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Influence of N-levels × plant spacing interactions on growth of tomato cv. H-86 under protected condition

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Abstract
The present investigation was carried out at the Horticulture Nursery, College of agriculture, Rewa M.P. during rabi season 2017-18. To find out the N-level and plant spacing interactions in tomato under protected cultivation. The treatments consisted of 12 combinations of 4 levels of nitrogen (0, 60, 80 and 100 kg/ha) and 3 levels of plant spacing (60 ×45 cm and 60 × 55 cm) and were laid out in randomized block design with 3 replications. The best interaction was the widest (60 × 55 cm) spacing with 100 kg N/ha for all the characters under study. The treatment interactions where found to the significant in case all the growth parameters.

Keywords: N-levels × plant spacing interactions, growth, tomato

Introduction

Tomato (*Lycopersicon esculentum* Mill.) belongs to family solanaceae and it is world's largest grown vegetable crop after potato and onion. Tomato fruit contains water 93.1%, protein 1.9%, fat 0.3 g, fiber 0.7%, carbohydrates 3.6%, calorie 23, vitamin 'A' 320 I.U., vitamin 'B_1' 0.07 mg, vitamin 'B_2' 0.01 mg, nicotinic acid 0.4 mg, vitamin 'C' 31 mg, calcium 20 mg, phosphorus 36 mg and iron 0.8 mg. Nitrogen is considered to be the most and easily available plant nutrient of the major elements. It has a great stimulating influence on the development of the vegetable parts. Nitrogen application has shown marked influence in the development of the onion bulbs. Nitrogen is removed by plants in comparatively in large amounts and the recovery of applied nitrogen seldom exceeds 50%. Indian soils are mostly deficient in N and the application of nitrogen fertilizers is essential for crop production in all soil (Kaur *et al.*, 2003) [6]. In order to get maximum benefit from nitrogen use it should not only be applied in right quantity but also at right time according to the growth stages of crop. The growth and yield of the tomato is governed by several factors out of them planting date and plant spacing plays the most important role. However the crop response to fertilize and spacing vary with soil and agro climatic conditions.

Material and Methods

The presented investigation was carried out under agro-climatic conditions of Kymore plateau of Madhya Pradesh during the rabi season of 2017-18. The experiment was conducted in the vegetable from of Horticulture Section, College of Agriculture, Rewa (M.P.). Rewa is situated in the North Eastern part of M.P. The climate of the region is semi-arid and sub-tropical having extreme winter and summer. Rewa is also situated at the latitude of $24^0$31 N longitudes $81^0$15 and altitude of 306 m above the sea level. The experiment was conducted in randomized block design (RBD) factorial with four levels of nitrogen and three levels of plant spacing comprising 12 treatment viz. Levels of nitrogen (0 kg/ha, 60 kg/ha, 80 kg/ha, 100 kg/ha) and Levels of plant spacing (60 × 35 cm, 60 × 45 cm, 60 × 55 cm) . The height of plants was recorded in centimeter from ground level up to the growing point with the help of meter scale from 15 days transplanting at an interval of 15 days. The number of branches per plant were counted and recorded from 30 days after transplanting at an interval of 15 days at successive stages of growth.

Result and Discussion

Growth characters

Plant height

The glance of data presented in Table 1 reveals that at all the stages of plant growth; the N × S interactions influenced the height significantly.

The maximum height was recorded in case of 100 kg N/ha with 60 × 55 cm plant spacing. This was significantly superior to all the remaining interactions. On the other hand, the lowest height was noted in case of zero level of nitrogen with 60 × 35 cm plant spacing. At 90 DAT stage, the height under both the interactions was 60.75 and 54.85 cm, respectively.

Table 1: Plant height (cm) of tomato as influenced by N-levels × plant spacing interactions

Plant spacings (cm)	Nitrogen levels (kg/ha)				S.Em± C.D. (P=0.05)
	0	60	80	100	
30 DAT					
60 × 35	25.18	25.92	27.07	28.40	
60 × 45	25.53	26.26	27.31	31.44	0.04
60 × 55	25.71	26.58	27.47	32.14	0.115
45 DAT					
60 × 35	35.18	36.117	37.35	41.19	
60 × 45	35.42	36.69	37.64	41.72	0.06
60 × 55	35.83	36.94	38.06	41.78	0.132
60 DAT					
60 × 35	44.19	45.06	45.81	46.66	
60 × 45	44.61	45.32	45.05	46.19	0.034
60 × 55	44.88	45.55	45.28	46.62	0.100
75 DAT					
60 × 35	49.04	50.12	50.79	51.6	
60 × 45	49.43	50.28	50.94	51.55	0.045
60 × 55	49.67	50.55	50.19	51.38	0.130
90 DAT					
60 × 35	54.85	56.18	57.25	60.12	
60 × 45	54.96	56.58	57.46	60.55	0.047
60 × 55	54.35	56.87	57.79	60.75	0.136

Number of branches per plant

The data presented in Table 2 reveal that the nitrogen × plant spacing interactions influenced the number of branches per plant significantly at every stage. Thus at 90 DAT stage, the maximum number of branches (12.53 /plant) was observed under 100 kg N/ha with widest plant spacing (60 × 55 cm). In contrast the minimum branches 11.17/plant were noted under closest plant spacing (60 × 35 cm) without nitrogen application. The similar results trend was observed at 30, 45, 60 and 75 DAT stages of plant growth.

Table 2: Number of branches/plant of tomato as influenced by N-levels × plant spacing interactions

Plant spacings (cm)	Nitrogen levels (kg/ha)				S.Em± C.D. (P=0.05)
	0	60	80	100	
30 DAT					
60 × 35	8.15	8.28	8.60	9.30	
60 × 45	8.23	8.48	9.23	9.52	0.07
60 × 55	8.36	8.51	9.31	9.59	0.204
45 DAT					
60 × 35	9.31	9.57	9.77	10.11	
60 × 45	9.54	9.72	10.04	10.48	0.065
60 × 55	9.59	9.83	10.10	10.51	0.189
60 DAT					
60 × 35	10.21	10.54	10.77	10.99	
60 × 45	10.51	10.70	10.90	11.42	0.022
60 × 55	10.53	10.75	10.96	11.54	0.062
75 DAT					
60 × 35	11.11	11.52	11.8	12.22	
60 × 45	11.41	11.75	11.98	12.42	0.023
60 × 55	11.48	11.79	12.19	12.48	0.067
90 DAT					
60 × 35	11.17	11.54	11.81	12.27	
60 × 45	11.49	11.77	12.02	12.45	0.013
60 × 55	11.51	11.8	12.18	12.53	0.038

The beneficial effect of applied nitrogen may be due to the fact that application on maximum amount nitrogen maintained the nitrogen requirement of the plant by supplying sufficient quantity of nutrients essential for their growth. Nitrogen is directly associated with the vegetative growth of the plant. Togun *et al.* (2003) [10]. Badruddin *et al.* (2004) [2]. Warner *et al.* (2004) [11]. Talukder *et al.* (2004) [9]. Singh *et al.* (2005) [1] and Rahman *et al.* (2007) [7]. Belemi (2007) [3] reported that increasing doses of nitrogen from 0 to 150 kg N/ha significantly increased growth parameters. The benefiical effect of nitrogen were also reported by Singh *et al.* (2005) [8]. Direkvandi *et al.* (2008) [4] and Haque *et al.* (2011) [5]. The average number of branches per plant was also significantly increased at every stage due to wider spacing.

Thus at 90 DAT the maximum number of branches 12.0 per plant were recorded under 60 × 55 cm, followed by 60 × 45 cm (11.93) and 60 × 35 cm (11.69/plant). Thus the wider spacing favoured the more number of branches per plant due to lesser competition for space moisture, light and nutrients. These results are in the same line as recorded by Ali (1995). Sharma *et al.* (2001). Badrudin *et al.* (2004) [2] and Singh *et al*. (2005) [8].

Conclusion

The treatment interactions where found to the significant in case all the growth parameters. Thus the best interaction was the widest (60 × 55 cm) spacing with 100 kg N/ha for all the characters under study.

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