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Performance Evaluation of Vegetable Cow Pea Variety Arka Garima for Enhancing Productivity in Northern Telangana Zone, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

In Northern Telangana, vegetable cowpea is a favored crop due to its nutritional value and culinary uses, but growers face challenges with varieties and yields and a lack of seed availability. To address these issues, our KVK trails promoting the high-yielding Arka Garima variety trail were conducted by KVK, Jammikunta in consecutive years of 2021-22 and 2022-23. The study aimed to bridge technology gaps and enhance yields to improve farmer's income. Data were collected from farmer cum members of FPOs and individual farmer's studies. The trails were incorporated with drip irrigation and without drip irrigation in some farmer's fields. The results indicated significant improvements in agricultural productivity and economic returns for the demonstration plots compared to traditional practices. The demonstration plots achieved an average yield of 15.5t /ha, a substantial increase over the 12.0 t ha-1 yield from check plots, reflecting a 29.08 % yield increase. The cost of cultivation was also lower for the demo plots, averaging Rs. 37,050.00 ha-1, compared to Rs.44,700.00 ha-1 for the check plots. Consequently, economic returns were higher with average gross returns of Rs.2, 32,500 ha-1 and net returns of Rs. 1, 95,450 ha-1 for demo plots. The benefit-cost ratio for demo plots averaged 1:5.2 significantly outperforming the 1:3.02 ratio for check plots. It indicates the need for improved extension services, farmer training and better dissemination of best practices. Targeted interventions could further enhance productivity and profitability fully realizing the potential of the Arka Garima variety.

Keywords: Arka garima; vegetable cowpea; KVK Jammikunta; cowpea (Vigna unguiculata); cow pea varieties; crop diversification; improved varieties.

1. INTRODUCTION

Arka Garima vegetable cowpea was released by Indian Institute of Horticultural Research, Bengaluru, in 2006. Plants are tall, photo-insensitive. Pods are light green, long, thick, round, fleshy and stringless. Suitable for vegetable purposes. Tolerant to heat and low moisture stress [1-4]. Derivative of the cross T.U.V.762 x V.uniquiculata sub sp. sesquipedalis Developed by back cross and pure line selection. Plants are tall, vigorous, and bushy, with small vines and photo-insensitive. The leaf colour is light green. The flower colour is purple. Pods are light green, long, thick, round, fleshy and stringless. Duration 90 days. It is also known as black-eyed pea or southern pea etc. and has multiple uses like food, feed, forage, fodder, green manuring and vegetables [5-7]. Cowpea seed is a nutritious component in the human diet, and cheap livestock feed as well. Both the green and dried seeds are suitable for canning and boiling as well. For fewer landholders best crop is cowpea, which gives a high yield in very less days, so Crop Diversification with Vegetable Cowpea improves productivity, resource-use efficiency, soil and human health (Sudhir Kumar) Rajpoot and D S Rana, [8]. With cow pea cultivation we can reach Soil and water conservation; Soil and water are the most precious natural resources which need to be conserved and utilized most efficiently for sustainable agriculture explained by Sudhir Kumar Rajpoot and D S Rana, [8]. Degradation of soil through water and wind erosion is a serious environmental problem that threatens ecosystem health. There is a scope for development of cultivars with multiple resistances to biotic and abiotic stresses is an important current breeding objectives in vegetable cow pea J.D. Ehlers, A.E. Hall, [9], it gives good yield with recommended dose of fertilizer application, Even though cowpea, a leguminous crop, as the ability to fix atmospheric nitrogen, it requires a starter dose of nitrogen for early growth and establishment [10]. The trail and farmer's field mostly followed flood irrigation in ridge and furrow method but better performance of micro-sprinkler method of irrigation was probably due to the favorable micro-climatic conditions, availability of uniform and adequate moisture for plant growth and keeping the soil structure loose and friable which was conducive to good aeration resulting in the better growth and partitioning of DMP [11]. Moreover that differential micro sprinkler irrigations significantly influenced the days to 50 per cent flowering. The treatment micro sprinklers attained 50 percent flowering earlier and recorded maximum number of pods per plant. It is the suitable and suggestible crop Under climate resilient agriculture for its lesser crop period, heat Tolerant, drought tolerant and less moisture stress (IIHR, Bengaluru) and there are many promising varieties available for crop diversification in India

for vegetable purpose are Pusa Rituraj, Pusa Phalguni, Pusa Dofasli, Pusa Barsati, V 240, V 16, Gujarat cowpea 1, Gujarat cowpea 2, K 11, K 14, GC 3, FS 68, Swarna (V 38), Gomti, Krishnamani (PTB 2), Kanakmani (PTB 1), Co 1, Co 2, Co 3, Co 4, V16 (Amba), S 228, S 448, JC 5 and SU 88.

2. MATERIALS AND METHODS

The present study was carried out by Krishi Vigyan Kendra (KVK), Jammikunta Karimnagar District, for two consecutive years from 2021– 22 to 2022–23 in the farmers field in different locations of erstwhile Karimnagar and Peddapalli districts of Northern Telangana state [12-14]. The trail demonstration began with a benchmark survey in different villages in the district. Diversified information was collected through agricultural extension officers and farmers practicing cow pear growers in the districts. Secondary information was collected from Mandal horticultural officers, experienced vegetable growers, vendors of rythu bazars, and other key stakeholders in the vegetable cowpea [15]. Identified issues included traditional cultivation methods with intensive inputs, inadequate fertilizer usage, insufficient plant protection measures, and high cultivation costs leading to reduced profits. So KVK, Jammikunta initiated on farm testing study to promote the adoption of the high-yielding, early harvesting Arka Garima variety. Production costs, yields, and economic metrics from OFT farmers and other farmers' plots were collected for comparison. The study evaluated yield, cultivation costs and net returns including the benefit-cost ratio to gauge the impact of the OFT on Vegetable cowpea cultivation practices and economic outcomes. A total of 8 farmers actively involved in cowpea cultivation were selected consisting of 8 participants from demonstration groups across 6 villages and 6 non-participating farmers (check). On-farm trials focusing on the cowpea Arka Garima variety were carried out during the Kharif seasons from 2021– 22 to 2022–23, implementing comprehensive package practices outlined in Table 1. Both participant and non-participant groups were equally represented for data analysis and interpretation. The technology index, denoting the technical viability resulting from on-farm trails, was employed in the efforts to promote the Arka Garima variety in the Northern Telangana Zone. The evaluation encompassed assessments of technology and extension gaps, the technology index [16]. Applied FYM 25 t/ha, *Azospirillum* and *Phosphobacteria* 2 kg /ha and N 25 kg and P 50 kg/ha for irrigated crop. Apply FYM at 12.5 t/ha and N 12.5 and P 25 kg/ha for rainfed crops. Fertilizers can be applied in several split doses at fortnightly intervals. Apply *25kg Zn SO4*, and 10kg borax as soil application basally for demonstrations [17].

Table 1. Performance evaluation of the of vegetable cowpea var. Arka Garima

Name of KVK	**Prakasam Krishi Vigyan Kendra**
Crop and Variety	Vegetable cow pea –Arka Garima
Locations	Jammikunta, Edulagattepalli,Gopalpur ,Mallannapalli and Peddapalli
Background information about farmer field	Irrigated medium black soils
No of trials /No of farmers/area	6 locations with 12 farmers -2.4 Ha
Details of technology demonstrated	• IIHR variety • Derivative of the cross T.U.V.762 x V.uniquiculata sub sp. sesquipedalis Developed by back cross and pure line selection. • Plants tall, vigorous, bushy, with small vines and photo insensitive. • Leaf colour light green. • Flower colour purple. Pods are light green, long, thick, round, fleshy and stringless. • Suitable for vegetable purposes. • Tolerant to heat, drought and low moisture stress.
Check: Farmer’s Practice	Local variety cowpea Thick green in color and susceptible to mosaic virus

3. RESULTS AND DISCUSSION

The provided data set (Table 2) offers a comparative analysis of the promotion of the Arka Garima variety through OFT in the Northern Telangana zone of India through on farm testing plots (Demo) versus check plots (farmers practice) over two consecutive years (2021–22 and 2022–23). The key parameters evaluated include yield (kg ha-1), cost of cultivation (Rs. ha-1), and gross returns (Rs. ha-1), net returns (Rs. ha-1), and the benefit-cost (B: C) ratio. This analysis aims to determine the effectiveness of the demonstration plots in improving productivity and economic returns compared to traditional practices represented by the check plots. The demonstration plots reported a yield of 155Q ha-1, significantly higher than the check plots, which produced 120 Q ha-1. During the year 2022–23. This represents an increase of approximately 29.00 % in yield due to the improved variety of Arka Garima over hybrids cultivated by traditional practices. The trend of higher productivity during the year 2022–23 in the demonstration plots continued with a yield of 155Q ha-1 compared to 142Q ha-1 in the check plots, marking an increase of approximately 29.16 % which is 0.16 % higher than the previous year 2021-22. Lamptey and Koomson [18] have demonstrated similar yield increase in tomato crop in demonstrations. The average yield over the two years was 148.5 Q ha-1 for the demo plots and 115Q kg ha-1 for the check plots. This consistent increase in yield indicates that the practices employed in the demonstration plots significantly enhance crop productivity. The cost of cultivation for the demo plots, using Arka Garima was Rs. 34825.00 ha-1, slightly lower than the Rs. 42600.00 ha-1 for the check plots where private hybrids were used as seed material. This suggests that the demo plots not only achieved higher yields but also managed to do so at a reduced cost during the year 2021–22. The cost of cultivation for the demo plots during the year 2022-23 increased to Rs. 44700.00 ha-1, while the check plots incurred a cost of Rs. 34825.00 ha-1. Although the demo plots experienced a slight increase in costs, they remained lower than the check plots. The average cost of cultivation over the two years was Rs. 34825.00 ha-1 for the demo plots and Rs. 42600.00 ha-1 for the check plots. The lower cultivation costs in the demo plots indicate more efficient resource use and cost management. The gross returns during the year 2022–23 for the demo plots were Rs. 232500.00 ha-1 substantially higher than the Rs. 170400.00 ha-1 for the check plots. Consequently, the net returns for the demo plots were Rs. 195450.00 ha-1 compared to Rs. 137800.00 ha-1 for the check plots, showing a significant advantage for the demo plots. The demo plots again outperformed during 2022–23 with gross returns of Rs. 166625.00 ha-1 compared to Rs. 113400.00 ha-1 for the check plots [19,20].

The net returns for the demo plots were Rs. 166625.00 ha-1 significantly higher than the Rs. 113400 .00 ha-1 for the check plots. Over the two years, the average gross returns were Rs. 201450.00 ha-1 for the demo plots and Rs. 156000 ha-1 for the check plots. The average net returns were Rs.166625.00ha-1 for the demo plots and Rs. 133850.00 ha-1 for the check plots (Table 2). These figures highlight the superior economic performance of the demonstration plots. The Benefit-Cost (B: C) ratio is a critical indicator of economic efficiency, reflecting

Table 2. Evaluation of the performance of vegetable cowpea var Arka Garima in northern Telangana zone Parameters

Performance of technology vis-à-vis Local check (Increase in productivity and returns)						
	Used Practice	**Yield (q/ha)**	**Gross cost (Rs/ha)**	**Gross income (Rs/ha)**	**Net income (Rs/ha**	**B:C ratio**
2022-23	Farmer practices	120	44700.00	180000.00	135300.00	1:3.02
	Demonstration	155	37050.00	232500.00	195450.00	1:5.2
	% Increase	29.16				
2021-22	Farmer practices	110	40500.00	132000.00	91500.00	1:2.3
	Demonstration	142	32600.00	170400.00	137800.00	1:4.2
	% Increase	29				
Average	Farmer practices	115	42600.00	156000.00	113400.00	1:5.32
	Demonstration	148.5	34825.00	201450.00	166625.00	1:9.4
	% Increase	29.08				

the return on investment for every unit of currency spent. The benefit-cost (B: C) ratio is a critical indicator of economic efficiency, reflecting the return on investment for every unit of currency spent. The B: C ratio for the demo plots was 5.2: 1 significantly higher than the 3.02:1 for the check plots during 2022–23. This indicates that the demo plots generated Rs.1:9.4 for every rupee spent, compared to Rs. 5.32:1 for the check plots. Similar results were reported in mustard by Sagar and Chandra [21] in frontline demonstration [22].

The demo plots maintained a higher B: C ratio of 5.2:1 while the check plots had a ratio of 3.02:1 during 2022– 23. The average B: C ratio over the two years was 9.4:1 for the demo plots and 5.32:1 for the check plots. This consistently higher B: C ratio for the demo plots underscores their superior economic efficiency and profitability.

4. CONCLUSION

The promotion of the vegetable variety Arka Garima through on farm testing (OFT) in the Northern Telangana zone has demonstrated significant improvements in agricultural productivity and economic returns compared to traditional farming practices. The data from the years 2021-22 and 2022-23 clearly illustrate that the demonstration plots outperformed the check plots across all key metrics, including yield, cost of cultivation, net returns, and benefit-cost (B:C) ratio. The yie-ld from the demonstration plots was consistently higher, with an average yield of 148.5 Q ha-1 compared to 115Q ha-1 for the check plots. This represents an average increase of 29.0 % in 2021-22 and 29.08 % in 2022-23, highlighting the superior productivity of the Arka Garima variety. The cost of cultivation was also lower for the demo plots, averaging Rs.34825.00 ha-1 over two years compared to Rs. 42600.00 ha-1 for the check plots, indicating more efficient resource use. Economic returns were significantly better for the demo plots, with average gross returns of Rs. 201450.00 ha-1 and net returns of Rs.166625.00 ha-1, compared to Rs. 156000.00 ha-1 and Rs. 133850.00 ha-1 for the check plots, respectively. The B:C ratio for the demo plots was 1:9.4, substantially higher than the 1:5.32 for the check plots, emphasizing their superior economic efficiency and profitability. In conclusion, while the Arka Garima variety has shown clear advantages over traditional varieties and practices, realizing its full potential will require concerted efforts to enhance agricultural practices and technology adoption among farmer.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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