Seed Research Vol. 33(1) 82-87, 2005

Influence of Spacing, Nipping and Fruit Retention on Seed Yield and Seed Quality in Cucumber*

RAVIKUMAR, G.H., SHEKHAR GOUDA, M.**, VASUDEVAN, N.
BASAVEGOWDA AND MAHADEVAREDDY
Regional Agricultural Research Station, Raichur-584 101, Karnataka
(dr_ravikumargh@yahoo.co.in)

ABSTRACT An experiment on seed production in cucumber conducted during *kharif* indicated that closer spacing of 1.50m x 0.50m (S_2) recorded higher fruit yield (154.9 q ha^{-1}), seed setting (84.1%) and seed yield (76.6 kg ha^{-1}) though lower in fruit length (18.9 cm) and diameter (19.7 cm) as compared to wider spacing 1.50 x 0.75m (S_1). Unnipped (no nipping) treatment recorded higher number of filled seeds per fruit (115.6 $fruit^{-1}$), seed extraction (0.54%) seed setting per cent (81.9%) resulting in more seed yield (71.4 kg ha^{-1}) compared to nipping at 12th node (67.3 kg ha^{-1}) and spraying of CCC @ 100 ppm at 40 DAS (64.2 kg ha^{-1}). Retention of four fruits per vine (F_2), recorded significantly higher numbers of filled seeds per fruit (122.2 $fruit^{-1}$) seed setting percentage (83%) and seed yield (70 kg ha^{-1}) compared to retention of 2 fruits per vine (F_1). During summer similar trend was also observed, but the yield levels were relativity lower than *kharif*. The data clearly indicated that seed yield (86.5 kg ha^{-1}), seed quality and benefit cost ratio were higher (2.92) in *kharif* by adopting narrow spacing, no nipping and retention of four fruits per vine ($S_2N_1F_2$).

Keywords: Spacing, nipping, fruit retention, cucumber, *Cucumis sativus* L., seed production

Cucumber (*Cucumis sativus* L.) is warm season crop mainly grown in tropical and subtropical regions. It grows well at day temperatures between 20° C and 35° C and cannot tolerate frost and strong winds. Low temperature and short days stimulate development of female flowers. Dry warm and long growing season is essential for seed production and therefore, the northern part of Karnataka, Telengana region of Andhra Pradesh, Marathawada and Vidharbha regions of Maharashtra and eastern districts of Uttar Pradesh are best suited for seed production of cucumber [1]. Nipping is one of the technique to suppress the apical dominance in many indeterminate crops. By nipping the apical bud, the concentration of auxins accumulated in the tips is reduced and diverted to the lower part of plant thereby plant becomes more active physiologically resulting in production of more number of branches and fruits. Since the information on the influence of seasons coupled with nipping, plant density, fruit retention on seed yield and quality is meagre, the present investigation was carried out.

MATERIALS AND METHODS

The field experiment was carreid out at Regional Agricultural Research Station, Raichur during *kharif* 1999 and summer 1999-2000. It is situated in the north-eastern dry zone of the Karnataka state and it lies between 16° 15' N latitude and 77° 20' E longitude and at an altitude of 389 m above mean sea level. The soils of the experimental site was sandy clay loam (red soil). The experimental treatments consisted of 18 treatment combinations involving two levels of spacing (Main plot) (S_1-1.50 x 0.75m: S_2-1.50x0.50m), three levels of nipping-sub plots (N_1-No nipping, N_2-Nipping at 12th node and N_3-CCC 100 ppm spray at 40 DAS) and three level of fruit retention sub-sub plots (F_1-2 fruits, F_2-4 fruits and F_3-all fruits per vine). The plot size selected for the study was 7.50 m x 3.00 m. The experiment was conducted in split-split plot design with three replications. Cucumber cv. Pionsette was sown on 28-7-1999 and 2-12-1999 during *kharif* and summer seasons respectively. The basal dose (60:50:80 kg

* Part of Ph.D. Thesis submitted by the Senior author to the University of Agricultural Sciences, Dharwad-5.
** Department of Seed Science & Technology, Agriculture College, UAS, Dharwad.

Received Dec., 2002 Revised Feb., 2005 Accepted May, 2005

NPK ha^{-1}) containing 50 per cent N, whole P and K was applied before sowing. The remaining 50 per cent N was applied at 20 days after sowing. Nipping of the main shoot was attended on 20th day after sowing and allowed two primary branches to grow laterally. The crop was well managed and protected from pests and diseases. The fruits were harvested when they turned yellow on 3-10-1999 and 3-4-2000 during *kharif* and summer seasons respectively and fruits were stored in ambient condition for 10 days post harvest ripening. Seeds were extracted by fermentation technique. There was not much difference in the temperature between crop growth periods of *kharif* and summer. However higher relative humidity was recorded in *kharif* due to precipitation during August, September and October in 1999, while relative humidity levels were low in January, February and March in 2000.

RESULTS AND DISCUSSION

The data presented in Table-1 indicate that during kharif cucumber planted in closer spacing of 1.50m x 0.50m (S_2) recorded significantly higher fruit yield (154.9 q ha^{-1}) than wider spacing (S_1). Higher fruit yield in S_2 was mainly attributed to higher planting density (13,333 vines ha^{-1}) as compared to S_1 (8,888 vines ha^{-1}). This is in accordance with findings of Dhillon [2] in muskmelon and Reiners and Riggs [3] in pumpkin. Closer spacing (S_2) recorded lower fruit length and diameter. This was due to competition in higher planting density and resulted higher fruit yield ha^{-1}. Closer spacing (S_2) recorded significantly higher seed setting per cent (84.1%) than wider spacing (65.7%). This is in accordance with findings of Den *et al* [4], who observed that pollen tube never reached distal half of the ovary in long fruitted cucumber. Closer spacing recorded significantly higher seed yield (76.6kg ha^{-1}) than S_1 (58.7 kg ha^{-1}). Higher seed yield in S_2 was mainly attributed higher fruit yield and higher seed set per cent though fruit possessing lower length. This finding is in line with Pandita and Randhawa [5] who observed higher seed yield in muskmelon with planting density of 10,000 vines ha^{-1} compared to lower planting density (6,666 and 5000 vines ha^{-1}). Similar trend was noticed in summer 1999-2000 (Table 2) with slightly declined yield levels compared to *kharif*.

Nipping the vine at 12th node (N_2) produced significantly higer fruit yield ha^{-1} (139 q ha^{-1}) than N_3 (132.2 q ha^{-1}) and was on par with N_1 (135.6 q ha^{-1}). Higher fruit yield in N_2 was attributed to efficient utilization of photosynthates near to fruit point. Lower fruit yield ha^{-1} in N_1 and N_3 might be due to distribution of leaves away from the fruiting point. Similar observations have been reported by Mangal and Yadava [6] in cucumber. No nipping recorded significantly higher percent seed set (81.9%) as compared to N_3 (76.1%) and N_2 (75.5%). Higher per cent seed set in N_1 was mainly attributed to higher number of filled seeds (115 $fruit^{-1}$) and lower number of unfilled seeds (31.3 $fruit^{-1}$) as compared to N_3 (110.6 and 36.3 $fruit^{-1}$ respectively) and N_2 (102.6 and 36.9 $fruit^{-1}$ respectively). No nipping produced significantly higher seed yield (71.4 kg ha^{-1}) compared to N_2 (67.3 kg ha^{-1}) and N_3 (64.2 kg ha^{-1}). Higher seed yield in N_{io} was evidenced by higher seed attributes viz higher number of filled seeds, lower number of unfilled seeds per fruit and higher extraction (0.54%). Similar trend was noticed in summer 1999-2000 (Table 2) with slightly declined yield levels compared to *kharif*.

Retention of 2 fruits per vine (F_1) recorded (Table 1) significantly higher fruit length (21.4 cm) and diameter (22.4 cm) as compared to retention of four (F_2) and retention of all fruits per vine (F_3). Higher fruit length and diameter in F_1 was mainly attributed to diversion of more photosynthates towards the development of two fruits as compared to four fruits and all fruits per vine [7]. Retention of all fruits per vine recorded significantly higher fruit yield (144.7 q ha^{-1}) compared to F_1 (119.7 q ha^{-1}) but was on par with F_2 (142.3 q ha^{-1}). More fruit yield in F_3 and F_2 clearly indicates that there was, no much differences in retention of four or more than four fruits $vine^{-1}$. Retention of four fruits per vine recorded significantly higher seed setting (83%) as compared to F_1 (73.7%) and F_3 (76.7%). Higher per cent seed set in F_2 mainly attributed to higher number of filled seeds (122.2 $fruit^{-1}$) and lower number of unfilled seeds (28 $fruit^{-1}$) as compared to F_1 (102.3 and 43.2 $fruit^{-1}$ respectively) and F_3 (104.2 and 35.2 $fruit^{-1}$ respectively). Retention of all fruits per vine (F_3) recorded significantly higher seed yield (71.7 Kg ha^{-1}) compared to F_1 (60.8 kg ha^{-1}) but on par with F_2 (70 Kg ha^{-1}). Higher seed yield in F_2 and F_3 clearly indicates no much differences in seed yield when four or more than four fruits were retained per vine.

Among the seed quality characters F_1 recorded significantly higher germination (87.7%) test weight (2.4g), vigour index (2237) and seedling weight (18.64mg) compared to F_3 (82.6% 2.2g, 1950, 17.91 mg respectively) but was on par with F_2 (85.5%, 2.35g, 2124 and 18.40 mg respectively). This reflects that F_2 recorded higher seed yield and quality. Similar trend was noticed (Table 2) with respect to seed yield and quality character.

Table 1. Influence of spacing, nipping and fruit retention on fruit length (cm), fruit diameter (cm), fruit yield (q/ha), seed extraction (%), 100 seed weight (g) and seed yield (kg/ha), germination (%), root length (cm) and shoot length (cm) vigour index and seedling dry weight (mg) during *Kharif* 1999 in cucumber cv. Poinsette.

Treatments	Fruit Length (cm)	Fruit Diameter (cm)	Fruit yield (q/ha)	Seed extraction (%)	No. seeds of fruit	No. of unfilled seeds/fruit	Seed setting (%)	100 seed weight (g)	Seed yield (kg/ha)	Germination (%)	Vigour Index	Seedling dry weight (mg)
	1	2	3	4	5	6	7	8	9	10	11	12
Spacing (S)												
S_1 (1.50r. x 0.75m)	19.6	20.5	116.3	0.51	120.7	63.0	65.7(54.15)*	2.37	58.7	85.9(67.96)*	2153	18.44
S_2 (1.50 m x 0.50m)	18.9	19.7	154.9	0.50	98.0	38.0	84.1 (66.52)	2.32	76.6	84.9 (67.05)	2080	18.20
S.Em±	0.1	0.2	0.2	0.01	0.6	0.6	(0.23)	0.01	0.4	(0.86)	49	0.22
C.D. at 5%	0.4	NS	1.2	NS	3.5	3.5	(1.40)	NS	2.2	(NS)	NS	NS
Nipping (N')												
N_1 (No Nipping)	19.6	20.1	135.6	0.54	115.6	31.3	81.9(64.83)	2.33	71.4	85.4 (67.54)	2097	18.12
N_2 (Nipping at 12th node)	19.1	20.2	139.0	0.48	102.6	36.9	75.5 (60.32)	2.36	67.3	84.6(66.91)	2070	18.33
N_3 (CCC@100ppm)	19.0	19.9	132.2	0.48	110.6	36.3	76.1 (60.75)	2.34	64.2	86.1 (68.06)	2181	18.50
S.Em±	0.2	0.2	1.5	0.01	1.6	1.7	(0.72)	0.05	1.2	(0.96)	33	0.18
C.D. at 5%	NS	NS	4.9	0.03	5.3	5.3	(2.35)	NS	3.7	(NS)	NS	NS
Fruit retention (F)												
F_1 (2 Fruits/vine)	21.4	22.4	119.7	0.51	102.3	43.2	73.7(59.13)	2.40	60.8	87.7(69.51)	2237	18.64
F_2 (4 Fruits/vine)	19.4	20.1	142.3	0.50	122.2	28.0	83.0(65.66)	2.35	70.0	85.5 (67.66)	2124	18.40
F_3 (All Fruits/vine)	17.0	17.7	144.7	0.49	104.2	35.2	76.7(61.12)	2.20	71.1	82.6(65.34)	1950	17.91
S.Em±	0.2	0.2	2.8	0.01	1.4	1.4	(0.61)	0.03	0.8	(0.77)	40	0.15
C.D. at 5%	0.5	0.5	8.2	0.03	4.1	4.1	(1.79)	0.10	2.2	(2.26)	115	0.42

NS-Non significant * Figures in parenthesis indicate angular transformed valves

Table 2. Influence of spacing, nipping and fruit retention on fruit length (cm), fruit diameter (cm), fruit yield (q/ha), seed extraction (%), 100 seed weight (g) and seed yield (kg/ha), germination (%), root length (cm) and shoot length (cm) vigour index, and seedling dry weight (mg) summer 1999-2000 during in cucumber cv. Poinsette

Treatments	Fruit Length (cm)	Fruit Diameter (cm)	Fruit yield (q/ha)	Seed extraction (%)	No. of seeds fruit	No of unfilled seeds/fruit	Seed setting (%)	100 seed weight (g)	Seed yield (kg/ha)	Germination (%)	Vigour Index	Seedling dry weight (mg)
	1	2	3	4	5	6	7	8	9	10	11	12
Spacing (S)												
S_1 (1.50 m x 0.75m)	18.9	19.4	116.1	0.41	85.5	99.3	46.5(42.97)*	2.24	47.0	79.3 (62.93)*	16.76	15.93
S_2(1.50m x 0.50m)	18.7	19.2	130.4	0.47	75.7	61.2	54.9(47.84)	2.19	60.8	79.1(62.80)	16.05	15.38
S.Em±	0.1	0.2	1.5	0.03	1.40	1.4	(0.46)	0.02	0.4	(0.50)	31	0.19
C.D. at 5%	NS	NS	8.9	0.05	8.7	8.7	(2.85)	NS	2.5	(NS)	NS	NS
Nipping (N)												
N_1 (No Nipping)	18.6	19.2	123.9	0.46	87.0	75.7	54.3 (47.48)	2.20	57.5	78.6 (62.44)	1652	14.86
N_2 (Nipping at 12th node)	19.3	19.8	125.0	0.40	72.9	88.9	46.2 (42.81)	2.23	50.1	79.6 (63.15)	1685	15.04
N_3 (CCC@100ppm)	18.7	19.1	120.9	0.45	80.3	76.2	51.6 (45.93)	2.22	54.2	80.3 (63.68)	1700	15.57
S.Em±	0.2	0.2	1.8	0.01	1.3	1.3	(0.42)	0.05	1.1	(0.28)	45	0.20
C.D. at 5%	NS	NS	NS	0.03	4.2	4.2	(1.38)	NS	3.6	(0.94)	NS	NS
Fruit retention (F)												
F_1 (2 Fruits/vine)	21.8	21.9	111.0	0.43	74.1	92.1	45.5(42.85)	2.26	47.0	81.2(64.27)	1774	15.72
F_2 (4 Fruits/vine)	18.7	19.1	129.1	0.45	93.1	71.4	57.0(49.05)	2.22	57.6	79.4(63.01)	1638	15.36
F_3 (All Fruits/vine)	16.1	16.8	129.7	0.44	73.1	77.3	49.5 (44.73)	2.10	57.1	77.0(61.32)	1492	14.39
S.Em±	0.2	0.2	3.5	0.02	1.9	1.9	(0.68)	0.04	1.1	(0.54)	39	0.27
C.D. at 5%	0.6	0.6	10.5	NS	5.5	5.5	(1.97)	0.10	3.1	(1.56)	115	0.77

NS-Non significant * Figures in parenthesis indicate angular transformed valves

Table 3. Benefit Cost ratio of seed yield of cucumber as influenced by seasons, spacing, nipping and fruit retention treatments in *Kharif* 1999 and summer 1999-2000.

Treatments	Variable cost of both in *kharif* and summer	Total Cost of cultivation(Rs)		Seed yie!d(Kg/ha)		Gross return(Rs/ha)		Net Income(Rs/ha)		Benefit Cost ratio	
		Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
$S_1N_1F_1$	250	17,730	22,993	54.7	43.0	32,820	25,800	15,090	2,807	1.85	1.12
F_2	250	17,730	22,993	64.4	51.2	38,640	30,720	20,910	7,725	2.17	1.33
F_3	—	17,480	22,743	65.3	52.7	39,180	31,620	21,700	8,877	2.24	1.39
$S_1 N_2 F_1$	350	17,830	23,093	52.8	38.1	31,680	22,860	13,850	-233	1.77	-0.98
F_2	350	17,830	23,093	60.8	46.1	36,460	27,660	18,650	4,567	2.04	1.19
F_3	100	17,580	22,843	62.0	47.2	37,200	28,320	19,620	5,477	2.11	1.23
$S_1N_3F_1$	350	17,830	23,093	50.4	40.5	30,240	24,300	12,410	1,207	1.69	1.05
F_2	350	17,830	23,093	57.7	51.7	34,620	30,720	16,790	7,627	1.94	1.33
F_3	100	17,580	22,843	60.2	52.6	36,120	31,560	18,540	8,717	2.05	1.38
$S_2N_1F_1$	250	17,730	22,993	73.0	57.7	43,800	34,620	26,070	11,627	2.47	1.50
F_2	250	17,730	22,993	86.5	70.9	51,900	42,540	34,170	19,547	2.92	1.85
F_3	—	17,480	22,743	84.7	69.1	50,820	41,460	33,340	18,717	2.90	1.82
$S_2N_2F_1$	350	17,830	23,093	68.5	50.0	41,100	30,000	23,270	6,907	2.30	1.29
F_2	350	17,830	23,093	80.5	60.7	48,300	36,420	30,470	13,327	2.70	1.57
F_3	100	17,580	22,843	79.4	58.6	47,640	35,160	30,060	12,317	2.70	1.53
$S_2N_3F_1$	350	17,830	23,093	65.5	52.9	39,300	31,740	21,470	8,647	2.20	1.37
F_2	350	17,830	23,093	76.1	64.9	45,660	38,940	27,830	15,847	2.56	1.68
F_3	100	17,580	22,843	75.3	62.2	45,180	37,320	27,600	14,477	2.56	1.63

	Kharif	Summer
Cost of cultivation	Rs. 17,480	Rs. 22,743

Among two seasons, *kharif* accounted for lesser cost of cultivation (Table 3) towards the plant protection chemicals being used for control of serpentine leaf miner, pumpkin beetle and fruit fly. Especially serpentine leaf minor was suppressed due to usual rains prevailed during the months of August, September and October. In summer, the cost of plant protection chemicals alone was Rs 5,263 ha^{-1} against control of leaf miner due to more number sprays 9-10 times (once 5-6 days) during the crop growth.

The data reveal that the *kharif* season favoured help to get higher seed yield and resulted higher benefit cost ratio (2.92) by adopting narrow spacing, no nipping and retention of four fruits per vine ($S_2N_1F_2$).

REFERENCES

1. SESHADRI, V.S. (1990). Vegetable seed production in India. Problems, prospects and policies. Paper presented at international conference of Seed Science and Technology, New Delhi. Feb. 1990.
2. DHILLON, N.P.S. (1994). F_1 hybrid seed production in muskmelon (*Cucumis melo* L) management of the male sterile population. *Seed Sci. & Technol.* **22**(3): 601-605.
3. REINERS, S. & D.I.M. RIGGS (1999). Plant population affects yield and fruit size of pumpkin *Hort. Science* **34**(6): 1076-1078.
4. DEN. APM. NILS., MIOTAY. P. & APM. NIJS. DEN. (1991). Fruit and seed set in the cucumber (*Cucumis sativus* L) in relation to pollen tube growth sex type and parthenocapy. *Gartenbau-wissenschaft*, **56**(2): 46-49.
5. PANDITA, V.K. & K.S. RANDHAWA (1992). Seed production studies in muskmelon under different planting density and fertility levels. *Seed Res.* **20** (2): 144-146.
6. MANGAL J.L.& A.N. YADAVA (1979). Effect of plant population and prunning on performance of cucumber. *Punjab Horticultural Jouranal* **19**: 194-197.
7. HONNORATO.R., L. GUR. OVICH & R. PINA (1993). Absorption rates of N.P. and K in Cucumber for seed production. *Cienciae Investigation Agararia* **20**(3): 169-172.