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### Integrated approaches to enhance ridge gourd productivity

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#### Abstract

Cucurbits group of vegetables are among the protective ones with more nutritional value. They are also very important with respect to more medicinal value and are economically significant cultivable crop among small and marginal farmers. Ridge gourd is the important cucurbit vegetable crop with more of Vit A, B, C, minerals like Fe, Mg and high fibre content. Antioxidant and anti-inflammatory nature in the gourds making them placing in new area for food selection for present day requirement for health management. In Koppal district of Karnataka horticulture crop are increasing steadily and at present 210 ha. area is under cucurbit group of vegetable crop ridge gourd. Farmers are cultivating this crop by getting a district average productivity of 11.43 t/ha. which could be 3.5 times lesser when all the management practices are followed along with high yielding varieties. To address this front-line demonstration on nutritionally rich high yielding variety Arka Prasan was carried out for three consecutive years of 2022-23, 2023-24 and 2024-25. Along with yield parameter the fruit and plant health parameters were recorded. During demonstration 55.81% and 17.94% of higher yield was recorded compared to district average and farmers practise respectively. In the demonstration Arka Prasan exhibited 68.46% higher yield over potential yield of 26.0 t/ha. In fruit parameters Arka Prasan fruits exhibited more tenderness (1.19 K-Pa) compared to check (1.38 K-Pa). The crop duration was extended to extra 15 days allowing a greater number of picking (15.07 VS 11.93). Higher fruit weight (104.93g), fruit length (31.78 cm) and a greater number of fruits per plant (140.06) were observed in demonstrated variety compared to farmers check variety (81.3g, 20.74 cm and 105.93 no. respectively). It was observed that percent fruit damage by fruit fly in demo plot was 3.33 and percent powdery mildew incidence was 6.27 as compared to farmers practice (7.65% and 10.99% respectively). These were all resulted in higher net returns with more B:C ratio of 4.81 over check 3.21. This established awareness of higher profitability and economic advantages upon adopting Arka Prasan with nutrient, pest and disease management and also with cultural operation like staking or pendal system of cultivating, which is helped to the greater extent in expression of the crop variety potential which are having and breed for their indeterminate type of plant growth.

**Keywords:** Ridge gourd, integrated approach, Arka Prasan, high yield, productivity, quality

#### Introduction

Vegetables are nutrient rich plant sources with vitamins and minerals. Among vegetable group most powerfully protective Indian origin Cucurbits occupies prime position. The cucurbits important for their nutritional value, medicinal properties and economic significance. Gourds are rich sources of vitamins, mineral and also dietary fibres. Cucurbits contribute to overall health with plenty of vitamins and minerals in them and these are helpful for gut health. Gourds known for their nutritional value these are rich in Phosphorous, Iron, Calcium, copper, Potassium along with vitamins A, B1, B2 and C. Sufficient amount of CHO in them contributes to energy intake. As medicinally important group of vegetables gourds important due to their antioxidant and anti-inflammatory properties. And as medicinally these are purgative, Anti-helminthic, heal wound, maintains insulins production, cures piles and helpful for blood and respiratory disorders. Antioxidant and anti-inflammatory nature helpful for neutralizing the free radicals and protects the cells from damage and helpful for arthritis management, this could be due to presence of luffien a gelatinous substance present in ridge gourd (Karthick *et al.*, 2017) [6]. Apart from these health benefits and nutritional security, cucurbits provide handsome income

to marginal and small farmers, as it is suitable to cultivate as small area from 10 gunta to few acres but not more than 5 acres.

Among cucurbits Ridge gourd (*Luffa accutangula* L.) is one of the important vegetable crops in India, China and Southeast Asia (Pootakham *et al.* 2021) [12]. This crop is originated in India with diploid chromosome number ( $2n = 26$ ). It is also known with different names like Kalitori, angled gourd, angled loofah, and ribbed gourd. It is monoecious and highly cross-pollinated cucurbit. Ridge gourd is good source of vitamin A, B and C helpful for vision, immune function. Iron and magnesium present in ridge gourd good for RBC production, nerve and muscle function. Higher fiber present in ridge gourd good for digestion, flavonoids and phenols are helpful for protection against cell damage. As it is low in calory which makes this good choice for weight management. Ridge gourd contained 0.5g of fibre, 0.5% of protein, 0.35% of carbohydrate, 37 mg of carotene, 5.0 mg of vit C, 19 mg of calcium and 0.5 mg of Iron per 100 g of serving (Hazra and Som, 2005) [18]. Ridge gourd is cultivating 24800 acres, 316.92 metric tons of production with average yield of 39 tonnes/acre in India (NHB 2023). In Karnataka this vegetable is being cultivating in an area of 4200 ha with production of 38882

tonnes. In Koppal district ridge gourd is cultivating in 210 ha area and 2421 metric tonnes of production. (Anonymous, 2023)<sup>[7]</sup>

Ridge gourd is annual herbaceous with 3-4 months of crop duration. This vegetable process creeping, climbing and trailing habits. This is suitable to cultivate this crop in Kharif from June - July and in summer from January - February. Ridge gourds grow well in warm, humid climatic conditions with optimum temperature of 25 °C and at 32-40°C this crop thrives well. At vegetative and fruiting period plenty of sunlight helpful for harnessing the plant potential. This crop required well drained and fertile soil with pH of 6.0 to 7.0. Traditionally ridge gourd is cultivated in ridges and furrow system on the soil surface, as it creeps on the ridges, furrow irrigation is to be followed. This kind of practices attracts diseases like phytophthora blight, collar rot, bacterial wilt, gummosis, downy mildew anthracnose etc.

At present there are number of ridge gourd varieties are available with variability in the fruit shape and size. The yield potential of particular variety depends on both genetics, environmental, cultural and management practices followed during cultivation. High yielding varieties results in higher productivity per unit area. In Karnataka farmers are cultivating high yielding and open pollinated varieties of ridge gourd, which are released from public and private sector. In public sector IIHR Bengaluru has developed early, open pollinated, high yielding and nutrient rich ridge gourd variety Arka Prasan in the year 2022-23. As it is early harvesting variety, first picking starts from 42-45 days after sowing. Arka Prasan produces long light green fruit with excellent cooking quality. Average yield of this variety could be 26 ton/ha over a period of 120-135 days (<https://iihr.res.in>).

Frontline demonstration acts as effective method to showcase the technologies suitable for particular region. In horticulture crop always high yielding varieties/hybrids are very well accepted by the farmers if the performances are best in the field condition. Horticulture is high volume and high value crop, variety/hybrid with high yield would be given more preference. Holistic approach towards maximum yield benefit would be practicing integrated practices like selecting high yielding variety/hybrid, integrated nutrient, pest and disease management, different growing method are plays important role in potential yield obtaining. Krishi Vigyan Kendra's as extension centres helps in region specific technology adoption and narrowing the gap between lab to land. These approaches resulted in higher production and better social status of the farmer. ICAR-KVK, Koppal situated in northern dry zone of Karnataka has conducted front line demonstration of high yielding ridge gourd variety Arka Prasan with integrated approaches from 2022-23, 2023-24, and 2024-25. Koppal district is diversifying towards horticulture crops with an area of 27212 ha which is 10.30% of total cultivable area and the area under gourd is around 800 ha. which requires new technology adoption for better crop performance.

## Materials and Methods

Front line demonstration on high yielding ridge gourd

variety Arka Prasan was carried out during 2022-23, 2023-24 and 2024-25 from ICAR-Krishi Vigyan Kendra, Koppal. Before finalising this demonstration, participatory rural appraisal (PRA) was conducted in the selected villages which are prominent vegetable growing region of the Koppal district. During PRA primary information like variety cultivated by the farmer, Nutrient application to the crop, pest and disease management of the crop, harvest and post-harvest practices followed were discussed. In the discussion it was found that the farmers were cultivating private ridge gourd varieties which were nearly exhibited 40 per cent yield difference than that of Arka Prasan. The ridge gourd farmers were growing this crop in ridge and furrow method, so that crop spread could be possible on the ridges and irrigation through furrows. Due to these traditional growing methods crops came across with the diseases from soil born pathogens. Nutrient management of the crop was followed randomly without soil testing-based fertiliser application. Farmers are unaware of micronutrient application and its benefit. Integrated approaches were not followed to control the pest and diseases.

Total 15 farmers were selected for high yielding Ridge gourd open pollinated variety Arka Prasan demonstration. Each farmer informed to cultivate ridge gourd variety which they use to cultivate previously as check plot. The demonstrated ridge gourd variety Arka Prasan has advantages like, it comes to first picking from 42-45 days after sowing, fruits are long, green and tender with excellent cooking quality. The fruits are nutritionally rich in antioxidant activities and minerals like phosphorous Calcium and Zinc. The yield of this variety is 26 tonnes/ha, which is 127 per cent higher than that of Koppal district ridge gourd average yield (11.43 tonnes/ha). In the demonstration plot the fertilizer requirement to the crop was applied as per the requirement based on the soil testing report and farmers were informed to apply Arka vegetable special, the micronutrient mixture at 40,60 and 80 days after sowing for better plant health and fruit quality. Awareness on how different macro, secondary and micronutrients are important in different crop stages was informed. Support system to the plants were given after 25 days of sowing. Farmers were informed to put pheromone trapes (8 No./acre) 30 days after sowing. In the check plot farmers cultivated variety in ridge and furrow method with no proper fertiliser and micronutrient application. To the check plot farmers applied the pesticides for pest and disease control with firsthand information from pesticide shops without any appropriate dose of application. Farmers did not have the idea of pheromone trap usage to control the fruit flies.

The demonstrations were evaluated by measuring some of the yield and quality attributes like tenderness (Kilo pascal), Length of the fruit (cm), Duration of the crop (days), Number of pickings, No. of fruit per plant, Fruit weight (g), Per cent fruit fly damage, per cent disease incidence (Powdery mildew) and yield (tonnes/ha). Based on the local market price gross return net return and benefit cost ratio per hectare was calculated.

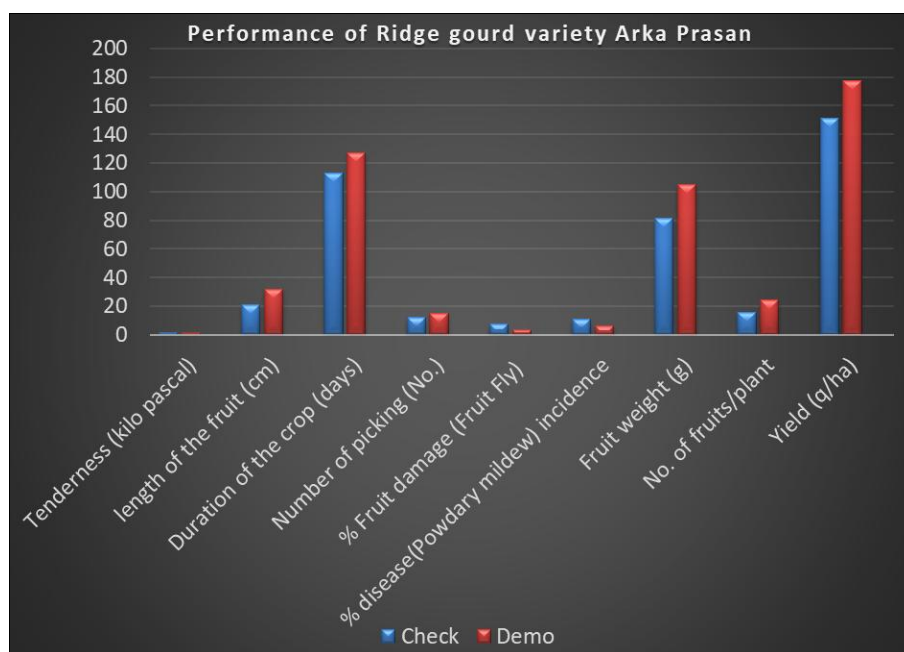
## Results and Discussion

**Table 1:** Technologies followed under farmers practice and technology demonstrated

Farmers practice	Technology demonstrated
Private variety and Local variety	High yielding nutrient rich Ridge gourd variety Arka Prasan
Do not followed soil testing based recommended dose of fertiliser application	Applied soil testing based recommended dose of fertiliser
No application of micronutrient	Application of micronutrients Arka vegetable special @ 1 g/ lit at 40, 60 and 80 DAS
Staking not followed	Staking after 25 days of sowing
Lack of awareness of use of fruit fly traps	Installation of fruit fly traps after 30 days of sowing (5 No./acre)

Plant supporting system like pendal system with GI wires and staking with wooden poles and plastic wires can be used to train the ridge gourd plants apart from ground based growing method. In ground growing of ridge gourd recorded less yield up to 25-30 per cent and 8-10 per cent of the fruits become unmarketable, could be due to fruit loss from soil borne pathogens and dis-shaped fruit formation. On the other way plant supporting system allows the healthy plant growth due to sufficient and uniform availability of sunlight and better air circulation. This plant supporting system adds an advantage of early flowering and fruiting. The length of the fruit would increase due to freely hanging of the fruit, this positively could be due to gravitational pull. Free hanging of the fruits makes them long and straight in shape,

this could make the grading and packing easier and able to get the majority marketable quality fruits, and this would further help to get the steady market price. Plant supporting system encourages use of drip irrigating method compared to furrow irrigation in ground growing, where there could be water saving up to 60 per cent. Highest yield in the pendal system was observed by Bellamkonda *et, al* (2020) in ridge gourd at Nalgonda district of Telangana, India. Similarly, konsler and Shridar (1973) <sup>[2]</sup>, Sadanandan (2013) <sup>[3]</sup>, Tokatly and Ozgur (1999) <sup>[4]</sup> also reported positive effect of supporting system like vertical and horizontal trailing system on yield of cucumber where they recorded higher fruit yield and also good quality.



**Graph 1:** Graphical representation of fruit quality and plant health parameters recorded under ridge gourd front line demonstration

The demonstration recorded clear superiority over the check for all major traits. Fruits from the demo were more tender (1.19 kPa) and longer (31.78 cm) compared to the check (1.38 kPa and 20.74 cm). The crop duration was extended to 127.20 days in the demo against 112.73 days in the check, allowing more number of pickings (15.07 vs. 11.93). Similarly, higher fruit weight (104.93 g) and more fruits per

plant (24.06) were observed in the demo compared to the check (81.13 g and 15.93, respectively). Incidence of fruit fly damage (3.33%) and powdery mildew disease (6.27%) was also markedly lower under demonstration compared to the check (7.65% and 10.99%). These results highlight the overall advantage of the demo practice in terms of productivity, quality, and resistance to pests and diseases.

**Table 2:** Fruit quality and plant health parameters recorded under ridge gourd front line demonstration

Particulars	Tenderness (kilo pascal)	Length of the fruit (cm)	Duration of the crop (days)	Number of picking (No.)	Fruit weight (g)	No. of fruits/plant	% Fruit damage (Fruit Fly)	%disease (Powdery mildew) incidence
Check	1.38	20.74	112.73	11.93	81.13	105.93	7.65	10.99
Demo	1.19	31.78	127.20	15.07	104.93	140.06	3.33	6.27

Fruit tenderness is the primary requirement for most of the vegetable crops for their acceptance in the culinary purpose. This tenderness parameter makes the vegetable easy to cook and palatable, this could be because presence of less fibrous and less mature seeds present inside the pulp. Tenderness of Arka Prasan ridge gourd fruit was recorded 1.19 kilo pascal as compared to fruits of farmers grown ridge gourd variety Arjun (1.38 kilo pascal). As a result of this open pollinated high yielding ridge gourd variety was accepted in the market of koppal district. The ridges of Arka Prasan were very superficial due to this the wastage while preparing the fruits for culinary purpose could be less. Similar finding was documented by Jadeja *et.al.* 2019 <sup>[1]</sup> in ridge gourd vegetable while studying the ridge gourd parental line, where they studied the fruit quality parameter like Skin to pulp ratio of GARG-1, GRG-2, and Pusa Nasdar.

Fruit length is one of the important yield attributing characters in all the gourd crops. Fruit length also related to market acceptability and selection of packing methods. In Arka Prasan demonstrated ridge gourd variety, the average fruit length 31.74 cm was recorded compared with 20.74 cm in variety Arjun farmers cultivated check variety. There was nearly 53 per cent higher than the farmers check variety. The pendal or support system of growing the ridge gourd fruits presented themselves straight as compared to ground system of growing. That makes them easy to grading, packing and loading in plastic trays to the market. 25.44 cm and 15.00 cm were the fruit length of ridge gourd genotypes RIGVAR-6 and Pusa Nasdar respectively recorded by sing *et al.* (2023). This finding was supported by Khatoon *et al.* (2016).

Fruit weight represents the yield of the crop cultivated. This yield attributing parameter also related with the fruit length in case of gourd crops and also crop duration and number of pickings in a crop life cycle, when it is helping in finalising the yield of individual plant and overall yield per unit area. It was recorded that the average fruit weight of Arka Prasan over a period of three years of demonstration study was 104.93 g over fruit weight of farmers cultivated check variety 81.13 g. Over all genetics of the crop variety, environmental condition, nutrition supply are the important aspects which would decide the quality of the fruit produces that include fruit weight as one of the quality parameters. Singh *et al.* (2023) <sup>[16]</sup> observed the weight variation in different ridge gourd genotypes. They recorded maximum of 162g and minimum pf 143.02g in RIGVAR-6 and Pusa Nasdar respectively. This kind of fruit weight variation was also reported by Rabbani *et al.* (2012) <sup>[13]</sup>, Karthok *et al.* (2017 and Bhargav *et al.* (2017).

Number of fruits per plant is very good yield parameter of the crop variety developed. Over all plot yield majorly depends on the number of fruits per plant. Stacking and pendal system of growing also help in stimulus movement of pre-existed plant growth hormone with in the plant resulting in more number of flower bearing intern number of

fruits per plants. During the demonstration it was observed that the three years average data on number of fruits per plant, the open pollinated Arka prasan variety yielded 24.06 fruits per plant compared to 15.93 in farmers check variety. The number of fruits per plant has positive correlation with the length of the vine (Hanume Gowda 2020) <sup>[8]</sup>. Even though ridge gourd is vine, its potentiality could be greatly explored by providing supporting system like vertical or horizontal wire and pendal for its growth. Higher the vein length higher would be the expression of node to first female and male flower appearance, sex ratio expression which resulted in higher fruit setting and development. The genotype RIGVAR-6 recorded 10.22 number of fruits per plant as compared to Pusa Nasdar (5.33) during the ridge gourd genotypic study by Singh *et al.* (2023) <sup>[16]</sup>. Similar to this Hanumeguda (2020) <sup>[8]</sup> and Yadav *et al.* (2017) <sup>[17]</sup> reported variation in the number of fruits per plant of ridge gourd in genotypic screening and correlation study. Similar result were obtained by Rao *et. al* (1999) <sup>[9]</sup> in ridge gourd, Rathod (2007) <sup>[10]</sup> in bitter gourd and Kumar *et.al.* (2007) <sup>[11]</sup> in bottle gourd. This could be concluded that parental lines which were selected to develop Arka Prasan was exhibited superior with respect to No. of fruits per vine fruit weight, fruit length and good sex ratio.

Number of pickings is depending on the in how many days the plant will come to first picking. If the particular variety is having faster and sufficient vegetative growth in a smaller number of days it exhibits early harvesting. The demonstrated variety Arka Prasan exhibited a smaller number of days to taken for first picking, 43-44 days, compared to the farmers check variety 52-53 days. It showed almost 9-10 days of gap. This varietal character helpful in getting the greater number of fruits per plant and over all yield of the crop cultivated. During the demonstration the ridge gourd variety exhibited 15.07 number of picking as compared to 11.93 number in farmers check variety.

Crop duration is another important yield attributing parameter taken in to consideration when any of the crop variety/hybrid has to be developed. This parameter could be less or more to be required by the particular crop based on the soil type, environment condition water availability, response to nutrient availability. With in the crop duration days taken to crop stage conversion from vegetative to reproductive is very much crucial. As ridge gourd is herbaceous annual it generally takes nearly 120 days or few more days to complete the life cycle and first harvest attain at 50-60 days from sowing. The demonstrated Arka Prasan ridge gourd verity attained its first picking at 42-44 days after sowing which was nearly 1 week earlier compared to farmers grown check variety. The crop duration of 127.2 days of ridge gourd variety Arka Prasan was documented compared to 112.73 which was of 2 weeks extra crop time. In total Arka Prasan has got on an average 3 weeks more of crop duration compared to farmers grown ridge gourd varieties.



**Table 3:** Yield and economics of recorded under ridge gourd front line demonstration

Particulars	2022-23		2023-24		2024-25		Average	
	Check	Demo (Arka Prasan)	Check	Demo (Arka Prasan)	Check	Demo (Arka Prasan)	Check	Demo (Arka Prasan)
Yield (q/ ha)	152.7	187.8	148.4	167.2	151.97	178.58	151.02	178.19
% increase		22.98		12.66		17.51		17.72
Gross return (Rs. /ha)	152775	225435	267120	384560	273546	392846	231147	334280
Net return (Rs. /ha)	72775	160435	199560	312530	204982	321683	159105	264882
B: C	1.91	3.46	3.95	5.34	3.99	5.52	3.21	4.81

Yield of front line demonstrated ridge gourd variety Arka Prasan recorded in between 12.66% to 22.98% of increased yield, on an average of 17.72% over three years of demonstration. As per the varietal character the potential yield is 26.0 t/ha and in the field condition the open self-pollinated variety exhibited 68.46% of its potential with 17.72 t/ha. The results clearly indicated that Arka Prasan performed better than the check during all three years of study. The average yield obtained under demonstration was 178.19 q/ha as against 151.02 q/ha in the check, showing a 17.72% increase. Consequently, the gross return (₹3,34,280/ha) and net return (₹2,64,882/ha) were much higher in demonstration compared to ₹2,31,147/ha and ₹1,59,105/ha, respectively, in the check. Similarly, the benefit-cost ratio was also superior in Arka Prasan (4.81) over the check (3.21), which establishes the higher profitability and economic advantage of adopting Arka Prasan with all the integrated approaches towards pest, disease and nutrient management along with cultural operation like staking and adopting pendal system of growing. Similar results were reported by Rashmi *et al.* (2025)<sup>[20]</sup> in ridge gourd front line demonstrations.

### Conclusion

As vegetables are nutrient rich sources of vitamins and minerals, Indian origin cucurbits occupy prime position with higher health benefits. Among gourds ridge gourd is one of the important with good sources of Vit A, B, and C and minerals Iron and Magnesium. Higher productivity of the crop is need of the hour. To enhance the ridge gourd productivity ICAR-kvk Koppal demonstrated integrated approaches with varietal introduction in ridge gourd. The result recorded during the demonstration showed that average yield obtained under demonstration was 178.19 q/ha as against 151.02 q/ha in the check, showing a 17.72% increase. Consequently, the gross return (₹3,34,280/ha) and net return (₹2,64,882/ha) were much higher in demonstration compared to ₹2,31,147/ha and ₹1,59,105/ha, respectively, in the check. Similarly, the benefit-cost ratio was also superior in Arka Prasan (4.81) over the check (3.21), which establishes the higher profitability and economic advantage of adopting Arka Prasan with all the integrated approaches towards pest, disease and nutrient management along with cultural operation like staking and adopting pendal system of growing.

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