



# MUSHROOM

## Newsletter

Volume 13, No. 1

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This issue is dedicated to the organic button mushroom production in India

### FROM DIRECTOR'S DESK



The conservation and sustainable use of natural resources is a prerequisite for meeting the ever-increasing demand for food and over-all welfare of human race in the years to come. The organic mushroom farming without polluting the environment and

integration of this novel microbial-crop with agriculture will be a hallmark in achieving the much-desired 'Mushroom Revolution' in India. The successful attempts to grow button mushroom crop organically at this centre is an important step towards the promotion of this venture in India and to enhance the trade with developed countries of Europe and America under stringent WTO regime. The work on organic mushroom production was initiated at this Centre in 2002 under the project entitled "Organic Mushroom Production and Quality Produce". No chemical/pesticide were used at any stage of crop cycle. Yellow light traps are used for insect-pest control and common salt to manage the diseases. Strict hygiene is maintained during cropping to prevent the inoculum of diseases gaining entry into the cropping rooms. The technology for organic button mushroom production has been perfected with good yield and quality produce, and is ready for transfer to mushroom farmers, entrepreneurs and industry.

*R.P. Tewari*  
(Dr. R.P. Tewari)

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### EDITORIAL COMMITTEE

Dr. Mahesh C. Yadav, Senior Scientist  
Dr. S.K. Singh, Senior Scientist,  
Mrs. Shailja Verma, Technical Officer

### DR. H.P. SINGH JOINED AS DDG (HORT.)

Dr. H.P. Singh, renowned horticulturist, has assumed office as Deputy Director General (Horticulture), ICAR, New Delhi, on 5<sup>th</sup> February, 2007. Dr. Singh obtained his Doctorate in Horticulture from the University of Agricultural Sciences, Bangalore. Starting his career as a Scientist at Central Horticultural Experiment Station, Chetalli, Karnataka in 1972, Dr. Singh has contributed significantly to horticulture Research and Development, and has set an example as researcher and research manager, which has brought him national and international recognition. He is a recipient of several awards for his contribution to Horticultural R&D, which includes International Awards Kalpvriksha Award-2001 of Asia Pacific Coconut Community (APCC), Jakarta, Indonesia and International Award Pisang Raja 1996 ASPNET (INIBAP) and many others. Dr. Singh has served as Project Coordinator (Tropical Fruits) IIHR, founder Director of NRC on Banana, Horticulture Commissioner in Deptt. of Agriculture & Cooperation, Dean, COA, GBPUAT, Pantnagar and Vice Chancellor, RAU, Samastipur, Bihar.



### SALIENT ACHIEVEMENTS

- Wild mushroom specimens of *Stropharia rugoso-annulata*, *Chlorophyllum hortense*, *Lepista hyalodes* and *Flammulina* sp. were collected and identified.
- An interesting ligninolytic enzyme *Agrocybe aegerita* peroxidase (Aap) was identified, isolated and purified from a wild *Agrocybe* species.
- In *Pleurotus florida*, highest yield was recorded in strain H-25 (81% BE), while strain H-9 of *P. sajor-caju* yielded 63% B.E.
- Strain OE-272 of paddy straw produced highest mushroom yield with 14.62% BE.
- Organically grown button mushroom *Agaricus bisporus* produced 18-20 kg good quality mushrooms/ 100 kg compost in 6 weeks of cropping.
- An improved method of indoor composting resulted in 3.53 tonnes of quality compost in 12 days time from one tonne of straw and an average yield of 15.24 kg button mushrooms/100 kg compost.
- International Conference on "Mushroom Biology and Biotechnology" was jointly organised by Mushroom Society of India and National Research centre for Mushroom, Solan from 10-11 February, 2007.
- NRCM scientists imparted training to 351 farmers/persons by conducting 9 training programmes.



## RESEARCH ACCOMPLISHMENTS

### 1. Genetic Resources

Wild mushroom specimens of *Stropharia rugoso-annulata*, *Chlorophyllum hortense*, *Lepista hyalodes* and *Flammulina* sp. were collected and identified. An interesting ligninolytic enzyme *Agrocybe aegerita peroxidase* (Aap) was identified, isolated and purified from a wild *Agrocybe* species. The enzyme could tolerate very high conc. of hydrogen peroxide and has optimum pH of 7.0 for its maximum activity. One another wood rotting *Agrocybe* species produced three different ligninolytic enzymes namely manganese peroxidase, manganese independent peroxidase and laccase. It was interesting to note that the optimum pH for laccase and manganese independent peroxidase was 3.0. Three different isozymes of laccase were isolated from a wild *Flammulina* species.

### 2. Genetic Improvement

**2.1 Strainal evaluation in *Pleurotus*:** In *P. florida*, six hybrids developed by mating of compatible single spores were evaluated during winter months (Dec-Feb) on pasteurized wheat straw. Highest yield was recorded in strain no. H-25 (81% BE) followed by strains H-18, H35 and H-4. In case of *P. sajor-caju*, nine high yielding hybrids evolved by mating of compatible single spores were evaluated for 3<sup>rd</sup> time on pasteurized wheat straw. Five strains have given more than 22 to 30% higher yield than the parent strain. Highest yield was recorded in Strain H-9 (63% B.E.).



A bumper crop of oyster mushroom in NRCM cropping room

### 2.2 Strainal evaluation in paddy straw mushroom:

Strain OE-272 gave highest mushroom yield with 14.62% BE. It was followed by SSI, OE-55-30 and OE-1222 with 10.54 and 10.11% BE, respectively. These strains also took the shortest duration (11-12 days) for first harvest (post spawning) and the beds spawned with these strains also revealed superior mycelial colonization and lowest incidence of competitor moulds.



### 3. Organic Button Mushroom Production Technology (NCM- 31; PI: Dr. B.L. Dhar)

**3.1 Raw materials used:** The raw materials used during entire cultivation cycle were organic based. No chemical fertilizer/pesticides were used at any stage of cultivation. The compost formulation was standardized by using carbon and nitrogen sources of organic origin. The C : N ratio was balanced by supplementing the base materials with organic based animal manures, wheat bran, brewers grain, cotton seed cake and other such materials. The nitrogen/dry matter was balance in the formulation using the analytical values determined by Sharma *et al.* (UK). The compost and casing were steam treated for pasteurization and no chemicals were added any stage of its preparation, except gypsum (cal. sulphate) which is basically used for flocculating / coagulating the colloides in the compost and to remedy pH.

#### Composting formulations:

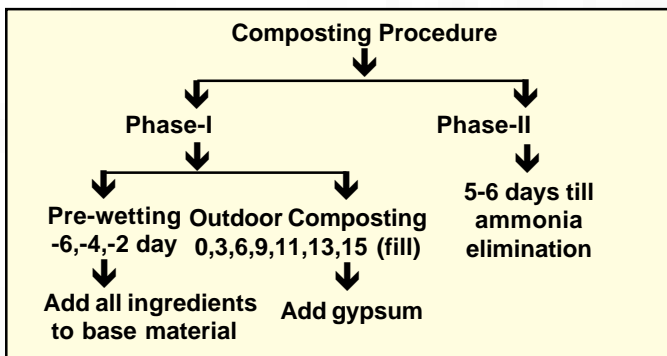
Wheat straw	-	1000 kg
Poultry manure	-	800 kg
Wheat bran	-	250 kg
Cotton seed cake	-	150 kg
Brewers' grain (wet)	-	400 kg
Gypsum	-	35 kg
Water	-	4000-4500 litres
N content at start	-	1.57%

#### 3.2 Composting technology:

**Phase-I:** The turnings were more temperature dependent, ensuring temperature of 75°C±2 before each turning. The moisture content on 0-Day was at 75%, indicated by slow flow of leaching black fluids from the base of the stack before 1<sup>st</sup> and 2<sup>nd</sup> turning. The moisture content is slowly lowered to about 70-72% indicated by leacheates at the bottom present in minute quantities, but not flowing away. Gypsum is added on 5<sup>th</sup> turning when ammonia production is at its maximum. The contents are filled into the chamber one or two days after mixing gypsum.

**Phase-II:** Phase-II is done inside the bulk pasteurized chamber, in a normal fashion. Equalization of temperature with vents closed. Injecting steam immediately on temperature equalization to increase the temperature to 57-58 °C (air tempt.). Hold at the temperature for 8 hours. After completing the pasteurization fresh air was introduced (20-25%), which brought down the tempt. to around 50 °C. The conditioning was done at air temperature of 48-53 °C for 5 days till ammonia was not detected. Ammonia content

checked with dragger tube, which was below 3 ppm. The compost was tested for pH, moisture, N-content, dry matter, smell and other attributes, before spawning.



**3.3 Spawning and spawn run:** Spawning was done at 0.5% of wet weight of compost that means adding 500 g spawn to 1 tonne compost by through spawning method. The spawn run compost was filled into polythene bags of 10 kg capacity, compacted and month loosely closed. The bags were maintained for spawn run at 24°C (air tempt.), high CO<sub>2</sub> conc. (vents closed) and 95% RH. The complete spawn run took 2 weeks time, when compost in all bags was fully colonized by mushroom mycelium. Spawn stain A-15 of *Agaricus bisporus* of Sylvan International was used in the trial. Spawning was done in sterile area.

**3.4 Casing and case run:** Various casing materials were used in the trials. These are:

- i) Spent Mushroom Substrate (2 years old)
- ii) Farm Yard Manure (2 years old)
- iii) Coir pith – well decomposed.
- iv) Different combinations of (i), (ii) and (iii).

The casing materials were steam treated at 65-70 °C for 8 hours, before application. The casing was done in sterile area. Uniform layer of 1" thick casing layer was applied over fully spawn run compost, using 1" thick wooden buttons. The compost surface was leveled before casing application. Water was sprayed over the casing layer in small quantities to keep the casing layer wet. Case run was done at same growing parameters at spawn run, 24°C (air tempt.), 95% RH and high CO<sub>2</sub> concentration (vents closed/ no fresh air introduced). Case run was completed in 1 week.

**3.5 Airing/pinhead formation/cropping:** The ventilation was opened after complete case run, bringing in about 30% fresh air and exhausting CO<sub>2</sub>. The temperature was simultaneously lowered to 15-17 °C (air tempt.), RH of 85% (steam introduction), and CO<sub>2</sub> concentration lowered to

almost ambient (around 1000 ppm). The pinheads appeared in 5-7 days after venting. The first harvest was done 17 days after the casing application. The air temperature was maintained in the range of 15-17 °C throughout with RH of 85% (steam injection with sensor cut off), and reduced CO<sub>2</sub> concentration (continuous exhaust of CO<sub>2</sub> laden air & introduction of 20-30% fresh air). It was ensured that bed temperature stayed 1-2 °C higher than the air temperature during entire cropping period. The pins developed into harvestable mushrooms in 3-4 days time. Luxurious mushroom growth all over the cased bed was observed with each flush lasting 5-6 days.

**3.6 Harvesting:** Average mushroom yield of 18-20 kg was harvested in 6 week of cropping from 100kg compost, with bulk of crop yield obtained in fresh 3 weeks of cropping. Mushrooms were harvested with care, and casing soil applied at places where mushrooms were picked. Water spraying was given after the crop harvest. No pest/disease/competitor mould was observed on the beds during first 3 weeks of cropping, when about 3/4<sup>th</sup> of the yield was harvested.



Director Dr. R.P. Tewari alongwith Dr. B.L. Dhar, PI observing the good crop of organic button mushroom and a close view of mushrooms (inset)

### 3.7 Non-chemical pest control:

No chemical/pesticide was used at any stage of crop cycle. Flies when detected were trapped on a oil coated polythene sheet hanging at one side of the room with a small yellow bulk at the back side of the sheet. Yellow light attracts the flying insects and brings them to the exposed oiled surface of the sheet, thereby trapping them. This proved very effective in fly control, especially after 3<sup>rd</sup> week of cropping, when flies start appearing in the room. Diseased mushrooms, as & when spotted on the beds, were covered with common salt and later removed from the bed. This prevents the spread of the disease organism and also kills



the infecting fungus alongwith the mushroom at the site of infection.

Strict hygiene was maintained during cropping to prevent the source of inoculum gaining entry into the cropping room. Separate spraying equipment was used for water spraying to the mushroom beds. Provision of double protection on the doors, one insulated door and second inner polythene curtain to prevent entry of inset pests/disease organisms with air steams.

**3.8 Pesticide residue analysis:** The pesticide residue analysis was done for all the base materials used for composting, casing, spawn, water and finally the fruitbody. While pesticides were detected from the base materials before start of composting, but these were successfully eliminate after following the modified composting technique, as no pesticides were detected from the mushroom harvested. No pesticides were detected from the fruitbody after following modified method of composting. For pesticide (insecticides) residue analysis, all organic chlorines, synthetic pyrethroides and organophosphorus pesticides were analysed on Gas Chromatograph (Model HP5890-A, Series II) using Electron Capture Detector (ECD) and Nitrogen Phosphorus Detector (NPD) by following the method of Kadenczki *et al.* 1992. For pesticide (fungicide) residue analysis, Ethylene-bis-dithiocarbamates were detected by second derivative UV Spectroscopic method of Dubey and Stan, 1998. Carbendazim (MBC) was detected by Nath *et al.*, 1993 method.

**3.9 Quality of the fruitbody as compared to mushrooms produced by non-organic method:** The quality of the mushrooms harvested from organic crops was found to be superior in following attributes:

- i) Increased individual fruitbody weight.
- ii) Higher pileus: stipe ratio
- iii) Reduce cavity size – defining toughness of mushrooms.
- iv) Increased pileus weight/pileus thickness
- v) Higher total nitrogen content in the fruitbody.

**3.10 Conclusion and cost – benefit ratio:**

- By producing button mushrooms organically, we are ensuring the consumer that pesticides/chemicals are not gaining entry into the human body, which are harmful in many ways.
- Organically produced mushrooms are superior in all quality attributes, besides being free from chemicals/pesticides.
- Consuming organically produced foods slowly and steadily reduce the pesticides residue accumulation in the human body, thereby proving useful to humans on long term basis.

- Organically produced foods are tastier as compared to areas raised with use of fertilizer.
- Though cost of production of organically produced button mushrooms was found to be 10-15% higher as compared to non-organically produced mushrooms, but the producer is amply compensated for higher costs fetched by organically produced food crops, including mushrooms.
- For conclusion, it can be declared with surely that organic button mushrooms can be produced by following the cultivation technology outlined in this protocol document, which will ensure the elimination of pesticides during prolonged high temperature fermentation process during phase-I of composting as confirmed by residue analysis. This will form the basis for “Crop certification of button mushrooms” in India.

**4. Express composting for button mushroom**

Succession and population dynamics of thermophilic fungi were studied in the compost prepared by short method in order to select thermophiles for hastening the composting process. As the temperature in the heap rises above 48 °C true thermophiles including *Scytalidium thermophilum*, *Humicola insolens*, *Humicola grisea* and *Chaetomium thermophile* established in the compost governing the whole process of composting. After kill, only *S. thermophilum* (98.05 % dominance) was isolated from the compost. The compost was prepared by the combinations of INRA and Anglo-Dutch methods wherein compost was fermented at a temperature range of 65-7 °C in the bunker for 6 days followed by its conditioning and pasteurization in phase two tunnel again for six days. The compost was finally ready in 12 days time and 3.53 tonnes of finished compost from one tonne of straw could be obtained by such method. An average yield of 15.24 kg button mushrooms/100 kg compost was obtained from the trial.

**5. Extension and Transfer of Technology**



Participant of Entrepreneur’s training receiving certificate



S. No.	Name of Training Programme	Sponsored by	No. of Trainees	Course Director and Course Coordinator
1.	Eight days training programme on mushroom production technology for farmers of Sikkim w.e.f. 26 - 5 <sup>th</sup> March, 2007	MM-I Scheme	28	Dr. B. Vijay Dr. M.P. Sagar
2.	Three days off-campus training programme on mushroom production technology for progressive farmers and officers of Aizwal (Mizoram), w.e.f. 5 – 7 <sup>th</sup> March, 2007	MM-I Scheme	40	Dr. B. Vijay Dr. M.P. Sagar
3.	Three days off-campus training programme on mushroom production technology for mushroom growers/ farmers and officers of Guwahati (Assam) at Guwahati, w.e.f. 20 – 22 <sup>nd</sup> Feb, 2007	MM-I Scheme	40	Dr. B. Vijay Dr. M.P. Sagar
4.	Three days off-campus training programme on mushroom production technology for mushroom growers/ farmers at Agartala (Tripura) w.e.f. 23–25 <sup>th</sup> Feb, 2007	MM-I Scheme	65	Dr. B. Vijay Dr. M.P. Sagar
5.	Ten days national training course on mushroom production technology for entrepreneurs w.e.f. 19 - 28 <sup>th</sup> April, 2007	Paid training programme, NRCM	33	Dr. R.P. Tewari Dr. Mahesh C. Yadav
6.	Seven days training on mushroom production for farmers sponsored by Mid Himalayan Watershed Dev. Project, Solan (H.P.) w.e.f. 3 - 9 <sup>th</sup> May, 2007	MI-WDP, Solan	25	Dr. S.R. Sharma Dr. S. Kumar
7.	Seven days training on mushroom production for farm women Sponsored CDP, Solan (H.P.) w.e.f. 15 - 21 <sup>st</sup> May, 2007	CDPO, Solan	35	Dr. B. Vijay Sh. Y. Gautum
8.	Seven days training on mushroom production for farmers Sponsored DRDA, Chamba (H.P.) w.e.f. 7 - 13 <sup>th</sup> June, 2007	DRDA, Chamba	40	Dr. B.L. Dhar Dr. M.P. Sagar
9.	Seven days training on mushroom production for farmers and unemployed youths w.e.f. 20 to 26 <sup>th</sup> June, 2007	NRCM, Solan	45	Dr. R.P. Tewari Dr. M.P. Sagar



Trainees undergoing practical on postharvest technology of mushrooms

## STAFF NEWS

### 1. Promotion

- Assured Career Progression (ACP) was given to Sh. Dharam Dass, LDC w.e.f. 02 – 02 - 2007 in the higher pay scale of Rs.4,000 - 100 - 6000.

- ACP was given to Smt. Shashi Poonam, LDC w.e.f. 09-02-2007 in the higher pay scale of Rs. 4000-100-6000.

### 2. Transfer

- Sh. Hari Singh, Administrative Officer has transferred from NRCM to IARI, New Delhi w.e.f. 04 -04 - 2007.

### 3. Joining

- Sh. Raj Kumar, Administrative Officer joined this Centre on 25 - 05 - 2007.

### 4. Awards/Recognitions

- Dr. R.C. Upadhyay awarded DAAD reinvitation Fellowship for doing research work at International Hochschul Institute, Zittau (Germany) under Prof. Dr. Martin Horticulture for two months for 24<sup>th</sup> April, 2007 to 22<sup>nd</sup> June, 2007.



Dr. Upadhyay worked on estimation, separation and purification of various ligninolytic enzymes of wood rotting *Agrocybe* spp. and *Flammulina* sp.



- Dr. M.P. Sagar Senior Scientist (Agri. Extension), was awarded Young Scientist Award - 2007 presented by the Society of Extension Education, situated at Advance Research and Management Centre of Rural Development, Agra (UP) for recognition of multi dimensional transfer of technology work in the field of mushroom cultivation. The award was presented by Sh. Ishwer Das Rohani, Hon'ble Chairman, Madhya Pradesh Vidhan Sabha during 4<sup>th</sup> National Extension Education Congress on "Livelihood Security and Extension System Perspectives" held at JNKVV Jabalpur from 9-11<sup>th</sup>, March, 2007.



## 5. Conferences/workshops/trainings attended

- All the scientists of NRCM, Solan participated in the International Conference on Mushroom Biology and Biotechnology" held at NRCM, Solan from 10-11 February, 2007.
- Dr. M.P. Sagar, Senior Scientist attended the 4<sup>th</sup> National Extension Education Congress at NKVV, Jabalpur from 9-11 March, 2007.
- Dr. R.C. Upadhyay, Principal Scientist availed DAAD reinvitation Fellowship from 24<sup>th</sup> April, 2007 to 21<sup>st</sup> June, 2007 and worked on *Agrocybe aegerita* peroxidase (Aap) enzyme at the International Hochschul Institute, Zittau (Germany).
- Dr. S.K. Singh, Senior Scientist, NRCM, Solan acted as an examiner for evaluation of Ph.D. thesis at the Deptt. of Botany, University of Jodhpur, Rajasthan on 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> June, 2007.
- Dr. Mahesh C. Yadav, Senior Scientist delivered the lecture on 2<sup>nd</sup> June, 2007 as guest faculty in the Summer School on "Recent Advances in Agricultural Sciences" at the College of Agriculture, CSA University of Agriculture and Technology, Kanpur – 208 002 (UP).
- Dr. R.P. Tewari, Director attended the Horticulture Summit – 2007 from 16-19<sup>th</sup> June, 2007 at Lucknow.
- Er. T. Arumuganthan, Scientist, NRCM, Solan attended the National Workshop on "Application of High Pressure in Food Processing" on June 21, 2007 held at Central Institute of Post Harvest Engineering and Technology, Abohar (Pb.).

## INTERNATIONAL CONFERENCE ORGANIZED

An International Conference on "Mushroom Biology and Biotechnology" was jointly organised by Mushroom Society



Dr. H.P. Singh, DDG (Hort.) presiding over the plenary session of the ICMBB-2007

of India and National Research centre for Mushroom, Solan from 10-11 February, 2007. The conference was inaugurated by His Excellency Sh. V.S. Kokje, Hon'ble Governor, Himachal Pradesh. More than 250 mushroom scientists, students, industrialists and growers from almost all the states of Indian Union participated in the conference. Reputed mushroom scientists from Australia, U.K., Israel, Pakistan, Nepal and Bangladesh participated and deliberated in the conference.



Dr. S.T. Chang, a renowned mushroom scientist visited Molecular Genetics Laboratory of NRCM

## IMPORTANT MEETINGS

- Research Advisory Committee meeting was held on 7-8 June, 2007

## VISITORS

- The Hon'ble Governor of Himachal Pradesh Sh. V.S. Kokje visited the NRCM, Solan on 10<sup>th</sup> February, 2006 as Chief Guest in the International Conference on Mushroom Biotechnology held at NRCM, Solan on 10-11 February, 2006.





Dr. Mangala Rai, hon'ble DG, ICAR and Secretary, DARE, interacting with young researcher during his visit to NRCM



Sh. A.K. Upadhyay, Secretary, ICAR and Additional Secretary DARE, New Delhi on a visit to NRCM

- Sh. A.K. Upadhyay, Additional Secretary DARE and Secretary, ICAR, New Delhi visited NRCM on 24 - 04 - 2007.
- Dr. Mangala Rai, Secretary, DARE and Director General, ICAR visited NRCM on 15 - 05 - 2007.

## FORTHCOMING EVENTS

- Fourth International Medicinal Mushroom Conference from 23-27<sup>th</sup> September, 2007 at Ljubljana, Slovenia.
- First International Symposium of Edible and Medicinal Mushrooms and second Meeting of the Biology of Edible and Medicinal Mushrooms in November, 2007, at Bahia Blanca, Argentina.
- Second Asian Congress of Mycology and Plant Pathology from 19-22 December, 2007 at Department of Botany, Osmania University, Hyderabad, India.
- Seventeenth International Congress on the Science and Cultivation of Edible and Medicinal Fungi from 21-24<sup>th</sup> May, 2008 at Cape Town, South Africa. Visit Website: [www.mushroominfo.co.za](http://www.mushroominfo.co.za).

## FARMER'S/HOUSEWIFE'S NEWS

### MUTTAR MUSHROOM

#### Ingredients: (Serves – 4)

- Fresh button - 300 g (washed mushrooms and cut into quarters)
- Fresh peas - 250 g
- Onion - 3 (medium and chopped)

- Ginger - 50g (grated)
- Garlic - 5 cloves (crushed)
- Tomato puree - 1 cup
- Red chillies - to taste
- Oil - 1½ cup
- Coriander leaves - 50 g (chopped)
- Cumin seed - 1½ tbs
- Coriander powder - 1tbs
- Garam Masala - 2 tbs
- Turmeric powder - ½tbs
- Salt - to taste



**Method:** Heat oil in pressure cooker, add cumin seeds and when spluttering, add onion. Fry till golden brown and add coriander powder, turmeric, salt and other spices according to taste for one minute. Add tomato puree to the fried contents and fry until it starts leaving oil, then add cut mushroom and peas, fry for 5 minutes. Add two cups of water and give pressure for 3-4 minutes. Season with coriander leaves before serving.

“Serve for lunch and dinner in main dishes”



## निदेशक की कलम से

आने वाले समय में लगातार हो रही जनसंख्या वृद्धि के लिये भोजन आपूर्ति एवं जनकल्याण के मध्येनजर प्राकृतिक संसाधनों का संरक्षण एवं टिकाऊ उपयोग अतिआवश्यक है। भारतवर्ष में मशरूम क्रांति लाने हेतु जैविक मशरूम की खेती का पारम्परिक कृषि में समायोजन एक महत्वपूर्ण कदम होगा। विकसित देशों के साथ व्यापार बढ़ाने के लिये इस केन्द्र द्वारा जैविक मशरूम का सफलतापूर्वक उगाना एक मील का पत्थर साबित होगा। जैविक मशरूम पर अनुसंधान कार्य सन् २००२ में 'जैविक मशरूम उत्पादन और बेहतर गुणवत्ता का उत्पाद' नामक प्रोजेक्ट के माध्यम से राष्ट्रीय खुम्ब अनुसंधान केन्द्र ने शुरू किया। इस प्रकार की खेती में किसी प्रकार के रसायनों या कीटनाशकों का प्रयोग नहीं किया जाता है। हानिकारक कीटों को पीले प्रकाश एवं चिपचिपे पीले रंग के पालीथीन की पन्नी द्वारा नियंत्रित किया जाता है तथा साधारण नमक के प्रयोग से बीमारियों को नियंत्रित किया जाता है। कड़ी स्वच्छता द्वारा बीमारियों के बीजाणुओं को उत्पादन कक्ष में आने से रोका जाता है। जैविक मशरूम उत्पादन तकनीकी को अच्छी उत्पादकता एवं बेहतर उत्पादन गुणवत्ता वाले उत्पाद के साथ विकसित किया गया है जो कि किसानों तथा उद्यमियों को हस्तान्तरण हेतु तैयार है।

रा. प्र. तिवारी  
(राजेन्द्र प्रसाद तिवारी)  
निदेशक

### मटर मशरूम

#### 4 व्यक्तियों के लिये सामग्री

मशरूम	- 300 ग्राम (धुली व कटी हुई)
ताजे मटर के दाने	- 250 ग्राम
प्याज	- 3 (मध्यम आकार के बारीक कटे हुए)
अदरक	- 50 ग्राम (कद्दूकस किया हुआ)
लहसुन	- 5 फांके कुटी हुई
टमाटर प्यूरी	- 1 कप
लाल मिर्च	- स्वादानुसार
तेल	- आधा कप
हरा धनिया	- 50 ग्राम (बारीक कटा हुआ)
जीरा	- आधा चम्मच
धनिया पाउडर	- 1 चम्मच
गरम मसाला	- 2 चम्मच
हल्दी पाउडर	- आधा चम्मच
नमक	- स्वादानुसार

**विधि:** प्रेशर कुक्कर में तेल गरम करें व जीरा डालें। जीरा चटक जाने पर तेल में प्याज डालकर भूरा होने तक भूनें फिर उसमें धनिया पाउडर, हल्दी पाउडर, नमक व अन्य मसाले मिलाएं तथा एक मिनट के लिये भूनें। मिश्रण में टमाटर की प्यूरी डालकर अच्छे से भूने जब तक कि वह तेल न छोड़े। इस मसाले में अब कटी हुई मशरूम व मटर के दाने डालें तथा हल्की आंच पर पांच मिनट के लिये भूने और फिर दो कप पानी डालकर तीन चार मिनट के लिये कुक्कर में प्रेशर दें। तैयार होने पर कटा हुआ धनिया छिड़ककर गरम-गरम चावल/रोटी के साथ परोसें।

### OBITUARY



1930-2007

**Dr. Harnek Singh Sohi** breathed his last on February 11, 2007. Born on February 25, 1930 in Ropar, Punjab, Dr. Sohi obtained his Ph.D. in 1966 from IARI, New Delhi. Dr. Sohi served Himachal Pradesh as State Plant Pathologist and Deputy Director (Crop Research) (1962-1969). In ICAR, he occupied the position of Plant Pathologist (1969-72), Division of Plant Pathology (1972-79), IIHR, Bangalore; Project Coordinator, AICMIP and Director, National Research Centre for Mushroom, Solan, H.P. (1984-90). He also served as Chairman, Botany Department, Punjab University, Chandigarh (1979-83). Dr. Sohi was instrumental in developing cost-effective methods for disease management of vegetable, fruit and ornamental crops. He developed and perfected techniques for cultivating edible mushrooms, besides popularizing the same. He described scores of new taxa of fungi including edible mushrooms. He guided several M.Sc. and Ph.D. research scholars and published one book and around 300 research articles in reputed journals, bulletins, review articles and chapters in various books. Dr. Sohi was Fellow of Indian National Science Academy, NAAS, Indian Academy of Horticulture and Society of Plant Pathologist. He was honoured with Jeersa Nidhi Award. NRCM scientists and staff members pay their deep homage and pray for peace of the departed soul.

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