A STUDY ON MUSHROOM PRODUCTION IN INDIA AND ODISHA VIS A VIS GLOBAL LEVEL

Abstract:

In the 21st century, mushroom is seen as the favoured alternate source of food that would help compensate scarcity of nutritious food as mushroom is grown indoors using vertical space and more specifically address the issues of environment sustainability due to recycling of farm wastes. Mushrooms which were earlier found in the forest and forest areas have now been the most prolific and versatile agricultural and horticultural venture. The current study has been undertaken to study the comparative trends in mushroom growth in Odisha, India and world. China is the leading mushroom producer in the world with a lion share of ninety three per cent while India ranks at sixth position with a contribution of slightly more than half a per cent. Odisha, Bihar, Maharastra contribute nearly one third mushroom production in India. In Odisha four districts i.e., Puri, Ganjam, Khurda, Dhenkanal contribute sixty per cent of total mushroom production in the state. The study indicated that the (Compounded Annual Growth Rate) CAGR of world, India and Odisha in mushroom production from 2013-2022 is three, thirty six and sixteen per cent respectively Rajasthan is witnessing a new dawn in mushroom production as it contributed only one per cent with 1300 tons in 2018, is now contributing five per cent with 15000 tons in 2022 with a CAGR of sixty six per cent. Even if with the favourable climatic condition, production of mushroom in the north eastern states of India is negligible. The button mushroom which is the highest contributor in India with seventy three percent contributes only eleven per cent in the world level and one per cent in Odisha. Similarly paddy straw mushroom that contributes almost sixty six per cent in Odisha has a meagre contribution of only one per cent in the global level and seven per cent in India. Oyster mushroom has a uniform share of twenty six per cent in the world, sixteen per cent in India and thirty three per cent in Odisha. It may be estimated that if the current growth rate continues then in the next five years by 2027 the world mushroom production will be around fifty million tons, while the mushroom production in India and Odisha would stand at around six lakhs tons and sixty five thousand tons respectively.

Key words: Environment, Sustainability, Recycling, Mushroom, Agriculture, Horticulture

Introduction:

The struggle for achieving food and nutritional security is still continuing in 21st century owing to increasing population, depleting agricultural land, water scarcity, change in climate, so on and so forth. In this perspective, mushroom is seen as the favoured alternate source of food that would help compensate scarcity of nutritious food as mushroom is grown indoors using vertical space and more specifically address the issues of environment sustainability due to recycling of farm wastes. So mushrooms which were earlier found in the forest and forest areas have now been the most prolific and versatile agricultural and horticultural venture. Mushrooms, the fleshy fungi, are now popular all over the world for its nutritional, medicinal, economical and many other factors. Although the production of mushroom in Asian countries made its marks some thousand years back, but the mushroom cultivation is relatively a new phenomenon in India. Mushrooms like Auricularia, Lentinula, and Flammulina were first cultivated most likely during 600-800 AD in China and other Asian countries (Chang and Waser, 2017). But with the preparation of mushroom cultures from spores, mushroom cultivation was started on scientific lines during 20th century. In those days, button mushroom production was prioritised and mushroom was synonymous to button mushroom. But this situation took a turn during the later part of 20th century and early part of 21st century as there was a sharp decline in the percentage of button mushroom to the total mushroom production in the global level owing to unimaginable growth in production of shiitake mushroom, oyster mushroom, wood ear mushroom and Flammulina mushroom. In contrast to it, Indian mushroom industry is focused on white button mushroom. The state Odisha which has remained as the top mushroom producing state of India is known for the production of paddy straw mushroom. With the setting up of Centre of Tropical Mushroom Research and Training in OUAT, Bhubaneswar in 1921-92 commercial mushroom cultivation in Odisha took its origin that was further strengthened in 2009-10 when All India Coordinated Research Project on Mushroom was established in OUAT Bhubaneswar. Although the mushroom production data is available in different literatures, hardly found any literature that comprehensively presents the growth rate of mushroom production, contributing percentage along with the varietal and production comparisons in the regional, national and international level. With this backdrop the current study has been undertaken to have a clear and lucid image of status of mushroom production at all levels i.e., regional, national and international level in an exhaustive manner.

Materials and Methods:

The study is designed based on the data from the secondary sources like FAOSTAT, publications from Department of Agriculture and Farmers Welfare, Govt. of India and AICRP on mushroom, OUAT, Bhubaneswar and other relevant published and unpublished sources. Indian mushroom production data was available in the FAOSTAT from 1961. For the purpose of analysis we have taken the official data from 2003 to 2021 and production data of 2022 was the third advance estimate data. The time series data from 2013 to 2022 was divided into two periods of five years each viz. period I (2013-2017), period II(2018-2022). The CAGR during these two periods and overall period were calculated and compared. Besides, the annual growth rate was also calculated for the last ten years. Based on the availability of the regional time series data of mushroom production in India from 2018-2022, the CAGR over these five years for each state was calculated and comparison was done among them.

The exponential compound annual growth rates are estimated by using log linear functions on the time series data on production of mushroom. The semi log exponential functional form is used to analyze the trend in growth rate, which is one of the appropriate functional forms to estimate the growth rate. That is, the growth rate is estimated by using the following semi log functional form:

$\log Y_t = a + bt$..... (1)

This equation (1) can be elaborated in details as:

$Y_t = Y_o (1+r)^t$..... (i)

Taking log on both sides, we get

$\text{Log } Y_t = \text{Log } Y_o + t \text{ Log } (1+r)$..... (ii)

Equation (ii) can be rewrite as

$Y = a + bt$..... (iii)

Where $Y = \text{Log } Y_t$; $a = \text{Log } Y_o$; $b = \text{Log } (1+r)$,

In equation (iii)

Y_t= mushroom production

a= constant

t= Time variable in year (1, 2,...n)

b= Regression Coefficient that shows the rate of change or growth rates in a series

The annual compound growth rate (s) can be worked out by using:

Antilog (b) =Antilog (log (1+r)).

Antilog (b) =1+r

and

r = Antilog b-1

When multiplied by 100, it gives the percentage growth rate in production of mushroom. That is, **Compound Annual Growth Rate (CAGR) (%) = r = (Antilogb-1) x100.**

Results and discussion:

Table 1 represents the major mushroom producing countries in the global level. China is the leading mushroom producer in the world with a lion share of ninety three per cent. Next to it, Japan is the only country whose per cent contribution is more than one per cent and all other countries with less than one per cent. In this list India ranks at sixth position with a contribution of slightly more than half a per cent. Similarly figure 1 represents the major mushroom growing states in India. Odisha stands at the top level with a share of eleven per cent while, Bihar and Maharashtra each contribute ten per cent. In this way, these three states contribute nearly one third mushroom production in the country. Besides, Punjab shares eight percent, and Haryana, Himanchal Pradesh and Uttar Pradesh contribute seven per cent each. In total these seven states of India shares sixty per cent total mushroom production in India. Detailed mushroom production of each state is given in table 4. In the same line, in Odisha four districts i.e., Puri, Ganjam, Khurda, Dhenkanal contribute almost sixty per cent of total mushroom production in the state which has been highlighted in fig 2. So, it can be said that there are regions of concentration within countries and states even in global level too. A deeper study also indicated that there are regions of concentration within districts. In Ganjam district it is highly localised in Chikiti, Chhatrapur and Rangeilunda blocks while in Puri districts it is highly localised in Nimapara, Pipili and Satyabadi blocks. Similar is the case with other districts like Dhenkanal i.e., Odapada and Dhenkanal sadar blocks and Khurda i.e., Balainta, Balipatna and Khurda blocks.

Table 1: Leading mushroom and tuffle producing countries worldwide, 2021

SL. NO.	COUNTRY	PRODUCTION (000 MT)
1	CHINA, MAINLAND	41117.74 (93.01%)
2	JAPAN	469.05 (1.06%)
3	POLAND	378.8 (0.86%)
4	UNITED STATES	343.82 (0.78%)
5	NETHERLAND	260(0.59%)
6	INDIA	243(0.55%)
7	SPAIN	163.8(0.37%)
8	CANADA	137.8(0.31%)
9	RUSSIAN FEDERATION	110.98(0.25%)
10	FRANCE	99.11(0.22%)

Figures in the parentheses indicate the relative per cent contribution to the total production

Fig. 1: States' share in India's total mushroom production

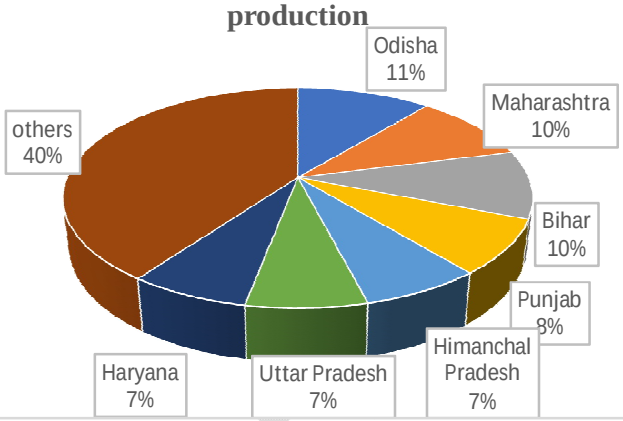


Fig. 2: Districts' share in Odisha's total mushroom production

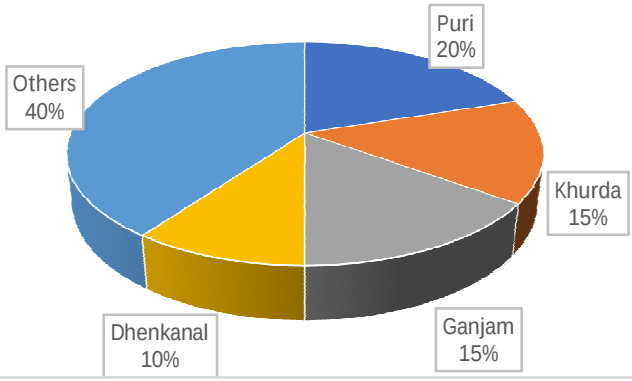


Table 2 highlights the quantum of mushroom production in the world, India and Odisha over a period of ten years. The growth rate of mushroom in the global level is remaining almost constant. In India in 2015, mushroom production increased in an increasing rate and in the subsequent years a decreased annual growth rate is seen. For the last three

years, the annual growth rate is almost constant. From 2013 to 2022, sixteen fold increase in mushroom production is seen, but as compared with 2018, the production has just doubled in 2022. In the perspective of Odisha, the annual growth rate is uneven over the years. Although in 2018 there was a negative growth rate but it was one per cent only. But in these ten years there is a four time increase in the production. So it can be comprehended that the production in the developed countries has reached its plateau and though India and odisha are witnessing good progress in production with a sound growth rate, several years hence they may also experience production plateau.

Table 2: Mushroom Production and Annual Growth Rate(AGR) over the years

PRODUCTION / YEAR	WORLD (Tons)	AGR	INDIA (Tons)	AGR	ODISHA (Tons)	AGR
2013	34283973	-	17000	-	7990	-
2014	35368308	3%	28000	65%	8440	6%
2015	37479711	6%	51000	82%	9710	15%
2016	38660680	3%	76000	49%	10890	12%
2017	39811126	3%	102021	34%	16110	48%
2018	40583205	2%	134000	31%	15990	-1%
2019	41739260	3%	182000	36%	19530	22%
2020	42923396	3%	211000	16%	21530	10%
2021	44207117	3%	243000	15%	22500	5%
2022	45533330*	3%	285000	17%	32050	42%

*Estimated value at 3 per cent

Fig.3 Annual growth rate in mushroom production over the years

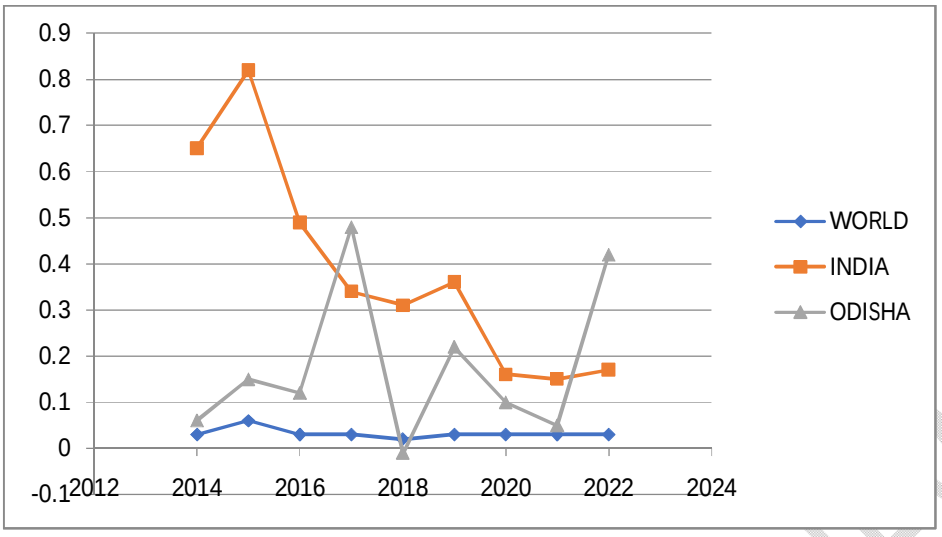


Table 3: CAGR (Compounded Annual Growth Rate) of mushroom production in World, India and Odisha for different periods

Sl. No.	Group	CAGR(%)		
		Period I (2013-2017)	Period II (2018-2022)	Pooled
1	World	4	3	3
2	India	58	20	36
3	Odisha	18	17	16

Compounded Annual Growth Rate of mushroom production in world, India and Odisha for different periods has been represented in table 3. In the first and second period at the global level the CAGR was four per cent and three per cent respectively. In the first period India had a high CAGR of fifty eight percent, which reduced to twenty per cent in second period. In Odisha there was a constant CAGR of eighteen and seventeen per cent in first and second periods. Above all the CAGR of world, India and Odisha in mushroom

production from 2013-2022 is three per cent and thirty six per cent and sixteen per cent respectively.

As per data in table 4, if we compare the per cent contribution of current major mushroom growing states of India to the total mushroom production it is seen that Himanchal Pradesh, Uttar Pradesh, Maharashtra and Odisha have almost uniform shares over the years. Bihar which contributed only two per cent to the total mushroom production in 2018 is now contributing ten per cent with a production of 29860 tons and CAGR of eighty six per cent. On the contrary, the share of the Punjab and Haryana is constantly decreasing though the CAGR is two and seven per cent. Jharkhand and Chhatisgarh are the emerging states which produced negligible quantities in 2018, are now producing 7,600 and 18,000tons respectively with CAGR of 148 and 135 per cent. Rajasthan is witnessing a new dawn in mushroom production as it contributed only one per cent with 1300 tons in 2018, is now contributing five per cent with 15000 tons in 2022 with a CAGR of sixty six per cent. Even if with the favourable climatic condition, production of mushroom in the north eastern states is negligible. It is mainly due to the marketing aspects (Phuralatpam S 2021)

Table 4 : State wise mushroom production for the last five years with the CAGR (Compounded Annual Growth Rate)

SL.NO.	STATE	2018	2019	2020	2021	2022	CAGR
1	ANDHRA PRADESH	3.52 (3%)	3.65(2%)	3.65(2%)	3(1%)	0.04(0%)	-60
2	ARUNCHAL PRADESH	0.03(0%)	0.06(0%)	0.06(0%)	0.08(0%)	0.08(0%)	25
3	ASSAM	0.13(0%)	0.22(0%)	1.2(1%)	1.4(1%)	1.62(1%)	99
4	BIHAR	2.6(2%)	5.6(3%)	20.28(10%)	21.33(9%)	29.86(10%)	86
5	CHHATTISGARH	0.34(0%)	7.6(4%)	1.05(0%)	13.9(6%)	17.9(6%)	135
6	GUJARAT	11.2(8%)	12(7%)	14(7%)	14.5(6%)	13(5%)	5
7	HARYANA	15.1(11%)	20.05(11%)	20.05(10%)	19.6(8%)	21.5(8%)	7

8	**HIMACHAL PRADESH**	9.15(7%)	14.51(8%)	15.6(7%)	14.8(6%)	18.9(7%)	16
9	**JAMMU & KASHMIR**	0.63(0%)	1.5(1%)	1.5(1%)	3.5(1%)	2.82(1%)	47
10	**JHARKHAND**	0.22(0%)	1(1%)	3(1%)	7.5(3%)	7.6(3%)	148
11	**KARNATAKA**	1.18(1%)	1.22(1%)	1.22(1%)	4.5(2%)	1.58(1%)	21
12	**KERALA**	0.8(1%)	0.91(1%)	0.91(0%)	1(0%)	0.05(0%)	-42
13	**MADHYA PRADESH**	0.02(0%)	0.5(0%)	0.5(0%)	1.5(1%)	1.8(1%)	175
14	**MAHARASHTRA**	16(12%)	18.54(10%)	19(9%)	22(9%)	29.53(10%)	15
15	**MANIPUR**	0.06(0%)	0.07(0%)	0.07(0%)	0.1(0%)	0.05(0%)	-
16	**MEGHALAYA**	0.03(0%)	0.04(0%)	0.04(0%)	0.05(0%)	0.07(0%)	21
17	**MIZORAM**	0.05(0%)	0.07(0%)	0.07(0%)	0.07(0%)	0.08(0%)	10
18	**NAGALAND**	0.33(0%)	0.41(0%)	0.41(0%)	0.5(0%)	0.13(0%)	-15
19	**ODISHA**	15.99(12%)	19.53(11%)	21.53(10%)	22.5(9%)	32.05(11%)	17
20	**PUNJAB**	18(13%)	18(10%)	18(9%)	18.5(8%)	19.75(7%)	2
21	**RAJASTHAN**	1.3(1%)	11.8(6%)	15.4(7%)	14.6(6%)	14.91(5%)	66
22	**SIKKIM**	0(0%)	0.01(0%)	0.01(0%)	0.02(0%)	0.03(0%)	-
23	**TAMIL NADU**	10(7%)	11.48(6%)	11.48(5%)	11(5%)	13.52(5%)	6
24	**TELANGANA**	-	-	-(%)	-(%)	-(%)	-

25	**TRIPURA**	0.1(0%)	0.12(0%)	0.12(0%)	0.15(0%)	0.14(0%)	9
26	**UTTAR PRADESH**	7.1(5%)	9.7(5%)	9.7(5%)	14(6%)	19.8(7%)	27
27	**UTTARAKHAND**	10.24(8%)	12.4(7%)	14.2(7%)	16.02(7%)	17.4(6%)	14
28	**WEST BENGAL**	2.05(2%)	3(2%)	7.5(4%)	7(3%)	9.5(3%)	48
29	**OTHERS**	7.59(6%)	8.02(4%)	10.37(5%)	9.75(4%)	11.36(4%)	11
	TOTAL	**133.7**(100%)	**182**(100%)	**210.9**(%)	**242.87**(100%)	**285.07**(100%)	**20**

Figures in the parentheses indicate per cent contribution to the total production

Fig. 4 Relative contribution of different varities of mushroom to total production in World

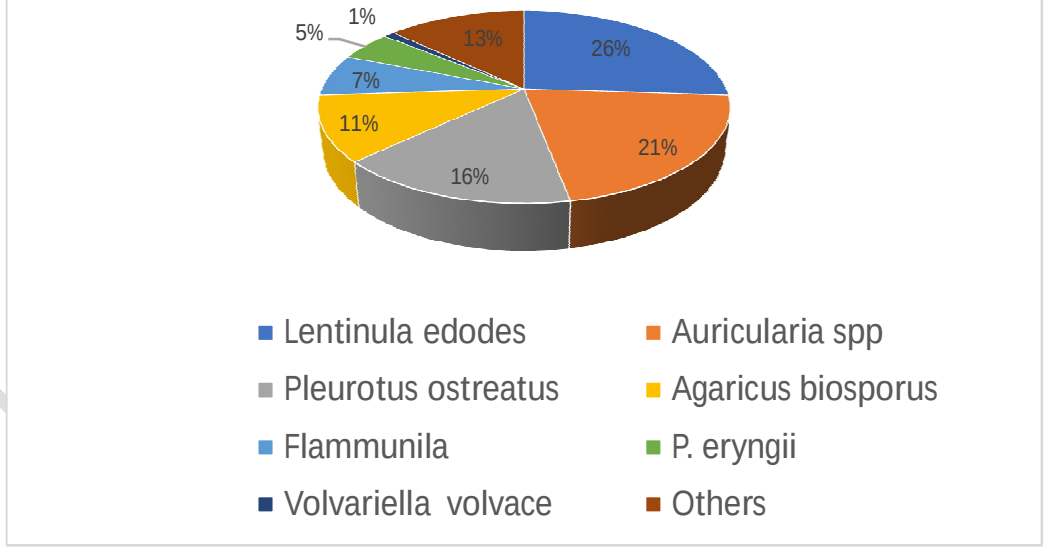
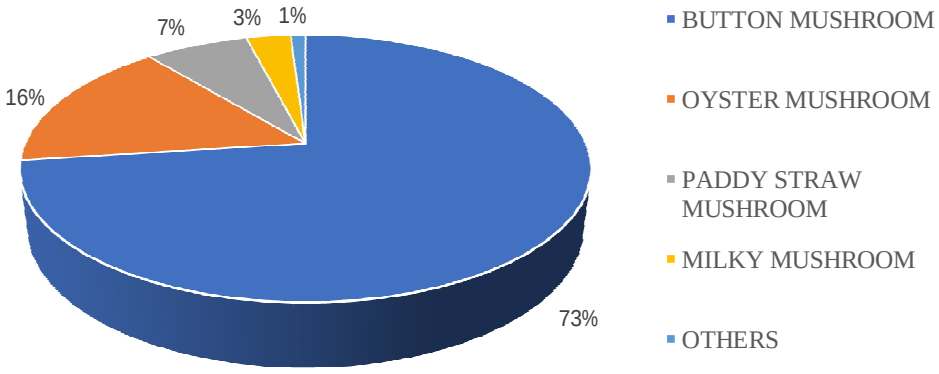


Fig. 5: Relative contribution of different varities of mushroom to total production in India



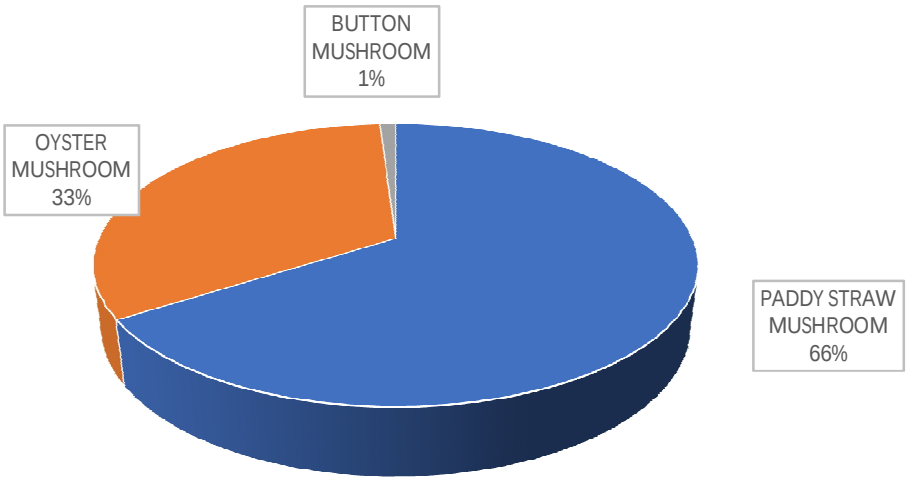


Fig. 6: Relative contribution of different varities of mushroom to total production in Odisha

The relative contribution of different varieties of mushroom in the world, India and odisha has been presented in the figures 4, 5 and 6. It points out that the share of *Lentinula edodes* is highest at twenty six per cent at the global level followed by Auricularia species at

twenty one per cent and *Pleurotus ostreatus* at sixteen per cent. The button mushroom (*Agaricus biosporus*) which is the highest contributor in India with seventy three percent contributes only eleven per cent in the world level and one per cent in Odisha. Similarly, paddy straw mushroom (*Volvariella volvace*) that contributes almost sixty six per cent in Odisha has a meagre contribution of only one per cent in the global level and seven per cent in India. Oyster mushroom (*Pleurotus sp*.) has a uniform share of twenty six per cent in the world, sixteen per cent in India and thirty three per cent in Odisha. The cropping time of milky mushroom is march to October that coincides with the timing of paddy straw mushroom. So cutivators prefer to go for 100 per cent in paddy straw mushroom cultivation during this period with no miky mushroom cultivation.

Conclusion

It may be estimated that if the current growth rate continues then in the next five years by 2027 the world mushroom production will be around fifty million tons, while the mushroom production in India and Odisha would stand at around six lakhs tons and sixty five thousand tons respectively. The diverse climatic condition greatly favours India for production of varied mushrooms. With the availability of huge agricultural residues and by employing the technical knowhow, mushroom production can be enhanced and this increase in production will help fresh quality mushroom and its value added products reaching in each corner of the globe.

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