Technologies for Mushroom Production

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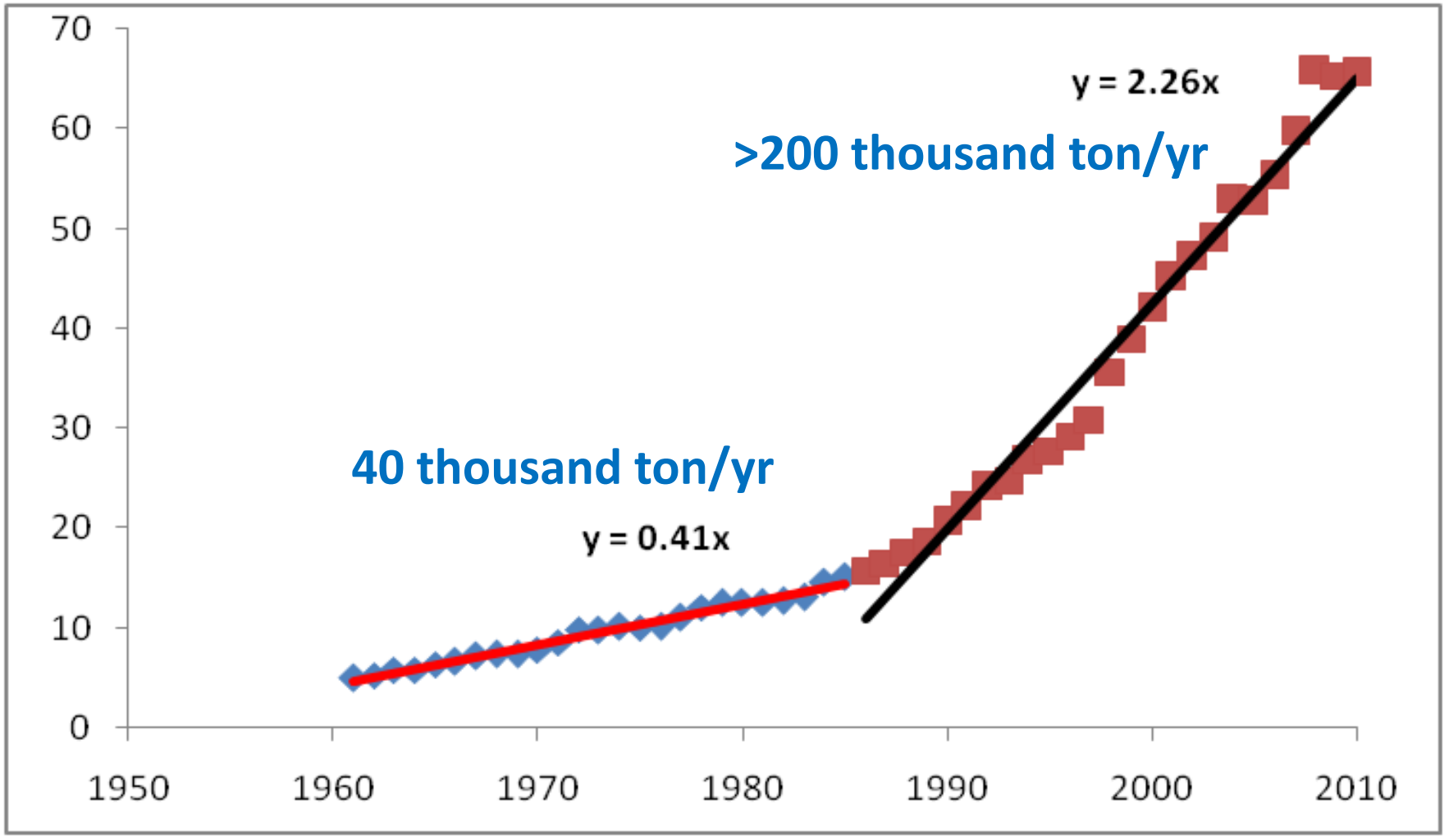
World Mushroom Production (FAO Stat)

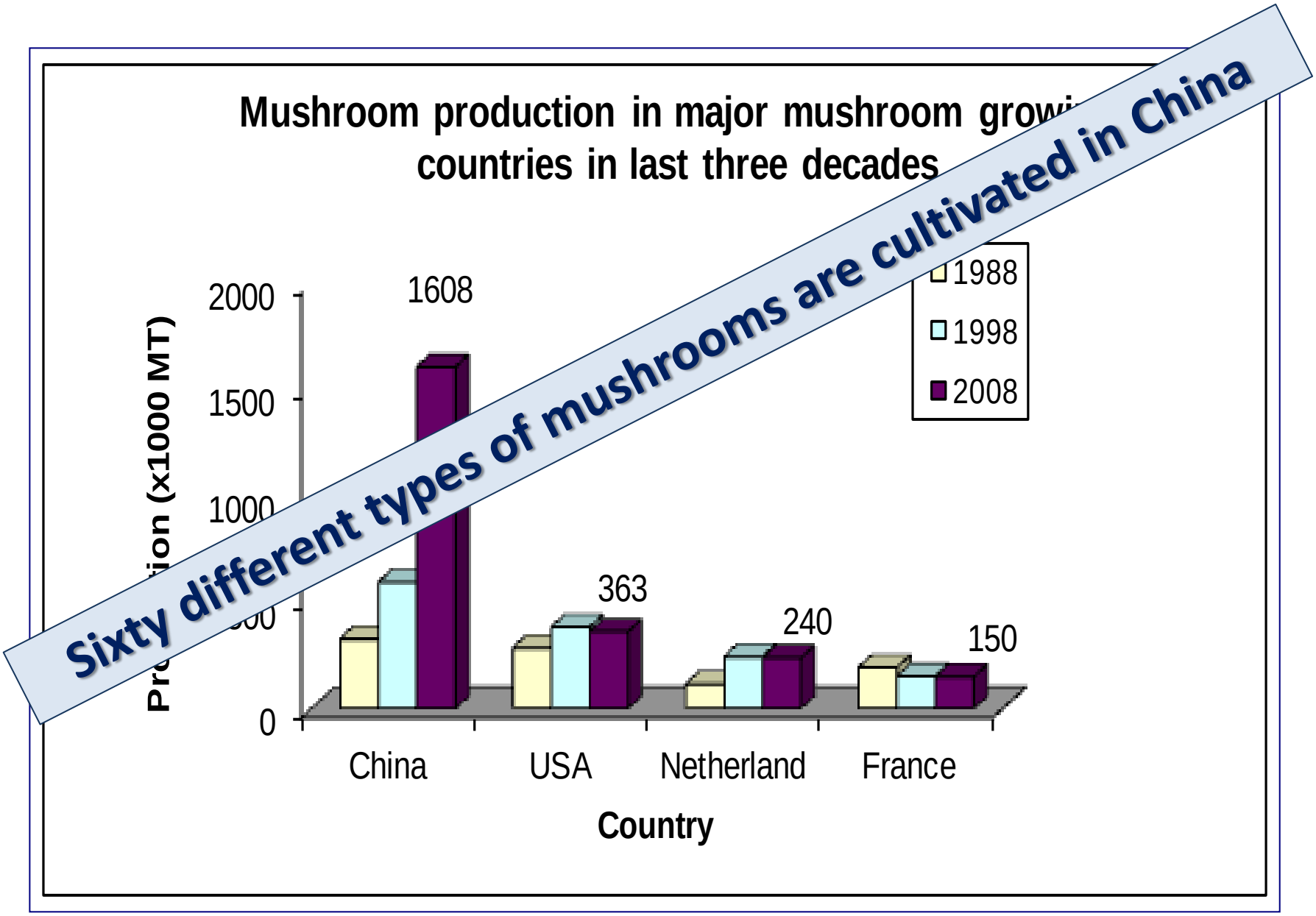
(in lakh tons)

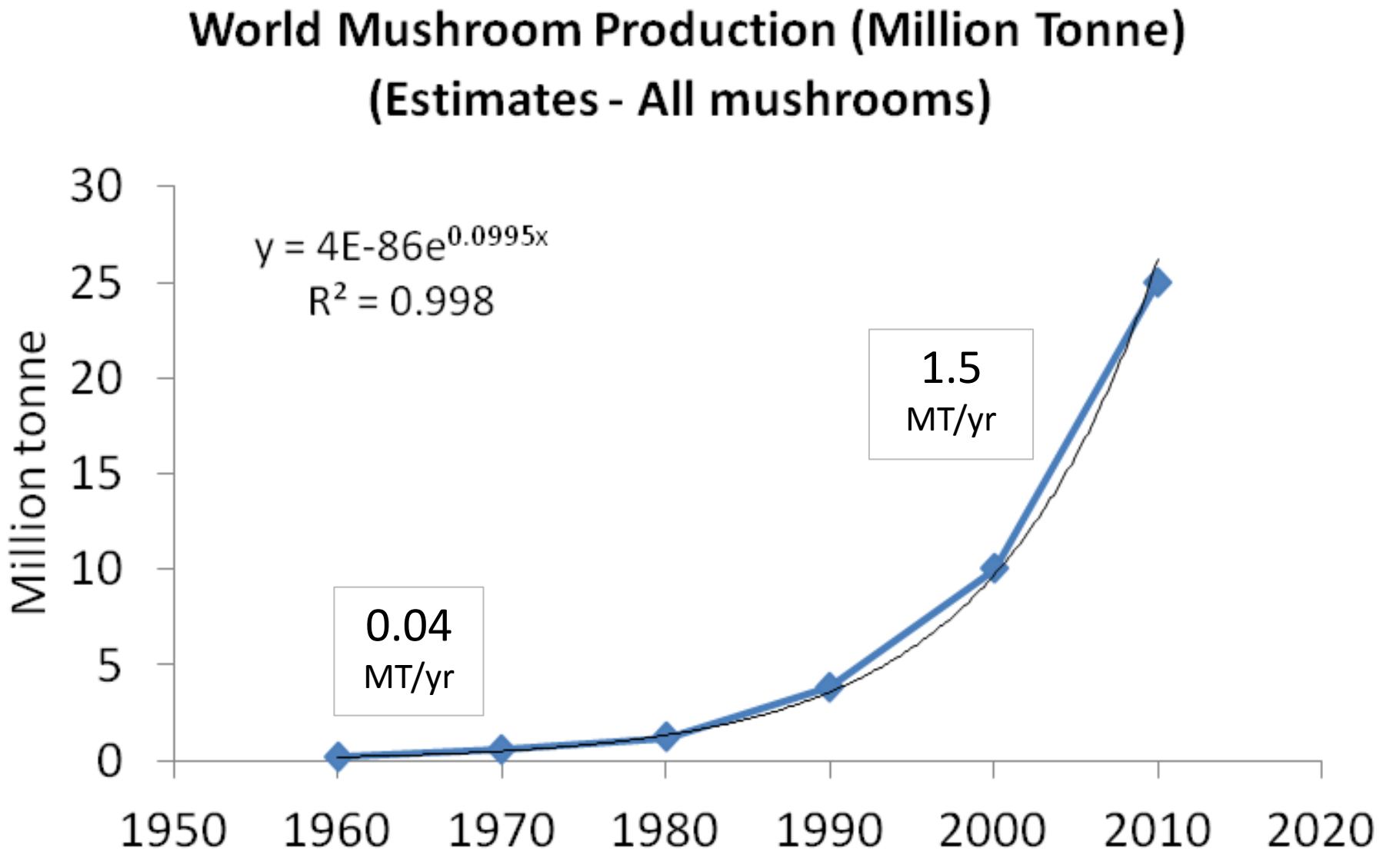


Mushroom Production – China & World

Year	World ,000 ton	China ,000 ton	%
1978	1,060	60	5.7
1983	1453	175	12.0
1990	3,763	1,083	28.8
1994	4904	2640	53.8
1997	6,158	3,918	63.6
2002	12,250	8,650	70.6
2006	?	14,400	?
2008	?	18,200	?
2010	?	? 21,500	80?

Chinese Association of Edible Fungi, Chang 2006, ISMS 2012


Mushroom production in major mushroom growi
countries in last three decades
1988
1998
2008
2000
1500
1000
0
1608
363
240
150
China
USA
Netherland
France
Country
Sixty different types of mushrooms are cultivated in China


World Mushroom Production (Million Tonne)
(Estimates - All mushrooms)
Million tonne
30
25
20
15
10
5
0
y = 4E-86e^0.0995x
R² = 0.998
0.04
MT/yr
1.5
MT/yr
1950
1960
1970
1980
1990
2000
2010
2020

	Button (%)	Shiitake (%)	Oyster (%)	Others (%)
US	98	1	0.5	0.5
Spain	80	15	5	0
China	13	21	24	42
Korea	12	25	37	26
Taiwan	4	33	4	59
Japan	0	11	2	87
World	31	24	14	31

Mushrooms under cultivation in India

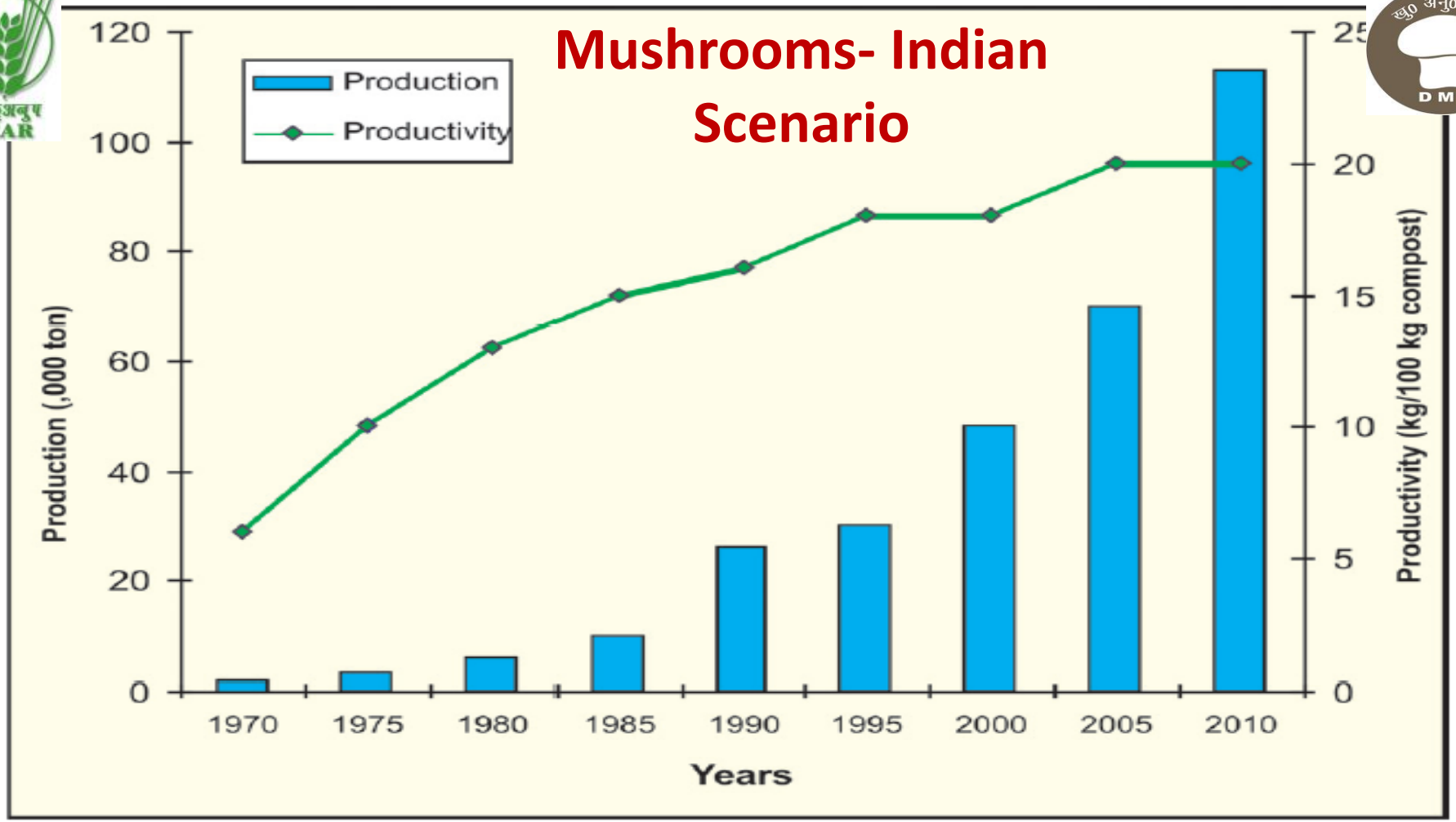

Button Mushroom


Milky Mushroom


Oyster Mushroom


Paddy Straw Mushroom

Mushrooms- Indian Scenario



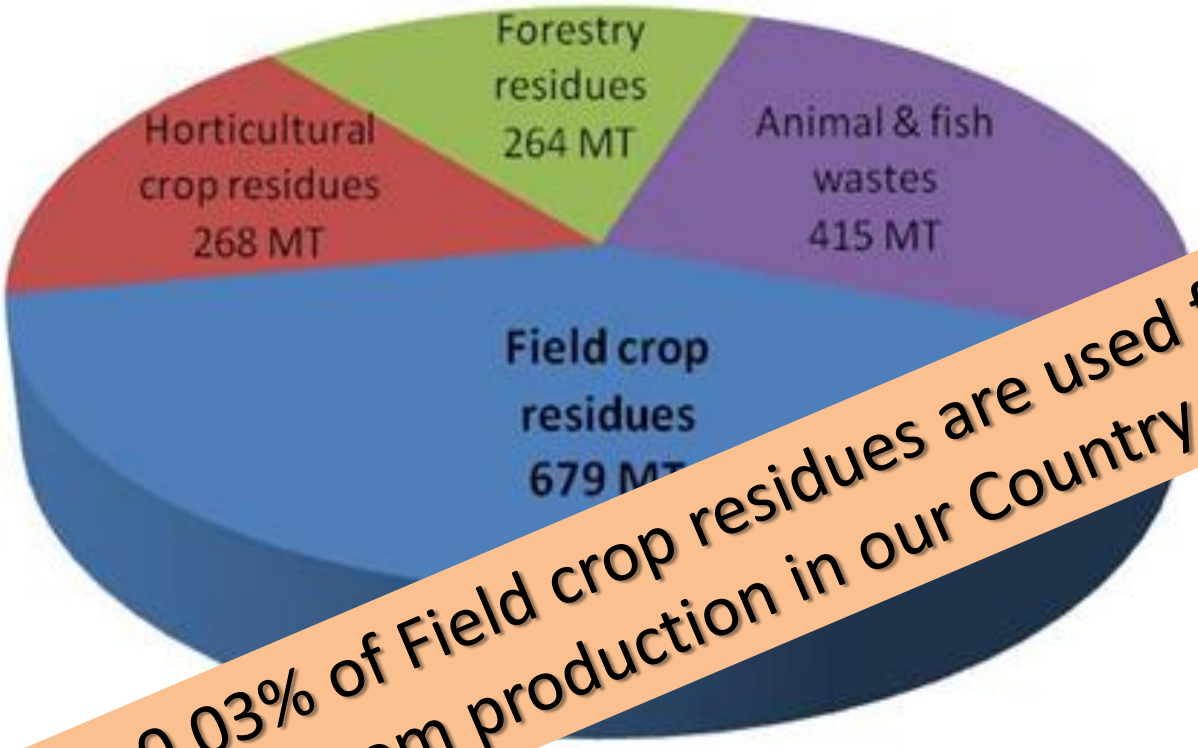
Button	Oyster	Milky	Paddy Straw, etc	Total Production
1,00,700	6,400	900	10,300	1,18,300

Agricultural Residues

(million tonnes)

	MT
Crop residues from field crops	679
Crop residues from horticultural crops	268
Total Agri-residues	**947**
Road side/ forestry/ social forestry waste	204
TOTAL	**1151**

From 'Agricultural waste management'
Policy paper 49 NAAS, Dec 2010



Only 0.03% of Field crop residues are used for mushroom production in our Country

...ltural wastes in the country are 1566 MT

(NAAS, 2010)

Considering the availability of vast amounts of agrowastes, adequate labour, shift towards hi-tech agriculture and need for employment generation, particularly for youth, there is a vast potential in growth of mushroom cultivation

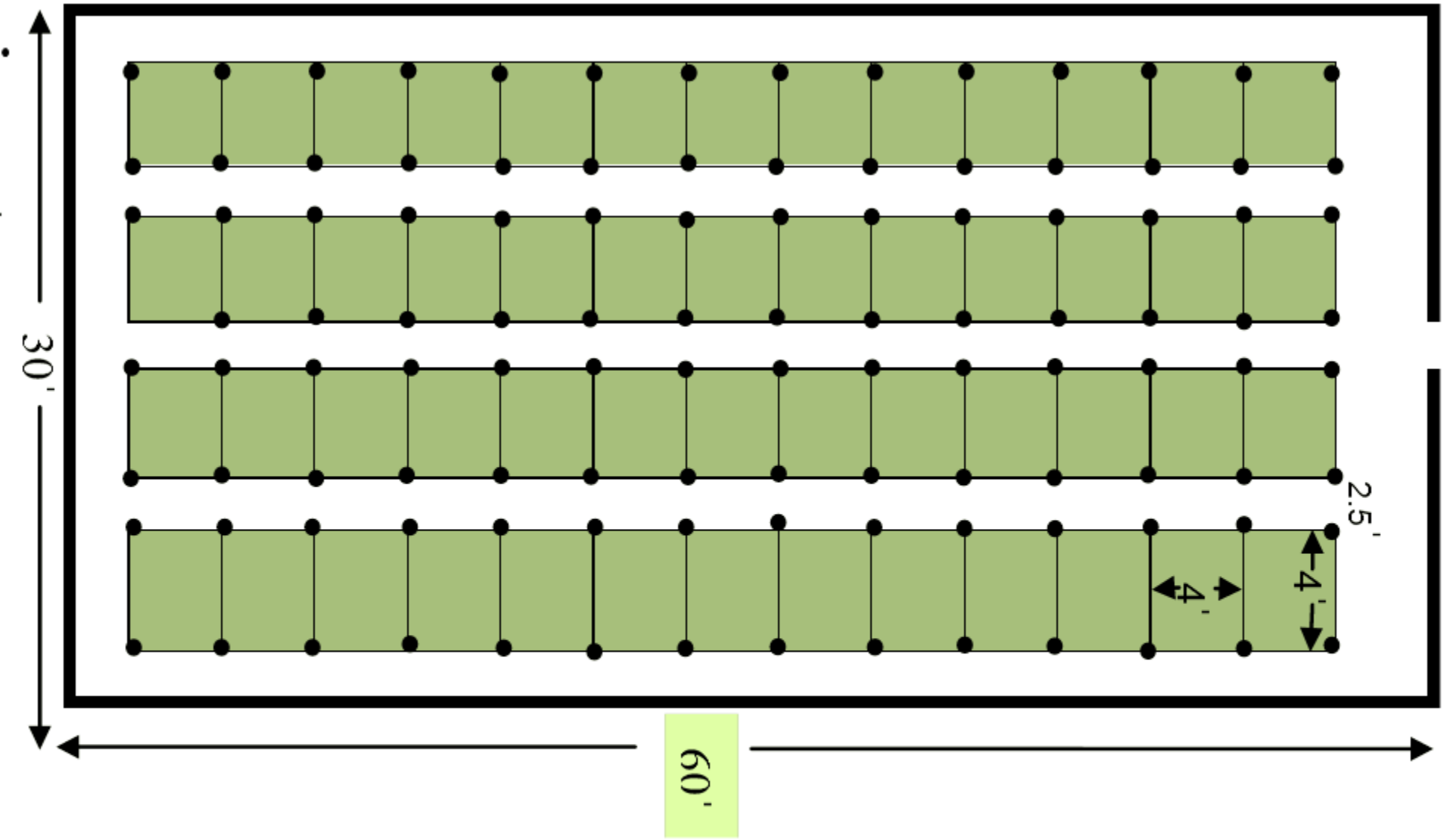
Button Mushroom
16-18^{o}C

Cultivated In India in 60’s

Spawn → Compost → Cropping

Three steps in cultivation of white button mushroom

Spawn production



Lay out of mushroom shed commonly used for seasonal cultivation

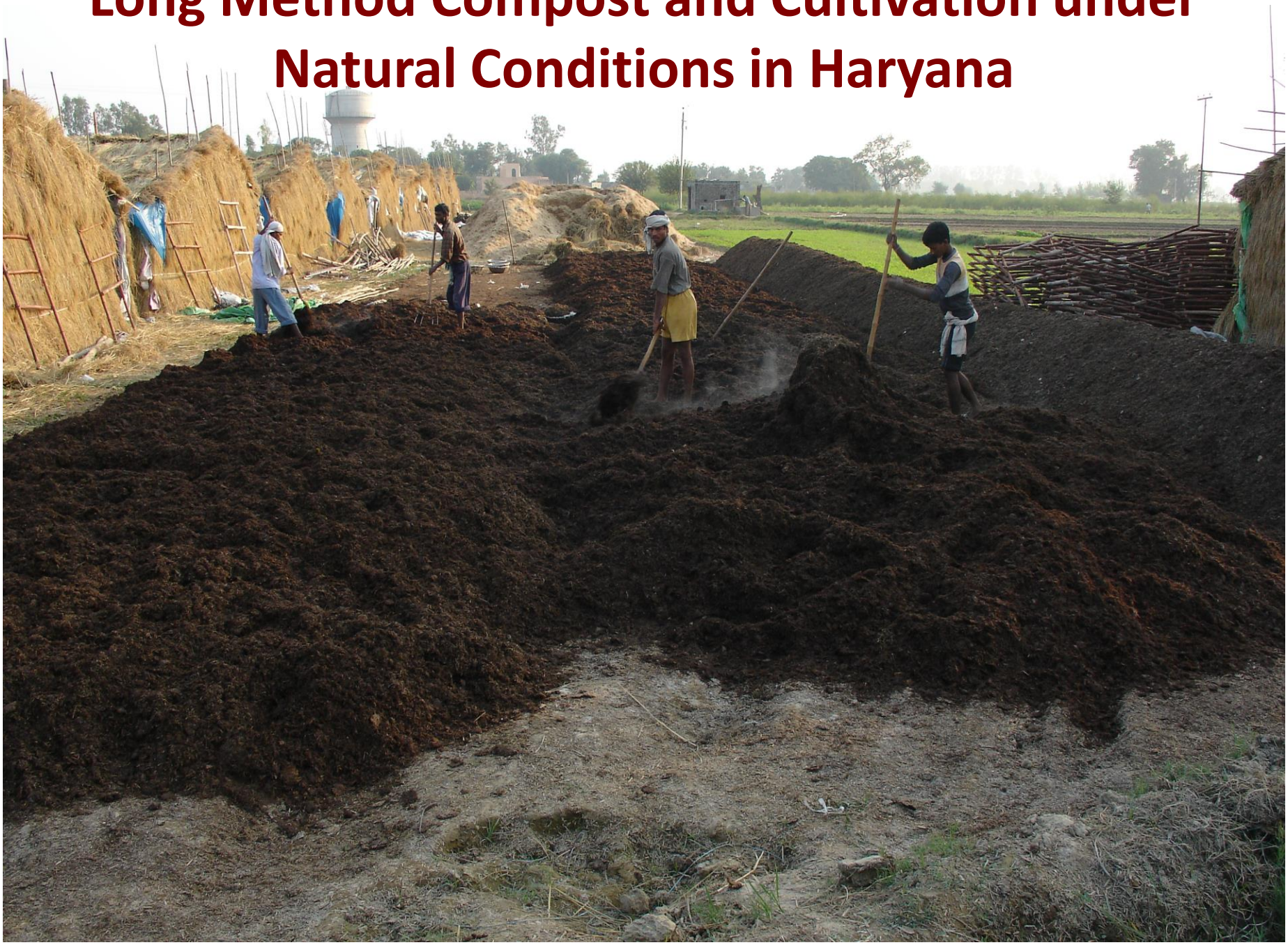
A locally made tool (auger) to make holes

An innovative tool to make holes

Cost –Benefit / shed Compost (12 MT)

~ Cost of shed (1st year)	:	Rs 45,000
~ Cost of shed (2nd year)	:	Rs 10,000
Production cost	:	Rs 1,00,000
Mushroom Production	:	3,000 kg
Gross Sale @ Rs 60/kg	:	Rs 1,80,000
(market price in 2013 was Rs 50-100)		
Benefit (1st year)	:	Rs 35,000
Benefit (2nd year)	:	Rs 70,000

Long Method Compost and Cultivation under Natural Conditions in Haryana

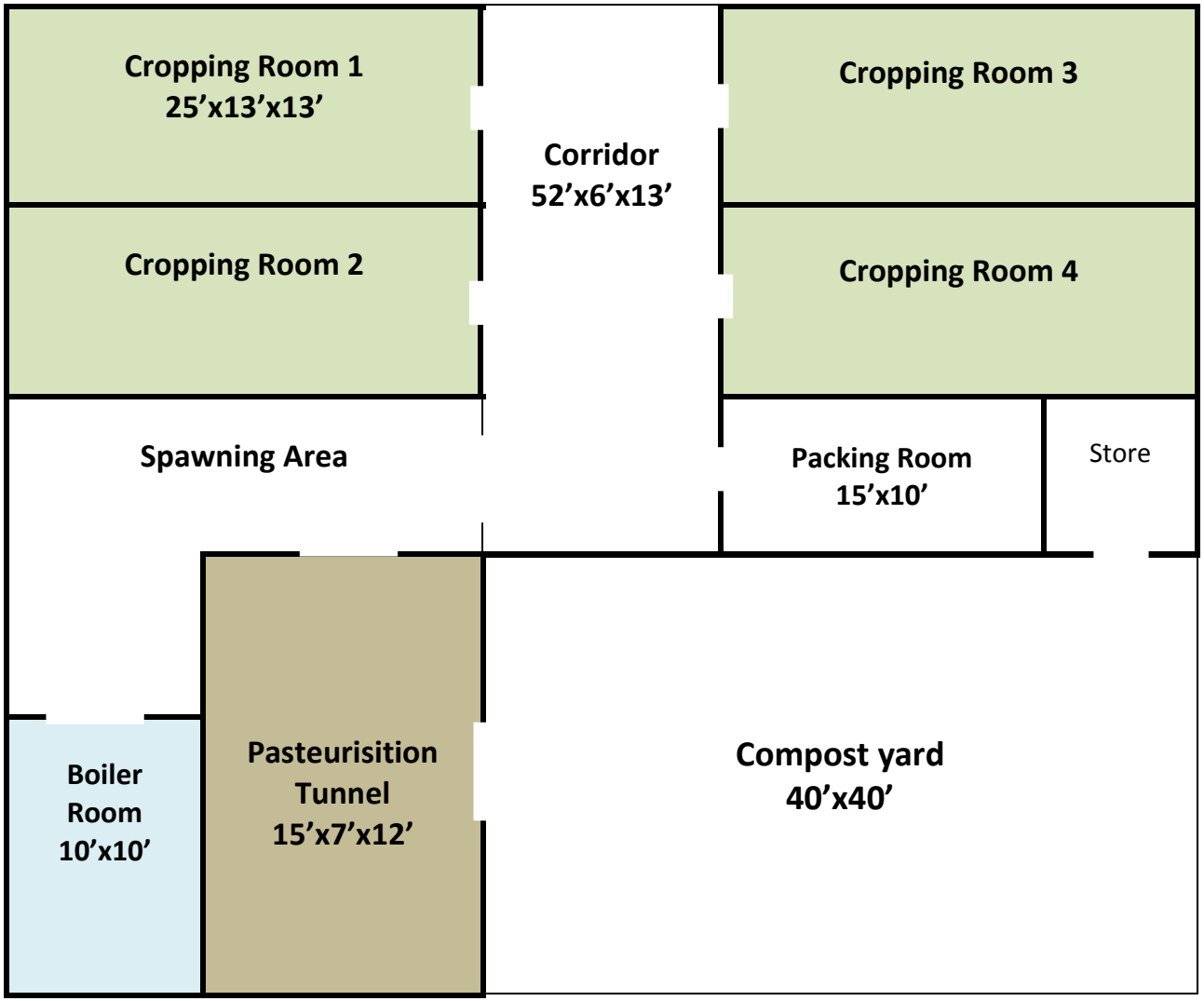


Zero Energy Poly-tunnel Technology developed for compost preparation of button mushroom

1. A novel composting technology for small-scale seasonal button-mushroom growers

2. This composting technique also gave good results for oyster and milky mushroom

Need for State of the Art Facility



Tentative Layout for a Farm of 25-30 TPA capacity

DMR regularly prepares TEFR for various capacities

Bunkers

Indoor composting

Scytalidium thermophilum (X-21)

Modified total indoor composting technique produced compost in eight days

Humicola insolens (I-33)

Substrate inoculated with selected thermophilic fungi viz.,

- *Humicola insolens* I-33 and

- *Scytalidium thermophilum* X-21

Button Mushroom (16-18^{o}C)

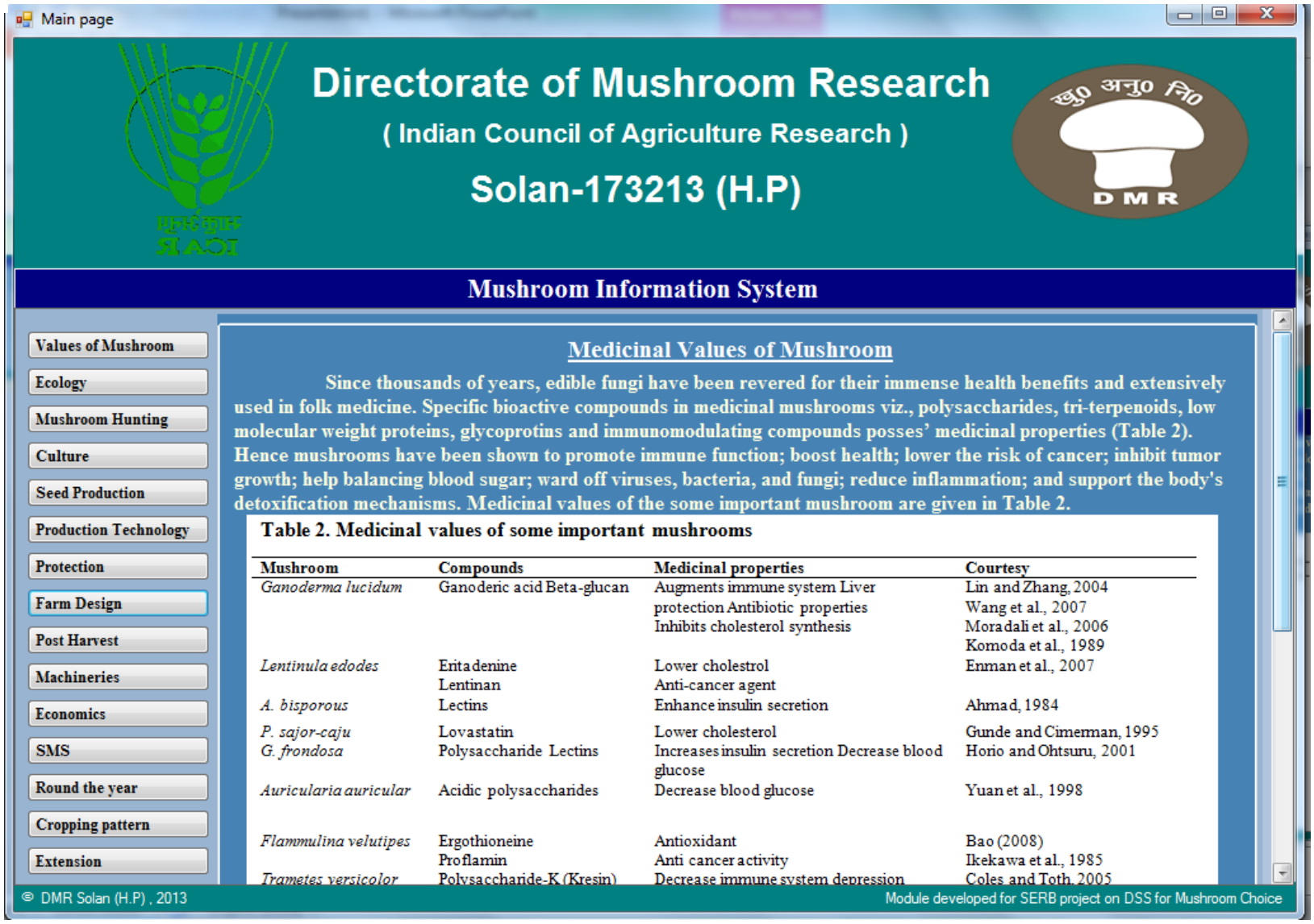
Strain	Morphological features
	Avg Cap dia: 43 mm Avg Cap length: 9 mm Avg Stem length: 17 mm Avg Fruit body weight: 12 g Fruit body White to off white Yield : Average 20-22 kg/100 kg compost
	Avg Cap dia: 41.5 mm Avg Cap length: 9.3 mm Avg Stem length: 18 mm Avg Fruit body weight: 10 g Fruit body colour: Brown Yield: Average 20-25 kg/100 kg compost

High yielding strain of button mushroom adopted at commercial scale (Balaji Mushrooms, Baramati)

Vitamin D and health

Exposing mushrooms to UV light for one hour increased Vit D content by 100 times

Mushroom Information system



Oyster Mushroom

14-20^{o}C, 20-30+^{o}C

Chemical Sterilization Technique for treatment of straw developed at this Directorate has contributed immensely in popularizing oyster mushroom cultivation in the Country

Oyster mushroom cultivation

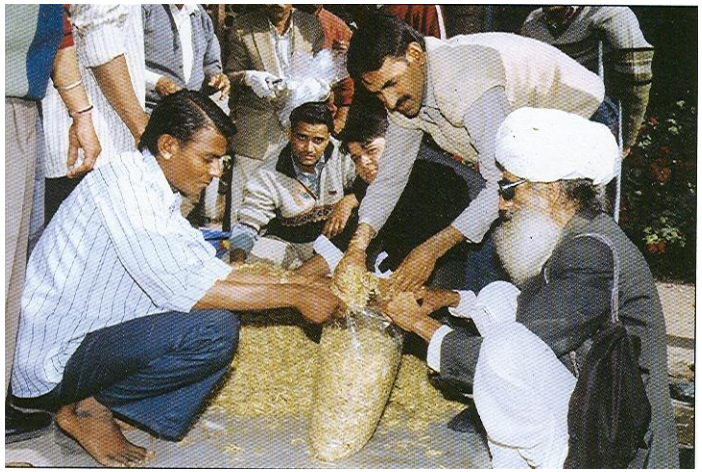
Easy Cultivation technique – hot water

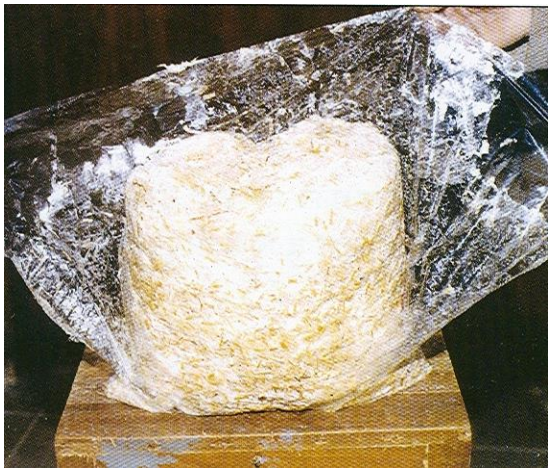
Chemical Sterilisation Technique

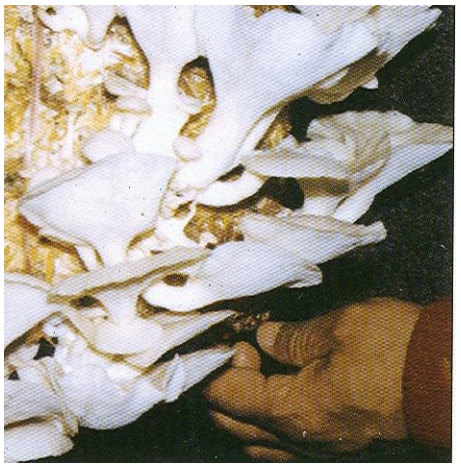
Choice or Raw Materials

Sun drying

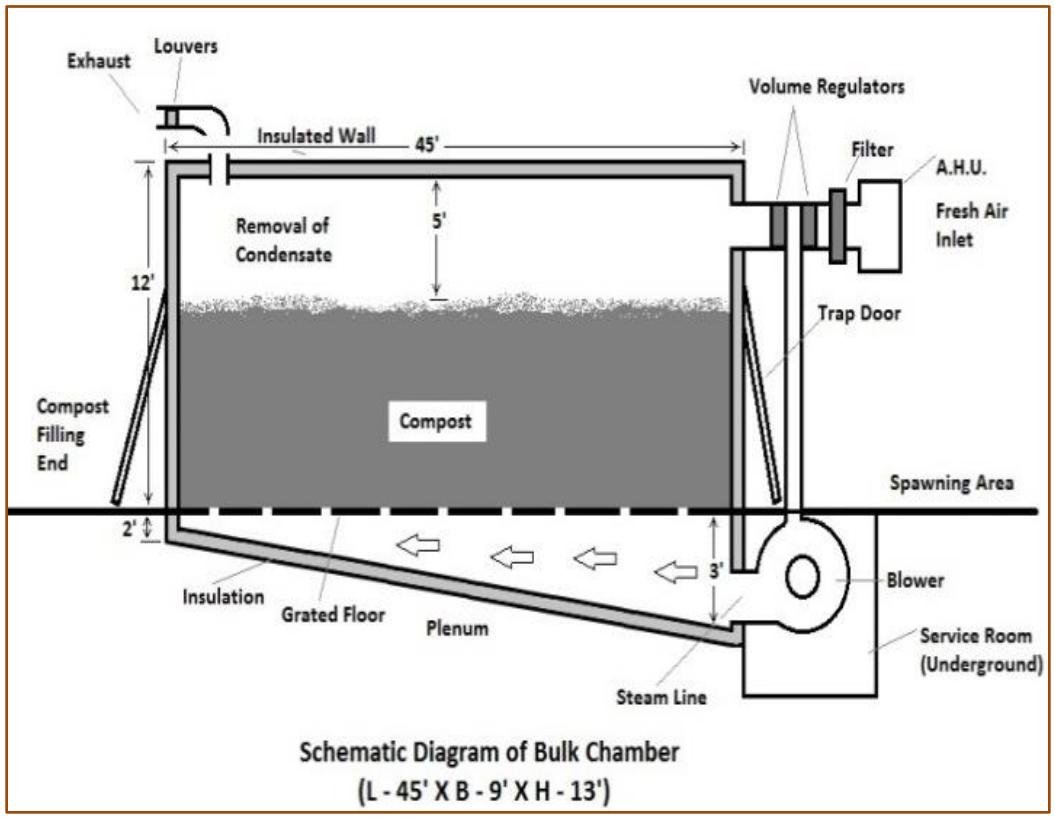
Commercial models ??







Tunnel technology for commercial cultivation of Oyster mushroom – multifunctional use of Pasteurization Tunnel



Schematic Diagram of Bulk Chamber
(L - 45' X B - 9' X H - 13')

- Wet substrate
- Mix lime @1% of dry wt
- Prepare pile, Turn every alternate day
- After two turnings fill the substrate in pasteurization tunnel up to 4’
- Pasteurize at 60-62C for 4 hours, condition at 40-45C for 30-36 hours
- Cool, spawn

Ready to Grow packets available

TQM : Right – First Time, Every Time

Oyster Mushroom – a source of Lovastatin

Used for lowering cholesterol and so preventing cardiovascular diseases

Kabul Dhingri / King Oyster

(Pleurotus eryngii)

- Kabul Dhingri is a edible *Pleurotus* specis which grows in nature at very high altitude in North West Himalayas.
- It can be artificially cultivated using wheat or paddy straw at low temperature.
- This mushroom has potential for its export due to its delicious taste and flavour.

Milky Mushroom

(30-35°C)

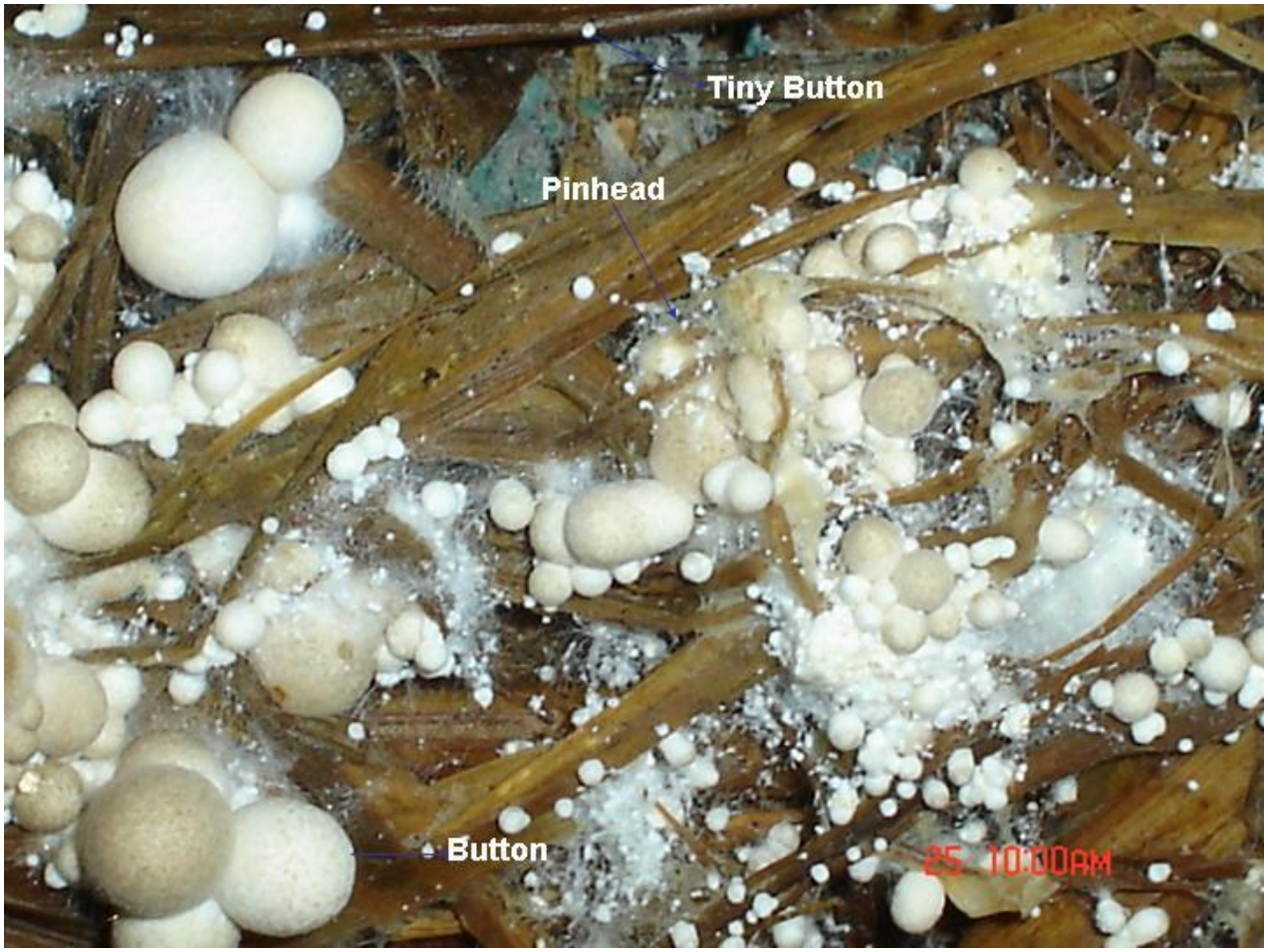
Milky Mushroom

Milky/ Macrocybe Mushroom

Strain	Morphological features & yield (%)
 DMR-Milky-334	Cap spherical white, long stipe Cap dia. 7-8 cm Stipe length 11-12 cm Fruit body weight: 33-38 g Fruit body colour: White Yield: 74-82 kg/100 kg of dry wheat /paddy straw
 DMR-*Macrocybe*-01	1. The cultural conditions : Temp =25-35^{o}C, R.H.% = 70-80%, Light = 8-10 hours (more than 100 lux), CO_2 less than 800 ppm. 2. Av fruit body wt. 20-40 g and B.E.% 40-70% 3. The mushroom do not have the off smell 4. Mushrooms can be stored up to 10 days in refrigerator and 3-4 days at room temperature (20-26 ^{o}C).

Paddy straw mushroom (30-38ºC)

Production efficiency enhanced from 15% to 40% by improved production technology



Paddy Straw Mushroom

Strain	Morphological features & yield (%)
	Fruit body shape: Oval; Fruit body size; Big (5-7 cm long × 4-5 cm wide) Fruit body weight: 14-18 g; Fruit body colour: Light brown; Yield: 12-38 kg/100kg dry compost/different substrates
	Fruit body shape: Oval Fruit body size; Big (5-7 cm long ×3-5 cm wide) Fruit body weight: 14-20 g Fruit body colour; Whitish or greyish Fruit body size : Big (5-7 cm long and 4-5 cm wide); Yield: 14-40 kg/100kg dry compost/different substrates


Paddy Straw Mushroom cultivation in Orissa

Outdoor cultivation of Paddy Straw Mushroom

Paddy Straw Mushroom cultivated outdoors under shade of tree at Solan during Summer Months using poly sheet as cover

Shiitake

(18-22^{o}C)

Cultivation technology standardized on saw dust and wheat straw and new strains selected

Shiitake Mushroom

Strain	Morphological features & yield (%)
DMR-Shiitake- 38 	Spherical, centre dark brown , outer light brown white scars uniformly distributed throughout the cap Cap dia 6.5-8.0 cm stipe length 5-6cm Fruit body weight: 40-45 g Yield: 31-40 kg/100 kg saw dust
DMR-Shiitake-388 	Spherical, Initially fruit bodies are pale yellow in colour, turns light brown with maturity, ring of white scars on the cap Cap dia 6-7 cm stipe length 5-6cm Fruit body weight: 35-39 g Fruit body colour: Light brown Yield=22.3-43.9kg/100kg wheat straw

Shiitake

-a source of Lentinan

Anti-tumour activity

Activates immune system

OTHER POTENTIAL MUSHROOMS

Wood Ear Mushroom

(*Auricularia polytricha*)

22-28°C

Winter mushroom
10-14°C

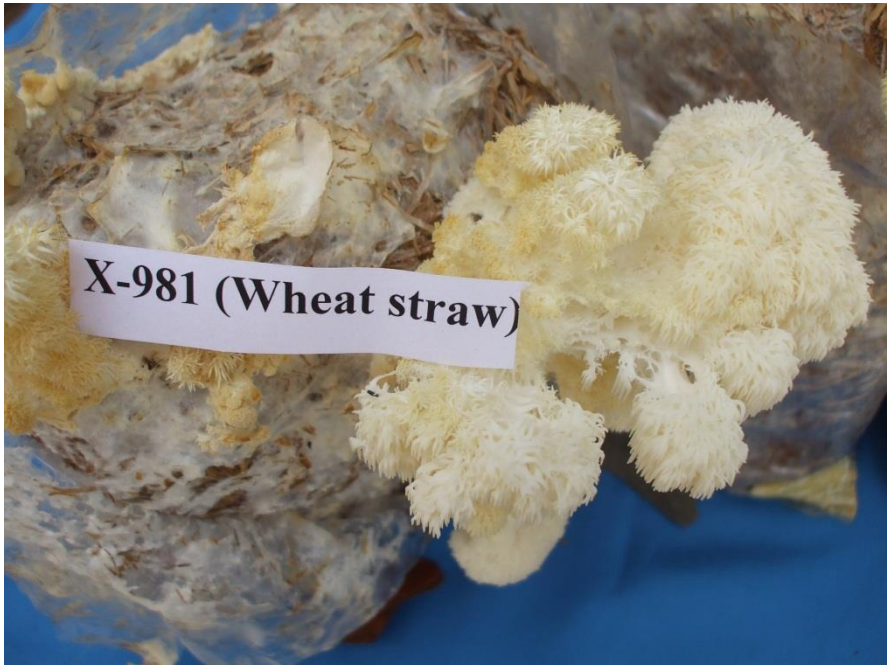
Flammulina velutipes

Macrocybe giganteum

25-35° C

Hericium erinaceus

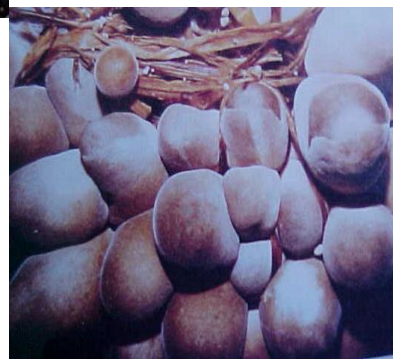
20-24 °C



Reishi Mushroom
(Ganoderma lucidum)

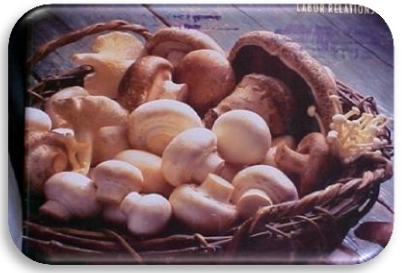
- ***Ganoderma lucidum*** **is the most important medicinal mushroom with global trade of about 2 billion $.**
- **It has very strong immunostimulating properties and is being used in Cancer, AIDS, Heart diseases, Diabetes, B.P. and Kidney failure etc.**
- **Its cultivation technology has been developed at NRCM, Solan. It grows on saw dust & B.E. 15-20%. It is a tropical variety growing in temp.30-35^{0}C.**

Mushrooms - highly perishable because of high moisture content (90%)



Short life (Decrease)

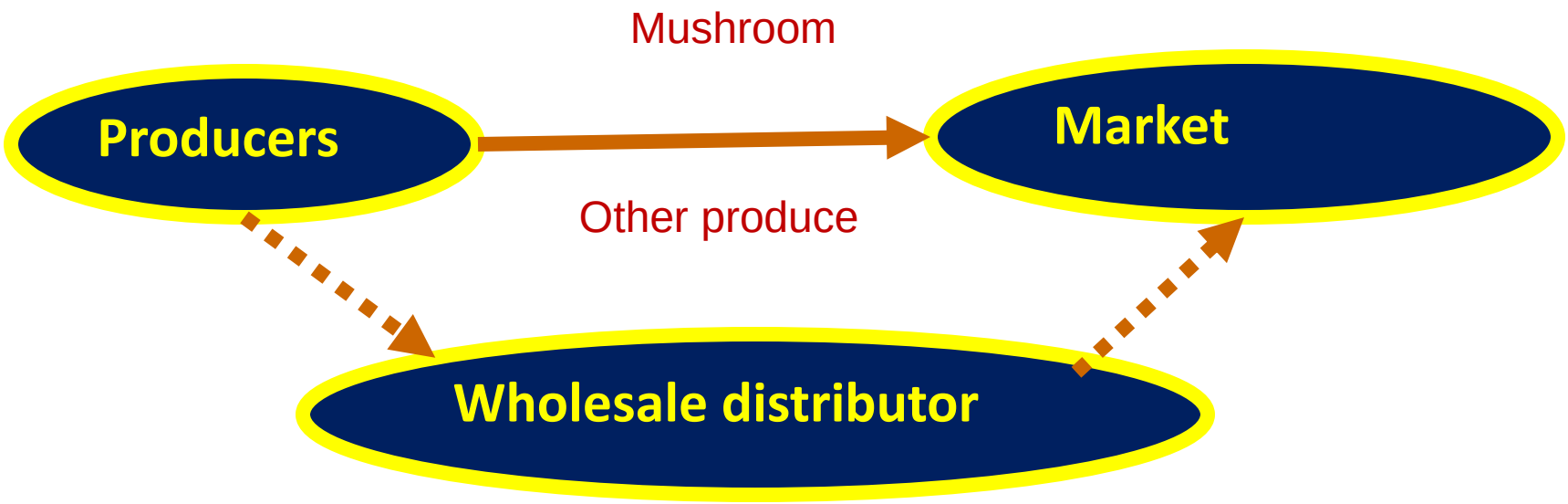
Value added products



- Mushroom pickle
- Mushroom nuggets
- Mushroom cookies
- Mushroom soup powder
- Mushroom ketchup
- Mushroom candy
- Mushroom papad
- Mushroom powder …..

Mushroom Marketing

- Door to door
- Farmer to big stores, hotels
- Farmer to local market
- Distributer to farmer



Is it better to provide subsidy of 55 lakh and allow the grower to choose the component instead of compartmentalization of 15-20-20, etc?

Spawn Unit	Compost Unit	Cropping	Technical competence	Risk	B:C Ratio
			High	High	Low
			High	Med	Med
			Med	Med	Med
			High	Low	High
			Med	Med	Med
			Low	High	Med

Need for interaction and feed back from the end users

Sum up

The growth is a function of positive interaction among researchers, extension workers, farmers, industry and policy makers.

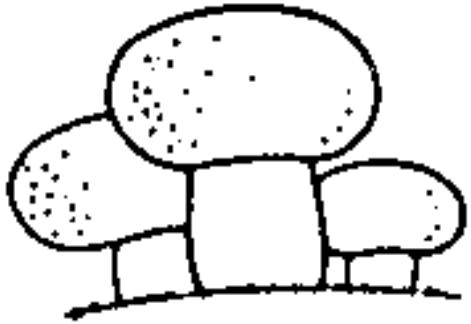
Need for synchronized approach in

- systematically generating the awareness about mushroom consumption,
- proper technologies and environment for mushroom cultivation,
- development of marketing chains for supply of fresh mushrooms and
- production of indigenous mushroom products.

International Societies

Society	Estd	Focus on
ISMS	1950	Edible mushrooms 18th 2012, Beijing
WSMBMP	**1993**	**Mushroom biology and Mushroom Products** **8th ICMBMP, 19-22 Nov 2014, New Delhi**
IWEMM	1999	Workshops on Edible Mycorrhizal Mushrooms 6th 2011, Morocco
IMMC	2001	Intl Med. Mushroom Conference 7th 2013, Beijing

Thanks



Mushroom The Health Food

Grow mushrooms Eat mushrooms