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Sustainable ridge gourd production through introduction of high yielding variety Arka Prasan in Annamayya district of Andhra Pradesh, India

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Abstract

Ridge gourd is an important cucurbitaceous vegetable crop widely cultivated in Andhra Pradesh for its tender fruits, nutritional value, and role in sustaining the livelihoods of small and marginal farmers. However, productivity remains low due to traditional cultivation practices, imbalanced nutrient usage, and lack of adoption of improved varieties. To address these constraints, Front Line Demonstrations (FLDs) were conducted during 2022-23 and 2023-24 in Annamayya district of Andhra Pradesh to popularize the high-yielding open-pollinated variety Arka Prasan. The demonstrations incorporated Arka Prasan seeds, micronutrient mixture (Arka Vegetable Special), Arka Microbial Consortium, improved nutrient management, fruit fly traps, and integrated plant protection practices. The results indicated a significant increase in economic returns and yield in demonstration sites when contrasted with farmer practices. The average yield of demonstration plots was 185.52 q ha⁻¹, against 129.25 q ha⁻¹ in check plots, recording a 35.37% superiority. Demonstration plots also showed higher economic returns with an average B: C ratio of 3.35, compared to 2.62 in farmers' practice. Despite improved performance, the technology index remained high (average 39.75%), indicating the need for better adoption of recommended practices. The study underscores the significance of effective extension interventions and the potential of Arka Prasan to increase productivity and profitability.

Keywords: Ridge gourd, arka prasan, frontline demonstrations, technology gap, extension gap, technology index, economic analysis

Introduction

Ridge gourd (*Luffa acutangula* L.) is one of the important cucurbitaceous crops in India and other Southeast Asian countries. This crop, which is believed to have originated in India, is highly regarded for its rich nutritional content, delicate fruits, and diverse culinary applications. The ridge gourd has a tapering end and a dark green color. The pulp is edible once the skin is removed, and it will be white (Shadrach *et al.*, 2023) ^[11]. The pulp is tender and edible, whereas the peel is traditionally used in preparing chutneys in South India. Ridge gourd is rich in fiber, vitamin C, zinc, iron, riboflavin, magnesium, and essential amino acids (Swetha and Muthukumar, 2016) ^[15]. It also has medicinal properties, including anti-inflammatory and detoxifying effects.

In Annamayya district of Andhra Pradesh, farmers commonly cultivate local varieties or private hybrids, often using intensive inputs without scientific guidance. This has led to unstable yields, high production costs and reduced profits. The absence of understanding of enhanced variety and essential inputs further constrains yield. A baseline study was done in several villages in the district before the front-line demonstration began. Diversified information was collected through structured personal interviews of practicing ridge gourd growers in the districts. Secondary information was collected from mandal horticultural officers, experienced vegetable growers, vendors of rythubazars, and other key stakeholders in the Ridge Gourd value chain (Poshadri *et al.*, 2020) ^[7].

Arka Prasan, an early, open-pollinated, high-yielding variety appropriate for a variety of agroclimatic situations, was developed by ICAR-IIHR, Bengaluru. It is characterized by early

harvest (42-45 days after sowing), long tender fruits, and an average potential yield of 26 t ha⁻¹ over a 120-135 day crop cycle.

To bridge the technology gap, Krishi Vigyan Kendra (KVK), Kalikiri implemented FLDs during 2022-23 and 2023-24 to popularize Arka Prasan alongside enhanced nutrient management, pest and disease management and scientific cultivation practices in Annamayya district.

Materials and Methods

The FLDs were conducted for two consecutive years (2022-23 and 2023-24) in farmers’ fields across selected villages of Annamayya district under irrigated conditions. Benchmark surveys and structured interviews were conducted to identify

existing gaps in ridge gourd cultivation. Major issues identified included: use of local varieties, imbalanced fertilizer use, lack of micronutrient application, absence of fruit fly traps and indiscriminate pesticide use.

The demonstrations utilized Arka Prasan seeds, micronutrient mixture, recommended nutrient schedule, yellow sticky traps, and fruit fly traps. Farmer practice plots with local varieties were provided as the check. Field days, trainings and demonstrations were conducted to disseminate the technology.

Economic analysis was carried out by computing gross returns, net returns, and B: C ratio. Yield improvement, extension gap, technology gap and technology index were calculated using standard formulas as suggested by Sagar and Chandra (2004)^[10], Sunil Kumar *et al.* (2021)^[13].

Table 1: Technological Interventions under FLD and farmer’s practice

S. No.	Components	Demonstration	Farmers practice
01	Selection of high yielding variety	High yielding Variety Arka Prasana	Local variety/private hybrids
02	Planting system	Pandal system of planting	Pandal system of planting
03	Seed rate	2.5 Kg/ha	5 kg/ha
04	FYM	22 t/ha	7.5 t/ha
05	Spacing	2.5 m × 0.75 m	1.5 × 0.5 m
06	Fertilizer	NPK 70:80:50 Kg/ha	NPK 100:70:50 Kg/ha
07	Micronutrients	Micronutrient mixture 5 g/lit @ 30 days interval for 3 times	No micronutrients application
08	Plant protection	Installation of Yellow sticky traps @ 20/acre Installation of fruit fly traps @ 10/acre. Need based application ofb Neem oil (10000 ppm) @ 1 ml/lit and recommended chemicals	Without installation of Fruit fly traps. Indiscriminate usage of pesticides

Percent increase in yield = ((Demonstration yield - Farmers yield) / Farmers yield) × 100

Technology Gap = Pi (Potential yield) - Di (Demonstration yield)

Extension Gap = Di (Demonstration yield) - Fi (Farmers yield)

Technology index = ((Potential yield - Demonstration yield) / Potential yield) × 100

Results and Discussion

The Technological Interventions under FLD and farmer’s practice details are given in Tables 2, 3 and 4. The provided data set offers a comparative analysis of the promotion of the Arka Prasan variety through FLD in the southern zone of Andhra Pradesh through demonstration plots (demo) versus check plots (farmers practice) over two consecutive years 2022-23 and 2023-24. The key parameters evaluated include yield attributing characters viz., days taken for first picking, weight of the fruit, number of fruits per vine, fruit length, yield (q/ha), cost of cultivation (Rs. /ha), gross returns (Rs./ha), net returns (Rs. /ha) 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. Yield and yield attributing characters Demonstration plots of high-yielding ridge gourd var. Arka Prasan led to a marked effect on total fruit yield. The yield attributing traits viz., days taken for first picking was early in Arka Prasan (43.09 days), weight of the fruit (195.12 g), number of fruits per vine (15.87) and fruit length (69.56 cm) were

significantly higher in demonstrated plots. Whereas a comparatively lower number of fruits per vine (10.60), fruit length (38.19 cm) and fruit weight (153.12 g) were recorded in farmers practiced plots. Higher values of yield attributing traits observed in the demonstrated plot might be due to the high yielding of a variety of seeds, bio-fertilizers, micronutrients, integrated nutrient management, integrated pest and disease management.

This represents an increase of approximately 35.37% in yield due to the improved variety of Arka Prasan over hybrids/local varieties cultivated by traditional practices. The demonstrated plot recorded higher yield might be due to the higher number of fruits per vine, fruit length and fruit weight. The ridge gourd genotypes showed significant variation in growth, yield (Krishnamoorthy and Ananthan, 2017)^[4] and quality of fruits (Choudhary *et al.*, 2014)^[2]. Fruit weight is strongly associated with fruit length, fruit weight and total yield as reported by Sunil Kumar *et al.* (2024)^[14]. Yield is a complex and dependent trait in which one is determined by the fruit weight and number of fruits per plant and their inheritance any change in these would reflect on total yield (Karthick *et al.*, 2017)^[3].

Table 2: Yield and yield attributing characters of Ridge gourd var. Arka Prasan

Year	Days taken for first picking		Weight of the fruit (g)		Length of the fruit (cm)		Number of fruits per vine		Yield q/ha		% increase over control
	Demo	Check	Demo	Check	Demo	Check	Demo	Check	Demo	Check	
2022-23	44.04	51.18	191.94	151.94	67.62	44.24	15.42	11.97	175.52	136.25	28.67
2023-24	42.15	50.78	198.30	154.30	71.50	32.14	16.32	09.24	195.52	122.25	42.07
Average	43.09	50.98	195.12	153.12	69.56	38.19	15.87	10.60	185.52	129.25	35.37

Yield and Yield Attributes

Arka Prasan recorded significantly higher yield and yield attributes compared to local varieties (Table 2). Demonstration

plots consistently recorded higher fruit weight, length, number of fruits per vine and earlier picking compared to farmers’ practice. The average yield in demonstration plots was 185.52 q

ha⁻¹ compared to 129.25 q ha⁻¹ in check plots, resulting in an average 35.37% increase in yield. The superior performance is attributed to improved variety, balanced nutrition, micronutrient sprays, fruit fly management and scientific spacing. Similar results were reported in ridge gourd by Sundharaiya *et al.* (2022)^[12] in the frontline demonstration. Lamptey and Koomson

(2021)^[5] have demonstrated similar yield increase in tomato crop in frontline demonstrations. The average yield over the two years was 13,664 kg ha⁻¹ for the demo plots and 11,300 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.

Table 3: Cost economics on demonstration of Ridge gourd var. Arka Prasan

Year	Yield q/ha		Gross cost of cultivation		Gross returns		Net returns		Benefit cost ratio	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check	Demo	Check
2022-23	175.52	136.25	165680	176264	526254	435700	381000	192012	3.18	2.47
2023-24	195.52	122.25	195286	205960	687080	567524	430248	212500	3.52	2.76
Average	185.52	129.25	180483	191112	606667	501612	405624	202256	3.35	2.62

Economic Analysis

The cost economics presented in Table 3 shows that the average cost of cultivation was slightly lower in demonstration plots compared to farmer practices due to optimal input use. Demonstration plots recorded higher gross and net returns over both years with an average B: C ratio of 3.35, compared to 2.62 in farmers' practice, indicating significantly better profitability. Similar results were reported in mustard by Sagar and Chandra

(2004)^[10, 8] in frontline demonstration. The demo plots maintained a higher B: C ratio of 2.33:1 while the check plots had a ratio of 1.77:1 during 2023-24. The average B: C ratio over the two years was 2.35:1 for the demo plots and 1.76:1 for the check plots. This consistently higher B: C ratio for the demo plots underscores their superior economic efficiency and profitability

Table 4: Yield, extension gap, technology gap, and technology index on demonstration of Ridge gourd var. Arka Prasan

Year	Yield q/ha		Potential Yield q/ha	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
	Demo	Check	Demo			
2022-23	175.52	136.25	260.00	55.62	121.20	42.25
2023-24	195.52	122.25		53.24	86.24	37.25
Average	185.52	129.25		54.43	103.72	39.75

The extension gap averaged 54.43 q ha⁻¹, indicating substantial yield improvement due to FLD technologies. This may be due to the soil fertility, managerial skills of individual farmers and climatic conditions of the selected area. Hence, need-based location-specific recommendations are necessary to bridge these gaps (Sundharaiya *et al.*, 2022 and Sunil Kumar *et al.*, 2024)^[12, 14]. The technology index averaged 39.75%, showing that the full potential of Arka Prasan is yet to be realized and that further extension efforts are required. The results align with earlier studies where FLDs significantly improved yield and economic returns in vegetable crops (Rashmi *et al.*, 2024a; Rashmi *et al.*, 2024b)^[8, 9].

Conclusion

The FLDs on Arka Prasan implemented by KVK, Kalikiri clearly demonstrated the superiority of the variety over local checks in terms of yield, profitability and overall performance. The improved variety recorded an average 35.37% higher yield with increased economic returns and a higher B: C ratio. Despite positive outcomes, the high technology index indicates a need for continued capacity building, timely input supply and wider dissemination of recommended practices. Implementation of Arka Prasan along with scientific crop management practices can substantially increase ridge gourd productivity and profitability in Annamayya district.

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