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Evaluating Some Cucumber Varieties in Ranchi: An In-Depth Vegetative Performance

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A B S T R A C T

The performance of many cucumber cultivars cultivated in Ranchi, India, is thoroughly analyzed in this research. Under local growing circumstances, the growth, yield, and quality characteristics out of several cultivars only five common cucumber cultivars were assessed. For parameters including vine length, leaves per vine, days to the first female flower, fruit length, fruit girth, number of fruits per vine, and total yield per vine, there were noticeable variations across the types. Based on their vegetative vigor and production, the study offers crucial information for choosing acceptable cucumber cultivars for growing in Ranchi.

Introduction

Background on cucumber cultivation in Ranchi

Due to its culinary use and nutritional benefits, cucumber (*Cucumis sativus* L.) is a significant vegetable crop in India (Kumar *et al.,* 2013). The cucumber fruit has a high water content, is low in calories, and is an excellent source of antioxidant polyphenols, potassium, magnesium, and vitamin K (AgriBusiness, 2018). With an annual production of about 7 million tons, India is the second-largest cucumber producer after China (Soleimani & Ahmadikhah, 2009).

Cucumber is cultivated in Jharkhand throughout both the winter and rainy seasons. Ranchi, Hazaribagh, Chatra, Palamu, Gumla, Simdega, East Singhbhum, West Singhbhum, Saraikela Kharsawan, and Bokaro are the principal cucumber-growing regions (Ene, 2016). In contrast to the national average of 16.2 tons/ha, Jharkhand's cucumber production is relatively low at about 7.6 tons/ha (Knoema, 2019). Cucumber yields in Jharkhand must be increased by appropriate measures.

A subtropical climate makes Ranchi district, which is in southern Jharkhand, the perfect place to cultivate veggies. Tomato, brinjal, okra, beans, cowpea, cucumber, bitter gourd, bottle gourd, pumpkin, radish, carrot, spinach, and coriander are some of the prominent crops cultivated in the region. Cucumber is grown as a separate crop, as well as in mixtures with other fruits, vegetables, and herbs.

Seeds are used to propagate cucumber, and seedlings may occasionally be nurtured in polythene bags or tiny nursery beds before being transplanted to the main field.

A healthy sandy loam or loamy soil with adequate drainage and aeration is necessary for growing cucumbers. The physical and nutritional state of the soil is improved by applying 10 to 15 tonnes of well-rotten farmyard manure or compost per hectare throughout the land preparation process. For optimal yields, cucumber is very sensitive to fertilizer and irrigation (Chinatu *et al.,* 2017).

A number of open pollinated and hybrid high yielding cucumber cultivars have been created by commercial seed corporations and agricultural research institutions. To find the cultivars that are best suited for a location, it is necessary to assess the growth, flowering behavior, fruit qualities, and yield potential of several cucumber types under local environmental circumstances (Pradhan *et al.,* 2018). In the Ranchi area, there has been little comparative analysis of cucumber cultivars.

Purpose and scope of the study

The present study was undertaken with the aim of analyzing the vegetative performance of five popular cucumber varieties grown in Ranchi, Jharkhand. The specific objectives were to:

Evaluate the differences among cucumber varieties for vine growth parameters like vine length, leaves per vine, days to first female flower.
Assess the variation in fruit traits namely fruit length, fruit diameter, shape among the selected varieties.
Determine the variation in yield attributing characters such as fruits per vine, yield per vine in the test varieties.
Identify correlation among vegetative, flowering, fruit and yield traits in cucumber.
Rank the varieties based on their overall growth and yield performance.
Recommend suitable high yielding cucumber varieties for successful cultivation in the target region.

The results of this study will assist in identifying cucumber cultivars that thrive in Ranchi settings and will propose suitable cultivars for enhancing production. The findings will also provide light on the interactions between several cucumber horticultural features that plant breeders may use in varietal development initiatives. Cucumber breeders may also benefit from the information on phenotypic variability among the analyzed germplasm when choosing parents for hybridization.

In addition to enhanced open pollinated varieties and hybrids created by governmental and commercial sector institutes, India possesses a great diversity of native cucumber germplasm (Sharma *et al.,* 2012). Testing and identification of location-specific, high performing cultivars across various agro climatic zones of the nation are necessary to make the most of this genetic diversity. In order to identify acceptable cultivars, several researchers in various geographical locations have evaluated the growth patterns, production potential, and quality criteria in cucumber varieties (Prasad *et al.,* 2009; Sareedha *et al.,* 2006).

In order to find variations that would be suited for greenhouse growing in Iran, Soleimani and Ahmadikhah (2009) tested 16 cucumber cultivars across several age groups over the course of two years. In terms of fruit yield and quality characteristics including total soluble solids, titratable acidity, and vitamin C content, they found considerable variations amongst the types. The study found that under protected settings, native Iranian cultivars outperformed imported hybrids. In a study published in 2010, Narayanamma *et al.,* (2010) demonstrated the impact of integrated nutrient management strategies on cucumber cv. Tasty hybrid growth, yield, and quality. In comparison to 100% inorganic fertilizers, the treatment including 75% of the necessary fertilizer dose, vermicompost, and biofertilizers considerably enhanced the quantity and weight of marketable fruits.

At Umudike, Nigeria, Chinatu *et al.,* (2017) evaluated the yield and yield components of 16 genotypes of cucumbers that represented local landraces and improved cultivars. For characteristics including fruit length, fruit diameter, fruit yields, and the quantity of fruits produced per plant, there was significant diversity across the test entries. Three newly introduced hybrid types, Poinset 76, Dasher 11, and Jazzer, outperformed local landraces in terms of yield.

The study demonstrated the potential for native germplasm to be improved by hybridization with foreign material. Pushpalatha *et al.,* (2017) evaluated the genetic diversity and heritability of 25 cucumber genotypes in Coimbatore, India. Fruit length, fruit girth, number of fruits per vine, and yield per vine all showed significant genotypic and phenotypic coefficients of variation together with high heritability, indicating strong opportunities for genetic improvement. In order to increase the production and quality of cucumber cv,

Pradhan *et al.,* (2018) showed the positive impacts of combined application of organic manures, biofertilizers, and chemical fertilizers. In Odisha, Japanese Long Green is cultivated during the *rabi* season. Compared to using only inorganic fertilizers, integrated nutrition management approaches considerably boosted the fruit length, fruit diameter, individual fruit weight, and overall yield. In order to increase the yields and incomes of smallholder cucumber growers, the study stressed the importance of popularizing sustainable integrated farming methods.

In 35 different cucumber genotypes tested over three seasons in the western Himalayan area of India, Kumar *et al.,* (2013) analyzed the genetic variability and character relationships for yield and quality indices. Fruit length, fruit diameter, average fruit weight, and number of fruits per vine all showed high genotypic and phenotypic coefficients of variation. Studies of correlation found a substantial positive relationship between cucumber fruit yield per plant and cucumber fruit yield per plant with number of fruits per plant, average fruit weight, fruit length, and fruit diameter.

Ahirwar and Singh (2018) evaluated the kind and level of genetic diversity found in 40 genotypes of cucumber cultivated in Raipur, India, throughout the summer. Vine length, days to the first female flower, number of fruits per vine, and fruit production per vine all showed strong genotypic and phenotypic coefficients of variation along with high heritability.

This demonstrated the great heritability of these variables and the dominance of additive gene action. Fruit output significantly correlated positively with vine length, fruit count, and fruit weight. For use as parents in upcoming breeding operations, the study identified potential cucumber genotypes.

The cultivation of unimproved local varieties, unbalanced fertilization, insufficient plant protection measures, poor irrigation management, a lack of modern technologies, and other factors limit cucumber production in India, resulting in a significant difference between potential and realized yields (AgriBusiness, 2018; Sharma *et al.,* 2012). The country's average cucumber production is about 16.2 tons/ha, although the yield that may be achieved with ideal management is above 30 tons/ha (Knoema, 2019). With the use of better cultivars and prudent crop management techniques, there is a lot of room to increase production and earnings.

Materials and Methods

Experimental site description

The experiment was carried out at the RLSY College Campus, Kokar, Ranchi, Jharkhand, which is situated at a height of 625 m above mean sea level and is located at 23.3° N latitude and 85.3° E longitude. The area has scorching summers and chilly winters due to its subtropical climate. The majority of the 1200–1400 mm of yearly precipitation, which occurs from June through September during the monsoon season. The soil had a sandy loam texture, decent drainage, little organic carbon (0.52%), and a pH that was just slightly acidic (6.2).

Cucumber varieties selected

Five cucumber varieties were selected for evaluation based on their popularity among local farmers:

1. SHEETAL: Open pollinated variety, green elongated fruits, widely grown by smallholders
2. MOTI: Hybrid variety, dark green medium sized fruits, high yielding
3. GREEN LONG: Open pollinated variety, large cylindrical dark green fruits
4. F1SAGAR: Hybrid variety, medium-long green fruits, high yielding, powdery mildew resistant
5. DAMINI: Hybrid variety, small-sized fruits, early maturing, high yielding

The seeds were procured from authorized commercial seed companies. The varieties represented a diverse range of fruit characteristics and maturity periods.

Field layout and crop management

A randomized block design with three replications and a plot size of 3 m x 2 m for each treatment was used to set up the experiment. In pro-trays, cucumber seedlings were nurtured before being moved to the main field at the 4-5 leaf stage. Plant spacing was kept at 60 cm between plants and 90 cm between rows. To maintain the ideal plant population, gap filling was carried out one week following transplanting. For the application of fertilizer, irrigation, weeding, and the management of pests and diseases, recommended techniques were followed. Bamboo poles were used for staking in order to support the vines. Fruits were picked at marketable stages every three to four days.

Data collection and observations recorded

Observations were recorded on five randomly tagged plants in each replication for the parameters:

Vine length (cm)
Number of leaves per vine
Days to first female flower appearance
Days to first male flower appearance
Fruit length (cm)
Fruit diameter (cm)
Number of fruits per vine
Fruit yield per vine (kg)

Using OPSTAT software, the acquired data was submitted to analysis of variance (ANOVA) in accordance with the experimental design. The least significant difference (LSD) test was used to compare the treatment means at a 5% confidence level. Heritability, genetic progress, and phenotypic and genotypic coefficients of variation were calculated using conventional statistical techniques. The Pearson's correlation coefficients were used to calculate the correlations between various qualities.

Statistical analysis

Using the randomized block design and analysis of variance, the data on different vegetative, reproductive, and yield factors was statistically examined. F-test was used to determine the significance of the treatment mean squares. PCV, GCV, heritability, and genetic progress were computed using estimates of the phenotypic and genotypic components of variation. To calculate the degree of relationship between various variables, phenotypic and genotypic correlation coefficients were determined.

Results and Discussion

Varietal differences in vine length, leaves per vine

Vine length and leaves per vine showed a significant variation amongst cucumber cultivars (Table 1). The longest vine length was 252.6 cm for the F1SAGAR variety, and MOTI came in second. However, MOTI had the most leaves (28.6), whilst DAMINI had the fewest. Greater light absorption is made possible by more robust vines with more leaf production, which promotes higher yield. These results are consistent with those published by Kumar *et al.,* (2013) and Hanchinamani *et al.,* (2008), who also found substantial varietal variations for vine characteristics.

Days to anthesis, sex expression

Due to their earliness, the cucumber types varied greatly in the days until the first female bloom (Table 2). MOTI (33.2 days) had the earliest female blossoming, which was followed by DAMINI and F1SAGAR. The female blossoming of the cultivars GREEN LONG and SHEETAL started later. Early blooming enables the vine to begin producing fruit and quickly increase output. All of the cultivars demonstrated their monoecious character by producing female flowers far earlier than male blooms.

Fruit characteristics like length, girth, shape

The fruit length and diameter of the several cucumber types varied significantly (Table 3). While F1SAGAR had the largest fruit diameter (6.2 cm), variety GREEN LONG produced the fruits with the greatest lengths (41.6 cm). Long varieties like GREEN LONG and medium varieties like MOTI were two different fruit shapes. The characteristics of the fruit affect its marketability and consumer appeal. These results concur with those made by Kumar *et al.,* (2013), who noted similar varietal variations in cucumber fruit morphological characteristics.

Yield attributes and total yield

Indicators of production, such as fruits per vine and total yield per vine, showed notable variance across the cucumber cultivars (Table 4). The cultivar F1SAGAR had the highest overall yield per vine (3.42 kg), with the most fruits per vine (21.6). DAMINI, in comparison, had the lowest yield, mostly as a result of fewer grapes per vine. The reproductive ability and growth vigor of cultivars affect how prolific their fruit is. These results support past research that discovered similar varietal variations in cucumber production (Chinatu *et al.,* 2017; AgriBusiness, 2018).

Correlations among different traits

At the 1% level of significance, correlation analysis showed a significant positive relationship between vine length and leaves per vine, fruit length, and yield per vine (Table 5). Similar to fruits per vine and production per vine, leaves per vine shown a positive association. The

relationship between yield indices and days to first female blossom was negative. Fruit length, fruit girth, and yield per vine all showed favorable correlations. Overall, the inter-trait correlations illustrate how cucumber reproductive development and yields are influenced by vegetative features. These outcomes are consistent with the conclusions made by Kumar *et al.,* (2013) and Hanchinamani *et al.,* (2008).

Performance ranking of varieties

Based on the overall vegetative vigor and fruit productivity, the cucumber varieties can be ranked as follows:

F1SAGAR>MOTI>GREEN LONG>SHEETAL>DAMINI

The variety F1SAGAR was the best performer exhibiting excellent vine growth, early flowering, higher fruits per vine and maximum yield under Ranchi conditions. MOTI and GREEN LONG also showed good performance for the traits evaluated.

Key findings and interpretations

Cucumber varieties differed significantly for vine length, leaves per vine, earliness, fruit traits, yield attributes and total yield indicating the presence of substantial genetic variability among them.

Varieties F1SAGAR and MOTI were early flowering, had vigorous vines, more number of fruits and gave highest yields. Hence they are suitable for cultivation in Ranchi region.

Traits like vine length, leaves per vine, fruits per vine showed positive association with yield indicating their direct influence on productivity.

Days to first female flower was negatively related to yield parameters signifying that early flowering enhances fruit setting and yield.

Table.1 Vine length and leaves per vine of cucumber varieties

Variety	Vine length (cm)	Leaves per vine
SHEETAL	201.5b	25.3c
MOTI	246.7ab	28.6a
F1SAGAR	252.6a	27.3ab
GREEN LONG	240.1ab	26.1bc
DAMINI	210.8b	24.2c
Mean	230.3	26.3
CD (P=0.05)	24.7	2.9

Table.2 Sex expression in cucumber varieties

Variety	Days to 1st female flower	Days to 1st male flower
SHEETAL	38.5a	42.3a
MOTI	33.2c	37.1c
F1SAGAR	34.6bc	39.7b
GREEN LONG	37.2ab	41.6ab
DAMINI	34.9bc	40.2b
Mean	35.7	40.2
CD (P=0.05)	2.3	1.9

Table.3 Fruit characteristics of cucumber varieties

Variety	Fruit length (cm)	Fruit diameter (cm)
SHEETAL	34.5b	5.3c
MOTI	37.6c	5.8b
F1SAGAR	39.2bc	6.2a
GREEN LONG	41.6a	5.6bc
DAMINI	33.1c	5.1c
Mean	37.2	5.6
CD (P=0.05)	3.2	0.5

Table.4 Yield attributes and yield of cucumber varieties

Variety	Fruits per vine	Yield per vine (kg)
SHEETAL	15.3c	2.51c
MOTI	19.2b	3.21b
F1SAGAR	21.6a	3.42a
GREEN LONG	18.5b	2.98b
DAMINI	13.6d	2.12d
Mean	17.6	2.85
CD (P=0.05)	1.8	0.24

Table.5 Correlation matrix showing relationship among cucumber traits

Trait	Vine length	Leaves per vine	Days to female flower	Fruit length	Fruit girth	Fruits per vine	Yield per vine
Vine length	1						
Leaves per vine	0.891**	1					
Days to female flower	-0.638*	-0.516	1				
Fruit length	0.732**	0.612*	-0.491	1			
Fruit girth	0.543	0.482	-0.321	0.721**	1		
Fruits per vine	0.824**	0.761**	-0.572*	0.612*	0.491	1	
Yield per vine	0.892**	0.829**	-0.642*	0.732**	0.532	0.961**	1
*, ** - Significant at 5% and 1% level, respectively							

Best performing varieties identified

Based on the cumulative evaluation of vegetative, reproductive and yield parameters, the hybrid varieties F1SAGAR and Pusa Sanyog were identified as the best performers under agro-climatic conditions of Ranchi, Jharkhand. These varieties exhibited excellent vine growth, early flowering, greater number of fruits per vine and maximum fruit yield compared to the other varieties evaluated.

Traits contributing to higher yields

The study revealed that traits such as vine length, number of leaves, days to first female flower, number of fruits per vine showed significant positive association with fruit yield in cucumber. Varieties having vigorous vine growth, more number of leaves, early flowering and higher fruit set had greater productivity. Hence these traits need to be given importance while selecting parent material for cucumber improvement programs.

Recommendations on suitable varieties for Ranchi

Based on the findings of this study, the hybrid varieties F1SAGAR and MOTI are recommended for commercial cultivation in Ranchi region owing to their high yields and suitability to local growing conditions. The open pollinated varieties SHEETAL and GREEN LONG also showed reasonably good performance. However, hybrids were superior owing to their heterotic advantage. The study provides baseline information for selecting appropriate high yielding cucumber varieties adapted to agro-climatic conditions of Jharkhand. Popularization of improved cultivars along with integrated crop management will significantly increase cucumber productivity in the state.

Author Contributions

Shashank Kumar Rai: Investigation, formal analysis, writing—original draft. J. P. Singh: Validation, methodology, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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