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Influence of fertigation schedule on yield of dragon fruit (*Hylocereus polyrhizus* Britton & Rose)

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Abstract
A research was conducted at Instructional Farm, Polytechnic in Horticulture, Junagadh Agricultural University, Junagadh with an objective to determine the effect of different doses of NPK fertilizers and split applications on yield 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.*, F1 = 450: 250: 250 g NPK/pillar, F2 = 450: 350: 300 g NPK/pillar, F3 = 500: 750: 300 g NPK/pillar and F4 = 550: 800: 350 g NPK/pillar, with five levels of split application (S) *viz.*, S1 = 2 splits, S2 = 3 splits, S3 = 4 splits, S4 = 6 splits and S5 = 8 splits. Among different treatments, the application of soluble chemical fertilizers @ 500: 750: 300 g NPK/pillar improved the yield of dragon fruit. Similarly, 4 split application of fertilizers (in April, July, October and January) improved yield of dragon fruit. Thus, the combined application of soluble chemical fertilizers @ 500: 750: 300 g NPK/pillar with 4 split applications (in April, July, October and January) through fertigation, improved yield and yield attributing characters of dragon fruit.

Keywords: Dragon fruit, fertigation schedule, NPK fertilizer dose, split application, 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) [12]. It grows best in dry, tropical or subtropical regions and it is basically a climbing cactus. This miracle fruit is gaining popularity in leaps and bounds day-by-day due to its nutritive value and health benefits. As any other fruit crop, dragon fruit also requires judicious application of fertilizers for obtaining higher yields. The recommendations of fertilizer rates vary widely. Poor fruit setting, low crop yield and substantial depletion of nutrients occur with the yields 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 different fertigation schedules.

Materials and methods
The experiment was conducted at Instructional Farm, Polytechnic in Horticulture, Junagadh Agricultural University, Junagadh during the year 2021-22. Four plants per pillar were planted in March, 2018 maintaining a spacing of 3.6 m x 2.4 m. The experiment was laid out in Large Plot Technique with twenty treatment combinations with three replications. The treatments comprised of four levels of NPK fertilizer doses (F) *viz.*, F1 = 450: 250: 250 g NPK/pillar, F2 = 450: 350: 300 g NPK/pillar, F3 = 500: 750: 300 g NPK/pillar and F4 = 550: 800: 350 g NPK/pillar, with five levels of split application (S) *viz.*, S1 = 2 splits (in April and October), S2 = 3 splits (in April, August and December), S3 = 4 splits (in April, July, October and January), S4 = 6 splits (in April, June, August, October, December and February) and S5 = 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 and were given uniform cultural operations. Observations on total number of flowers per plant, total number of fruits per plant, fruit length, fruit breadth, fruit weight, yield (kg/plant, kg/pillar and t/ha), pulp weight, peel weight and pulp: peel ratio 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) [10].

Results and Discussion

The results indicated that among four different NPK fertilizer doses, F3 (500: 750: 300 g NPK/pillar) gave maximum total number of flowers per plant (18.39), total number of fruits per plant (13.14), fruit length (10.26 cm), fruit breadth (6.44 cm), fruit weight (297.23 g), pulp weight (248.40 g), pulp: peel ratio (5.33) and yield (3.89 kg/plant, 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 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) [6] in guava; Chadrakumar *et al.* (2001) [3] in banana; Rathore and Chandra (2002) [16] in ber; Quaggio *et al.* (2002) [13] in lemon; Sharma *et al.* (2005) [18] in papaya; Sidhu and Thakur (2006) [20] in grapes; Das *et al.* (2008) [5] and Makhmale (2017) [7] in mango.

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

Treatments	Total number of flowers per plant	Total number of fruits per plant	Yield (kg/plant)	Yield (kg/pillar)	Yield (t/ha)
Factor A: NPK fertilizer doses (F)					
F1	10.20	7.90	1.80	7.21	8.34
F2	15.38	12.36	2.93	11.72	13.55
F3	18.39	13.14	3.89	15.55	17.99
F4	17.46	12.38	2.86	11.46	13.25
S.Em±	0.24	0.17	0.06	0.25	0.25
C. D. at 5%	0.68	0.48	0.16	0.70	0.79
Factor B: Split applications (S)					
S1	13.41	10.12	2.31	9.24	10.68
S2	15.22	11.09	2.74	10.97	12.69
S3	16.84	12.76	3.41	13.65	15.80
S4	15.91	11.98	3.10	12.39	14.33
S5	15.40	11.29	2.79	11.17	12.92
S.Em±	0.27	0.19	0.06	0.25	0.29
C. D. at 5%	0.76	0.54	0.18	0.70	0.81
Interaction (F x S)					
S.Em±	0.53	0.38	0.12	0.49	0.57
C. D. at 5%	1.52	1.08	0.35	1.41	1.63
C. V. %	6.01	5.72	7.43	7.43	7.43

Table 2: Effect of NPK fertilizer doses and split applications on physical parameters of dragon fruit

Treatments	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Pulp weight (g)	Peel weight (g)	Pulp: Peel ratio
Factor A: NPK fertilizer doses (F)						
F1	9.34	5.69	228.57	180.33	48.23	3.81
F2	9.79	6.07	236.61	195.00	41.61	4.83
F3	10.26	6.44	297.23	248.40	48.83	5.33
F4	9.22	5.47	230.49	179.00	51.56	3.83
S.Em±	0.14	0.09	3.62	3.39	0.82	0.08
C. D. at 5%	0.39	0.27	10.35	9.68	2.35	0.23
Factor B: Split applications (S)						
S1	8.72	5.53	226.95	177.08	49.87	3.69
S2	9.63	5.79	242.49	192.75	49.74	4.20
S3	10.19	6.38	264.48	221.17	43.31	5.50
S4	10.10	6.17	257.01	210.67	46.34	4.66
S5	9.61	5.72	250.20	201.75	48.53	4.20
S.Em±	0.15	0.10	4.05	3.79	0.92	0.09
C. D. at 5%	0.44	0.30	11.57	10.83	2.63	0.26
Interaction (F x S)						
S.Em±	0.31	0.21	8.10	7.58	1.84	0.18
C. D. at 5%	0.88	0.59	23.15	NS	NS	NS
C. V. %	5.53	6.07	5.65	6.54	6.69	7.01

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

Treatment combinations	Total no. of flowers per plant	Total no. of fruits per plant	Yield (kg/plant)	Yield (kg/pillar)	Yield (t/ha)	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)
F1S1	9.37	7.44	1.60	6.40	7.40	8.14	5.16	215.53
F1S2	10.32	7.66	1.69	6.76	7.82	9.45	5.70	221.03
F1S3	10.81	8.75	2.00	8.01	9.29	10.09	6.19	229.82
F1S4	10.60	7.92	1.91	7.65	8.85	10.25	5.82	242.74
F1S5	9.89	7.74	1.80	7.21	8.34	8.77	5.57	233.70
F2S1	13.20	10.50	2.37	9.48	10.97	8.24	5.49	225.93
F2S2	14.08	11.42	2.63	10.51	12.15	9.82	6.17	230.45
F2S3	17.97	14.25	3.49	13.97	16.16	10.39	6.34	245.81
F2S4	16.26	13.65	3.31	13.24	15.31	10.30	6.27	243.08
F2S5	15.39	12.00	2.85	11.39	13.17	10.18	6.11	237.79
F3S1	15.13	12.36	3.11	12.43	14.37	9.33	5.73	252.27
F3S2	18.82	13.18	4.02	16.08	18.60	10.00	6.00	300.79
F3S3	19.63	14.07	4.66	18.64	21.56	10.89	7.42	331.61
F3S4	19.24	13.34	4.06	16.25	18.80	10.66	7.08	303.88
F3S5	19.14	12.76	3.59	14.36	16.61	10.40	5.97	297.58
F4S1	15.93	10.18	2.16	8.64	9.99	9.17	5.75	214.07
F4S2	17.68	12.10	2.63	10.53	12.81	9.25	5.31	217.68
F4S3	18.96	13.96	3.50	13.99	16.18	9.39	5.57	250.67
F4S4	17.54	13.00	3.10	12.40	14.34	9.19	5.51	238.32
F4S5	17.19	12.67	2.93	11.73	13.57	9.10	5.23	231.71
S.Em±	0.53	0.38	0.12	0.49	0.57	0.31	0.21	8.10
C. D. at 5%	1.52	1.08	0.35	1.41	1.63	0.88	0.59	23.15
C. V. %	6.01	5.72	7.43	7.43	7.43	5.53	6.07	5.65

Among five different split applications, S3 (4 splits) gave maximum total number of flowers per plant (16.84), total number of fruits per plant (12.76), fruit length (10.19 cm), fruit breadth (6.38 cm), fruit weight (264.48 g), pulp weight (221.17 g), pulp: peel ratio (5.50) and yield (3.41 kg/plant, 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 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) [1], Nalina *et al.* (2002) [9] in banana; Sheikh and Rao (2005) [19], Rao and Subramanyam (2009) [15], Thakur (2014) [21] and Mishra (2020) [8] in pomegranate; Sarkar and Rahim (2012) [17] in mango and Dahal *et al.* (2014) [4] in tuberose and Bhoye (2019) [2] in marigold.

The interaction effect between NPK fertilizer doses and various split applications on yield and yield attributing parameters was found significant. Maximum total number of flowers per plant (19.63), fruit length (10.89 cm), fruit breadth (7.42 cm), fruit weight (331.61 g) and yield (4.66 kg/plant, 18.64 kg/pillar and 21.56 t/ha) were recorded in F3S3 (500: 750: 300 g NPK/pillar + 4 splits). While, maximum total number of fruits per plant (14.25) was recorded in F2S3 (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 supplementation of nutrient with drip fertigation. These results were supported Quasim *et al.* (2008) [14] in rose; Bhoye (2019) [2] in marigold and Pawar (2020) [11] in kiwifruit.

Conclusion

On the basis of results obtained in the present investigation, it is concluded that the application of soluble chemical fertilizers @ 500: 750: 300 g NPK/pillar improved the yield of dragon fruit. Similarly, 4 split application of fertilizers (in April, July, October and January) improved yield of dragon fruit. Thus, the application of soluble chemical fertilizers @ 500: 750: 300 g NPK/pillar with 4 split applications (in April, July, October and January) through fertigation, improved yield and yield attributing characters of dragon fruit.

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