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Effect of fertigation and foliar nutrition on growth and yield of papaya cv. Surya

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Abstract

A field experiment was conducted at Instructional Farm, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala from 2018 - 2020 to standardize the nutrient level for yield improvement through fertigation and foliar nutrition in papaya cv. Surya. The experiment was carried out in randomised block design with four fertigation doses (75%, 100%, 125% and 150% recommended dose (RD) of N and K), three foliar sprays [19:19:19 (1.0%) (at bimonthly interval starting from 4 month after planting (MAP) to 16 MAP), (ZnSO₄ (0.5%) and Borax (0.3%) (4th, 8th, 12th and 16th MAP)) and water spray (at bimonthly interval starting from 4 MAP to 16 MAP)], and two control treatments (KAU POP and organic POP (100% of RD of NPK as organic) replicated thrice. Application of 100% RD of N and K through fertigation at weekly interval from one MAP to 20 MAP with foliar application of 19:19:19 (1%) at bimonthly interval starting from 4 MAP to 16 MAP significantly improved the plant height, plant girth, number of leaves, number of fruits per plant, fruit weight and yield per plant in papaya cv. Surya. Also it was found that application of 100% RD of N and K through fertigation at weekly interval from one MAP to 20 MAP with foliar application of ZnSO₄ (0.5%) and Borax (0.3%) at 4th, 8th, 12th and 16th MAP was on par with the above treatment on number of fruits per plant, fruit weight and yield per plant in papaya cv. Surya.

Keywords: Fertigation, foliar nutrition, 19:19:19, ZnSO₄ and Borax

Introduction

Papaya (*Carica papaya* L.) is one of the most commonly cultivated tropical fruit crops, which gained popularity due to its nutraceutical properties. It is slowly emerging from the status of a homestead crop to that of commercial crop in Kerala. So there is a pressing need to enhance its productivity and to improve the fruit quality. The productivity of papaya can be raised by optimal use of fertilizer, water and other inputs. Conventional method of nutrient application followed in papaya leads to the loss of nutrients and reduction in nutrient use efficiency, whereas through fertigation, fertilizers are applied along with irrigation water directly to the region where most of the plant roots develop and it ensures supply of both nutrients and water in controlled and balanced manner resulting in high nutrient use efficiency. Fertigation which combines irrigation with fertilizers is well recognized as the most effective, economical and convenient means of maintaining optimum fertility level and water supply according to the specific requirement of each crop and resulting in higher yields and better quality fruits (Smith *et al.*, 1979) [18]. Also, micronutrients are key elements in plant growth and development and deficiencies of zinc and boron had been increasingly reported in papaya. Hence foliar spraying with zinc and boron was resorted in the study.

Materials and Methods

A field experiment was conducted at Instructional Farm, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala from June 2018 to February 2020 to study the influence of fertigation and foliar nutrition on growth and yield of papaya cv. Surya. The experimental field was located at 8° 25' 46''N latitude and 76° 59'24'' E longitude and at an altitude of 19 m above mean sea level. The soil of the experimental site was sandy clay loam which belonged to the order oxisols, Vellayani series having pH 4.50, electrical conductivity (EC) 0.10 d S m⁻¹, organic carbon 1.30%, medium in available nitrogen (160.00 kg ha⁻¹), available phosphorus (18.50 kg ha⁻¹) and available potassium (207.50 kg ha⁻¹).

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The experiment was laid out in randomised block design with 14 treatments replicated thrice. Gross plot size was 24 m². Fertigation treatments were fixed based on the N and K recommendation as per KAU POP (240: 480 g NK plant⁻¹ year⁻¹, soil application of nutrients) for papaya. Three different foliar sprays [19:19:19 (1.0%), (ZnSO₄ (0.5%) + Borax (0.3%)) and water spray] were also used with different levels of fertigation. 19:19:19 (1.0%) and water spray were sprayed at bimonthly interval starting from 4 MAP to 16 MAP, whereas ZnSO₄ (0.5%) + Borax (0.3%) were applied at 4th, 8th, 12th and 16th MAP.

Different treatments were T₁ - 75% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%), T₂ - 75% RD dose of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%), T₃ - 75% RD dose of N and K through fertigation with water spray, T₄ - 100% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%), T₅ - 100% RD dose of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%), T₆ - 100% RD dose of N and K through fertigation with water spray, T₇ - 125% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%), T₈ - 125% RD dose of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%), T₉ - 125% RD dose of N and K through fertigation with water spray, T₁₀ - 150% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%), T₁₁ - 150% RD dose of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%), T₁₂ - 150% RD dose of N and K through fertigation with water spray, T₁₃ - control 1 - KAU POP (240:240:480 g NPK plant⁻¹ year⁻¹, soil application of nutrients with conventional land management) and T₁₄ - control 2 - organic POP (100% of RD of NPK as organic).

The general practices such as deep ploughing (50 cm) and taking raised beds (30 cm height, 1.5 m width) were uniformly followed except in control. Pits of 50 cm x 50 cm x 50 cm size were taken at 2 m x 2 m spacing in control 1 and control 2 and lime @ 500 g/plant was applied to these pits. Organic manure (15 kg FYM plant⁻¹) was given uniformly to all treatments as basal. The requirement of lime and phosphorus was calculated based on the initial soil status and the 500 g lime per plant and 200 g rock phosphate per plant was applied uniformly as basal for all treatments except control. For organic treatment, combination of FYM, poultry manure and vermicompost in the ratio of 2:1:1 were given at bimonthly interval. Additional requirement of P and K were met through the application of rock phosphate and potassium sulphate respectively.

For the experiment, papaya cv. Surya seeds were treated with 200 ppm GA₃ for 8 hours for uniform germination and were sown in polybags filled with a mixture of FYM, soil and sand in equal proportions. Later 15 days old seedlings were transplanted into polythene bags of 20 cm x 15 cm size. 45 days old seedlings were transplanted into main field.

To deliver water and fertilizer to the respective plots, four submains were laid out in the field. From each submain, lateral was connected to the respective plots. On the laterals, drippers (pressure compensating) with a discharge rate of 8 litres hour⁻¹ were connected to deliver water and fertilizer to

individual plots. The submains and laterals were provided with flushing devices to remove water and fertilizer after each application. Fertigation was carried out using injector. Urea and Muriate of Potash (MOP) were used as fertilizer sources for fertigation and applied weekly from 1 MAP to 20 MAP.

Plant height, girth and number of leaves as influenced by different levels of fertigation and different foliar sprays were recorded at bimonthly intervals from 2 MAP to peak harvesting stage (16 MAP). Height of papaya plants were recorded in centimeters from soil level to the tip of growing point from all observation plants and average were worked out. Girth of the stem was measured with help of measuring tape at 10 cm above the ground level and average were worked out and expressed in centimeters. Total number of active leaves per plant was counted from all observation plants and the average number of leaves was worked out. Total number of fruits from each observation plants was counted and average was worked out. Five fruits were randomly selected from each observation plants and average fruit weight was worked out and recorded in grams. Total number of fruits from each plant was multiplied with average fruit weight for getting total yield per plant and expressed in kilogram plant⁻¹.

Results and Discussion

Application of 125% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%) (T₇) registered highest plant height at 2 MAP and 4 MAP (85.70 cm and 112.53 cm respectively) (Table 1). Whereas, from 6 MAP to 16 MAP at bimonthly intervals, application of 100% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%) (T₄) recorded highest plant height (149.19 cm, 190.23 cm, 214.80 cm, 236.40 cm, 249.25 cm and 262.56 cm respectively). It was found to be on par with treatments receiving 100% RD of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%) (T₅) at 6 MAP, 10 MAP and 14 MAP (147.11 cm, 211.88 cm and 245.39 cm respectively). Plants receiving 75% RD dose of N and K through fertigation with water spray (T₃) registered lowest plant height from 2 MAP to 16 MAP. The maximum plant height that was recorded in treatment T₄ might be due to split application of adequate quantity of fertilizers during growth and development of papaya through fertigation that enhanced fertilizer use efficiency in addition to the foliar application of 19:19:19 (1.0%). Similar results of enhanced plant height under 100% fertigation was reported by Agrawal *et al.* (2010) [1] in papaya cv. Red Lady. Krishnamoorthy (2011) [11] also reported significant increase in plant height in cococa due to the better utilization of resources like water and optimum dose of nutrients through fertigation system. Shimi (2014) [16] reported that foliar application of 19:19:19 at 4 MAP was effective in enhancing the plant height in banana cv. Nendran. The minimum plant height in T₃ treatment might be due to the insufficient application of fertilizers through fertigation (75% RDF). Shirgure *et al.* (2001) [17] reported less plant height with lower fertilizer dose in Nagpur mandarin. The findings of Deshmukh and Hardaha (2014) [3] in papaya cv. Taiwan 786 was also in accordance with the study.

Table 1: Effect of fertigation and foliar sprays on height (cm) of papaya plants

Treatments	Plant height (cm)							
	2 MAP	4 MAP	6 MAP	8 MAP	10 MAP	12 MAP	14 MAP	16 MAP
T ₁	60.16	91.53	124.19	165.14	187.49	208.55	219.19	235.36
T ₂	63.15	90.72	123.25	162.81	185.96	205.27	218.87	233.49
T ₃	61.21	88.18	108.46	144.09	164.10	176.52	192.47	201.73
T ₄	82.37	106.56	149.19	190.23	214.80	236.40	249.25	262.56
T ₅	81.36	106.55	147.11	184.50	211.88	230.15	245.39	258.28
T ₆	82.17	104.72	139.08	158.76	179.32	199.98	210.80	224.41
T ₇	85.70	112.53	145.57	171.46	205.08	221.62	234.22	250.96
T ₈	85.36	110.62	145.09	175.71	208.56	226.05	238.50	254.72
T ₉	84.98	111.03	142.60	161.01	181.50	201.64	215.51	229.38
T ₁₀	68.83	92.59	122.74	155.38	174.98	194.23	207.58	217.76
T ₁₁	72.31	95.97	127.67	170.76	197.17	219.33	232.36	244.30
T ₁₂	70.09	93.12	118.32	151.02	170.16	183.54	199.99	210.12
T ₁₃	73.86	103.87	132.05	153.53	173.29	185.69	202.09	213.50
T ₁₄	73.17	102.04	135.22	167.88	188.50	209.19	223.02	238.30
SEm (±)	1.13	1.49	0.78	0.74	1.06	1.38	1.80	1.19
CD(5%)	3.30	4.35	2.26	2.14	3.10	4.02	5.22	3.45

The results obtained from the present investigation revealed that girth of plants varied significantly among treatments from 2 MAP to 16 MAP (Table 2). At 2 MAP and 4 MAP, highest plant girth (11.29 cm and 21.99 cm respectively) was noticed in T₇ which received 125% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%). Application of 100% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%) (T₄) recorded highest plant girth at 6 MAP, 8 MAP, 10 MAP, 12 MAP, 14 MAP and 16 MAP (25.92 cm, 39.33 cm, 45.80 cm, 51.65 cm, 54.78 cm and 56.92 cm respectively). It was on par with T₅ (100% RD of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%)) at 6 MAP, 10 MAP and at 14 MAP with 25.36 cm, 45.75 cm and 53.03 cm plant girth respectively. Whereas, plants receiving 75% RD of N and K through fertigation with water spray (T₃) registered lowest plant girth along these time period. Increased uptake of nutrients, nitrogen and potassium under optimum dose of

fertigation with foliar application of 19:19:19 (1.0%) might have contributed to expansion of stem girth. Jeyakumar *et al.* (2010) [7] reported significantly higher stem girth on application of 100% RD of N and K through fertigation in papaya. The absorbed nitrogen and potash might have been utilized by the plants in the formation of complex substances like protein and amino acids which in turn help to build up new tissues (Childers, 1966) [2]. Also the supply of nutrients at adequate doses would have increased the synthesis of IAA stimulating the cell elongation and increasing the stem girth. Ghanta *et al.* (1995) [5] pointed that increase in the girth of trunk might be due to the higher uptake and accumulation of nutrients in leaf tissues which in turn ensure photosynthetic efficiency causing greater synthesis, translocation and accumulation of carbohydrates. Shimi (2014) [16] reported that foliar application of 19:19:19 at 6 MAP was effective in enhancing the pseudostem girth in banana cv. Nendran.

Table 2: Effect of fertigation and foliar sprays on girth (cm) of papaya plants

Treatments	Plant girth (cm)							
	2 MAP	4 MAP	6 MAP	8 MAP	10 MAP	12 MAP	14 MAP	16 MAP
T ₁	7.04	13.68	21.16	30.04	36.23	40.00	43.12	46.09
T ₂	7.08	12.80	20.47	28.57	34.35	37.94	41.04	44.20
T ₃	6.79	12.23	18.32	21.86	25.09	30.92	33.92	36.48
T ₄	10.85	20.08	25.92	39.33	45.80	51.65	54.78	56.92
T ₅	10.89	20.15	25.36	37.46	45.75	49.99	53.03	55.17
T ₆	10.85	19.50	20.78	28.00	32.29	37.01	40.69	43.41
T ₇	11.29	21.99	24.94	32.94	40.24	45.27	47.28	50.16
T ₈	11.25	21.94	23.08	34.30	43.31	48.90	51.06	52.97
T ₉	10.77	20.72	21.17	30.03	34.09	39.99	43.26	45.69
T ₁₀	8.50	13.68	19.87	24.01	28.49	32.01	34.78	37.58
T ₁₁	8.36	14.29	21.31	32.88	37.92	43.91	47.74	49.79
T ₁₂	8.21	14.28	18.39	23.94	25.31	31.00	34.61	37.53
T ₁₃	8.31	17.79	19.82	26.19	30.11	35.17	36.86	38.92
T ₁₄	7.52	17.99	20.99	30.70	36.08	39.73	41.40	44.00
SE	0.31	0.31	0.34	0.39	0.47	0.42	0.60	0.42
CD(5%)	0.89	0.92	0.99	1.15	1.38	1.21	1.75	1.23

Observations on number of leaves recorded at bimonthly intervals from 2 MAP to 16 MAP (peak harvest stage) showed significant variation among treatments (Table 3). At 2 MAP, maximum number of leaves (13.67) was noted in T₈ (125% RD of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%)). Whereas, least number of leaves (8.89 each) was recorded in T₂ (75% RD dose of N and K through fertigation with foliar spraying of ZnSO₄

(0.5%) and Borax (0.3%)) and T₃ (75% RD dose of N and K through fertigation with water spray) at 2 MAP. At 4 MAP, T₇ (125% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%)) registered a maximum leaf number (16.56). Whereas from 6 MAP to 16 MAP, application of 100% RD of N and K with foliar spraying of 19:19:19 (1.0%) (T₄) recorded maximum number of leaves (18.11, 22.34, 29.11, 31.22, 28.67 and 25.11 respectively),

which was on par with T₅ (100% RD of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%)) at 6 MAP, 8 MAP and 14 MAP (17.78, 21.78 and 27.78 leaves respectively). T₃ which received 75% RD dose of N and K through fertigation with water spray registered minimum number of leaves from 4 MAP to 16 MAP. Improved number of leaves in T₄ could be attributed to improved nutrient uptake because of optimum dose of fertigation in addition to foliar spray with 19:19:19. Wuertz *et al.* (2000) [21] observed that drip fertigation at frequent intervals provided a consistent moisture regimes and nutrient pool in the soil and therefore, roots remain active for a longer

period. The proper and continuous moisture in the soil also increases the availability of nutrients and translocation of food materials which accelerate the vegetative growth of plant parts (Mishra *et al.*, 2005) [14]. The results was in accordance with the findings of Martinsson *et al.* (2006) [13] and Kachwaya and Chandel (2015) [8] which registered more number of leaves in plants fertigated with full nutrient package as compared to soil fertilization in strawberry. Shimi (2014) [16] reported that foliar application of 19:19:19 at 4 and 6 MAP significantly increased the number of functional leaves per plant in banana cv. Nendran.

Table 3: Effect of fertigation and foliar sprays on number of leaves of papaya plants

Treatments	Number of leaves							
	2 MAP	4 MAP	6 MAP	8 MAP	10 MAP	12 MAP	14 MAP	16 MAP
T ₁	9.44	11.33	14.11	19.67	24.33	26.22	24.34	19.78
T ₂	8.89	12.00	14.00	19.22	22.22	23.89	22.89	19.00
T ₃	8.89	10.67	11.00	14.89	15.11	16.56	15.00	11.67
T ₄	11.89	15.78	18.11	22.34	29.11	31.22	28.67	25.11
T ₅	11.33	14.44	17.78	21.78	27.89	29.33	27.78	23.00
T ₆	11.55	14.33	15.56	17.89	19.00	21.00	19.78	17.22
T ₇	12.22	16.56	17.22	20.78	26.44	27.66	26.11	21.22
T ₈	13.67	16.22	17.44	21.56	27.78	29.22	27.00	21.78
T ₉	13.00	15.89	16.33	18.44	20.67	23.11	22.67	17.78
T ₁₀	11.89	13.22	14.11	17.67	18.22	19.45	17.11	14.33
T ₁₁	11.22	13.33	15.78	20.11	25.78	26.66	25.22	21.22
T ₁₂	11.33	12.67	13.56	16.00	17.11	19.11	15.22	12.67
T ₁₃	11.78	13.66	14.00	17.22	18.00	19.78	17.67	14.00
T ₁₄	11.66	13.56	14.78	19.89	25.22	26.67	25.00	20.00
SE	0.41	0.49	0.32	0.48	0.35	0.36	0.36	0.34
CD (5%)	1.20	1.41	0.92	1.38	1.01	1.07	1.07	0.97

The data on number of fruits per plant revealed significant difference among different treatments (Table 4). Plants receiving 100% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%) (T₄) registered highest number of fruits per plant (48.11), which was on par with T₅ (100% RD of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%)) with 47.45 fruits. Lowest number of fruits per plant (28.45) was registered in T₃ (75% RD of N and K through fertigation with water spray). Maximum number of fruits recorded in T₄ and T₅ might be due to the efficient and timely utilization of optimum dose of nutrients through fertigation with foliar sprays of 19:19:19 (1.0%) and ZnSO₄ (0.5%) + Borax (0.3%). Similar results of increment in number of fruits on application of 100% RD of N and K was reported by Tank and Patel (2013) [19] in papaya cv. Madhu Bindu and Jadhav *et al.* (2016) [6] in papaya cv. Red Lady. This was in confirmity with reports of Khan *et al.* (2012) [10] which registered significantly increased number of fruit per trees in *Citrus reticulata* Blanco cv. Feutrell's Early upon foliar application of zinc and boron. Edward (2009) [4] opined that zinc stabilizes membrane permeability and boron plays a positive role by increasing photosynthesis and providing carbohydrates supply for good calcium uptake which ultimately increase the number of fruits. Deshmukh and Hardaha (2014) [3] reported less number of fruits in plants receiving lower fertilizer dose in papaya cv. Taiwan 786.

The data on fruit weight of 14 treatments influenced by different levels of fertigation and different foliar sprays revealed significant difference (Table 4). Highest fruit weight of 797.51 g was noticed in plants receiving 100% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%) (T₄), which was on par with T₅ (100% RD of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and

Borax (0.3%)) with a fruit weight of 792.42 g. Lowest fruit weight of 569.84 g was noticed in plants receiving 75% RD of N and K through fertigation with water spray (T₃). Application of 100% RDF might have first improved the internal nutritive condition of plant leading to increased growth and vigour associated with photosynthesis, by which the applied nutrients accelerated mobility of photosynthates from source to sink as influenced by the growth hormones and finally translocation of assimilates into the fruits (Sharma *et al.*, 2013) [15] thereby increasing the fruit weight. According to Jadhav *et al.* (2016) [6] application of 100% RD of N and K through fertigation improved the fruit weight in papaya cv. Red Lady. Similar results were put forth by Jeyakumar *et al.* (2010) [7] in papaya cv. Co.7 and Tank *et al.* (2011) [20] in papaya cv. Madhu Bindu. Deshmukh and Hardaha (2014) [3] reported lowest fruit weight in plants receiving lower fertilizer dose in papaya cv. Taiwan 786, which was in accordance with the findings of the present study.

The results obtained from the present investigation revealed significant difference in total yield per plant among treatments (Table 4). Application of 100% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%) (T₄) registered highest yield of 38.30 kg plant⁻¹, which was on par with T₅ (100% RD of N and K through fertigation with foliar spraying of ZnSO₄ (0.5%) and Borax (0.3%)) with 37.60 kg plant⁻¹. Lowest yield of 16.21 kg plant⁻¹ was noticed in T₃ (75% RD of N and K through fertigation with water spray). Higher yield per plant obtained in treatments T₄ and T₅ might be due to application of optimum dose of fertilizers through fertigation (100% RD of N and K) in addition to foliar spray with 19:19:19 and ZnSO₄ + Borax, resulting in more preferential influx of photosynthates to the sink contributing to increased fruit weight. Kumar *et al.*, (2007) [12] opined that

fertigation increases the nutrient use efficiency of crop by permitting timely application of fertilizers in small quantities in the vicinity of root zone matching with the plants nutrient need, besides substantial saving in fertilizer usage and reducing nutrient losses. Shimi (2014) ^[16] reported that foliar application of 19:19:19 at 2, 4 and 6 MAP was effective in enhancing the number of hands in banana cv. Nendran, thereby increasing the yield. These results are in line with the work of Kavitha *et al.* (2000) ^[9] who reported that foliar sprays of zinc sulphate (0.5%) and boric acid (0.1%) at 4th and 8th month after planting increased the yield in papaya cv. CO.5. Zinc plays a role in regulating the semi-permeability of cell walls, thus mobilizing more water into fruits resulted in increased in fruit size, thereby enhancing fruit yield. Deshmukh and Hardaha (2014) ^[3] also reported lowest yield in plants receiving lower fertilizer dose in papaya cv. Taiwan 786.

Table 4. Effect of fertigation and foliar sprays on number of fruits per plant, fruit weight and total yield per plant

Treatments	Number of fruits per plant	Fruit weight (g)	Total yield per plant (kg)
T ₁	41.00	708.93	29.06
T ₂	40.11	703.47	28.21
T ₃	28.45	569.84	16.21
T ₄	48.11	797.51	38.30
T ₅	47.45	792.42	37.60
T ₆	37.22	634.60	23.62
T ₇	44.33	747.95	33.16
T ₈	45.00	754.60	33.96
T ₉	38.44	644.11	24.76
T ₁₀	33.78	631.38	21.33
T ₁₁	42.00	741.49	31.14
T ₁₂	30.00	592.45	17.78
T ₁₃	34.55	608.71	21.03
T ₁₄	42.56	711.31	30.27
SE	0.40	2.80	0.32
CD (5%)	1.15	8.13	0.93

Conclusion

In the present study, it was concluded that application of 100% RD of N and K through fertigation with foliar spraying of 19:19:19 (1.0%) (at bimonthly interval starting from 4 MAP to 16 MAP) with weekly fertigation from 1 MAP to 20 MAP resulted in increased plant height, plant girth, number of leaves, fruit weight, number of fruits per plant and yield per plant in papaya cv. Surya. Also it was found that application of 100% RD of N and K through fertigation at weekly interval from one MAP to 20 MAP with foliar application of ZnSO₄ (0.5%) and Borax (0.3%) at 4th, 8th, 12th and 16th MAP was on par with the above treatment on number of fruits per plant, fruit weight and yield per plant in papaya cv. Surya.

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