The Pharma Innovation Journal 2022; 11(4): 2030-2033

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(4): 2030-2033

www.thepharmajournal.com
Received: 01-01-2022
Accepted: 12-02-2022

Raveena
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh, India

Vinod Kumar Sharma
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh, India

Pooja
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh, India

Shilpa
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh, India

SK Yadav
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh, India

Mohan Singh
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh, India

Corresponding Author:
Raveena
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh, India

Investigation on effect of date of transplanting, planting geometry and training system on the fruit yield and economics of cucumber (*Cucumis sativus* L.) under naturally ventilated polyhouse

Raveena, Vinod Kumar Sharma, Pooja and Shilpa

Abstract
An experiment was conducted during the off-season 2017 at the Research Farm of Department of Agricultural Engineering, College of Agriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, to investigate the effect of date of transplanting, planting geometry and training system on the fruit quality, fruit yield and economics of cucumber (*Cucumis sativus* L.) under naturally ventilated polyhouse. The experiment was laid out in Factorial Randomized Block Design with three replications, consisting of eighteen treatments, comprising of three date of transplanting (1st fortnight of March, 2nd fortnight of March and 1st fortnight of April), two planting geometry *viz*., 60 cm x 30 cm, 75 cm x 30 cm and three training systems *viz*., two shoots, three shoots and four shoots. Results revealed that plants transplanted earlier (1st fortnight of March) at a wider spacing of (75 cm x 30 cm) recorded significantly higher fruit yield per plant (3.10 kg) while maximum fruit yield (1024.02 kg/100 m^2) was recorded under closer spacing of 60 cm x 30 cm. With regards to the number of shoots per plant, plants with three shoots recorded significantly higher fruit yield per plant (3.48 kg) and fruit yield (1084.69 kg/100 m^2). Study revealed that cucumber transplanted in the 1st fortnight of march, spaced at 60 cm x 30 cm and trained to three shoots recorded maximum gross return, net return and B:C ratio. So we can conclude that plants transplanted in the 1st fortnight of march, trained to three shoots and spaced at 60 cm x 30 cm apart were found to be the best for higher fruit yield and economic return.

Keywords: Cucumber, economic feasibility, protected agriculture, quality, soilless culture

Introduction
Cucumber (*Cucumis sativus* L., 2n = 14) belongs to Cucurbitaceae family, containing 118 genera with 825 species, it is one of the most important cucurbitaceous vegetable crops. It is a cross pollinated crop. It is grown in summer season as well as in rainy season also. It is thermophilic and highly frost susceptible crop. It is grown best at the temperature between 18-30 ℃. Cucumbers are composed of 96% water, which may help you increase hydration. It contains good amount of fibre, antioxidants, including tannins and flavonoids, which prevent the crop from harmful free radicals and may also decreases the risk of chronic disease**.** Now a days, cucumber is gaining importance due to awareness among consumers regarding its medicinal properties leading to increased demand, higher yield and income in short period of time which is attracting more farmers to cultivate. However, it is a frost susceptible, so during winter season, cultivation is difficult becaouse it causes injury. So it is one of the limiting factor for successful cultivation of cucumber especially during winter which adversely causes negative effect on the overall performance of cucumber like morphological growth, fruit set and ultimately interrupts supply chain. Under such prevailing condition, protected cultivation under polyhouse can be a feasible option to provide mere climate for crop growth and development (Kumar *et al.* 2007). Presently cucumber is gaining popularity for greenhouse cultivation due its indeterminate growth habit, response to training and pruning and also due to development of gynoecious parthenocarpic hybrids (Maragal *et al.* 2010) [14]. Transplanting time is one of the important factors as optimum date of transplanting has positive response in terms of proper growth and development of plants resulting in maximum yield of the crop and economic use of land (Longjam and Devi, 2009). Greenhouse production technology of cucumber emphasizes the need for proper density in order to boost up the production per unit area by utilizing the available space and nutrients applied. The previous researches showed that proper row spacing affected crop growth and yield.

In addition, spacing not only affected crop growth and yield but also influenced plant characters, insects, weeds, diseases, soil environment, germination and emergence (Sanni and Adenubi, 2012) [16].

Training methods vary with the cultivars and different growth habits, different plant densities of cucumber. Different training systems improves plant's ability to achieve the sunlight, required for favourable environment around the plant and also reduces the risk of fungus and insect problems. Manipulation of canopy architecture by training with appropriate spatial arrangements has been identified as an important management practices for getting good, marketable yields from greenhouse grown cucumber (Shivaraj *et al*. 2013). Very few reports are available on cucumber production under protected condition in India. Therefore, the aim of present study was to observe the effect of date of transplanting, planting geometry and training system on the fruit yield and economics of cucumber (*Cucumis sativus* L.) under natural ventilated polyhouse which would be beneficial for farmers.

Method and Material

The experiment was conducted at the Research Farm of Department of Agricultural Engineering, College of Agriculture, CSKHPKV, Palampur, Himachal Pradesh during off season in 2017. Experiment was laid out in factorial randomized block design with three replications. The experiment was comprising of total eighteen treatments, combination of three date of transplanting, two planting geometry and three training systems. The size of the polyhouse was 20 m × 12 m (240 sq.m) covered with aluminate sheet and ultra violet stabilized low density polyethylene sheet having 200 micron thickness. Mean annual rainfall ranges between 2000 to 2500 mm, minimum and maximum temperature of 10.31 ^{0}C to 24.00 ^{0}C and 21.64 °C to 37.07 ^{0}C, respectively. On an average, the greenhouse recorded 6.5 ^{0}C higher temperature than outside the polyhouse. The average relative humidity inside polyhouse ranged between 35.1 and 77.8 per cent during the growth period of the crop. The experimental site was properly tilled and prepared well manually. Beds of size 3.0 m x 1.2 m were thoroughly prepared and sterilized with 4 per cent formalin. The seeds of hybrid 'Isetis' were sown in plastic plug trays by using soiless media having coco peat, perlite and vermiculite in the ratio of 3:1:1 respectively. After 30-35 days of transplanting, plants were trained according to the different treatments like two shoots, three shoots and four shoots and staked with the help of nylon thread. Five plants from the net plot were tagged to record yield parameters like fruit yield per plant (kg) and fruit yield (kg/100m^2). For quality attributes, total soluble solid was determined with the help of hand refract meter, averaged and analyzed. Economics of cucumber production under polyhouse was worked out by considering the present price of inputs and produce. The analysis of variance (ANOVA) was performed to find out the significance of variation among the treatments while the statistical significance of various effects was tested at 5% probability level. The data recorded for various characters were subjected to statistical analysis using Cochren and Cox, (1963) method.

Results and Discussion

Yield attributes and yield

Fruit yield per plant (kg)

Result of the study (Table 1) revealed that fruit yield per plant decreased significantly as the transplanting of the crop delayed from 1st fortnight of March to 2nd fortnight of March and further to 1st fortnight of April. Maximum fruit yield (3.23 kg) was obtained when crop was transplanted in the 1st fortnight of March. This yield was significantly higher than later dates of transplanting. This might be attributed to the favourable climatic conditions that prevailed throughout the growth period of the crop transplanted in the 1st fortnight of March leading to higher vegetative growth, contributing to more number of flowers, more number of fruits per plant, maximum fruit weight and fruit volume. Similar results were obtained by Singh *et al*. (2002) [19], Eifediyi and Remison (2009) [6] and Kumar *et al*. (2018) [11].

Planting geometry also had a significant effect on fruit yield per plant. The crop planted at a spacing of 75 cm x 30 cm produced significantly higher fruit yield per plant (3.10 kg) than the crop planted at a spacing of 60 cm x 30 cm (2.63 kg). The crop planted at a closer spacing (60 cm x 30 cm) produced minimum fruit yield per plant. The reason for the higher fruit yield per plant may probably be due to less competition for light, nutrients, water and space in wider row-spacing compared to closer one. Similar results were also reported by Devi and Gopal krishnan (2004) [4], Nerson (2005) [15] and Kapuriya and Ameta (2017) [9].

Yield per plant is one of the most important factor which attributes to the yield per unit area. Improvement in quality and increase in yield will ultimately decide the practical utility of adopting different training systems in combination with varying plant population per unit area as Kosson *et al*. (2002) [10] observed that spacing in cucumber was linked with the method of training.

Table 1: Effect of different dates of transplanting, planting geometry and training system on the yield and economics of cucumber

Treatment	Fruit yield per plant (kg)	Fruit yield (kg/100m^2)	Gross Returns (Rs/100m^2)	Net Returns (Rs/100m^2)	B:C Ratio
1st fortnight of March	3.23	1154.02	34620.6	23546.9	2.13
2nd fortnight of March	2.89	964.44	28933.2	18521.3	1.78
1st fortnight of April	2.47	816.48	24494.4	14411.6	1.43
S.Em ±	0.04	14.42	-	-	-
CD(P=0.05)	0.11	41.43	-	-	-
60 cm x 30 cm	2.63	1024.02	10627.7	30720.6	20092.9
75 cm x 30 cm	3.10	932.61	10417.9	27978.3	17560.4
S.Em ±	0.03	11.77	-	-	-
CD(P=0.05)	0.09	33.83	-	-	-
Two shoots	2.70	978.16	10325.1	29344.8	19009.7
Three shoots	3.48	1084.69	10517.3	32540.7	22023.4
Four shoots	2.42	872.09	10726.1	26162.7	15436.6
S.Em ±	0.04	14.42	-	-	-
CD(P=0.05)	0.11	41.43	-	-	-

Fruit yield (kg/100m^2)

Result of the study revealed that fruit yield/100m^2 decreased significantly as the transplanting of the crop delayed from 1st fortnight of March to 2nd fortnight of March and further to 1st fortnight of April. Maximum fruit yield/100 m^2 (1154.02 kg) was obtained when crop was transplanted in the 1st fortnight of March. This yield was significantly higher than plantings in the 2nd fortnight of March and 1st fortnight of April. Cucumber transplanting in the 1st fortnight of March registered an increase of 19.66 and 41.34 per cent over the transplanting of cucumber in the 2nd fortnight of March and 1st fortnight of April, respectively. The later two dates of transplanting also differed significantly. This might be attributed to the favourable climatic conditions that prevailed throughout the growth period of the crop transplanted in the 1st fortnight of March leading to higher vegetative growth, contributing to more number of flowers, more number of fruits, maximum fruit weight and fruit volume. Similar results were obtained by Borah (2001) [1], Jaksungnaro and Akali-Sema (2001) [8] and Guo *et al*. (2008) [7].

Planting geometry also had significant effect on the fruit yield of cucumber and it was observed that significantly higher fruit yield/100m^2 (1154.02 kg) was recorded with the closer spacing of 60 cm x 30 cm and lowest (932.61 kg) with the wider spacing of 75 cm x 30 cm. Closer spacing of 60 cm x 30 cm on an average registered an increase of 9.80 per cent over wider spacing of 75 cm x 30 cm. This might be due to higher plant population per unit area at narrow spacing. A positive correlation was reported between stand density and yield and negative one between stand density and individual plant productivity. These results are in agreement with the Kapuriya and Ameta (2017) [9] and Kumari *et al*. (2020) [12].

Training systems also had a significant influence on fruit yield/100 m^2. Training the plants to three shoots recorded significantly higher fruit yield than plants trained to two and four shoots and this increase in yield was 10.89 and 24.30 per cent, respectively. The higher yield from the plants trained to three shoots may be attributed to its better performance in yield per plant which ultimately resulted in increase in yield per 100 m^2. Similar results were also reported by Utobo *et al*. (2010), Bhatia *et al*. (2012) [2] and Dhillon *et al*. (2017) [5].

Interaction effect of planting geometry and training systems had significant effect on fruit yield (Table 2). Highest fruit yield/100m^2 was recorded from three shoot trained plants spaced at 60 cm x 30 cm which was significantly higher than other treatment combinations of this study. Minimum fruit yield/100 m^2 was recorded from four shoot plants spaced at 75 cm x 30 cm. Two shoots trained plants spaced at 60 cm x 30 cm without differing with two shoot trained plants spaced at 75 cm x 30 cm and three shoot trained plants spaced at 75 cm x 30 cm.

Table 2: Interaction effect of planting geometry and training systems on fruit yield/100m^2 (kg)

Planting geometry	Training systems		
	Two shoots	Three shoots	Four Shoots
60 cm x 30 cm	987.16	1202.76	882.16
75 cm x 30 cm	969.17	966.62	862.02
S.Em ±		20.38	
CD(P=0.05)		58.59	

Economic studies

As a result of the study, cucumber transplanted in the 1st fortnight of March recorded maximum gross returns, net returns and B:C ratio followed by 2nd fortnight of March and 1st fortnight of April. The higher net returns and B:C ratio registered by the cucumber transplanted in the 1st fortnight of march are attributed to higher fruit yield by the plants transplanted in the 1st fortnight of march. Planting geometry of 60 cm x 30 cm recorded maximum gross returns, net returns and B:C ratio over 75 cm x 30 cm plant spacing. Training the plants to three shoots recorded maximum gross returns, net returns and B:C ratio as compared to two and four shoots trained plants.

Conclusion

From the experimental results, it was concluded that transplanting of cucumber in the 1st fortnight of March proved to be the best for higher yield and economic returns. Plants trained to three shoots and spaced at 60 cm x 30 cm apart were found to be the best for higher yield of the produce.

Hence, transplanting of cucumber at a spacing of 60 cm x 30 cm in the 1st fortnight of March and the plants trained to three shoots can be recommended for growing cucumber in cost effective naturally ventilated polyhouse for higher fruit yield and economic returns in mid hills of Himachal Pradesh.

References

1. Borah, RK. Effect of sowing dates on incidence of fruit fly (*Bactrocera cucurbitae* Coq.) and yield of cucumber (*Cucumis sativus* L.) in the Hill zones of Assam. Annals of Biology. 2001;17:211-212.
2. Bhatia AK, Batra VK, Singh VP. Performance of gynocecious hybrids of cucumber under plastic greenhouse. High value vegetables in Southeast Asia Production, Supply and Demand (SEAVEG) Report, 2012.
3. Cochran WG, Cox GM. Experimental Designs. Asia publishing house, Bombay, 1963, 293-316.
4. Devi MJ, Gopalkrishnan TR. Spacing influences growth and productivity of less spreading and short duration oriental pickling melon (*Cucumis melo var. common Mak.* cv. saubhagya). Journal of Tropical Agriculture. 2004;42(1):59-62.
5. Dhillon NS, Sharma, P, Kumar P, Singh H. Influence of training on vegetative growth characteristics and yield of polyhouse grown cucumber. Journal of Experimental Agriculture International. 2017;18:1-5.
6. Eifediyi EK, Remison SU. Effect of time of planting on the growth and yield of five varieties of cucumber (*Cucumis sativus* L.). Report and Opinion. 2009;1(5):81-90.
7. Guo R, Xiaolin L, Christie P, Qing C, Zhang F. Seasonal temperatures have more influence than nitrogen fertilizer rates on cucumber yield and nitrogen uptake in a double cropping system. Environmental pollution 2008;151(3):443-451.
8. Jaksungnaro, Akali-Sema. Effect of sowing time and nitrogen level on growth, yield and quality of cucumber variety AAUC2. Haryana Journal of Horticultural Science. 2001;30:108-110.
9. Kapuriya VK, Ameta KD, Teli SK, Chittora A, Gathala S, Yadav S. Effect of spacing and training on growth and yield of polyhouse grown cucumber (*Cucumis sativus* L.). International Journal of Current Microbiology.

2017;6:299-304.
10. Kosson R, Dobrzanska J. The effect of plant training system on yielding and storability of cucumber fruits. Vegetable Crops Research Bulletin. 2002;56:57-65.
11. Kumar S, Patel NB, Saravaiya SN. Influence of fertigation and training systems on yield and other horticultural traits in greenhouse cucumber. Indian J Hortic. 2018;75:252-258.
12. Kumari S, Singh P, Bhardwaj A, Kumar R, Sharma R. K. Effect of fertigation levels and spacing on growth and yield of cucumber (*Cucumis sativus* L.) cv. KPCH-1 grown under polyhouse. International Journal Communication and Society. 2020;8:1065-1070.
13. Longjam M, Devi AB. Investigation on effect of time of planting in cucumber (*Cucumis sativus* L.) under polyhouse conditions in Manipur, India. Journal of Applied and Natural Sciences. 2020;9:1651-1657.
14. Maragal SY, Singh AK, Behera TK, Munshi AD, Dash S. Effect of planting time and fertilizer dose on growth, yield and quality of parthenocarpic cucumber (*Cucumis sativus* L.) grown under polyhouse and nethouse conditions. Indian J Agric. Sci. 2018;88:63-9.
15. Nerson H. Plant density, fruit length and fruit type affect seed yield and quality in cucumber. Advances in Horticultural Science. 2005;19(4):206-212
16. Sanni KO, Adenubi OO. Influence of intra row spacing on weed suppression in cucumber (*Cucumis sativus* L.) production in humid rainforest agro-ecological zone of lagos, Nigeria. Global Journal Ecology. 2010;5:38-43.
17. Sharma D, Sharma K, Kumari A. Effect of spacing and training on growth and yield of polyhouse grown hybrid cucumber (*Cucumis sativus* L.). International Journal of Current Microbiology. 2018;7:1844-1852.
18. Shivaraj D, Prasanth P, Lakshminarayana D and Ramesh T. Studies on the Effect of Training Systems on Cucumber (*Cucumis sativus* L.) cv. Malini Grown under Protected Condition. Curr. Appl. Sci. Technol 2020;39:539-544.
19. Singh SK, Chaudhary BM, Prasad KK, Suman S. Early production of important cucurbitaceous vegetables. Journal of Applied Biology. 2002;12:49-53.
20. Utobo EB, Ekwu LG, Ogah EO, Nwokwu GN. Growth and yield of cucumber varieties as influenced by pruning. Continental Journal of Agronomy. 2010;4:23-27.