



International Journal of Research in Agronomy

E-ISSN: 2618-0618

P-ISSN: 2618-060X

© Agronomy

www.agronomyjournals.com

2024; 7(7): 286-289

Received: 06-05-2024

Accepted: 12-06-2024

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Assessment of growth, yield, and quality of hybrid ridge gourd (*Luffa acutangula* L.) in the agro-climatic conditions of Prayagraj

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DOI: <https://doi.org/10.33545/2618060X.2024.v7.i7d.1037>

Abstract

This research evaluated the performance of ten hybrid ridge gourd (*Luffa acutangula* L.) varieties under Prayagraj's agro-climatic conditions, aiming to identify the best-performing hybrids. The study utilized a randomized block design, testing varieties such as USM-Sunita, F1-Kumbh, and F1 Hybrid Sonia, each with three replicates. Parameters assessed included germination time, vine length, time to first flower appearance, sex ratio, time to first harvest, fruit yield, and vitamin C content. Key findings highlighted F1 Hybrid Sigma's longest germination time (5.33 days), F1-Kumbh's longest vine length at 60 days (388.59 cm), and F1 Hybrid Sonia's highest fruit yield per plant (4.43 kg) and per hectare (394.07 q/ha). Additionally, significant differences were observed in vitamin C content, with F1 Hybrid Sonia and F1 Hybrid Ridge Gourd Green-333 having the highest content (0.67), and F1 Hybrid Alok and F1 Hybrid Sigma the lowest (0.40). An economic analysis revealed that F1 Hybrid Sonia had the highest benefit-cost ratio (0.94), making it the most profitable hybrid. In conclusion, F1 Hybrid Sonia, due to its superior growth, yield, quality, and profitability, is recommended for cultivation in Prayagraj. This study provides valuable insights for future ridge gourd cultivation and hybrid selection in this region.

Keywords: Ridge gourd, hybrid varieties, evaluation, growth, yield, quality

1. Introduction

Ridge gourd (*Luffa acutangula* L.), a valuable vegetable in tropical and subtropical regions, is renowned for its nutritional and medicinal benefits, including antioxidant, anti-inflammatory, and antimicrobial properties. Enhancing its cultivation is crucial for improving human health and agricultural economies. However, farmers often encounter challenges due to varying agro-climatic conditions. This study aims to evaluate ten hybrid varieties of ridge gourd in Prayagraj, northern India, to understand their response to local conditions and assist farmers in selecting the best varieties for cultivation. Using a randomized block design with three replicates per hybrid, the study assessed key parameters such as germination, vine length, flowering time, fruit characteristics, yield, and economic viability. The hybrids tested included USM-Sunita, F1-Kumbh, F1 Hybrid Sonia, DS-10 F1 Hybrid, F1 Zen 200, F1 Saheli, F1 Hybrid Alok, F1 Hybrid Sigma, F1 Ridge Gourd-KSP 1501 ANU, and F1 Hybrid Ridge Gourd Green-333. By providing comprehensive data on adaptability and productivity, this research offers actionable recommendations for farmers, contributing to sustainable agriculture and enhancing food security and economic stability in similar agro-climatic regions.

2. Materials and Methods

This investigation, titled "Assessment of Growth, Yield, and Quality of Hybrid Ridge Gourd (*Luffa acutangula* L.) in the Agro-Climatic Conditions of Prayagraj," was conducted during the rainy season of 2023 at the Vegetable Research Farm of the Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom University of Agriculture, Technology and Sciences, Uttar Pradesh. This section details the materials used, procedures followed, and criteria adopted for evaluating the treatments throughout the study.

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2.1 Experimental Site and Geographical Location

The experiment was conducted at the Vegetable Research Farm, Department of Horticulture, located 8 km from Prayagraj city, positioned at a latitude of 25° North and a longitude of 81° East, with an elevation of 98 meters above mean sea level (MSL).

2.2 Design of Experiment

Prayagraj, in the eastern region of Uttar Pradesh within the northern Gangetic alluvial plains, experiences a subtropical climate with an average annual rainfall of approximately 1100 mm, primarily during the rainy season from mid-June to mid-October. This study was conducted from August to November 2023, during which meteorological observations, including maximum and minimum temperatures, rainfall, and relative humidity, were recorded.

The experimental site featured sandy loam soil with low clay content and a high percentage of sand. Soil samples were analyzed for pH, electrical conductivity (EC), organic carbon, and available nutrients. The experimental materials comprised ten hybrid varieties of ridge gourd sourced from the local seed market. The plot was prepared through ploughing, harrowing, and leveling.

The experiment employed a Randomized Block Design (RBD) with three replications per variety, focusing on plant growth, yield, and quality parameters. Key parameters included days to germination, vine length, flowering time, fruit characteristics, and economic analysis. Growth and floral parameters such as days to the first appearance of male and female flowers, node numbers at which flowers appeared, sex ratio, and vine length were meticulously recorded. Yield parameters measured included the number of fruits per plant, fruit weight, diameter, length, and yield per plant and hectare. Quality parameters assessed were total soluble solids and vitamin C content. Economic analysis considered input costs, gross income, net income, and benefit-cost ratio.

Data were analyzed using ANOVA, with significant differences tested at the 5% probability level. The study aimed to provide comprehensive data on the adaptability, productivity, and economic viability of the hybrids, offering actionable recommendations for farmers to enhance ridge gourd cultivation and contribute to sustainable agriculture in similar agro-climatic regions.

3. Results and Discussion

The investigation titled “Assessment of Growth, Yield, and Quality of Hybrid Ridge Gourd (*Luffa acutangula* L.) in the Agro-Climatic Conditions of Prayagraj” was conducted at the experimental station of the Department of Horticulture, Sam Higginbottom University of Agriculture, Technology, and Sciences, Allahabad, Uttar Pradesh. The study involved twelve distinct genotypes of ridge gourd, assessing their growth, yield, and quality attributes under local conditions. The data collected throughout the experiment are detailed in this section, with tables and illustrations provided to enhance the clarity and understanding of the results.

Growth Parameters

The study on ridge gourd hybrids revealed various growth parameters. Germination times ranged from the fastest at 3.00 days for USM-SUNITA, F1 HYBRID SONIA, F1 RIDGE GOURD-KSP 1501 ANU, and F1 HYBRID RIDGE GOURD GREEN-333, to the slowest at 5.33 days for F1 HYBRID SIGMA. Early germination is beneficial for market pricing, while late germination extends the harvesting period, aligning

with Kumar *et al.* (2007) [7]. The first female flowers appeared earliest in USM-SUNITA and F1 SAHELI at 36.33 days and latest in F1 HYBRID SIGMA at 40.00 days, affecting crop earliness and yield timing similar to Panwar *et al.* (1977) [24] and Arora *et al.* (1983) [1]. The node appearance for the first male flower ranged from 5.33 in USM-SUNITA and F1 HYBRID SIGMA to 6.67 in F1 SAHELI, influencing male flower numbers as supported by Chaudhary and Kumar (2011) [7]. The first female flower appearance varied from node 10.67 in USM-SUNITA to node 12.67 in F1-KUMBH, affecting the total number of female flowers produced, corroborated by Kumar (2011) [7].

Yield Parameters

The sex ratio (male: female) varied among varieties, with the highest ratio at 3.00 in several hybrids and the lowest at 2.50 in F1-KUMBH. This ratio impacts reproductive potential and yield, with variations supported by Shah and Kale (2002) [25]. Vine length at final harvesting ranged from 4.27 m in F1 RIDGE GOURD-KSP 1501 ANU to 4.67 m in F1 HYBRID ALOK, influenced by genetic characteristics and growth vigor, consistent with Khanikar *et al.* (1995) [26].

Fruit production varied, with the highest number of fruits per plant (13.67) in USM-SUNITA and F1 HYBRID ALOK, and the lowest (9.67) in F1 ZEN 200, influenced by sex ratio and fruit set percentage. Days to first harvest ranged from 44.00 days in USM-SUNITA and F1 ZEN 200 to 46.00 days in F1-KUMBH and F1 SAHELI, highlighting the importance of harvest timing as noted by Choudhary and Kumar (2011) [7].

Yield per plant ranged from 10.67 kg in USM-SUNITA and F1 HYBRID ALOK to 6.67 kg in F1 ZEN 200 and F1 HYBRID RIDGE GOURD GREEN-333. Yield per hectare also showed significant differences, with F1 HYBRID SONIA achieving the highest yield (394.07 q/ha) and F1 RIDGE GOURD-KSP 1501 ANU the lowest (281.48 q/ha). Total soluble solids content varied, with DS-10 F1 HYBRID having the highest (3.50%). Vitamin C content showed no significant differences, though trends indicated variations among varieties, warranting further investigation.

Economic Analysis

The economic analysis revealed stable selling prices at Rs. 25/kg despite yield variations, impacting gross returns and profitability in ridge gourd cultivation. The findings indicate that hybrid ridge gourd varieties demonstrate considerable differences in growth, yield, and quality under the agro-climatic conditions of Prayagraj, providing valuable insights for farmers to enhance ridge gourd cultivation and contribute to sustainable agriculture in similar regions.



Fig 1: Sowing of Ridge hybrids in Experimental site, NAI – SHUATS, Prayagraj – 211007



Fig 2: Display of produce of Ridge Gourd Hybrids, Department of Horticulture, NAI – SHUATS, Prayagraj – 211007

Table 1: Distribution of Ridge Gourd hybrids performance in various growth parameters (Days to germination, first male flower appearance, First Female flower appearance, Node at Male flower)

V. No.	Name of varieties	Days to germination	First Male Flower	First Female Flower	Node at Male Flower
V1	USM -SUNITA	3.00	33.33	36.33	5.33
V2	F1- KUMBH	4.00	34.33	38.67	6.00
V3	F1 HYBRID SONIA	3.00	33.33	36.67	5.67
V4	DS-10 F1 HYBRID	4.00	35.00	39.67	5.67
V5	F1 ZEN 200	3.33	33.67	37.33	6.00
V6	F1 SAHELI	3.70	33.33	36.33	6.67
V7	F1 HYBRID ALOK	4.00	34.67	37.67	5.67
V8	F1 HYBRID SIGMA	5.33	37.67	40.00	5.33
V9	F1 RIDGE GOURD- KSP 1501 ANU	3.00	33.33	37.33	5.00
V10	F1 HYBRID RIDGE GOURD GREEN - 333	3.00	33.67	37.33	6.00
	F-test	S	S	S	S
	S.Ed ($\pm$)	0.24	0.48	0.70	0.58
	C.D at 5%	0.5	1.02	1.47	1.22
	C.V	8.03	1.73	2.26	12.42

Table 2: Distribution of various parameters according to performance of ridge gourd hybrids (Node at female flower, sex ratio, length of main vein, number of fruits per plant, days to first harvest, fruit diameter, fruit length, fruit weight)

V. No.	Node at female flower	Sex Ratio	Length of main vein (m)	No. of fruits per plant	Days to first harvest	Fruit diameter (cm)	Fruit length (cm)	Fruit weight (gm)
V1	10.67	3.00	4.53	13.67	44.00	4.70	30.07	174.97
V2	12.67	2.50	4.47	12.67	46.00	4.03	48.73	283.47
V3	11.00	3.00	4.50	11.67	45.00	4.37	25.40	222.50
V4	11.00	3.00	4.60	10.67	45.00	3.38	31.03	205.93
V5	11.67	2.83	4.40	9.67	44.00	4.38	28.90	173.40
V6	11.67	3.00	4.47	11.67	46.00	4.04	24.83	220.80
V7	11.00	3.00	4.67	13.67	45.33	4.04	20.90	214.53
V8	11.00	3.00	4.37	12.67	45.00	4.38	25.97	198.47
V9	11.33	2.83	4.27	11.67	45.33	4.37	35.73	253.77
V10	11.33	3.00	4.53	10.67	44.00	3.39	25.93	162.00
F-test	S	S	S	S	S	S	S	S
S.Ed ($\pm$)	1.09	2.83	0.23	1.06	0.78	0.39	2.62	30.23
C.D at 5%	2.28	12.57	0.49	2.22	1.64	0.82	5.51	63.50
C.V	11.75	11.67	6.31	23.24	2.13	11.70	10.80	17.55

Table 3: Distribution of various parameters according to performance of ridge gourd hybrids (Fruit yield per plant, Fruit yield per hectare, Total Soluble Solids, Vitamin C)

V. No.	Fruit yield per plant (kg)	Fruit yield per hectare (q)	Total Soluble Solids ($^{\circ}$ Brix)	Vitamin 'C' (mg/100gm)
V1	10.67	331.85	3.17	0.43
V2	9.67	379.26	3.40	0.43
V3	8.67	394.07	3.17	0.67
V4	7.67	337.77	3.50	0.60
V5	6.67	290.37	3.20	0.43
V6	8.67	293.33	3.13	0.50
V7	10.67	334.81	3.03	0.40
V8	9.67	364.44	3.03	0.40
V9	8.67	281.48	3.20	0.47
V10	7.67	322.96	3.40	0.67
F-test	S	S	S	NS
S.Ed ($\pm$)	0.35	25.90	0.03	0.14
C.D at 5%	0.73	54.42	0.07	0.30
C.V	4.05	9.54	1.32	34.58

Table 4: Economics of different varieties and benefit cost ratio

Varieties	Marketable Yield (q/ha)	Selling Price (Rs. /Kg)	Gross Returns (Rs. /ha)	Total Cost (Rs. /ha)	Net Returns (Rs. /ha)	BC Ratio
V1	298.67	25	7,466.75	79,154	71,687.25	0.90
V2	341.33	25	8,533.25	79,154	70,620.75	0.89
V3	354.66	25	8,866.50	79,154	70,287.50	0.94
V4	303.99	25	7,599.75	79,154	71,554.25	0.90
V5	261.33	25	6,533.25	79,154	72,620.75	0.92
V6	263.99	25	6,599.75	79,154	72,554.25	0.92
V7	301.33	25	7,533.25	79,154	71,620.75	0.90
V8	328.00	25	8,200.00	79,154	70,954.00	0.89
V9	353.33	25	8,833.25	79,154	70,320.75	0.89
V10	290.66	25	7,266.50	79,154	71,887.50	0.91

4. Conclusion

Based on the current investigation, it can be concluded that among the ten ridge gourd hybrids studied, F1 HYBRID SONIA exhibited superior performance in terms of growth, yield, and quality. This hybrid achieved a remarkable fruit yield of 394.07 q/ha. Additionally, the economic analysis revealed that F1 HYBRID SONIA also had the highest benefit-cost ratio of 0.94. This hybrid not only attained the highest yield per hectare but also demonstrated exceptional profitability, making it the most favourable option for ridge gourd cultivation among the hybrids evaluated in this study.

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