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Performance of Different Varieties of Cucumber (*Cucumis sativus*) under Prayagraj Agro-Climatic Condition

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Eight cucumber varieties were evaluated at SHUATS, Prayagraj Uttar Pradesh, in randomized block design with three replications during *summer* season-2022 for growth, yield and fruit quality traits. The variety AGRI GREEN gave maximum mean value for maximum vine length (217.33cm), number of primary branches (5.67), number of nodes per plant (39.10), Days to first female flower appearance and node to first female flower appearance were minimum and that was about (50.76) and (4.33) respectively, fruit length and weight with (15.83cm) and (126.00gm) respectively), node number at which first female flower appears (4.33), number of female flowers per Plant (16.37), fruit yield/ha (164.10 q/ha), number of fruits per plant (13.30), TSS (4.20 ^{o}Brix), was observed in same variety. The maximum fruit diameter was found in SS-100 (45.50 mm). AGRI GREEN was found superior based on overall performance in terms of growth, yield, and quality parameters. The study revealed that, these varieties of cucumber provide high benefit to the farmers through easy cultivation, better stress tolerance, diseases resistance and higher yields.

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Keywords: Varieties treatment; cucumber; growth; yield.

1. INTRODUCTION

Cucumber (*Cucumis sativus*) is a member of the family Cucurbitaceae, the family Cucurbitaceae is moderately large one, comprising about 117 genera and 825 species. It is grown in summer season [1]. Cucumber is a thermophilic and frost susceptible species preferring warm weather and bright light for its better growth and development. It grows best at a temperature range of 18-30^{o}C. Cucumber can grow on a wide range of soil but can do best on deep well drained sandy loam soils with a pH of 5.5-6.7 and high content of organic matter. This implies that sex expression in the plant is subject to regulation by a number of environmental factors such as photoperiod, temperature and plant hormones [2]. On the basis of flowering habit, cucumber has three types- “gynoecious” which produces only female flowers, “predominantly gynoecious” which also bears some male flowers and “monoecious” which produces both male and female flowers. The first two types produce fruits parthenocarpically and fruit development takes place without pollination whereas pollination is required by monoecious types for seed setting which is accomplished by honey bees [3]. As the lateral branches are developed, flower clusters appear at leaf axils. In conventional cultivars, the first cluster always consists of male flowers in response to photoperiod in exceeding of 14 hrs. Female flowers normally do not appear until the day length begins to decline. The flowers are monoecious and flowering start normally 40-45 days after sowing depending on the weather conditions. Under long days and high light intensities male (staminate) flowers predominate, whereas under short days and low light intensities female (pistillate) flowers predominate [4]. In a typical monoecious sex form, the number of staminate flowers is produced in far greater proportion than pistillate flowers from 25-30: 1-15.

The condition with greater number of pistillate flowers per plant is advantageous and economical as it results in higher fruit set and yield. Sex ratio is highly sensitive to environmental conditions. High N, long days and high temperature generally promote the greater number of male flowers. The proportion of male and female flowers affects the yield and the cultivars having more pistillate flowers will set more fruits resulting in higher yields. The productivity of a particular crop in an area largely depends on the environment and protected cultivation is widely used to provide and maintain a controlled environment suitable for optimum crop production [5]. Limitation of weather and small holdings faced by agriculturists can be mitigated to large extent by protected cultivation. The green houses protect the crop from extreme climatic conditions ensuring round the year harvest. The low-cost bamboo-based greenhouse structures covered with polythene are now within the reach of small and marginal farmers [6]. According to (Narayan et al*.,* 2008) training is an important practice which enhances vegetative growth, yield and quality of fruits. The exposure to sunlight helps in physiological and photosynthetic activities leading to more growth, flowering, fruit development and ultimately higher yields of better quality. Lower light intensity gives rise to more female flowers where as high light intensity causes more male flowers [7]. The plant requires fertile soil, infertile soil results, bitter taste and misshapen fruits that are rejected by consumers [7]. Cucumber rarely grows luxuriantly in infertile soils, hence, its level of susceptibility to poor soil fertility manifests in the form of low fruit yield, bitter and malformed fruits that have little marketability value. However, the nutrient requirements of the crop vary depending on soil type, native fertility, previous cropping and cultural practices but it responds positively to organic, inorganic or combined nutrient applications for optimum growth and productivity [8]. Breeding for disease resistance, use of amended cultural practices tend to stimulate the production of pistillate flowers and increase cucumber yields, [8]. At present, farmers are growing some hybrids which are having varying levels of yield and quality but there is considerable scope and demand for high yielding as well as good quality varieties or hybrids. The main constrains for cucumber cultivation are irrigation facilities, labor, construction of adequate storage structures in view of the nature of the fruit, and pests and diseases control and management. There is considerable scope and demand for high yielding and good quality cultivars Rajawat et al*.,* [9].

This study aimed to evaluate the performance of various Varieties of cucumber in terms of growth, yield and quality and to estimates the economics of various varieties under Prayagraj agro-climatic condition.

2. MATERIALS AND METHODS

The present investigation entitled "Performance of different varieties of Cucumber (*Cucumis sativus*) under Prayagraj Agro-Climatic Condition" was carried out during the *summer* season of the year, 2022 at vegetable research farm, Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (U.P.). Soils of the experimental site are classified as rich loam soil. The annual rainfall in the region is about 1042 mm. The experiment was laid out in randomized block design with three replications on 1st March 2022. The sowing was done on flat beds with spacing of 75 cm and 1 m plant to plant and row to row respectively, each plot with 6 plants. Adopting the recommended cultivation practices for raising a healthy crop and stacking was given for vine climbing. Data were recorded on all the important characters pertaining to the present study. There were total eight variety treatment of Cucumber viz. V_1 (Heera), V_2 (Sampada-95), V_3 (F-999), T_4 (Wonder Green Long), V_5 (Ss-100), V_6 (Green Long) and V_7 (Kh-10), V_8 (Agi Green).

2.1 Statistical Analysis

The Data recorded throughout the course of investigation was subjected to Statistical analysis by using analysis of variance (ANOVA) for randomized block design (RBD) by Fischer and Yates (1963). Whenever 'F' test was found significant for comparing the means of two treatments, a critical difference (C. D. at 5%) was worked out.

3. RESULTS AND DISCUSSION

Growth Parameters: Data pertaining to growth parameters which are Vine length (cm), Number of branches per plant, Number of nodes per plant

3.1 Vine Length (cm)

The data related to the length of main axis of plant are given in Table 1. The various varieties treatments have significant effect on length of main axis of plant. At harvesting time, maximum vine length (217.33 cm) was recorded in variety V_8 (Agri Green) and minimum (174.67 cm) vine length was recorded in V_3 (F-999) which were significantly different.

3.2 No of Branches per Vine

The results obtained on the effect of different varieties treatments on number of branches per plant have been presented in Table 1. The results revealed that various treatments significantly influenced the number of branches per plant. The maximum number of branches per plant (5.57) was recorded in V_8 Agri Green and V_3 F-999 recorded significantly the lowest number of branches per plant (2.33).

3.3 No of Nodes per Plant

The results obtained on the effect of different varieties treatments on number of nodes per plant have been presented in Table 1. The results revealed that various treatments significantly influenced the number of nodes per plant. The maximum number of nodes per plant (39.10) was recorded in V_8 Agri Green and F-999 recorded significantly the lowest number of nodes per plant (30.27).

Earliness parameters: Data pertaining to earliness parameters which are days to emergence of 1st male flower. days to emergence of 1st female flower, node No. at which 1st male flower in appears, node No at which 1st female flower in appear, number of Male flowers, number of Female flowers, Sex ratio, days to first fruit setting, days to first fruit picking.

3.4 Days to Emergence of 1st Male Flower

The data related to Days of 1st male flower is given in Table 2 and showed significant differences among the varieties and the days to the emergence of first male flower which ranged from 35.83 to 43.33 and minimum days to emergence of first male flower were recorded in Agri green (35.00), while maximum days to first male flower were recorded in F-999 (43.33).

3.5 Days Emergence of 1st Female Flower

The data related to Days of 1st female flower is given in Table 2 and showed significant differences among the varieties the days to the emergence of first female flower which ranged from 50.76 to 57.22 and minimum days to emergence of first female flower were recorded in Agri green (50.76), while maximum days to emergence of first female flower were recorded in F-999 (57.22).

3.6 Node Number at Which First Male Flower Emergence

The data related Node at first male flower emergence is given in Table 2 and showed significant differences among the varieties the node number to first male flower which ranged from 3.67 to 5.67 and minimum node number to

first male flower was recorded in Ss-100 (3.67), while maximum node number to first male flower was recorded in F-999 (5.67).

3.7 Node Number at Which First Female Flower Emergence

The data related Node at first female flower emergence is given in Table 2 and showed significant differences among the varieties the node number to first female flower which ranged from 4.33 to 9.67 and minimum node number to first female flower was recorded in Agri green (4.33), while maximum node number to first female flower was recorded in Sampada-95 (9.67).

3.8 No of Male Flowers

The data related to no of male flowers is given in Table 2 and showed significant differences among the varieties the number to male flower which ranged from 65.57 to 90.20 and minimum number of male flowers was recorded in Green long (65.57), while maximum number of male flowers was recorded in Agri green (90.20).

3.9 No of Female Flowers

The data related to no of female flowers is given in Table 2 and showed significant differences among the varieties for the number to female flower which ranged from 8.47 to 16.37 and minimum number of female flowers was recorded in F-999 (8.47), while maximum number of female flowers was recorded in Agri green (16.37).

3.10 Sex Ratio

The data related to Sex ratio is given in Table 2 and showed significant differences among the varieties for sex ratio which ranged from 5.50 to 8.11 and minimum number of female flowers was recorded in F-999 (8.47), while maximum number of female flowers was recorded in Agri green (16.37).

3.11 Days Taken to First Fruit Setting

The data related to Days taken to first fruit setting is given in Table 3 and showed significant differences among the varieties for Days taken to first fruit at ranges between 54.20-60.78 to days after sowing. The significantly minimum days taken to fruit setting at (54.20) days after sowing recorded in the variety Kh-10, Whereas, maximum days taken to fruit setting was recorded in the variety F-999 (60.78).

3.12 Days Taken to First Fruit Picking

The data related to Days taken to Days taken to first fruit picking is given in Table 3 and showed significant differences among the varieties for Days taken to first fruit picking which ranged from 58.73 to 64.11 and minimum days to first fruit picking were recorded in Agri green (58.73), while maximum days to first fruit picking were recorded in F-999 (64.11).

3.13 Number of Pickings

The data related to Number of Pickings is given in Table 3 and showed significant differences among the varieties for Number of Pickings which ranged from 4.30 to 7.56 and minimum number of pickings was recorded in F-999 (4.30), while maximum number of pickings was recorded in Agri green (7.56).

Table 1. Performance of different varieties on growth parameter notation

Notation	Treatments	Vine length (cm) (At harvest)	Number of branches per vine	No of Nodes (At harvest)
V_1	Heera	208.33	3.33	37.10
V_2	Sampada-95	195.33	5.33	35.47
V_3	F-999	174.67	2.33	30.27
V_4	Wonder Green long	201.67	3.67	36.23
V_5	Ss-100	192.67	4.00	32.97
V_6	Green Long	190.00	3.00	34.27
V_7	Kh-10	198.00	2.67	32.00
V_8	Agri Green	217.33	5.67	39.10
F-Test		S	S	S
SE(d)±		6.75	0.66	1.83
CD 5%		14.48	1.41	3.93
C.V		4.19	21.47	6.47

Table 2. Performance of different varieties on earliness parameter of cucumber

Notation	Treatments	Days to 1st male flower	Days to 1st female flower	Node at 1st male flower emergence	Node at 1st female flower emergence	No of Male flowers	No of Female flowers	Sex ratio
V_1	Heera	39.33	55.96	4.33	4.67	87.06	12.40	7.02
V_2	Sampada-95	38.67	55.67	4.67	9.67	75.13	10.53	7.13
V_3	F-999	43.33	57.22	5.67	8.33	69.30	8.47	8.11
V_4	Wonder Green long	37.33	54.87	4.33	7.33	68.37	9.77	6.90
V_5	Ss-100	38.00	56.89	3.67	8.00	74.97	10.33	7.20
V_6	Green Long	39.67	54.89	4.33	6.33	65.57	9.57	6.80
V_7	Kh-10	38.33	52.52	3.67	6.00	80.40	11.57	6.90
V_8	Agri Green	35.00	50.76	4.00	4.33	90.20	16.37	5.50
F-Test		S	S	NS	S	S	S	S
SE(d)±		0.93	2.14	0.55	1.32	0.87	1.07	0.09
CD 5%		2.00	4.59	1.18	2.82	1.86	2.29	0.19
C.V		2.95	4.80	15.61	23.64	1.39	11.76	1.57

Table 3. Performance of different varieties on earliness parameter of cucumber

Notation	Treatments	Days taken to first fruit setting	Days taken to first fruit picking	Number of Picking
V_1	Heera	58.33	61.89	6.52
V_2	Sampada-95	56.00	60.78	6.89
V_3	F-999	60.78	64.11	4.30
V_4	Wonder Green long	58.56	62.11	5.22
V_5	Ss-100	59.27	63.17	4.90
V_6	Green Long	57.14	61.27	5.00
V_7	Kh-10	54.20	59.60	6.10
V_8	Agri Green	55.56	58.73	7.56
F-Test		S	S	S
SE(d)±		1.68	1.48	0.89
CD 5%		3.61	3.18	1.91
C.V		3.59	2.96	18.73

Yield parameters: Data pertaining to yield parameters which are Fruit length (cm), Fruit diameter (cm), Number of fruits per plant, Fruit weight (kg), Total fruit yield per plot (kg), Fruit yield per hectare (tones).

3.14 Number of Fruits per Plant

The data presenting to number of fruits per plant as affected by various Varieties treatments are presented in Table 4. Results indicated that Fruit yield per plant was recorded between ranges 8.47 to 13.30. The variety Agri Green (13.30 fruit per plant) was found significantly superior as compared to rest of the varieties. While, the lowest (8.47 fruit per plant) was noted in the variety F-999.

3.15 Average Weight of Fruits (g)

The data as presented in Table 4 revealed that various varieties treatments has a significant effect on average weight of fruit (g) of Cucumber. It is observed from the data that fruit weight was recorded between the ranges 93.43 to 126.00 g. The variety Agri green was found significantly superior (126 g) as compared to rest of the varieties. While, the lowest (93.33 g) average weight of fruits was noted in the variety F-999.

3.16 Fruit Length (cm)

The mean data on fruit length (cm) of Cucumber as affected by different varieties treatments are presented in Table 4. There was significant difference found in various varieties of fruit length

Table 4. Performance of different varieties on yield parameter of cucumber

Notation	Treatments	Fruit per plant	Average weight of fruits(g)	Fruits Length (cm)	Fruit Diameter (mm)	Total fruit yield per plot (kg)	Fruit yield (q/ha)
V_1	Heera	10.27	110.33	13.40	41.23	18.60	146.77
V_2	Sampada-95	10.53	121.33	14.77	42.03	21.20	159.10
V_3	F-999	8.47	93.43	13.47	38.97	16.37	134.43
V_4	Wonder Green long	9.77	121.07	14.13	40.90	19.33	156.60
V_5	Ss-100	10.33	118.33	12.27	45.50	17.73	146.40
V_6	Green Long	9.57	111.67	15.10	43.07	19.53	145.53
V_7	Kh-10	11.57	101.63	14.90	39.90	17.70	137.33
V_8	Agri Green	13.30	126.00	15.83	41.90	21.53	164.10
F-test		S	S	S	S	S	S
SE(d)±		1.06	7.13	0.43	1.43	1.12	4.58
CD 5%		2.28	15.29	0.92	3.07	2.41	9.82
C.V		12.43	7.73	3.39	4.20	7.24	3.77

Table 5. Performance of different varieties on quality parameter of cucumber

Notation	Treatments	TSS (°Brix)	Ascorbic acid (mg/100 g)	Hedonic Rating
V_1	Heera	2.90	1.43	5.67
V_2	Sampada-95	3.10	1.33	7.00
V_3	F-999	2.50	1.57	6.00
V_4	Wonder Green long	4.10	1.40	6.33
V_5	Ss-100	3.33	1.37	6.67
V_6	Green Long	2.80	1.40	7.17
V_7	Kh-10	4.13	1.30	8.60
V_8	Agri Green	4.20	1.20	8.00
F-test		S	S	S
SE(d)±		0.07	0.08	0.79
CD 5%		0.16	0.17	1.70
C.V		2.62	6.92	13.97

Table 6. Performance of different varieties on economics

Notation	Treatments	Gross return (Rs. /ha)	Cost of cultivation (Rs. /ha)	Net return (Rs. /ha)	B:C Ratio
V_1	Heera	2,93,540	1,34,257	1,59,283	2.18
V_2	Sampada-95	3,18,200	1,37,382	1,80,818	2.31
V_3	F-999	2,68,860	1,32,632	1,36,228	2.02
V_4	Wonder Green long	3,13,200	1,36,007	1,77,193	2.30
V_5	Ss-100	2,92,800	1,31,132	1,61,668	2.23
V_6	Green Long	2,91,060	1,36,384	1,54,676	2.13
V_7	Kh-10	2,74,660	1,36,882	1,37,778	2.06
V_8	Agri Green	3,28,200	1,32,132	1,96,068	2.48

which ranged from 12.27cm to 15.83cm. The mean values for fruit length revealed that the maximum fruit length was recorded in the Agri green (15.83cm) and Minimum was recorded in the Ss-100 (12.27cm).

3.17 Fruit Diameter (cm)

The mean data on fruit diameter (mm) of Cucumber as affected by different varieties treatments are presented in Table 4. There was significant difference found in various varieties of fruit diameter which ranged from 38.97mm to 45.50mm. The mean values for fruit diameter revealed that the maximum fruit diameter was recorded in the Ss-100 (45.50mm) and minimum was recorded in the F-999 (38.97mm).

3.18 Fruit Yield per Plot (kg)

The mean data on fruit yield (kg/plot) of Cucumber as affected by different varieties treatments are presented in Table 4. There was significant difference found in various varieties for fruit yield per plot which ranged from 16.37 to 21.53 kg. The mean values for fruit yield per plot revealed that the maximum fruit yield per plot was recorded in the Agri green (21.53kg) and minimum was recorded in the F-999 (16.37kg).

3.19 Fruit Yield (q/ha)

The fruit yield (q/ha) of cucumber as affected by various treatments and different varieties treatments are presented in Table 4. There was significant difference found in various varieties for fruit yield (q/ha) which ranged from 134.43 to 164.10. The mean values for fruit yield per plot revealed that the maximum fruit yield (q/ha) was recorded in the Agri green (164.10q/ha) and minimum was recorded in the F-999 (134.43q/ha).

Quality parameters: Data pertaining to Quality parameters which are TSS (^{o}Brix), Vitamin C (mg/100g), Organoleptic test.

3.20 TSS (°Brix)

The mean data on TSS of Cucumber affected by different varieties treatments are presented in Table 5. There was significant difference found in various varieties for Total Soluble Solid (^{o}Brix) which ranged from 2.50 to 4.20. The maximum Total Soluble Solid (^{o}Brix) was recorded in the Agri green (4.20^{o}Brix) and minimum was recorded in the F-999 (2.50^{o}Brix).

3.21 Ascorbic Acid (mg/100 g)

The analysis of variance presented in Table 5 showed significant differences among varieties treatments and their interactions for Vitamin C (mg/100g) and ranged from 1.20 to 1.57. The mean values for Ascorbic acid (mg/100g) revealed that the maximum Ascorbic acid (mg/100g) was recorded in the F-999 with (1.57 (mg/100g)) and Followed by the Heera with (1.43(mg/100g)) and Minimum was recorded in the Agri green with (1.20 (mg/100g).

3.22 Organoleptic Test

The mean data on Organoleptic Test of Cucumber affected by different varieties treatments are presented in Table 5. There was significant difference found in various varieties for Organoleptic test based on taste, flavor and overall acceptability on Hedonic scale rating was recorded ranged from 5.67 to 8.60. The mean values for overall acceptability on hedonic scale was revealed the maximum hedonic scale rating was recorded in the Kh-10 (8.60) and minimum was recorded in the Heera (5.67).

Cost benefit analysis: Considering all the economics of different Varieties treatment It can be seen from the Table 6 that Cucumber Variety V_8 recorded higher net monitory returns (Rs 196068) and lowest net monitory return in Variety V_3 F-999 (Rs 136228). The maximum B:C ratio was obtained in Agri green (2.48) followed by Sampada-95 (2.31), while the minimum B:C ratio was obtained in F-999(2.02).

4. DISCUSSION

The analysis of variance indicated significant differences for all the characters indicating variation in the materials. The vine length, number of branches per plant increased significantly with the increase in crop growth stages. It might be due to the inherent genetic makeup of the varieties, interaction with the microclimate prevails. The increase in vine length, may largely determine by variety characteristics. The similar finding were also recorded by Ahmed et al*.,* (2004), Eifediyi and Samson [10], Golabadi et al*.,* [11], Patel et al*.,* [12] and Khan et al*.,* (2015). It is concluded that the reason for number of nodes per plant is a varietal character or it may be increased due to the different rates of photosynthesis and photosynthates supply for maximum growth.

These findings are in agreement with the results reported by Haque et al*.,* (2009), Sharma et al*.,* [13], Thappa et al*.,* (2011) and Golabadi et al*.,* [11]. The variation in first appearance of male flower, female flower, node number at which first male flower appeared, node number at which first female flower appear, might have been due to internodal length, number of internodes, genetic factor, environmental factor, hormonal factor and vigour of the crop [14-16]. Number of male flowers, number of female flowers, Sex ratio is highly sensitive to environmental conditions, High N, long days and high temperature generally promote the greater number of male flowers. The proportion of male and female flowers affects the yield and the cultivars having more pistillate flowers will set more fruits resulting in higher yields [17,18]. The variation in number of fruits per plant, total fruit yield might have been due sex ratio, fruit set percentage, genetic nature and their response to varying environmental conditions. Similar results also been reported by Jat et al. (2014). The variation in fruit length, fruit diameter, fruit weight might have been due to genetic nature, environmental factor and vigour of the crop. These findings are in agreement with several workers reported by Sharma et al., [13]. Golabadi et al*.* [11] and Tekale et al*.,* (2014). The Ascorbic Acid (mg/100g), T.S.S. value in varieties might be due to its inherent characteristics. The similar finding were also recorded by Jeevansab (2000), Megharaja (2000), Ganesan (2003) and Choi et al*.,* (2012). The organoleptice score. It might be due to microbial spoilage more yellowing and shriveling of cucumber. The Finding corroborates with their results obtained by Patel et al*.,* [12].

5. CONCLUSION

From the present investigation, it is concluded that the Cucumber variety Agri Green (V_8) was found most suitable for growth, yield, quality characters and F-999 variety given poor performance under Prayagraj agro climate condition, V_8 recorded with maximum Vine length (217.33cm), fruit weight (126g), Fruit Length (15.83), Fruit yield per plot (21.53), Fruit yield (164.10 q/ha). The highest Cost-Benefit ratio also found in the same variety i.e., Agri Green with (2.52).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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