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Evaluation of chilli varieties for growth, yield, and productivity in Prakasam district of Andhra Pradesh

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Abstract

Four Chilli hybrids LCA-620, LCA-625, Arka Meghana, along with the local check Devanur, were evaluated through on-farm testing across the villages of Pedhannapalem, Pothavarm, Nadim Palli, and Nagabotlapalem in Prakasam district, Andhra Pradesh, covering an area of approximately 5 ha during 2021-2024. The experiment aimed to assess growth, yield, pest incidence, and economic performance of chilli varieties under farmers' field conditions. The experiment was conducted in a randomized block design with farmers as replications. The results revealed that LCA-625 recorded significantly higher values for plant height (170.67 cm), number of fruits per plant (126.33), fruit weight (7.67 g), fruit length (8.97 cm), yield per plant (920 g), and yield per hectare (51.67 q ha⁻¹) compared to other varieties. LCA-625 also flowered earlier (37 days) and recorded significantly lower thrips incidence (27.6%) than the local check (43%). Economic analysis indicated that LCA-625 resulted in the highest net returns (₹ 3,62,333 ha⁻¹) and benefit-cost ratio (2.77), followed by LCA-620. The yield advantage of LCA-625 over the local check was 39.6%. The consistent superior performance of LCA-625 across the three years indicates its suitability for cultivation under Prakasam district conditions.

Keywords: Chilli hybrids, on-farm testing, yield performance, pest incidence

Introduction

Chilli (*Capsicum annuum* L.) is one of the most important spice crops cultivated worldwide, valued for its culinary, nutritional, and industrial significance. It is consumed both as a vegetable and as a spice, owing to its characteristic pungency, flavour, and attractive colour. Dried red chilli powder is widely used in the preparation of curries, pickles, sauces, soups, and other food products. In addition to its culinary importance, chilli is a rich source of capsaicin, which is extensively used in the pharmaceutical industry for the manufacture of analgesics, balms, and medicinal formulations.

The quality and market value of chilli are primarily determined by pungency and fruit colour, which strongly influence consumer preference. In India, chilli is cultivated across tropical, sub-tropical, and temperate regions, reflecting its wide adaptability and economic importance (Hazra *et al.*, 2011) [3]. India ranks first globally in chilli production, consumption, and export, with Andhra Pradesh being one of the major chilli-producing states, contributing substantially to the total area and production of the crop.

Despite its importance, chilli cultivation is often constrained by price fluctuations arising from variations in global supply and demand. Export markets prefer highly pungent red chillies, while domestic markets favour medium-long fruits with moderate pungency and bright red colour. Additionally, chilli cultivation involves high input costs, particularly for hybrid varieties, and is affected by issues such as spurious seed availability, pest and disease incidence, and climate variability, leading to yield instability and economic uncertainty for farmers.

To address these challenges, improved chilli varieties such as LCA-620 and LCA-625, developed by the Horticulture Research Station (HRS), Lam, Guntur, Andhra Pradesh, have been introduced for potential adoption. These varieties, presently under mini-kit trials, require systematic evaluation under farmers' field conditions to assess their adaptability, yield performance, pest tolerance, and economic viability.

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Therefore, on-farm trials were conducted across multiple locations over three consecutive years (2021-2024) to evaluate the performance of LCA-620, LCA-625, and Arka Meghana in comparison with the local check Devanur.

The present study was undertaken with the objectives of assessing growth and yield attributes, pest incidence (thrips), and economic parameters including net returns and benefit-cost ratio of the evaluated chilli varieties under real farming conditions. The study aimed to identify a high-performing and economically viable chilli variety suitable for cultivation in Prakasam district, Andhra Pradesh, under farmers' management practices.

Materials and Methods

The on-farm evaluation of chilli varieties was conducted during three consecutive seasons from 2021-22 to 2023-24 in farmers' fields located in Prakasam district, Andhra Pradesh. The chilli varieties LCA-620 and LCA-625 were sourced from the Horticulture Research Station (HRS), Lam, Guntur, Andhra Pradesh, while Arka Meghana was procured from the Indian Institute of Horticultural Research (IIHR), Bengaluru. The locally cultivated variety Devanur was used as the control.

The experiment was laid out in a Randomized Block Design (RBD) with farmers as replications. Each selected farmer maintained all four varieties in comparable plots of 0.4 ha, resulting in 25 replications over a total experimental area of 10.0 ha. The experimental fields were characterized by sandy loam soils and were irrigated using a check basin irrigation system. To minimize field-to-field variability, treatment and control plots were carefully demarcated within each farmer's field to ensure uniformity in soil type, fertility status, and management practices.

Standard agronomic practices, including soil test-based fertilizer application, intercultural operations, irrigation scheduling, and plant protection measures, were uniformly followed across all treatments and replications. Pest and disease management practices were applied at identical doses and schedules across

locations to maintain uniformity. *Trichoderma viride* was applied for wilt management by inoculating it into 200 kg of compost, which was uniformly applied in all experimental plots. Krishi Vigyan Kendra (KVK), Darsi, maintained a buffer stock of nursery seedlings to ensure timely and uniform supply.

Regular field visits were undertaken for observation and data recording. Growth and yield attributing parameters, namely plant height, number of primary branches per plant, days to first flowering, number of fruits per plant, fruit length, fruit weight, and thrips incidence, were recorded at appropriate crop growth stages. In each plot, ten plants were randomly selected for recording plant height and number of fruits per plant. Plant height and number of branches were recorded at peak flowering and fruiting stages. Fruit length and fruit weight were recorded from a random sample of 100 fruits collected from each plot prior to harvest.

Data on yield, cost of cultivation, and prevailing market prices were collected from participating farmers for each variety and the control. Gross returns, net returns, and benefit-cost (B:C) ratio were computed using standard economic formulas. The overall performance of the varieties for yield and economic parameters over the three years was evaluated using original year-wise data.

Statistical Analysis

The recorded data on growth, yield attributes, pest incidence, and economic parameters were analysed using analysis of variance (ANOVA) under Randomized Block Design (RBD). The significance of differences among chilli varieties was tested using F-test at the 5% level of significance. Whenever the F-test was found significant, treatment means were compared using critical difference (CD) at 5% probability level. Percentage data on pest incidence were subjected to arc sine square-root transformation prior to analysis. Year-wise analyses were carried out for all parameters, and the overall performance was interpreted using original values.

Table 1: Performance of chilli varieties under farmers' field conditions (Mean of three years: 2021-2024)

S. No.	Particulars	LCA-620	LCA-625	Arka Meghana	Devanur (Check)	S.Em $\pm$	CD ($p = 0.05$)	CV (%)
1	Plant height (cm)	156.67	170.67	143.67	157.33	0.37	1.14	13.56
2	Number of branches per plant	17.67	21.67	14.00	11.00	0.24	0.72	8.28
3	Days to first flowering	43.33	37.00	43.00	51.00	0.53	1.61	11.62
4	Days to first harvest	71.33	70.67	78.00	81.00	0.17	0.54	14.21
5	Number of fruits per plant	102.67	126.33	79.00	91.00	1.28	3.87	12.05
6	Average fruit weight (g)	6.30	5.87	7.67	5.70	0.03	0.11	9.66
7	Fruit length (cm)	8.33	8.97	7.07	6.10	0.12	0.34	8.24
8	Fruit yield per plant (g)	666.67	920.00	710.00	589.00	56	171	15.27
9	Yield per hectare ($q\ ha^{-1}$)	47.67	51.67	41.00	37.00	0.62	1.85	13.51
10	Thrips incidence (%)	(33)35.06	(27.6)31.74	(36)36.87	(43)40.98	0.25	0.76	12.94
11	Whitefly incidence (%)	(9)17.45	(14)21.97	(16.7)23.83	(24.7)29.80	0.32	0.98	10.62
12	Fruit rot incidence (%)	(11.3)19.67	(16)23.58	(20)26.57	(10.5)18.91	0.18	0.55	9.47

Table 2: Cost-Economics of chilli varieties under farmers' field conditions (Mean of three years: 2021-2024)

S. No.	Particulars	LCA-620	LCA-625	Arka Meghana	Devanur (Check)
1	Yield ($q\ ha^{-1}$)	47.67	51.67	41.00	37.00
2	Cost of cultivation ($\text{₹}\ ha^{-1}$)	224,333	204,333	228,667	237,000
3	Gross returns ($\text{₹}\ ha^{-1}$)	524,667	566,667	451,667	407,000
4	Net returns ($\text{₹}\ ha^{-1}$)	300,333	362,333	223,000	170,000
5	Benefit-cost ratio (B:C)	2.34	2.77	1.98	1.72

Results and Discussion

Growth and Yield Attributes

The pooled analysis of three years (2021-2024) presented in Table 1 revealed significant differences among the chilli varieties for growth, yield, and pest incidence parameters. The improved variety LCA-625 consistently outperformed the other varieties across most of the observed traits.

Plant height varied significantly among the varieties, with LCA-625 recording the maximum plant height (170.67 cm), followed by Devanur (157.33 cm) and LCA-620 (156.67 cm), while Arka Meghana exhibited the shortest plants (143.67 cm). Increased plant height in LCA-625 may be attributed to its superior genetic potential and better vegetative vigour. Similar variations in plant height among cultivars have been reported earlier by Satish Babu *et al.* (2022) ^[13], Rajamanickam (2020) ^[11], Dhayani *et al.* (2017) ^[1], Jatav *et al.* (2017) ^[4], Kumar *et al.* (2018) ^[6], and Parmar *et al.* (2018) ^[10].

Earliness is a desirable trait in chilli cultivation, as it enables early harvesting and better market realization. LCA-625 flowered significantly earlier (37 days) compared to LCA-620 (43.33 days), Arka Meghana (43.00 days), and the local check Devanur (51 days). Early flowering observed in LCA-625 may be attributed to varietal genetic differences, as also reported by Rajamanickam (2020) ^[11] and Mishra *et al.* (2017) ^[7]. Similar trends have been documented in other solanaceous crops by Singh *et al.* (2014) ^[14].

Yield-attributing traits such as number of branches and number of fruits per plant showed significant variation among the varieties. LCA-625 recorded the highest number of branches per plant (21.67) and maximum fruits per plant (126.33), which directly contributed to its superior yield performance. In contrast, the local check Devanur recorded fewer branches (11.00) and fruits per plant (91.00). The importance of number of branches and fruits per plant in determining yield has also been emphasized by Rohini and Lakshmanan (2017) ^[12] and Nagaraju *et al.* (2018) ^[8].

Fruit characters showed clear varietal differences. LCA-625 recorded the longest fruits (8.97 cm), whereas Arka Meghana produced the heaviest fruits (7.67 g). However, despite slightly lower fruit weight, the higher fruit number in LCA-625 resulted in superior total yield. The local check recorded the lowest fruit length (6.10 cm) and fruit weight (5.70 g). Similar findings regarding varietal differences in fruit characters were reported by Satish Babu *et al.* (2022) ^[13], Rajamanickam (2020) ^[11], and Hadora *et al.* (2017) ^[2].

The cumulative effect of improved growth and yield components resulted in significantly higher yield per plant (920 g) and yield per hectare (51.67 q ha⁻¹) in LCA-625, followed by LCA-620 (47.67 q ha⁻¹). The local check recorded the lowest yield (37.00 q ha⁻¹). The superiority of LCA-625 in yield performance may be attributed to its better source-sink relationship and enhanced yield-contributing traits.

Pest Incidence

Significant differences were observed among varieties for pest incidence (Table 1). LCA-625 recorded the lowest thrips incidence (27.6%), compared to the local check Devanur (43%). Similarly, whitefly and fruit rot incidences were lower in LCA-625 compared to other varieties. Reduced pest incidence in LCA-625 may be due to inherent varietal tolerance, which has also been reported by earlier researchers. Lower pest pressure contributes directly to higher marketable yield and better economic returns.

Economics

The economic analysis presented in Table 2 clearly demonstrated the superiority of improved varieties over the local check. Although the cost of cultivation was comparable among the improved varieties, LCA-625 recorded the highest gross returns (₹ 5,66,667 ha⁻¹) owing to higher yield and better market preference.

LCA-625 achieved the maximum net returns (₹ 3,62,333 ha⁻¹) and highest benefit-cost ratio (2.77), followed by LCA-620 with a net return of ₹ 3,00,333 ha⁻¹ and B:C ratio of 2.34. In contrast, the local check Devanur recorded the lowest net returns (₹ 1,70,000 ha⁻¹) and B:C ratio (1.72), mainly due to lower yield and higher cultivation costs.

The adoption of LCA-625 resulted in a 39.6% increase in yield over the local check, indicating its strong economic advantage under farmers' field conditions. Similar economic superiority of LCA-625 has been reported by Satish Babu *et al.* (2022) ^[13] and Venkanna and Bhaskar Rao (2020) ^[16]. The results corroborate earlier findings by Singh *et al.* (2009) ^[15], who emphasized that adoption of high-yielding varieties significantly narrows the extension gap and improves farm profitability.

Conclusion

The results of the present three-year on-farm evaluation (2021-2024) clearly indicate that the improved chilli varieties LCA-625 and LCA-620 performed better than the local check Devanur under Prakasam district conditions. Superior performance of these varieties was primarily attributed to improved yield-contributing traits such as number of branches, number of fruits per plant, fruit length, fruit weight, yield per plant, and yield per hectare.

Among the evaluated varieties, LCA-625 emerged as the most promising, recording the highest yield (51.67 q ha⁻¹), maximum net returns (₹ 3,62,333 ha⁻¹), and the highest benefit-cost ratio (2.77). In addition, LCA-625 exhibited relatively lower thrips incidence (27.6%) compared to the local check (43%), indicating better field tolerance to pests. The yield advantage of LCA-625 over the local variety was 39.6%, highlighting its productivity potential under farmers' management conditions.

LCA-620 also demonstrated improved yield and economic returns over the local check, suggesting its suitability as an alternative high-performing variety. Overall, the consistent superiority of LCA-625, followed by LCA-620, in terms of growth, yield, pest incidence, and profitability indicates their suitability for cultivation in Prakasam district.

Based on the findings, LCA-625 and LCA-620 can be recommended for large-scale adoption and promotion through frontline demonstrations and mass demonstrations to enhance chilli productivity and farm income in the region.

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