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Status of mushroom production in the world and India

***R. Ramalakshmi and **C. Namesh**

*Department of Economics, **Department of Computer Science
S.T. Hindu College, Nagercoil
Affiliated to Manonmaniam Sundaranar University, Abishekapatti,
Tirunelveli – 627012 (India)

Abstract

The last 20 years have seen a very rapid increase in the global mushroom sector due to the introduction of newer types of mushrooms for commercial growing. Even Nevertheless Indian consumers do not regularly consider mushrooms to be vegetables. Because the state's per capita land holding is falling, mushroom cultivation is a beneficial option for the cultivators. This research examines the global trend and expansion of mushroom cultivation, particularly in India. The global mushroom production during the last two decades has grown at an average yearly growth rate (Mean) of 26.9393 million tonnes. At 25.0269 million tonnes, Asia has the highest average growth rate, followed by Europe at 1.34409 million tonnes. Oddly, despite significant changes in China over the past 20 years, the average growth rate of fresh mushroom production has remained consistent at 24.3195 million tonnes compared to 0.0689 million tonnes. It shows that mushroom output has been rising globally at a compound growth rate of 7.34% and in India at an 8.51 percent rate, respectively. The trend coefficients show a positive and significant trend in mushroom output globally and in India at the five percent significance level. The trend coefficient for global mushroom production is 0.068, whereas the trend coefficient for Indian mushroom output is 0.063. There are several strategies to grow the mushroom industry in India, such as improving farmers' technical support, making funding more accessible, expanding the availability of high-quality spawn, creating a marketing structure, promoting mushrooms in new regions, setting up storage facilities, and building institutional capacity. To increase mushroom production and public awareness campaigns, the government should start more extension efforts.

Key words : Production, mushroom, agriculture sector, human consumption, economic significance.

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*,**Assistant Professors

Indian agriculture has evolved significantly from its current perception as being non-commercial and using traditional farming techniques[2]. Despite its favourable agro climate, an abundance of agricultural wastes, relatively cheap labour, and diversity of fungal species, India's expansion has been met with a lacklustre greeting. The main reason mushrooms are important economically is because they are used as food for humans[4]. Recent shifts in consumer behaviour have increased demand for specialised, high-quality goods, pushing the agriculture industry to develop commercially, technically, and financially feasible agribusiness solutions[10].

Opportunities for business and investment in this industry have suddenly increased dramatically[15]. Due to their nutritional and therapeutic qualities, mushrooms are becoming more and more popular among consumers in this diet-conscious age. In recent years, there has been a noticeable increase in the demand for mushrooms[3]. Because they are so easily digested, mushrooms are being explored as a possible replacement for muscle protein[13]. Mushrooms are a great source of protein and vitamin D, which is not found in other dietary supplements[14].

The country's native tropical mushroom is called milky mushroom (Calocybe indica)[10]. However, market gluts in December and January are causing difficulties in the button mushroom harvest sales for seasonal growers[12]. Paddy straw mushroom production has grown in popularity in the states of Odisha and Chhattisgarh, accounting for 7% of all mushroom production[1]. The ICAR-DMR, Solan established a standard for the short-term indoor shiitake cultivation technology[16].

For developing countries that mostly rely on grains to meet their protein needs, the Food and Agriculture Organisation (FAO) has recommended mushrooms as a high-protein food[11]. Eating mushrooms is important because of their nutritional value and medicinal effects. Mushrooms contain essential amino acids and high-quality proteins that are easily digested[7]. Mushrooms are an excellent meal choice for those with diabetes because they are low in starch. Those with high blood pressure and obesity can also benefit from them because they are low in fat and cholesterol[4]. Because mushrooms have low land needs, good yields, therapeutic value, and both, they should be encouraged and embraced in India to fight poverty and improve nutritional security[5]. Mushrooms can be used for four general purposes: edible, toxic, medicinal, and other[9]. Because mushrooms are a short-duration crop with many economic and health benefits, they can help small and marginal farmers support their livelihoods both nutritionally and economically[17]. Additionally, multipurpose mushrooms have been reported in previous studies[6]. Due to ineffective marketing strategies, most farmers are unable to profit from their mushroom-producing endeavours[18]. This study aims to analyse and describe the global and Indian mushroom industry's production, import, and export patterns.

Objectives of the study :

The following goals are the focus of the study:

1. To research the production of mushrooms on each continent between 2000 and 2021.
2. To ascertain the global fresh mushroom production trend between 2000 and 2021.

3. To examine the patterns in India's mushroom production, imports, and exports between 2000 and 2021.

The research is predicated on secondary data. Secondary data is gathered from different government reports, research reports, books, journals, libraries, magazines, newspapers, websites, and other organisations. Compound growth rate, mean, standard deviation, trend analysis, and percentage analysis were the instruments employed in the study.

Global continent-wise mushroom production:

It's possible that China and other Asian nations initially cultivated mushrooms like lentinula, flammulina, and auricularia between 600 and 800 AD[6]. Currently, the world's total mushroom production is accounted for by 22, 19, 18, and 15% in the cases of shiitake, oyster, wood ear, and button mushrooms[19]. Table-1 shows the global production of mushrooms by continent from 2000 to 2021.

Table-1. Global continent-wise mushroom production (in million tonnes)

Year	World	Africa	America	Asia	Europe	Oceania
2000	8.781	0.011	0.464	7.196	1.066	0.045
2001	10.022	0.011	0.463	8.384	1.116	0.048
2002	10.980	0.011	0.452	9.342	1.123	0.052
2003	12.650	0.012	0.476	10.984	1.130	0.048
2004	13.849	0.013	0.472	12.174	1.135	0.055
2005	15.573	0.013	0.467	13.942	1.094	0.057
2006	16.943	0.013	0.472	15.335	1.071	0.052
2007	19.056	0.015	0.443	17.467	1.080	0.051
2008	20.887	0.016	0.485	18.960	1.372	0.055
2009	23.176	0.016	0.486	20.900	1.723	0.050
2010	24.977	0.017	0.474	22.761	1.678	0.047
2011	28.934	0.018	0.513	26.467	1.881	0.054
2012	31.780	0.020	0.528	29.016	2.166	0.050
2013	34.284	0.022	0.528	32.428	1.253	0.052
2014	35.368	0.025	0.554	33.458	1.271	0.061
2015	37.480	0.026	0.536	35.511	1.364	0.044
2016	38.661	0.025	0.547	36.730	1.307	0.052
2017	39.811	0.026	0.544	37.875	1.319	0.048
2018	40.583	0.028	0.542	38.726	1.235	0.053
2019	41.739	0.032	0.516	39.863	1.279	0.050
2020	42.923	0.034	0.503	40.929	1.406	0.051
2021	44.207	0.037	0.482	42.143	1.501	0.044
Total	592.664	0.441	10.947	550.591	29.57	1.119
Mean (μ)	26.9393	0.02005	0.49759	25.0269	1.34409	0.05086
S.D (σ)	12.1841	0.008	0.03441	12.043	0.28908	0.00417

Source: FAO, 2023

Over the past 20 years, the global output of mushrooms has increased at a rate of 592.664 million tonnes annually, as shown in Table-1. With 550.591 million tonnes, the Asian continent produces the most mushrooms, followed by the European continent with 29.57 million tonnes. Since 2000, the world's mushroom output has expanded more than five times, and as of 2023, it stands at 44 million tonnes (FAOSTAT, 2023). The Asian continent is the primary producer, accounting for 95% of the total, followed by the European (3%), American (1%), and other continents. Over the previous 20 years, global mushroom production has grown at an average yearly pace of 26.9393 million tonnes (Mean). With 25.0269 million tonnes, the average growth rate is highest on the Asian continent, followed by 1.34409 million tonnes in Europe.

Table-2. Production trend of fresh mushrooms in the world (million tonnes)

Year	China	Japan	Poland	USA	Nether lands	India	Spain	Canada	Russia	France
2000	6.644	0.424	0.109	0.384	0.265	0.024	0.063	0.080	0.006	0.204
2001	7.828	0.427	0.110	0.377	0.275	0.030	0.110	0.086	0.006	0.196
2002	8.774	0.430	0.120	0.377	0.270	0.040	0.135	0.075	0.007	0.175
2003	10.396	0.434	0.135	0.388	0.263	0.040	0.129	0.088	0.006	0.170
2004	11.610	0.406	0.150	0.388	0.260	0.040	0.139	0.085	0.006	0.165
2005	13.360	0.420	0.160	0.387	0.245	0.040	0.138	0.080	0.005	0.139
2006	14.749	0.430	0.169	0.383	0.235	0.035	0.135	0.089	0.006	0.116
2007	16.829	0.440	0.180	0.360	0.240	0.037	0.132	0.083	0.006	0.132
2008	18.278	0.450	0.185	0.369	0.255	0.037	0.134	0.116	0.006	0.139
2009	20.214	0.460	0.207	0.372	0.230	0.037	0.131	0.114	0.006	0.114
2010	22.020	0.470	0.230	0.359	0.266	0.041	0.133	0.115	0.005	0.119
2011	25.726	0.470	0.220	0.391	0.304	0.041	0.146	0.122	0.004	0.116
2012	28.289	0.460	0.230	0.403	0.307	0.030	0.147	0.125	0.005	0.117
2013	31.705	0.460	0.249	0.408	0.323	0.017	0.150	0.120	0.008	0.104
2014	32.708	0.460	0.263	0.432	0.310	0.028	0.150	0.122	0.008	0.109
2015	34.772	0.450	0.269	0.421	0.310	0.051	0.219	0.115	0.009	0.101
2016	35.979	0.460	0.280	0.428	0.300	0.076	0.148	0.119	0.010	0.100
2017	37.130	0.459	0.291	0.423	0.300	0.102	0.159	0.120	0.016	0.086
2018	37.901	0.467	0.200	0.416	0.300	0.134	0.166	0.126	0.031	0.083
2019	38.981	0.470	0.235	0.384	0.270	0.182	0.170	0.132	0.048	0.088
2020	40.008	0.471	0.320	0.370	0.260	0.211	0.166	0.133	0.086	0.080
2021	41.127	0.469	0.379	0.344	0.260	0.243	0.164	0.138	0.111	0.099
Total	**535.028**	**9.887**	**4.691**	**8.564**	**6.048**	**1.516**	**3.164**	**2.383**	**0.401**	**2.752**
Mean (μ)	24.3195	0.4494	0.2132	0.3893	0.2749	0.0689	0.1438	0.1083	0.0182	0.1251
S.D (σ)	11.9282	0.0195	0.0706	0.0239	0.0273	0.0646	0.0282	0.0204	0.0282	0.0362

Source: FAOSTAT, 2023

World fresh mushroom production :

Over the last 50 years, from 1965 to 2015, the number of mushrooms produced worldwide has progressively climbed from 0.30 million tonnes to 3.41 million tonnes and more[19]. Table-2 shows the global production trend of the top ten nations for fresh mushrooms from 2000 to 2021.

In terms of output by nation, as indicated in Table-2, the top three nations now produce the most fresh mushrooms: China (535.028 million tonnes), Japan (9.887 million tonnes), and Poland (USA 8.564 million tonnes). India is ranked sixth, with a production of 0.24 million tonnes in 2000 and 1.516 million tonnes in 2023 (FAO, 2023). However, according to changes to its domestic figures, it has reached 0.31 million tonnes.

Interestingly, despite significant developments in China, the average fresh mushroom production over the previous 20 years has been comparable between China (24.3195 million tonnes) and India (0.0689

Table-3. Mushroom production, export and import in India

Year	Production in Tonnes	Export Quantity in Tonnes	Export Value in 1000 USD	Import Quantity in Tonnes	Import Value in 1000 USD
2000	24000	7599	8728	0	9
2001	30000	11798	11369	0	3
2002	40000	14335	10661	0	0
2003	40000	6581	5306	17	35
2004	40000	4128	3101	5	40
2005	40000	2325	1850	20	130
2006	35000	1651	1633	9	59
2007	37000	381	459	9	53
2008	37000	172	166	2	5
2009	37000	497	415	9	26
2010	40600	763	1239	16	42
2011	40600	385	469	37	27
2012	30000	260	432	59	41
2013	17000	2313	4340	2	4
2014	28000	1580.76	2084	0.16	1
2015	51000	1099.52	1289	0	0
2016	76000	524.15	821	0.1	1
2017	102020.79	400.42	764	0	0
2018	134000	388.52	754	0.15	0
2019	182000	1445.78	866	0	0
2020	211000	568.05	837	13.96	22
2021	243000	1070.26	1204	24.18	91

Source: FAOSTAT, 2023

million tonnes), indicating an optimistic rise of the Indian mushroom sector relative to the world leader. India's mushroom industry is expanding at a promising rate in comparison to the global leader. It's interesting to note that, over the previous 20 years, fresh mushroom output has grown at a comparable average rate (24.3195 million tonnes and 0.0689 million tonnes, respectively) despite notable advancements in China.

Export and import of Mushroom production in India :

The total amount of canned and frozen white button mushrooms exported from India in 2016–2017 was 1054 quintals, bringing in Rs. 7282.26 lakhs[8]. An analysis of India's mushroom production, export, and import trends from 2000 to 2021 is presented, along with a discussion of Table-3.

The mushroom production scenario in India over time is depicted in the table, which shows a dynamic tendency. From 17 million tonnes in 2013 to a record 243 million tonnes in 2021, the production of mushrooms has fluctuated. India's mushroom exports fell over the last 20 years, from 2000 to 2021, from 7599 million tonnes to 1070.26 million tonnes. On the other hand, during the last 20 years, from 2000 to 2021, the value of Indian imports of mushrooms has progressively climbed from 9000 USD to 91 USD.

The trend in mushroom production in the globe and India :

Employs a trend line to evaluate the global and Indian mushroom output trends. The results of the analysis, which show the trend and growth of mushroom output globally and in India between 2000 and 2021, are presented in Table-4.

According to Table-4, global and Indian mushroom production has been rising at compound growth rates of 7.34 percent and 8.51% percent, respectively. The trend coefficients, which show a positive trend in mushroom output globally and in India, are significant and positive at the five percent level. The global trend coefficient for mushroom production is 0.068, whereas the Indian trend coefficient is 0.063.

Table-4. Trend and growth of mushroom production in the globe and India

Particulars	Trend Coefficients		R^2	CGR (percentage)
	a	b		
Mushroom production in the globe	6.44	0.068* (17.24)	0.45	7.34
Mushroom production in India	6.17	0.063* (19.31)	0.59	8.51

* Significant at 5 per cent level.

Note: CGR = Compound Growth Rate

Figures in parentheses indicate t-values.

Due to its diversified climate, India cultivates all edible and medicinal mushrooms, even though it is not a big producer of any particular variety. India possesses a sufficient number of both skilled and unskilled labourers required to manage the mushroom cultivation operations.

The practice of growing mushrooms is based on recycling agricultural leftovers, which are widely available across the nation. The second biggest cause of the current global warming is emissions of black carbon from burning biomass. India's rice and wheat farming regions are currently confronting a difficult issue in managing the growing amount of crop waste. In addition to being an important part of managing these agricultural wastes, mushroom farming is an efficient way to use these leftovers to produce food that is high in protein.

Better market prices for Indian mushroom producers would arise from the disparity between supply and demand in the global mushroom trade as well as the decline in production in Western nations due to high labour expenses. India is a significant market for mushrooms due to its population of over 1.2 billion people. In order to meet domestic consumer demands, there is more room for the sale of perishable items thanks to the development of quick infrastructural facilities and an efficient distribution network.

Success in the domestic and international markets depends on producing premium fresh mushrooms and value-added goods fortified with mushrooms at competitive costs and without the use of agricultural pesticides. A commercial effort should be made to prepare organic manure, vermicompost, briquettes, and other products using the leftover mushroom substrate from growing. Another factor supporting India's potential as a mushroom powerhouse is its advantageous position, which facilitates the export of mushrooms to the Middle East, Southeast Asia, and Europe.

Conflicts of Interest

There isn't any conflict of interest for the authors.

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