Enhancing Farmer Livelihoods through Improved Pearl Millet Variety ABV-04

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Introduction:

Millets are a group of small-seeded cereal crops belonging to the family Poaceae (grass family). They have been cultivated for millennia and are recognized for their high nutritional and agronomic value. Millets are rich sources of dietary fiber, proteins, vitamins, and essential minerals including iron, zinc, and calcium. Owing to their inherent tolerance to abiotic stresses such as drought, high temperatures, and low soil fertility, millets are classified as climate-resilient and environmentally sustainable crops. In recent years, millets have gained renewed attention as nutritionally superior alternatives to staple cereals such as rice and wheat. Among the various millet species, pearl millet (*Pennisetum glaucum*), commonly referred to as bajra, is one of the most significant, particularly in India. It is extensively cultivated in arid and semi-arid agro-ecological zones due to its exceptional adaptability to harsh environmental conditions. Pearl millet is a highly cross-pollinated species and exhibits protogynous flowering, wherein the female reproductive parts mature before the male parts. Pollination primarily occurs through wind (anemophily). Nutritionally, pearl millet is a dense source of macronutrients and micronutrients, providing appreciable amounts of protein, dietary fiber, and lipids. It is naturally gluten-free and characterized by a low glycemic index, making it suitable for individuals with celiac disease, gluten sensitivity, and diabetes mellitus. Additionally, its high fiber content supports gastrointestinal health and contributes to improved metabolic function. Despite its agronomic and nutritional advantages, the productivity of pearl millet is often constrained by the widespread cultivation of traditional, low-yielding cultivars. However, increasing awareness regarding nutritional security and sustainable agricultural practices has led to a resurgence in the cultivation and consumption of millets. Pearl millet, in particular, plays a crucial role in enhancing food and nutritional security while contributing to climate-resilient and sustainable farming systems.

Background

Pearl millet is cultivated across approximately 30,000 hectares in Andhra Pradesh, underscoring its significance as a resilient crop in semi-arid agro-ecological systems. Within the state, SPSR Nellore district contributes around 1,177 hectares under kharif cultivation. The crop is valued for its inherent tolerance to abiotic stresses such as drought, high temperature, and low soil fertility, rendering it particularly suitable for cultivation under marginal and resource-limited conditions. Despite its adaptive advantages, the productivity of pearl millet at both the state and district levels remains suboptimal. This limitation is largely attributable to the continued dependence on traditional cultivars, which are characterized by relatively low yield potential and reduced resistance to pests and diseases. Consequently, these factors collectively constrain overall productivity. Enhancing agronomic management practices alongside the adoption of improved, high-yielding, and stress-resistant varieties is therefore essential to improve both the productivity and sustainability of pearl millet-based farming systems in the region.

Intervention

A Front Line Demonstration (FLD) on the biofortified pearl millet variety ABV-04 was conducted by the Krishi Vigyan Kendra, Nellore, in the field of farmer G. Kantha Reddy (71 years, SSC education), at Kampasamudram village, Marripadu mandal, SPSR Nellore district with the objective of enhancing nutritional security and popularizing ABV-04 as a high-yielding and nutritionally superior pearl millet variety among farmers. ABV-04 was released in 2019 from agricultural research station, Anantapuramu, Acharya N.G. Ranga Agricultural University. The variety ABV-04 is a medium-duration cultivar (85-90 days) characterized by tall and erect plant growth, producing thick, compact panicles with bold grey obovate grains. It possesses resistance to major diseases such as downy mildew, smut, and blast, along with good tolerance to drought conditions, making it suitable for rainfed and resource-constrained environments. Nutritionally, ABV-04 contains higher levels of micronutrients, with approximately 70 ppm iron and 63 ppm zinc, compared to 45-50 ppm iron and 30-35 ppm zinc in traditional pearl millet varieties, thereby contributing to the alleviation of micronutrient deficiencies. In the demonstration, ABV-04 was taken up on

a plot within a larger farm where the farmer cultivated bajra over an area of 4 hectares. The demonstration area was established on sandy clay loam soil. Sowing was carried out during the first fortnight of June at a seed rate of 7.5 kg/ha, following two ploughings with a cultivator. Seeds were sown by broadcasting and subsequently incorporated into the soil with cultivator. The crop was managed with the recommended fertilizer dose of 80:40:30 kg NPK/ha. Six irrigations was given to the crop during critical growth stages. Hand weeding was performed at 25 days after sowing to ensure effective weed control and to promote optimal crop growth and development.

Impact:

The results demonstrated that ABV-04 significantly outperformed the local variety across all evaluated growth, yield, and economic parameters. Among the growth attributes, ABV-04 recorded the maximum plant height (232.9 cm), a higher number of productive tillers (3.7 per plant), longer panicle length (35.3 cm), and superior test weight (11.71 g), indicating enhanced vegetative and reproductive performance. In terms of productivity, ABV-04 achieved a grain yield of 3,529 kg ha^{-1}, which corresponded to a 10.00% increase over the local hybrid yield of 3,176 kg ha^{-1}. This yield advantage reflects the improved genetic potential and adaptability of ABV-04 under the given agro-climatic conditions. From an economic perspective, the cost of cultivation remained comparable between the treatments. However, ABV-04 generated higher gross returns (₹88,225 ha^{-1}) and net returns (₹42,160 ha^{-1}) due to its superior yield performance. Consequently, ABV-04 recorded a higher benefit-cost ratio (BCR) of 1.92, compared to 1.70 observed in the local variety. These findings indicate that ABV-04 is more productive and economically viable, making it a better option for cultivation under similar conditions.

Conclusion:

The Front Line Demonstration on pearl millet variety ABV-04 clearly established its superiority over the traditional local variety in terms of growth performance, yield potential, and economic returns under the agro-climatic conditions of SPSR Nellore district. The improved genetic traits of ABV-04, including its resistance to major diseases, tolerance to abiotic stresses, and higher micronutrient content, make it a promising option for enhancing both productivity and nutritional security. The demonstrated yield advantage, coupled with higher net returns and a better benefit-cost ratio, confirms its economic viability for farmers. The successful adoption of ABV-04 through this demonstration also highlights the importance of disseminating improved, biofortified varieties along with recommended agronomic practices to bridge the yield gap in pearl millet cultivation. Wider adoption of such high-yielding and nutritionally superior varieties, supported by continued extension efforts and farmer awareness programs, can significantly contribute to improving farmer livelihoods, ensuring food and nutritional security, and promoting sustainable agriculture in rainfed and resource-constrained regions.

Table 1. The following comparison highlights the significant physiological and economic advantages of adopting the biofortified bajra variety ABV-04 over local varieties

S.No.	Parameters	T_1: ABV-04	T_2: Local Variety
1.	Plant population/m^2	26.0	26.0
2.	Plant height (cm)	232.9	223.5
3.	No. of producitve tillers/plant	3.7	3.3
4.	Panicle length (cm)	33.3	29.6
5.	Test weight (g)	11.71	10.93
6.	Grain yield (kg/ha)	3,529	3,176
7.	Increase in yield (%)	10.00	-
8.	Cost of cultivation (Rs./ha)	46,065	46,673
09.	Gross returns (Rs./ha)	88,225	79,400
10.	Net returns (Rs./ha)	42,160	32,728
11	BCR	1.92	1.70

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