



Research Article

STATUS OF NUTRICEREALS – AN OVERVIEW OF GLOBAL AND INDIAN SCENARIO

Thanu Vaishubharathi E., Sivasakthi Devi T*, Swaminathan N.,
Pouchepparadjou A and Saravanan S

Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal, Puducherry UT, India

ARTICLE INFO

Article History:

Received 10th April, 2023

Received in revised form 2nd May, 2023

Accepted 26th May, 2023

Published online 28th July, 2023

Key words:

Millets, Compound Annual Growth Rate (CAGR), Production, Consumption

ABSTRACT

Millets are rich in minerals and vitamins compared to rice and wheat, it has the huge potential to provide security of food, nutrition, fodder, fiber, health, livelihood and ecology. In view of all these qualities, millets are called as Miracle Grains/ Nutri-Cereals. In this context, the current study was done to look at the millets status on a global and national basis. Global millets production and area in 2022 were 71.70 Mn Ha and 90.65 Mn MT, respectively. The production of millets increased at a 0.3% CAGR from 2012 to 2022, but there was no significant change in the area for millets during that time. In total, production and productivity of millets in India improved at 0.45% and 2% CAGR from 2012 to 2022 whereas, the area has a negative CAGR of 1.49%. From 1949–1950 to 2021–2022, the results revealed that the CAGR of Bajra and Ragi production and productivity increased while, the area under cultivation shrank. In Jowar and Small millets production and area under cultivation has declined, but their productivity increased.

Copyright© The author(s) 2023. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Millets were the first crops to be cultivated by mankind in Asia and Africa, which eventually expanded across the world as a pivotal food source for human civilization. Cultivation of little millets started in 2600 BC. Further domestication in other regions gave rise to secondary regions of diversity and adaptation and different end uses including animal feed. However, over time millets lost their place to other cereal crops such as rice and wheat which took precedence during the 1960s post-green revolution phase. Today, millets are mainly grown in arid lands in India and Africa by resource poor farmers.

The cultivation and consumption of millets is declining in many countries and their potential to address food and nutritional security is not being properly realized. Given the growing focus on consumption of nutritious food on the consumption side and sustainability aligned production on the supply side, there is an urgent need to promote the nutritional and ecological benefit of millets to consumers, producers, and decision-makers; improve millet production efficiencies, increase research & development investments and strengthen linkages of millets across the food sector. In 2013, India's National Food Security Act incorporated millets (then defined as coarse cereals) and by 2018 millets were officially made part of the National Food Security Mission. The Government of India also declared 2018 as the National Year of Millets.

The proposal for an International Year of Millets (2023) was put forth by the Government of India and endorsed by Members of FAO Governing Bodies at the 26th Session of

COAG; 160th Session of FAO Council, and 41 FAO Conference. It was adopted by the 75th Session of the UN General Assembly in March 2021. About 70 countries have pledged to engage various stakeholders for promoting the wider usage of millets and improve production and productivity of millets across the globe. India, being the largest producer of millets and proposer of IYoM-2023, is leading efforts for reviving millets and has initiated a number of policy initiatives to promote their production.

The International Year of Millets provides a unique opportunity for India to help create greater awareness of millet production, contribute to food and nutritional security, ensure sustainable livelihoods and incomes of farmers – particularly in regions that are drought-prone or threatened by climate change. The objective of the study is to analyze the trend in area, production and productivity of millets at Global and National level.

METHODOLOGY

Compound growth rate (CGR)

In the present study compound growth rate (CGR) of area, production, productivity and consumption for the millets at Global and National level were estimated to study the growth in area, production and productivity. The compound growth rates are found very convenient for any comparison of growth between two periods and two crops. It seems more appreciable to analyse the movement of agricultural crops in terms of compound rather than linear growth rate (Dandekar 1980).

*Corresponding author: Sivasakthi Devi T

Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal, Puducherry UT, India

The compound growth rates (CGRs) are usually estimated by fitting a semilog trend equation of the form:

$$\text{Log } Y_t = \alpha + \beta t + \varepsilon \dots\dots\dots(1)$$

Where, Y_t = Area, production and yield of selected major agricultural crops in years ‘t’,
 t = Year which takes value 1, 2,.....n, α and β are the parameters to be estimated,
 ε = Random error term

Equation (1) was estimated using ordinary least squares (OLS) technique. The t-test was applied to test the significance of β . This equation is generally used on the consideration that change in agricultural output in a given year would depend upon the output in the preceding year (Nikam and Deosthali 2004).

Compound growth rate was then estimated by using the following equation:

$$\text{CGR} = [(\text{Antilog of } \beta - 1) * 100] \dots\dots\dots (2)$$

The study considered the yearly database for the major agricultural crops to examine the growth performance of area of cultivation, production and productivity at Global and National level. The millets under examination including sorghum and other millets (ragi, pearl millet and minor millets) were analyzed to predict the better growth performance. The necessary data were collected purely based on secondary sources from FAO, USDA, Indiastat etc.

Global Millets

Global food and agricultural production has increased significantly since the end of World War II, spurred by a combination of population and economic growth along with technological and cultural shifts in production practices. Due to increases in population, wealth, and urbanization, the world has seen an overall increase in food demand, coupled with a shift in dietary preferences towards more resource intensive foods. Together with their high nutritional value, low-input and environmentally friendly millets are in a unique position to address growing demand for healthy food. Millets are hardy and grow well in dry zones as rain-fed crops, under marginal conditions of soil fertility and moisture. Apart from low inputs requirement, millets are also unique due to their short growing season (ready to harvest in 65 days).

Global Production of Millets

According to table 1, in 2022, the world's area devoted to millets was 71.70 Mn Ha, decreased from 78.16 Mn Ha in 2010. Millets were produced on a global scale in 2022, reaching 90.65 million metric tonnes (MT), increased from 92.97 million MT in 2010, with a decadal CAGR of 0.15% (2010-2022).

Countries in Millets Production, 2022

India was the highest millets producing country in the year 2022 with 11830 000’ MT production, contributing to 19.52 % of the global production. It was followed by Niger (3400 000’MT; 5.61%), China (2700 000’ MT; 4.45%), Nigeria (2000 000’MT; 3.30%), Mali (1800 000’MT; 2.97%). (Table 2)

Contribution of Millets to Global Area and Production

According to figure 1, Sorghum was grown on 40.44 million hectares (ha) worldwide in 2022, compared to 31.28 million

ha of other millets. 66% (60.13 MMT) of the world's millets were produced by sorghum, while 34% (30.52 MMT) were produced by other millets (small millets, finger millets, pearl millets, etc.).

Annual trends in area and production under Sorghum and other millets (2010 - 2022)

According to figure 2, between 2010 and 2022, the world's sorghum production increased by 0.02% CAGR, from 60.18 million tonnes to 60.13 million tonnes, but the area planted with the crop declined by a negative 0.3% CAGR, from 42.16 million to 40.44 million acres.

Using figure 3, While the area planted with other millets experienced a negative 0.9% CAGR decline from 36 Mn ha in 2012 to 31.28 Mn ha in 2022, global production of other millets increased at a 0.4% CAGR during this time, from 32.79 Mn MT to 30.52 Mn MT.

Consumption

The global consumption of millets stood at 90.43 Mn MT in the year 2022. The top ten countries contributed to nearly 80% of the total global millet consumption in the same period. Millets displayed their highest consumption in India with 17.75 Mn MT, followed by China (13.70 Mn MT) and Nigeria (8.80 Mn MT). (Figure 4)

Amongst millets, Sorghum was the major commodity consumed either in animal feed or in food, seeds and other industrial purpose. About 59.55MnMT of sorghum was consumed, contributing to about 65%of total millets consumption (in the year 2022).

In the USA, millets mainly in the form of sorghum are used in feed and for producing bioethanol. Usage of millets as food is limited in the USA as the flour is considered bitter. In China, Sorghum (local and imported from Australia) is used to make traditional liquor called Baiju. The Chinese also source Sorghum from U.S and Argentina for use in animal feed. Japan has a small but niche, health-conscious food market consisting of 50+ products with sorghum as ingredient. Japanese consumers enjoy sorghum in pancakes, pasta and more traditional meals like salmon rice balls. In Africa, sorghum is mainly used fermented bread, such as kisra and dosa, and stif porridges, such as ugali, tuwo, karo and mato.

Indian Scenario

Millet Area, Production and Productivity in India

India is the largest producer of millets in the world. Millets are mainly grown in poor agroclimatic regions, particularly rainfed areas of the country. In the year 2022, India produced 17.60 Mn MT of millets that included 4.40 Mn MT of sorghum and 13.20 Mn MT of other millets. Table 2 shows the area, production and productivity trends of millet in the last 10 years (2012-22). Millet production has grown at 0.45% decadal CAGR from 16.03 Mn MT in 2012 to 17.60 Mn MT in 2022. The area under millets in India was 15.40 Mn Ha in 2012 but fell to 14.00 Mn Ha in 2022, registering a negative 1.49% CAGR (2012-22). The productivity of millets has risen from approximately 1.04 MT/ha in 2012 to 1.26 MT/Ha in 2022, registering a decadal CAGR of 2%.

Contribution of Total Millet Production in India

Table 3 shows that in 2012, sorghum production was 5.28 Mn MT which dropped to 4.40 Mn MT in 2022, recording a negative 1.93% decadal CAGR. In 2012, other millets production was 10.72 Mn MT, which grew at 1.46% decadal CAGR (2012-2022) to reach 13.20 Mn MT in 2022.

The share of sorghum in millet production in India has been varying from 25% to 32% with an average of 29% in the last 10 years (2012-22). In 2022, sorghum contributed 25% (4.40 Mn MT) to the total millet production (17.60 Mn MT).

Trends in area, production and productivity of Bajra in India (1949-50 to 2021-22)

From figure 5, the trend revealed that between 1949 and 2021, the area used for Bajra farming decreased from 9300 to 7652 hectares. However, from 1949–1950 to 2021–2022, the production of bajra in India increased. The total production of Bajra increased by 9781 tonnes from 2800 tonnes in 1949–1950. The increase in production can be due to Bajra's increased productivity, which has increased from 306 kg/hectare to 1420 kg/hectare despite a decrease in the area under cultivation between 1949–1950 and 2021–2022.

Trends in area, production and productivity of Jowar in India (1949-50 to 2021-22)

From figure 6, the trend showed that over the years area under Jowar cultivation has reduced from 15571 hectares to 4378 hectares. Also decreasing trend in the production of Jowar in India during the year 1949-50 to 2021-22. The total production of Jowar was 5495 ton in 1949-50 which has decreased to 4151 ton. The increase in productivity of Jowar which has more than doubled from 353 kg/hectare to 1099 kg/hectare in the face of reduction in area of cultivation during the period 1949-50 to 2021-22.

Trends in area, production and productivity of Ragi in India (1949-50 to 2021-22)

Figure 7 demonstrated the decreasing trend in area under finger millet cultivation from 2203 hectares during 1949-50 to 1159 hectares during 2020-21. At the same time productivity has also increased from 649 kg/hectare in 2000-01 to 1724 kg/hectare in 2020-21. As a result, total finger millet production at the same period has gone up from 1429 ton during 2000-01 to 1998 ton in the year 2020-21.

Trends in area, production and productivity of Small millets in India (1949-50 to 2021-22)

Figure 8 showed change in the total area under cultivation of Small millets over the period of 1949-50 to 2021-22. The trend showed that over the years area under Small millets cultivation has reduced from 4605 hectares to 444 hectares. Decreasing trend in the production Small millets in India during the year 1949-50 to 2021-22. The total production of Small millets was 1750 ton in 1949-50 which has decreased 9367 ton. The productivity of Small millets which has doubled from 380 kg/hectare to 781 kg/hectare in the face of reduction in area of cultivation during the period 1949-50 to 2021-22.

Growth rate of Millets during 1949-50 to 2021-22 (in %)

Compound annual growth rates (CAGR) for the area, production and productivity of Millet was analysed using the exponential growth function. As of table 4 the compound

annual growth rate analysis showed that in the case of Bajra and Ragi area of cultivation has decreased and production and productivity have increased over the period 1949-50 to 2021-22. In the case of Jowar and Small millets, both areas under cultivation and production have decreased but productivity has increased over the period 1949-50 to 2021-22.

Though millets are one of the earliest grains that are being cultivated and consumed by the people, in the last few decades India and the world have witnessed significant decrease in the area under the millets crops. However, the productivity of these crops has gradually gone up due to adoption of high yielding varieties and improved production technologies.

Consumption

As of table 6, in 2022, millet consumption in India was estimated to be 17.75 Mn MT, growing at 0.5 % decadal CAGR from 16.05 Mn MT in 2012. The consumption of sorghum in the overall basket of millets showed a decadal decline at negative 4.95 % while consumption of other millets in the basket grew at 4.93 %, reflecting growing awareness of the latter's health benefits.

The pattern of millet consumption in India in the past 10 years (2012-22) and the present utilization of millets for feed and FSI (food, seed and industrial are depicted in figure 11. In 2022, around 0.45 Mn MT of sorghum was utilised as feed while 4.00 Mn MT was utilized as FSI. Around 1.60 Mn MT of other millets were utilised as feed while 11.70 Mn MT were utilised as FSI.

Table 1 Global Area and Production of Millets, 2012-2022

Year	Area (Mn Ha)	Production (Mn MT)
2010	78.16	92.97
2011	76.17	83.85
2012	71.87	88.31
2013	75.13	92.96
2014	76.85	101.98
2015	71.63	99.04
2016	77.77	94.37
2017	73.06	91.58
2018	75.7	97.02
2019	67.76	91.59
2020	72.67	95.03
2021	71.71	90.13
2022	71.72	90.65
CGR	-0.599	0.154

Source: Food and Agricultural Organization (FAO)

Table 2 Millet Area, Production and Productivity in India, 2012-2022

Country	Production (000 MT)	% Total
India	11830	19.52%
Niger	3400	5.61%
China	2700	4.45%
Nigeria	2000	3.30%
Mali	1800	2.97%
Sudan	1500	2.47%
Ethiopia	1100	1.81%
Burkina Faso	1000	1.65%
Senegal	1000	1.65%
Chad	700	1.15%

Source: United States Development of Agriculture

Table 3 Millet Area, Production and Productivity in India, 2012-2022

Year	Area(Mn ha)	Productivity (MT/ ha)	Production (Mn MT)
2012	15.4	1.04	16.03
2013	15.48	1.11	17.205
2014	15.28	1.12	17.08
2015	14.99	0.97	14.52
2016	14.72	1.1	16.13
2017	14.25	1.15	16.44
2018	12.54	1.09	13.72
2019	13.83	1.25	17.26
2020	13.63	1.32	18.02
2021	13.6	1.17	15.9
2022	14	1.26	17.6
CGR	-1.496	1.983	0.452

Source: Food and Agricultural Organization (FAO)

Table 4 Contribution of Millets to India’s Total Millet Production 2012-22 (Mn MT)

Year	Sorghum Production	Other Millet Production
2012	5.28	10.72
2013	5.54	11.66
2014	5.45	11.63
2015	4.24	10.28
2016	4.57	11.56
2017	4.8	11.64
2018	3.48	10.24
2019	4.77	12.49
2020	4.81	13.21
2021	4.5	11.4
2022	4.4	13.2
CGR	-1.939	1.465

Source: Agricultural and Processed Food Products Export Development Authority

Table 5 Growth in area, production and productivity of Millets during 1949-50 to 2021-22 (in %)

Crop	Parameter	CAGR
Bajra	Area	-0.567
	Production	1.694
	Productivity	2.285
Jowar	Area	-1.855
	Production	-0.625
	Productivity	1.253
Ragi	Area	-1.047
	Production	0.121
	Productivity	1.406
Small millets	Area	-3.601
	Production	-2.885
	Productivity	0.742

Source: Indiastat.com

Table 6 Millet consumption in India

Year	Other millet consumption (Mn MT)	Sorghum consumption (Mn MT)	Total consumption (Mn MT)
2012	5.15	10.9	16.05
2013	11.6	5.2	16.8
2014	11.6	5.1	16.7
2015	10.5	4.6	15.1
2016	11.3	4.5	15.8
2017	11.5	4.6	16.1
2018	10.6	3.55	14.15
2019	12.2	4.5	16.7
2020	13.2	4.55	17.75
2021	11.4	4.6	16
2022	13.3	4.45	17.75
CAGR %	4.934	-4.957	0.530

Source: Agricultural and Processed Food Products Export Development Authority

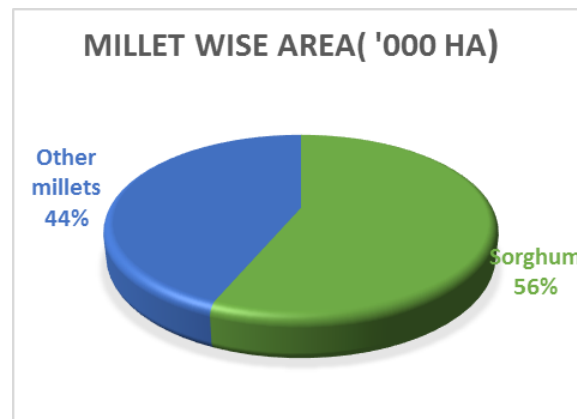
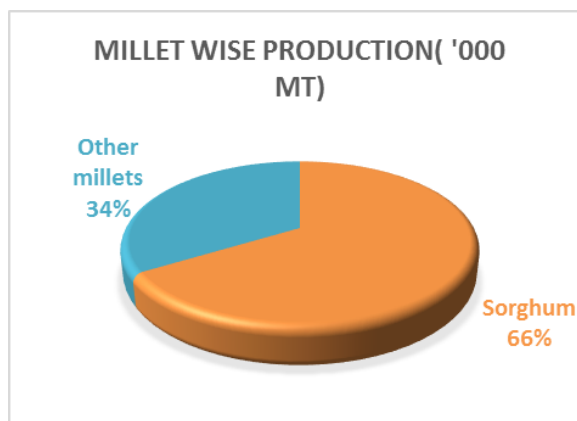


Figure 1 Contribution of Millets to Global Area and Production



Source: United States Development of Agriculture

Figure 2 Trend in Global Production and Area under Sorghum, 2010-2022

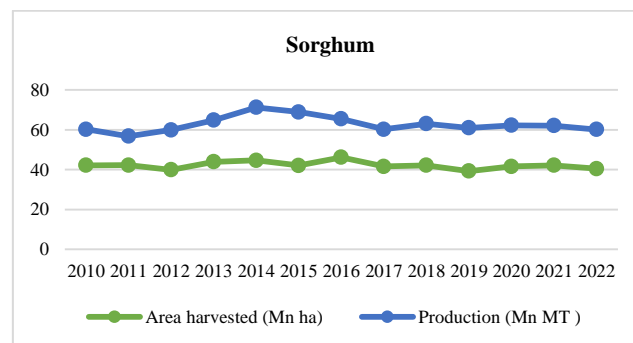
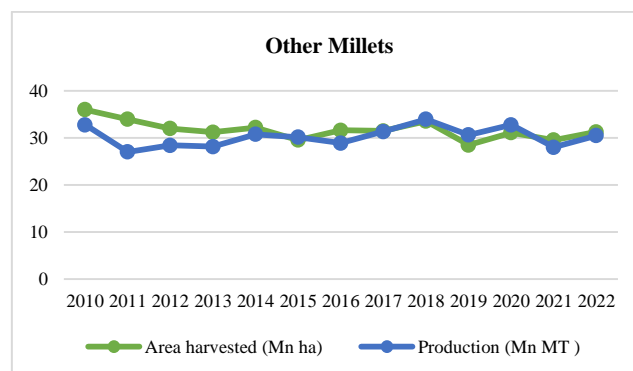
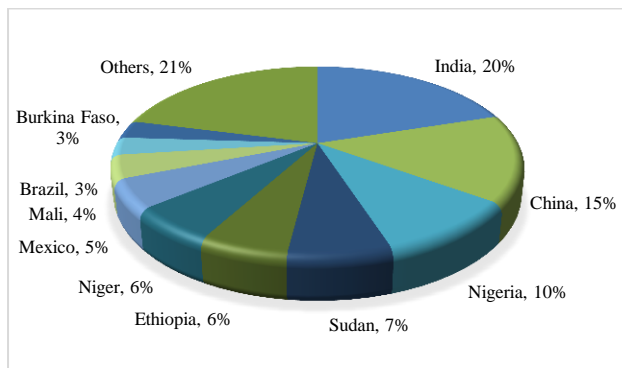


Figure 3 Trend in Global Production and Area under Other Millets, 2010-2022



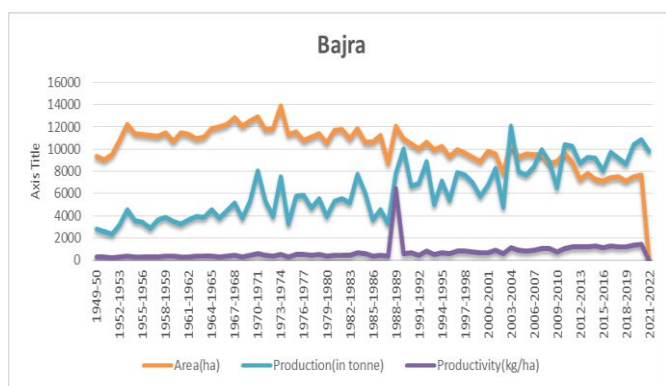
Source: Agricultural and Processed Food Products Export Development Authority

Figure 4 Country-Wise % Share in Millet Consumption (2022)



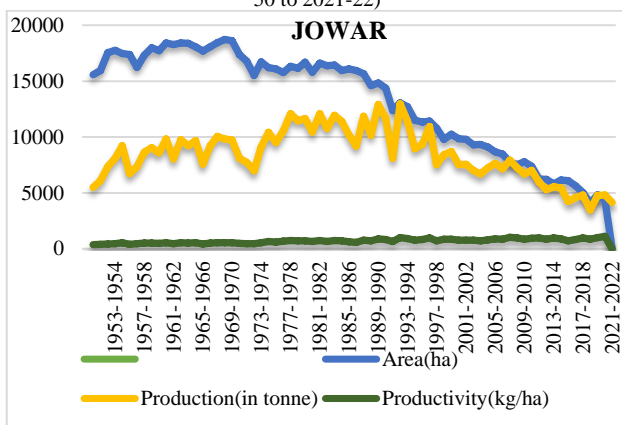
Source: Agricultural and Processed Food Products Export Development Authority

Figure 5 Trends in area, production and productivity of Bajra in India (1949-50 to 2021-22)



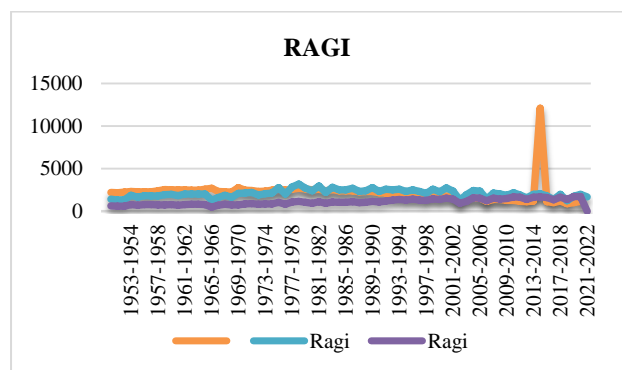
Source: Indiatat.com

Figure 6 Trends in area, production and productivity of Jowar in India (1949-50 to 2021-22)



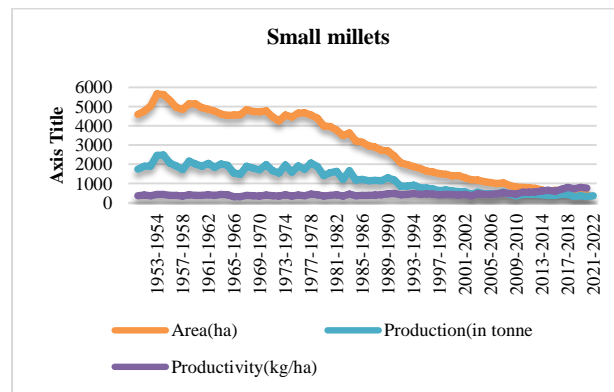
Source: Indiatat.com

Figure 7 Trends in area, production and productivity of Ragi in India (1949-50 to 2021-22)



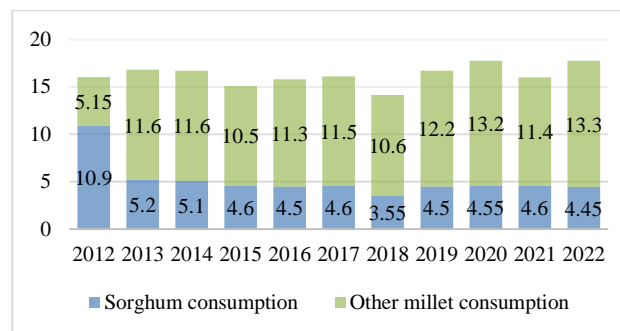
Source: Indiatat.com

Figure 8 Trends in area, production and productivity of Small millets in India



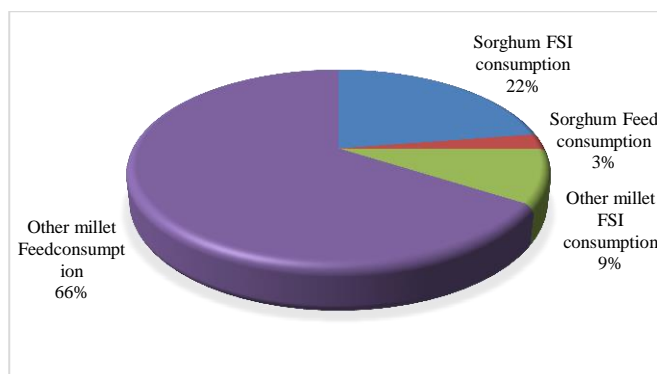
Source: Indiatat.com

Figure 9 Annual Millet Consumption in India 2012-22 (Mn MT)



Source: Agricultural and Processed Food Products Export Development Authority

Figure 10 End use of Millets in India in 2022(Mn MT, %)



Source: Agricultural and Processed Food Products Export Development Authority

CONCLUSIONS

Globally millets production and area in 2022 were 71.70 Mn Ha and 90.65 Mn MT, respectively. CAGR result revealed that the production of millets increased at a 0.3% from 2012 to 2022, but there was decrease in the area harvested for millets during that time. Sorghum contributed around 66% (60.13 Mn MT) to the global millets production while other millets (small millets, finger millets, pearl millets etc.) contributed the remaining 34% production (30.52 Mn MT). Over the period 2010-2022, global production of sorghum grew at 0.02% CAGR from 60.18 Mn MT to 60.13 Mn MT, while area under sorghum decreased by negative 0.3% CAGR from 42.16 Mn ha to 40.44 Mn ha. With respect to other millets, global production grew at 0.4% CAGR during this period - from 32.79 Mn MT to 30.52 Mn MT while area under other millets registered a negative 0.9% CAGR declining from 36 Mn ha in 2012 to 31.28 Mn ha in 2022.

Production and productivity in India improved at 0.45% and 2% CAGR from 2012 to 22 whereas the area under millets

experienced a negative CAGR of 1.49%. For the period 1949–1950 to 2021–2022, the examination of the CAGR revealed that in Bajra and Ragi production and productivity increased while the area under cultivation decreased. In Jowar and Small millet production and area under cultivation both declined, but their productivity rose.

Reference

- Malathi, B., Appaji, C., Reddy, G. R., Dattatri, K., & Sudhakar, N. (2016). Growth pattern of millets in India. *Indian Journal of Agricultural Research*, 50(4), 382-386.
- Behera, M. K. (2017). Assessment of the state of millets farming in India. *MOJ Eco Environ Sci*, 2(1), 16-20.
- Gowri, M. U., & Prabhu, R. (2017). Millet production and its scope for revival in India with special reference to Tamil Nadu. *International Journal of Farm Sciences*, 7(2), 88-93.
- Kumar, A., Tomer, V., Kaur, A., Kumar, V., & Gupta, K. (2018). Millets: a solution to agrarian and nutritional challenges. *Agriculture & food security*, 7(1), 1-15.
- Amarapurkar, S. and Banakar, B. (2019) 'Growth and instability in area, production and productivity of Major and minor millets in Karnataka', *International Research Journal of Agricultural Economics and Statistics*, 10(1), pp. 149–154. doi:10.15740/has/irjaes/10.1/149-154.
- B. Dayakar Rao, Raj Bhandari, and Tonapi, VA, K. (2021). "White Paper on Millets – A Policy Note on Mainstreaming Millets for Nutrition Security". ICAR-Indian Institute of Millets Research (IIMR), Rajendranagar, Hyderabad-500030.
- Meena, R. P., Joshi, D., Bisht, J. K., & Kant, L. (2021). Global scenario of millets cultivation. *Millets and millet technology*, 33-50.
- Lokesh, K., Dudhagara, C. R., Mahera, A. B., & Kumar, S. (2022). Millets: The future smart food. *The Pharma Innovation Journal*, 11(4), 75-84.
- Mahto, R. K., & Patil, C. (2023). Analyzing the impact of minimum support price policy on area, production and productivity of finger millet (Ragi) in India: A comprehensive analysis of trends, CAGR and associations. *Res. Jr. Agril. Sci*, 14(3), 668-671.
- FAOSTAT - <https://www.fao.org/faostat/en/#home>
- INDIASTAT - <https://www.indiastat.com/>
- USDA indexmundi - <https://www.usda.gov/Agricultural-Statistics-at-a-Glance-2022>

How to cite this article:

Thanu Vaishubharathi E *et al* (2023) 'Status of Nutricereals -An Overview of Global and Indian Scenario', *International Journal of Current Advanced Research*, 12(07), pp. 2271-2276. DOI: <http://dx.doi.org/10.24327/ijcar.2023.2276.1494>
