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Yield Gap Analysis of Cowpea Varietal Demonstrations in Eastern Region of Uttar Pradesh, India

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ABSTRACT: Cowpea is one of the most significant legume vegetable crops, thriving in dry environments and growing well in soils containing up to 85 percent sand particles. As a result, it is a key crop in semi-arid and arid locations where few other crops can grow. It is a short-season and very profitable crop for vegetable growers; nevertheless, in the Eastern Region of Uttar Pradesh, the main issues restricting production and productivity of this crop are the use of traditional cultivars with poor management techniques. ICAR-IIVR-KVK, Deoria held 23 front line demonstrations (FLDs) on 2.09 ha of farmer land in several adopted villages. High yielding varieties, watering, sowing dates, sowing methodologies, seed treatment, plant geometry, fertilizer dose, intercultural operations, and plant protection methods are among the agricultural approaches now being front-line demonstrated. Over farmers' practices, the average green pod production grew by 14.72%. Due to the front-line demonstration of cowpea over farmers' practices during both of the demonstration's years, the net return increased to 27.19%. Over a two-year timeframe, technology had a 14.47% greater benefit-cost ratio than farmer approaches. The improved B: C ratio and yield gap figures demonstrate that the method is more useful in eastern Uttar Pradesh, India. This appears to be a result of the agricultural community in the eastern plains of Uttar Pradesh not implementing suggested high-yielding cultivars and cutting-edge production techniques.

Keywords: Cowpea, Front line demonstration, Farmers practice, Yield and Benefit-cost ratio.

INTRODUCTION

Cowpea is an annual herbaceous legume crop that gives those in poverty a crucial source of protein as well as extra money. Its green pod can be consumed dry or uncooked as a vegetable or pulse. For many of the world's poorest people, since the plant's seeds have 22–24% protein content, they are a strong source of vegetable proteins. Cowpea seeds, leaves, and green pods are rich in protein, lipids, carbs, vitamins, dietary fibers, minerals, and vitamins. The majority of the macro- and micronutrients found in cowpeas may be utilized as human food and as livestock feed. Cowpeas can tolerate water shortages. In addition to improving soil fertility through the addition of crop residue, cowpea, a legume, may fix 150 kg/ha of atmospheric nitrogen describe in Rochester *et al*. (1998). It may also be used as animal feed for pets Nielsen *et al.* (1997). Because of its capacity to fix nitrogen, cowpea may be effectively intercropped with cotton, millet, sorghum, or spring-sown sugarcane. Compared to other growing regions, this one has much lower cowpea productivity. Cowpea exhibits, to some extent, resistance to water stress when compared to other crops Kumar *et al*. (2020). Adoption of low-yielding traditional Cowpea varieties and substandard agronomic methods are the key issues limiting output and productivity. New early maturing cultivars with determinate growth habits have been very effective in the extremely dry and hot environments. This appears to be a result of the agricultural community in the eastern plains of Uttar Pradesh not implementing suggested high-yielding cultivars and cutting-edge production techniques. In order to raise awareness among farmers and show them the benefits of good agricultural practices on raising production and income in the agricultural community in Deoria district, Uttar Pradesh, India, Krishi Vigyan Kendra organized the current frontline demonstration.

MATERIALS AND METHODS

The ICAR-IIVR, Krishi Vigyan Kendra, Deoria performed the investigation in a farmer's field in the district located in the Eastern Region of Uttar Pradesh during the Kharif seasons of 2019 and 2020. Over a 5.0 acre area, a total of 23 front line demonstrations (FLDs) were conducted to assess the effectiveness of the high yielding cowpea cultivars Kashi Kanchan and Kashi Nidhi with excellent agricultural techniques to farmer practices. The fertility of soils is average. The district's climate is distinguished by a dry summer and a chilly winter, with heavy rains during the Kharif season.

The soils in the study region are very deep, loam to silt loam in texture, moderately well drained, and irrigated

with ground water. The agronomical techniques applied for the current study in terms of FLDs and farmer practices are shown in Table 1. In the final week of June, the crop was sown and it was harvested in the first and following weeks of September. Farmers were given critical inputs in the form of excellent seeds of the recommended high yielding varieties Kashi Kanchan and Kashi Nidhi for FLDs. KVK subject matter specialists helped farmers carry out field activities including sowing, treating seeds, watering, applying fertilizer, weeding, pesticides, harvesting, and grading among them, through training, field visits, and field days. The yield and economic data of the conventional and Kashi Kanchan and Kashi Nidhi cowpea varieties, as well as those grown by the chosen farmers, were recorded and compared. The data was created using established techniques to calculate the B: C ratio and extension gaps between the activities of farmers and the technology provided. The B:C ratio is equal by the gross return divided by cost of cultivation and Net Return is equal to Gross Return less the cost of cultivation.

Table 1: Details of Agronomical practices used for the present study with respect to FLDs and farmer practices on cowpea.

Sr. No.	Technological interventions	Farmers cultivation practice	Frontline Demonstration (Recommended Improved crop management practices)
1.	Agriculture situation	Irrigated	Irrigated
2.	Soil Structure	Sandy loam	Sandy loam
3.	Variety	Local (Photo sensitive)	HYV Kashi Kanchan and Kashi Nidhi (Photo insensitive)
4.	Sowing time	Last week of June	Last week of June
5.	Treatment of seeds	Seed treatment practice not followed	Seed treatment with Fungicide (carbendazim 0.2 per cent)
6.	Approach to sowing	Broadcasting of seeds	Sowing on ridges
7.	Plant geomatry	Scattered	45 x 15 cm
8.	fertigation	Imbalance use of fertilizers	INM practices as per recommended
9.	Interculture	Untimely Hand weeding	Two hand weeding at 20-25 and 50-60 Days After Sowing
10.	Plant protection	Injudicious use of pesticides at regular interval.	Recommended chemicals used for plant protection

RESULTS AND DISCUSSION

A. Interpretations growth attributes

Fig. 1 depicts the growth and production parameters of t wo cowpea varieties, Kashi Nidhi, Kashi Kanchan and Local Check, cultivated on the front line demonstration. With enhanced crop management procedures, the cowpea variety Kashi Nidhi had a higher number of branches per plant (17.2), pods per plant (31.8), pod length (22.3 cm), and pod weight (13.1 g/pod), which was 4.87, 9.27, 7.72, and 24.76 per cent greater compared to farmer practices. The cowpea variety Kashi Kanchan produced more branches per plant (17.6), number of pods per plant (30.9), pod length (22.8 cm), and pod weight (13 g/pod) while using improved crop management practices, which were 10.69, 13.18, 15.15, and 12% higher than farmer practices during the demonstration period. Cow pea cultivars Kashi Nidhi and Kashi Kanchan mature 10 and 7 days earlier, respectively, than farmer practice.

B. Interpretations of crop yield

High yielding cowpea varieties Kashi Nidhi and Kashi Kanchan were compared to traditional varieties in front line demonstrations on farmer's fields in the Deoria area during the Kharif season 2019 and 2020. The results of shown technology are compared to farmer practices in Table 2. The average yield of the cowpea variety Kashi Nidhi under FLDs was 155.14q/ha, which was 11.77% more than the traditional variety used by farmers during the first year of the experiment. As a result, during the demonstration's second year, the average yield of variety Kashi Kanchan under FLDs was 142.40q/ha, 17.68% more than the traditional variety employed by farmers (Table 2). Similar findings through frontline demonstration in Indian mustard have also been reported in Meena *et al*. (2020). Several researchers (Meena *et al*., 2020; Srivastava *et al*., 2022; Meena *et al*., 2022) conducted yield gap evaluations and reported superiority over local or conventional technology in various crops in Uttar Pradesh's eastern region. Better performance and on-farm demonstration of high yielding varieties over local varieties is sufficient to encourage farmers to grow cowpeas in the district.

Table 2: Performance of Cowpea varieties for yield under FLDs.

Year	Variety	No. of Demonstration	Area (ha)	Yield (q/ha)		Yield increase (%)
				FLDs	FPs	
2019	KashiNidhi	11	1.09	155.14	130.8	11.77
2020	KashiKanchan	12	1	142.4	121	17.68
Average				148.77	125.9	14.72

C. Interpretations of Economics

According to the statistics on economic indicators in table 3, the average gross return found in demonstration (Rs.179370/ha) was higher than the farmers' practice (Rs.156150/ha). Front-line demonstration had a higher average net revenue of Rs. 145790/ha over Farmers practice (Fig. 2). The higher yield achieved in the demonstration is equivalent to an additional income of Rs.23340/ha. Additionally, comparable results were reported by Srivastava *et al.* (2022); Meena *et al.* (2022); Sreelakshmi *et al.* (2012); Singh (2017), who observed improvements in net income as a result of increased crop management tactics implemented in onion, lentil, pigeonpea, moth bean, and wheat.

On a two-year basis, the demonstration had a greater benefit-cost ratio (4.27), while farmers practice had a lower (3.73). The similar findings are reported by Bishnoi *et al*, 2021 in Cluster bean. It demonstrated the commercial viability of the technology displayed on the frontlines.

Table 3: Analysis of economic (Rs/ha) under front line demonstration during both the year of demonstration.

Year	Economic of Demonstration (Rs/ha)				Economic of Farmer Practice (Rs/ha)			
	Cost of cultivation	Gross Return	Net return	B:C	Cost of cultivation	Gross Return	Net return	B:C
2019-20	36560	155140	117580	4.24	36560	130800	94240	3.57
2020-21	49600	203600	174000	4.31	46500	181500	135000	3.9
Average	43080	179370	145790	4.27	41530	156150	114620	3.73

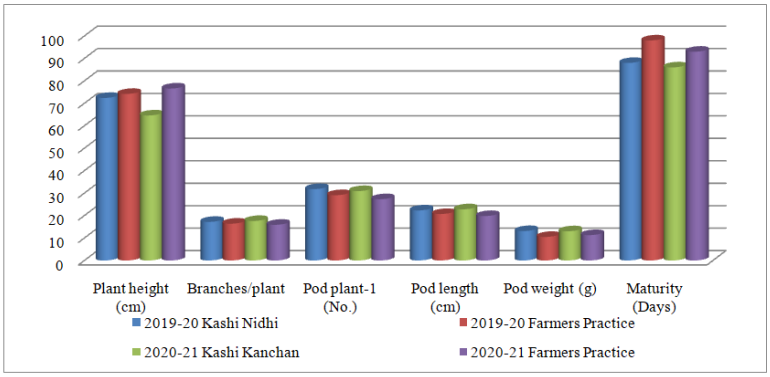

Fig. 1. Show the plant height, number of branches, number of pod/plant, pod length and pod weight under FLDs and traditional variety.

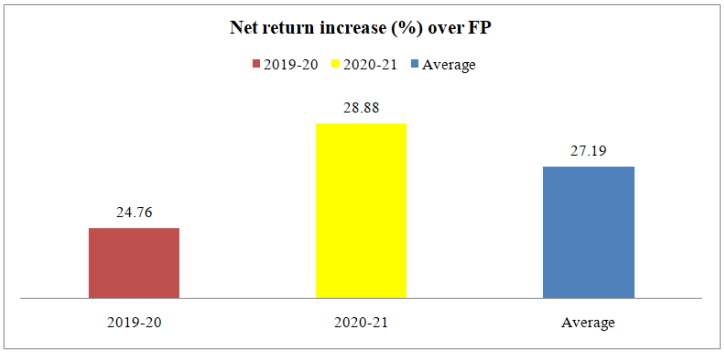

Fig. 2.

CONCLUSIONS

The findings of the frontline demonstration demonstrated that cultivating better varieties, together with improved crop management practices, significantly increased cowpea growers' productivity and profitability. Farmers were satisfied with the performance of both Cowpea types, Kashi Nidhi and Kashi Kanckan, and encouraged other farmers to adopt them on a large scale in their area, paving the way for their horizontal spread.

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Conflict of Interest. None.

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