

Effect of Plant Density and Shoot Pruning on Yield and Quality of Polyhouse Grown Cucumber

Navjot Singh Dhillon, Parveen Sharma,
K. D. Sharma, Pardeep Kumar

Received 20 January 2017; Accepted 22 February 2017; Published online 13 March 2017

Abstract Experiment was conducted in spring-summer season during 2015-16 to study the effect of plant density and training/pruning techniques on yield and quality of cucumber and to work out the economics of production. The experiment was laid out in factorial randomized block design with three replications, consisting of two plant spacings (70 × 30 cm and 70 × 60 cm) and two pruning methods, (two stems and control (no pruning)). Plants spaced at 70 × 30 cm were found to be the best for higher yield but fruit weight were better at closer spacing. Pruned plants also had higher quality fruits like fruit length, breadth and weight. Highest fruit yield/m² area and net returns/m² was recorded in unpruned plants at 70 × 30 cm spacing, whereas highest number of fruits/plant was in unpruned plants at 70 × 60 cm.

Keywords Cucumber, Polyhouse, Pruning, Spacing, Yield.

Introduction

Cucumber (*Cucumis sativus* L.) is a member of the gourd family Cucurbitaceae, which comprises of 117 genera and 825 species in warmer parts of the world [1]. It is a warm season crop and has little or no tolerance to frost. The optimum temperature for growing is between 20-30 °C. Under open environment cucumber is being grown in both summer and rainy seasons, with varying success due to various abiotic (low temperature and unpredictable weather) and biotic (red pumpkin beetle, fruit fly and incidence of downy/powdery mildew) stresses. Under the protected environment we can grow cucumber of good quality throughout the year in hills as compared to the open cultivation. In vegetable crops, profits are greatly dependent on the quantity and quality of the produce. Ideal plant geometry, pruning of leaves and side shoots contribute to the ultimate yield in various ways. Plant geometry and training maximizes the plant ability to obtain the sunlight needed for growth. It is also important to maintain adequate air movement around the plant to reduce risk of fungus and insect problems under the protected environment. On the other hand, dense canopy of leaves shade the fruits, causing them to be pale. Excessive pruning of leaves sometimes causes the plants to cease producing flowering. Therefore, it important to maintain proper spacing and sufficient foliage on the cucumber plant for adequate rates of photosynthesis under the protected environment.

Materials and Methods

The study was carried out in a modified naturally ven-

N. S. Dhillon, P. Sharma, K. D. Sharma*, P. Kumar
Department of Vegetable Science and Floriculture, CSK HPKV,
Palampur 176062, India
e-mail : andydhillon02@gmail.com

*Correspondence

Department of Agricultural Economics, Extension Education
and Rural Sociology, CSK HPKV, Palampur 176062, India.)

Table 1. Effect of plant density and shoot pruning on yield and related characters of cucumber.

Treatments	Days to 50% flowering	Days to first picking	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Number of fruits/plant	Fruit yield/plant (kg)	Fruit yield/m ² (kg)	Harvest duration (days)
Spacing									
70 × 30	27.3	39.0	16.2	4.2	127.1	17.6	2.2	11.0	50.7
70 × 60	25.8	38.0	16.7	4.3	128.6	19.7	2.6	6.3	52.5
CD (<i>p</i> = 0.05)	1.2	0.8	NS	NS	1.2	0.5	0.3	1.1	NS
Shoot pruning									
Two stems	24.3	35.7	17.1	4.6	135.6	14.8	2.0	6.9	55.3
Control (no pruning)	28.8	41.3	15.8	3.9	120.2	22.5	2.8	10.4	47.8
CD (<i>p</i> = 0.05)	1.2	0.8	0.2	0.4	1.2	0.5	0.3	1.1	2.5

tilated polyhouse at the experimental farm of Department of Vegetable Science and Floriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur during spring-summer season 2015-16. Public sector parthenocarpic cucumber hybrid Kian was used for conducting the trial. Nursery was raised in soil-less media having mixture of (cocopeat: perlite : vermiculite in the ratio of 3:1:1) and was transplanted under polyhouse in the month of March. The experiment was laid out in randomized block design (RBD) with three replications. Treatments comprised of two plant geometries (70 × 30 cm and 70 × 60 cm) and two pruning methods (unpruned and pruning to two stems). The observation were recorded on five plants taken randomly for the characters viz., days to flowering, days to first picking, fruit weight (g), fruit length (cm), fruit breadth (cm), number of fruits/plant, fruit yield/plant (kg), fruit yield (kg)/m² area, harvest duration (days), inter-nodal length (cm) and vine length (m). For total soluble solids (^obrix) the fruits were taken from the 5th picking. Economical analysis has also done on the basis of yield of the crop. The data on different parameters were subjected to statistical analysis by the method described by Cochran and Cox [2].

Results and Discussion

The wider spacing (70 × 60 cm) took significantly lesser number of days to flowering and to first picking than closer spacing (70 × 30 cm). This might be

due to availability of good sunshine and more nutrients availability to the plants at wider spacing that resulting in the accumulation of more photosynthesis and induction of early flowering as compared to closer spacing. The results are in close conformity with the finding of Jaffar and Wahid [3]. Pruned plants took significantly lesser number of days for flowering and to first picking than unpruned plants. The most probable reason for early female flower appearance in pruned plants was that the length of main shoot grew faster. Plants with two stem appeared to have quick absorption and utilization of nutrients and the various physiological processes boosted up at faster rate with a favorable balance between synthesis and utilization in flower induction. The findings are in accordance with the findings of earlier worker [4]. Similarly fruit weight was maximum at wider spacing as compared to the closer spacing. The results are in conformity with the findings of Kishor et al. [5]. Pruned plants had significantly more weight than unpruned plants. The reason for more weight of the fruits harvested from pruned plants was probably due to the better exposure of the plants to light, enhanced synthesis of photosynthates and more assimilation of carbohydrates. Findings are supported with the earlier conclusions drawn [6, 7]. Plant density had no significant effect on fruit length and fruit breadth Lopez et al. [8] also observed the same results. But pruning had significant effect on fruit length and fruit breadth. Pruned plants had more fruit length and breadth than unpruned plants (Table 1). The reason

Table 2. Effect of plant density and shoot pruning on quality and economic characters of cucumber.

Treatments	Inter-nodal length (cm)	Vine length (m)	TSS (^o Brix)	Cost of cultivation (Rs/m ²)	Gross return (Rs/m ²)	Net return (Rs/m ²)	Output : input ratio
Spacing							
70 × 30	9.7	2.1	2.8	73.9	219.7	145.8	3.0
70 × 60	9.6	2.0	2.9	56.1	126.3	70.3	2.3
CD (<i>p</i> =0.05)	NS	NS	NS	1.9	22.5	22.2	0.3
Shoot pruning							
Two stems	9.4	2.3	2.8	65.5	138.0	72.5	2.1
Control (no pruning)	9.8	3.8	2.8	64.5	208.0	142.5	3.2
CD (<i>p</i> = 0.05)	0.1	0.1	NS	NS	22.5	22.2	0.3

for better fruit size may be due to availability of favorable conditions, i.e. moisture, light, nutrients and less competition of plants among themselves in wider spacing. These results are again in line with the findings of Jaffar and Wahid [3]. Highest number of fruits/plant and fruit yield/plant was also at wider spacing of 70× 60 cm, whereas maximum fruit yield/m² area was at closer spacing of 70 × 30 cm. This might be due to higher plant population/unit area at narrow spacing. Similar findings were also reported earlier [9, 10]. Unpruned plants had highest number of fruits/plant, fruit yield /plant and fruit yield/m² area than pruned plants. Interaction affect between plant density and shoot pruning had significant influenced on number of fruits/plant and fruit yield/m² area. Maximum number of fruits/plant was recorded in unpruned plants at 70 × 60 cm spacing, whereas highest fruit yield/m² was recorded in unpruned plants at 70 × 30 cm spacing.

Plant density did not influence the harvest duration, inter-nodal length, vine length and total soluble solids. Pruned plants had significantly maximum harvest duration and vine length and minimum inter-nodal length than unpruned plants. Plant density significantly affected net returns and Output : Input ratio. Highest net returns and Output : Input ratio were recorded at a closer spacing of 70 × 30 cm. Shoot pruning also had significant influence on net returns and Output : Input ratio (Table 2). Highest net returns and Output : Input ratio was recorded in unpruned plants. Interaction between plant density and shoot pruning

had significant influence on net returns. Highest net returns/m² recorded in unpruned plants at 70 × 30 cm spacing.

Based upon present results, it can be concluded that plants spaced at 70 × 60 cm apart had higher number of fruits/plant and yield/plant. This was due to early flowering, early picking and longer harvest duration at wider spacing. Plants spaced at 70 × 30 cm

Table 3. Interaction effect of plant density and shoot pruning on cucumber.

Spacing	Shoot pruning		Mean
	Two stems	Control (no pruning)	
Number of fruits/plant			
70 cm × 30 cm	13.4	21.8	17.6
70 cm × 60 cm	16.2	23.1	19.7
Mean	14.8	22.5	
CD (<i>p</i> = 0.05)		0.8	
Yield/m² (kg)			
70 cm × 30 cm	8.6	13.4	11.0
70 cm × 60 cm	5.2	7.4	6.3
Mean	6.9	10.4	
CD (<i>p</i> = 0.05)		1.6	
Net return (Rs/m²)			
70 cm × 30 cm	96.9	194.6	145.8
70 cm × 60 cm	48.0	92.5	70.3
Mean	72.5	143.5	
CD (<i>p</i> =0.05)		31.4	

apart were found to be the best for higher yield but quality parameters like total soluble solids and fruit weight were better at 70 × 60 cm spacing (Table 3) Pruned plants also had higher quality fruits like fruit length, breadth and weight. Early flowering, early picking, longer harvest duration, higher vine length and smaller inter-nodal length was recorded in pruned plants. But unpruned plants had higher number of fruits/plant, yield/plant and also have higher yield/m² area. Unpruned plants spaced at 70 × 30 cm apart were proved to be the best for higher yield and higher economic returns.

References

1. Gopalkrishnan TR (2007) Cucurbits. In : Vegetable crops. New India Publ, pp 103.
2. Cochran WG, Cox GM (1963) Experimental designs. Asia Publ House, Bombay, pp 293—316.
3. Jaffar A, Wahid F (2014) Effect of row spacing on growth, yield and yield components of cucumber varieties. Sci Letters 2 : 33—38.
4. Ekwu LG, Nwokwu GN, Utobo EB (2013) Effect of mulching materials and pruning on growth and yield of cucumber (*Cucumis sativus* L.). Int J Agric Rural Dev 15 : 1014—1021.
5. Kishor S, Tomar BS, Balraj S, Munshi AD (2010) Effect of season, spacing and planting time on seed yield and quality in cucumber. Ind J Hort 67 : 66—69.
6. Utobo EB, Ekwu LG, Ogah EO, Nwokwu GN (2010) Growth and yield of cucumber varieties as influenced by pruning. Cont J Agron 4 : 23—27.
7. Santi A, Scarmuzza W, Soares D, Scarmuzza JF, Dallacort R, Krause W, Tieppo RC (2013) Performance and growth of conduction of Japanese cucumber in protected environment. Hort Brasileira 31 : 649—653.
8. Lopez J, Leon JJ, Amafor BM (2015) Production of cucumber (*Cucumis sativus* L.) depending on the density plantation under greenhouse. Eur Scient J 11 : 24.
9. Nerson H (2005) Plant density, fruit length and fruit type affect seed yield and quality in cucumber. Adv in Hort Sci 19 : 206—212.
10. Ngouajio M, Wang G, Hausbeck MK (2006) Changes in pickling cucumber yield and economic value in response to planting density. Crop Sci 46 : 1570—1575.