**PERFORMANCE OF DIFFERENT VARITIES OF CUCUMBER (*Cucumis sativus* L.) UNDER PRAYAGRAJ AGRO – CLIMATIC CONDITIONS*”***

**ABSTRACT**

A field study was conducted during the Rabi season of 2024 at SHUATS in Prayagraj, Uttar Pradesh, to evaluate eight cucumber varieties using a randomized block design with three replications. The evaluation focused on key parameters, including growth, yield, and fruit quality traits. Among the tested varieties, 2021/CUCUVAR-2 consistently outperformed the others. This variety exhibited the longest vine length (2.56 m) and the highest mean number of primary branches (5.57). It also achieved the earliest appearance of the first female flower (36.07 days) with the lowest node position for this occurrence (3.40 nodes).Furthermore, the fruit produced by 2021/CUCUVAR-2 stood out in terms of quality. It recorded an impressive fruit length of 16.90 cm, an average fruit weight of 179.18 g, and a maximum fruit diameter of 42.47 mm. In addition, this variety generated a higher number of female flowers per plant (15.47), more fruits per plant (12.55), and yielded a remarkable 38.13 t/ha. The fruit quality was further supported by a total soluble solids (TSS) content of 3.00 °Brix.Overall, the superior performance of 2021/CUCUVAR-2 in growth, yield, and quality parameters suggests that its cultivation can offer significant benefits to farmers. These benefits include ease of cultivation, enhanced stress tolerance, improved disease resistance, and higher overall productivity.

**Keywords**: Varieties, treatment, cucumber, growth, yield.

**1. INTRODUCTION**

**Cucumber (*Cucumis sativus* L.)** is a highly popular vegetable in the Cucurbitaceae family, characterized by a chromosome number of 2n = 14. Botanically classified as a pepo, cucumber is among the largest groups of summer crops and is extensively grown in tropical, subtropical, and other suitable zones of India. Since ancient times, cucurbits have played a vital role in human society, not only as essential food sources but also as raw materials for various utensils. Originally native to Southern Asia, cucumber is now cultivated on most continents, with numerous varieties traded globally **(Rajawat *et al*., 2017).**

Plants within the Cucurbitaceae family thrive in both tropical and temperate climates. Many of these edible species were among the first plants domesticated in both the Old and New Worlds, contributing significantly to human nutrition. The family is notable for its impressive diversity, with a high percentage of species consumed by humans. Most cucurbits are monoecious, producing both male and female flowers on the same plant; however, exceptions such as Coccinea and pointed gourd (Parval) are dioecious. In some crops like melons, cultivars exhibiting hermaphroditic or andro-monoecious traits are also available. Botanically, the fruit is classified as a pepo, and environmental factors such as light intensity influence flower production—lower light promotes more female flowers, while higher light intensity favors male flowers **(Elsheikh and Ahmed, 2005).**

In the field of variety plant architecture characteristics, due to the common characteristics of optimized internode configuration and reasonable spatial distribution of leaves in ideal plant architecture, researchers have constructed a leaf morphology–physiology coordination analysis system to reveal the high-yielding plant architectural features of crops through the analysis of indicators such as leaf area, leaf length, leaf width, leaf angle, specific leaf weight, specific leaf nitrogen, yield, and mature yield components. Previous research has employed a variety of methods to analysis differences in plant architecture, including traditional morphological measurements, modern phenomics techniques (such as 3D imaging and point cloud analysis and hyperspectral and thermal imaging), and genome-wide association studies (GWASs). These studies have indicated that compact plant architectures tend to enhance the light interception efficiency of plant populations, while more open architectures offer advantages in terms of photosynthetic product translocation efficiency. Plant architectural traits are not only dynamically regulated by light and temperature conditions as well as hormonal signalling networks but also reflect the trade-offs in the allocation of carbon assimilates among roots, stems, leaves, and reproductive organs such as flowers and fruits. For example, indeterminate growth types tend to favour continuous vegetative growth, whereas determinate growth types prioritize fruit development. The analysis of plant architectural traits holds significant research importance for several key areas: breeding optimization and cultivar design, precision in crop management, efficient use and sustainable development of resources, adaptation to climate change, and the promotion of interdisciplinary research. 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, labour, 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*., 2017).**

**2.** **MATERIALS AND METHODS:**

**2.1. Experimental Site**

The present investigation was carried out at the Horticultural Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology, and Sciences, Prayagraj, U.P., during the *Zaid* season 2024. All types of facilities necessary for the cultivation of a successful crop, including field preparation, inputs, irrigation facilities and labourers were provided from the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P.

**2.2. Location and climatic conditions of the experimental farm**

Prayagraj falls in the central plain sub-zone of Argo-climatic zone V (*Source: Perspective and Strategic Plan (SPSP) for IWMP* of Uttar Pradesh, Department of Land Development and Water Resources, Government of U.P.). Naini is situated between the parallels of 20° 33’ to 21° 50’ N latitude and 73° 27’’ and 73° 56’’ E longitude. The climate of this area is tropical characterized by a fairly hot summer, moderately cold winter, with humid and warm monsoon. The rainfall of this region is heavy and normally received from June to September. Most of the precipitation is received through the south-west advancing monsoon, concentrating in the months of July and August.

**2.3. Experimental Materials**

In the present investigation, the design used for analysis of variables were Randomized Block Design (RBD) comprising 8 treatments replicated thrice each enlisted below in table 1.

**Table 1: Treatment details**

|  |  |  |
| --- | --- | --- |
| **Treatments** |  **Name of Varieties** | **Source of Company** |
| V1 | 2021/CUCUVAR-1 | IIVR -VARANASI |
| V2 | 2021/CUCUVAR-2 | IIVR -VARANASI |
| V3 | 2021/CUCUVAR-3 | IIVR -VARANASI |
| V4 | 2021/CUCUVAR-4 | IIVR -VARANASI |
| V5 | 2021/CUCUVAR-5 | IIVR -VARANASI |
| V6 | 2021/CUCUVAR-6 | IIVR -VARANASI |
| V7 | 2021/CUCUVAR-7 | IIVR -VARANASI |
| V8 | SHEETAL  | THE TANDA SEED CO |

**3. RESULTS AND DISCUSSION**

**(A) Growth Parameters**

**1. Vine length**

The analysis of variance presented in Table 3 showed significant differences among varieties and their interactions for main vine length. The mean values for main vine length revealed that the maximum main vine length was recorded in the 2021/CUCUVAR-2 (2.56 m) and Followed by the 2021/CUCUVAR-3 (2.36 m) and Minimum was recorded in the 2021/CUCUVAR-6 (1.12 m). The vine length 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 Remison (2009), Patel *et al.,* (2013).**

**2.** **Number of Primary branches per plant**

The analysis of variance presented in Table 3 significant differences among varieties and among their interactions for number of branches per plant. The data revealed that average number of branches per plant were influenced significantly among different varieties treatments. The maximum number of primary branches per plant was recorded in the 2021/CUCUVAR-2 (5.57) and Followed by the SHEETAL (4.16) and Minimum was recorded in the 2021/CUCUVAR-6 (2.61).As regard to the data clearly indicated that the number of branches per plant of cucumber responded significantly to various varieties at all the growth stages. The variation in number of branches per vine might have been due to its own genetic makeup and also due to vine length, inter-nodal length, hormonal factor and environmental factor that confirming to reports of **Sharma and Bhattarai (2006)** in cucumber.

**3.** **Days to Emergence of First Male Flower**

The analysis of variance presented in Table 3 showed significant differences among varieties the days to emergence of first male flower ranged from 35.83 to 43.33 and minimum days to emergence of first male flower were recorded in 2021/CUCUVAR-2 (30.87) followed bySHEETAL (31.27), while maximum days to, male of first male flower were recorded in 2021/CUCUVAR-6 (43.67). The days of first appearance of male flower plays an important role in deciding the earliness or lateness of crop in general. Similar findings were reported by **Sharma and Bhattarai** **(2006) and Patel *et al.,* (2013).**

**6. Node number at which first female flower**

The analysis of variance presented in Table 3 showed significant differences among varieties the node number to first female flower ranged from 3.40 to 4.87 and minimum node number to first female flower was recorded in 2021/cucuvar-2 (3.40) followed by 2021/cucuvar-1 while maximum node number to first female flower was recorded in 2021/cucuvar-6 (4.87). The variation in node number at which first female flower appears might have been due to specific genetic makeup of different Varieties and prevailing environmental condition. Similar findings were reported by Sharma **and Bhattarai (2006) and Bairagi *et al.,* (2005).**

**7. Number of male flowers**

The analysis of variance presented in Table 3 showed significant differences among varieties the number to male flower ranged from 49.66 to 61.77 and minimum number of male flowers was recorded in 2021/cucuvar-2 (49.66) followed by 2021/cucuvar-7 while maximum number of male flowers was recorded in 2021/cucuvar-6 (61.77). The variation in number of male flowers might have been due to their genetic nature, environmental factor, hormonal factor and vigour of crop. Similar results have been reported by **Patel *et al.,* (2013)**

**8. Number of female flowers**

The analysis of variance presented in Table 3 showed significant differences among varieties for the number to female flower ranged from 10.22 to 15.47 and minimum number of female flowers was recorded in 2021/cucuvar-6 (10.22) followed by 2021/cucuvar-5 while maximum number of female flowers was recorded in 2021/cucuvar-2 (15.47). Generally, the hybrids having higher number of female flowers will set more fruits resulting in higher yield. Such statement is sustained also by the work of **Ahmed *et al.,* (2004) and Patel *et al.,* (2013)** in cucumber.

**9. Days to first harvest**

**(B) Yield parameters**

**1. Number of fruits per plant**

The data for various varieties with respect to the number of fruits per plant are summarized in Table 4 has been showed. Number of Fruits per plant was recorded between ranges 8.71 to 12.55. The variety 2021/cucuvar-2 (12.55 fruits per plant) was found significantly superior which was followed by sheetal (12.22 fruit per plant) as compared to rest of the varieties. While, the lowest (8.71 fruits per plant) was noted in the 2021/cucuvar-6. The variation in number of fruits per plant might be due to having more pistillate flowers and will set more fruits. These findings are in agreement with the results reported **by Sharma *et al.,* (2010)** and **Patel *et al.,* (2013).**

**2. Fruit length (cm)**

The analysis of variance presented in Table showed significant differences among varieties and among their interactions for fruit length ranged from 6.71 cm to 16.90 cm. The mean values for fruit length revealed that the maximum fruit length was recorded in the 2021/cucuvar-2 **(**16.90cm) and Followed by the 2021/cucuvar-4 (14.78cm) and Minimum was recorded in the 2021/cucuvar-6 (6.71cm). The variation in fruit length might have been due to genetic nature, environmental factor and vigour of the crop. These findings are in agreement with several workers reported by **Hossain *et al.,* (2010)** and **Sharma *et al.,* (2010).**

**3. Fruit diameter (cm)**

The analysis of variance presented in Table 4 showed significant differences among varieties and among their interactions for fruit diameter ranged from 25.21 mm to 42.47 mm. The mean values for fruit diameter revealed that the maximum fruit diameter was recorded in the 2021/cucuvar-2 (42.47 mm) and Followed by the 2021/cucuvar-4 (38.49 mm) and Minimum was recorded in the 2021/cucuvar-6 (25.21 mm). The variation in fruit diameter might have been due to genetic nature, environmental factor and vigour of the crop. These findings are in agreement with several workers reported by **Hossain *et al.,* (2010), Sharma *et al.,* (2010)** and **Golabadi *et al.,* (2012).**

**4. Fruit weight (g)**

The data for various varieties with respect to the fruit weight (g) are summarized in Table 4 has been showed. Fruit weight was recorded between the ranges 105.59 to 179.18 g. The variety 2021/cucuvar-2 was found significantly superior (179.18 g) which was followed by the variety 2021/cucuvar-3 (170.47 g) as compared to rest of the varieties. While, the lowest (105.59 g) fruit weight was noted in the variety 2021/cucuvar-6. The variation in fruit weight might be due to the higher fruit diameter and length and also the vigour of the different varieties and then adaptability to Prayagraj agro-climatic condition. The findings of present investigation are in close conformity with the findings of **Hossain *et al.,* (2010)** and **Patel *et al.,* (2013).**

**5. Fruit yield per plant (kg/plant)**

The analysis of variance presented in Table 4 showed significant differences among varieties and among their interactions for fruit yield per plant ranged from 1.10 to 2.86 kg. The mean values for fruit yield per plot revealed that the maximum fruit yield per plant was recorded in the 2021/cucuvar-2 (2.86 kg) and Followed by the 2021/cucuvar-3 (2.38 kg) and Minimum was recorded in the 2021/cucuvar-6 (1.10 kg).The variation in fruit yield per plant might have been due to fruit set percentage, fruit length, number of fruits per plant, fruit weight, genetic nature, environmental factor and vigour of the crop. The findings are in close conformity with the findings of **Patel *et al.,* (2013).**

**6. Fruit yield per hectare (t/ha)**

The analysis of variance presented in Table 4 showed significant differences among varieties and among their interactions for fruit yield (t/ha) ranged from 12.72 to 38.13. The mean values for fruit yield per plant revealed that the maximum fruit yield (t/ha) was recorded in the 2021/cucuvar-2 (38.13 t/ha) and Followed by the 2021/cucuvar-3 (31.73 t/ha) and Minimum was recorded in the 2021/cucuvar-6 (12.72 t/ha). High significant differences in the yield were observed among the varieties by **Soleimani *et al.,* (2009).** He recorded highest yield (23.81 kg/m') for E3215516 variety, which was significantly different from other varieties. It seems that cold season and chilling injury caused yield decrease in second year, as yield of E3215516 variety in first year was 26.16 kg/m'.

**(C) Quality parameters**

**1. Total Soluble Solid**

The analysis of variance presented in Table 4 showed significant differences among varieties and among their interactions for Total Soluble Solid (Brix) ranged from 1.90 to 3.00. The mean values for Total Soluble Solid (Brix) revealed that the maximum Total Soluble Solid (Brix) was recorded in the 2021/cucuvar-2 (3.00°Brix) and Followed by the 2021/cucuvar-6 (2.90°Brix) and Minimum was recorded in the sheetal (1.90°Brix). TSS is a one of the quality attribute of cucumber fruit. Increase in this parameter improves the flavour and increases the palatability and so cucumber is used for salad making, fruits with high TSS are highly preferred. Enhanced deposition of solids may be probable reason for higher TSS values. Similar results reported by **Kumar (2006)** in cucumber.

**2. Vitamin C content (mg/100g)**

The analysis of variance presented in Table 4 showed significant differences among varieties and among their interactions for Ascorbic acid (mg/100g) ranged from 1.49 to 1.87. The mean values for Ascorbic acid (mg/100g) revealed that the maximum Ascorbic Acid (m/100g) was recorded in the 2021/cucuvar-2 with (1.87 (mg/100g)) and Followed by the 2021/cucuvar-4,5,7 (1.81(mg/100g)) and Minimum was recorded in the 2021/cucuvar-6 with (1.49 (mg/100g). Generally, high ascorbic acid content would increase the nutritive value of cucumbers, which would help better retention of colour and flavor. Similar findings reported by **Rahman *et al.,* (2008)** in cucurbits. Therefore, cucumber hybrids possessing high ascorbic acid are highly preferred.

**3.** **Economics of cultivation various cucumber varieties**

The economic analysis of cucumber was carried out for three months. Presented in Table 2 show that the maximum B:C ratio was obtained in 2021/cucuvar-2 (5.45) followed by 2021/cucuvar-3 (4.93), while the minimum B:C ratio was obtained in 2021/cucuvar-6 (1.66). Though we took only three months crop duration, but, if we prolong the crop duration, the B:C ratio can be increased. **Hebber *et al.,* (2012)** also worked out the cost of production of cucumber under polyhouse and reported the similar findings in support of this. Higher money value and less cost of cultivation are desirable characters for getting higher retums. Hence, economics of the varieties was worked out. It is revealed from the data obtained that a significantly highest marketable fruit yield and net return along with benefit cost ratio was obtained under cucumber variety 2021/cucuvar-2 followed by 2021/cucuvar-3. While, the lowest marketable fruit yield and net return along with benefit cost ratio was recorded in variety 2021/cucuvar-6. The finding corroborates with their results obtained by **Singh** and **Kumar (2006)** and **Kumar *et al.,* (2016).**

**4CONCLUSION**

From the present investigation, it is concluded that the Cucumber 2021/CUCUVAR-2 performed best in terms of growth (vine length 2.56 m), yield (38.13 ton per ha), and quality (TSS 3.00oBrix, Vit. C 1.87 mg/100 g fresh weight) of cucumber. The highest B: C ratio was also recorded with the same variety, with 5:45.

**Table 2 Performance of various varieties for B:C Ratio of Cucumber.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatment Notation** | **Cost of Cultivation (INR/ha)** | **Fruit yield (t/ha)** | **SELLING RATE/Kg** | **Gross Return (INR/ha)** | **Net Return (INR/ha)** | **Benefit-Cost Ratio** |
| **V1** | 106950 | 23.99 | 20 | 479800 | 372850 | 3.49 |
| **V2** | **118200** | **38.13** | **20** | **762600** | **644400** | **5.45** |
| **V3** | 106950 | 31.73 | 20 | 634600 | 527650 | 4.93 |
| **V4** | 106950 | 27.99 | 20 | 559800 | 452850 | 4.23 |
| **V5** | 111450 | 26.66 | 20 | 533200 | 421750 | 3.78 |
| **V6** | **95700** | **12.72** | **20** | **254400** | **158700** | **1.66** |
| **V7** | 100200 | 19.99 | 20 | 399800 | 299600 | 2.99 |
| **V8** | 93200 | 20.35 | 20 | 407000 | 313800 | 3.36 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Notation** | **Treatment Details** | **Vine length****(cm)** | **No. of Primary branches per plant** | **Days to first male flowering** | **Days to first female flowering**  | **Node no. at which 1stmale flower** | **Node no. at which 1st****female flower** | **No. of male flowers** | **No. of Female flowers** | **Days to first harvest (DAS)** |
| **V1** | **2021/CUCUVAR-1** | **2.00** | **3.41** | **33.13** | **41.67** | **2.80** | **4.33** | **55.31** | **12.00** | **47.07** |
| **V2** | **2021/CUCUVAR-2** | **2.56** | **5.57** | **30.87** | **36.07** | **2.27** | **3.40** | **49.66** | **15.47** | **40.93** |
| **V3** | **2021/CUCUVAR-3** | **2.36** | **4.01** | **32.60** | **41.47** | **2.40** | **4.54** | **58.44** | **12.40** | **46.47** |
| **V4** | **2021/CUCUVAR-4** | **2.12** | **3.45** | **32.63** | **39.67** | **3.80** | **4.40** | **61.56** | **12.60** | **44.73** |
| **V5** | **2021/CUCUVAR-5** | **1.62** | **3.21** | **39.93** | **47.60** | **2.47** | **4.73** | **52.73** | **11.07** | **52.73** |
| **V6** | **2021/CUCUVAR-6** | **1.12** | **2.61** | **43.67** | **54.20** | **2.19** | **4.87** | **61.77** | **10.22** | **57.13** |
| **V7** | **2021/CUCUVAR-7** | **2.07** | **4.02** | **32.07** | **36.63** | **2.20** | **4.60** | **51.89** | **13.64** | **40.80** |
| **V8** | **SHEETAL** | **1.92** | **4.16** | **31.27** | **37.00** | **2.13** | **3.40** | **54.65** | **11.34** | **41.53** |
| **‘F’ Test** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| **C.D. at 5%** | **0.43** | **0.47** | **5.83** | **6.31** | **0.49** | **0.97** | **1.87** | **1.27** | **6.25** |
| **S.E (d) (±)** | **0.20** | **0.22** | **2.70** | **2.94** | **0.23** | **0.45** | **0.86** | **0.59** | **2.29** |
| **CV.** | **12.48** | **7.10** | **10.95** | **8.62** | **12.73** | **13.04** | **1.29** | **7.61** | **7.69** |

**Table.3- Mean Performance of cucumber varieties on growth and floral parameter**

**Table.4- Mean Performance of cucumber varieties on yield and quality parameter**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Notation** | **Treatment details** | **No. of fruits per plant**  | **Fruit length (cm)** | **Fruit diameter (mm)** | **Fruit weight (g)** | **Fruit yield per plant (kg/plant)** | **Fruit yield per hectare (t/ha)** | **TSS [°Brix]** | **Vitamin C content (mg/100g)** |
| **V1** | **2021/CUCUVAR-1** | **9.91** | **13.36** | **32.31** | **125.67** | **1.80** | **23.99** | **2.20** | **1.77** |
| **V2** | **2021/CUCUVAR-2** | **12.55** | **16.90** | **42.47** | **179.18** | **2.86** | **38.13** | **3.00** | **1.87** |
| **V3** | **2021/CUCUVAR-3** | **10.83** | **14.56** | **36.87** | **170.47** | **2.38** | **31.73** | **2.00** | **1.79** |
| **V4** | **2021/CUCUVAR-4** | **11.33** | **14.78** | **39.48** | **140.67** | **2.10** | **27.99** | **2.30** | **1.81** |
| **V5** | **2021/CUCUVAR-5** | **11.45** | **13.51** | **27.64** | **143.95** | **2.00** | **26.66** | **2.10** | **1.81** |
| **V6** | **2021/CUCUVAR-6** | **8.71** | **6.71** | **25.21** | **105.59** | **1.10** | **12.72** | **2.90** | **1.49** |
| **V7** | **2021/CUCUVAR-7** | **10.61** | **13.31** | **34.26** | **121.73** | **1.50** | **19.99** | **2.10** | **1.81** |
| **V8** | **SHEETAL** | **12.12** | **12.98** | **31.33** | **148.8** | **1.78** | **20.35** | **1.90** | **1.79** |
| **‘F’ Test** | **S** | **S** | **S** |  **S** | **S** | **S** | **S** | **S** |
| **C.D. at 5%** | **1.49** | **0.31** | **4.18** | **20.07** | **0.20** | **9.42** | **6.93** | **0.16** |
| **S.E (d) (±)** | **0.69** | **0.33** | **1.95** | **9.35** | **0.09** | **1.13** | **0.13** | **0.07** |
| **CV.** | **7.78** | **3.06** | **7.09** | **8.07** | **5.86** | **4.15** | **0.28** | **5.03** |

# **References**

1. Ahmed, M.; Hamid, A. and Akbar, Z. 2004. Growth and Yield Performance of Six Cucumber (Cucumis sativus L.) Cultivars Under Agro-Climatic Conditions of Rawalakot, Azad Jammu and Kashmir. International Journal of Agriculture & Biology. 6(2): 396-399.
2. Bairagi, S.K., Ram, H.H., Singh D.K. and Maurya, S.K. 2005. Exploitation of hybrid vigor for yield and attributing traits in cucumber. Ind. J. Hort. 62 (1):41-45.
3. Eifediyi, K. and Remison, S. U. 2009. Effect of Time of Planting on the Growth and Yield of Five Varieties of Cucumber (Cucumis sativus L.). Report and Opinion, 1(5): 81-90.
4. Hebbar, S. S.; Prabhakar, M.; Nair, A. K. and Murthy, D. S. 2012, Protected cultivation of cucumber hybrids in a naturally ventilated polyhouse during winter. In: National Seminar on "Protected cultivation of Vegetables and Flowers - A Value Chain Approach", G.B. P.U.A.& T., Pantnagar, Jan. 11-12, 2012. Pantnagar, G.B.P.U.A &T. 46р.
5. Hossain, M.E.; Rabbani, M.G.; Hakim, M.A.; Amanullah, A.S.M. and Ahsanullah, A.S.M. (2010). Study on variability character association and yield performance of cucumber (Cucumis sativus L.). Bangladesh Res. Publications J., 4(3): 297-311.
6. Kumar, A. 2006. Studies on heterosis and inheritance of resistance to fruit fly in cucumber (Cucumis sativus L.). Ph.D. Thesis, Department of Vegetable Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradhesh.
7. Kumar, R. and Verma, R. B. 2012. Yield and economic evaluation of cucumber under protected structures in Bihar. In: National Seminar on "Protected cultivation of Vegetables and Flowers - A Value Chain Approach", G.B.P.U.A.&T., Pantnagar, Jan. 11-12, 2012, Pantnagar, G.B.P.U.A.&T. 36p.
8. Patel, B. N., Solanki, S. R, Patelm, P. and Desai, J. R., 2011, Effect of bio-fertilizers growh, physiological parameters, yield and quality of brinjal. Insd. J. Hort., 68 (3): 370-374.
9. Patel, J. K; Vijay Bahadur; Devi Singh; Prasad, V. M.; Rangure, 5. B. (2013). Perfomance of cucumber (Cucumis sativus L.) hybrids in agro-climatic conditions of Allahabad, HortFlora Res. Spectrum, 2(1):50-55.
10. Patil, D. K., 2011, Integrated Nutrient Management in commercial vegetables. M. Sc. (Agri.,) Thesis, Univ. of Agric. Sci., Dharwad.
11. Rahman, A.H.M.M. Anisuzzaman, M. Ahmed, F. Islam, A.K.M.R. and Naderuzzaman, A.T.M. 2008. Study of nutritive value and medicinal uses of cultivated cucurbits. Journal of Applied Sciences Research. 17(5): 555-558.
12. Rajawat Kuldeep Singh, John Philip Collis., Gajendra Singh., Jalam Singh, and Ritu Rani Minz. (2017). Varietal Evaluation Studies in Cucumber (Cucumis sativus L.) Genotypes Under Allahabad Agro-Climate Condition Trends in Biosciences 10(2), Print: ISSN 0974-8431, 629- 631, 2017.
13. Sharma, S. K., 1995, Response of boron and calcium nutrition on pant growth, fruit and seed yield of tomato. Veg. Sci., 22: 27-29.
14. Sharma, A. K. and Vidyasagar. 2001. Development and evaluation of cucumber hybrids in the hills of Himachal Pradesh. Journal of Hill Research. 14(2): 101-103,
15. Sharma, M. K.; Negi, S. and Kumari, S. 2009. Effect of different growing media and fertigation levels on production of cucumber (Cucumis sativus) under protected conditions in the hills. Indian Journal of Agricultural Sciences. 79(11): 853-856.
16. Resende, G. M. de and Flori, J. E. 2003b. Effect of plant density on yield of comichon pickling cucumber cultivars. Pesquisa Agropecuaria Brasileira. 38(11): 1303- 1307.