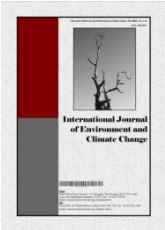

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Effect of Different N and K Fertigation Levels of Capsicum (*Capsicum annuum* var. *grossum* L.) as Influenced by Nutrient Content of Capsicum under Poly House

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was carried out during *rabi* season of 2018-19 at Water Technology Centre, College of Agriculture, Rajendranagar, Hyderabad on capsicum (*Capsicum annuum* var. *grossum* L.) with respect to different nitrogen and potassium fertigation levels under poly house. The experiment comprised of three replications in Factorial Randomized Block Design (FRBD) with two factors {*i.e.* N levels (4), K levels (3) } and twelve treatments Viz; N fertigation levels of 0 %, 120 % (216 kg N ha^{-1}) , 150 % (270 kg N ha^{-1}), 180 % (324 kg N ha^{-1}) and K fertigation levels of 0 %, 80 % (96 kg K_2O ha^{-1}), 100% (120 kg K_2O ha^{-1}) respectively. The 100 % RDF was 180, 90 and 120 kg N, P_2O_5 and K_2O ha^{-1}. The source of N was urea, P was single super phosphate (SSP) and K was white muriate of potash (MOP). The N and K were applied through drip fertigation on every fourth day during different crop growth stages. In the fertigation programme, during crop establishment stage (10 DAT to 14 DAT), 10 % of N and K_2O were applied in two splits. During vegetative stage, (15 to 46 DAT) 30 % of N and 20 % of K_2O were applied in eight splits. During flower initiation to fruit development (47 DAT to 74 DAT) 20 % of N and K_2O were applied in seven splits. From fruit development till final harvesting stage (75 DAT to 154 DAT) 40 % of N and 50 % K_2O were applied

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in 20 splits in a total of 37 splits. The soil of the experimental site was sandy loam in texture with low in available nitrogen (166.5 kg ha^{-1}), medium in available phosphorus (81.1 kg P_2O_5 ha^{-1}) and low in available potassium (245.4 kg K_2O ha^{-1}). Irrigation was scheduled at 0.8 Epan based on pan evaporation data. The total water applied to the crop was 414.8 mm. The total nitrogen content in capsicum shoots ranged from 3.41 to 4.57 %, 4.29 to 6.35 %, 4.43 to 6.67%, 4.76 to 6.86% and 4.53 to 6.58% at 30, 60, 90, and 120 and at final harvest respectively. In fruits, it ranged from 4.11 to 6.49 %, 3.92 to 6.35%, 4.01 to 6.25 % at 90, 120 and at final harvest respectively. The total phosphorus content in capsicum shoots ranged from 0.13 to 0.23 %, 0.42 to 0.92%, 0.14 to 0.33%, 0.12 to 0.24% and 0.12 to 0.20% at 30, 60, 90, 120 and at final harvest respectively. In fruits it ranged from 0.20 to 0.59 %, 0.24 to 0.57 %, 0.26 to 0.70 % at 90, 120 and at final harvest respectively. The total potassium content in capsicum shoots ranged from 0.87 to 1.83 %, 1.77 to 2.65%, 1.50 to 2.23%, 0.96 to 1.54% and 0.83 to 1.38% at 30, 60, 90, 120 and at final harvest respectively. In fruits it ranged from 1.02 to 1.47%, 0.98 to 1.35%, 0.93 to 1.28% at 90, 120 and at final harvest respectively.

Keywords: Capsicum; nutrient content (N, P and K) fertigation schedule; poly house; fertigation.

1. INTRODUCTION

Capsicum (*Capsicum annuum* var. *grossum* L.) also referred to as sweet or bell pepper is a highly priced vegetable crop both in the domestic and international market. It is a cool season crop occupying an area of 32,000 ha, producing 493 thousand metric tonnes of fruit yield in India. In Telangana it occupies an area of 150.2 ha, with 2873 metric tonnes production [1]. The major capsicum producing states in India are Himachal Pradesh, Karnataka, Madhya Pradesh, Haryana, Jharkhand, Uttarakhand and Orissa. Capsicum is native to tropical South America and was introduced in India by the Portuguese in the middle of sixteenth century.

In India capsicum is grouped under non-traditional category of vegetables. Nutritionally it provides vitamin C (283 mg) and zinc, the two nutrients which are vital for a strong and healthy immune system. It also has high content of vitamin A, rutin (a bioflavonoid), ß carotene, iron [2]. And minerals like calcium (13.4 mg), magnesium (14.9 mg) phosphorus (28.3 mg), potassium (263.7 mg), energy (24 Kcal), protein (1.3g), carbohydrate (4.3g) and fat (0.3g) per 100 g fresh weight [3]. It also finds place in preparations like pizza stuffing's and burger with growing of fast food chain. The high market price is attributed to the heavy demand from the consumers. There is a good demand for export too. The export market has specific requirements like fruits with longer shelf life, medium sized fruits with attractive colour, mild pungency with good taste. It is also used in salad and soup preparation. A 100 g of edible portion of capsicum provides 24 kcal of energy, 1.3 g of protein, 4.3 g of carbohydrate and 0.3 g of fat [4].

In India, in spite of its great potential the yield per unit area is very low than that of developed countries, mainly due to lack of proper production technologies especially, the nutrient management. For harnessing higher yield, balanced application of nutrition is a prerequisite. The continuous application of chemical fertilizers alone without use of organic manures has deteriorated soil health in terms of chemical, physical and biological characters resulting in decline in crop yield. This indicates that sole application of organics or inorganic fertilizers are in no way a suitable solution for maintaining soil health and enhancing crop productivity. So the solution lies in the integrated use of chemical fertilizers and organic manures/sprays for obtaining sustainable crop production, better nutrient availability and efficient nutrient use, besides reducing nutrient losses [5] and improving fruit quality.

2. MATERIALS AND METHODS

A field experiment was conducted at Horticultural Farm, College of Agriculture, Rajendranagar, Hyderabad during *rabi* season of 2019-20. The study was initiated on Response of capsicum (*Capsicum annuum* var. *grossum* L.) to different nitrogen and potassium fertigation levels under poly house. The soil of the experimental site was sandy loam in texture with a pH of 7.6, electrical conductivity of 0.75 dS m^{-1}, medium in organic carbon (0.7%), low in available nitrogen (166.5 kg ha^{-1}), medium in available phosphorus (81.1 kg P_2O_5 ha^{-1}) and low in available potassium (245.4 kg K_2O ha^{-1}).

Capsicum (pasarella) seeds were sown in pro trays on 5th August 2019 and 35 days old

seedlings were transplanted on 10th September 2019 in a zig zag manner in a paired row pattern on raised beds. The experiment comprised of three replications in Factorial Randomized Block Design (FRBD) with two factors { N levels (4), K levels (3) } with twelve treatments Viz; T_1 - Control (No N, K_2O), T_2 - N_0 (No fertilizer) + 80 % RD of K_2O, T_3 - N_0 (No fertilizer) + 100 % RD of K_2O, T_4 -120 % RD of N + K_0 (No fertilizer), T_5 – 120 % RD of N + 80 % RD of K_2O, T_6 – 120 % RD of N + 100 % RD of K_2O, T_7 – 150 % RD of N + K_0 (No fertilizer), T_8 -150 % RD of N + 80 % RD of K2O, T_9 – 150 % RD of N + 100 % RD of K_2O, T_{10} – 180 % RD of N + K_0 (No fertilizer), T_{11} – 180 % RD of N + 80 % RD of K_2O, T_{12}- 180 % RD of N + 100 % RD of K_2O. {The 100 % (RDF) was 180, 90 and 120 kg N, P_2O_5 and K_2O ha^{-1}} The source of N is urea, P was single super phosphate (SSP) and K was white muriate of potash (MOP). A common dose of phosphorous was applied uniformly to all the treatments at basal.

The nitrogen and potassium were applied through fertigation by ventury, which was carried out at three day interval i.e., on every fourth day. In the fertigation programme during crop establishment stage (10 DAT to 14 DAT), 10 % of N and K_2O were applied in two splits. During vegetative stage, (15 to 46 DAT) 30 % of N and 20 % of K_2O were applied in eight splits. During flower initiation to fruit development (47 DAT to 74 DAT) 20 % of N and K_2O were applied in seven splits. From fruit development and colour formation stage onwards till final stage (75 DAT – 154 DAT) 40 % of N and 50 % K_2O were applied in 20 splits. Then the fertigation schedule was completed in a total of 37 splits. In addition, the crop had received a common dose of 12.5 t ha^{-1} vermicompost and 1.5 t ha^{-1} neem cake and 90 kg P_2O_5 ha and also waste decomposer, vermi wash sprays at every 15 days interval. Irrigation was scheduled based on 0.8 E pan and the total water applied through drip at 0.8 E pan (common to all the treatments) was 384.8 mm, water applied for nursery including special operations (bed preparation, wetting before transplanting) was 30.4 mm. The total water applied was 414.8 mm. The weight of mature fruits harvested from each picking was recorded till final harvest and total yield of fruits per hectare was computed and expressed in kg and tons per hectare.

Nitrogen content (%) in the plant samples was estimated by the micro Kjeldhal method (AOAC, 1965) using Kelplus Supra LX - analyser. The di-acid digested plant samples were analyzed for phosphorus content by Vanado-molybdo phosphoric acid [6]. The intensity of yellow colour developed was measured by using UV-VIS spectrophotometer (Make - Systronics, Model -108) at 420 nm. Potassium content in the di-acid was determined by using flame photometer (Make - Elico, Model - CL 361) [7]

3. RESULTS AND DISCUSSION

3.1 Nutrient Contents (N, P and K) in Shoots and Fruits of Capsicum

Nutrient content plays a major role in higher yield and quality of fruits. Data regarding total nitrogen content of capsicum in shoots at 30, 60 DAT and in shoot and fruit at 90 DAT is presented in Table 1. Data at 120 DAT and final harvest is presented in Table 2. The interaction effect of N and K fertigation levels on total nitrogen content at any stage was found to be non significant. In general, the total N content increased with increase in crop growth stage up to 150 DAS. The N content in the shoots was observed to be relatively more than in capsicum fruits.

3.1.1 Total nitrogen content (%)

At 30 DAT, the total nitrogen content in shoot ranged from 3.41 to 4.57%. The highest total nitrogen content was noticed in N_{180} (4.12%) which was significantly superior over N_{120} and N_0 and was statistically on par with N_{150} (4.01%). However N_{150}, N_{120} and N_{120}, N_0 were on par with each other. The lowest N content was noticed in N_0 (3.55%), whereas in potassium fertigation significantly higher N content was recorded with K_{100} (4.10%) compared to all other levels. The K_{80} (3.73%) and K_0 (3.71%) were on par with each other.

At 60 DAT in shoots, among nitrogen fertigation levels, N_{180} (5.88%) recorded the highest N content compared to all other levels except N_{150} (5.51%) which was on par with N_{180}. Among potassium doses the highest N content was noticed in K_{100} (5.54%) whereas the lowest was observed in K_0 (4.92%) it was on par with K_{80} (5.10%).

The total N content at 90 DAT in shoot and fruits revealed that N_{180} (6.18, 6.11%) recorded significantly higher value compared to N_{120} and N_0 and was found to be on par with N_{150} (5.88, 5.71%). However in fruits N_{150} was on par with N_{120} (5.40%). The lowest N content was noticed in N_0 (4.60, 4.57%) respectively. With regard to potassium fertigation levels the highest N content

was observed with K_{100} (5.87, 5.90%) in shoot and fruits respectively. Whereas the lowest was observed with K_0 (5.1, 5.10%) and it was on par with K_{80}.

The total N content at 120 DAT in shoots ranged from 4.76% to 6.86% and it was significantly influenced by nitrogen fertigation levels. The highest N content was observed in N_{180} (6.30%) which was significantly superior over all other levels except N_{150} (6.02%). In fruits, it ranged from 3.92% to 6.35%. The highest N content was realized in N_{180} (6.05%) it was doses significantly higher N content was noticed in K_{100} (6.24 %, 5.62%) in shoot and fruit respectively. However K_{80} (5.65, 5.19%) and K_0 (5.47, 4.90%) were on par with each other.

At final harvest the nitrogen content in shoots ranged from 4.53 to 6.58%. The highest N content was observed in N_{180} (6.13%) which was significantly higher over other levels of nitrogen and was statistically on par with N_{150} (5.90%). The lowest was noticed in N_0 (4.78%). Among potassium levels significantly higher N content was noticed with K_{100} (6.00%) while the lowest was observed in K_0 (5.27%).

At final harvest the total N content in fruits ranged from 4.01% to 6.25%. However the highest N content was realized in N_{180} (6.05%) it was followed by N_{150} (5.72%). As concerned with potassium applications significantly higher N content was noticed in K_{100} (5.66 %) followed by K_{80} (5.27%) and K_0 (4.98%).

3.1.2 Total phosphorus content (%)

Data on total phosphorus content of capsicum in shoot at 30, 60 DAT and in shoot and fruit at 90 DAT is presented in Table 3 and at 120 DAT, final harvest is presented in Table 4. In general, higher P content was noticed in shoots at 60 DAS. The total P content was relatively higher in capsicum fruits than shoots. The fruit P content also recorded higher values with advancement of crop growth stage from 90 DAT to final harvest stage.

Table 1. Effect of N and K fertigation levels on nitrogen content (%) of capsicum under poly house at 30, 60, 90 DAT (Shoot and fruit) during rabi 2019-20.

30 DAT (%N)					60 DAT (%N)				
	K_0	**K_{80}**	**K_{100}**	**Mean**		**K_0**	**K_{80}**	**K_{100}**	**Mean**
N_0	3.41	3.55	3.69	**3.55**	**N_0**	4.29	4.48	4.53	**4.43**
N_{120}	3.69	3.69	3.73	**3.70**	**N_{120}**	4.71	4.85	5.23	**4.93**
N_{150}	3.97	3.69	4.39	**4.01**	**N_{150}**	5.18	5.27	6.07	**5.51**
N_{180}	3.78	4.01	4.57	**4.12**	**N_{180}**	5.51	5.79	6.35	**5.88**
Mean	**3.71**	**3.73**	**4.10**		**Mean**	**4.92**	**5.10**	**5.54**	
		C.D					**C.D**		
	S.E.m±	**(P=0.05)**				**S.E.m±**	**(P=0.05)**		
N	0.13	0.37			**N**	0.13	0.39		
K	0.11	0.32			**K**	0.12	0.34		
(N*K)	0.22	NS			**(N*K)**	0.23	NS		

90 DAT (%N)									
	Shoot					**Fruit**			
	K_0	**K_{80}**	**K_{100}**	**Mean**		**K_0**	**K_{80}**	**K_{100}**	**Mean**
N_0	4.43	4.62	4.76	**4.60**	**N_0**	4.11	4.57	5.04	**4.57**
N_{120}	4.90	4.76	5.51	**5.06**	**N_{120}**	5.13	5.37	5.69	**5.40**
N_{150}	5.41	5.69	6.53	**5.88**	**N_{150}**	5.37	5.37	6.39	**5.71**
N_{180}	5.83	6.02	6.67	**6.18**	**N_{180}**	5.79	6.07	6.49	**6.11**
Mean	**5.15**	**5.27**	**5.87**		**Mean**	**5.10**	**5.34**	**5.90**	
		C.D					**C.D**		
	S.E.m ±	**(P=0.05)**				**S.E.m ±**	**(P=0.05)**		
N	0.11	0.32			**N**	0.17	0.51		
K	0.09	0.27			**K**	0.15	0.44		
(N*K)	0.19	NS			**(N*K)**	0.30	NS		

100% RDF = 180: 90: 120 kg N-P_2O_5-K_2O ha^{-1},
N_0 –No Nitrogen, N_{120} - 216 kg N ha^{-1}, N_{150} - 270 kg N ha^{-1}, N_{180}- 324 kg N ha^{-1}
K_0 –No potassium, K_{80} - 96 kg K_2O ha^{-1}, K_{100} - 120 kg K_2O ha^{-1}

Table 2. Effect of N and K fertigation levels on nitrogen content (%) of capsicum under poly house at 120 DAT, final harvest (Shoot and fruit) during *rabi* 2019-20

120 DAT (%N)									
	Shoot					Fruit			
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	4.76	5.13	5.51	**5.13**	N_0	3.92	4.20	4.53	**4.22**
N_{120}	5.55	5.65	5.88	**5.69**	N_{120}	4.76	5.04	5.37	**5.06**
N_{150}	5.65	5.69	6.72	**6.02**	N_{150}	5.09	5.55	6.25	**5.63**
N_{180}	5.93	6.11	6.86	**6.30**	N_{180}	5.83	5.97	6.35	**6.05**
Mean	**5.47**	**5.65**	**6.24**		**Mean**	**4.90**	**5.19**	**5.62**	
	S.E.m±	**C.D (P=0.05)**				**S.E.m±**	**C.D (P=0.05)**		
N	0.11	0.32			**N**	0.15	0.45		
K	0.09	0.28			**K**	0.13	0.39		
(N*K)	0.19	NS			**(N*K)**	0.27	NS		

Final harvest (%N)									
	Shoot					Fruit			
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	4.53	4.71	5.09	**4.78**	N_0	4.01	4.15	4.76	**4.31**
N_{120}	5.23	5.41	5.83	**5.49**	N_{120}	4.90	5.13	5.37	**5.13**
N_{150}	5.55	5.65	6.49	**5.90**	N_{150}	5.18	5.74	6.25	**5.72**
N_{180}	5.79	6.02	6.58	**6.13**	N_{180}	5.83	6.07	6.25	**6.05**
Mean	**5.27**	**5.45**	**6.00**		**Mean**	**4.98**	**5.27**	**5.66**	
	S.E.m±	**C.D (P=0.05)**				**S.E.m±**	**C.D (P=0.05)**		
N	0.11	0.32			**N**	0.16	0.46		
K	0.10	0.28			**K**	0.14	0.40		
(N*K)	0.19	NS			**(N*K)**	0.27	NS		

100% RDF = 180: 90: 120 kg N-P_2O_5-K_2O ha^{-1},
N_0 –No Nitrogen, N_{120} - 216 kg N ha^{-1}, N_{150} - 270 kg N ha^{-1}, N_{180}- 324 kg N ha^{-1}
K_0 –No potassium, K_{80} - 96 kg K_2O ha^{-1}, K_{100} - 120 kg K_2O ha^{-1}

In shoot at 30 DAT, the total phosphorus content ranged from 0.13 to 0.23%. The highest total phosphorous content was noticed in N_{180} (0.22%) and it was on par with N_{150} (0.20%) which were significantly higher over all other levels. Among potassium doses, significant difference was not observed. However, K_{100} recorded maximum value (0.19%), which was statistically on par with K_{80} (0.18%) followed by K_0 (0.16%).

The total phosphorous content at 60 DAT ranged from 0.42% to 0.92%. However the highest total phosphorous content was realized in N_{180} (0.81%) it was followed by N_{150} (0.77%). With regard to potassium applications, significantly higher phosphorous content was noticed in K_{100} (0.76 %) which was significantly higher than K_{80} (0.64%) and K_0 (0.61%). However, K_{80} and K_0 were on par with each other.

In shoot, at 90 DAT, the total phosphorus content varied differently with the nitrogen fertigation levels and it ranged from 0.14 to 0.32%. The highest total phosphorfollowed by N_{150} (5.63%). Among various potassium content was noticed in N_{120} (0.31%) which was significantly higher than all other levels. However N_{180} (0.21%) was statistically on par with N_{120} and N_0 while the lowest total phosphorous content was noticed in N_{150} (0.15%). The K_{100} (0.23%) recorded the highest value among various potassium doses which was statistically on par with K_{80} and K_0. The lowest was realized with K_0 (0.22%).

At 90 DAT in fruits it ranged from 0.20% to 0.59%. The highest total phosphorous content was noticed in N_{180} (0.55%) which was significantly higher than other levels, followed by N_{120} (0.42%) it was on par with N_{150} (0.39%). However, the lowest value was recorded with N_0 (0.26%). Among potassium levels the highest total phosphorous content was noticed in K_{100} (0.45%) which was statistically on par with K_0 (0.41%) followed by K_{80} (0.36%).

Table 3. Effect of N and K fertigation levels on phosphorous content (%) of capsicum under poly house at 30, 60, 90 DAT (Shoot and fruit) during *rabi* 2019-20

30 DAT (%P)					60 DAT (%P)				
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	0.14	0.13	0.13	**0.13**	N_0	0.42	0.56	0.59	**0.52**
N_{120}	0.14	0.16	0.16	**0.15**	N_{120}	0.52	0.65	0.59	**0.59**
N_{150}	0.18	0.19	0.23	**0.20**	N_{150}	0.66	0.72	0.92	**0.77**
N_{180}	0.20	0.23	0.23	**0.22**	N_{180}	0.86	0.64	0.92	**0.81**
Mean	**0.16**	**0.18**	**0.19**		**Mean**	**0.61**	**0.64**	**0.76**	
	S.E.m±	**C.D (P=0.05)**				**S.E.m±**	**C.D (P=0.05)**		
N	0.01	0.02			**N**	0.04	0.13		
K	0.01	0.02			**K**	0.04	0.11		
(N*K)	0.01	NS			**(N*K)**	0.07	NS		

90 DAT (%P)									
	Shoot					Fruit			
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	0.20	0.27	0.28	**0.25**	N_0	0.20	0.24	0.32	**0.26**
N_{120}	0.32	0.33	0.27	**0.31**	N_{120}	0.45	0.40	0.41	**0.42**
N_{150}	0.16	0.14	0.14	**0.15**	N_{150}	0.40	0.32	0.46	**0.39**
N_{180}	0.19	0.19	0.23	**0.21**	N_{180}	0.57	0.48	0.59	**0.55**
Mean	**0.22**	**0.23**	**0.23**		**Mean**	**0.41**	**0.36**	**0.45**	
	S.E.m±	**C.D (P=0.05)**				**S.E.m±**	**C.D (P=0.05)**		
N	0.01	0.04			**N**	0.02	0.06		
K	0.01	0.03			**K**	0.02	0.05		
(N*K)	0.02	NS			**(N*K)**	0.03	NS		

100% RDF = 180: 90: 120 kg N-P_2O_5-K_2O ha^{-1},
N_0 –No Nitrogen, N_{120} - 216 kg N ha^{-1}, N_{150} - 270 kg N ha^{-1}, N_{180}- 324 kg N ha^{-1}
K_0 –No potassium, K_{80} - 96 kg K_2O ha^{-1}, K_{100} - 120 kg K_2O ha^{-1}

At 120 DAT, the total phosphorus content in shoot ranged from 0.13 to 0.24%. Among nitrogen levels significantly higher total phosphorous content was noticed in N_{180} (0.23%) compared to all other levels. However N_{150} (0.16%) was on par with N_{120} and N_0. The lowest phosphorous content was recorded with N_0 (0.13%). With respect to different potassium doses there was no significant difference was observed. K_{100} (0.17%) recorded the highest total phosphorous content which was on par with K_{80} and K_0. However K_{80} and K_{100} were on par with each other.

At 120 DAT the total phosphorous content in fruits ranged from 0.24% to 0.57%. Significantly higher total phosphorous content was noticed with N_{180} (0.55%) which was superior over N_{150}, N_{120} and N_0. However N_{120} (0.45%) was on par with N_{150} (0.42%). Among potassium doses K_{80} recorded the highest value (0.46%) which was on par with K_{100} (0.43%) it was followed by K_0 (0.31%).

At final harvest the total phosphorous content was significantly influenced by various nitrogen fertigation levels. The N_{180} recorded significantly higher value (0.19%, 0.68%) in shoot and fruits respectively. While, the lowest was recorded with N_0 (0.12%, 0.35%). With respect to different potassium fertigation levels, K_{100} (0.15%, 0.53%) recorded the highest total phosphorous content while the lowest was observed with K_0 (0.14%, 0.46%) in shoot and fruits respectively.

3.1.3 Total potassium content (%)

Data pertaining to the total potassium content of capsicum in shoots at 30, 60 DAT and in shoot and fruit at 90 DAT is presented in Table 5 and the data at 120 DAT and final harvest is presented in Table 6. The interaction effect of N and K fertigation levels on total potassium content was found to be non significant. In general, higher total K content was noticed in shoots at 60 DAT. Relatively, shoots contained higher K content when compared to shoots.

Table 4. Effect of N and K fertigation levels on phosphorous content (%) of capsicum under poly house at 120 DAT, final harvest (Shoot and fruit) during *rabi* 2019-20

120 DAT (%P)									
	Shoot					Fruit			
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	0.13	0.13	0.12	**0.13**	N_0	0.24	0.37	0.30	**0.31**
N_{120}	0.14	0.15	0.15	**0.15**	N_{120}	0.45	0.50	0.39	**0.45**
N_{150}	0.16	0.17	0.16	**0.16**	N_{150}	0.39	0.42	0.45	**0.42**
N_{180}	0.22	0.23	0.24	**0.23**	N_{180}	0.52	0.57	0.56	**0.55**
Mean	**0.16**	**0.17**	**0.17**		**Mean**	**0.40**	**0.46**	**0.43**	
	S.E.m±	**C.D (P=0.05)**				**S.E.m±**	**C.D (P=0.05)**		
N	0.01	0.03			**N**	0.01	0.04		
K	0.01	0.02			**K**	0.01	0.04		
(N*K)	0.02	NS			**(N*K)**	0.02	NS		

Final harvest (%P)									
	Shoot					Fruit			
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	0.12	0.12	0.13	**0.12**	N_0	0.26	0.39	0.38	**0.35**
N_{120}	0.14	0.14	0.14	**0.14**	N_{120}	0.48	0.52	0.53	**0.51**
N_{150}	0.14	0.14	0.15	**0.14**	N_{150}	0.42	0.52	0.51	**0.48**
N_{180}	0.18	0.19	0.20	**0.19**	N_{180}	0.68	0.67	0.70	**0.68**
Mean	**0.14**	**0.15**	**0.15**		**Mean**	**0.46**	**0.52**	**0.53**	
	S.E.m±	**C.D (P=0.05)**				**S.E.m±**	**C.D (P=0.05)**		
N	0.00	0.01			**N**	0.02	0.06		
K	0.00	0.01			**K**	0.02	0.05		
(N*K)	0.00	NS			**(N*K)**	0.03	NS		

100% RDF = 180: 90: 120 kg N-P_2O_5-K_2O ha^{-1},
N_0 –No Nitrogen, N_{120} - 216 kg N ha^{-1}, N_{150} - 270 kg N ha^{-1}, N_{180}- 324 kg N ha^{-1}
K_0 –No potassium, K_{80} - 96 kg K_2O ha^{-1}, K_{100} - 120 kg K_2O ha^{-1}

Table 5. Effect of N and K fertigation levels on potassium content (%) of capsicum under poly house at 30, 60, 90 DAT (Shoot and fruit) during *rabi* 2019-20

	30 DAT (%K)					60 DAT (%K)			
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	0.87	0.93	1.35	**1.05**	N_0	1.77	1.89	2.07	**1.91**
N_{120}	1.53	1.58	1.65	**1.59**	N_{120}	2.20	2.33	2.34	**2.29**
N_{150}	1.54	1.55	1.77	**1.62**	N_{150}	2.23	2.18	2.58	**2.33**
N_{180}	1.60	1.69	1.83	**1.71**	N_{180}	2.29	2.41	2.65	**2.45**
Mean	**1.39**	**1.44**	**1.65**		**Mean**	**2.12**	**2.20**	**2.41**	
	S.E.m±	**C.D (P=0.05)**				**S.E.m±**	**C.D (P=0.05)**		
N	0.03	0.10			**N**	0.04	0.12		
K	0.03	0.08			**K**	0.04	0.10		
(N*K)	0.06	NS			**(N*K)**	0.07	NS		

	90 DAT (%K)								
	Shoot					Fruit			
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	1.50	1.56	1.63	**1.56**	N_0	1.02	1.05	1.08	**1.05**
N_{120}	1.78	1.88	2.02	**1.89**	N_{120}	1.09	1.11	1.21	**1.14**
N_{150}	1.93	1.93	2.19	**2.02**	N_{150}	1.17	1.29	1.40	**1.29**
N_{180}	1.96	2.02	2.23	**2.07**	N_{180}	1.19	1.27	1.47	**1.31**
Mean	**1.79**	**1.85**	**2.02**		**Mean**	**1.12**	**1.18**	**1.29**	
	S.E.m±	**C.D (P=0.05)**				**S.E.m±**	**C.D (P=0.05)**		
N	0.03	0.10			**N**	0.02	0.06		
K	0.03	0.08			**K**	0.02	0.05		
(N*K)	0.06	NS			**(N*K)**	0.04	NS		

100% RDF = 180: 90: 120 kg N-P_2O_5-K_2O ha^{-1},
N_0 –No Nitrogen, N_{120} - 216 kg N ha^{-1}, N_{150} - 270 kg N ha^{-1}, N_{180}- 324 kg N ha^{-1}
K_0 –No potassium, K_{80} - 96 kg K_2O ha^{-1}, K_{100} - 120 kg K_2O ha^{-1}

Table 6. Effect of N and K fertigation levels on potassium content (%) of capsicum under poly house at 120 DAT, final harvest (Shoot and fruit) during *rabi* 2019-20

	120 DAT (%K)								
	Shoot					Fruit			
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	0.96	1.09	1.18	**1.08**	N_0	0.98	1.07	1.11	**1.05**
N_{120}	1.25	1.29	1.31	**1.28**	N_{120}	1.13	1.15	1.23	**1.17**
N_{150}	1.27	1.35	1.42	**1.35**	N_{150}	1.14	1.17	1.27	**1.20**
N_{180}	1.31	1.37	1.54	**1.41**	N_{180}	1.17	1.22	1.35	**1.25**
Mean	**1.20**	**1.27**	**1.36**		**Mean**	**1.10**	**1.15**	**1.24**	
	S.E.m±	**C.D (P=0.05)**				**S.E.m±**	**C.D (P=0.05)**		
N	0.02	0.07			**N**	0.02	0.07		
K	0.02	0.06			**K**	0.02	0.06		
(N*K)	0.04	NS			**(N*K)**	0.04	NS		

	Final harvest DAT (%K)								
	Shoot					Fruit			
	K_0	K_{80}	K_{100}	Mean		K_0	K_{80}	K_{100}	Mean
N_0	0.83	1.03	1.11	**0.99**	N_0	0.93	0.95	1.09	**0.99**
N_{120}	1.20	1.20	1.27	**1.22**	N_{120}	1.08	1.11	1.14	**1.11**
N_{150}	1.21	1.27	1.31	**1.26**	N_{150}	1.13	1.15	1.19	**1.16**
N_{180}	1.27	1.28	1.38	**1.31**	N_{180}	1.14	1.18	1.28	**1.20**

Final harvest DAT (%K)							
		Shoot				Fruit	
Mean	**1.13**	**1.20**	**1.27**	**Mean**	**1.07**	**1.10**	**1.17**
	S.E.m±	**C.D (P=0.05)**			**S.E.m±**	**C.D (P=0.05)**	
N	0.02	0.07		**N**	0.02	0.07	
K	0.02	0.06		**K**	0.02	0.06	
(N*K)	0.04	NS		**(N*K)**	0.04	NS	

100% RDF = 180: 90: 120 kg N-P_2O_5-K_2O ha^{-1},
N_0 –No Nitrogen, N_{120} - 216 kg N ha^{-1}, N_{150} - 270 kg N ha^{-1}, N_{180}- 324 kg N ha^{-1}
K_0 –No potassium, K_{80} - 96 kg K_2O ha^{-1}, K_{100} - 120 kg K_2O ha^{-1}

Among different nitrogen doses, N_{180} (1.71%, 2.45%) recorded the highest total potassium content in shoot at 30, 60 DAT respectively which was significantly superior over N_{120} and N_0 and was found to be on par with N_{150} (1.62, 2.33%). However N_{150} and N_{120} were on par with each other. The lowest was observed with N_0 (1.05, 1.91%) respectively. Similarly the total potassium content at 30 and 60 DAT in shoot revealed that the highest total potassium content was recorded with K_{100} (1.65%, 2.41%) respectively compared to K_{80} and K_0. However K_{80} and K_0 were on par with each other.

The total potassium content at 90 DAT in shoot and fruits revealed that N_{180} (2.07%, 1.31%) recorded significantly higher value compared to N_{120} and N_0. And was found to be on par with N_{150} (2.02%, 1.29%). The lowest N content was noticed in N_0 (1.56, 1.05%) respectively. With regard to potassium fertigation, there was a significant difference observed in fruits. The highest potassium content was observed with K_{100} (2.02%, 1.29%) in shoot and fruits respectively. The lowest was observed with K_0 (1.79%, 1.12%).

At 120 DAT, the total potassium content in shoot ranged from 0.96% to 1.54%. Among nitrogen levels the highest total potassium content was noticed in N_{180} (1.41%) and it was followed by N_{150} (1.35%) and N_{120} (1.28%). The lowest potassium content was recorded with N_0 (1.08%). With respect to different potassium doses, a significant effect was noticed. The K_{100} (1.36%) recorded significantly higher total potassium content compared to other levels where as the lowest was recorded with K_0 (1.20%).

At 120 DAT, the total potassium content in fruits ranged from 0.98% to 1.35%. The highest total potassium content was noticed with N_{180} (1.25%) which was significantly superior over N_{120}, N_0 and was on par with N_{150} (1.20%). The N_{150} (1.20%) was on par with N_{120} (1.17%). The lowest was recorded with N_0 (1.05%). Among different potassium doses, K_{100} recorded the highest value (1.24%) compared to other levels. The K_{80} and K_0 were on par with each other.

At final harvest, among the nitrogen levels N_{180} (1.31%) recorded the highest total potassium content in the shoot which was followed by N_{150} (1.26%) and N_{120} (1.22%) respectively and the lowest was observed with N_0 (0.99%). As concerned with potassium applications a significant difference was noticed. Significantly higher total potassium content was noticed with K_{100} (1.27%) while the lowest was observed with K_0 (1.13%). In fruit, at final harvest the values ranged from 0.93% to 1.28%. The highest total potassium content was recorded in N_{180} (1.20%) which was significantly higher than N_{120} and N_0 and was found to be on par with N_{150} (1.16%). However N_{150} and N_{120} were on par with each other. The lowest was observed with N_0 (0.99%). Among potassium fertigation, significantly higher potassium content was noticed in K_{100} (1.17%) compared to K_{80} and K_0. However K_{80} and K_0 were on par with each other. In general, lower K contents were noticed in both shoots and fruits of capsicum.

4. CONCLUSION

Finally it can be concluded that the highest N content was observed in N_{180} at all the stages in shoot and fruits, which was significantly higher over other levels of nitrogen and was statistically on par with N_{150}. The lowest was noticed with N_0. Among varied potassium doses significantly higher N content was noticed with K_{100}. The lowest was recorded in K_0. The total phosphorous content was significantly influenced by various nitrogen fertigation levels. However N_{180} recorded significantly higher value in shoot

and fruits respectively. The lowest was recorded with N_0, with respect to different potassium fertigation K_{100} recorded the highest total phosphorous content while the lowest was observed with K_0 in shoot and fruits respectively. The highest total potassium content (shoot and fruit) was recorded in N_{180} which was significantly higher than N_{120} and N_0 and was found to be on par with N_{150}. The N_{150} and N_{120} were on par with each other. The lowest was observed with N_0. Among potassium fertigation, significantly higher total potassium content was noticed in K_{100} compared to K_{80} and K_0. The lowest was recorded with K_0

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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