papaya cultivar Red Lady. Planting was done with a spacing of 2x2 M on sandy loam soil with available ph 6.8. The experiment was laid out in Randomized

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Block Design with four treatments replicated four times. The details of the treatments are given below:

F_1 = 100% Recommended dose of fertilizer through Fertigation

F_2 = 80% Recommended dose of fertilizer through Fertigation

F_3 = 60% Recommended dose of fertilizer through Fertigation

F_4 = Control (Recommended dose of fertilizer applied through basal application)

In fertigation treatments N, P and K was applied in the form of water-soluble fertilizers by dissolving with water in a fertilizer tank. The venturi was used to fertigate the papaya plants. In control plots, the fertilizers were applied on soil by manually through basal application. Fertilizer application through drip system was scheduled at weekly intervals spread over a period of 48 weeks starting from one month after transplanting in the main field. The fertigation scheduling was so planned to meet the recommended dose of fertilizer. Irrigation was scheduled at alternate days based on pan evaporation. For the control plants irrigation was given in basin irrigation method once in a week. Observations on growth parameters, flowering and fruiting characters, yield-attributing characters were recorded and used for statistical analysis.

RESULTS AND DISCUSSION

It is evident from the tables that fertigation has marked effect on growth, yield and quality of papaya. Growth attributes particularly plant height, stem girth and numbers of functional leaves were differed significantly between control and fertigation treatments. Table 1 showed that the maximum plant height 200.72 cm was recorded under the treatment 100% RDF through fertigation. However the treatment F_2 and F_3 having plant height 190.76 and 189.32 cm was significantly at par with each other. Minimum plant height 174.21 cm was noticed under control. Similarly maximum stem girth 51.72 cm was found under the treatment F_2 and minimum 39.75 cm was observed under control plot. However the treatments F_4 and F_3 and F_3 and F_2 were found statistically at par with each other. Maximum number of functional leave 35.50 was recorded under 100% RDF through fertigation and minimum 30.75 functional leaves were observed under control treatment (F_4). This increase in might be due to the higher uptake by roots and accumulation of nutrients in leaf tissues which intern ensure photosynthetic efficiency causing greater synthesis, translocation and accumulation of carbohydrates (Ghanta *et al.* 1995).

Table 2 showed that the treatment F_2 (80% RDF through fertigation) required minimum days for flowering (123.78) while the treatment F_4 (control) takes maximum days (148.38) to initiate flowering in papaya plant. However all the treatment showed significant differences with each other. Similarly time required for first fruit set was minimum (139.26 days) under 80% RDF through fertigation (F_2) and maximum days (167.35) required for fruit set was under treatment (F_4) control.

This might be probably due to the efficient and timely utilization of nutrients applied through fertigation. As reported by Turner (1970) in banana the increased production of leaves might have helped to produce more photosynthetic and to induce flowering stimulus and early flowering. The number of functional leaves in this treatment showing same trend in this investigation.

As per as the number of fruit is concern, the maximum number of fruit per plant (76.27) was recorded under 80% RDF through fertigation and minimum number of fruit per plant (51.42) was recorded under control (F_4). Weight of fruit was significantly affected by different fertigation levels. The maximum fruit weight (1.42 kg) was noticed under F_2 treatment and minimum (0.92 kg) was recorded under F_4. However the treatments F_4 & F_3, F_3 & F_1 and F_1 & F_2 were statistically at par with each other.

Table 1 showed that yield is significantly affected by different levels of fertigation in papaya plant. The maximum yield (145.23 t/ha) was observed under 80% RDF (F_2) and minimum (88.25 t/ha) was recorded under the treatment F_4 (Control). The treatments F_3 and F_1 having yield 106.18 and 119.08 t/ha respectively found significant difference with each other. The result indicated that the application of 80% RDF through fertigation system gave the maximum yield without affecting the fruit quality. Also this increase in yield may be due to precise and continuous supply of water and nutrients in solution foam to the wetted area of the root zone might have favoured better vitality and uptake of nutrients where the active roots are concentrated this 80 percent of fertilizer in the present study was highly helpful in increasing the yield. Srinivas (1998) and Mahalakshmi *et al.* (2000) also recorded that increase in yield and quality of Ney Poovan and Robusta banana under drip irrigation. The higher yield of banana under fertigation is presumably because fertilizer and water are applied

to soil where active roots are concentrated. Colapietra (1987) also reported that fertigation through drip system was very effective in increasing the grapes yield when compared to conventional system.

The table 2 showed that the different fruiting characters i.e. length of fruit and diameter of fruit is also affected by application of different treatments. The maximum fruit length (30.54 cm) was recorded under treatment F_2 (80% RDF through fertigation) and minimum fruit length (21.06 cm) was observed under F_4 (control). Similarly maximum fruit diameter (34.15 cm) was observed under 80% RDF through fertigation and minimum fruit diameter (24.46 cm) was noticed under control. However the treatments F_1 and F_3 having fruit diameters 30.27 and 28.35 cm showed statistically at par with each other.

It is evident from the table 2 that the quality parameter i.e. total soluble solid (TSS) was recorded maximum (13.38%) under 80% RDF through fertigation. However the treatments F3 and F1 having 10.32 and 11.35 per cent TSS showed non-significant difference with each other. Minimum TSS per cent (8.72) was noticed under control plot.

The improvement in quality is due to the involvement of K in carbohydrate synthesis, breakdown and translocation of starch, synthesis of protein and neutralization of physiologically important organic acids. The reason explain by Hedge *et al.*(1990) confirm the results of present investigation, who reported that when irrigation was given in precise amounts at frequent intervals TSS increased with increasing levels of fertilizer irrespective of the water levels. In present study the irrigation was given on the basis of pan evaporation and fertilizers were applied through drip system.

Table 1
Effect of RDF through fertigation on growth and yield parameters of papaya

Treatments	*Plant Height (cm)*	*Stem girth (cm)*	*No. of functional leaves*	*No. of fruits per plant*	*Wt. of fruit (kg)*	*Yield (t/ha)*
100% RDF	200.72	45.70	35.50	67.59	1.37	119.08
80% RDF	190.76	51.72	32.62	76.27	1.42	145.23
60%RDF	189.32	42.26	31.45	62.93	1.13	106.18
Control	174.21	39.75	30.75	51.42	0.92	88.25
CD at 5%	**3.42**	**4.28**	**1.32**	**2.72**	**0.26**	**3.14**

Table 2
Effect of RDF through fertigation on flowering, fruit characters and quality of papaya

Treatments	*Day's regd. to first flowering*	*Day's reqd. to fruit set*	*Length of fruit (cm)*	*Diameter of fruit (cm)*	*TSS(%)*
100% RDF	127.70	141.96	27.31	30.27	11.35
80% RDF	123.78	139.26	30.54	34.15	13.38
60%RDF	133.94	158.78	23.78	28.35	10.32
Control	148.38	167.35	21.06	24.46	8.72
CD at 5%	**3.37**	**3.30**	**1.77**	**2.43**	**1.86**

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