

An Empirical Analysis of the Trend and Productivity of Pearl Millet between Uttar Pradesh and Rajasthan

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Abstract

Time series data on Area, Production and productivity of pearl millet from 2000-1 to 2024-25 was analysed for Uttar Pradesh and Rajasthan state. India has a long and rich history of millet cultivation and eating that goes back thousands of years. India produces 18 million tonnes (mt.), or 60% of the world's total millet production, making it the greatest producer in the world. China and Niger come in second and third, respectively, with 2.7 and 2.15 mt. (FAOSTAT, 2023).

*According to findings, Rajasthan is producing pearl millet on large scale in comparison to Uttar Pradesh on the basis of area and productivity. To enhance Rajasthan's millet farming, focused efforts on irrigation systems, climate-resilient practices, and farmer empowerment are imperative. Rajasthan's dominance in millet production can be attributed to its **arid and semi-arid climate, sandy and loamy soil, and government support** for millet cultivation. In Uttar Pradesh, the situation warrants aggressive promotion of millet in these rainfed tracts in view of increased recognition for their nutritional value among people. Promotional efforts to increase the area covered by millets, however, must be bolstered.*

Keywords: Pearl Millet, Area and Production, Uttar Pradesh, Rajasthan

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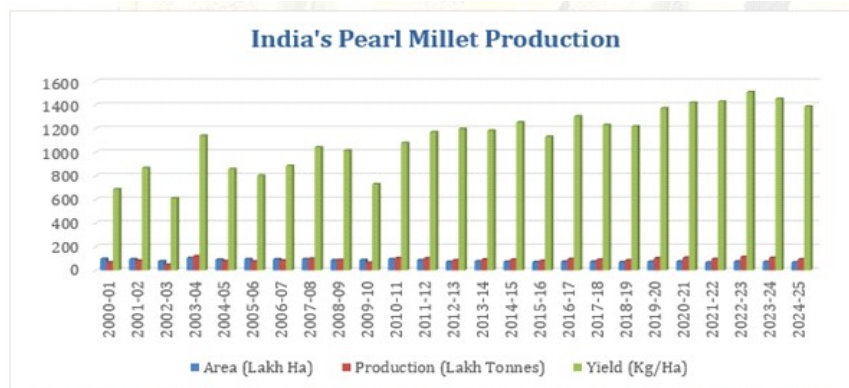
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Introduction

Millets are a group of small-seeded cereal crops that have been grown for thousands of years across Asia and Africa. These ancient grains are now attracting the world for their extraordinary health benefits and their ability to grow in challenging environments. Millets are highly nutritious and naturally gluten free. They are rich in fibers, proteins, essential vitamins, and minerals such as iron, calcium, and magnesium. From an environmental point of view, millets are climate smart crops. They require very little water, can grow in poor soils, and are resistant to pests and diseases. This makes them an excellent alternative to water-intensive crops like rice and wheat, especially in regions facing drought and climate change. Millets are traditional staple food for the rural poor in dry land regions of the country. India is the world's largest producer of millets with a share of 38.4% of world's production (FAO 2023).

Between 2000-01 and 2024-25, the Compound Annual Growth Rate (CAGR) of millet cultivation in India shows a decrease in Area by -1.44%, while production has increased by 1.37%, and Productivity has improved significantly by 2.85%.

Recognizing the nutritional and environmental benefits of millets, India has been actively promoting their cultivation and consumption. In 2023, the country spearheaded the global celebration of the **International Year of Millets**, aiming to raise awareness and boost both domestic and international demand for these ancient grains.



Rajasthan is the leading state in millet production in India, contributing approximately 27% to 32% of the nation's total millet output

as of the 2023–24 agricultural year. This significant share underscores Rajasthan's pivotal role in India's millet cultivation landscape.

The state government had started the **Rajasthan Millet Promotion Mission in 2022-23** and made a provision of **Rs 40 crore** to set up 100 primary processing units by farmers, entrepreneurs and voluntary organisations.

Uttar Pradesh contributes approximately 17 % to India's total millet production. In Uttar Pradesh, districts like Chitrakoot, Raebareli, Farrukhabad, Bijnor, Kushinagar, Pilibhit, Chandauli, Baghpat, Varanasi and Ambedkarnagar are major producer of millets (Shri Anna).

The Uttar Pradesh Millets Revival Programme (**UPMRP**) was approved by the Uttar Pradesh Cabinet in 2023. It promotes the production, processing, and consumption of millet in the state. The government has allotted Rs. 186.26 crore for the operation of the **Uttar Pradesh Millets Revival Programme (UPMRP)** from 1 January 2023 to 2026-27.

Literature Review

Manga and Kumar (2011) have examined the comparative production of pearl millet between hybrids and open-pollinated varieties with respect to their grain yield and dry fodder yield in A zone (average annual rainfall <600 mm) and A1 zone (average annual rainfall <400 mm with high temperature). This study finds that hybrid varieties have clear advantage over open-pollinated varieties in terms of grain yield as well as dry fodder yield in A zone and A1 zone. Further, this study also suggested that A zone and A1 zone should adapt hybrid cultivation over open-pollinated varieties to increase the production of pearl millet for grain yield and fodder yield.

Goyal and Kumar (2013) have discussed the cropping pattern and production trends of agriculture in Uttar Pradesh from 1950-51 to 2011-12. This study highlighted the changes in major crops like wheat, Rice, pulses, oilseeds, potatoes and coarse cereals in Uttar Pradesh from 1950-51 to 2011-12. This study shows that there is increasing trends of Wheat and Rice as well as potatoes production in Uttar Pradesh. On the other-hand there is negative trends of pulses, oilseeds and coarse cereals production in Uttar Pradesh. Over-all there is increasing trends of major crops in Uttar Pradesh. This study also stated that the status of crop diversification is improving across the state and technological advancement help to reduce water consumption in rice, wheat and sugarcane crops.

Singh and Nayak (2017) have analysed the impact of rainfall, minimum & maximum temperature, irrigation, rural literacy, consumption of fertilisers, pump set and tractors on the productivity of selected crops like rice, wheat, sorghum, pearl millet, maize, finger millet, pigeon pea, chickpea, sugarcane, cotton, groundnut and barley by using feasible generalised least square method during 1966 to 2015. The empirical results shows that the maximum temperature is negatively related to the yield of all twelve crops. On the other hand, irrigated area, rainfall, rural literacy, pump set, tractors and fertiliser consumption coefficients are positively related to the yield of rice, wheat, sugarcane, finger millet, pearl millet. The marginal effect of rainfall shows that maize, barley and chickpea crops are adversely affected during 1966 to 2015. The predicted results depict that the productivity of sorghum, maize, finger millet, pigeon pea and groundnut would be declined by -178.60, -181.92, -143.06, -111 and -179.36 percent by 2100.

Sammauria, Meena, Yadav, Gupta, Gupta and Yadav (2018) have discussed the cropping system for higher productivity, resource-use efficiency and profitability in semi-arid eastern plain zone of Rajasthan during 2010 to 2016. This study finds that cropping system for productivity was highest for pearl millet with groundnut-wheat-cluster bean-onion crop rotation. Further, there was highest sustainable yield index (SYI) for groundnut-wheat-cluster bean-onion and for land use efficiency was followed by pearl millet-wheat-cluster bean-barley sequence (0.63 and 65.75%). At the end, we can conclude that in Rajasthan, semi-arid agro climatic conditions are more productive, sustainable, resource use efficiency and remunerative for groundnut-wheat-cluster bean-onion, followed by pearl millet-wheat-cluster bean-barley.

Lal, Kumar and Singh (2020) have analysed the economics of pearl millet in Sikar district of Rajasthan in the year 2019-20 with a sample of 120 respondents. There were 57 small respondents, 42 medium respondents and 21 large respondents out of 120 total respondents in Sikar district of Rajasthan. This study employed interview method for the data collection. This study finds that large size cultivators have greater advantage than the medium and small size cultivators in terms of net returns per hectare in Sikar district of Rajasthan.

Soni and Sivasankar (2020) have studied the realm of production of pearl millet in Rajasthan as well as in India from 2000 to 2020. This

study suggested that Rajasthan's erratic agricultural environment emphasizes the need for focused investments in technology, infrastructure, and farmer education. These actions are essential for reducing environmental uncertainty and guaranteeing steady output even in the face of hardship. And additionally, in Rajasthan, it is crucial to strategically prioritize climate-resilient methods, irrigation systems, and farmer empowerment when it comes to millet growing.

Sah, Dixit, Kumar, Ojha, Katiyar, Singh, Dubey and Singh (2021) have examined the area, production and Productivity of major millets using time series data from 2000-01 to 2019-20 for Bundelkhand region of Uttar Pradesh. This shows that the sorghum was the highest produced millet with the 34% and also highest in area 36.6% in Uttar Pradesh. In Chitrakoot district, there was highest area 31.6% covered under the millets. This study also highlighted that among all the millets, pearl millet contributed the highest growth rate in area 0.97%, production 3.57% and productivity 1.59% with low instability index for area. This study finds that there is overall decline in area and production in Bundelkhand region for all the seven districts. The highest decline districts in area are Lalitpur, Chitrakoot and Jhansi during the study period while the Banda district was contributing in area 1.16% and production 4.77% of pearl millet during the same period.

Objectives of the Study-

1. To study the Pearl Millet production in Rajasthan and Uttar Pradesh.
2. To study the reasons behind less/more Pearl Millet production In Rajasthan and Uttar Pradesh.

Scope of the study-

In this research paper, we have analysed the Pearl Millet production in Rajasthan and Uttar Pradesh. This research paper focused on reasons behind the Pearl Millet production in Rajasthan and Uttar Pradesh. The future researchers can include large millets and small millets for comprehensive results in Rajasthan and Uttar Pradesh.

Data collection and Methodology-

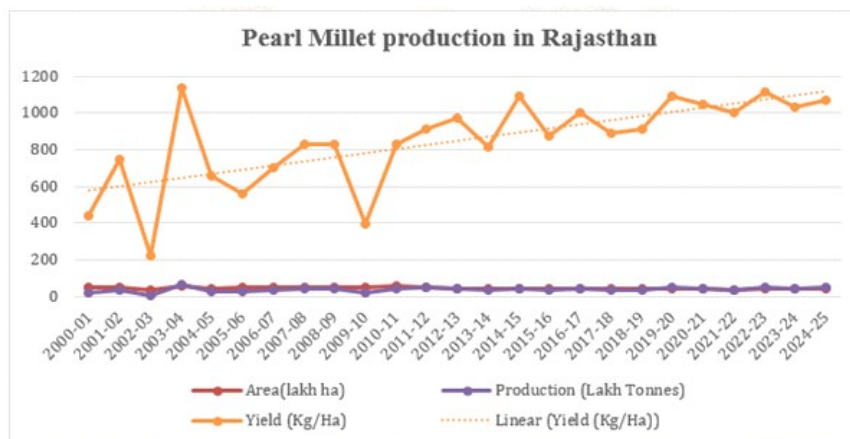
This research paper is mainly based on secondary data. The secondary data is collected from various sources like govt. ministries, news article and journals. In this study, we have also explored quantitative aspects of study. In this study, we have used CAGR method for annual growth computation. In this study, we have used MS world and MS excel for the tabulation of datasets.

Results and Interpretation

The “National Leader in Pearl Millets” is the state of Rajasthan, which produces the majority of India’s millet. With over 46 lakh hectares and 28 lakh tons pearl millet produced annually, it has the greatest area and highest production in the nation. Rajasthan’s dedication to millet cultivation, especially Bajra (Pearl millet), guarantees a steady supply of this wholesome and sustainable crop.

In Rajasthan, the CAGR (Compound Annual Growth Rate) of Bajra (Pearl Millet) for Area (lakh/ha) and Yield (Kg/ha) was -0.25% and 3.62%, respectively from 2000-01 to 2024-25. Additionally, the CAGR of Pearl Millet cultivation (lakh tonnes) was increased by 3.35% from 2000-01 to 2024-25 in Rajasthan. In agriculture year 2003-04, there was highest production (66.57 lakh tonnes) and productivity (1117 Kg/ha) of Pearl Millet in Rajasthan.

In Rajasthan, the lowest production (7.18 lakh tonnes) and productivity (223 Kg/ha) of Pearl Millet was in agricultural year 2003-04.



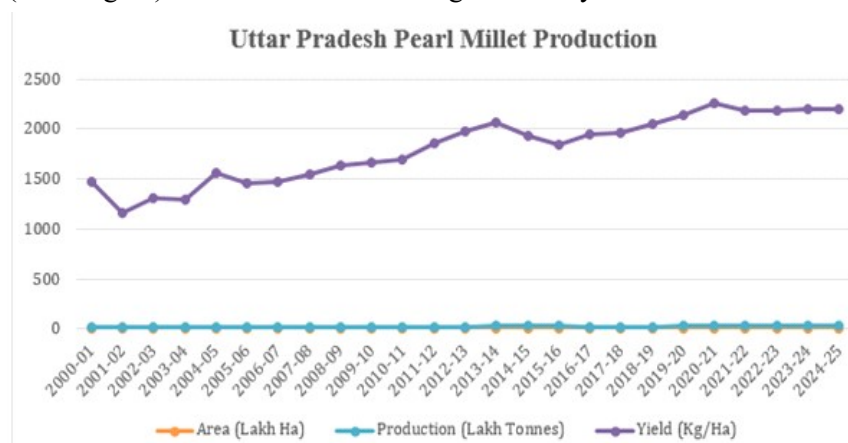
Source: Department of Agriculture and Farmers Welfare.

Uttar Pradesh has emerged as a significant contributor to India’s millet production, ranking second nationally after Rajasthan. The Pearl millet constitute about 17.43% of the state’s millet production.

In Uttar Pradesh, the CAGR (Compound Annual Growth Rate) of Bajra (Pearl Millet) for Area (lakh/ha) and Yield (Kg/ha) was 0.10% and 1.64%, respectively from 2000-01 to 2024-25. Additionally, the CAGR of Pearl Millet cultivation (lakh tonnes) was increased by 1.75% from 2000-01 to 2024-25 in Uttar Pradesh. In agriculture year 2023-24, there was

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highest production (21.95 lakh tonnes) of Pearl Millet in Uttar Pradesh. In Uttar Pradesh, the lowest production (9.68 lakh tonnes) and productivity (1137 Kg/ha) of Pearl Millet was in agricultural year 2001-02.



Decadal variation in Area, Production and Productivity of Pearl Millet crop

Decadal variation in Area, Production and Productivity of Pearl Millet in India

	CAGR				
	2000	2010	2020	2000-10	2011-20
Area (Lakh Ha)	98.29	89.04	75.43	-0.98%	-2.39%
Production (Lakh Tonnes)	67.59	65.06	103.63	-0.38%	-0.01%
Productivity (Kg/Ha)	688	731	1374	0.61%	2.45%

Decadal variation in Area, Production and Productivity of Pearl Millet in Rajasthan

	CAGR				
	2000	2010	2020	2000-10	2011-20
Area (Lakh Ha)	46.37	51.69	42.87	1.09%	-2.44%
Production (Lakh Tonnes)	20.47	20.35	46.86	-0.06%	0.26%
Productivity (Kg/Ha)	441	394	1093	-1.12%	2.77%

Decadal variation in Area, Production and Productivity of Pearl Millet in Uttar Pradesh

	CAGR				
	2000	2010	2020	2000-10	2011-20
Area (Lakh Ha)	8.81	8.48	9.17	-0.38%	-0.19%
Production (Lakh Tonnes)	12.77	13.89	19.39	0.84%	2.22%
Productivity (Kg/Ha)	1449	1638	2115	1.23%	2.48%

Reasons Behind High Production of Millets in Rajasthan

Arid and Semi-Arid Climatic Conditions:

Drought Resistance: Millets, especially pearl millet, are highly drought-resistant and thrive in conditions of low and erratic rainfall, high temperatures, and water scarcity. Rajasthan's climate, with its arid and semi-arid regions, is perfectly suited for these "climate-resilient" crops.

Adaptability to Harsh Environments: Unlike many other crops, millets can grow well even in less fertile, sandy soils, which are prevalent in Rajasthan. They require fewer resources like water and land, making them an economically beneficial crop for the region's farmers.

Traditional Farming Practices and Crop Choice:

Historical Significance: Millets have been an integral part of Rajasthan's traditional diet and agricultural practices for centuries. Farmers in the region have long relied on millets as a staple, given the prevailing environmental conditions.

Intercropping and Innovative Practices: Farmers often employ traditional intercropping methods and other innovative farming practices to cultivate millets, optimizing land use and potentially enhancing yields.

Government Support and Initiatives:

Rajasthan Millet Promotion Mission: The state government launched the "Rajasthan Millet Promotion Mission" in 2022-23, providing significant support to boost millet production. This includes:

Financial Provisions: Allocating funds for setting up primary processing units by farmers, entrepreneurs, and voluntary organizations.

Free Seed Kits: Distributing free seed kits of bajra and jowar to farmers to encourage cultivation and improve yields.

Center for Excellence: Establishing a "Center for Excellence" for Millets in Jodhpur, focusing on research, development, processing, and marketing.

Promotion and Awareness: Efforts are being made to promote millets as a culinary destination for tourists and to incorporate them into daily diets and street food, creating a stronger market demand.

Nutritional and Economic Benefits:

Nutritional Superiority: Millets are recognized as "Nutri-cereals" due to their richness in protein, vitamins, minerals, and dietary Fiber, making

them superior to wheat and rice in many aspects. This growing awareness contributes to increased demand.

Farmer Income and Sustainable Agriculture: Millets enhance farmers' income due to their low input costs (less fertilizer, water, labour) and their ability to grow in challenging conditions, supporting sustainable agricultural practices.

Technological Advancements (Emerging Factor):

Improved Varieties: Research institutes and agricultural universities are developing improved and high-yielding millet varieties that are more pest-resistant and suitable for varying weather conditions.

Forecasting and Adaptation: Machine learning models and other technological advancements are being used to analyse weather patterns and yield data, helping farmers adapt to changing climatic conditions and make better decisions.

Reasons Behind Less Production of Millets in Uttar Pradesh

Historical Policy Focus on Rice and Wheat (Green Revolution Effect):

During the Green Revolution, Indian policymakers prioritized wheat and paddy (rice) to achieve food self-sufficiency. This led to an extensive support framework for these crops, including assured irrigation facilities, high-yielding varieties, and guaranteed returns (Minimum Support Prices - MSPs).

Millets, often seen as “coarse cereals” or “cereals of the poor,” were overlooked in this policy push, leading to a significant reduction in their cultivated area.

Economic Disadvantages for Farmers:

Lower Profitability: Millets often offer lower net margins compared to commercial crops like wheat and rice. The prices realized for millets have often been stagnant, even as production costs increase.

Inadequate MSP and Procurement: While MSPs exist for some millets, they have grown at a slower rate than production costs, unlike wheat and paddy where MSPs grew faster. Additionally, government procurement of millets is limited to a few states and central stocks are small, creating market uncertainties for farmers.

Competition from Other Crops: Farmers tend to shift to more profitable and less risky crops, especially those with assured irrigation and better market linkages.

Agricultural Challenges:

Low Yields: The productivity of millets (like sorghum and pearl millet) has either fallen or stagnated compared to the significant yield increases seen in rice and wheat.

Labor-Intensive Post-Harvest Processing: Millets, especially small millets, require laborious post-harvest processing (dehusking, cleaning) due to their small grain size and outer husk. This makes them less attractive to farmers, especially in the face of labor shortages.

Limited High-Yielding Varieties: There's a lack of widespread availability and adoption of high-yielding, pest-resistant millet varieties compared to other major crops.

Pest, Disease, and Weed Pressure: While millets are generally hardy, they are still susceptible to pests, diseases, and weeds, which can impact yields and farmer income if not managed effectively.

Lack of Mechanization: The smaller grain size and specific processing needs of millets mean that mechanization is less developed compared to major cereals, making cultivation and post-harvest handling more labour-intensive and less efficient.

Market and Infrastructure Deficiencies:

Limited Market Linkages: There is often a disconnect between millet farmers and established markets. Lack of dedicated markets and value chains makes it challenging for farmers to sell their produce at fair prices.

Insufficient Processing Facilities: Limited facilities for processing, value addition, and proper storage of millets lead to post-harvest losses and reduce their marketability.

Limited Marketing and Branding: Millets have historically lacked proper marketing and branding, contributing to low consumer demand and a perception of them as a "poor man's food."

Competition from Cheaper Imports: In some cases, cheaper imports of other grains can further displace millets in the market.

Consumer Perception and Awareness:

Changing Food Habits: Modern food habits have shifted away from traditional millets towards more processed and easily available cereals like rice and wheat.

Lack of Awareness of Nutritional Benefits: Many consumers are still unaware of the significant nutritional and health benefits of millets, leading to lower demand.

Perceived Taste and Preparation Difficulty: Some people perceive millets as having a bland or unpleasant taste, or they are unfamiliar with how to prepare them.

Government Initiatives and Efforts: It's important to note that the Uttar Pradesh government, recognizing these challenges and the importance of millets (often referred to as "Shree Anna"), has launched initiatives like the Uttar Pradesh Millets Revival Programme (approved in 2023). This program aims to:

- Promote millet cultivation, processing, and consumption across all 75 districts.

- Provide financial assistance, free mini-kits of millet seeds, and training to farmers.

- Strengthen the millet value chain, including processing, packaging, and marketing.

- Collaborate with agricultural universities for research and development of high-yield varieties.

- Conduct awareness campaigns about millet's health benefits.

Conclusion

Rajasthan remains India's undisputed leader in pearl millet (Bajra) production, contributing the largest area under cultivation and the highest output nationally. Despite a slight decline in cultivated area (CAGR of – 0.25%), significant gains in yield (3.62% CAGR) have driven overall production growth of 3.35% from 2000–01 to 2024–25—demonstrating improved agricultural practices and productivity.

Uttar Pradesh holds a strong second position, accounting for approximately 17.43% of the nation's pearl millet output. The state has shown steady, albeit modest, growth in both area and yield, with production peaking in 2023–24.

Together, these two states anchor India's pearl millet supply chain, underscoring the crop's importance for food security, nutrition, and sustainable agriculture in semi-arid regions.

Rajasthan's success is largely driven by its arid climate, which naturally favors drought-resistant crops like millets, along with strong

traditional practices and recent government support. Millets fit well into the region's resource constraints, making them both an ecologically and economically sustainable choice.

In contrast, Uttar Pradesh's lower millet production is mainly due to the legacy of the Green Revolution, which prioritized rice and wheat through better irrigation, MSP support, and procurement systems. This created a structural bias against millets, further reinforced by market limitations, lower profitability, and changing consumer preferences.

Overall, the future of millet production in both states will depend on policy support, market development, technological innovation, and consumer awareness, making millets a key crop for sustainable agriculture and food security in India.

References

1. Manga, V. K. and Kumar, A. (2011). Cultivar Options for Increasing Pearl Millet Productivity in Arid Regions. *Indian journal of Fundamental and Applied Life Sciences*, Vol. 1 (2), Pg. **200-208**
2. Goyal, A.K. and Kumar, Dr. S. (2013). Agricultural Production Trends and Cropping Pattern in Uttar Pradesh: An Overview. *International Journal of Agriculture Innovations and Research*, Vol. 2
3. Singh, S. and Nayak, S. (2017). Climate Variability and Agricultural Productivity in Uttar Pradesh, India: Evidence from Panel Study. *Journal of Regional Development and Planning*, Vol. 6, No. 2
4. Sammauria, R., Meena, O. P., Yadav, M. R., Gupta, K. C., Gupta, A. K. and Yadav, H. L. (2018). Crop diversification of predominant Pearl millet based cropping system for higher productivity, resource-use efficiency and profitability in Semi-Arid Rajasthan. *Legume Research- An International Journal*
5. Lal, S., Kumar, S. and Singh, V. (2020). An Economic Analysis of Production of Pearl Millet (*Pennisetum glaucum*) in Sikar District of Rajasthan, India. *International journal of Current Microbiology and Applied Sciences*, Vol. 9, No. 12
6. Sah, U., Dixit, G. P., Kumar, H., Ojha, J., Katiyar, M., Singh, V., Dubey, S. K. and Singh, N. P. (2021). Performance of Millets in Bundelkhand Region of UP State. *Indian Journal of Extension Education*, Vol. 57, No. 4 Pg. **120-125**

An Empirical Analysis of the Trend and Productivity of Pearl Millet between.....

7. Soni, K. and Sivasankar, V. (2023). A Time Series Analysis of Production and Productivity of Millets in Rajasthan. Research Gate Journal
8. <https://apeda.gov.in/IndianMillets>
9. <https://desagri.gov.in>
10. <https://pixabay.com/photos/pearl-millet-pennisetum-glaucum-204106>