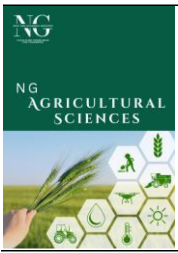

NG Agricultural Sciences
ISSN (Online): 3107-5053
Volume 1, Issue 1 (January-March), 2025, (8-15)

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Genotype Assessment of Chilli (*Capsicum annuum* L.) for Sustainable Production in Southern Odisha

Sai Manoj Goddu[1], Archana Mishra[1], Chinmaya Jena[1*] and Ajay Kumar Prusty[2]

[1]Department of Horticulture, M S Swaminathan School of Agriculture, Centurion University of Technology & Management, Odisha, 7651211, India
[2]Department of Agricultural Extension Education, M S Swaminathan School of Agriculture, Centurion University of Technology & Management, Odisha, 7651211, India

*Corresponding author email ID: jenachinmaya3@gmail.com

HIGHLIGHTS

- Evaluated 13 chilli genotypes in Southern Odisha, finding significant differences in growth, flowering, and yield.
- Arka Abhir showed the best performance regarding plant height, fruit traits, and yield.
- The study highlights the need to select suitable genotypes and use scientific practices to boost chilli production.

ARTICLE INFO

Article History:
Received: 05 February 2025
Revised: 01 March 2025
Accepted: 09 March 2025
Published: 31 March 2025

Keywords:
Capsicum annuum
Chilli yield
Genotype evaluation
Growth parameters
Southern Odisha

ABSTRACT

This study aimed to evaluate the performance of 13 genotypes of chilli (*Capsicum annuum* L.) under the agroclimatic conditions of Southern Odisha during the Rabi season of 2022-23. The experiment was conducted at the PG Instructional Research Farm, Bagusala, using a Randomized Block Design with three replications. The results revealed significant variations among the genotypes in terms of growth, flowering, and yield parameters. The genotype Arka Abhir consistently demonstrated superior performance, achieving the highest plant height, number of primary branches, leaf area, fruit length, fruit girth, average fruit weight, and overall fruit yield. These findings suggest that Arka Abhir is well-suited for cultivation in Southern Odisha due to its adaptability to local conditions and high yield potential. The genotype Andhra Local also showed promising results, particularly in fruit yield. The study highlights the importance of selecting appropriate genotypes and adopting scientific cultivation practices to enhance productivity and ensure sustainable chilli production. Future research should focus on exploring the potential of other genotypes, improving cultivation techniques, and addressing challenges related to climate change and pest management.

1. INTRODUCTION

As an important member of Solanaceae the vegetable crop *Capsicum annuum* L. contains 24 chromosomes in its genome. The scientific genus name Capsicum stems from the Latin word 'capsa' which refers to a box because chilli pepper fruits snugly organize their seeds like a small chest (Pramanik et al., 2020). The plant system behaves as both a variable herb and a cross-pollinated entity which displays an erect branched shoot system and strong taproots and simple leaves as well as single-flower blooms and many-seeded indehiscent berries that make up its fruit. The scientific name Capsicum represents both hot pepper varieties known as chilli and bell pepper as well as sweet pepper. The acid

https://doi.org/10.5281/zenodo.15109519

compound capsaicin/capsicutin (C18 H27NO3) contained in chili peppers leads to their hot taste which benefits treatment through Ayurvedic medicine as well as allopathic medicine and functions to remove various harmful radicals directly. The bell pepper species contains capsaicin as its primary carotenoid substance. The substance 'oleoresin' embedded within chilli pepper creates significance because it enhances food flavor distribution (Erwin et al., 2019).

Worldwide pepper cultivation comprises approximately 1,600 varieties and five primary species namely *Capsicum annuum, Capsicum frutescens, Capsicum Chinenses, Capsicum baccatum* together with *Capsicum pubescens*. Despite being extremely spicy to taste chilli peppers maintain their position among the most beloved spices that possess various medicinal and health benefits. The worldwide dominance belongs to C. annuum among all five important domesticated Capsicum species (Tripodi & Kumar, 2019). The plant serves multiple purposes as a vegetable and jarred salad and ketchup product. Chilli peppers function as a flavoring agent in multiple kitchen preparations including both food and liquid dishes. People eat this material to enhance both flavor and taste when cooking vegetables. Consumers widely enjoy pickle preparations that use unripe green fruits and ripe red fruits of this plant. Extremely promising export numbers exist for the essential oil ingredient known as oleoresin which appears as chilli oil. Green chilli fruits offer an ample amount of vitamin C yet Indian cuisine requires chilli to be considered entire (Arain, 2019).

The anti-cancer effects of chilli together with its medicinal advantages include its ability to reduce cholesterol levels, combat obesity and treat arthritis pain and hypertension as well as ischemic heart disease (Bal et al., 2022). The antimicrobial element of Capsaicin functions to decrease post-operative pain in patients who undergo mastectomies. Due to its variety importance the nutritional value of chilli varies but 100 g of edible fruit typically contains 40 kcal energy together with 8.81 g carbohydrates, 1.87 g protein, 0.44 g total fat and 1.5 g dietary fiber in addition to 23 mg magnesium, 14 mg calcium, 1.03 mg iron and 43 g phosphorus along with 952 IU vitamin A, 143.7 mg vitamin C, 0.69 mg vitamin E, 14 µg vitamin K, 534 µg carotene-β, 36 µg carot (Robertson et al., 2018).

Although the agro-climatic conditions of Odisha is suitable for cultivation of Chilli and a number of open pollinated varieties have been released but due to climatic changes, the varieties are losing its properties and stability in maintaining quality (Gade et al., 2020). A variety of a particular crop can perform differently under different agroclimatic conditions and some varieties of the same species when grown under same environment give different yields as the performance of a cultivar depends mainly on the interaction of genetic makeup and environment (Singh et al., 2021). Odisha is not self-sufficient for domestic consumption in chilli and it extremely depends upon supply from Andhra Pradesh during lean period. Hence, there is a need for evaluation of performance of different varieties possessing desirable characters suitable for this region. Further, productivity of chilli in Odisha is low, due to unscientific cultivation practices and farmers dependence on local market for availability of seed which are poor in germination and quality. Keeping this in view, the experiment aimed at identifying the best suitable variety having all desirable traits with a good adaptability to this region coupled with good management practices. Hence, the present investigation "Performance of chilli (*Capsicum annuum* L.) genotypes under Southern Odisha during Rabi season" was undertaken with the following objectives.

2. MATERIALS AND METHODS

The "Performance of chilli (*Capsicum annuum* L.) genotypes under Southern Odisha during Rabi season" investigation took place at PG instructional Research Farm, Bagusala, which belongs to the Department of Horticulture from M.S. Swaminathan School of Agriculture at Centurion University of Technology and Management in Paralakhemundi, Odisha from Rabi, 2022-23. A research testing 13 chilli genotypes was performed to evaluate their performance. A typical sub-tropical and sub-humid climate prevails at the Bagusala PG instructional farm in the Gajapati district, Odisha which belongs to the North Eastern Ghat Agro-climatic zone. The tested site contained sandy loam soil with pH 6.40 along with 0.64% organic carbon. The fertility values indicated a nitrogen availability of 75.26 kg/ha-1 and phosphorus content of 18.26 kg/ha-1 together with potassium content at 32.44 kg/ha-1. The experimental design included three replications of thirteen treatments arranged according to Randomized Block Method. Every plot contained area of 2.6 by 6 meters with 60cm and 50cm between plant rows. They initiated the trial operations throughout the Rabi season of 2022-23. Farm Yard Manure (FYM) received 25 tons per hectare as part of the fertilizer application together with 100:120:110 kg per hectare N, P, and K rates.

The seeds were sown in a protrays to grow the seedlings for transplanting inthe main field. The seeds were soaked in water for 10 hours before sowing for better germination. Seeds were treated with carbendazim @ 2 g kg-1. The seeds were sown in the protrays on 28th September 2022 followed by light watering with rose can. The protrays were covered with straw till seed germination was completed and water sprinkled regularly. Seedlings drenched with 0.2-0.3% fungicide twice, at 15 days and 30 days after sowing. Before 15 days of transplanting, the experimental field was ploughed using a tractor drawn cultivator followed by two cross harrowing to pulverize the soil to make fine tilth. All the weeds, stones and stubbles were removed from the field. FYM was incorporated into the soil @ 25t ha-1 at the time of first harrowing. The layout of the field was prepared as per the experimental design. The field was divided into plots (2.6 m x 6 m) with irrigation channels according to number of treatments and replications. A fertilizer dose of 100 kg N, 120 kg P2O5 and 110 kg K2O ha-1 was applied in the main field 10 days before transplanting. Fifty per cent of recommended nitrogenous fertilizer at 50 kg ha-1, full dose of P2O5 at 120 kg and 110 kg K2O ha-1 in the form of urea, diammonium phosphate and muriate of potash was applied as basal dose. The remaining 50 percent of urea was divided into two splits and top- dressed 30 and 45 days after transplanting. After 40 days of seed sowing i.e on 7th november the healthy seedlings were transplanted to the main field ata spacing of row to row 60 cm and plant to plant 50 cm. Application of pendimethalin @ 2ml lt-1 a pre-emergence herbicide followed by two hand weedings at 30 and 45 days after transplanting were carried out to keep the plots free from weeds to avoid plant and weed for nutrient competition during the crop growth period. Herbicide was applied after irrigation for better result and flood irrigation was given at aregular interval of 5-6 days. The recommended plant protection measures were taken against thrips and leaf curl virus with suitable insecticides and fungicides. Chilli fruits were harvested at marketable maturity when the fruit attains its maximum size and shape. The maximum genotypes were harvested between 90-120 days after transplanting. Five plants were selected randomly and tagged in each treatment and recorded the observations for various growth, yield and quality parameters.

3. RESULTS

3.1. Growth parameters

3.1.1. Plant height (cm)

The table reveals the plant dimensions at 120 days after transplanting (DAT) through its mean measurements. Various genotypes displayed a large and significant distinction in plant height which extended from 52.20 cm to 97.61 cm with an average of 67.26 cm. The genotypes Pusa Sadabahar (97.61 cm) displayed the tallest plant height that matched the measurements of Andhra Local (89.51 cm) and Pusa Jwala (83.06 cm). The shortest plants appeared in Kashi Tej (52.50 cm) while Kashi Abha measured 54.74 cm from the ground. Plant height of five genotypes exceeded the grand mean values by statistical significance. This variation in plant height measurement up to 120 DAT between genotypes can be attributed to local environmental and heritable genetic aspects between these genotypes and their environmental interaction. Chilli plants display specific genetic makeup which controls their final stature. Similar variations in plant height were reported by Jogdhande et al. (2017), Mopidevi et al. (2018), Prasad et al. (2019), and Molonoro et al. (2022).

3.1.2. Number of primary branches plant^{-1} (Nos.)

Table 1 together with Figure 2 contains data regarding primary branch number per plant at 120 DAT. The different genotypes demonstrated an extensive range of primary branch numbers per plant from 5.02 to 9.18 as the mean outcome was 6.72. Seven genotypes exceeded the average primary branch count which reached 6.72 per plant. Among all genotypes studied Andhra Local (9.18) produced the most primary branches along with Kashi Early (8.02), Kashi Abha (7.04) and Utkal Abha (7.00) and Kashi Sindhuri (6.98). The genotype Kashi Anmol displayed the least number of primary branches among all genotypes at 5.02 with Utkal Rashmi at 5.51 primary branches. Plant architecture seems to impact the number of primary branches per plant at 120 DAT since both genotype genetics and environmental conditions influence plant structure. Similar findings were reported by Jogdhande et al. (2017), Prasad et al. (2019), Jeevitha et al. (2021), and Nirmalya et al. (2021).

3.1.3. Leaf area (cm^2)

Several of the genotypes featured different leaf area measurements at day 120. The unit leaf area represents an appropriate method to evaluate how short-term environmental changes affect photosynthesis rates. The table presented the mean leaf area measurements (Table 1). The leaf area measurements of different genotypes produced significant variation because they fell between 9.08 cm^2 and 23.80 cm^2 with an average of 15.72 cm^2. Grand mean leaf area proved lower than the detected leaf area in six genotypes. The leaf area measurements showed their maximum value in Andhra Local (23.80 cm^2) which had no statistically significant differences from the areas of Arka Abhir (21.23 cm^2) and Arka Lohit (21.19 cm^2) but the minimum value was obtained from Bhagya Lakhsmi (9.08 cm^2) and Pusa Jwala (10.55 cm^2). Environmental conditions together with photosynthetic capabilities influenced the leaf area results for each studied genotype. Similar findings were reported by Chowdhury et al. (2015), Joshi et al. (2020), and Mounika et al. (2022).

3.2. *Flowering parameters*

3.2.1. *Days to 1st flowering (Days)*

The time needed for the first flowers to appear contributed heavily to determining chilli genotypes as early, mid-late or late types. The early flower production resulted in early fruit setting that enabled producers to collect their produce before market competition increased thus obtaining better prices. Data from Table 1 demonstrated 43.17 days as the average first flowering period while these periods differed widely between 36.73 and 52.40 days. The genotype Kashi Early displayed first flowering in 36.73 days and stood as the best performer while demonstrating identical performance to Kashi Sindhuri (38.53) and Kashi Abha (39.40). The genotype Utkal Rashmi (52.40) required the longest number of days for first flowering yet Utkal Abha occupied second place with 51.60 days. The data presented in Table 1 showed the days to first flowering with graphical representation displayed in Figure 4. Hormonal factors together with moderately genetic factors and environmental factors collectively influenced the number of days required for flowering initiation between genotypes. Similar variations were reported by Jogdhande et al. (2017), Farwah et al. (2020), Joshi et al. (2020), Mukesh et al. (2021), Molonoro et al. (2022).

3.2.2. *Days to 50% flowering (Days)*

The information about the time needed for 50% blooming strategy was displayed in Table 1. The studied data indicated that the flowering period required between 41.67 to 58.00 days yet manifested an average time of 48.46 days. The experimental plants of Kashi Early flowered 41.67 days after planting which matched their flowering time with Kashi Sindhuri (42.33) and Kashi Abha (43.67). The longest period of 50% flowering occurred in Utkal Abha which lasted 58 days before other genotypes Utkal Rashmi (57 days) appeared. Any crop benefits from early flowering characteristics because this quality proves valuable for vegetable growers who wish to harvest earlier and earn better market rates. The measurement of days until reaching 50% flowering differed because of three main factors: the genetic blueprint of each genotype and minimal environmental effects and robust crop development. Similar findings were reported by Janaki et al. (2015), Mopidevi et al. (2020), Mukesh et al. (2021), Sayed et al. (2022).

Table 1. Evaluation of different genotypes of Chilli for growth and flowering parameters

Genotypes	Plant height (cm)	Number of branches plant^{-1} (Nos.)	Leaf area (cm^2)	Days to 1st flowering (Days)	Days to 50% flowering (Days)
Kashi Anmol	55.68	5.02	11.82	43.06	49.00
Bhagya Lakshmi	69.21	6.53	9.08	41.26	50.67
Utkal Rashmi	59.51	5.51	10.87	52.40	57.00
Utkal Abha	50.69	7.00	13.58	51.60	58.00
Arka Abhir	69.27	5.82	21.23	41.53	46.00
Arka Lohit	66.93	6.14	21.19	40.60	46.00
Pusa Sadabahar	97.61	6.75	13.84	43.93	47.67
Pusa Jwala	83.06	6.42	10.55	48.53	56.00
Kashi Abha	54.74	7.04	18.25	39.40	43.67
Kashi Sindhuri	66.77	6.98	18.33	38.53	42.33
Kashi Early	58.87	8.02	18.57	36.73	41.67
Kashi Tej	52.50	6.95	13.20	41.33	44.33
Andhra Local	89.51	9.18	23.80	42.33	47.67
SE (m)+	3.86	0.40	0.72	0.88	0.84
CD (0.05)	11.25	1.16	2.10	2.58	2.45

3.3. *Yield and yield attributing parameters*

3.3.1. *Number of fruits plant^{-1} (Nos.)*

Research indicated that experimental plants produced widely different numbers of fruits with counts ranging from 43.26 to 112.40 exposing a mean of 74.26. The statistical data appeared in Table 2. Seven genotypes produced fruit number results above the grand mean value. The genotype Arka Abhir displayed 112.40 plants per fruit whereas Andhra Local reached 103.20 and Arka Lohit attained 92.73. Fruits per plant reached their minimum value of 43.26 in Kashi Anmol with Utkal Abha following closely at

57.20. The plant genetics served as the main reason for these results. Similar findings were reported by Tariq et al. (2022), Mopidevi et al. (2018), Prasad et al. (2019), Nirmalya et al. (2021), Sayed et al. (2022).

3.3.2. Fruit length (cm)

The data regarding fruit length appeared in Table 2. Fruit dimensions of experimental genotypes measured 5.38 cm to 9.56 cm and yielded 7.26 cm as the average length while six genotypes were found to exceed the grand mean for fruit length. The very longest fruits appeared on Arka Abhir with 9.56 cm length which showed no significant difference to Kashi Abha with 8.65 cm and Kashi Sinduri with 9.26 cm. Kashi Anmol (5.38 cm) exhibited the shortest fruit length whereas Utkal Rashmi (5.51 cm) followed it. The natural genetic structure of the plant along with the quantity of nutrient intake and plant growth condition directly controlled the length of the fruits. Similar variations in fruit length in different chilli genotypes were noted by Yatagiri et al. (2017), Prasad et al. (2019), Joshi et al. (2020), Sayed et al. (2022).

3.3.3. Fruit girth (cm)

All genotypes spanned from 2.73 cm to 4.51 cm in terms of fruit girth measurements while the average measurement reached 3.40 cm. The fruit girth measurement achieved its peak in Arka Abhir by reaching 4.51 cm which held equivalent results to Andhra Local (3.63 cm), Arka Lohit (3.61 cm) and Kashi Abha (3.56 cm). The shortest apple girth measure was recorded in Utkal Abha (2.73 cm) and Utkal Rashmi displayed the same girth value of 2.73 cm. A total of seven genotypes produced plums with fruit girth values exceeding the general mean. Table 2 showed the broad range of girth measurements recorded among fruits. Fruit girth variations between genotypes result from a blend between genetic potential and plant capacity to distribute dry matter in different parts. Similar variations in fruit girth were reported by Mopidevi et al. (2018), Prasad et al. (2019), Molonoro et al. (2022), Sayed et al. (2022).

Table 2. Evaluation of different chilli genotypes for yield and yield attributes

Genotypes	Number of fruits plant^{-1} (Nos.)	Fruit length (cm)	Fruit girth (cm)	Average fruit weight (g)	Fruit yield/plant (g)	Fruit yield/plot (kg)
Kashi Anmol	43.26	5.38	3.44	2.56	102.34	2.43
Bhagya Lakshmi	66.33	7.92	3.41	2.61	164.78	4.43
Utkal Rashmi	60.86	5.51	2.78	1.71	98.73	2.23
Utkal Abha	57.20	6.55	2.73	1.68	97.23	1.93
Arka Abhir	112.40	9.56	4.51	4.12	423.87	9.13
Arka Lohit	92.73	8.39	3.61	4.04	347.39	6.86
Pusa Sadabahar	80.33	7.11	3.45	1.84	133.27	3.46
Pusa Jwala	74.40	6.02	3.27	3.08	203.52	4.00
Kashi Abha	64.73	8.65	3.56	2.74	170.34	3.53
Kashi Sindhuri	58.13	9.26	3.31	2.78	159.99	3.20
Kashi Early	77.73	6.28	3.05	3.67	239.34	3.66
Kashi Tej	74.06	7.52	3.38	2.66	165.52	4.03
Andhra Local	103.20	6.52	3.63	3.92	341.75	6.36
SE (m)+	3.53	0.25	0.15	0.15	11.51	0.22
CD (0.05)	10.29	0.70	0.43	0.45	33.59	0.64

3.3.4. Average fruit weight (g)

Chilli plants exhibit the fruit weight as their primary factor which drives yield creation. The yield capacity of chilli genotypes primarily depends on two key elements: individual fruit size and total number of produce per plant. Table 2 contained data about different genotypes and their average fruit weights which showed significant variance. Throughout the chilli genotypes the measured average fruit weight differed between 1.68 g and 4.2 g equating to an overall mean of 2.88 g. Among the genotypes examined Arka Abhir attained the greatest average fruit weight measurement at 4.12 g while it showed no significant differences compared to Arka Lohit at 4.04

g and Andhra Local at 3.92 g. The chilli genotype Utkal Abha exhibited the lowest fruit weight of 1.68 grams and was seconded by Utkal Rashmi at 1.71 grams. The amount of photosynthates accumulated by fruits differed between the genotypes leading to variations in their final weights. Similar findings were reported by Chowdhury et al. (2015), Prasad et al. (2019), Jeevitha et al. (2021), Nirmalya et al. (2021), Molonoro et al. (2022), Sayed et al. (2022).

3.3.5. Fruit yield plant^{-1} (g)

The data indicated a noticeable change in the amount of produced fruits for each plant. The researchers presented the data in Table 2. Records showed that the measured fruit yield from each plant varied between 97.23 g to 423.87 g with an average of 203.70 g. The research indicated that the highest amount of harvested fruit per plant appeared in Arka Abhir (423.87 g) to the same level as Arka Lohit (423.87 g) and Andhra Local (341.75 g). Utkal Abha produced the lowest amount of fruit per plant with 97.23 g while Utkal Rashmi had a fruit yield of 98.73 g as its minimum result. Similar findings were reported by Chowdhury et al. (2015), Janaki et al. (2015), Yatagiri et al. (2017), Joshi et al. (2021), Nirmalya et al. (2021), Sayed et al. (2022).

3.3.6. Fruit yield plot^{-1} (kg)

The evaluated genotypes showed meaningful variations in their yield output for each plot. The data visualization took place through Table 2. The research data showed plot fruit yield ranged from 1.93 kg to 9.13 kg with an average of 4.25 kg. The highest yield per plot amounting to 9.13 kg was obtained from the Arka Abhir genotype and matched similar results with Arka Lohit (6.86 kg) and Andhra Local (6.36 kg). Utkal Abha stood as the genotype with the lowest yield of 1.93 kg per plot while Utkal Rashmi yielded 2.23 kg per plot. The variation in chilli genotypes for yield per plot was also noted by Chowdhury et al. (2015), Janaki et al. (2015), Yatagiri et al. (2017), Nirmalya et al. (2021), Sayed et al. (2022).

3.3.7. Fruit yield ha^{-1} (t)

The information in Table 2 demonstrated considerable differences in chilli genotypes per hectare yield ranging between 1.23 t and 5.80 t with an average of 2.69 t. As recorded by the Arka Abhir genotypic population yielded 5.80 t of produce per hectare and performed at the same statistical level as Arka Lohit and Andhra Local which yielded 4.36 t and 4.07 t respectively. The least fruit output per hectare among the genotypes belonged to Utkal Abha with 1.23 t while Utkal Abha obtained 1.53 t. Similar findings were reported by Janaki et al. (2015), Abraham et al. (2016), Yatagiri et al. (2017), Prasad et al. (2019), Farwah et al. (2020), Molonoro et al. (2022).

4. DISCUSSION

Genotypic makeup together with local environmental conditions, creates the significant variations that lead to differences in plant height and number of primary branches and leaf area among tested genotypes. Among the examined genotypes, Pusa Sadabahar reached the highest plant height, although Kashi Tej remained the shortest. Research by Jogdhande et al. (2017) and Prasad et al. (2019) showed parallel findings which explained why genetic traits create different plant height variations. The most number of primary branches existed in Andhra Local plants among all genotypes. According to Jeevitha et al. (2021) and Nirmalya et al. (2021), plant architecture, together with genetic factors, controls the patterns of branching. Andhra Local exhibited the maximum leaf area measurements as an essential indicator of photosynthetic efficiency because it recorded the greatest leaf area measurements. Results matched those reported by Mehraj et al. (2014) and Mounika et al. (2022) about leaf area variations caused by genetic and environmental elements.

Genotypic variation produced meaningful differences in the time-span between generation of first flowers along with generation of flowering in half the plants. Between the tested genotypes, Kashi Early exhibited the shortest flowering period, whereas Utkal Rashmi demonstrated the longest flowering period. The capability to flower early remains a preferred characteristic for chilli plant breeders because it allows producers to start fruiting production and maximize their early harvest profits. The data support earlier studies by Tembhurne et al. (2007) and Joshi et al. (2020), which demonstrated that both natural factors and genetic composition affect the flower development period. The time required for Kashi Early to reach 50% flowering was the lowest among all participants in this experiment. The research findings agree with Sayed et al. (2022), who established that early flowering traits benefit crops which have multiple harvest cycles.

The tested genotypes displayed different patterns in terms of the number of fruits per plant as well as fruit length and girth and average fruit weight and fruit yields recorded per plant and per plot. The combination of high values for fruit per plant and fruit length and fruit girth and average weight let Arka Abhir become the genotype with the maximum fruit yield per plant and per plot. The study results match the findings from Tariq et al. (2022) and Prasad et al. (2019), who discovered that genetic traits strongly impact yield and yield-attributing characteristics. The genotype Utkal Abha demonstrated the lowest outcome levels, thus suggesting it is not advisable for cultivation in this particular study area. The studied agroclimatic conditions of Southern Odisha favor Arka Abhir and Andhra Local genotypes as the most suitable options for high yield production.

5. CONCLUSIONS

The study conducted by the research team has provided valuable insights into the performance of 13 genotypes of chilli (*Capsicum annuum* L.) under the agroclimatic conditions of Southern Odisha during the Rabi season of 2022-23. The research demonstrates important genetic variations between the chilli genotypes because choosing the correct plant type proves central for regional crop optimization. Testing of the Arka Abhir genotype confirmed its leading position through exceptional results across whole set of qualities, which incorporated plant height, number of primary branches and leaf area together with fruit length, fruit girth and average fruit weight and total fruit yield metrics. The data shows that Arka Abhir stands out as an optimal cultivation variety for Southern Odisha because it succeeds remarkably in local conditions and produces high yields. Farms in the region now have another suitable cultivation choice through the Andhra Local genotype, which demonstrated exceptional fruit production capabilities. Research development must continue to investigate and endorse chilli varieties which excel in diverse agroclimatic environments and yield high yields. The research results show that scientific cultivation techniques must be adopted because they guarantee sustainable production and maximum yields for chilli agriculture. Extant research initiatives should direct their attention to exploring alternative genotypes as well as improving cultivation methods alongside solutions to deal with climate change and pest control systems.

Conflicts of Interest: The authors declare no conflicts of interest.

Funding: This research received no external funding.

Acknowledgments: The authors would like to express their gratitude to the Centurion University of Technology & Management for their support and assistance in conducting this research.

Author Contributions: Conceptualization, S.M.G. and C.J.; methodology, S.M.G.; validation, S.M.G., C.J., and A.M.; formal analysis, S.M.G.; investigation, S.M.G.; writing—original draft preparation, S.M.G.; writing—review and editing, S.M.G., C.J., A.M., and A.K.P.; supervision, C.J. All authors have read and agreed to the published version of the manuscript.

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