

Performance and Popularization of Kashmiri Chilli Cultivar KL-1 for Yield and Profitability Enhancement in Pulwama District

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Abstract

Kashmiri red chilli, particularly the KL-1 (Kashmiri Long-1) type, is renowned across India and abroad for its vibrant colour, moderate pungency, and high market value. Despite its economic importance, productivity in farmers' fields across Pulwama district remains limited due to the predominant use of low-yielding local varieties and traditional cultural practices. The present study aimed to evaluate the performance and promote the adoption of the high-value chilli cultivar KL-1 through on-farm demonstrations conducted across six community locations in District Pulwama during the years 2020 and 2021. Two treatments were compared: T₀ (local check) and T₁ (KL-1). KL-1 exhibited distinct superiority in vegetative growth and fruiting behaviour. It recorded increased plant height, longer fruits, greater fruit girth, higher number of fruits per plant, and improved dry matter content traits directly contributing to yield enhancement. KL-1 achieved an average dry chilli yield of 45 q/ha, which represented a 44% increase over the local variety (26 q/ha). Economic analysis revealed a clear profitability advantage, with KL-1 recording a cost benefit ratio of 1:4 compared to 1:3 for the local check. The consistent performance of KL-1 across all six locations over two years demonstrates its strong adaptability to the temperate agro-climatic conditions of Pulwama. The superior yield, desirable fruit characteristics, and higher economic returns indicate that KL-1 is a promising cultivar for large-scale popularization and an effective intervention for enhancing chilli productivity and farmer income in the region.

Key words: Kashmiri chilli, KL-1, On-farm demonstration, Yield performance, Profitability

Chilli (*Capsicum annum* L.) is one of the most economically significant spice crops cultivated across India, valued for its colour, aroma, pungency, and wide utility in fresh, dried, and processed forms. Among the various chilli types grown in the country, Kashmiri red chilli occupies a distinguished position due to its unique deep red colour, moderate pungency, and high pigment content, making it highly demanded both nationally and internationally. The Kashmiri Long-1 (KL-1) cultivar represents one of the premium types traditionally associated with the Kashmir Valley, known for its attractive fruit characteristics, consumer preference, and elevated market premium. As reported by Ahmad *et al.* [1], Kashmiri chilli varieties are widely recognized for their high colouring ability and lower capsaicin content, making them a preferred choice for culinary and industrial applications. Despite its commercial importance, chilli productivity in Pulwama district remains below potential. This is largely due to the continued reliance on local, low-yielding cultivars and inadequate adoption of improved varieties with superior morphological and yield-attributing traits. Yield in chilli is strongly influenced by factors such as fruit length, fruit girth, number of fruits per plant, fruit weight, and dry matter accumulation, all of which contribute to total dry chilli output. According to Sharma and Kumar [2], improved chilli cultivars

expressing longer fruits, enhanced fruit set, and greater fruit-bearing potential tend to exhibit significantly higher yields under temperate field conditions. Furthermore, studies conducted in various chilli-growing regions have stressed the need for farmer-level demonstrations to validate the performance of improved cultivars and facilitate their adoption [3]. Besides morphological and yield traits, chilli (*Capsicum annum* L.) performance is influenced by its physiological and biochemical characteristics, including chlorophyll content, nutrient use efficiency, and capsaicin accumulation. Studies by Singh *et al.* [4] and Verma and Joshi [5] reported that cultivars exhibiting higher chlorophyll content and better photosynthetic efficiency tend to produce longer and heavier fruits, contributing to increased dry chilli yield. Similarly, Das *et al.* [6] highlighted the role of nutrient management in enhancing fruit set and quality in high-value chilli varieties. The capsaicin concentration, responsible for pungency, is often lower in temperate cultivars like KL-1, which aligns with market preference for moderately pungent red chilli [7]. These findings underline the importance of integrating morphological, physiological, and biochemical traits to optimize productivity and quality in chilli cultivation. The agro-climatic conditions of Pulwama district characterized by cool temperate weather, fertile soils, and favourable humidity provide a suitable

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environment for quality chilli cultivation. However, productivity constraints persist due to poor seed replacement rates and limited penetration of promising cultivars like KL-1. On-farm demonstration has emerged as a practical approach to bridge this gap by enabling real-time evaluation of improved varieties under farmer management conditions, thereby improving adoption and awareness. As highlighted by Lone *et al.* [8], technology demonstrations at the community level play a crucial role in enhancing farmers' confidence and accelerating the spread of high-performing cultivars. KL-1 is a high-value chilli cultivar known for its elongated fruits, desirable colour, superior dry matter content, and strong market acceptability. Preliminary departmental trials have reported encouraging performance in terms of fruit length, fruit number per plant, and total dry chilli yield, yet systematic evaluation under farmers' field conditions in Pulwama has been limited. Multi-location demonstration trials are therefore essential to assess its yield potential, profitability, and adaptability across diverse micro-environments. The present study was undertaken during the 2019 and 2020 cropping seasons across six community-managed locations in Pulwama district with the objective of evaluating the performance, productivity gains, and economic feasibility of KL-1 in comparison to the local chilli cultivar. The study also aimed at promoting the popularization and adoption of KL-1 among chilli growers through participatory demonstration approaches.

MATERIALS AND METHODS

The study was conducted during the cropping seasons of 2020 and 2021 across six community-managed locations of District Pulwama, Jammu and Kashmir. The region lies in a temperate agro-climatic zone characterized by cool summers, cold winters, and fertile clay-loam soils suitable for high-quality chilli cultivation. The selected sites represented typical farmer field conditions of the district to ensure realistic performance assessment of the cultivar.

Planting material

Two treatments were evaluated in the study: T0: Local chilli cultivar commonly grown by farmers (control) T1: Kashmir Long-1 Cultivar KL-1. KL-1 seed/Seedlings material was supplied through KVK, while farmer-saved seeds were used for the local check to reflect actual field conditions.



Different locations of the experiment

Experimental design

On-farm demonstrations were established using a randomized block design (RBD) with two treatments and six

replications corresponding to the six community locations. Each demonstration plot followed the standard farmer-managed size and layout to simulate real-world cultivation practices. The design ensured a fair comparison of cultivars under diverse micro-environments across the district.

Crop establishment and agronomic practices

Field preparation was carried out according to locally adopted practices. Transplanting of chilli seedlings took place during the appropriate spring planting window, maintaining uniform spacing and plant population across all locations. Application of farmyard manure and the recommended dose of NPK fertilizer was done uniformly. Intercultural operations such as weeding, irrigation, staking, and plant protection were done as per recommended Package & Practices Vegetable Crops (Vol II) and kept consistent between treatments to avoid management bias. Harvesting of mature red fruits was done in multiple pickings as per the crop's maturity pattern.

Meteorological conditions

Meteorological data, including daily maximum and minimum temperature, rainfall, and relative humidity for both seasons, were obtained from the nearest agro-meteorological station. The chilli crop experienced typical temperate climatic conditions during both years, with moderate daytime temperatures and suitable humidity favouring good fruit set and colour development.

Observations recorded

Observations were recorded from ten randomly selected tagged plants in each demonstration plot. The following morphological and yield-related parameters were assessed:

- Plant height (cm)
- Number of primary branches
- Fruit length (cm)
- Fruit girth (cm)
- Number of fruits per plant
- Fresh fruit weight (g)
- Dry matter percentage (%)
- 100-seed weight (g)
- Dry chilli yield (q/ha)

These observations were used to compare the performance of KL-1 with the local check and assess its suitability for popularization in the district.

RESULTS AND DISCUSSION

Morphological performance

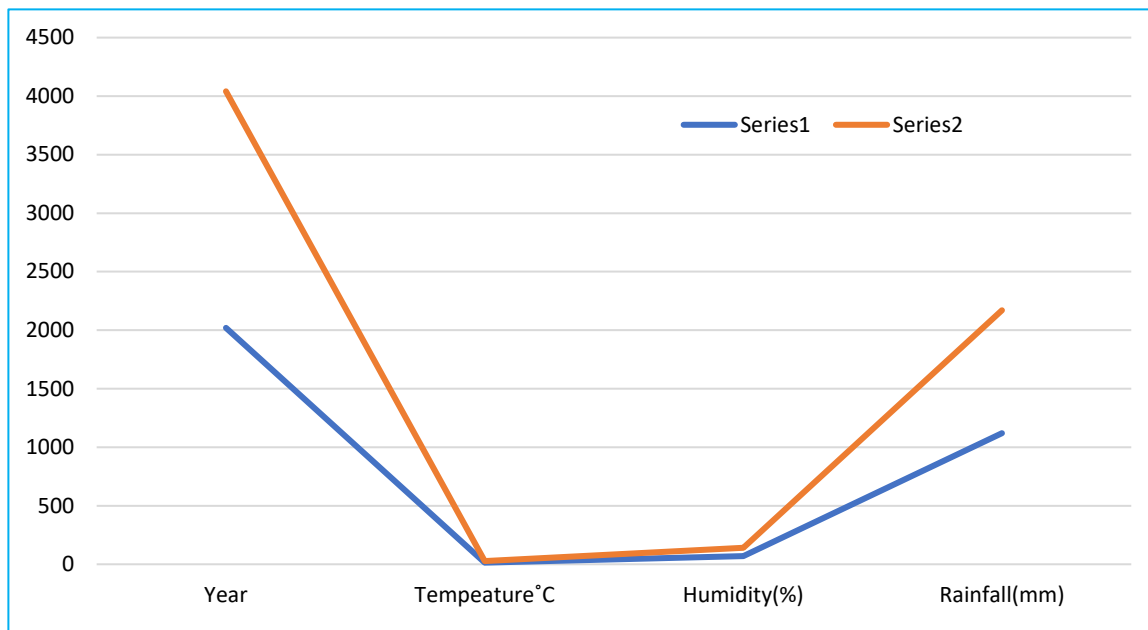
KL-1 exhibited clear superiority over the local chilli cultivar across all six demonstration sites. The cultivar recorded higher mean plant height (95 cm) compared to the local variety (78 cm). KL-1 produced significantly longer fruits (11.2 cm) and greater fruit girth (1.45 cm), while the local check recorded 7.6 cm fruit length and 1.08 cm girth. A marked difference was also observed in the number of fruits per plant, with KL-1 producing 238 fruits per plant against 142 fruits in the local variety. KL-1 further exhibited higher mean fresh fruit weight (4.6 g), increased dry matter percentage (21.4%), and higher 100-seed weight (0.78 g), in contrast to the local check which recorded 3.1 g fresh fruit weight, 16.9% dry matter, and 0.62 g 100-seed weight. These improved morphological traits in KL-1 contributed collectively to its higher dry chilli yield [9-10].

Yield performance

Significant yield differences were recorded between the two treatments. KL-1 achieved a mean dry chilli yield of 45 q/ha, while the local variety recorded only 26 q/ha. The yield

superiority of KL-1 over the local check was 44 percent. This yield advantage was consistent across both years (2020 and

2021) and all six community locations, indicating the stability and adaptability of KL-1 under farmer field conditions [11].



Year	Temperature °C	Humidity (%)	Rainfall (mm)
2020	13.8	70	1120
2021	13.5	71	1050

Economic analysis

Higher productivity of KL-1 resulted in improved economic returns. The cultivar recorded a benefit–cost ratio of 1:4, whereas the local check achieved a ratio of 1:3. Increased yield, better fruit quality, and strong market preference for Kashmiri red chilli collectively contributed to higher profitability [12].

Location-wise performance

Analysis across the six demonstration sites revealed uniform performance of KL-1 with only minor variation attributable to micro-climatic factors. In all locations, KL-1 outperformed the local variety in both morphological traits and yield parameters. The consistency in performance over two consecutive years confirmed its suitability for wider popularization in Pulwama district.

The results of the present study clearly demonstrated the superiority of the chilli cultivar KL-1 over the local farmer variety across two consecutive years and six community locations of Pulwama district. The improved performance of KL-1 can be attributed to its enhanced morphological and yield-contributing traits, which have been widely recognized as key determinants of productivity in chilli under temperate conditions. KL-1 recorded substantially higher plant height, fruit length, fruit girth, and number of fruits per plant compared to the local check. These traits play a crucial role in increasing the photosynthetic surface area, fruit-bearing capacity, and assimilate partitioning toward reproductive structures. Earlier studies have also emphasized the positive contribution of fruit length, number of fruits per plant, and fruit weight to dry chilli yield, suggesting that genotypes expressing higher values for these parameters tend to outperform traditional cultivars [13]. The higher fresh fruit weight and dry matter percentage observed in KL-1 further supported efficient conversion of fresh biomass into dry chilli, which directly influenced final yield. A major factor contributing to the 44 percent yield

advantage of KL-1 was the significantly higher fruit load per plant. While the local variety produced 142 fruits per plant, KL-1 registered 238 fruits, reflecting improved fruit setting and better sink strength. This strong reproductive vigour is consistent with the characteristics reported for high-performing chilli cultivars in temperate environments. Longer fruits with greater girth, as observed in KL-1, also contributed to higher cumulative dry matter, aligning with previous findings that fruit size parameters are closely correlated with yield. The consistent superiority of KL-1 across all six locations and both years highlights its adaptability and stability in the temperate agro-climatic conditions of Pulwama. Minor differences among locations were expected due to variation in soil fertility, micro-environmental conditions, and farmer management practices; however, KL-1 maintained its advantage under all situations, demonstrating wide suitability for the district [14]. Such stability is an important trait for recommending a variety for popularization among farming communities. Economic analysis further strengthened the case for KL-1 adoption. The benefit–cost ratio of 1:4 recorded under KL-1 indicates significantly higher profitability compared to the 1:3 ratio of the local check. Higher market preference for Kashmiri red chilli, combined with its superior colour and dry matter recovery, likely contributed to enhanced returns [15]. The strong economic performance aligns with earlier reports that introduction of improved chilli varieties with better fruit characteristics can substantially enhance farmers’ income through higher market value and improved yield. Overall, the findings confirm that KL-1 is a high-yielding, economically viable, and farmer-friendly chilli cultivar suitable for popularization in Pulwama district. Its superior morphological traits, higher dry chilli yield, and better profitability provide strong justification for its large-scale dissemination. Adoption of KL-1 can play a significant role in improving chilli productivity and enhancing livelihood security of farmers in temperate regions of Kashmir [16].

CONCLUSION

The on-farm demonstrations conducted across six locations in Pulwama district during 2020 and 2021 clearly demonstrated the superior performance of the Kashmiri chilli cultivar KL-1 over the local variety. KL-1 exhibited enhanced morphological traits, including greater plant height, longer and thicker fruits, higher fruit number per plant, and improved dry matter content, which collectively contributed to a 44% higher dry chilli yield (45 q/ha) compared to the local check (26 q/ha). Economic analysis indicated better profitability for KL-1, with

a benefit–cost ratio of 1:4 versus 1:3 for the local cultivar. The consistent performance across all locations and years highlights KL-1's adaptability, stability, and suitability for temperate agro-climatic conditions. Overall, KL-1 is a high-yielding, profitable, and farmer-friendly chilli cultivar with strong potential for large-scale popularization in Pulwama district, contributing to enhanced productivity and improved farmer income. Adoption of recommendations will facilitate effective popularization of KL-1 and contribute to increased chilli productivity, profitability, and livelihood security of farmers in temperate regions.

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