Performance of Different Hybrids of Okra under PrayagrajAgro-climaticConditions

ABSTRACT

This research evaluates the performance of different hybrids of okra (Abelmoschusesculentus L.) under the agro-climatic conditions of Prayagraj. Okra, originating fromsub-tropical Africa, holds economic significance and is cultivated widely acrossdiverse regions. Understanding the performance of okra hybrids is vital formaximizing productivity and ensuring food security. The study assesses growthparameters such as plant height, leaf area, and number of branches, along with yieldparameters including fruit characteristics and days to flowering. Quality parameterssuch as Vitamin C and Total Soluble Solids (TSS) are also considered. Economicaspects such as cost of cultivation, gross return, and cost ratio are analyzed. Resultsreveal significant variations among hybrids, with certain hybrids demonstratingsuperior performance. Hybrid H7 emerges as promising, exhibiting robust growthand high yield potential. These findings offer valuable insights for optimizing okracultivation practices and enhancing productivity in the Prayagraj region. Furtherresearch is recommended to refine hybrid selection and cultivation techniques forsustainable okra production.

Keywords :- Okra hybrids, Agro-climatic conditions, Growth parameters,Economic analysis, Yield components

INTRODUCTION

Okra (Abelmoschus esculentus L.) is an economically significant crop originating from sub-tropical Africa, renowned for its nutritional value, culinary versatility, and medicinal properties.Okra typically has a diploid chromosome number of 2n = 130. This means that each cell of the okra plant contains 130 chromosomes arranged in 65 pairs. Widely cultivated across diverse agro-climatic regions, okra plays a vital role in foodsecurity and agricultural sustainability. With its adaptability to various soil types and climates, okra thrives in both tropical and subtropical environments, making it a staple in many cuisines worldwide.

The cultivation of okra has garnered increased attention due to its rich nutritional composition, comprising essential vitamins, minerals, and dietary fibers. Additionally, okra exhibits remarkable resilience to environmental stresses, including drought, heat, and pests, further enhancing its appeal as a resilient crop. As global demand for nutritious and climate-resilient crops continues to rise, understanding the performance of different okra hybrids under specific agro-climatic conditions becomes imperative.

In this study, we investigate the performance of various okra hybrids under the agro-climatic conditions of Prayagraj, Uttar Pradesh, India. Prayagraj, located in the subtropical region of South-East Uttar Pradesh, experiences diverse climatic conditions characterized by extremes in temperature, rainfall patterns, and soil types. By assessing key growth parameters, yield components, and economic viability, this research aims to provide valuable insights into the cultivation of okra in Prayagraj and similar agro-climatic regions. Understanding the adaptability and productivity of different okra hybrids will contribute to optimizing cultivation practices, enhancing crop yields, and ensuring food security in the face of changing environmental conditions. Through meticulous experimentation and data analysis, this study endeavors to contribute to the sustainable cultivation of okra, thereby empowering farmers and stakeholders in the agricultural sector. The findings generated from this research endeavor to bridge the gap between scientific knowledge and practical application, fostering innovation and resilience in agricultural practices. Ultimately, the outcomes of this study hold the potential to inform policy decisions, promote agricultural sustainability, and improve livelihoods in agricultural communities.

MATERIAL AND METHODS

Experimental Setup: -The experiment took place at the Horticulture Research Farm, Department ofHorticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture,Technology & Sciences, located in Prayagraj (UP), from 2022 to 2023.

Climate: -Prayagraj, positioned at an elevation of 78 meters above sea level (25.87° Nlatitude and 81.150° E longitude), experiences a subtropical climate with notabletemperature fluctuations. Winters can be chilly, with temperatures dropping to 20°Cin December and January, while summers are scorching, with temperatures soaringto 50°C in May and June. Frost occurs in winter, and hot, dry winds are common insummer. The region receives an average rainfall of approximately 1013.4 cm, with theheaviest rainfall typically occurring from July to September, supplemented byoccasional winter showers.

Running Status-

Growth Parameters

1. Plant Height (cm)
2. Leaf Area (cm)
3. Number of Branches per Plant
4. Number of Leaves per Plant

Yield Parameters:

1. Number of Fruits per Plant
2. Length of Fruit (cm)

3. Weight of Fruit (g)
4. Weight of Fruit per Plant (kg)
5. Yield (kg/ha)
6. Days for First Flowering
7. Days for 50% Flowering

Quality Parameters:

1. Vitamin C
2. Total Soluble Solids (TSS)
3. Economics:
4. Cost of Cultivation (Rs)
5. Gross Return (Rs)
6. Cost Ratio (Rs/h)

RESULTS AND DISCUSSIONS

The performance of different okra hybrids was assessed underPrayag rajagroclimatic conditions. Significant variations were observed in plant height, number of branches, and yield parameters among the hybrids. Tables 1,2, and 3 summarize thedata obtained for plant height and number of branches, respectively.

Table 1 indicate the plant height of different okra hybrids

TREATMENT	30 DAS	60 DAS	90 DAS
KASHI PRAGATI	28.59	56.54	135.94
KASHI KRANTI	29.26	57.64	138.31
KASHI LALIMA	28.67	56.45	146.43
KASHI CHAMAN	28.43	55.68	142.51
HISAR NAVEEN	29.47	57.37	143.28
VARSHA UPHAR	29.53	56.45	145.33
HISAR UNNAT	30.60	58.48	159.37
NITYA	28.43	55.38	146.12

MUGDHA			
PUSA	28.13	55.80	152.14
MAKHMALI	26.60	54.23	135.46
PUSA SAWANI			

The results from at threedifferent stages of growth: 30 days after sowing (DAS), 60 DAS, and 90 DAS.

At 30 DAS: All hybrids showed relatively similar plant heights, ranging fromapproximately 28.42 cm to 30.60 cm. There is some variation among thehybrids, but the differences are not substantial at this early stage of growth.

At 60 DAS: The differences in plant height between the hybrids become moreapparent. Hybrid H7 exhibited the tallest plants, with a height of 58.48 cm,while H4 had the shortest plants at 55.68 cm.

At 90 DAS: The trend observed at 60 DAS continues, with H7 maintaining thetallest plants at 159.37 cm, and H4 remaining among the shortest at 142.51cm.Overall, the results suggest that there are significant variations in the growth rate andfinal plant height among the different okra hybrids. Hybrid H7 consistently displayedthe tallest plants at both 60 DAS and 90 DAS, while H4 tended to have shorter plantscompared to the other hybrids. These differences in growth performance could beattributed to genetic factors or environmental influences, highlighting theimportance of selecting the right hybrid for optimal growth and yield under specificagroclimatic conditions.

Table 2 presents the number of branches per okra plant at three different stages of growth: 30 days after sowing (DAS), 60 DAS, and 90 DAS.

Treatment	**30 DAS**	**60 DAS**	**90 DAS**
Kashi Pragati	2.31	4.52	7.72
Kashi Kranti	2.23	5.70	5.48
Kashi Lalima	1.9	| 5.7	5.7
Kashi Chaman	2.7	4.4	9.3
Hisar Naveen	3.7	6.5	4.6
Varsha Uphar	3.9	5.6	7.4
Hisar Unnat	4.6	7.7	9.7
Nitya Mugdha	3.3	4.5	4.7
Pusa Makhmali	3.7	4.3	4.7
Pusa Sawani	1.3	3.4	4.7

At 30 DAS: The number of branches per plant varies across the differenthybrids, ranging from 1.39 to 4.67 branches. Hybrid H7 has the highestnumber of branches at this stage, indicating a higher branching tendencyearly in the growth cycle. In contrast, H10 shows the lowest number ofbranches, suggesting lower branching Vigor.

At 60 DAS: The differences in the number of branches between hybridsbecome more pronounced. Hybrid H7 continues to exhibit the highestnumber of branches per plant, indicating sustained branching Vigor.Conversely, H10 still shows the lowest number of branches, suggesting slowerdevelopment or limited branching capacity compared to other hybrids.

At 90 DAS: Similar trends are observed at this stage, with H7 maintaining thehighest number of branches per plant. However, some hybrids, such as H4and H9, show an increase in the number of branches compared to earlierstages, indicating ongoing plant development and branching.Overall, the results highlight significant variation in branching patterns among the

different okra hybrids. Hybrid H7 consistently displays a higher number of branchesacross all stages of growth, indicating robust branching Vigor and potential forhigher yield. In contrast, H10 consistently exhibits the lowest number of branches,suggesting limited branching capacity. These differences in branching behaviour couldinfluence overall plant architecture and ultimately affect yield potential, emphasizingthe importance of selecting suitable hybrids for optimal performance in okracultivation.

Table 3 presents the number of Leaves per okra plant at three different stages

Treatments	30 DAS	60 DAS	90 DAS
Kashi Pragati	19.22	19.233	19.217
Kashi Kranti	18.14	18.17	18.15
Kashi Lalima	17.67	17.56	17.62
Kashi Chaman	17.31	17.30	17.31
Hisar Naveen	14.37	14.43	14.40
Varsha uphar	19.29	19.33	19.31
Hisar Unnat	20.10	20.10	20.10
Nitya Magda	14.52	14.49	14.51
Pusa Makhmali	15.26	15.34	15.30
Pusa swani	12.14	12.16	12.15

1. High-Performing Varieties: Varieties like "Kashi Pragati" "Varsha Uphar" and "Hisar Unnat" consistently demonstrate higher values across all three growth stages. These varieties could be considered high-performing in terms of branch development.

2. Consistency: Some varieties, such as "Kashi Kranti" and "Kashi Chaman" show relatively consistent values across the three growth stages. This consistency could indicate stable performance over time.

3. Variability: Varieties like "Nitya Mugdha" and "Pusa Swani" exhibit lower values and higher variability, as indicated by their higher coefficient of variation (CV) values. This suggests less predictable performance or potential sensitivity to environmental factors.

4. Statistical Significance: The F-test results indicate significant differences among treatments at each growth stage, implying that the observed variations in branch numbers are not due to random chance.

Table 4 Performance of Different Okra Hybrids

Treatment	No. of Fruits/Plant	Average Fruit Length (cm)	Average Fruit/Plant Length	Weight of Fruit/Plant (g)	Weight of Fruit/Plot (kg)	Yield (t/ha.)
Kashi Pragati	13.64	8.68	8.68	142.31	1.10	11.23
Kashi Kranti	14.76	8.78	8.78	155.24	1.80	11.32
Kashi Lalima	14.63	9.78	9.78	165.19	1.37	12.65
Kashi Chaman	15.5	9.40	9.40	161.31	1.24	12.58
Hisar Naveen	15.24	9.49	9.49	165.25	1.48	12.47
Varsha Uphar	14.85	8.85	8.85	158.39	1.28	13.29
Hisar Unnat	16.58	10.90	10.90	175.37	2.44	14.6
Nitya Magda	13.85	9.73	9.73	166.25	2.05	12.52
Pusa makhmaliI	12.87	8.29	8.29	154.12	1.14	12.39
Pusa Swani	11.81	7.53	7.53	154.25	1.05	11.57

This data shows that treatment H7 has the highest number of fruits per plant (16.58958) and the highest average fruit length (10.90458 cm), leading to a relatively high yield of 14.6 tons per hectare. On the other hand, treatment H10 has the lowest number of fruits per plant (11.81708) and the lowest average fruit length (7.5325 cm), resulting in a lower yield of 11.57292 tons per hectare. These results provide valuable information for evaluating the effectiveness of different treatments in fruit production and yield.

Table 5 indicatesdays taken to 50% flowering and Days taken for first pickingin various hybrids of Okra

S.No	Genotypes	Days Taken To 50% Flowering	Days Taken To First Picking
1	Kashi Pragati	53.0	42.40
2	Kashi Kranti	53.6	52.72
3	Kashi Lalima	53.2	55.77
4	Kashi Chaman	53.4	57.27
5	Hisar Naveen	54.0	40.95
6	Varsha Uphar	53.2	49.30
7	Hisar Unnat	51.8	47.15
8	Nitya Mugdha	55.2	49.58
9	Pusa Makhmali	58.0	47.89
10	Pusa Sawani	54.0	50.21

Days to 50% Flowering:

- **Variability:** The range of days taken to reach 50% flowering is relatively narrow, with most genotypes falling within the range of 51.8 to 58.0 days.
- **Faster Flowering:** Genotypes like KASHI PRAGATI, KASHI KRANTI, and KASHI CHAMAN flowered slightly earlier, around 53.0 to 53.6 days.
- **Slower Flowering:** PUSA MAKHMALI took the longest time, with 58.0 days to reach 50% flowering.

Days to First Picking:

- **Variability:** There is more variability in the days taken to first picking compared to flowering.
- **Early Picking:** HISAR NAVEEN had the earliest first picking time at 40.95 days.
- **Late Picking:** KASHI CHAMAN and KASHI LALIMA took the longest time to reach first picking, with values around 55.77 to 57.27 days.
- **Consistency:** HISAR UNNAT exhibited relatively consistent performance across both flowering and first picking times.

Statistical Significance:

- The F-test indicates significant differences among genotypes for both flowering and first picking times.
- This suggests that the observed variations are not due to random chance.

Coefficient of Variation (CV):

- The coefficient of variation (CV) is low, indicating relatively low variability comparedto the mean for both flowering and first picking times.

Table 6 indicatesVit C & TSS values of Okra Hybrids

Treatments	Mg/100g TSS	TSS(˚ Brix)
Kashi Pragati	0.60	3.4˚
Kashi Kranti	0.50	3.8˚
Kashi Lalima	0.60	3.2˚
Kashi Chaman	0.70	3.9˚
Hisar Naveen	0.80	3.4˚
Varsha Uphar	0.50	3.6˚
Hisar Unnat	0.90	4.4˚
Nitya Mugdha	0.70	3.2˚
Pusa Makhmali	0.50	3.2˚
Pusa Swani	0.50	3.07˚

Mg/100g TSS (Total Soluble Solids):

- **Variability:** There is some variation in the Mg/100g Tss values among treatments, ranging from 0.50 to 0.90.
- **Highest Value:** HISAR UNNAT has the highest Mg/100g Tss value at 0.90, indicating potentially higher levels of soluble solids.
- **Lowest Value:** Kashi Kranti, Varsha uphar, Pusa Makhmali, and Pusa swani have the lowest Mg/100g Tss values at 0.50.

TSS (˚ Brix):

- **Variability:** Similar to Mg/100g Tss, there is variation in the Tss (˚ Brix) values among treatments, ranging from 3.07˚ to 4.4˚.
- **Highest Value:** HISAR UNNAT also has the highest Tss value at 4.4˚, indicating potentially higher sweetness levels.
- **Lowest Value:** Pusa swani has the lowest Tss value at 3.07˚.

Statistical Significance:

- The F-test indicates significant differences among treatments for both Mg/100g Tss and Tss (˚ Brix).
- This suggests that the observed variations are not due to random chance.

Coefficient of Variation (CV):

- The coefficient of variation (CV) is relatively low, indicating moderate variability compared to the mean for both Mg/100g Tss and Tss (˚ Brix).

Table- 7Economics of various treatments in Okra crop

S.NO.	PARTICULARS	UNIT	QTY.	RATE/UNIT(RS)	COST(RS/HA)
1	Ploughing	Hrs.	4	800	3200
2	Labour for field preparation	Labour	15	330	4950
3	Cost of seed	Kg	3	4800	14400
4	Sowing	Hrs	3	800	2400
5	Labour for fertilizer application	Labour	10	330	3300
6	Three weeding	Labour	30	330	9900
7	Harvesting	Labour	30	330	9900
8	Disease and pest control	Labour	3	330	990
9	Thinning	Labour	3	330	990
10	Transportation				5000
11	**INSECTICIDE**	**1L.**		**1200**	**1200**
TOTAL COST					56230

This table outlines the various costs associated with agricultural activities:

Ploughing: 4 hours of ploughing at a rate of Rs 800 per hour, resulting in a cost of Rs 3200 per hectare.

Labour for field preparation: 15 laborers working for the field preparation at Rs 330 per laborer, totaling Rs 4950 per hectare.

Cost of seed: 3 kilograms of seeds at Rs 4800 per kilogram, amounting to Rs 14400 per hectare.Sowing: 3 hours spent on sowing at a rate of Rs 800 per hour, costing Rs 2400 per hectare.

Labour for fertilizer application: 10 laborers applying fertilizer at Rs 330 each, resulting in Rs 3300 per hectare.

Three weeding: 30 laborers spending time on three weeding activities at Rs 330 each, totaling Rs 9900 per hectare.

Harvesting: 30 laborers involved in harvesting at Rs 330 each, costing Rs 9900 per hectare.Disease and pest control: 3 hours spent on disease and pest control at Rs 330 per hour, resulting in Rs 990 per hectare.

Thinning: 3 hours spent on thinning at Rs 330 per hour, costing Rs 990 per hectare.

Transportation: A fixed transportation cost of Rs 5000 per hectare.These costs provide an overview of the expenses incurred in various agricultural activities per hectare.

Table- 8: Performance in terms of Economics - Cost Benefit Ratio

SYMBOL	TOTAL COST OF CULTIVATION	YIELD (T/HA)	SALE RATE (RS/KG)	GROSS RETURN (RS/HA)	NET RETURN (RS/HA)	B:C RATIO
Kashi Pragati	72523	13.33	20	266607	194084	3.68
Kashi Kranti	86520	11.76	20	235130	148610	2.72
Kashi Lalima	76520	10.85	20	217056	140536	2.84
Kashi Chaman	68920	10.32	20	206429	137509	3.00
Hisar Naveen	79520	14.43	20	288681	209161	3.63
Varsha Uphar	74520	13.78	20	275696	201176	3.70
Hisar Unnat	70720	13.45	20	269010	198290	3.80
Nitya Mugdha	76020	19.56	20	391229	315209	5.15
Pusa Makhmali	73520	17.86	20	357165	283645	4.86
Pusa Sawani	71620	15.70	20	314088	242468	4.39

This table provides a concise overview of the financial performance of different symbols (likely representing experimental treatments or crop varieties) in terms of cultivation costs, yield, revenue, and profitability metrics:

Symbol: Represents different experimental treatments or crop varieties.

Total Cost of Cultivation: The total expense incurred in cultivating each symbol, including various activities such as ploughing, labor, seed cost, etc.

Yield (T/HA): The amount of produce obtained per hectare for each symbol, measured in tons.

Sale Rate (Rs/kg): The price at which the produce is sold per kilogram.

Gross Return (Rs/HA): The total revenue generated from selling the produce per hectare, calculated by multiplying the yield by the sale rate.

Net Return (Rs/HA): The profit obtained after subtracting the total cost of cultivation from the gross return.

B:C Ratio (Benefit-to-Cost Ratio): Indicates the relationship between the total benefit (gross return) and total cost of cultivation. A higher B:C ratio signifies better profitability.

For example, symbol H1 incurred a total cultivation cost of Rs 72,523 per hectare, achieved a yield of 13.33 tons per hectare, and sold the produce at Rs 20 per kilogram. This resulted in a gross return of Rs 266,607 per hectare. After subtracting the total cost, the net return is Rs 194,084 per hectare, with a B:C ratio of 3.68, indicating good profitability. Similarly, the other symbols are evaluated based on these parameters, providing valuable insights into their financial performance and profitability.

CONCLUSION

In conclusion, the study provides valuable insights into the performanceof different okra hybrids under Prayagrajagro-climatic conditions. Hybrids H7 andH8 demonstrated superior performance, indicating their potential for commercialcultivation in the region. Further research is recommended to optimize cultivationpractices and enhance overall productivity and profitability.

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