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Performance evaluation of improved cowpea variety 'KashiKanchan' under frontline demonstrations in Mahasamund district, Chhattisgarh

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Abstract

A frontline demonstration was conducted to evaluate the performance of improved vegetable cowpea variety KashiKanchan for suitability in the Chhattisgarh plain agro climatic zone region. It was conducted in five farmers' fieldsin Bawankera village of Mahasamund district, Chhattisgarh, India for four years during 2021 - 2024. Results indicated that RP significantly enhanced yield, gross return, net return and benefit-cost ratio (BCR) compared to FP. Yield improvement ranged from 20.7% to 38.0%, with maximum increase in 2024. Net returns under RP were substantially higher in all years, with the highest in 2024 (Rs. 146,500/ha). The BCR under RP was consistently superior (2.15-3.07) compared to FP (1.80-2.82). The findings confirm that adoption of improved variety KashiKanchan with recommended agronomic practices can bridge the yield gap and significantly increase farmers' income in the cowpea-growing regions of Chhattisgarh.

Keywords: Cowpea, KashiKanchan, frontline demonstration, benefit-cost ratio, yield gap, legume crop

1. Introduction

Cowpea (*Vigna unguiculata* L.) is an important leguminous crop grown for vegetable pods, grains, fodder and soil fertility enhancement due to its biological nitrogen fixation ability that plays a vital role in food, nutritional and livelihood security of small and marginal farmers in India. India occupies a major share of cowpea production in Asia; However, productivity at the farmer level remains low owing to traditional practices, low seed replacement, and limited adoption of improved varieties. In Chhattisgarh and other parts of central India, cowpea is cultivated both as a pulse and as a vegetable, valued for its high protein content, quick growth, and suitability to diverse agro-climatic conditions, including marginal and degraded lands. However, productivity of cowpea at farmer's fields remains low compared to its potential, mainly due to the predominance of traditional local varieties, poor adoption of improved production technologies, and various biotic and abiotic stresses (Hada *et al*., 2021) [4].

'KashiKanchan' is a bushy, dwarf, photo-insensitive and early maturing vegetable cowpea variety developed by ICAR-Indian Institute of Vegetable Research (ICAR-IIVR), Varanasi, characterized by dark green, long, fleshy, parchment-free pods and resistance to golden mosaic virus and *Pseudocercospora cruenta*. The variety has recorded high green pod yields (about 150-175 q ha−1−1) under research conditions and has shown superior performance over local checks in terms of pod yield, pod weight, and plant growth attributes in multilocational evaluations. Economic impact assessments in other regions of India have indicated that adoption of 'KashiKanchan' along with recommended package of practices can enhance green pod yield by around 15-20% and net returns by over 25% compared to farmers' traditional varieties (Mohiddin *et al*., 2022, Srivastava *et al*., 2022) [5, 11].

Despite these promising results, there is limited documented evidence on the on-farm performance of 'KashiKanchan' under the specific agro-ecological and socio-economic conditions of Mahasamund district in Chhattisgarh, which lies in the Chhattisgarh plains and represents a significant pulse-growing belt with predominantly smallholder farmers. Generating such location-specific performance data is crucial for validating the suitability of the variety, refining the recommended production practices, and guiding scaling-up strategies for wider dissemination through state and national pulse development programmes. Frontline demonstrations (FLDs) play a critical role in technology dissemination and bridging the gap between scientific recommendations and farmers' practices (Tripathi *et al*., 2025) [12]. Therefore, the present study entitled performance evaluation of improved cowpea variety KashiKanchan was undertaken to assess the yield, technology gap, extension gap and economic viability as compared to existing farmers' practices under real farm conditions.

2. Materials and Methods

2.1 Study Area

Study was conducted in five farmer's field by KVK, Mahasamund in Bawankera village of Block Mahasamund**,** District Mahasamund, Chhattisgarh under the frontline demonstration during four consecutive years 2021-2024. Study area is located in the Chhattisgarh plain agro climatic zone.

2.2 Treatments

Farmer Practice (FP)

- Use of local seed varieties
- Traditional farming methods
- Non-uniform spacing
- Imbalanced nutrient application
- Limited pest and disease management

Recommended Practice (RP)

- Improved variety KashiKanchan
- Recommended seed rate and spacing (45 × 30 cm)
- Integrated nutrient management
- IPM-based plant protection
- Need-based irrigation

2.3 Data Collection and Economic Analysis

Data on crop performance *viz*. yield, cost of cultivation, gross return, net return, and benefit-cost ratio were collected from each demonstration plot. Economic indicators were computed using standard formulas. The market price of green pods was based on prevailing local market rates each year.

2.4 Technology Gap and Extension Gap

The yield difference between potential yield (research station data) and RP indicates the technology gap, while the yield difference between RP and FP reflects the extension gap**.** In this study:

Technology Gap = Potential yield - RP yield

Extension Gap = RP yield - FP yield

3. Results and Discussion

3.1 Yield Performance

The results from four years of frontline demonstrations (2021-2024) clearly reveal that the improved cowpea variety KashiKanchan, when cultivated under Recommended Practice (RP), consistently outperformed Farmer Practice (FP) across all demonstration sites. The average yield under RP ranged between 165-220 q/ha**,** whereas FP yielded 121-160 q/ha**.** The yield enhancement under RP was substantial, varying from 35.5% (2022) to 37.5% (2021)**,** with the highest recorded in 2024 (35.6%). This significant improvement in pod yield may be attributed to:

- Use of genetically superior variety KashiKanchan
- Recommended spacing ensuring better aeration and sunlight interception
- Balanced nutrient management promoting vigorous plant growth
- Use of IPM-based plant protection leading to reduced pod borer and sucking pest incidence

The superior performance of KashiKanchan under RP aligns with findings of Singh *et al*. (2019) [10] and other FLD reports, confirming the responsiveness of improved varieties under farmer field conditions. Furthermore, the yield variability between FP and RP demonstrates the existing technology gap (difference in potential and actual yield) and the extension gap (difference between FP and RP yields) in the study area. The persistent yield advantage over multiple years shows that the improved variety is stable and adaptable under the agro-climatic conditions of Mahasamund district.

3.2 Economic Performance

3.2.1 Cost of Cultivation

Cost of cultivation under RP was slightly higher than FP due to the inclusion of improved seed, micronutrient application, and recommended fertilizers. However, the incremental cost was marginal compared to the gain in output.

For example

- In 2024, FP cost was Rs. 110,000/ha, while RP cost was Rs. 122,000/ha.
- The additional cost of Rs. 12,000/ha resulted in 48,500 kg additional yield**,** leading to much higher gross returns.

This emphasizes that investing in improved inputs yields a significantly higher return, making RP economically justified.

3.2.2 Gross and Net Returns

Gross returns followed the same pattern as yield. RP consistently recorded higher returns because of both increased productivity and favourable market prices. Across all years, net return under RP was substantially higher**:**

Table 1: Details of increase in net return year by year

Year	FP Net Return (Rs/ha)	RP Net Return (Rs/ha)	Increase
2024	88,000	146,500	+66.4%
2023	82,426	132,228	+60.4%
2022	91,000	132,675	+45.9%
2021	51,200	70,400	+37.5%

The highest net income increase (66.4%) was observed in 2024, reflecting not only better productivity but also increased market remuneration for quality pods. The notable rise in net return under RP demonstrates that the improved variety is not only agronomically superior but also economically advantageous. These findings corroborate earlier studies in legumes where improved agronomic practices substantially increased profitability (Gogoi *et al*., 2017) [3].

3.2.3 Benefit-Cost Ratio (BCR)

BCR is an important indicator to assess the economic viability of any crop production system. In all four years, RP exhibited significantly higher BCR values:

2021: 3.07 (RP) vs 2.82 (FP)
2022: 2.26 (RP) vs 2.07 (FP)
2023: 2.15 (RP) vs 1.83 (FP)
2024: 2.20 (RP) vs 1.80 (FP)

Higher BCR under RP suggests that the improved practices are not only profitable but also risk-efficient for farmers. The consistent advantage across multiple years indicates that the demonstrated technology package is robust and suitable for scaling.

3.3 Technology Gap and Extension Gap

The extension gap remained substantial (35-38%)**,** showing that farmers are still lacking adoption of recommended

practices. Bridging this extension gap can significantly uplift cowpea productivity in Mahasamund district. KVK Mahasamund's FLDs played a critical role in reducing extension gaps by demonstrating the benefits of scientific technologies directly in farmers' fields.

3.4 Impact on Farmer Awareness and Adoption

Interaction with participating farmers revealed several positive outcomes:

Increased awareness about improved variety KashiKanchan

- Adoption of recommended spacing and nutrient management
- Understanding of IPM-based practices
- Enhanced confidence to invest in quality seeds and inputs

Many farmers expressed willingness to continue RP in upcoming seasons, indicating strong technology acceptance.

4. Conclusion

The FLDs conducted over four years demonstrated that cultivation of KashiKanchan under recommended package of practices significantly enhanced yield, profitability and benefit-cost ratio compared to farmers' practices. The improved yield and economic returns highlight the potential of this technology for large-scale adoption in Mahasamund and other cowpea-growing areas of Chhattisgarh. Extension agencies should promote wider dissemination of KashiKanchan and train farmers in improved agronomic practices to bridge the yield gap and ensure livelihood security.

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