Plant Archives **Vol. 25, Special Issue (ICTPAIRS-JAU, Junagadh) Jan. 2025 pp. 150-156**
e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives
Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.SP.ICTPAIRS-026

EFFECT OF FERTIGATION SCHEDULE ON GROWTH, YIELD, QUALITY AND NUTRIENT STATUS OF SOIL AND CLADODE OF DRAGON FRUIT (*HYLOCEREUS POLYRHIZUS* BRITTON & ROSE)

Disha M. Thanki[1]*, K.D. Patel[2], Puri H. Rajatiya[3] and Srushti K. Pandya[4]

[1]Department of Horticulture, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India.
[2]Polytechnic in Horticulture, Junagadh Agricultural University, Junagadh, Gujarat, India.
[3]Fruit Science, COH, Junagadh Agricultural University, Junagadh, Gujarat, India.
[4]Department of Floriculture and Landscaping, A.C.H., Navsari Agricultural University, Navsari, Gujarat, India.
*Corresponding author E-mail : dishathanki98@gmail.com

ABSTRACT

The objective of this study was to determine the effect of different doses of NPK fertilizers and split applications on growth, yield and quality of dragon fruit. The selected plants were subjected to different fertigation schedules during April, 2021 to February, 2022. The treatments comprised of four levels of NPK fertilizer doses (F) *viz.*, F_1 = 450 : 250 : 250 g NPK/pillar, F_2 = 450 : 350 : 300 g NPK/pillar, F_3 = 500 : 750 : 300 g NPK/pillar and F_4 = 550 : 800 : 350 g NPK/pillar, with five levels of split application (S) *viz.*, S_1 = 2 splits, S_2 = 3 splits, S_3 = 4 splits, S_4 = 6 splits and S_5 = 8 splits. Among different treatments, the application of soluble chemical fertilizers @ 500 : 750 : 300 g NPK/pillar improved plant growth, yield, plant nitrogen, phosphorus and potassium content, while chemical fertilizers @ 550 : 800 : 350 g NPK/pillar improved soil available N, P_2O_5 and K_2O. Whereas, the dose of soluble chemical fertilizers @ 450 : 350 : 300 g NPK/pillar improved quality of dragon fruits. Similarly, 4 split application of fertilizers (in April, July, October and January) improved plant growth, yield and quality of dragon fruit. The application of soluble chemical fertilizers @ 500 : 750 : 300 g NPK/pillar in 4 split doses (in April, July, October and January) through fertigation, improved yield of dragon fruit.

Key words : Dragon fruit, Fertigation schedule, Growth, NPK fertilizers, Quality, Yield.

Introduction

Dragon fruit is a tropical fruit that is becoming increasingly popular in recent years. Botanically, known as *Hylocereus polyrhizus* and belonging to the Cactaceae family, it originated in Southern Mexico and Central America. It was introduced in India somewhat in late 90s, but now it is an important underutilized fruit crop which is considered as an exotic future fruit of India (Perween *et al.*, 2018). It is cultivated in Maharashtra, Gujarat, Karnataka, Kerala, Tamil Nadu, Telangana, Andhra Pradesh, West Bengal, Meghalaya, Rajasthan, *etc.* The total area under dragon fruit cultivation, in India, is 3085 hectares with a production of 12,113.4 MT and productivity of 10.7 MT/ha. Gujarat ranks first in India, with the total area under dragon fruit cultivation of 1,214.1 hectares and a production of 4,079.3 MT (Wakchuaure *et al.*, 2020). It grows best in dry, tropical or subtropical regions. This miracle fruit is gaining popularity in leaps and bounds day-by-day due to its nutritive value and health benefits. Various processed products like juice, jam, jelly, candy, syrup, ice cream, pastry, wine, *etc.* can be prepared from it. Dragon fruit, as any other fruit crop, requires judicious application of fertilizers for optimum growth and better quality. The recommendations of fertilizer rates vary widely. Poor fruit setting, low crop yield and substantial depletion of nutrients occur where no NPK fertilizer is applied, which can be improved by proper nutrient application. For commercial exploitation of this crop and increased fertilizer use efficiency, it is necessary to know the nutrient requirement and performance of

the crop under various fertigation schedules. Hence, an attempt was made to standardize fertigation schedule for economical productivity of dragon fruit in terms of growth, quality and nutrient uptake.

Material and Methods

The experiment was conducted at Instructional Farm, Polytechnic in Horticulture, Junagadh Agricultural University, Junagadh during the year 2021-22. The soil of the experimental plot was silty loam in texture, calcareous in nature and slightly alkaline in reaction with 203.84 kg/ha available N, 14.87 kg/ha available P_2O_5 and 401.85 kg/ha available K_2O. Four plants per pillar were planted in March, 2018 maintaining a spacing of 3.6 m × 2.4 m. The experiment was laid out in Large Plot Technique (CRD with Factorial Concept) with twenty treatment combinations with three replications. The treatments comprised of four levels of NPK fertilizer doses (F) *viz.*, F_1 = 450 : 250 : 250 g NPK/pillar, F_2 = 450 : 350 : 300 g NPK/pillar, F_3 = 500 : 750 : 300 g NPK/pillar and F_4 = 550 : 800 : 350 g NPK/pillar, with five levels of split application (S) *viz.*, S_1 = 2 splits (in April and October), S_2 = 3 splits (in April, August and December), S_3 = 4 splits (in April, July, October and January), S_4 = 6 splits (in April, June, August, October, December and February) and S_5 = 8 splits (in April, May, June, July, August, September, October and November). In addition to application of fertigation as per above schedule, each treatment was also supplied with 20 kg FYM per pillar in January, 2022.

All the selected plants were almost uniform in growth and vigour. The plants were given uniform cultural operations during the course of investigation. Observations on stem length, stem circumference, stem width, total number of fruits per plant, yield (kg/pillar), TSS, fruit pulp percentage, total sugar, reducing sugars, non-reducing sugar, titrable acidity, ascorbic acid content, soil available nitrogen, soil available phosphorus and soil available potassium and plant nitrogen content, plant phosphorus content and plant potassium content were recorded during experimentation. Statistical analysis was done by using method of analysis of variance (ANOVA) for Large Plot Technique (FCRD) by Panse and Sukhatme (1967).

Results and Discussion

From the data presented in Table 1, it can be said that among different NPK fertilizer doses, maximum stem length (241.35 cm) was recorded in F_3 (500 : 750 : 300 g NPK/pillar), while there was no significant effect on stem circumference and stem width. Under fertigation, uniform distribution of nutrients, coupled with their confinement in the root zone, might have increased the nutrient uptake. It might have led to higher synthesis of metabolites and their translocation, resulting in enhanced vegetative growth. The results were in close proximity with Mahalakshmi *et al*. (2001) and Srinivas *et al.* (2001) in banana; Santos and Chandler (2009) in strawberry and Makhmale (2017) in mango.

Table 1 : Effect of NPK fertilizer doses and split applications on growth parameters in dragon fruit.

Treatments	Stem length (cm)	Stem circumference (cm)	Stem width (cm)
Factor A: NPK fertilizer doses (F)			
F_1	221.59	17.58	5.26
F_2	233.05	17.62	5.29
F_3	241.35	17.50	5.31
F_4	236.11	17.55	5.35
S. Em.±	3.31	0.23	0.09
C. D. at 5 %	9.46	NS	NS
Factor B: Split applications (S)			
S_1	225.62	17.52	5.25
S_2	228.98	17.57	5.28
S_3	242.08	17.61	5.30
S_4	236.33	17.58	5.34
S_5	232.12	17.54	5.33
S. Em.±	3.70	0.26	0.10
C. D. at 5 %	10.57	NS	NS
Interaction (F x S)			
S. Em.±	7.40	0.52	0.20
C. D. at 5 %	NS	NS	NS
C. V. %	5.50	5.13	6.61

Similarly, S_3 (4 splits) gave maximum stem length (242.08 cm) while no significant effect was observed on stem circumference and stem width. In case of nutrient application, when to apply is the prime requirement to obtain optimum growth of crop. Timely supplementation of nutrients is known to overcome the ill effects of deficient nutrients and enhanced the nutrient use efficiency, which increased plant growth. It might be due to increased cell division and elongation. Similar results were obtained by Ravitchandirane *et al.* (2002), Parmar (2017) in papaya; Babu *et al*. (2004) and Navaneethkrishnan *et al.* (2015) in banana and Mishra (2020) in pomegranate.

The results indicated in Table 2 revealed that among four different NPK fertilizer doses, F_3 (500 : 750 : 300 g NPK/pillar) gave maximum total number of fruits per plant (13.14) and yield (15.55 kg/pillar and 17.99 t/ha). This might be due to probable reduced nutrient losses by leaching, runoff and efficient availability of the nutrients at the root zone, which might have increased the transport

Table 2 : Effect of NPK fertilizer doses and split applications on yield parameters in dragon fruit.

Treatments	Total number of fruits per plant	Yield (kg/pillar)	Yield (t/ha)
Factor A: NPK fertilizer doses (F)			
F_1	7.90	7.21	8.34
F_2	12.36	11.72	13.55
F_3	13.14	15.55	17.99
F_4	12.38	11.46	13.25
S. Em.±	0.17	0.25	0.25
C. D. at 5 %	0.48	0.70	0.79
Factor B: Split applications (S)			
S_1	10.12	9.24	10.68
S_2	11.09	10.97	12.69
S_3	12.76	13.65	15.80
S_4	11.98	12.39	14.33
S_5	11.29	11.17	12.92
S. Em.±	0.19	0.25	0.29
C. D. at 5 %	0.54	0.70	0.81
Interaction (F x S)			
S. Em.±	0.38	0.49	0.57
C. D. at 5 %	1.08	1.41	1.63
C. V. %	5.72	7.43	7.43

of metabolites to the growing plant. It might have resulted in higher production of photosynthates and thereby improving fruit size and fruit weight, and ultimately yield. In higher dose of fertilizer, the flowering and yield parameters were reduced due to negative effect of additional dose of fertilizers. It is true that higher N always disturbs the C : N ratio of plant and negatively affects flowering and fruiting. In case of phosphorus, it might have combined with Ca^{2+} and formed insoluble calcium phosphate and which might been unavailable to the plants, while higher dose of potassium might not be taken up by plants due to fixation in clay mineral. Furthermore, these findings are well supported by Jat and Kacha (2014) in guava; Chadrakumar *et al.* (2001) in banana; Rathore and Chandra (2002) in ber; Quaggio *et al.* (2002) in lemon; Sharma *et al.* (2005) in papaya; Sidhu and Thakur (2006) in grapes; Das *et al.* (2008) and Makhmale (2017) in mango.

Among five different split applications, S_3 (4 splits) gave maximum total number of fruits per plant (12.76) and yield (13.65 kg/pillar and 15.40 t/ha). Split application of water soluble fertilizers might have resulted in increased fertilizer use efficiency by fulfilling the need based requirement of nutrients to the plants at proper stage which converted energy to reproductive growth and finally

Table 3 : Interaction effect of NPK fertilizer doses and split applications on yield of dragon fruit.

Treatments	Total number of fruits per plant	Yield (kg/pillar)	Yield (t/ha)
F_1S_1	7.44	6.40	7.40
F_1S_2	7.66	6.76	7.82
F_1S_3	8.75	8.01	9.29
F_1S_4	7.92	7.65	8.85
F_1S_5	7.74	7.21	8.34
F_2S_1	10.50	9.48	10.97
F_2S_2	11.42	10.51	12.15
F_2S_3	14.25	13.97	16.16
F_2S_4	13.65	13.24	15.31
F_2S_5	12.00	11.39	13.17
F_3S_1	12.36	12.43	14.37
F_3S_2	13.18	16.08	18.60
F_3S_3	14.07	18.64	21.56
F_3S_4	13.34	16.25	18.80
F_3S_5	12.76	14.36	16.61
F_4S_1	10.18	8.64	9.99
F_4S_2	12.10	10.53	12.81
F_4S_3	13.96	13.99	16.18
F_4S_4	13.00	12.40	14.34
F_4S_5	12.67	11.73	13.57
S. Em.±	0.38	0.49	0.57
C. D. at 5 %	1.08	1.41	1.63
C. V. %	5.72	7.43	7.43

increased yield. It might also be due to enhanced utilization and translocation of metabolites which were required for reproductive growth by frequent application of applied N, P and K. These results were supported by Babu *et al.* (2004), Nalina *et al.* (2002) in banana; Sheikh and Rao (2005), Rao and Subramanyam (2009), Thakur (2014) and Mishra (2020) in pomegranate; Sarkar and Rahim (2012) in mango and Dahal *et al.* (2014) in tuberose and Bhoye (2019) in marigold.

The interaction effect between NPK fertilizer doses and various split applications on yield parameters was found significant and its data is presented in Table 3. Maximum and yield (18.64 kg/pillar and 21.56 t/ha) was recorded in F_3S_3 (500 : 750 : 300 g NPK/pillar + 4 splits). While, maximum total number of fruits per plant (14.25) was recorded in F_2S_3 (450 : 350 : 300 g NPK/pillar + 4 splits). This might be probably due to reduced nutrient losses by leaching, runoff and efficient availability of the nutrients at the root zone, which resulted in increased transport of metabolites to the plant growth which led to higher production of photosynthates by timely

Table 4 : Effect of NPK fertilizer doses and split applications on quality of dragon fruit.

Treatments	TSS (^{O}Brix)	Fruit pulp (%)	Total sugar (%)	Reducing ugar(%)	Non-reducing sugar (%)	Titrable acidity (%)	Ascorbic acid (mg/100 g pulp)
Factor A: NPK fertilizer doses (F)							
F_1	11.95	79.05	11.56	8.87	2.68	0.136	8.13
F_2	14.54	82.61	14.16	11.61	2.53	0.165	8.65
F_3	13.73	83.62	13.37	10.79	2.63	0.128	8.38
F_4	10.17	77.89	12.73	10.01	2.75	0.119	8.10
S. Em.±	0.18	1.07	0.17	0.15	0.03	0.002	0.11
C. D. at 5 %	0.52	3.06	0.48	0.44	0.10	0.005	0.32
Factor B: Split applications (S)							
S_1	11.96	78.26	12.52	9.72	2.86	0.126	8.09
S_2	12.51	79.52	12.75	10.12	2.65	0.129	8.19
S_3	13.14	83.56	13.36	10.82	2.54	0.149	8.63
S_4	12.97	81.96	13.17	10.70	2.41	0.143	8.40
S_5	12.41	80.68	12.97	10.25	2.78	0.137	8.27
S. Em.±	0.20	1.20	0.19	0.17	0.04	0.002	0.12
C. D. at 5 %	0.58	3.42	0.54	0.49	0.11	0.006	0.36
Interaction (F x S)							
S. Em.±	0.41	2.39	0.38	0.35	0.08	0.004	0.25
C. D. at 5 %	NS	NS	NS	NS	NS	NS	NS
C. V. %	5.62	5.13	5.05	5.81	5.05	5.41	5.19

supplementation of nutrient with drip fertigation. These results were supported Quasim *et al*. (2008) in rose; Bhoye (2019) in marigold and Pawar (2020) in kiwifruit.

From the data presented in Table 4, it can be stated that among different NPK fertilizer doses, F_2 (450 : 350 : 300 g NPK/pillar) gave maximum TSS (14.54 -^{o}Brix), total sugar (14.16%), reducing sugars (11.61%) and ascorbic acid content (8.65 mg/100 g pulp). While maximum fruit pulp (83.62%) was observed in F_3 (500 : 750 : 300 g NPK/pillar) and minimum titrable acidity (0.119%) and maximum non-reducing sugar (2.75%) was recorded in F_4 (550 : 800 : 350 g NPK/pillar). Good performance in quality parameters might be due to the action of water-soluble fertilizer, which was easily translocated by higher moisture regimes. Nutrients is a constituent of proteins, amino acids, nucleic acid, various enzymes and coenzymes which are associated with the increased cladode length and cladode area that are significantly contributing to more photosynthesis and thereby increased the transformation of manufactured food material from source to sink (fruit). It was possible due to reduced nutrient losses by leaching and efficient use of nutrients through fertigation, which attributed to improved quality of fruits. The higher dose of fertilizer had given poor result, which might be due to additional dose of fertilizers being leached out or volatilized due to high pH in calcareous soil. These findings are supported by Mahalakshmi *et al*. (2001), Sharma and Chakrabarty (2003) in banana; Goswami *et al*. (2012) and Ramniwas *et al*. (2012) in guava; Makhmale (2017) in mango; Perween and Hasan (2019) in dragon fruit and Pawar (2020) in kiwifruit.

From the data presented in Table 5, it can be concluded that among the different NPK fertilizer doses, maximum soil available nitrogen (220.53 kg/ha), phosphorus (26.74 kg/ha) and potassium (425.97 kg/ha) was recorded in F_4 (550 : 800 : 350 g NPK/pillar). It might be because with application of higher dose of NPK fertilizers, plants uptake nutrient at their critical limit and remaining nutrients are left in soil which increases the availability of nutrients in the soil. Similar results on availability of N, P_2O_5 and K_2O were recorded by Kavino *et al*. (2002) in banana; Tumbare *et al*. (1999) in okra and Makhmale (2017) in mango.

Maximum plant nitrogen content (0.98%), phosphorus content (0.181 %) and potassium content (1.61%) was

Table 5 : Effect of NPK fertilizer doses and split applications nutrient content of dragon fruit.

Treatments	Soil available nutrients (kg/ha)			Plant (cladode) nutrient content (%)		
	N	P_2O_5	K_2O	N	P	K
Initial	203.84	14.87	401.85	-	-	-
Factor A: NPK fertilizer doses (F)						
F_1	207.72	15.21	402.44	0.88	0.128	1.47
F_2	209.74	19.27	411.79	0.94	0.141	1.53
F_3	214.88	24.26	419.03	0.98	0.181	1.61
F_4	220.53	26.74	425.97	0.96	0.170	1.55
S. Em.±	2.80	0.33	5.98	0.02	0.002	0.03
C. D. at 5 %	8.00	0.93	17.09	0.04	0.006	0.09
Factor B: Split applications (S)						
S_1	212.26	21.07	406.43	0.92	0.151	1.52
S_2	213.11	21.67	413.15	0.93	0.154	1.53
S_3	210.38	20.56	417.15	0.96	0.158	1.59
S_4	214.17	21.67	417.84	0.95	0.157	1.55
S_5	216.18	21.89	419.50	0.94	0.155	1.50
S. Em.±	3.13	0.36	6.68	0.02	0.002	0.03
C. D. at 5 %	NS	NS	NS	NS	NS	NS
Interaction (F x S)						
S. Em.±	6.26	0.73	13.37	0.03	0.005	0.07
C. D. at 5 %	NS	NS	NS	NS	NS	NS
C. V. %	5.08	5.91	5.58	6.37	5.32	7.59

recorded in F_3 (500 : 750 : 300 g NPK/pillar). The plant nutrient content increased significantly with the application of inorganic sources of nitrogen, phosphorus and potassium. Accumulation of any nutrient in plant depends considerably on the nutrient uptake from the soil. Also, soluble fertilizers can be easily absorbed by the plants and translocated within the plants. The results were similar to the findings of Vasane *et al.* (1996); Singandhupe *et al.* (2003) and Badr *et al.* (2010) in tomato.

The effect of various split applications on soil available nitrogen, phosphorus and potassium along with plant nitrogen, phosphorus and potassium content was found non- significant.

Conclusion

From the results obtained, it can be concluded that among different treatments, the application of soluble chemical fertilizers @ 500 : 750 : 300 g NPK/pillar improved plant growth, yield, plant nitrogen, phosphorus and potassium content, while chemical fertilizers @ 550 : 800 : 350 g NPK/pillar improved soil available N, P_2O_5 and K_2O. Whereas, the dose of soluble chemical fertilizers @ 450 : 350 : 300 g NPK/pillar improved quality of dragon fruits. Similarly, 4 split application of fertilizers (in April, July, October and January) improved plant growth, yield and quality of dragon fruit. The application of soluble chemical fertilizers @ 500 : 750 : 300 g NPK/pillar in 4 split doses (in April, July, October and January) through fertigation, improved yield of dragon fruit.

References

Babu, N., Sharma A. and Singh S. (2004). Effect of different nitrogen doses and their split applications on growth, yield and quality of 'Jahajee' banana. *South Indian Horticult.*, **52(1-6)**, 35-40.

Badr, M., Shaban A., El-Tohamy W. and Nazim G. (2010). Nutrient uptake and yield of tomato under various methods of fertilizer application and levels of fertigation in arid lands. *Gesunde Pflanzen*, **62**, 11-19.

Bhoye, V.B. (2019). Effect of different doses of chemical fertilizer with split application through fertigation on growth, flower yield and quality of African marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda. *M. Sc. Thesis* submitted to Junagadh Agricultural University,

Junagadh, Gujarat, India.

Chandrakumar, S.S., Thimmegowda S., Srinivas S. K., Reddy B.M. and Devakumar N. (2001). Performance of Robusta banana under nitrogen and potassium fertigation. *South Indian Horticult.*, **49 (Special)**, 92-94.

Dahal, S., Mishra K., Pun U.K., Dhakal D.D. and Sharma M. (2014). Evaluation of split doses of nitrogen at different growth stages of tuberose (*Polianthes tuberosa* L.) for improving flowering and vase life. *Nepal J. Sci. Technol.*, **15 (1)**, 23-30.

Das, A., Mandal K.K., Hasan M.A., Bhattacharya B., Majumdar D. and Bandopadhyay B. (2008). Effect of organic and inorganic nutrients on improving flowering in mango. *Acta Horticult.*, **820**, 371-380.

Goswami, A.K., Lal S. and Mishra K.K. (2012). Integrated nutrient management improves growth and leaf nutrient status of guava cv. Pant Prabhat. *Indian J. Horticult.*, **69**, 168-172.

Jat, G. and Kacha H.L. (2014). Response of guava to foliar application of urea and zinc on fruit set, yield and quality. *J. Agricult. Search*, **1**, 86-91.

Kavino, M., Kumar N., Soorianathasundaram K. and Jeyakumar P. (2002). Influence of fertigation on leaf and soil nutrient status in ratoon banana Robusta (AAA) under high density planting system. *Global Conference on banana and plaintain*, 28-31 October, 2002, Bangalore, India, p 121.

Mahalakshmi, M., Kumar N., Jeyakumar P. and Soorianathasundara K. (2001). Fertigation study in banana under high density planting system. *South Indian Horticult.*, **49 (Special)**, 86-91.

Makhmale, S.J. (2017). Effect of fertigation system on growth, flowering, yield and quality of mango cv. Kesar raised under ultra-high density planting (UHDP) system. *Ph. D. Thesis* submitted to Junagadh Agricultural University, Junagadh, Gujarat, India.

Mishra, P.V. (2020). Effect of split application of fertilizers and multi-micronutrient mixture (Grade–IV) on yield and quality of pomegranate cv. Bhagwa. *M. Sc. Thesis* submitted to Junagadh Agricultural University, Junagadh, Gujarat, India.

Nalina, L., Kumar N., Soorianathasundaram K. and Jeyakumar P. (2002). Effect of different fertilizer treatments on growth, yield and fruit quality of tissue cultured banana Robusta (AAA). *Global Conference on Banana and Plantain*, 28-31 Oct. 2002, Bangalore, India. pp-127.

Navaneethakrishnan, K.S., Dhaliwal H.S. and Brar J.S. (2015). Response of ratoon crop of banana to various combinations of nitrogen and phosphorus. *Agricult. Res. J.*, **52(3)**, 35-38.

Panse, V.G. and Sukhatme P.V. (1985). *Statistical Methods for Agricultural Workers* (4th Ed.). New Delhi, ICAR. p. 359.

Parmar, P. (2017). Response of fertilizer application on growth, yield and quality of papaya var. Red Lady. *M. Sc. (Horti.) Thesis* submitted to Navsari Agricultural University, Navsari, Gujarat, India.

Pawar, R. (2020). Standardization of fertigation schedule and bio-fertilizers on growth, yield and quality of kiwifruit (*Actinidia deliciosa* Chev.) cv. Allison. *Ph. D. Thesis* submitted to Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan (Nauni), Himachal Pradesh, India.

Perween, T., Mandal K.K. and Hasan M.A. (2018). Dragon fruit, An exotic super future fruit of *Indian J. Pharmacog. Phytochem.*, **7**, 1022-1026.

Perween, T. and Hasan M.A. (2019). Growth, yield and quality of dragon fruit as influenced by NPK fertilization. *Indian J. Horticult.*, **76(1)**, 180-183.

Quaggio, J.A., Mattos D.J., Canterella H., Almeida L.E. and Cardoso A.B. (2002). Lemon yield and fruit quality affected by NPK fertilization. *Scientia Horticulture*, **96**, 151-162.

Quasim, M., Iftikhar A. and Tanveer A. (2008). Optimizing fertigation frequency for *Rosa hybrida*. *Pak. J. Bot.*, **40(2)**, 533-545.

Ramniwas, Kaushik R.A., Saroliya 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. *Afr. J. Agricult. Res.*, **7(47)**, 6350-6356.

Rao, K.D. and Subramanyam K. (2009). Effect of nitrogen fertigation on growth and yield of pomegranate cv. Mridula under low rainfall zone. *Agricult. Sci. Digest*, **29(2)**, 1-3.

Rathore, R.S. and Chandra A. (2002). Effect of application of nitrogen on nutrient content, yield and quality of ber. *Orrisa J. Horticult.*, **30(4)**, 46-50.

Ravitchandirane, V., Kumar N., Jeyakumar P., Soorianathasundaram K. and Vijayakumar R.M. (2002). Influence of planting density and nutrient levels on growth and yield of papaya cv. CO-2. *South Indian Horticult.*, **50(1-3)**, 36-43.

Santos, B.M. and Chandler C.K. (2009). Influence of nitrogen fertilization rates on the performance of strawberry cultivars. *Int. J. Fruit Sci.*, **9(11)**, 126-135.

Sarkar, B.C. and Rahim M.A. (2012). Effect of doses and splits of fertilizer application on harvesting time, yield and quality of mango cv. Amrapali. *Bangl. J. Agricult. Res.*, **37(2)**, 279-293.

Sharma, B. and Chakrabarty B.K. (2003). Effect of some chemicals on finger characteristics of banana. *Crop Res.*, **25(3)**, 484-487.

Sharma, H.G., Dubey P., Agrawal N. and Satpute P. (2005). Effect of fertigation through water soluble fertilizers on growth, yield and quality of papaya. *International Conference on Plasticulture and Precision Farming*. 17-21 November, 2005, New Delhi, p 250.

Sheikh, M.K. and Rao M.M. (2005). Effect of split application of N and K on growth and yield of pomegranate. *Karnataka J. Agricult. Sci.*, **18(3)**, 854-856.

Sidhu, A.S. and Thakur A. (2006). Effect of different levels of nutrients on quality and fruit yield of grapes cv. Perlette. *Haryana J. Horticult. Sci.*, **35(3&4)**, 221-222.

Singandhupe, R.B., Rao G.G., Patil N.G. and Brahmanand P.S. (2003). Fertigation studies and irrigation scheduling in drip irrigation system in tomato crop (*Lycopersicon esculentum* L.). *Europ. J. Agron.*, **19**, 327–340.

Srinivas, K., Reddy B.M., Kumar S.S., Gowda S.T., Raghupati H.B. and Padma P. (2001). Growth, yield and nutrient uptake of Robusta banana in relation to N and K fertigation. *Indian J. Horticult.*, **58(4)**, 287–293.

Thakur, M. (2014). Studies on NPK fertigation on growth, yield and quality of pomegranate (*Punica granatum*) cv. Kandhari Kabuli. *Ph. D. Thesis* submitted to Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan (Nauni), Himachal Pradesh, India.

Tumbare, A.D., Shinde B.N. and Bhoite S.U. (1999). Effects of liquid fertilizer through drip irrigation on growth and yield of okra (*Hibiscus esculentus*). *Indian J. Agron.*, **44(4)**, 176-178.

Vasane, S.R., Bhoi P.G., Patil A.S. and Tumbare A.D. (1996). Effect of liquid fertilizer through drip irrigation on yield and NPK uptake of tomato. *J. Maharashtra Agricult. Univ.*, **21(3)**, 488–489.

Wakchuaure, G.C., Kumar S., Meena K.K., Rane J. and Pathak H. (2020). Dragon fruit cultivation in India, scope, marketing, constraints and policy issues. Technical Bulletin No. 46. ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, Maharashtra, India.