IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
e ISSN-0976-593X Volume **11** | Issue 2 | July, 2016 | 322-330

DOI: 10.15740/HAS/IJPS/11.2/322-330
Visit us - *www.researchjournal.co.in*

RESEARCH ARTICLE

Effect of growth regulators and fruit retention on fruit set, seed yield and quality of tomato parental lines

■ **SANJEEVKUMAR, B.S. VYAKARNAHAL, V.K. DESHPANDE AND PRIYA KIVADASANNAVAR**

SUMMARY

Parental seed production in tomato, number of fruits retained on seed parent and pollen parent will decide not only seed yield but also seed quality. Application of growth regulators like GA_3, NAA are known to modify plant morpho-physiological characters and help in getting higher seed yield coupled with better quality traits. Among growth regulators GA_3 100 ppm recorded significantly higher fruit yield/plant (1206.01g), seed yield/plant (8.12 g) and germination (90.92%) and vigour index (1424) over control (1101.69g, 7.36g, 87.60% and 1301, respectively) Retention of all fruits recorded higher fruit yield (1824.79g) and seed yield/plant (11.38g) compared to 10,15 and 20 fruits. Germination (91.51%) and vigour index (1460) were significantly higher in 10 fruits per plant compared all fruits treatments. Among the treatment combinations, GA_3 100 ppm with retention of all fruits recorded significantly higher fruit yield/plant (1898.10g), seed yield/plant (11.95g). vigour index (1501) was significantly higher in GA_3 100 ppm with 10 fruits compared to other treatment combinations.

Key Words : Growth regulators, Fruit retention, Tomato, Parental lines

How to cite this article : Sanjeevkumar, Vyakarnahal, B.S., Deshpande, V.K. and Kivadasannavar, Priya (2016). Effect of growth regulators and fruit retention on fruit set, seed yield and quality of tomato parental lines. *Internat. J. Plant Sci.*, **11** (2): 322-330, **DOI: 10.15740/HAS/IJPS/11.2/322-330**.

Article chronicle : Received : 28.12.2015; **Revised :** 23.05.2016; **Accepted :** 23.06.2016

Tomato is an important vegetable crop grown in India in recent years, exploitation of heterosis led to release of number of hybrids for commercial cultivation. The efforts were made to meet the ever increasing demand for tomato hybrids. In this context, efforts were made to standardize hybrid seed production techniques in tomato with respect to crossing ratio pollination time, growth regulators and fruit retention. The growth behaviour of many crop plants could be modified and controlled by applying small amount of growth regulators. But the time and method of application, the biological activity of growth regulators, its movement and persistence are important consideration when parent plant treatment investigated. The exogenous application of growth regulators like GA_3 and NAA stimulate the flowering, pollination, fertilization and seed setting to yield better quality seeds.

The plant growth regulators have contributed a great

MEMBERS OF THE RESEARCH FORUM

Author to be contacted :
B. S. VYAKARANAHAL, Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA
Email: basannasv@gmail.com; basannasv@rediffmail.com

Address of the Co-authors:
SANJEEVKUMAR, V.K. DESHPANDE AND PRIYA KIVADASANNAVAR, Department of Seed Science and Technology, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA
Email: Priya.bk@rediffmail.com

deal to the progress of olericulture. Hence, the manipulation of production techniques to achieve optimum source-sink, relationship that would augment high fruit and seed yield accompanied by seed quality attributes can be achieved by spraying suitable growth regulators at proper stage of crop growth.

Quality seed is basic and crucial input for successful vegetable production. The important aspect in seed programme is to supply of high quality seeds to the farmers for commercial tomato production. It is also necessary to produce genetically pure seed and good quality seed by adopting suitable seed production techniques.

MATERIAL AND METHODS

The field experiment consisted of three treatment combinations, first factor varities *viz.*, Arka Vikas (V_1) and Megha (V_2), second factor, (G_1) GA_3 @ 100 ppm, (G_2) NAA @ 10 ppm, (G_3) No spray (control) and third factor, fruits retained per plant *viz.*, 10 fruits per plant (N_1), 15 fruits per plant (N_2), 20 fruits per plant (N_3) and all fruits per plant (N_4). The parental seeds were treated with captan @ 2 g per kg of seeds and used for sowing in the nursery. Two raised bed of 7 m length, 1.2 m width and 10 cm height with fine tilth was prepared and 4-5 baskets of well decomposed farm yard manure was incorporated and mixed thoroughly. The 500 g of 15:15:15 complex fertilizer was added to the bed and mixed thoroughly in the soil. Previous day sowing, the bed was drenched with captan @ 3 gram per litre of water. Furrows were made at a distance of 10 cm across the length of the bed and beds were sown with seeds of female parent and male parent separately. The nursery beds were watered and plant protections were taken regularly.

The experiment was laid out in Randomized Block Design with factorial concept in black soil with 24 treatment combinations. The required concentration of GA_3 and NAA and required quantity of spray solution were prepared separately and sprayed twice to the plants. First spray was given at the initiation of flowering (25 DAT) and second spray was given at fruit initiation (45 DAT).

RESULTS AND DISCUSSION

The results are presented in Table 1,2 and 3. At 90 days after transplanting (DAT), N_1 recorded maximum plant height (105.25 cm) followed by N_2 (104.22 cm), N_3 (104.06 cm). The lowest plant height was recorded in N_4 (102.90 cm). Similar trend was noticed at harvest. The interactions between variety and growth regulators showed non-significant difference on plant height at all growth stages. The interactions involving growth regulator and number of fruits per plant were found to be non significant. However, irrespective of variety, growth regulators and number of fruits per plant the mean plant height increased from 35.51 cm at 30 DAT to 133.64 cm at harvest. Similar trend was noticed with number of leaves per plant. However, irrespective of variety, growth regulator and number of fruits per plant, the mean number of days taken for initiation of flowering was 29.61 and days to 50 per cent flowering 38.82.

Effect of growth regulators :

Irrespective of the fruit retention per plant, significant variations were observed for growth regulators on seed yield and its components such as fruit girth, fruit weight per plant, number of seeds per fruit, seed weight per fruit, 1000 seed weight and seed weight per plant and seed yield per hectare were observed with GA_3 100 ppm (16.37 cm, 1206.01 g, 136.32, 0.525g, 3.86g, 8.12g and 225.65 kg, respectively) compared to NAA 10 ppm. All these yield parameters were lower in control (without spray).

The increase in seed yield and its components such as fruit weight per plant, seeds per fruit, seed weight per fruit, 1000 seed weight and seed weight per plant with GA_3 100 ppm, might due to better translocation of photosynathates from source (leaf) to sink(seed). These findings are supported by heavier build up of sufficient food reserves in the developing fruits and seeds in the physiologically active plant, due to spraying of growth regulators. This might have favoured the increased supply of photosynthates and mobilized efficiently in the plants, giving rise to well developed seeds in the fruits and ultimately resulted in higher seed yield. These results are in agreement with the findings of Bhat and Singh (1997) in okra, Goudappalavar (2000) in tomato and Patil (2005) in brinjal and Basavaraj (2006) in okra.

Among seed quality parameters, germination percentage, field emergence, root length, shoot length, vigour index and seedling dry weight exhibited marked variations due to growth regulators spray. All these quality parameters were significantly more in GA_3 100 ppm (90.92%, 83.96%, 7.0 cm, 8.7 cm, 1424 and 27.22 mg, respectively) followed by NAA 10 ppm. Whereas they were less in the control (87.60% 78.08%, 6.4cm,

Table 1: Effect of growth regulators and fruit retention on growth stages of tomato parents

Treatments	Plant height (cm)		Number of leaves per plant		Days to flower initiation	Days to 50% flowering	Fruit girth (cm)	Fruit weight/ plant (g)
	At 90 DAT	At harvest	At 90 DAT	At harvest				
Variety (V)								
V_1 Arka Vikas	102.21	132.31	137.88	127.08	29.42	38.71	15.54	1169.91
V_2 Megha	106.01	134.96	136.11	126.73	29.81	38.93	15.44	1130.95
S.E.±	1.32	0.85	1.22	1.14	0.528	0.728	0.28	10.96
C.D. (P=0.05)	3.76	2.42	3.66	NS	NS	NS	NS	31.20
Growth regulators (G)								
G_1 GA_3 100 ppm	105.78	134.50	138.07	137.39	29.27	36.63	16.37	1206.01
G_2 NAA 10 ppm	103.25	133.12	137.15	126.93	29.60	39.63	15.41	1143.59
G_3 Control	103.00	133.00	135.90	126.40	29.95	40.19	14.84	1101.69
S.E.±	1.61	1.04	1.49	1.39	0572	0.891	0.34	13.43
C.D. (P=0.05)	4.84	3.12	4.47	NS	NS	2.537	098	38.22
No.of fruits per plant								
N_1 10	105.25	136.24	137.91	127.58	29.50	38.68	16.91	612.84
N_2 15	104.22	134.18	137.74	127.30	29.51	38.83	16.00	891.33
N_3 20	104.06	133.01	136.36	126. 56	29.68	38.87	15.22	1272.76
N_4 All	102.90	131.17	136.16	126. 19	29.75	38.89	14.03	1824.79
S.E.±	1.86	1.20	1.72	1.61	0.747	1.029	0.4	15.50
C.D. (P=0.05)	5.58	3.42	5.16	NS	NS	NS	1.13	44.13
Interaction (VxG)								
V_1G_1	102.71	132.91	139.74	128.08	29.21	36.60	16.39	1230.48
V_1G_2	102.50	132.20	137.96	127.29	29.68	39.58	15.26	1156.33
V_1G_3	101.41	131.84	135.93	126. 58	29.50	39.95	14.99	1122.93
V_2G_1	108.80	137.10	136.41	126.70	29.33	36.67	16.35	1181.54
V_2G_2	105.01	134.00	136.34	126. 92	29.53	39.69	15.56	1130.85
V_2G_3	104.17	133.77	135.87	125.87	30.41	40.42	14.70	1080.45
S.E.±	2.28	1.47	2.11	1.97	0.915	1.260	0.48	18.99
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	1.44	56.97
Interaction (VxN)								
V_1N_1	106.08	135.46	139.98	128.00	29.22	38.71	17.02	629.37
V_1N_2	103.00	132.91	136.35	127.11	29.80	38.80	16.10	913.89
V_1N_3	102.04	131.81	139.13	126.44	30.04	38.75	15.24	1289.44
V_1N_4	100.57	129.72	137.77	126.77	29.66	38.58	13.82	1846.94
V_2N_1	107.27	137.65	137.40	127.16	29.31	38.66	16.81	596.30
V_2N_2	105.46	134.83	135.83	127.50	29.68	38.86	15.89	868.78
V_2N_3	103.22	134.21	134.93	126.34	29.46	39.03	15.20	1256.08
V_2N_4	105.23	132.51	134.91	125.94	29.71	39.15	14.24	1802.63
S.E.±	2.64	1.70	2.44	2.28	1.056	1.455	0.56	21.93
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Interaction (GxN)								
G_1N_1	106.93	137.48	140.00	128.25	29.16	36.60	18.03	630.69
G_1N_2	105.36	135.53	139.68	127.50	29.36	36.73	16.91	977.81
G_1N_3	106.43	133.40	138.26	127.33	29.13	36.78	16.06	1317.44
G_1N_4	104.40	135.60	136.05	126.50	28.43	36.43	14.48	1898.10
G_2N_1	105.00	134.50	138.11	127.91	29.70	39.55	16.99	606.89
G_2N_2	102.63	135.65	138.00	127.25	29.30	39.23	15.76	868.38
G_2N_3	102.93	133.55	138.66	126.00	29.80	39.86	15.01	1276.60
G_2N_4	102.46	132.56	136.05	126.58	29.63	39.90	13.87	1822.49
G_3N_1	103.81	130.73	136.78	127.33	29.63	39.91	15.72	600.94

Table 1 : Contd.……

Table 1: Contd…

Interaction(VxGxN)								
G_3N_2	101.85	131.60	136.45	126.41	29.86	40.53	15.32	827.82
G_3N_3	102.83	133.48	134.36	126.00	29.33	40.03	14.60	1224.24
G_3N_4	104.61	133.06	132.12	125.25	29.00	40.28	13.74	1753.76
S.E.±	3.23	2.08	2.99	2.79	1.294	1.782	0.69	26.85
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	80.55
Interaction(VxGxN)								
$V_1G_1N_1$	104.00	136.60	141.70	128.66	29.20	36.73	17.96	649.41
$V_1G_1N_2$	103.13	132.66	141.36	128.33	29.33	37.13	17.32	1004.25
$V_1G_1N_3$	103.00	131.20	140.93	128.33	29.26	36.46	16.24	1338.05
$V_1G_1N_4$	100.73	130.03	140.06	127.66	29.06	36.06	14.04	1930.20
$V_1G_2N_1$	103.73	134.70	140.40	128.00	29.86	39.60	16.78	624.98
$V_1G_2N_2$	101.33	132.96	136.60	127.33	29.46	39.00	15.64	892.86
$V_1G_2N_3$	100.53	132.50	136.33	127.00	29.80	40.06	14.90	1282.66
$V_1G_2N_4$	100.40	131.80	131.56	126.16	29.60	39.66	13.70	1824.80
$V_1G_3N_1$	101.93	135.03	137.56	127.00	29.00	39.80	16.30	613.73
$V_1G_3N_2$	104.53	133.10	136.20	125.66	29.60	40.26	15.33	844.56
$V_1G_3N_3$	102.60	132.73	135.60	125.66	29.06	39.73	14.60	1247.60
$V_1G_3N_4$	100.60	130.33	132.13	125.16	29.13	40.03	13.72	1785.83
$V_2G_1N_1$	109.86	139.20	139.93	127.16	29.40	36.46	17.10	611.97
$V_2G_1N_2$	109.85	138.40	138.00	127.16	29.00	36.33	16.50	951.37
$V_2G_1N_3$	107.60	133.60	135.76	126.66	29.80	37.10	15.88	1296.84
$V_2G_1N_4$	108.06	134.20	134.67	125.33	29.53	36.80	14.92	1866.00
$V_2G_2N_1$	106.26	134.76	140.10	127.66	29.13	39.50	17.19	588.80
$V_2G_2N_2$	103.93	134.13	136.93	126.16	29.80	39.46	15.87	843.89
$V_2G_2N_3$	105.33	133.63	134.96	125.83	29.66	39.66	15.13	1270.18
$V_2G_2N_4$	104.53	131.66	134.67	125.33	29.26	40.13	14.04	1820.18
$V_2G_3N_1$	105.70	136.16	139.93	127.66	29.13	40.03	15.14	588.14
$V_2G_3N_2$	104.83	133.86	137.36	127.53	29.60	40.80	15.32	811.08
$V_2G_3N_3$	103.06	133.40	134.53	127.16	29.66	40.33	14.59	1200.88
$V_2G_3N_4$	103.10	132.66	134.53	125.33	29.56	40.53	13.76	1721.70
Mean	104.13	133.64	138.04	126.91	29.61	38.82	15.54	1150.43
S.E.±	4.57	2.95	4.23	3.95	1.830	2.521	0.97	37.98
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

DAT: Days after transplanting NS=Non-significant

8.3 cm, 1301 and 22.67 mg, respectively).

The increased in seed quality parameters due to spraying of GA_3 100 ppm may be due to higher percentage of bolder seeds with good seed weight such bold seeds were harvested from these treatments due to increased translocation and assimilation of photosynthetes from source to the sink (seeds).Similar findings were also reported by Balakumar and Balasubramanian (1988) and Goudappalavar (2000) in tomato, Singh and Lal (1995) in chilli and Patil (2005) in brinjal and Basavaraj (2006) in bhendi hybrid seed production.

The results of the experiment indicated that foliar spray of GA_3 100 ppm at flower and fruit initiation stage of tomato was proved to be better in recording higher seed quality parameters compared to control.

Effect of fruit retention :

Irrespective of growth regulators, significant differences in seed yield and its attributes were noticed due to different fruit retention treatment. The higher fruit girth (16.9 cm), number of seeds per fruit (137.9), seed weight per fruit (0.529 g) and 1000 seed weight (3.84 g)

Table 2 : Effect of growth regulators and fruit retention on yield parameters of tomato parents

Treatments	Fruit yield/ ha	Seed weight /fruit (g)	No.of seeds/fruit	1000 seed weight	Seed weight/ plant (g)	Seed yield / ha(kg)	Germination (%)	Field emergence (%)
Variety (V)								
V_1 Arka Vikas	32.92	0.511	134.70	3.79	8.21	230.44	89.65 (71.17)*	82.43 (65.24)*
V_2 Megha	31.41	0.483	130.91	3.69	7.46	206.90	88.68 (70.45)	80.44 (63.95)
S.E.±	0.40	0.006	1.147	0.03	0.16	4.34	0.250	0.15
C.D. (P=0.05)	1.15	0.018	3.264	0.09	0.45	12.35	0.713	0.45
Growth regulators (G)								
G_1 GA_3 100 ppm	16.37	1206.01	136.32	3.86	8.12	225.65	90.92 (72.63)	83.96 (66.35)
G_2 NAA 10 ppm	15.41	1143.59	133.02	3.72	8.02	222.93	88.98 (70.67)	81.54 (64.64)
G_3 Control	14.84	1101.69	129.09	3.64	7.36	207.42	87.60 (69.13)	78.08 (62.79)
S.E.±	0.34	13.43	1.405	0.04	0.19	5.31	0.307	0.19
C.D. (P=0.05)	098	38.22	4.00	1.1	0.55	15.13	0.873	0.55
No.of fruits per plant								
N_1 10	16.91	612.84	137.90	3.84	4.60	127.92	91.51 (73.18)	85.33 (67.65)
N_2 15	16.00	891.33	133.65	3.78	6.94	197.65	90.03 (71.66)	83.04 (65.71)
N_3 20	15.22	1272.76	132.25	3.71	8.41	233.51	88.08 (69.40)	80.03 (63.38)
N_4 All	14.03	1824.79	127.44	3.63	11.38	315.59	87.04 (69.00)	77.33 (61.64)
S.E.±	0.4	15.50	1.622	0.04	0.22	6.14	0.354	0.22
C.D. (P=0.05)	1.13	44.13	4.616	0.13	0.64	17.47	1.008	0.64
Interaction (VxG)								
V_1G_1	34.17	0.549	139.13	3.96	8.45	234.63	91.37 (73.17)	84.35 (66.53)
V_1G_2	32.08	0.506	135.36	3.74	8.37	232.77	89.20 (70.81)	82.41 (65.30)
V_1G_3	35.52	0.477	129.61	3.67	7.80	223.91	88.36 (69.47)	80.53 (63.88)
V_2G_1	32.81	0.501	133.51	3.76	7.87	218.67	90.46 (72.08)	83.58 (66.17)
V_2G_2	31.40	0.483	130.67	3.70	7.59	211.08	88.75 (70.49)	80.66 (63.98)
V_2G_3	30.00	0.465	128.56	3.62	6.92	190.94	86.84 (68.79)	77.08 (61.70)
S.E.±	0.70	0.011	1.986	0.05	0.27	7.52	0.434	0.27
C.D. (P=0.05)	2.28	0.033	5.94	0.15	0.81	22.56	NS	0.78
Interaction (VxN)								
V_1N_1	17.47	0.551	141.82	3.88	4.89	135.88	91.66 (73.39)	86.01 (68.07)
V_1N_2	25.37	0.525	137.24	3.83	7.46	216.88	90.62 (72.23)	83.86 (66.33)
V_1N_3	35.39	0.501	133.06	3.76	8.70	241.56	88.65 (69.47)	81.63 (64.33)
V_1N_4	51.26	0.466	126.68	3.69	11.79	327.43	87.65 (69.57)	78.22 (62.22)
V_2N_1	16.65	0.507	133.97	3.79	4.31	119.96	91.35 (72.96)	84.66 (67.23)
V_2N_2	24.12	0.485	130.06	3.73	6.42	178.42	89.45 (71.09)	82.22 (65.09)
V_2N_3	34.88	0.471	131.43	3.66	8.13	225.45	87.51 (69.34)	78.44 (64.22)
V_2N_4	50.06	0.458	128.20	3.57	10.98	303.76	86.43 (68.43)	76.44 (61.07)
S.E.±	0.80	0.013	2.29	0.06	0.32	8.68	0.501	0.31
C.D. (P=0.05)	2.40	NS	6.87	0.18	0.97	26.08	NS	NS
Interaction (GxN)								
G_1N_1	17.51	0.553	140.80	3.93	4.98	138.46	93.68 (75.49)*	87.35 (69.17)*
G_1N_2	27.15	0.530	137.00	3.88	7.06	196.20	91.35 (72.95)	84.50 (66.82)
G_1N_3	36.58	0.524	136.83	3.83	8.49	235.87	89.60 (71.22)	83.18 (65.33)
G_1N_4	52.72	0.492	130.66	3.78	11.95	332.08	89.05 (70.85)	80.83 (64.03)
G_2N_1	16.85	0.527	137.56	3.83	4.67	129.75	90.91 (72.49)	85.66 (67.77)

Table 2 : Contd……..

Table 2 : Contd…….

G_2N_2	24.11	0.507	135.06	3.76	7.18	199.67	89.91 (71.50)	82.83 (65.54)
G_2N_3	35.45	0.484	131.38	3.68	8.65	240.40	88.26 (69.97)	80.00 (63.45)
G_2N_4	50.56	0.461	128.06	3.60	11.58	321.89	86.83 (68.74)	77.66 (61.81)
G_3N_1	16.68	0.507	135.33	3.75	4.16	115.55	89.93 (71.55)	83.00 (66.01)
G_3N_2	22.99	0.478	128.90	3.70	6.57	197.08	88.85 (70.53)	81.80 (64.77)
G_3N_3	36.67	0.465	128.53	3.62	8.10	224.25	86.38 (67.02)	76.93 (61.35)
G_3N_4	48.71	0.434	123.60	3.51	10.61	292.82	85.25 (67.42)	73.50 (59.04)
S.E.±	0.99	0.016	2.80	0.08	0.39	10.63	0.613	0.39
C.D. (P=0.05)	2.99	0.048	8.4	0.24	1.17	31.95	NS	1.11
Interaction(VxGxN)								
$V_1G_1N_1$	18.03	0.58	145.40	4.03	5.26	146.20	94.33 (76.28)	87.70 (69.47)
$V_1G_1N_2$	27.88	0.56	142.13	3.97	7.33	203.70	92.00 (73.66)	85.00 (67.22)
$V_1G_1N_3$	37.16	0.54	139.20	3.93	8.36	232.21	90.00 (71.62)	83.70 (65.25)
$V_1G_1N_4$	53.61	0.50	129.80	3.90	12.54	348.42	89.16 (71.13)	81.00 (64.19)
$V_1G_2N_1$	17.35	0.555	144.20	3.84	5.03	139.88	90.50 (72. 07)	86.66 (68.59)
$V_1G_2N_2$	24.79	0.527	139.86	3.77	7.79	216.48	90.00 (71.58)	84.00 (66.42)
$V_1G_2N_3$	35.62	0.484	130.33	3.71	9.09	252.48	88.70 (70.36)	81.00 (64.17)
$V_1G_2N_4$	50.57	0.462	127.06	3.63	11.89	330.26	87.63 (69.42)	78.00 (62.03)
$V_1G_3N_1$	17.04	0.513	135.86	3.78	4.37	121.57	90.16 (71.82)	83.66 (66.17)
$V_1G_3N_2$	23.45	0.486	129.73	3.74	7.25	230.46	89.86 (71.47)	82.60 (65.35)
$V_1G_3N_3$	39.98	0.472	129.66	3.64	8.64	240.00	87.26 (66.43)	80.20 (63.58)
$V_1G_3N_4$	49.60	0.435	123.20	3.53	10.94	303.60	86.16 (68.18)	75.66 (60.45)
$V_2G_1N_1$	16.99	0.521	136.20	3.83	4.70	130.73	93.03 (74.70)	87.00 (68.87)
$V_2G_1N_2$	26.42	0.498	131.86	3.79	6.79	188.70	90.70 (72.25)	84.00 (66.42)
$V_2G_1N_3$	36.01	0.501	134.46	3.73	8.62	239.53	89.20 (70.82)	82.66 (65.40)
$V_2G_1N_4$	51.83	0.482	131.53	3.67	11.36	315.74	88.93 (70.57)	80.66 (63.98)
$V_2G_2N_1$	16.35	0.500	130.93	3.83	4.30	119.62	91.33 (72.91)	84.66 (66.96)
$V_2G_2N_2$	23.43	0.488	130.26	3.74	6.58	182.87	89.83 (71.42)	81.66 (64.66)
$V_2G_2N_3$	35.29	0.484	132.43	3.66	8.22	228.33	87.83 (69.58)	79.00 (62.73)
$V_2G_2N_4$	50.55	0.459	129.06	3.56	11.28	313.51	86.03 (68.06)	77.33 (61.60)
$V_2G_3N_1$	16.33	0.501	134.80	3.72	3.94	109.53	89.70 (71.28)	82.33 (65.86)
$V_2G_3N_2$	22.52	0.469	128.06	3.66	5.89	163.70	87.83 (69.60)	81.00 (64.19)
$V_2G_3N_3$	33.35	0.458	127.40	3.59	7.55	208.51	85.50 (67.62)	73.66 (59.13)
$V_2G_3N_4$	47.82	0.434	124.00	3.49	10.29	282.03	84.30 (66.67)	71.33 (57.33)
Mean	32.16	0.497	132.81	3.74	7.83	218.67	89.16 (70.81)	81.43 (64.60)
S.E.±	1.40	0.022	3.97	0.11	0.55	15.03	0.867	0.55
C.D. (P=0.05)	NS	NS	NS	NS	1.65	45.09	NS	1.57

DAT: Days after transplanting NS=Non-significant * Figures in parentheses indicate arc sine transformed values

were noticed in the ten fruits per plant followed by 15 and 20 fruits per plant. It may be due to more availability and translocation of photosynthetes from source to the developing fruits. when fruit retention per plant gradually increased, the yield components were slowly decreased, where as less fruit girth, number of seeds per fruit, seed weight per fruit, 1000 seed weight (14.03 cm, 127.44, 0.462g,3.63g) were noticed when all fruits retained per plant. It may be due to decreased availability and distribution of photosynthates and higher competition between developing fruits and developed fruits when it was allowed to have higher fruit load per plant. These results are in confirmation with the reports of Bhat (1994) in orka, Jolli (2004) in tomato and Patil (2005) in

Table 3 : Effect of growth regulators and fruit retention on seed quality attributes of tomato parents

Treatments	Root length (cm)	Shoot length (cm)	Seedling dry weight (mg)	Seedling vigour index	EC of seed leachate (dS m^{-1})
Variety (V)					
V_1 Arka Vikas	6.80	8.66	25.90	1390	1.085
V_2 Megha	6.77	8.49	25.12	1354	1.137
S.E.±	0.051	0.03	0.156	6	0.013
C.D. (P=0.05)	NS	NS	0.444	17	0.036
Growth regulators (G)					
G_1 GA_3 100 ppm	7.02	8.79	27.22	1424	1.078
G_2 NAA 10 ppm	6.87	8.59	26.65	1391	1.100
G_3 Control	6.46	8.34	22.67	1301	1.155
S.E.±	0.06	0.03	0.191	7	0.016
C.D. (P=0.05)	0.17	0.11	0.544	21	0.045
No.of fruits per plant					
N_1 10	7.14	8.81	26.19	1460	0.948
N_2 15	6.88	8.66	25.81	1400	1.107
N_3 20	6.73	8.54	25.39	1350	1.171
N_4 All	6.39	8.28	24.66	1278	1.218
S.E.±	0.07	0.04	0.221	8	0.018
C.D. (P=0.05)	0.20	0.12	0.628	24	0.051
Interaction (VxG)					
V_1G_1	7.07	8.75	27.37	1426	1.071
V_1G_2	6.88	8.64	26.70	1403	1.071
V_1G_3	6.46	8.59	23.65	1341	1.113
V_2G_1	6.87	8.84	27.08	1422	1.085
V_2G_2	6.97	8.54	26.60	1378	1.130
V_2G_3	6.47	8.09	21.68	1262	1.119
S.E.±	0.08	0.05	0.270	10	0.220
C.D. (P=0.05)	NS	0.15	0.769	30	NS
Interaction (VxN)					
V_1N_1	7.30	8.89	26.50	1490	0.958
V_1N_2	6.92	8.76	26.29	1421	1.084
V_1N_3	6.65	8.62	26.01	1361	1.132
V_1N_4	6.35	8.36	24.82	1289	1.166
V_2N_1	6.98	8.72	25.88	1431	0.939
V_2N_2	6.85	8.56	25.34	1379	1.130
V_2N_3	6.82	8.47	24.77	1339	1.209
V_2N_4	6.44	8.20	24.49	1267	1.271
S.E.±	0.10	0.06	0.312	12	0.026
C.D. (P=0.05)	NS	NS	NS	NS	NS
Interaction (GxN)					
G_1N_1	7.03	9.05	28.03	1501	0.917
G_1N_2	7.18	9.00	27.55	1479	1.067
G_1N_3	6.88	8.73	26.93	1399	1.128
G_1N_4	6.41	8.39	26.39	1318	1.200
G_2N_1	7.57	8.81	27.22	1491	0.920

Table 3 : Contd.……

Table 3: Contd…

G_2N_2	7.01	8.65	26.89	1408	1.103
G_2N_3	6.88	8.65	26.47	1371	1.173
G_2N_4	6.63	8.24	26.01	1292	1.205
G_3N_1	6.82	8.56	23.32	1389	1.008
G_3N_2	6.46	8.66	22.99	1314	1.152
G_3N_3	6.43	8.54	22.78	1279	1.210
G_3N_4	6.14	8.22	21.58	1224	1.220
S.E.±	0.12	0.07	0.382	15	0.031
C.D. (P=0.05)	NS	NS	NS	44	NS
Interaction(VxGxN)					
$V_1G_1N_1$	7.44	9.06	28.16	1517	0.910
$V_1G_1N_2$	7.34	8.93	27.85	1496	1.053
$V_1G_1N_3$	6.74	8.66	27.00	1386	1.130
$V_1G_1N_4$	6.32	8.34	26.45	1307	1.190
$V_1G_2N_1$	7.93	8.85	27.06	1523	0.953
$V_1G_2N_2$	6.95	8.66	26.83	1404	1.103
$V_1G_2N_3$	6.83	8.72	26.63	1380	1.107
$V_1G_2N_4$	6.57	8.33	26.27	1306	1.120
$V_1G_3N_1$	6.82	8.77	24.27	1430	1.010
$V_1G_3N_2$	6.47	8.69	24.18	1363	1.097
$V_1G_3N_3$	6.37	8.48	24.41	1317	1.160
$V_1G_3N_4$	6.16	8.41	21.76	1256	1.187
$V_2G_1N_1$	6.92	9.04	27.89	1485	0.923
$V_2G_1N_2$	7.03	9.08	27.25	1461	1.080
$V_2G_1N_3$	7.02	8.80	26.86	1412	1.127
$V_2G_1N_4$	6.51	8.44	26.33	1330	1.210
$V_2G_2N_1$	7.20	8.78	27.39	1459	0.887
$V_2G_2N_2$	7.07	8.65	26.95	1413	1.103
$V_2G_2N_3$	6.94	8.59	26.31	1364	1.240
$V_2G_2N_4$	6.70	8.15	25.75	1278	1.290
$V_2G_3N_1$	6.82	8.34	22.37	1348	1.007
$V_2G_3N_2$	6.46	7.96	21.81	1265	1.207
$V_2G_3N_3$	6.49	8.02	21.40	1241	1.260
$V_2G_3N_4$	6.11	8.02	21.14	1192	1.313
Mean	6.79	8.57	25.51	1372.31	1.11
S.E.±	0.17	0.11	0.540	21	0.044
C.D. (P=0.05)	NS	NS	NS	NS	NS

DAT: Days after transplanting NS=Non- significant * Figures in parentheses indicate arc sine transformed values

brinjal and Basavaraj (2006) in okra parental seed production.

In contrast to these results, seed yield per plant was significantly more in higher fruit load per plant with the retention of all fruits per plant, which was followed by 20 and 15 fruits per plant. The increase in seed yield per plant in all fruits treatment may be due to retention of more number of fruits per plant. Whereas, seed yield per plant was significantly less in 10 fruit, retained per plant in view of its lower fruit retention per plant.

Seed quality parameters differed significantly due to fruit retention treatment. The significant results were noticed for germination percentage, field emergence, root length, shoot length, seedling dry weight and vigour index.

All these seed quality parameters were significantly higher in 10 fruits retained per plant (91.51%, 85.33%, 7.1 cm, 8.8cm, 26.19 mg and 1460, respectively) followed by 15 and 20 fruits per plant. Whereas, in the treatment of all fruits retained per plant, they were significantly low (87.04%, 77.33%, 6.3 cm 8.2cm, 24.66 mg and 1278, respectively) in all the seed quality attributes.

As the number of fruits per plant has increased, the seed quality parameters gradually decreased. This may be due to less competition among fruits in 10 fruits retention treatment and higher competition for metobolites among the fruits that retained all, due to less availability of photosynthates to the individual seed for development that might resulted in the low quality of seeds. These results are in agreement with the reports of Jolli (2004) in tomato, Patil (2005) in brinjal, Bhat (1994) and Basavraj (2006) in okra.

From the above discussion, it can be concluded that parental seed production in tomato, retention of all fruits recorded higher seed yield per plant whereas better quality seeds could be obtained from 10 fruits retained per plant as compared to 15, 20 and all fruits retention.

Interaction effect

The interaction effect between growth regulator and fruit retention were found to be significant for most of the seed yield and quality parameters studied. Significantly higher number of seeds per fruit (140.80) and seed weight per fruit (0.553g) was recorded with G_1N_1 compared to G_3N_4 (123.60 and0.434 g, respectively), however, significantly higher seed yield per plant (11.95 g) and seed yield per hectare (332.08 kg) were recorded with G_1N_4 combination compared to G_3N_1 (41.6 g and 115.55 kg, respectively). These results are in agreements with the reports of Jolli (2004) in tomato, Patil (2005) in brinjal, Bhat (1994) and Basavaraj (2006) in okra.

REFERENCES

Balakumar, T. and Balasubramanian, N. A. (1988). Effect of hormonal treatment on biomass production of tomato. *Tropic. Agric.*, **65**: 373-375.

Basavaraj (2006). Studies on hybrid seed production of bhendi [*Abelmoschus esculentus* (L.) Moench]. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Bhat, C. P. (1994). Studies on physiological maturity and seed production techniques in okra [*Abelmoschus esculentus* (L.) Moench] M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Bangalore, KARNATAKA (INDIA).

Bhat, K.L. and Singh, A.K. (1997). Effect of different levels of phosohorus, gibberllic acid and picking on seed production of okra [*Abelmoschus esculentus* (L.) Moench]. *Veg. Sci.*, **24** (1) : 4-6.

Goudappalavar, H.B. (2000). Effect of mother plant nutrition and chemical spray on seed yield quality in tomato (*Lycopersicon esculentum* Mill) M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Jolli, R. B. (2004). Standerdization of hybrid seed production techniques in tomato (*Lycopersicon esculentum* Mill). Ph. D. Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Patil, S.B. (2005). Standardization of hybrid seed production techniques in brinjal (*Solanum melongena* L.). Ph.D. Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Singh, D. K. and Lal, G. (1995). Effect of plant growth regulators on the fruit set, yield quality of chilli. (*Capsicum annuum* L) *Adv. Hort. Fores.*, **4** : 133-141.