Indian Farming 76 (05): 10-13; May 2026

Pearl millet in Haryana: Past roots, present trends, and future horizons

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Pearl millet or bajra, is Haryana's traditional grain, now gaining renewed prominence as a climate-resilient, nutrient-rich and profitable crop. Historically a lifeline in semi-arid regions, it is valued for its drought tolerance, low input needs and high nutritional profile, including iron and zinc. Declining groundwater, reduced canal water, and pest issues in cotton are pushing farmers toward pearl millet as an alternative to water-intensive crops. Besides, government incentives such as MSP of ₹2,775/q and assured procurement along with high-yielding biofortified hybrids like 'HHB 299' and 'HHB 311', further support its expansion. The article provides information related to its importance, nutritional value, hybrids and limitations to its adoption.

Keywords: Bajra, Climate resilience, Nutritional security, Sustainable agriculture

PEARL millet or bajra [*Pennisetum glaucum* (L.) R. Br.] is the most important millet crop of the world accounting for almost half of the global millet production. It is mainly grown in the arid and semi-arid regions of Asia and Africa. It is the sixth most important cereal crop after rice, wheat, maize, barley and sorghum. It is grown over around 30.9 million hectare (mha) area and serves as staple food for 90 million people worldwide. India is the largest producer of pearl millet and accounts for almost one third of world's total production. In India, it is grown on an area of around 7.36 mha with total production of 11.20 million tonnes (Agricultural Statistics at a Glance 2024-25). Rajasthan, Maharashtra, Uttar Pradesh, Haryana and Gujarat are the major pearl millet growing states of India contributing 90% to the total production.

Due to its nutritional properties, pearl millet has been renamed as nutri-cereal (Gazette of India, No. 133 dated 13 April, 2018) and can play a vital role in overcoming malnutrition and ensure food and nutritional security. It is highly photosynthetic efficient crop that can withstand drought and even thrives in less fertile soils with low nutrient and water retention capacity. Because of these features, it is favoured by farmers due to uncertain weather conditions.

Table 1. Area, production and productivity of pearl millet in Haryana (5 years)

Year	Area (lakh ha)	Production (lakh tonnes)	Productivity (kg/ha)
2021	4.83	11.20	2,318
2022	4.59	10.62	2,311
2023	5.28	12.98	2,460
2024	5.74	16.62	2,897
2025	5.88	14.74	2,515

Source: Ministry of Agriculture and Farmers Welfare, Government of India.

Pearl millet: Haryana's traditional grain

Pearl millet has been cultivated in Haryana for several decades, long before the rise of modern irrigation and hybrid crops. In fact, its presence is deeply rooted in the cultural and agricultural heritage of the state, especially in semi-arid districts such as Mahendragarh, Bhiwani, Rewari, Hisar, Jind, Charkhi Dadri and Jhajjar, where rainfall is sparse and water sources are unreliable.

In these water-scarce environments, pearl millet is not just a crop, it is a lifeline. For generations, it served as a critical food security buffer. Farmers grew indigenous landraces passed down through generations. While these landraces had lower yields compared to today's hybrids, they were remarkably adaptable to local conditions, required minimal inputs, and could thrive on marginal, low-fertility soils. These traditional varieties matured slowly, had strong stalks for fodder, and exhibited natural resilience to pests, heat, and water stress.

It also played a major role in nutritional security. Its flour was used to prepare *bajre ki roti*, a dense, energy-rich flatbread eaten with jaggery, buttermilk, or seasonal vegetables. The grain kept people full longer and helped them endure long working hours in the fields. Equally valuable was the stover (crop residue), which served as an essential fodder resource for cattle, especially during dry months when green fodder was scarce.

Table 2. Nutritional comparison of pearl millet with sorghum, rice and wheat (in 100 g grain)

Content	Crop			
	Pearl millet	Sorghum	Rice	Wheat
Carbohydrates (g)	61.8	67.7	78.2	64.7
Protein (g)	10.9	9.9	7.9	10.6
Fat (g)	5.43	1.73	052	1.47
Energy (Kcal)	347	334	356	321
Dietary fibre (g)	11.5	10.2	2.8	11.2
Calcium (mg)	27.4	27.6	7.5	39.4
Phosphorus (mg)	289	274	96	315
Magnesium (mg)	124	133	19	125
Zinc (mg)	2.7	1.9	1.2	2.8
Fe (mg)	6.4	3.9	0.6	3.9
Thiamine (mg)	0.25	0.35	0.05	0.46
Riboflavin (mg)	0.20	0.14	0.05	0.15
Niacin (mg)	0.9	2.1	1.7	2.7
Folic acid (µg)	36.1	39.4	9.32	30.1

Source: National Institute of Nutrition, Hyderabad (2018).

Until the 1980s, pearl millet cultivation was largely traditional. The first scientific breakthrough came with the release of hybrid variety 'HHB 67', developed by Chaudhary Charan Singh Haryana Agricultural University (CCS HAU), Hisar, in collaboration with ICRISAT and ICAR. These hybrids marked the beginning of a new chapter, ushering in better yields, earlier maturity, and disease resistance, while retaining the adaptability that had always made it indispensable.

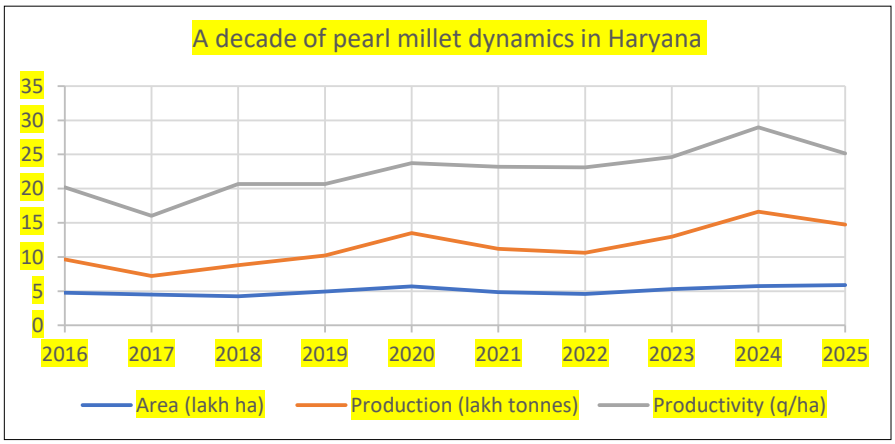
Current scenario of pearl millet cultivation in Haryana

Currently, around 80–83% of Haryana's total land area (3.5–3.8 mha) is under cultivation with rice, cotton, bajra, and guar being the major crops grown during the *kharif* season. Over the past decade, the area under pearl millet has expanded from about 4.78 lakh ha in 2016 to nearly 5.88 lakh ha in 2025, reflecting an average increase of around 11,000 ha. This shift has been driven by multiple factors. Haryana's dependence on groundwater for irrigation surged after the Green Revolution, particularly for water-intensive crops like wheat and rice, leading to a steady decline in water tables. Another major source of irrigation, 'Bhakra canal system', has historically played a pivotal role in sustaining the rice–wheat cropping pattern. However, in recent years, Haryana's share of Bhakra water has been reduced. This severe irrigation water crisis has compelled farmers to consider altering the existing cropping system, which has long been dominated by wheat, rice, and cotton. Additionally, the susceptibility of *Bt* cotton varieties to pink bollworm infestations has further aggravated farmers' challenges. In this changing context, pearl millet is increasingly being adopted as an alternative crop, particularly in the southern and south-western regions of Haryana.

In recent years, the government has actively promoted the cultivation of crops other than cereals such as pulses, oilseeds, and nutri-cereals/ *Shree Anna* by offering higher Minimum Support Prices (MSP) and assured procurement. For the 2025-26 season, the MSP of pearl millet has been fixed at ₹2,775 per quintal, representing a 5.7% increase over the previous year. This price offers farmers an estimated 63% margin over the cost of production, making it one of the most profitable *kharif* crop options in the state.

New high yielding hybrids from public and private sector

In recent years, significant improvements in pearl millet productivity have been achieved, driven by the release of several high-yielding hybrids with remarkable yield potential. These hybrids are considerably more input-responsive compared to traditional cultivars. Haryana currently records the highest pearl millet productivity in the country, averaging 2,897 kg/ha with a consistent upward trend over the past several years. CCS HAU, Hisar, is the leading public-sector institution engaged in pearl millet improvement in the state. Among its notable achievements, 'HHB 67' (Further improved 'HHB 67 imp.' and 'HHB 67 imp. 2') remains one of the most successful public-bred hybrids, still widely cultivated in arid regions of the country. The university has also released biofortified hybrids 'HHB 299' and 'HHB 311', gaining rapid popularity among farmers. With elevated iron and zinc content, these hybrids have potential to mitigate malnutrition issue. Pearl millet hybrid 'HHB 299' has emerged as one of the most popular hybrids in the semi-arid ecologies of Haryana and Rajasthan during recent years owing to its



Biofortified hybrid 'HHB 299' developed by CCS HAU, Hisar

high yield potential, adaptability, and nutritional superiority. During 2024-25, approximately 12,000–15,000 quintals of 'HHB 299' seed was produced by MoU partners of the university (TP-2026, Bajra Section, CCS HAU, Hisar). While public institutions play a vital role, several key private seed companies such as Pioneer Hi-Bred, Kaveri, Crystal Crop Protection, Rasi, and SeedWorks International, Nuziveedu Seeds, etc. are significantly expanding the hybrid landscape. These players focus primarily on medium and late-maturing segments designed to maximise yield potential.

Future horizon and challenges

Assessing the effects of global climate change and implementing new tools and strategies to mitigate its impact are crucial for maximising agricultural production. In this context, pearl millet stands out as a highly valuable crop, capable of delivering higher economic returns under marginal conditions compared to other cereals, even under harsh temperature extremes associated with climate change. It is a gluten-free grain that retains its alkaline properties even after cooking, making it suitable for individuals with gluten intolerance. Furthermore, pearl millet contains higher levels of slowly digestible starch (SDS) and resistant starch (RS), which contribute to its lower glycemic index (GI), making it increasingly preferred in the context of evolving diets, changing food habits, and growing health-consciousness in the food industry. Pearl millet is no longer confined to rural fields and traditional village kitchens. With rising awareness of lifestyle-related diseases, urban consumers are actively adopting its products such as millet noodles, cookies, multigrain flours, and snack bars. The International Year of Millets 2023, spearheaded by India and recognised by the United Nations, has further propelled millets into the global spotlight. Apart from its importance in the human diet, pearl millet can also be effectively incorporated into poultry feed formulations, offering a promising avenue to reduce dependence on maize. With appropriate research, optimised formulations, and institutional support, pearl millet has the potential to emerge as a viable alternative that benefits both poultry producers and the broader agricultural ecosystem.

Considering these factors, the demand for nutrient-rich 'superfoods' like pearl millet is expected to rise substantially in the coming years. To bridge the future demand-supply gap, special attention must be given to advanced production technologies. In Haryana, where farm labour shortages are becoming a significant constraint, mechanical harvesting is a critical factor that policymakers and researchers must address. Developing new hybrids that are well-suited for mechanical harvesting could significantly reduce dependence on manual labour, thereby saving both time and cost for farmers. Such innovations align seamlessly with Haryana's broader vision of promoting farm mechanisation and precision agriculture, ensuring sustainable and profitable pearl millet cultivation in the future.

However, the road ahead is not without challenges. One of the major post-harvest concerns for pearl millet is rancidity (process in which the flour develops a bitter taste due to the oxidation of its healthy fats). This significantly limits the shelf life, posing difficulties in marketing its products in supermarkets or exporting them without advanced

Table 3. Details of biofortified hybrids released by CCS HAU, Hisar

Hybrid	Suitable region	Characteristics
HHB 299	Irrigated areas of Haryana, Rajasthan, Delhi, Gujarat, Punjab, Maharashtra and Tamil Nadu	• Average grain yield: 39.5 q/ha • Potential grain yield: 49.0 q/ha • Dry fodder yield: 109 q/ha • Grain iron content: 75–81 ppm • Grain zinc content: 39–42 ppm • Maturity: 75–81 days • Resistant to downy mildew and blast diseases
HHB 311	Irrigated areas of Haryana, Rajasthan, Delhi, Gujarat, Punjab, Maharashtra and Tamil Nadu	• Average grain yield: 37.5 q/ha • Potential grain yield: 45.0 q/ha • Dry fodder yield: 87–100 q/ha • Grain iron content: 81–87 ppm • Grain zinc content: 39–42 ppm • Maturity: 75–80 days • Resistant to downy mildew

packaging solutions. The rancidity issue is currently a major hotspot of discussion among both industry stakeholders and the research community, as it hampers the full potential of a crop capable of simultaneously addressing two of today's greatest challenges i.e. climate change adaptation and human health improvement. Moving forward, greater emphasis will be needed on strategic investments in post-harvest infrastructure, provision of government subsidies for processing units, and enhanced research funding aimed at reducing rancidity-causing compounds such as phytic acid directly in the grain.

SUMMARY

Pearl millet, deeply embedded in Haryana's agricultural heritage, is now emerging as a crop of the future due to its climate resilience, nutritional richness, and profitability. Supported by government policies, higher MSP and the continuous hybrid development, it is gradually reshaping the state's cropping system away from water-intensive cereals. Rising urban demand for millet-based foods and its potential use in animal feed strengthen its market prospects. The growing scarcity of irrigation water and recurring pest pressures in cotton, especially pink bollworm, have further highlighted the need for a reliable and sustainable alternative, making it an increasingly attractive choice for farmers. However, realising its full potential will require overcoming challenges such as rancidity, limited post-harvest infrastructure, and the need for mechanisation. With sustained research, institutional support, and farmer-centric innovations, pearl millet can serve as a cornerstone for ensuring food, nutritional, and livelihood security in Haryana.

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