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RESEARCH ARTICLE

EFFECT OF FERTIGATION, SPLIT AND MULCHING ON N, P AND K CONTENTS (%) IN LEAF OF PAPAYA CV. TAIWAN 786UNDER SOUTH GUJARAT CONDITIONS

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ABSTRACT

An experiment was conducted on "effect of fertigation, split and mulching on N, P and K contents (%) in leaf of papaya cv. Taiwan 786 under south Gujarat conditions" with twelve treatments *viz.,* 1st factor three levels of N and K_2O @ 100, 80 and 60 % of RD (200:200:250), 2nd factor two levels of splits and 3rd factor two levels of mulching of black plastic mulch (BPM) @ 20 % area coverage (50 μ) in RBD with factorial concept (FRBD) including three replications at two locations during 2012-13. The results indicated that the nutrient status in papaya leaf were found statistically effective at the age 180 and 300 days due to N and K_2O @ 100 % RDF (F_1)applied with 18 splits as well as 15 days after transplanting (DAT) in both the locations showed better results as compared to control. For getting higher uptake of nutrient contents (%) in leaf of papaya, fertigation with N and K_2O @ 100 % RDF and 18 splitsat 15 days intervals after transplanting of papaya cv. Taiwan 786 should be adopted.

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INTRODUCTION

Papaya (*Carica papaya* Linn.) is an important fruit crop of tropical world and has long been known as wonder fruit of the tropics. It requires less area for growth, comes to fruiting in a year, is easy to cultivate and provides more income next to banana (Jadhav *et al.*, 2015). Taiwan 786 variety of papaya a gynodioecious in nature, which preferred by growers of south Gujarat. Plants begin to bear fruits at 80 cm height and normally have over 30 fruits per plant in each fruit setting season. Fruits are short-oblong on female plants and rather long shaped on bisexual plants, weighing about 1.5 - 2 kg. Flesh is thick, red, and 13% in sugar content and aromatic. Good to transport and export. It's a product of M/s. Known You Seed Co., Ltd., TAIWAN. Improved production technology on papaya has been developed for different agro-climatic regions of the country. However, it is felt that precision farming be used in India, it will be possible with the introduction of advanced techniques in papaya cultivation like water management through drip irrigation, fertigation, crop geometry, plastic mulching and tissue culture techniques with introduction and multiplication of excellent varieties (Jadhav, 2014). In Gujarat, papaya is grown in 17,800 ha with the productivity of 54.70 t/ha(Anonymous, 2011). Though, the productivity is more than the national average of 24.3 t/ha. Yet there is good scope of increasing productivity of papaya by adopting drip irrigation, fertigation, split fertilizer application and black polythene mulching (BPM). The nutritional demand of papaya differs from other fruit crops because of its tremendous yield potential, precocious bearing and indeterminate growth habit with simultaneous vegetative growth, flowering and fruiting quality. The present study was planned with an objective *i.e.*to find out the effect of fertigation, split and mulching on N, P and K contents (%) in leaf of papaya cv. Taiwan 786 under south Gujrat conditions.

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MATERIALS AND METHODS

An experiment was conducted with twelve treatments *viz.,* T_1- N & K_2O @ 100 % RD + (S_1)14 splits of N and K +

(M_0)without mulching, T_2-N & K_2O @ 100 % RD + (S_2)18 splits of N and K + (M_0)without mulching, T_3-N & K_2O @ 100 % RD + (S_1)14 splits of N and K + (M_1) with mulching of 20% coverage (50 micron), T_4- N & K_2O @ 100 % RD + (S_2)18 splits of N and K + (M_1) with mulching of 20% coverage (50 micron), T_5- N & K_2O @ 80 % RD + (S_1)14 splits of N and K + (M_0)without mulching, T_6- N & K_2O @ 80 % RD + (S_2)18 splits of N and K + (M_0)without mulching, T_7- N & K_2O @ 80 % RD + (S_1)14 splits of N and K + (M_1) with mulching of 20% coverage (50 micron), T_8- N & K_2O @ 80 % RD + (S_2)18 splits of N and K + (M_1) with mulching of 20% coverage (50 micron), T_9- N & K_2O @ 60 % RD + (S_1)14 splits of N and K + (M_0)without mulching, T_{10}- N & K_2O @ 60 % RD + (S_2)18 splits of N and K + (M_0)without mulching, T_{11}- N & K_2O @ 60 % RD + (S_1)14 splits of N and K + (M_1) with mulching of 20% coverage (50 micron) and T_{12}- N & K_2O @ 60 % RD + (S_2)18 splits of N and K + (M_1) with mulching of 20% coverage (50 micron) in RBD (FRBD) with three replications at two locations *i.e*. 1) Regional Horticultural Research Farm, Navsari and 2) Fruit Research Station, Gandevi, Navsari Agricultural University, Navsari (Gujarat) during 2012-13. Papaya var. Taiwan 786 was planted at a spacing of 2.4 x 1.8 m. The lateral lines of 16 mm diameter with online two drippers (8 lph) were placed 30 cm away on either side of papaya plant. The system was operated at 1.2 kg/cm^2 pressure on alternate day and fertigated @ 200:200:250 g / plant. Nitrogen and potash should be applied in the form of urea and muriate of potash (MOP), respectively as per treatment, in 14 splits (S_1) and 18 splits (S_2) equal splits starting form 45 and 15 days after transplanting, subsequently at 15 days intervals through drip irrigation. Recommended dose of Phosphorus (200g/plant) applied in two equal splits first at $1^1/_2$ month and second at 3 months after transplanting.

Nutrient status of papaya leaf

For getting the idea of nutrient status of papaya crop, the healthy and matured leaf samples were taken from five plant of net plot for analysis at 180 and 300 days after transplanting of seedlings. Collected leaf samples were washed with tap water followed by distilled water and double distilled water and shade were dried and then the samples were dried in an oven at 65^0 C for 48 hours and samples were grind in stainless steel jar grinder and passed through a 40 mesh sieve. All relevant procedures and care was taken as described by Chapman (1964) for collection, cleaning, drying, grinding and storage of the samples and were analyzed for macro nutrients. The method employed is furnished in Table 1.

RESULTS

NPK nutrients content (%) in papaya leaf at 180 and 300 days after transplanting

The data related to NPK nutrients content in papaya leaf at 180 and 300 days after transplanting as influenced by various treatments are presented in Table- 2 and Table 3, respectively.

Effect of fertigation on NPK nutrients content (%) in papaya leaf at 180 and 300 days after transplanting

N nutrient content in leaf was recorded significantly the highest in plant received N and K_2O 100 % RDF (F_1) in collected leaf samples on 180 (1.62 % and 1.60%) and 300 (1.58 % and 1.57 %) days after transplanting at Gandevi and Navsari centres, respectively. Likewise, K nutrient content in leaf was recorded significantly the highest in same treatment on 180 (2.64 % and 2.63 %) and 300 (2.62 and 2.60 %) days after transplanting in collected leaf samples at Gandevi and Navsari centers, respectively.

Table 1. Methods employed for chemical analysis of leaf of papaya cv. Taiwan 786

S.No.	Element	Method employed	Reference
1	Total N	Wet digestion, Diacid mixture, 4:1 ($HClO_4$:H_2SO_4), Micro kjeldahl	Jackson (1973)
2	Total P	Wet digestion, Diacid mixture, 4:1 ($HClO_4$:H_2SO_4), Vanadomolybdo phosphoric acid yellow colour	
3	Total K	Wet digestion, Diacid mixture, 4:1 ($HClO_4$:H_2SO_4), Flame photometric	

Table 2. Effect of fertigation and mulching on N, P and K contents (%) in leaf of papaya cv. Taiwan 786

Treatments	N content in leaf (%)			P content in leaf (%)			K content in leaf (%)		
	Locations			Locations			Locations		
	Gandevi	Navsari	Pooled	Gandevi	Navsari	Pooled	Gandevi	Navsari	Pooled
Fertilizer levels									
F_1	1.62	1.60	1.61	0.41	0.41	0.41	2.63	2.63	2.63
F_2	1.56	1.56	1.56	0.40	0.40	0.40	2.56	2.54	2.55
F_3	1.31	1.26	1.29	0.40	0.40	0.40	2.30	2.30	2.30
S. Em.±	0.05	0.05	0.03	0.00	0.00	0.006	0.51	0.05	0.04
C. D. at 5 %	0.15	0.13	9.53	NS	NS	NS	0.15	0.15	0.10
Split levels									
S_1	1.40	1.55	1.48	0.40	0.40	0.40	2.43	2.42	2.43
S_2	1.44	1.56	1.50	0.41	0.41	0.41	2.56	2.55	2.56
S. Em.±	0.04	0.04	0.03	0.00	0.00	0.005	0.04	0.04	0.03
C. D. at 5 %	0.12	0.10	7.87	NS	NS	NS	0.12	0.12	0.08
Mulch levels									
M_o	1.46	1.44	1.45	0.40	0.40	0.40	2.45	2.54	2.50
M_1	1.53	1.51	1.52	0.41	0.41	0.41	2.45	2.54	2.50
S. Em.±	0.04	0.04	0.03	0.00	0.00	0.005	0.04	0.04	0.03
C. D. at 5 %	NS	NS	NS	NS	NS	NS	NS	NS	0.34
C. V.%	11.71	10.73	11.24	7.92	7.57	7.75	7.08	7.21	7.15

Note: All the interactions were found non-significant.

Table 3. Effect of fertigation and mulching on N, P and K contents (%) in leaf of papaya cv. Taiwan 786

Treatments	N content in leaf (%)			P content in leaf (%)			K content in leaf (%)		
	300 DAP								
	Locations			Locations			Locations		
	Gandevi	Navsari	Pooled	Gandevi	Navsari	Pooled	Gandevi	Navsari	Pooled
Fertilizer levels									
F_1	1.58	1.57	1.57	0.41	0.40	0.41	2.62	2.60	2.61
F_2	1.52	1.50	1.51	0.40	0.39	0.40	2.54	2.50	2.52
F_3	1.29	1.29	1.29	0.40	0.39	0.40	2.29	2.33	2.31
S. Em.±	0.05	0.05	0.04	0.008	0.008	0.006	0.05	0.05	0.04
C. D. at 5 %	0.15	0.14	0.10	NS	NS	NS	0.16	0.17	0.11
Split levels									
S_1	1.41	1.40	1.40	0.40	0.39	0.40	2.42	2.40	2.41
S_2	1.53	1.52	1.52	0.41	0.41	0.41	2.55	2.56	2.56
S. Em.±	0.04	0.041	0.03	0.006	0.007	0.007	0.04	0.05	0.03
C. D. at 5 %	0.12	0.12	0.84	NS	NS	NS	0.13	0.14	0.10
Mulch levels									
M_o	1.44	1.43	1.43	0.40	0.39	0.40	2.44	2.45	2.45
M_1	1.49	1.48	1.48	0.41	0.40	0.41	2.53	2.51	2.52
S. Em.±	0.04	0.12	0.03	0.006	0.007	0.007	0.04	0.05	0.03
C. D. at 5 %	NS	NS	NS	NS	NS	NS	NS	NS	NS
C. V.%	12.26	12.10	12.18	7.23	7.56	7.39	7.46	7.87	7.67

Note: All the interactions were found non-significant.

With similar trends in pooled data, the maximum NK nutrients content in leaf was recorded on 180 (1.61 % and 2.63 %) and 300 (1.57 % and 2.61) days after transplanting in F_1 (N and K_2O 100 % RDF). However all the treatments stood at par with N and K_2O 80 % RDF (F_2) treatment.

Effect of split application on NPK nutrients content (%) in papaya leaf at 180 and 300 days after transplanting

There was significant effect of split application on NK nutrients status in leaf of papaya cv. Taiwan 786 at 180 and 300 days in collected samples, after transplanting at both the locations. N nutrient content in leaf was significantly highest and recorded as 1.44 % and 1.56 % at 180 days after transplanting from the collected samples of leaves which received 18 split application (S_2) of fertilizers at Gandevi and Navsari locations, respectively. At Gandevi and Navsari centres, N nutrient content in leaf was recorded significantly the highest as 1.53 % and 1.52 % at 300 days after transplanting respectively from collected samples with 18 splits application (S_2) treatment. K nutrient content from the collected leaf samples was recorded significantly the highest in 18 splits application (S_2) as 2.56 %, 2.55 % and 2.55 %, 2.56 %, on the 180 and 300 days at Gandevi and Navsari centers, respectively. The pooled data revealed that the maximum N nutrient content in leaf was recorded with 18 splits application (S_2) on 180 (1.50 %) and 300 (1.52 %) days after transplanting, respectively. The maximum K nutrient content in leaf was significantly recorded in 18 splits fertigation (S_2), on 180 (2.56 %) and 300 (1.52 %) days in collected samples, respectively.

Effect of mulching on NPK nutrients content (%) in papaya leaf after transplanting

The nutrient content in leaf was not affected significantly by various treatments of mulching on papaya cv. Taiwan 786 during the period of experimentation. With regards to the pooled mean, the maximum N and K nutrient contents were noted in 100 % RDF (N and K_2O) (F_1) treatment at 180 and 300 days at Gandevi and Navsari centres, however, application of N and K_2O @ 80 % RDF (F_2) also exerted the similar results and stood at par with F_1 treatment.

Interaction effect

The interactions were found non-significant.

DISCUSSION

Leaf analysis was done two times *i.e.*, at 180 and 300 days after transplanting. There was a significant effect of fertigation on N and K nutrients content in papaya cv. Taiwan 786 on 180 and 300 days after transplanting at both the centres. With regards to the pooled mean, the maximum N and K nutrient contents were noted in 100 % RDF (N and K_2O) (F_1) treatment at 180 and 300 days at Gandevi and Navsari centres, however, application of N and K_2O @ 80 % RDF (F_2) also exerted the similar results and stood at par with F_1 treatment.The nutritional demand of papaya differs from other fruit crops because of its tremendous yield potential, precocious bearing and indeterminate growth habit with simultaneous vegetative growth, flowering and fruiting (Satya *et al.,* 2008). The macro nutrients which are required more in quantity but essential for various physiological activities. It may be attributed to the fact that macro nutrients might have enhanced the physiological processes in papaya leaves in present study which in turn have led to rapid absorption and utilization of nutrients for primary metabolic processes.Potassium is involved in all major physiological processes including photo-assimilation and transport ofassimilates and the conversion of these assimilates into storage products such as sugar, starch, protein and oil/fats (Epstein and Bloom, 2005).

Conclusion

Looking to nutrient status of papaya leaf, it was mostly influenced by 18 splits (S_2) application of N and K_2O @ 100 %

RDF (F_1) at 15 days interval application after transplanting the seedlings at both the centres and in pooled study, respectively.

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