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अखिल भारतीय समन्वित खुम्ब अनुसंधान परियोजना
All India Coordinated Research Project on Mushroom



खुम्ब अनुसंधान निदेशालय
DIRECTORATE OF MUSHROOM RESEARCH

(भारतीय कृषि अनुसंधान परिषद्)
(Indian Council of Agricultural Research)

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Chambaghat, Solan - 173 213 (H.P.), India

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Directorate of Mushroom Research

Solan - 173 213, India

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Cover Page (Front) : **Top to bottom**
Button mushroom crop at Pune
Oyster mushroom strainal evaluation at Raipur
Oyster mushroom at Coimbatore
Paddy straw mushroom crop at Solan
Oyster mushroom crop in semi open condition at Bhubaneswar
Agrocybe aegerita crop at Solan
Phellorinia at sale in local market at Udaipur

Cover Page (Back) : **Left to Right**
1st line : Participation of AICRP Bhubaneswar Centre in state festival
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2nd line : *Pleurotus* training at Barapani Centre, Meghalaya
Mushroom Divas at Samastipur Centre
3rd line : Sale of wild mushrooms at local market of Ranchi
Sale of local mushrooms at Raipur market

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PREFACE

Mushrooms, like number of other entheogenic plants, played an important role in development and cultural structure of many primitive societies. It is important to gather the ethnic information as well as collect and conserve the mushrooms identified as edible or medicinal by our ancestors.

Quality food, health, and environment are the three key issues of concern to mankind. These problems are bound to increase as the world's population grows. Applied Mushroom Biology offers meaningful solutions to these issues (1) the generation of relatively cheap source of high quality food protein, (2) the provision of health-enhancing dietary supplements/mushroom nutraceuticals, (3) the bioconversion of various agro-residues, (4) generation of manure for field crops and (5) alternative source of biofuel.

Mushroom cultivation in India has come a long way since 1960s. Initially experiments were conducted on button mushroom. Since then number of other mushroom species have been brought under cultivation in the country. The diverse agro-climate, colossal amount of agricultural wastes, cheap labour and availability of suitable strains as well as cultivation technology have contributed to the growth and diversification of mushrooms. Today the mushrooms under cultivation include temperate species like button mushroom, sub-tropical species like oyster and shiitake mushrooms and tropical species like paddy straw, milky and reishi mushroom. The present production of mushroom in the country has touched 1.2 lakh tonnes.

The All India Coordinated Research Project on Mushroom (AICRPM) came into existence during VI Five-Year Plan on 01.04.1983 with its Headquarters at Directorate of Mushroom Research, Solan (HP). The Director, DMR, Solan (HP) also functions as the Project Coordinator of the project. At present, 14 Coordinating and 2 Cooperating Centres are working under AICRPM programme with its Headquarters at DMR, Solan. The technical programme for conducting participatory research in 2010-11 at these centres was finalized in a biennial workshop organised at IIHR, Bangalore on 31st May and 1st June 2010. From 2011-12 the workshop will be held annually.

During the year under report, attempts were made to collect edible mushrooms in different parts of the country, evaluate promising varieties/ strains of white button mushroom, paddy straw mushroom, milky mushroom, oyster mushroom, and evaluate locally available agro-industrial wastes as casing materials for button mushroom. Report also includes work undertaken on post harvest technology and standardization of cultivation technology of specialty mushrooms, which are needed to diversify the mushroom cultivation scenario in the country.

Strainal evaluation trials at multi-locations has helped in identification of some better strains of *Agaricus bisporus* like ABL-3, ABL-1 on long method compost and ABS-4 and ABS-2 on



pasteurized compost, Vv-12, Vv-11 and Vv-12 of *Volvariella volvacea*, P-1 and P-5 of *Pleurotus florida* and P-6 and P-9 of *Pleurotus sajor-caju*. In experiment on casing mixture for *A. bisporus*, use of FYM + Spent Compost (1:1) mixed with *Alcaligines faecalis* as casing mixture resulted in good yields as well as lesser time required for first harvest. At Nauni centre, different substrates were tested for fruiting of *P. ostreatus* and cotton spinning waste was identified as best substrate for the cultivation of oyster mushroom.

Standardization of the cultivation technology of *Agrocybe aegerita* was carried out at four centres based upon locally available raw materials. Maximum yield efficiency was recorded in wheat straw supplemented with 5% wheat bran. At Coimbatore Centre, good yield was also obtained in paddy straw supplemented with 5% wheat bran treatment. The cultivation trial of shiitake mushroom identified wheat straw with 20% wheat bran as the best substrate.

Not only the production but the preservation and post harvest handling of any crop is also mandatory to obtain good returns. Drying pretreatments were tested for oyster and milky mushroom along with their consumer acceptability. In paddy straw mushroom, the storage treatments were tested along with its market acceptability after storage for of 48 hours.

The results of various experiments exhibited a vast scope of commercialization of mushroom farming as secondary agriculture. Depending upon the climatic conditions and availability of raw materials, the mushroom varieties and raw materials can be identified to promote mushroom cultivation in a particular region. Also, India is rich in mushroom biodiversity and has a large number of mushroom species suiting to different climatic conditions. Hence it is the time to diversify the mushroom cultivation profile of our country so that minimum energy is required during mushroom cultivation making it a more profitable venture.

Manjit Singh

(Manjit Singh)



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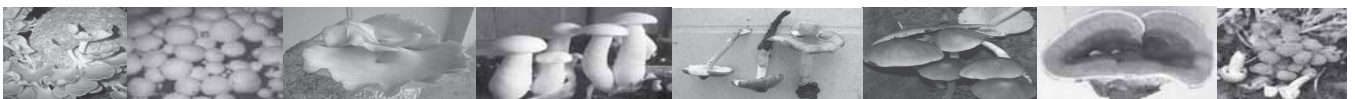
कार्य सारांश

अखिल भारतीय समन्वित खुम्ब अनुसंधान परियोजना के अंतर्गत चौदह समन्वित तथा दो सहयोगी केन्द्र हैं जो देश के विभिन्न जलवायु क्षेत्रों में स्थित हैं। ये मशरूम की विभिन्न तकनीकियों तथा उन्नत किस्मों का सत्यापन करने के लिये तकनीकी कार्यक्रम के अनुसार प्रयोग करते हैं। वर्ष 2010-11 में विभिन्न केन्द्रों पर किये गये परीक्षण 31 मई-1 जून, 2010 को आई.आई.एच.आर., बंगलूरु में आयोजित कार्यशाला में तय किये गये थे।

विभिन्न केन्द्रों पर तीन अलग-अलग मशरूमों, श्वेत बटन मशरूम (*एगोरिकस बाईस्पोरस*), आयस्टर मशरूम (*फ्लोटस फ्लोरिडा* एवं *पी० साजोर-काजू*) व पुआल मशरूम (*वॉल्वेरियेला वॉल्वेसिया*) के प्रजाति मूल्यांकन पर कुल तीन प्रयोग किये गये। लम्बी विधि द्वारा तैयार खाद के साथ किये गये प्रजाति मूल्यांकन में अधिकतम उपज (15.8 कि०ग्रा०/100 कि०ग्रा० खाद) प्रजाति ए.बी.एल.-03 में लुधियाना व फैजाबाद (14.00 कि०ग्रा०) केन्द्र पर प्राप्त की गई। जबकि उदयपुर केन्द्र पर सर्वाधिक उपज ए.बी.एल.-1 प्रजाति में प्राप्त की गई। कुल मिलाकर ए.बी.एल.-03 ने औसतन सभी केन्द्रों पर अच्छा प्रदर्शन किया। प्रथम तुड़ान (पश्च कोसिंग) ए.बी.एल.-03 प्रजाति में सबसे कम 20 दिन फैजाबाद केन्द्र पर दर्ज की गई जबकि यह सर्वाधिक 24 दिन लुधियाना केन्द्र पर ए.बी.एल.-02 एवं ए.बी.एल.-06 में दर्ज की गई। औसत फलनकाय का सर्वाधिक वजन 21.72 ग्राम फैजाबाद केन्द्र पर ए.बी.एल.-08 प्रजाति में तथा सबसे कम 14.6 ग्राम लुधियाना केन्द्र पर ए.बी.एल.-02 प्रजाति में पाया गया।

एक अन्य प्रयोग में लघु विधि द्वारा तैयार खाद पर बटन मशरूम प्रजातियों का मूल्यांकन किया गया तथा सर्वाधिक उपज 24.8 कि०ग्रा०/100 कि०ग्रा० खाद ए.बी.एस.-04 प्रजाति में मूर्थल केन्द्र पर दर्ज की गई। जबकि पंतनगर केन्द्र पर सर्वाधिक उपज ए.बी.एस.-02 प्रजाति में 21.44 कि०ग्रा० पाया गया। इसके अलावा पूणे केन्द्र पर ए.बी.एस.-07 (14.32 कि०ग्रा०) एवं हिसार केन्द्र पर ए.बी.एस.-04 (16.80 कि०ग्रा०) की उपज प्राप्त की गई। सोलन केन्द्र पर सर्वाधिक उपज प्रजाति ए.बी.एस.-04 (21.65 कि०ग्रा०) पाई गई। कुल मिलाकर ए.बी.एस.-04 प्रजाति ने सभी केन्द्रों पर 19.36 कि०ग्रा० की औसत से सबसे अच्छा प्रदर्शन किया जबकि ए.बी.एस.-02 प्रजाति 17.48 कि०ग्रा० की औसत उपज के साथ दूसरे स्थान पर रही। प्रथम तुड़ान का समय सबसे कम 23 दिन ए.बी.एस.-03, ए.बी.एस.-04 एवं ए.बी.एस.-08 प्रजाति में हिसार केन्द्र पर तथा ए.बी.एस.-06 प्रजाति में पंतनगर केन्द्र पर पाया गया। फलनकायों का औसत भार 10-15.2 ग्राम तक ए.बी.एस.-07 प्रजाति में हिसार केन्द्र पर पाया गया जबकि पंतनगर केन्द्र पर यह 14.39 ग्राम ए.बी.एस.-02 प्रजाति में दर्ज किया गया।

पुआल मशरूम की पांच प्रजातियों को सात अलग-अलग केन्द्रों पर मूल्यांकित किया गया। सर्वाधिक जैविक क्षमता 26.3 प्रतिशत (कि०ग्रा०/100 कि०ग्रा० सूखे पोशाधार) पर प्रजाति वी.वी.-01 में कोयम्बटूर केन्द्र

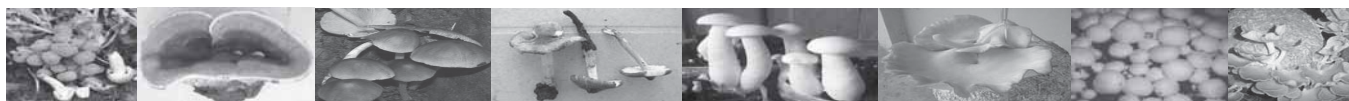


तथा 22.0 प्रतिशत वी.वी.-12 प्रजाति में लुधियाना केन्द्र पर दर्ज की गई। भूवनेश्वर केन्द्र पर सर्वाधिक जैविक क्षमता 16.42 प्रतिशत वी.वी.-11 प्रजाति में प्राप्त हुई जबकि फैजाबाद केन्द्र पर यह 13.32 प्रतिशत वी.वी.-01 प्रजाति में प्राप्त हुई। प्रथम तुड़ान में सबसे कम समय 9 दिन प्रजाति वी.वी.-12 में तथा 11 दिन प्रजाति वी.वी.-13 में लुधियाना केन्द्र पर दर्ज की गई। फलनकायों का औसत वजन सर्वाधिक 23 ग्राम वी.वी.-09 प्रजाति में कोयम्बटूर केन्द्र पर प्राप्त हुआ। साधारणतः सभी प्रजातियों में सर्वाधिक फलनकाय का वजन कोयम्बटूर केन्द्र पर प्राप्त हुआ।

ढोंगरी मशरूम की प्रजातियों का मूल्यांकन 10 विभिन्न केन्द्रों पर किया गया। कुल चार संकर प्रजाति एवं एक पैतृक प्रजाति को इस प्रयोग में मूल्यांकित किया गया। *पी० फ्लोरिडा* की प्रजातियों में सर्वाधिक उपज 134.4 प्रतिशत (कि०ग्रा०/100 कि०ग्रा० सूखा पुआल) प्रजाति पी.-01 में तथा 111.4 प्रतिशत प्रजाति पी.-02 में रांची केन्द्र पर प्राप्त हुई। औसतन प्रजाति पी.-01 की उपज सभी केन्द्रों पर सर्वाधिक (77.84 प्रतिशत) प्राप्त हुई हालांकि कुछ केन्द्रों पर पी.-04 एवं पी.-05 प्रजातियों ने अच्छा प्रदर्शन किया। प्रथम तुड़ान ने सबसे कम 23.1 दिन का समय प्रजाति पी.-04 में वेल्यानी केन्द्र पर प्राप्त हुआ। हालांकि सभी केन्द्रों की औसत से सबसे कम समय प्रजाति पी.-01 में 32.63 दिन प्राप्त हुआ। फलनकायों का सर्वाधिक वजन 21.08 ग्राम पी.-04 प्रजाति में बड़ापानी केन्द्र पर प्राप्त हुआ।

पी० साजोर-काजू प्रजातियों के मूल्यांकन में सर्वाधिक उपज 104.42 प्रतिशत प्रजाति पी.-09 में रायपुर केन्द्र पर तथा प्रजाति पी.-06 में 91.4 प्रतिशत एवं पी.-09 प्रजाति में 87.2 प्रतिशत बड़ापानी केन्द्र पर दर्ज किया गया। फैजाबाद केन्द्र पर सर्वाधिक जैविक क्षमता 56.5 प्रतिशत पी.-06 प्रजाति में तथा 84.98 प्रतिशत एवं 82.40 प्रतिशत क्रमशः रांची एवं समस्तीपुर केन्द्र पर पी.-09 प्रजाति में दर्ज की गई। कुल मिलाकर पी.-09 प्रजाति औसतन 62.24 प्रतिशत उपज के साथ प्रथम स्थान पर रही। प्रथम तुड़ान में सबसे कम समय 20 दिन पी.-06 एवं पी.-09 प्रजाति में समस्तीपुर केन्द्र पर प्राप्त हुई। सभी केन्द्रों के औसत से प्रथम तुड़ान में सबसे कम समय प्रजाति पी.-06 में 29.83 दिन लगे। फलनकायों का सर्वाधिक वजन 13.91 ग्राम रायपुर केन्द्र पर प्रजाति पी.-09 में दर्ज किया गया।

फसल उत्पादन में कुल तीन प्रयोग किये गये जिनमें बटन मशरूम की केसिंग में बैक्टीरिया *एल्कैलीजीन्स फिकैलिस* का असर, *एग्रोसाईब ऐजेरिटा* एवं *लेन्टाईनस इडोडस* की उत्पादन तकनीक का मानकीकरण शामिल थे। बटन मशरूम के उत्पादन पर बैक्टीरिया *एल्कैलीजीन्स फिकैलिस* के असर का परीक्षण कुल छः केन्द्रों पर किया गया। इस प्रयोग में कुल आठ केसिंग मिट्टियों का प्रयोग किया गया जिसमें गोबर की खाद, स्पेंट मशरूम कंपोस्ट, नारियल के रेशे तथा उनके मिश्रणों का प्रयोग किया गया। बैक्टीरिया द्वारा बटन मशरूम के उत्पादन में वृद्धि सुनिश्चित करने हेतु ये प्रयोग किये गये तथा बटन मशरूम के उत्पादन में महत्वपूर्ण वृद्धि पंतनगर केन्द्र पर सभी केसिंग मिट्टियों में बैक्टीरिया के निवेश से प्राप्त की गई। इस प्रयोग में सर्वाधिक उत्पादन (21.27 कि०ग्रा०/100 कि०ग्रा० कम्पोस्ट) गोबर की खादस्पेंट मशरूम कंपोस्टबैक्टीरिया



में प्राप्त हुई। लुधियाना केन्द्र पर भी उत्पादन वृद्धि गोबर की खाद एवं स्पेंट मशरूम कंपोस्ट के बैक्टीरिया से निवेशन से ही प्राप्त हुई। प्रथम तुड़ान में सबसे कम समय 20 दिन फैजाबाद केन्द्र पर स्पेंट कंपोस्ट की केसिंग, जिसमें बैक्टीरिया का निवेशन किया गया था, में लगा जबकि सबसे अधिक समय 38 दिन गोबर की खाद एवं स्पेंट कंपोस्ट (बिना बैक्टीरिया के) में हिसार केन्द्र पर दर्ज किया गया। प्रथम तुड़ान में लगे समय में किसी तरह की कमी लुधियाना, हिसार एवं उदयपुर केन्द्रों पर दर्ज नहीं की गई। फलनकायों का औसत वजन 22.86 ग्राम फैजाबाद केन्द्र पर स्पेंट कंपोस्ट *एल्कैलीजीनस फीकैलिस* वाली केसिंग मिट्टी में प्राप्त हुआ जबकि सबसे कम वजन (8.90 ग्राम) गोबर की खाद तथा स्पेंट मशरूम कंपोस्ट से बनी केसिंग में उदयपुर केन्द्र पर प्राप्त हुआ।

सोलन के नौणी केन्द्र पर *प्लुरोटस ऑस्ट्रीएटस* के उत्पादन के लिये कुल 10 पोषाधारों एवं मिश्रणों का मूल्यांकन किया गया जिसमें सर्वाधिक उत्पादन (99.8 कि०ग्रा०/100 कि०ग्राम सूखे पोषाधार पर) कॉटन स्पिनिंग वेस्ट पर तथा गेहूं के पुआल पर प्राप्त हुआ। कॉटन जीनिंग वेस्ट पर भी 94.5 कि०ग्रा० का उत्पादन दर्ज किया गया।

एग्रोसाईब एजेरिटा मशरूम की उत्पादन तकनीकी के मानकीकरण के लिये कुल चार केन्द्रों पर प्रयोग किये गये। इन केन्द्रों पर कुल आठ पोषाधार का परीक्षण किया गया। कोयम्बटूर केन्द्र पर गेहूं के पुआल के स्थान पर धान का पुआल प्रयोग किया गया। सर्वाधिक उत्पादन क्षमता 54.54 प्रतिशत पन्तनगर केन्द्र पर गेहूं के पुआल और गेहूं के चोकर (5 प्रतिशत) के मिश्रण में प्राप्त हुई। कोयम्बटूर केन्द्र पर सर्वाधिक उत्पादन क्षमता (21.20 प्रतिशत) धान के पुआल 5 प्रतिशत गेहूं के चोकर के मिश्रण में प्राप्त हुई। औसतन सभी केन्द्रों पर सर्वाधिक जैविक क्षमता गेहूं के पुआल एवं 5 प्रतिशत चोकर के मिश्रण में प्राप्त हुई। प्रथम तुड़ान में सबसे कम समय 38 दिन गेहूं के पुआल एवं चोकर (5 प्रतिशत) के मिश्रण में जबकि सबसे अधिक समय (85 दिन) लकड़ी के बुरादे पर पन्तनगर केन्द्र पर दर्ज किया गया। फलनकायों का औसत वजन सर्वाधिक 22.60 ग्राम धान के पुआल पर कोयम्बटूर केन्द्र पर प्राप्त हुई।

शिटाके मशरूम के उत्पादन पर इस वर्ष पांच केन्द्रों पर प्रयोग किये गये जिसमें कुल 12 पोषाधारों, उनके मिश्रण तथा परिशिष्टों का परीक्षण उत्पादकता के लिये किया गया। इन प्रयोगों में सर्वाधिक उत्पादकता 43.47 प्रतिशत (कि०ग्राम०/100 कि०ग्रा० सूखा पोषाधार) गेहूं के पुआल तथा 20 प्रतिशत चोकर के मिश्रण में पन्तनगर केन्द्र पर तथा 40.97 प्रतिशत उत्पादकता लकड़ी के बुरादे एवं 20 प्रतिशत चोकर के मिश्रण में उदयपुर केन्द्र पर प्राप्त हुई। सबसे कम उत्पादकता 7.5 प्रतिशत धान के पुआल के पोषाधार पर कोयम्बटूर केन्द्र पर दर्ज की गई। सभी केन्द्रों की औसत से लकड़ी के बुरादेगेहूं के पुआल 20 प्रतिशत चोकर के पोषाधार पर सबसे अच्छी उत्पादन क्षमता दर्ज की गई। फलनकायों का औसत भार सर्वाधिक 50.70 ग्राम तथा 49.91 ग्राम क्रमशः गेहूं के पुआल 10 प्रतिशत चोकर तथा गेहूं के पुआल 20 प्रतिशत चोकर पर प्राप्त हुई।



पश्च फसल तकनीकियों में ढींगरी एवं मिल्की मशरूम के धूप में सुखाने से पहले के उपचार पर दो केन्द्रों में प्रयोग किये गये। ढींगरी मशरूम में पांच पूर्व उपचारों का परीक्षण किया गया एवं उन उत्पादों की गुणवत्ता एवं उपभोक्ता स्वीकार्यता का परीक्षण भी किया गया। इसके लिये उत्पादों की विभिन्न विशेषताओं जैसे कि शुभ्रता, भार में कमी, भंगुरता, भण्डारण क्षमता एवं पुनर्जलीकरण गुणों का विश्लेषण किया गया। सूखे हुए मशरूम में सर्वाधिक शुभ्रता बिना किसी पूर्व उपचार के धूप में सुखाने से रायपुर केन्द्र पर दर्ज की गई जबकि सर्वाधिक भार में कमी केबिनेट सुखावन विधि द्वारा प्राप्त की गई। सूखे मशरूम की सबसे अच्छी भण्डारण क्षमता 60° सेल्सियस पर केबिनेट सुखावन द्वारा प्राप्त हुई। सूखे मशरूम की भण्डारण क्षमता तीन महीने तक लगभग सभी उपचारों में अच्छी दर्ज की गई। हिसार केन्द्र पर सर्वाधिक शुभ्रता ब्लांचिंग द्वारा तथा सर्वाधिक भार में कमी, भंगुरता एवं भण्डारण क्षमता 60° सेल्सियस केबिनेट सुखावन द्वारा प्राप्त हुई। सूखे मशरूम की सबसे अच्छी पुनर्जलीकरण गुणवत्ता ब्लांचिंग एवं केबिनेट सुखावन में पाई गई।

मिल्की मशरूम के सुखावन पर कुल तीन केन्द्रों पर प्रयोग किये गये तथा सर्वाधिक शुभ्रता ब्लांचिंग पूर्वउपचार तथा तत्पश्चात धूप में सुखाने पर रायपुर केन्द्र पर दर्ज की गई। सर्वाधिक भार में कमी एवं भंगुरता केबिनेट सुखावन द्वारा प्राप्त हुई। पूणे केन्द्र पर भी लगभग समान परिणाम प्राप्त हुए। सूखे मशरूम की पुनर्जलीकरण गुणवत्ता लगभग सभी उपचारों में अच्छी पाई गई तथा हिसार केन्द्र पर यह ब्लांचिंग एवं केबिनेट सुखावन में सर्वोत्तम देखी गई।

पुआल मशरूम के भण्डारण हेतु कुल 14 उपचारों का परीक्षण दो केन्द्रों पर किया गया। इन प्रयोगों में भुवनेश्वर केन्द्र पर जब मशरूम को कमरे के तापमान पर खुले हुए पॉलीप्रापलाइन बैग में रखा गया तो 48 घण्टे के अंदर सभी मशरूमों की टोपियां खुली पाई गई। यद्यपि किसी भी उपचार में मशरूम में बदबू नहीं पाई गई। रांची केन्द्र पर लगभग सभी उपचारों में टोपियां 48 घण्टों तक नहीं खुलीं। परन्तु कमरे के तापमान पर रखी मशरूम में खुली टोपियां देखी गई।

जंगली गुद्देदार कवकों को एकत्र करने, उन्हें पहचानने व संरक्षित करने के उद्देश्य से विभिन्न केन्द्रों द्वारा सर्वेक्षण किये गये। इन सर्वेक्षणों में इस बात का ध्यान रखा गया कि जो मशरूम किसी क्षेत्र विशेष की जनता द्वारा आम तौर पर खाये जाते हैं उन्हें भी एकत्र एवं संरक्षित किया जाये। इन नमूनों से जहां तक संभव हो सके शुद्ध संवर्धन प्राप्त किये गये। कुल 52 मशरूमों के नमूने उदयपुर केन्द्र से, 11 भुवनेश्वर से, 11 पासीघाट से, 15 पूणे से, 10 समस्तीपुर से, 32 रांची से, 2 बड़ापानी से, 35 रायपुर से, 2 पंतनगर से, 16 कोयम्बटूर से, 86 वेल्हानी केन्द्र एवं 111 मुख्यालय से एकत्रित किये गये। ज्यादातर केन्द्रों ने इन एकत्रित मशरूमों का संरक्षण अपने-अपने तौर पर किया है परन्तु कुछ केन्द्र जैसे कि रायपुर, रांची एवं उदयपुर ने कुछ शुद्ध संवर्धनों को निदेशालय में जमा करवाया है। सभी केन्द्रों पर बीमारी एवं कीटों के अध्ययन हेतु सर्वेक्षण एवं निरीक्षण का कार्य किया गया। लगभग सभी केन्द्रों पर अलग-अलग रोगजनक कवकों का संक्रमण दर्ज किया गया जिसमें से प्रमुख *एसपरजीलस*, *ट्राइकोडर्मा*, *कोपराईनस*, *राईजोपस*, *स्कलेरोशियम*,



पेनिसिलियम, सेपीडोनियम एवं माईकोगॉन थे। ये रोगजनक कवक पूरे देश में मशरूम की फसल को नुकसान पहुंचाते हुए पाए गए जबकि माईकोगॉन एवं सेपीडोनियम पंजाब, हरियाणा, हिमाचल प्रदेश एवं उत्तराखंड के फार्मों पर ज्यादा तौर पर देखे गये। कीट-पतंगों में मुख्यतः फोरिड, स्प्रिंगटेल एवं माईटस मशरूम की फसल में पाए गए जबकि वेल्यानी केन्द्र पर सियारिड मक्खियों का संक्रमण पाया गया।

सभी परियोजना केन्द्रों ने राष्ट्रीय/राज्य स्तरीय प्रदर्शनियों एवं मेलों में भाग लिया तथा आकाशवाणी व दूरदर्शन पर मशरूम से संबंधित वार्ताओं को प्रसारित कर प्रसार की गतिविधियों को बढ़ाया। इसके अतिरिक्त किसानों व मशरूम उत्पादकों को पत्रों, दूरभाष, ईमेल व फार्म भ्रमण द्वारा सलाह-मशवरा दिया गया। सभी केन्द्रों पर किसानों, बेरोजगार युवकों, महिलाओं एवं उद्यमियों के लिये विभिन्न अवधियों के प्रशिक्षण शिविर लगाये गये। लगभग सभी केन्द्रों ने अपने क्षेत्र में मशरूम उत्पादन को बढ़ावा देने हेतु शुद्ध संवर्धन एवं खुम्ब बीज किसानों को उपलब्ध करवाया। वर्ष के दौरान मुख्यालय पर कुल 9 प्रशिक्षण शिविर आयोजित किये गये जिसमें किसानों, उद्यमियों, कृषि विज्ञान केन्द्रों एवं राज्य बागवानी विभागों के विषय विशेषज्ञों ने भाग लिया।



SUMMARY

All India Coordinated Research Project on Mushroom comprises of fourteen coordinating and two cooperating centres located all over India in different agroclimatic zones to test and validate the technologies, and to identify varieties, developed at Directorate of Mushroom research, Solan. During the year under report (2010-2011), the research trials were conducted at all the sixteen centres based on technical programme finalized during the biennial group meeting of AICRPM workers held on 31st May –1st June 2010 at IIHR, Bangaluru.

Three experiments were conducted on strainal evaluation of three different mushrooms i.e. white button mushroom (*Agaricus bisporus*), oyster mushroom (*Pleurotus* spp.) and paddy straw mushroom (*Volvariella volvacea*) at various centres. Strain evaluation trials of white button mushroom using long method of compost was conducted at four centres and the maximum yield of 15.80 kg/100 kg compost was recorded in the strain ABL-3 at Ludhiana Centre, followed by the same strain at Faizabad centre (14.00 kg). ABL-1 was the best performing strain at Udaipur centre. Overall average productivity of ABL-3 strain was best, followed by ABL-1 on all the centres. The time taken for first harvest (days post casing) was lowest (20 days) in strain ABL-3 at Faizabad centre. At Ludhiana centre, the lowest time was 24 days in all the strains, except ABL-2 and ABL-6. Average fruit body weight was highest (21.72g) at Faizabad centre in the strain ABL-8, while at Ludhiana centre, it was 14.6 g in strain ABL-2.

In another set of experiment on evaluation of *A. bisporus* strains using short method of compost, highest yield of 24.80 kg /100 kg compost was recorded in the strain ABS-4 at Murthal centre, followed by strain ABS-2 at Pantnagar centre (21.44 kg). At Pune centre, the best performing strain was ABS-7 (14.32 kg), while ABS-4 (16.8 kg) at Hisar centre. At Solan centre, the best performing strain was also ABS-4 (21.65 kg). Overall yield average of different strains the centres showed that strain ABS-4 with an average yield of 19.36 kg was the highest yielder followed by ABS-2 (17.48 kg). The time taken for first harvest was lowest of 23 days (post-casing) in strains, ABS-3, ABS-4 and ABS-8 at Hisar centre, and strain ABS-6 at Pantnagar centre. The average fruit body weight ranged in 10 to 15.2 g with highest in strain ABS-7 at Hisar centre. At Pantnagar centre, the highest fruit body weight recorded was 14.39 g in the strain ABS-2.

A total of five strains of *Volvariella volvacea* were tested at seven different centres. Highest biological efficiency of 26.3 kg /100 kg of dry substrate was recorded in strain Vv-01 at Coimbatore centre, followed by 22.0 kg in strain Vv-12 at the Ludhiana centre. At Bhubaneswar centre highest biological efficiency recorded was 16.42 kg in strain Vv-11. At Faizabad centre highest BE was obtained in strain Vv-01 (13.32 kg). Lowest time taken for first harvest was 9 days in strain Vv-12 at Ludhiana centre, followed by 11 days in strain Vv-13 at Ludhiana. The average fruit body weight varied at different centres with a highest of 23.0 g at Coimbatore centre in the strain Vv-09. In different strains, highest fruit body weight was recorded at Coimbatore centre,



followed by at Bhubaneshwar centre. Highest fruit body weight recorded at Bhubaneshwar centre was 17.75 g in strain Vv-13.

Trial on strain evaluation of oyster mushroom was conducted at 10 different centres. A total of four hybrids and one parent strain of *P.florida* and *Psajor-caju* were under trial. Amongst strains of *P.florida*, the highest yield of 134.4 kg /100 kg of dry substrate was obtained in strain P-1 at Ranchi centre, followed by strain P-2 (111.4 kg) at the same centre. Strain P-1 recorded highest yield at most of the centres, however, at some centres P4 and P-5 strains also performed well. Cumulative average of the yield showed highest yield of 77.84 kg /100 kg of dry substrate in strain P-1. Lowest time taken (23.1 days) for first harvest was in strain P-4 at Vellayani centre. The overall average time taken for first harvest was also lowest in Strain P-1 (32.63 days). The highest fruit body weight of 21.08 g was recorded in P-4 strain at Barapani centre.

Amongst *P.sajor caju* strains, highest yield of 104.42 kg/100 kg of dry substrate was recorded in strain P-9 at Raipur centre, followed by strain P-6 (91.4 kg) and P-9 (87.2 kg) at Barapani centre. At Faizabad centre, highest yield of 56.5 kg was recorded in strain P-6, while at Ranchi and Samastipur centres again P-9 performed best with 84.98 and 82.40 kg yield, respectively. Overall average indicated that strain P-9 out yielded all the other strains with a productivity of 62.24 kg/100kg of dry substrate. Lowest time taken for first harvest (20 days) was recorded in the strain P-6 and P-9 at Samastipur centre. Overall average of data from all the centres indicated that the lowest time taken for first harvest was in strain P-6 (29.83 days), closely followed by strain P-7 (30.98 days). Highest fruit body weight of 13.91 g was recorded in strain P-9 at Raipur centre.

In crop production trials, a total of three experiments were conducted, which included use of bacterium *Alcaligenes faecalis* in casing of white button mushroom and standardization of cultivation technology for *Agrocybe aegerita* and *Lentinula edodes*. In experiment on use of bacterial inoculation in button mushroom casing eight different treatments were tested, (FYM, Spent mushroom substrate and coir pith alone and in combination at six different centres). Significant yield enhancement was recorded at Pantnagar centre by inoculating the bacterium *Alcaligenes faecalis* in all the casing mixtures but highest yield of 21.27 kg/100 kg compost was in FYM + Spent compost + bacterium treatment. At Ludhiana centre, yield enhancement was recorded only in FYM+spent compost+A.*faecalis* treatment. Overall average yield showed mild yield enhancement on inoculation of bacterium *Alcaligenes faecalis*. Time taken for first harvest (days post casing) was lowest of 20 days in spent compost with bacterial inoculation at Faizabad centre, while highest of 38 days in FYM + SC without bacterial inoculation at Hisar centre. At Ludhiana, Hisar and Udaipur centres the difference in time taken for first harvest was insignificant in different treatments. Overall average of time taken for first harvest at different centres showed non-significant difference in time taken to first harvest. Average fruit body weight was recorded to be highest of 22.86 g in spent compost + *Alcaligenes faecalis* treatment at Faizabad centre, while lowest of 8.90 g was in FYM + SC treatment at Udaipur.



At Nauni centre, a total of ten substrate combinations were evaluated for production of *Pleurotus ostreatus*. Amongst the substrate tested, highest yield of 99.8kg/100 kg dry substrate was recorded in cotton spinning waste, followed by traditional wheat straw. Cotton ginning waste also showed good results with 94.5 kg yield.

The trial on standardization of the cultivation technology of *Agrocybe aegerita* was assigned to eight different centres, out of which only four centres successfully carried out trial. Yield of 54.54 kg/100kg dry substrate was recorded in wheat straw +5% wheat bran treatment at Pantnagar centre. At Coimbatore centre, out of two treatments, the yield of 21.20 kg was obtained in paddy straw + 5% wheat bran treatment. In overall average, highest bio-efficiency was recorded in wheat straw + 5% wheat bran treatment. The time taken for first harvest was least of 38 days in WS+WB (5%) treatment at Pantnagar centre, while highest of 85 days in sawdust treatment at the same centre. Overall average also showed lowest time taken for first harvest in WS+WB (5%) treatment. The average fruit body weight was highest (22.6 g) in paddy straw treatment at Coimbatore centre.

Cultivation trial of shiitake mushroom (*Lentinula edodes*) was conducted at five centres. A total of twelve substrates, their combinations and supplements were tested to optimize the yield of mushroom. Out of different substrates and supplements tested, highest yield of 43.37 kg /100 kg dry substrate was obtained in combination of wheat straw and wheat bran (20%) at Pantnagar centre, closely followed by saw dust with wheat bran (40.97 kg) at Udaipur centre, whereas lowest yield of 7.5 kg was obtained in paddy straw substrate at Coimbatore centre. Overall average of yield at different centres showed that highest yield was obtained in saw dust+WC+WB 20% treatment. This was due to uniform yield in this treatment at all the centres, except at Pune centre. The average fruit body weight varied at different centres and highest of 50.70 and 49.91 g was recorded in WS+WB10% and WS+WB20% treatments, respectively at Pantnagar centre.

In post harvest technology, pretreatment before sundrying of oyster and milky mushroom were tested. The trial was assigned to Solan and Hisar centres instead of Solan, Raipur centre has conducted the trial. Five pre-treatments of oyster mushroom were tested and their effect on quality and consumer acceptability was assessed. For this, whiteness, weight loss, brittleness, keeping quality and rehydration properties of the mushrooms we kept as the quality parameters. At Raipur centre, highest whiteness was recorded when no pretreatment was given before sun drying, whereas highest weight loss was recorded in cabinet drying at 40°C. The keeping quality was best cabinet dried (60°C) mushrooms. Keeping quality up to three month was good in all the treatments. At Hisar centre, the whiteness was highest in blanching pretreatment as well as in cabinet drying, whereas the weight loss was highest in cabinet drying. The brittleness and keeping quality was best in cabinet drying at 60°C. Rehydration properties of dried mushroom were best in blanched and cabinet dried samples.

In milky mushroom, three centres conducted the trials. Whiteness of the mushroom was highest in the blanched and dipping treatment, followed by sun drying at Raipur centre, while



cabinet drying did not exhibit good whiteness. Water loss and brittleness was highest in cabinet drying treatments. Keeping quality was good in all the treatments. Similar results were obtained at Pune Centre but the keeping quality was moderate in treatments, where dipping treatment or no treatment was given before sun drying. Rehydration property was good in all the treatments. Similar results were obtained in respect of whiteness and brittleness at Hisar centre. The rehydration property was best in blanching and cabinet drying treatments.

For storage of paddy straw mushroom, a total of 14 treatments were designed with the veil opening, moisture loss, liquefaction, change of colour, loss of texture and spoilage as per the quality parameters. This experiment was conducted at Bhubaneswar and Ranchi centres. Highest veil opening (100%) was recorded in mushrooms kept at room temperature in open PP bags, while highest moisture loss was recorded in open PP bag treatment in refrigerated conditions at Bhubaneswar centre. Liquefaction and change of odour were not recorded in any of the treatment up to 48 hours except in sealed PP bags treatment, where foul odour could be observed. At Ranchi centre, the veil opening was not recorded in majority of the treatments, however, under room conditions the veil opening was faster than in refrigerated conditions. Moisture loss was highest in paper envelop under refrigerated condition, while liquefaction was recorded mostly in the sealed pp bag treatments.

Surveys were conducted by various Centres to collect, identify and catalogue the mushroom samples used by local inhabitants and also from wild. Cultures were taken wherever possible. A total of 52 fleshy fungi were collected at Udaipur Centre, 11 at Bhubaneswar, 11 at Pasighat, 15 at Pune, 10 at Samastipur, 32 at Ranchi, 2 at Barapani, 1 at Faizabad, 35 at Raipur, 2 at Pantnagar, 16 at Coimbatore and 86 at Vellyani Centre. Most of Centre have collected and preserved the mushroom sample at their own level however some of the Centres like Raipur, Udaipur, Ranchi have submitted the culture of the collection at DMR. Also all the Centres have conducted the survey for prevalent mushroom diseases and pests in the respective areas. Among the common fungal pathogens/competitors *Aspergillus*, *Trichoderma*, *Coprinus*, *Rhizopus*, *Sclerotium rolfsii*, *Penicillium*, *Sepedonium*, *Mycogone* are major. These pathogens/competitors are distributed throughout the country on mushroom crop. But *Mycogone* and *Sepedonium* are particularly restricted in mushroom farms of Punjab, Haryana and Himachal Pradesh, Uttarakhand and have become endemic in the region. Amongst insect pest phorids, springtails and mites are generally encountered in different parts of the country. At Vellayani Centre sciarid fly incidence is also reported.

All the Centres carried out the extension activities by participating in State/National level Exhibition, Melas, Kisan Goshthies, mass communication through AIR/TV programmes, replying to letters, telephones, emails and on the spot guidance during farm visits. Almost all the Centres have conducted trainings for different durations for farmers, farmwomen, unemployed youths and entrepreneurs of their areas. The Centres have also supplied the spawn and pure culture to promote the mushroom cultivation practice in their respective areas. At headquarters a total of 9 on and off trainings were conducted for the farmers, entrepreneurs, KVK scientists and officials of state horticulture departments.



1. INTRODUCTION

With a view to test and disseminate the technology developed at Directorate of Mushroom Research and its Centres located in different agro-climatic regions of the country and to popularize mushrooms as secondary agriculture along with the existing farming system, the All India Coordinated Research Project on Mushroom (AICRPM) was launched during VI Five-Year Plan on 01.04.1983 with its Headquarters at Directorate of Mushroom Research, Solan (HP). The Director of DMR, Solan (HP) also functions as the Project Co-ordinator of the project.

Initially, the All India Coordinated Mushroom Improvement Project started with six Centres. At present, 14 Coordinating and two co-operating Centres are working under AICRPM. These are:

ICAR Institute based

- ICAR Research Complex for NEH Region, Barapani (Meghalaya)
- Horticulture and Agroforestry Research Programme (ICAR Research Complex for Eastern Region), Ranchi (Jharkhand)

State Agricultural Universities based

- Punjab Agricultural University, Ludhiana (Punjab)
- Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
- G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand)
- Mahatma Phule Agricultural University, Pune (Maharashtra)

- N.D. University of Agriculture and Technology, Faizabad (UP)
- Indira Gandhi Krishi Vishwa Vidyalaya, Raipur (Chhattisgarh)
- Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan)
- Kerala Agricultural University, Vellayani (Kerala)
- C.C.S. Haryana Agricultural University, Hisar (Haryana)
- Orissa University of Agriculture and Technology, Bhubaneswar (Orissa)
- Rajendra Agricultural University, Pusa, Samastipur (Bihar)
- College of Horticulture and Forestry, Central Agricultural University, Pasighat (Arunachal Pradesh)

Co-operating Centres

- Dr.Y.S.Parmar University of Horticulture & Forestry, Nauni, Solan (HP).
- Research and Development Centre, Haryana Agro-Industrial Corporation, Murthal (Haryana)

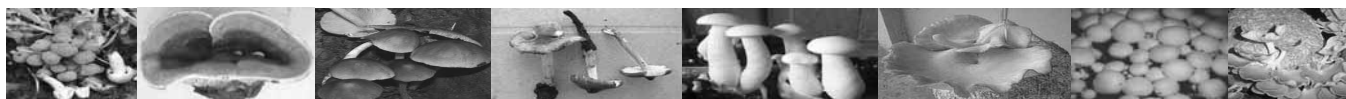
The last Group meeting of workers of AICRPM was held on 31st May and 1st June 2010 at Indian Institute of Horticulture Research, Bangalore. During the meeting the progress of last two years was monitored and technical programme for 2010-2011 was finalized.



2. MANDATE AND OBJECTIVES

The mandate of AICRP (Mushroom) is to coordinate and monitor multilocation trials with improved mushroom varieties / hybrids, cultivation practices related to crop production, crop protection measures and post harvest technology, all aimed at increasing production, productivity and utilization of mushroom in the country. Major activities under the project are:

1. To conduct survey of naturally occurring wild mushrooms to identify and catalogue the edible/ medicinal species as well as for exploring of possibilities of promising strains.
2. To evaluate the promising and high yielding strains for regional adaptability.
3. To carry multi-location trial for finalization of standard production techniques for different mushrooms.
4. To explore possibility of selection of cheaper locally available substrates for mushroom cultivation.
5. To supply good quality spawn to the mushroom growers.
6. Popularization of mushroom cultivation in different agro-eco-regions.



3. TECHNICAL PROGRAMME OF WORK (2010-11)

I. CROP IMPROVEMENT

Expt. 01: Collection, identification and conservation of wild edible mushrooms from local market

- a) Participating centres: All
- b) Data to be recorded

a. Rainfall and temperature data coinciding with the appearance/arrival of wild edible mushrooms in local markets.

b. ITK, exact location of collection, market information, method of consumption and other uses along with photographs/video of the natural habitat/market and soil sample of the location.

c. Sun dried fruit bodies/spore prints to be supplied along with cultures.

d. GPS data of the region from where mushroom was collected

e. Duly filled enclosed proforma.

c) Area of operation: Each Centre may select at least five districts inhabiting variable mushroom flora

d) Proforma for market data on mushroom collected:

Sl. No.	Item to be recorded	Observation/data
1.	Name/market/District	
2.	Date of collection	
3.	Sale price (Rs./Kg)	
4.	Mode of consumption (fresh/dried/both/raw/cooked as vegetable/with rice etc.)	
5.	Any association with tree(s)/soil type etc.	
6.	ITK if any	
7.	Temperature range during the collection period (15-20, 20-25, 25-30, 30-35°C)	



e) Proforma for mushroom identification (AICRP-Mushroom)



Collected by:

Date of collection	General characteristics				Locality
Habitat	Habit	Epigeous	Fungoid	Taste	
Soil type & pH	Forest type	Vegetational community	Spore print colour	Macroscopic characters	

A. PILEUS

Diameter	Colour	Shape	Pileus margin	Margin roll	Surface on touch	Hygrophorous
Scale	Cuticle	Pileus consistency	Fleshy colour	Thicken	Brushing colour and colour changes	

B. STIPE

Attachment	Stipe	Stipe size and length	Thickness at top	Thickness at middle	Stipe shape
Stipe base	Stipe texture	Stipe consistency	Stipe surface	Stipe context	Stipe trama colour

C. RING **D. VEIL** **E. VOLVA** **F. BASAL ASSOCIATION**

G. LAMELLA

Gill length	No. of sets of lamella	Gill consistency	Gill number	Lamella per cm	
Gill attachment	Gill separation	Gill nature	Gill breadth	Gill shape	Gill edge

Expt. 02: Testing of different strains of white button mushroom, *Agaricus bisporus*

a) Participating centres

- i. Pune, Pantnagar, Solan, Hisar, Murthal (Pasteurized compost using wheat straw)
- ii. Udaipur, Ludhiana, Faizabad and Samastipur (Unpasteurized compost)

b) Substrate

- i) Substrate quantity - 10 kg compost/bag
- ii) No. of replications - 4 replications each with 6 bags of 10 kg compost/replicate for each strain in RBD.

c) Strains to be evaluated

- i) Short method compost (ABS-01, ABS-02, ABS-03, ABS-04, ABS-05, ABS-06, ABS-07, ABS-08)



- ii) Long method compost (ABL-11, ABL-12, ABL-13, ABL-14, ABL-15, ABL-16, ABL-17, ABL-18)

d) Methodology to be adopted

i) Short Method

- Preparation of compost by short method in 2 phases (phase-I and phase-II) by following standard procedure (-6, -4/0, 2,4,6,8 (fill)/phase-II (6-7 days). Compost will be ready in 18 days.
- Ingredients to be used are wheat straw - 1000 kg, poultry manure-500 kg, urea-15 kg, wheat bran-70 kg, gypsum-40 kg.
- Data for compost N, colour, pH, moisture, ammonia, bulk density (kg per m³) to be reported for each trial.

ii) Long Method

- Long method compost to be prepared in single phase outdoors (without steam pasteurization) in 28 days (+6, 10, 13, 16, 19, 22, 25, 28 days and spawn).

- Ingredients to be used are wheat/paddy straw-1000 kg, wheat bran 80 kg, urea-18 kg, gypsum-40 kg and cotton seed meal 30 kg. Data for N, moisture, pH, colour, ammonia and bulk density (kg per m³) to be recorded for each trial.

e) Spawning rate to be used: 0.7% of wet compost

f) Data to be recorded during 4 weeks cropping

g) Environmental conditions to be maintained inside cropping room

- i) Spawn run - Bed temp- 24±1°C, RH- (bed temp.) 90 to 95%, CO₂- above 10,000 ppm.
- ii) Case run - Bed temp- 24±1°C, RH- (bed temp.) 90 to 95%, CO₂- above 10,000 ppm.
- iii) Cropping - Bed temp.-16-18°C, RH (bed temp.) 80-85%, CO₂- below 1000 ppm.

Strain	Days taken for					Mushroom yield (kg/100 kg compost)	Incidence of diseases/ insect-pests	Av. Wt. of mushroom	Mushroom quality/ remark
	1	2	3	4	5				

(1- Spawn run; 2- Case run; 3- Pinning (after ventilation); 4- First harvest (days post casing), 5- last harvest (cropping days))



Bag size: 20"x24" (polythene - 150 gauge)

- The yield data should be recorded in tabulated form replication wise.
- The replicates should be randomized in cropping rooms in different tiers in RBD.
- Watering should be restricted to wetting of casing material.
- Casing material: FYM + SMS (2:1, v/v) both two years old (pH to be adjusted in the range of 7.5 with CaCO_3).
- The casing material should be water leached for 8 hours before treatment with steam/chemicals. Uniform layer of casing to be applied on mycelia impregnated compost, with use of 4cm wide metal rings (4 cm thick).
- Harvest mushrooms in button form, removing the soiled stem end with knife before weighing. Do not discard the weight of open mushrooms, but the number of mushrooms opened in each harvest should be recorded to determine the quality of the fruit body produced by a particular strain.
- Average fruiting body weight to be recorded in each treatment (Total weight of mushrooms harvested divided by No. of mushrooms harvested) to determine the quality of mushrooms produced and ultimately the dry weight of the mushroom.
- Every effort should be made to strictly adhere to the above instructions to

facilitate generation of uniform data for assessment and final recommendation.

Expt. 03: Strain evaluation of paddy straw mushroom, *Volvariella volvacea*

a) Participating centres

Faizabad, Coimbatore, Raipur, Ranchi, Samastipur, Bhubaneswar

b) Substrate

1.5% CaCO_3 mixed water soaked (12-14 hours) paddy straw bundles (45 cm x15 cm)

c) Method

Bundle method (5 bundles x 4 layers + 2 bundles opened at the top) with plastic sheet covering for whole cropping period (tight during spawn run and loosely during cropping) with intermittent water spray on mushroom beds

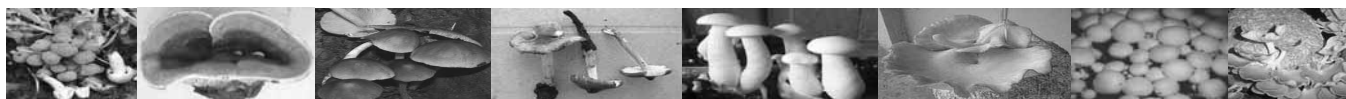
d) Strains

Vv-01, Vv-09, Vv-11, Vv-12 and Vv-13

e) 4 replications each with 3 beds for each strain

f) Data to be recorded

- Substrate moisture
- Substrate temperature during spawn run, pinning and cropping
- Relative humidity during cropping
- Time taken for mycelial colonization of the substrate



- Time taken for first harvest (days post-spawning)
- Mushroom yield weekly (kg/100 kg dry substrate) for 2 weeks cropping period
- Average fruiting body weight
- Incidence of diseases/insect-pests, if any
- Fruiting body quality of unopened mushroom (length, breadth, shape, colour and dry weight)
- Enclosure of ANOVA with data sheet

Expt. 04: Strain evaluation of oyster mushroom (*Pleurotus sajor-caju*)

a) Participating centres

Raipur, Barapani, Faizabad, Ranchi, Vellayani, Bhubneswar, Samastipur, Hisar, Passighat and Udaipur

Pleurotus florida: Four hybrid strains and one parent strain

Pleurotus sajor-caju: Four hybrid strains and one parent strain

b) Substrate

Wheat straw or paddy straw

- Substrate treatment : Hot water treatment (60-65°C for 2 hrs, pH to be adjusted to 7.50 with CaCO_3)
- Substrate quantity : 4 kg wet wt. (with 70 % moisture)/bag
- No of replications : 5 replication each with 8 bags and all bags of one replication to be placed in one tier (RBD)

c) Containers

Polybag (45 x 30 cm)

d) Season for laying trials

- Winter months between Dec. – Feb. for *P. florida*,
- Summer months for *P. sajor-caju* (August to September)

e) Information to be provided

- Substrate used and substrate preparation method
- Date of spawning
- Date of opening bags
- Max. and minimum temperature and RH% in the cropping rooms
- (Separate sheet is enclosed for recording)
- Daily yield record (replication wise)

f) Data to be recorded

- Days taken for spawn run.
- Days taken for pinhead formation.
- Yield data (number and weight upto 4 weeks).
- Time taken for I, II and III flush.
- Fruit body observations of individual hybrid strain
 - Pileus size, colour, stipe length, stipe thickness, organoleptic tests-liking of the consumers and coloured photograph of each strain.
 - The data on pileus and stipe size/thickness are to be recorded for at least 10 fruitbodies



Table 1. Cropping room temperature and relative humidity (RH) data

Date	Temperature (°C)		RH (%)	Remarks (bag opening, pinhead formation, 1 st harvest)
	Maximum	Minimum		

Table 2. Mushroom yield data

S.No.	Strain	Replication	Yield/bag (g)	Yield kg/100 kg dry substrate
1.	PF-01	R-1		
		R-2		
		R-3		
		R-4		
		R-5		
2.	PF-02	R-1		
		R-2		
		R-3		
		R-4		
		R-5		

- vi. Pest and disease incidence (as per proforma)
- vii. Photographs of each hybrid

II. CROP PRODUCTION

1. Button Mushroom

Expt. 05: To test role of heterotrophic bacterium *Alcaligenes faecalis* in button mushroom yield stimulation

a) Participating centres

- i. Short method compost: Pantnagar, Pune, Hisar and Murthal
- ii. Long method compost: Ludhiana, Faizabad, Udaipur and Samastipur

b) Substrate treatment

- i. FYM + SC (1:1; v/v), both two year old well rotted + culture of *A. faecalis*
- ii. FYM + SC (1:1; v/v), both two year old well rotted
- iii. Spent compost (2 year old) + culture of *A. faecalis*
- iv. Spent compost (2 year old)
- v. Coir pith + FYM (1:1; v/v) + culture of *A. faecalis*
- vi. Coir pith + FYM (1:1; v/v)
- vii. Coir pith + culture of *A. faecalis*
- viii. Coir pith



FYM and spent compost to be used should be two years old and coir pith well decomposed and mixing of broth culture of bacterium containing 10^5 to 10^6 cells/ml at the time of casing

c) No. of replications

Four replication with 3 bags of 10 kg compost/bag for each treatment

d) Design

RBD

e) Cost benefit ratio

f) Brief Description of Methodology

Cultivation method same as for Expt. No. 1

g) Data to be recorded

- i. pH
- ii. Water holding capacity
- iii. Conductivity
- iv. Density
- v. Quantitative enumeration of bacterial and fungal population
- vi. Yield (No. and weight of mushrooms).

2. *Agrocybe aegerita*

Expt. 06 Standardization of the cultivation technology of *Agrocybe aegerita*

a) Participating centres

Pantnagar, Coimbatore, Udaipur, Solan, Ludhiana, Murthal, Samastipur and Raipur.

b) Substrate

- i) Saw dust (SD)/paddy straw (at Coimbatore)
- ii) Wheat straw (WS)
- iii) SD + 5% wheat bran
- iv) Wheat straw + 5% wheat bran

c) Method of substrate preparation

Autoclaving at 22 p.s.i. for 1.50 h

d) Substrate quantity

2 kg /bag wet wt. basis

e) Spawn rate

@ 5% on wet weight basis

f) No. of replication

6 replications each with 4 bags in RBD

g) Observation to be recorded

Time (days) taken for spawn run

Time (days) taken for primordial formation

Total No. of fruit bodies/bag

Total mushroom yield/bag

- i) Cost benefit ratio



3. Shiitake mushroom (*Lentinula edodes*)

Expt. 07. Cultivation of shiitake mushroom, *Lentinula edodes*

a) Participating centres

Pantnagar, Coimbatore, Pune, Udaipur, Solan, Ludhiana, Bhubneswar, Samastipur, Hisar, Passighat and Raipur

b) Strain

OE-142

c) Substrate

- i) Saw dust (Broad leaved hard wood trees)
- ii) Wheat straw
- iii) Saw dust + wood chips in 1:1 ratio and supplementation with wheat bran @ 20% and treatment with 3% CaCO_3 on dry weight basis

d) Supplement

Wheat bran @10 and 20% dry weight basis

e) Method of substrate

Autoclaving preparation

f) Spawn rate

5% on wet weight basis

g) No. of replication

20 each (2 kg/bag) using T test in RBD design

h) Observation to be recorded

- i) Time taken for spawn run and total yield
- ii) Analysis for contents of carbohydrates and peripherals etc. of the substrates

i) Production technology to be followed

Take 40 kg hard wood broad leaved trees' saw dust



Add water (65%) for thorough wetting overnight



Add wheat bran and mix thoroughly



Fill in polypropylene bags 2kg each and put ring and cotton plug



Autoclave at 121°C for 1/2 hours



On cooling spawn aseptically @ 5% wet weight basis.



Incubate at 24°C



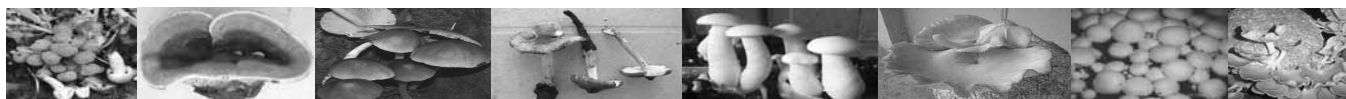
After completion of spawn run (about 60 days) allow them to turn brown.



Remove the PP bags and dip the blocks in chilled water (4-5°C) for about 5 minutes.



Keep the block for fruiting at <20°C



j) Cost benefit ratio

III. POST HARVEST TECHNOLOGY

Expt. 08: Drying of oyster (*Pleurotus* spp.), milky (*C. indica*) and paddy straw mushroom (*V. volvacea*)

a) Participating centres

Oyster mushroom: Hisar and Solan

Milky mushroom: Hisar and Solan

Paddy straw mushroom: Hisar and Solan

b) Strain/species

Oyster mushroom: *P. florida*, *P. sajor-caju* or local preference

Milky mushroom: C.I.-03 (40-50 gm size)

Paddy straw mushroom: Vv-11

c) Treatments

- i) Blanching (0.2% salt + 0.1% citric acid for 2 minutes)
- ii) Simple dipping (0.2% salt + 0.1% citric acid for 2 minutes)
- iii) No pretreatment simple sun drying
- iv) Cabinet drying ($40 \pm 2^\circ\text{C}$ till constant weight is achieved)
- v) Cabinet drying ($60 \pm 2^\circ\text{C}$ till constant weight is achieved)

d) Observation

1. Quality on Re-hydration / Reconstitution

2. Total microflora count

3. Weight gain/loss

4. Whiteness/yellowness

5. Brittleness

6. Keeping quality in pack of 100 gauge PP (3 months – rottage, insect attack, off-flavour etc.)

e) Cost benefit ratio

Expt. 09. Post harvest storage of paddy straw mushroom, *Volvariella volvacea*

a) Participating centres

Solan

b) Strain/species

Strain Vv-11

c) Treatments

- i) Polypropylene bag (100 gauge) open - Room temperature
- ii) PP bag (100 gauge) open – Refrigerated condition
- iii) PP bag (100 gauge) open – Deep freezer (-20°C)
- iv) PP bag (100 gauge) sealed – Room temperature
- v) PP bag (100gauge) sealed–Refrigerated conditions
- vi) PP bag (100 gauge) sealed – Deep freezer (-20°C)



- vii) Paper envelope – Room temperature
- viii) Paper envelope – Refrigerated conditions
- ix) Paper envelope – Deep freezer (-20°C)
- x) Air tight container – Room temperature
- xi) Air tight container – Refrigerated conditions
- xii) Air tight container - Deep freezer (-20°C)

d) Replications

Ten fruiting bodies harvested at button stage (unopened)

e) Observations

- i. Loss in weight after 24 & 48 hours (%)
- ii. Veil opening after 24 & 48 hours (%)
- iii. Loss in texture/toughness after 24 & 48 hours (range)
- iv. Specific odour if any (foul or pleasant)
- v. Liquefaction if any (yes/no, if yes then level)

- vi. Specific remarks like fungal growth or bacterial spoilage (yes/no)

f) Cost benefit ratio

IV. EXTENSION ACTIVITIES

1. Organization of at least 3 training programmes of 3-7 days duration each preferably in March, August and October months of the year.
2. Involvement of women in training programmes to empower them and help in creation of self help groups.
3. Organization of two field days at the farm of the progressive farmer.
4. Active participation in Workshops, Kisan-mela and Demonstration etc.
5. Development of mushroom museum
6. Supply of quality mushroom spawn to mushroom growers mentioning the quantity.
7. Feedback on diseases of respective areas
8. Impact analysis of training programmes and spawn supply data in kg instead of packets



4. RESEARCH PROGRESS

1. CROP IMPROVEMENT

1.1 Testing of different strains of white button mushroom *Agaricus bisporus*

This experiment was conducted in two sets (i) on long method-unpasteurized compost and (ii) on short method pasteurized compost. The experiment was assigned to different centres separately on short and long method compost and also the strains to be tested were different for short and long method compost. Udaipur, Ludhiana, Faizabad and Samastipur centres were assigned the experiment to evaluate the strains on long method compost, while Pune, Pantnagar, Solan, Hisar and Murthal on short method compost. The sample size of the experiment was six bags of 10 kg compost each in one replication and the experiment was replicated four times. The parameters of

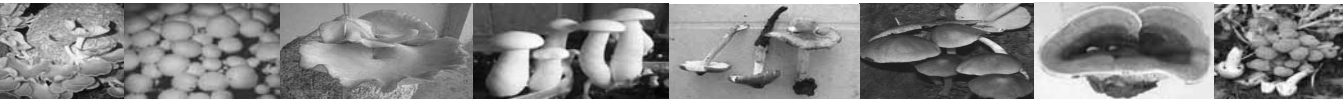
compost i.e. pH, nitrogen, moisture and colour were also recorded.

In trials conducted using the long method compost, maximum yield of 15.80 kg per 100 kg compost was recorded in the strain ABL-3 at Ludhiana Centre, followed by in the same strain at Faizabad centre. ABL-1 was the best performing strain at Udaipur centre. At Samastipur centre the experiment was not successful. Overall average productivity of ABL-1 strain was recorded to be the best followed by ABL-3 at all the centres (Table 1).

The compost parameters recorded at various centres have clearly indicated that the pH of the compost ranged between 6.67 to 7.5 while nitrogen percent between 1.68 to 2.0 and the moisture percent 69-75%. Colour of compost was invariably dark brown at all the centres. The parameters indicated that there was slight variation in the values but overall

Table 1. Yield of different strains of white button mushroom on long method compost in four weeks of cropping

A. bisporus strain	Mushroom yield (kg/100 kg compost) at different Centres				
	Udaipur	Ludhiana	Faizabad	Solan	Average
ABL-1	13.47	10.70	11.94	13.50	12.40
ABL-2	12.44	4.09	9.56	9.30	8.85
ABL-3	10.80	15.80	14.00	8.60	12.30
ABL-4	10.97	11.77	10.47	—	11.07
ABL-5	11.54	—	10.54	10.42	10.83
ABL-6	10.95	7.17	8.46	13.20	9.95
ABL-7	10.96	9.33	11.53	11.80	10.91
ABL-8	9.76	9.32	9.72	8.40	9.30
CD (0.05)	1.207	2.2	2.8	1.26	



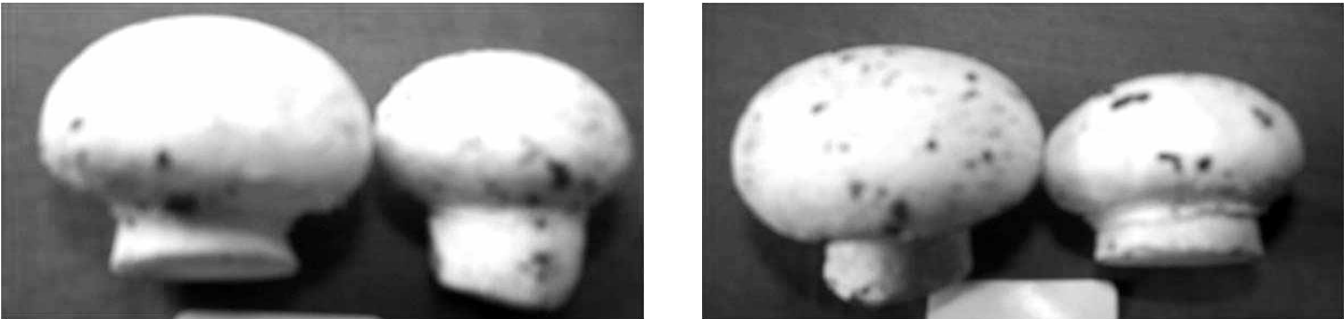


Fig. 1. Fruit bodies of ABL-2 (left) and ABL-6 (right) at Udaipur centre

Table 2. Compost parameters for long method compost

Centres	pH	Nitrogen (%)	Moisture (%)	Colour
Udaipur	6.65	1.68	69	Dark brown
Ludhiana	7.5	2.0	67	Dark brown
Faizabad	7.1	1.7	69.5	Dark brown
Samastipur	—	—	—	—
Solan	6.7	1.85	75	Dark brown

the parameters were well within the recommended range.

In another set of experiment on evaluation of *A. bisporus* strains using short method of compost, highest yield of 24.80 kg/100 kg compost was recorded in the strain ABS-4 at Murthal centre, followed by strain ABS-2 at Pantnagar centre (21.44 kg). The lowest yield of 10.95 kg/100 kg compost was recorded in ABS-3 strain at Pune centre. At Pune centre, the best performing strain was ABS-7 with an average yield of 14.32 kg /100 kg compost while at Hisar centre the best performing strain was ABS-4 with an average yield of 16.8 kg/100kg compost. At Solan centre the best performing strains were ABS-2, ABS-4 and ABS-5. Overall average of all the strains at all the centres shows that ABS-4 with an average yield of 18.87 kg was the best performing strain in all the conditions, followed by ABS-2 with an average yield of 17.48 kg. However,

all other strains performed well and were found at par with each other (Table 3).

The analysis of the compost at different centres showed that all the parameters varied in a very narrow range, like pH 7.2 to 7.3, nitrogen 2.1 to 2.2% and moisture 65 to 70%.



Fig. 2. fruitbodies of ABS-6 strain of button mushroom at Murthal centre



Table 3. Yield of different strains of white button mushroom on short method compost in four weeks of cropping

A. bisporus strain	Mushroom yield (kg/100 kg compost) at different Centres					
	Pune	Pantnagar	Hisar	Murthal	Solan	Average
ABS-1	13.71	16.89	14.3	17.28	8.10	14.06
ABS-2	12.70	21.44	15.2	18.16	19.90	17.48
ABS-3	10.95	19.62	16.2	21.18	8.70	15.33
ABS-4	13.84	19.73	16.8	24.80	19.20	18.87
ABS-5	14.15	15.73	15.1	17.04	19.50	16.30
ABS-6	13.92	17.28	15.6	19.32	16.30	16.48
ABS-7	14.32	16.64	14.5	17.16	15.40	15.60
ABS-8	—	14.48	14.1	16.06	18.30	15.74
CD (0.05)	0.17	2.65	0.8	0.71	0.91	

Table 4. Compost parameters for short method compost

Centres	pH	Nitrogen (%)	Moisture (%)	Colour
Pune	7.3	2.2	65	Dark brown
Pantnagar	7.2	2.1	70	Dark brown
Hisar	7.2	2.1	68	Dark brown
Murthal	—	—	—	—
Solan	—	—	—	—

This analysis shows that when compost is made by short method of composting involving bulk pasteurization the variation in compost parameters were minimized and uniform compost was prepared.

The time taken in first harvest (days post casing) when crop is raised using long method compost was lowest 20 days in strain ABL-3 at Faizabad centre, followed by ABL-2 and ABL-5 strains 21 and 22 days, respectively at the same centre. At Ludhiana centre the days taken for first harvest ranged between 24-28 days post casing and the lowest was 24 days in all the strains except ABL-2 and ABL-6. The highest time taken for first harvest was at

Udaipur centre and it ranged between 35-37 days (Table 5). Overall average showed the



Fig. 3. Strain ABS-2 under Fruiting condition at Nauni centre

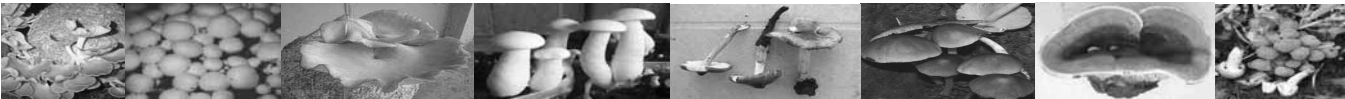


Table 5. Time taken to first harvest and average fruit body weight in strains of *A. bisporus* on long method compost

<i>A. bisporus</i> strain	Time taken for first harvest (days post casing) and fruit body wt (g)							
	Udaipur		Ludhiana		Faizabad		Average	
	a	b	a	b	a	b	a	b
ABL-1	35	11.23	24	11.5	23	21.23	27.33	14.65
ABL-2	37	10.68	28	14.6	21	21.33	28.67	15.54
ABL-3	35	09.35	24	12.6	20	21.13	26.33	14.36
ABL-4	35	10.72	24	13.6	24	20.23	27.67	14.85
ABL-5	37	09.35	—	—	22	19.87	29.50	14.61
ABL-6	35	11.65	27	15.1	26	21.03	29.33	15.93
ABL-7	37	11.44	24	14.4	27	21.05	29.33	15.63
ABL-8	37	10.19	24	14.4	28	21.72	29.67	15.44

a. First harvest (days post casing); b. average fruit body wt (g)

lowest time taken for first harvest was 26.33 days in the strain ABL-3.

Average fruit body weight also varied at different centres and was recorded highest (21.72 g) at Faizabad centre in the strain ABL-8, followed by ABL-2. The fruit body weight recorded at Ludhiana centre was 14.6 g in strain ABL-2, closely followed by strain ABL-8 (14.4 g). At Udaipur centre, the highest fruit body weight was recorded to be 11.65g in the strain ABL-6, followed by ABL-7 (11.44 g). The overall average shows the highest fruit body weight in the strains ABL-6, 7, 8. The data in table 5 indicates that strains having higher fruit body weights are generally low yielders.

The time taken for first harvest crop raised on steam-pasteurized compost was lowest of 23 days (post casing) in strains ABS-3, ABS-4 and ABS-8 at Hisar Centre, while also 23 days in strain ABS-6 at Pantnagar centre. The

highest time taken for first harvest was 42 days in strain ABS-1 at Pune centre, although all the strain took 39-42 days at Pune centre for first harvest. The overall average of time taken for first harvest showed the minimum days in ABS-8. In rest of the strains the lowset time taken was 28.67 days ABS-4 and ABS-7.

The average fruit body weight ranged in 10 to 15.2 g with highest in strain ABS-7 at Hisar centre. At Pantnagar centre the highest fruit body weight recorded was 14.39 g in the strain ABS-2 and minimum in strain ABS-8, while at Pune centre highest fruit body weight was recorded to be 14 g in ABS-5 and ABS-7. Overall average of the fruit body weight showed highest 13.72 g in strain ABS-7 followed by ABS-4 (13.57 g) while lowest was 11.70 g in strain ABS-3. Quality of fruit body in general was good in all the strains of *A. bisporus*, however, the quality of fruit bodies in strain ABS-3 and ABS-4 was found to be superior at Pantnagar centre.



Table 6. Time taken to first harvest and average fruit body weight in strains of *A. bisporus* on short method compost

<i>A. bisporus</i> strain	Time taken for first harvest (days post casing) and fruit body wt (g)							
	Pune		Pantnagar		Hisar		Average	
	a	b	a	b	a	b	a	b
ABS-1	42	11	27	12.95	24	13.7	31.00	12.55
ABS-2	41	12	23	14.39	26	13.5	30.00	13.30
ABS-3	41	10	29	13.81	23	11.3	31.00	11.70
ABS-4	40	12	23	13.91	23	14.8	28.67	13.57
ABS-5	41	14	26	11.74	26	12.6	31.00	12.78
ABS-6	40	13	23	12.50	25	14.8	29.33	13.43
ABS-7	39	14	23	11.96	24	15.2	28.67	13.72
ABS-8	—	—	26	10.87	23	13.4	24.50	12.14
CD (0.05)						1.6		

a. First harvest (days post casing); b. average fruit body wt (g)

Disease incidence in the button mushroom crop was also recorded at different centres but very low or no disease incidences could be recorded. However, in some cases phorid flies were seen on the beds but in a very low population.

1.2 Strain evaluation of paddy straw mushroom, *Volvariella volvacea*

The trial was assigned to seven centres and a total of five strains of *Volvariella volvacea* were tested. The biological efficiency of various strains varied in the range of 2.36 to 26.3 kg /100 kg of dry substrate at various centre in different strains. The highest biological efficiency of 26.3 kg /100 kg of dry substrate was recorded in strain Vv-01 at Coimbatore centre, followed by 22.0 kg in strain Vv-12 at the Ludhiana centre. It was also recorded that higher biological efficiency for all the test strain was achieved at the Coimbatore centre, while the lowest at Raipur



Fig. 3. Strain ABS-2 under Fruiting condition at Nauni centre

centre with an average yield of 2.36 kg /100 kg of dry substrate. At Bhubaneswar centre, highest and lowest biological efficiency recorded was 16.42 kg and 11.74 kg, respectively. At Ranchi centre, highest BE recorded was 10.1 kg in strain Vv-13, while lowest of 3.9 kg in strain Vv-12. At Faizabad centre, highest BE was obtained in strain Vv-01 (13.32 kg) and lowset of 5.69 kg in strain

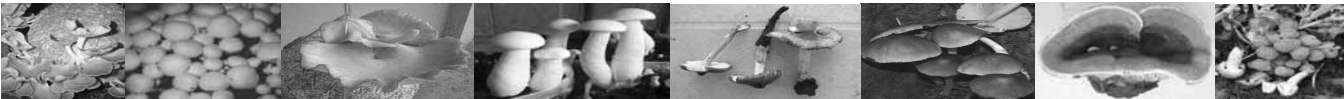


Table 7. Yield of different strains of Paddy Straw Mushroom, *Volvariella volvacea*

Strain	Mushroom yield (kg/100kh dry substrate)							
	Faizabad	Coimbatore	Raipur	Ranchi	Bhubaneswar	Solan	Ludhiana	Average
Vv-01	13.32	26.3	3.13	—	11.74	15.67	16.97	14.52
Vv-09	11.41	17.25	5.09	9.3	14.85	18.85	17.22	13.42
Vv-11	5.69	17.5	7.79	8.5	16.42	7.88	17.32	11.59
Vv-12	7.73	21.5	2.36	3.9	13.31	18.50	22.0	12.76
Vv-13	7.37	20.5	—	10.1	12.67	18.95	12.92	13.75
CD (0.05)	1.21	1.26	0.62	1.12	1.449	1.98	1.07	

Vv-11. The overall average showed that the highest BE (14.52 kg) was recorded in Vv-01 strain, while lowest (11.59 kg) in strain Vv-11.

Average fruit body weight varied at different centres with highest of 23.0 g at Coimbatore centre in the strain Vv-09, while lowest of 9.60 g at Bhubaneswar centre in the same strain Vv-09. All the strains have recorded the highest fruit body weight at Coimbatore centre itself, followed by Bhubaneswar centre. The highest fruit body weight recorded at Bhubaneswar centre was 17.75 g in strain Vv-13. At Ranchi centre the highest and lowest fruit body weight was

16.46 g and 10.13 g in strains Vv-12 and Vv-1, respectively. At Faizabad centre highest fruit body weight (12.38 g) was recorded in strain Vv-13, followed by Vv-11, while lowest was 11.80 g in strain Vv-12. Overall average showed that the highest fruit body weight (16.08 g) was in strain Vv-12, while lowest (13.92 g) in Vv-09 strain.

The lowest time taken for the first harvest was 9 days in strain Vv-12 at Ludhiana centre and 11 days in strain Vv-13 at Ludhiana centre. The overall average also indicated the lowest time taken for the first harvest was in strain Vv-12, while the highest time in strain Vv-01. A low level of disease incidence could be recorded in one centre in one strain.

Table 8. Average fruit body weight (g) and time taken to first harvest in strains of paddy straw mushroom

Strain	Average fruit body weight (g) and time taken for first harvest (days)												
	Faizabad	Coimbatore	Raipur	Ranchi	Bhubaneswar			Solan	Ludhiana		Average		
	a	a	b	a	a	b	c	a	b	a	b	a	b
Vv-01	12.23	20.2	16	10.13	13.87	16	-	13.66	14.81	14.0	12	14.02	14.70
Vv-09	11.96	23.0	14	12.34	9.60	14	+	13.30	13.50	12.9	12	13.85	13.38
Vv-11	12.23	20.5	13	13.49	13.82	13	-	15.27	13.28	11.6	12	14.49	12.82
Vv-12	11.80	20.0	12	16.46	17.18	16	-	15.53	13.55	13.9	09	15.81	12.64
Vv-13	12.38	18.0	14	10.13	17.75	16	-	14.13	14.37	14.9	11	14.55	13.84

a: average fruit body wt (g); b: time taken for first harvest (days): c: disease appearance



1.3 Strain evaluation of Oyster Mushroom species (*Pleurotus florida* and *P. sajor caju*)

This trial was conducted at 10 different centres. A total of four hybrids and one parent strain of both the *Pleurotus* species were under trial. Amongst strains of *P. florida*, the maximum yield of 134.4 kg /100 kg of dry substrate was obtained in strain P-1 at Ranchi Centre followed by strain P-2 (111.4 kg) at the same centre. At Raipur, Barapani, Hisar and Udaipur centres the best performer strain was again the P1 with 92.35, 80.6, 62.7 and 87.21 kg mushroom yield, respectively while at Faizabad, Vellayani, and Bhubaneshwar centre the best performer strain was P-4. At Samastipur centre strains P-5 followed by P-4 performed well. Cumulative average of the yield showed the maximum yield of 72.98 kg / 100 kg of dry substrate in strain P-1.

Amongst *P. sajor caju* strain, maximum yield of 104.42 kg / 100 kg of dry substrate was recorded in strain P-9 at Raipur centre followed by strain P-6 (91.4 kg) and P-9 (87.2 kg) at Barapani centre. At Faizabad centre the

maximum yield of 56.5 kg was recorded in strain P-6 while at Ranchi and Samstipur centre again P-9 strain performed the best with 84.98 and 82.40 kg yield, respectively. At Hisar centre strain P-8 gave maximum yield of 60.4 kg while at pasighat and Udaipur centre P-10 strain yielded best. Overall average indicated that P-9 out yielded all the other strains with a productivity of 57.98 kg.

In case of *P. florida*, minimum time taken (23.1 days) in first harvest of the crop was recorded in strain P-4 at Vellayani centre. While maximum time taken was 66.6 days in strain P-2 at Barapani centre. The overall average of all the centres showed the minimum time taken in first harvest was in P-1 strain (32.63 days). Amongst *P. sajor caju* strain, the minimum time taken for first harvest (20 days) was observed in the strain P-6 and P-9 at Samastipur centre. While maximum time taken was 45 days in strain P-10 at Udaipur centre. Overall average of all the centres indicated that the minimum time was taken for first harvest in strain P-6 (29.83 days) closely followed by strain P-7 (30.98 days).



Fig. 5. Strains of *P. florida* under fruiting at Raipur centre (Left) and at Ranchi centre (right)

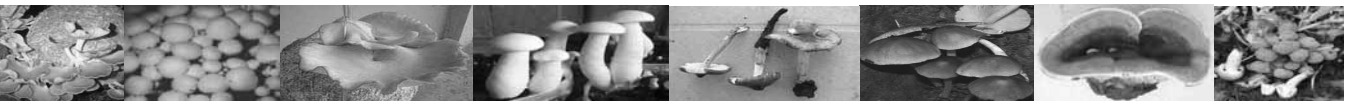


Table 9. Strain evaluation of oyster mushroom species (*P. florida* and *P. sajor caju*)

Strain/ Hybrid	Mushroom yield (kg/100 kg of dry substrate)											
	Raipur	Barapani	Faizabad	Ranchi	Vellayani	Bhubneswar	Samastipur	Hisar	Pasighat	Udaipur	Solan	Average
<i>Pleurotus florida</i>												
P-1	58.27	80.6	55.52	134.3	43.31	94.16	50.40	62.7	—	87.21	63.33	72.98
P-2	63.62	33.7	62.64	103.8	24.55	86.25	58.60	53.1	—	68.21	16.0	57.05
P-3	69.95	74.1	58.08	111.4	27.90	85.66	42.50	62.5	—	74.07	50.16	65.63
P-4	58.35	69.6	68.72	79.92	47.32	98.83	80.30	55.4	51.25	75.30	38.50	65.77
P-5	35.56	53.6	42.24	75.03	30.32	84.91	84.00	46.3	—	73.22	27.17	55.24
<i>Pleurotus sajor caju</i>												
P-6	63.62	91.4	56.50	51.7	31.48	68.16	80.50	59.8	46.25	44.52	40.50	57.68
P-7	36.48	79.9	19.60	—	17.38	69.33	48.40	47.1	—	57.13	40.0	46.15
P-8	37.68	70.2	3.80	76.45	15.03	62.00	57.60	60.4	43.25	51.20	44.0	47.42
P-9	104.42	87.2	14.60	84.98	17.30	61.66	82.40	51.7	—	55.94	19.58	57.98
P-10	59.22	83.3	13.9	66.13	15.12	77.16	—	55.6	47.88	60.53	29.17	50.80
CD 5%	0.139	7.69	1.40	5.39	4.21	6.82	3.54	10.3	3.24	0.87	4.60	—

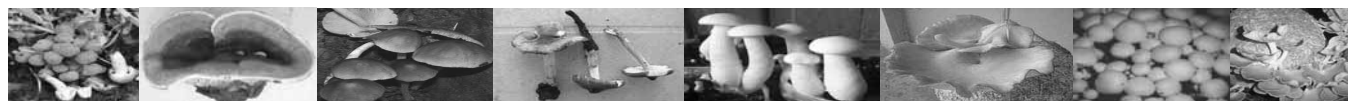




Fig. 6. *P. sajor caju* under fruiting at Bhubaneshwar (left) and Pasighat centre (right)

Average fruit body weight of strains of *P. florida* at different centre ranged between 4.55 to 21.08 g. The maximum fruit body weight of 21.08 g was recorded in P-4 strain at Barapani centre while the minimum of 4.55 g was recorded in P-1 strain at Udaipur centre. Overall average showed the maximum fruit body weight of 10.53 g in strain P-4 and the lowest of 7.84 g in P-3 strain.

In case of *P. sajor caju*, the maximum fruit body weight of 13.91 g was recorded in P-9 at Raipur centre while the minimum of 3.45 g in strain P-8 at Raipur centre itself. In general the lowest fruit body weight was recorded in all strains at Udaipur centre, which ranged between 3.72 to 4.54 g. The overall average indicated the maximum fruit body weight of 7.33 g in strain P-9 followed by strain P-10.

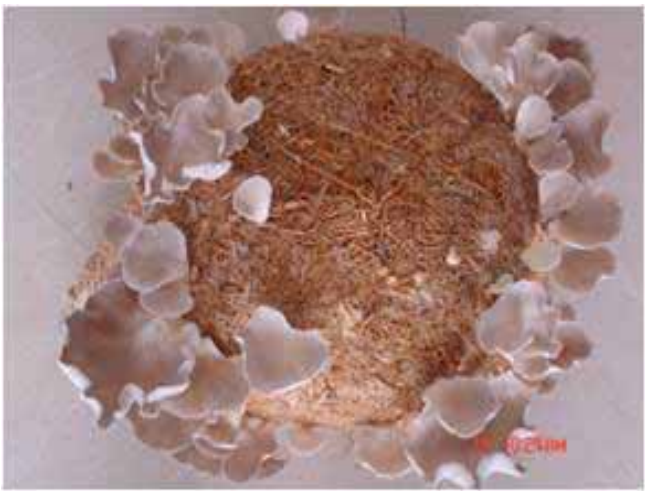


Fig. 7. *Pleurotus florida* (left) and *P. Sajor caju* (right) under fruing at Faizabad centre

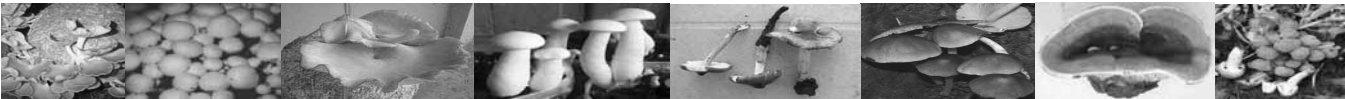


Table 10. Time taken for first harvest in different strains of *P. florida* and *P. sajor-caju*

Strain/	Time taken for first harvest (Days post spawning)									
Hybrid	Raipur	Barapani	Faizabad	Vellayani	Bhubneswar	Samastipur	Hisar	Passighat	Udaipur	Average
<i>Pleurotus florida</i>										
P-1	30	41.2	—	26.2	24	35	38	—	34	32.63
P-2	34	66.6	—	27.4	26	30	38	—	28	35.71
P-3	34	43.3	—	28.3	29	32	36	—	40	34.66
P-4	35	50.1	—	23.1	26	26	43	36	36	34.40
P-5	35	56.4	—	28.6	29	25	37	—	38	35.57
<i>Pleurotus sajor-caju</i>										
P-6	31	21.95	34.0	33.5	29	20	33	31	35	29.83
P-7	33	23.15	33.5	28.2	29	25	38	—	38	30.98
P-8	36	23.3	34.0	33.6	28	25	39	31	36	31.77
P-9	33	24.03	33.5	37.5	29	20	36	—	42	31.88
P-10	33	22.95	34.0	33.5	29	—	40	32	45	33.68
CD 5%	—	2.09	2.8	—	—	—	—	—	—	—

Table 11. Average fruit body weight in different strains of *P. florida* and *P. sajor-caju*

Strain/ Hybrid	Average fruit body weight (g)							Average
	Raipur	Barapani	Faizabad	Bhubneswar	Hisar	Udaipur		
<i>Pleurotus florida</i>								
P-1	12.80	14.71	9.4	6.98	9.1	4.55		9.59
P-2	12.44	8.50	9.1	7.36	8.2	10.03		9.27
P-3	7.09	10.37	7.5	7.01	10.2	4.89		7.84
P-4	10.95	21.08	8.9	8.18	9.5	4.56		10.53
P-5	12.33	13.10	8.88	6.40	10.4	6.49		9.60
<i>Pleurotus sajor-caju</i>								
P-6	6.36	8.72	6.25	4.32	5.2	3.72		5.76
P-7	7.18	13.91	4.45	4.71	4.7	4.34		6.55
P-8	3.45	8.50	5.30	4.20	5.5	3.89		5.14
P-9	13.45	8.13	6.0	4.27	7.6	4.54		7.33
P-10	9.74	10.81	5.94	4.31	6.8	4.44		7.01
CD 5%	—	5.98	0.41	—	0.7	0.23		—





Fig. 8. Fruit body of strains of *P. florida* (left) and *P. sajor-caju* (right) at Udaipur centre

2. CROP PRODUCTION

2.1 To test role of heterotrophic bacterium *Alcaligenes faecalis* in button mushroom yield stimulation

The trial was assigned to six different centres i.e. Ludhiana, Faizabad, Udaipur, Pantnagar, Pune and Hisar. Eight different treatments were tested which including FYM, spent mushroom substrate and coir pith alone and in combination. The bacterial inoculations

were also tested for probable yield enhancement in button mushroom. Significant yield enhancement was recorded at Pantnagar and Solan centre by inoculating the bacterium *Alcaligenes faecalis* in all the casing mixtures but the maximum yield of 21.27 kg / 100 kg of compost was obtained in the casing mixture made up of FYM + Spent compost + bacterium. At Ludhiana centre also, yield enhancement was noticed by bacterial inoculation but only with the casing mixture composed of FYM+SC. In other



Fig. 9. Button mushroom crop using Coir pith + FYM+ *A. faecalis* at Pune centre (left) and FYM+SC+ *A. faecalis* at Pantnagar centre

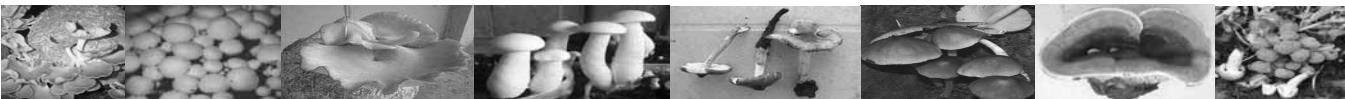


Table 12. Effect of bacterium *Alcaligenes faecalis* on yield of white button mushroom

Casing treatments	Mushroom yield kg/100 kg compost from 6 weeks of crooping							
	Ludhiana	Faizabad	Udaipur	Pantnagar	Pune	Hisar	Solan	Average
FYM + SC (1:1; v/v), both two year old well rotted + <i>A. faecalis</i>	11.47	7.73	13.20	21.27	19.25	13.7	16.96	14.80
FYM + SC (1:1; v/v), both two year old well rotted	10.46	7.91	10.46	19.24	18.60	15.1	13.68	13.64
Spent compost (2 year old) + culture of <i>A. faecalis</i>	10.09	7.37	14.53	20.55	18.85	15.4	—	14.47
Spent compost (2 year old)	13.92	6.33	12.24	18.84	17.95	15.8	—	14.18
Coir pith + FYM (1:1; v/v) + culture of <i>A. faecalis</i>	11.97	8.12	13.94	18.68	19.75	15.5	13.74	14.53
Coir pith + FYM (1:1; v/v)	16.35	8.17	11.22	16.67	18.45	14.1	11.32	13.75
Coir pith + culture of <i>A. faecalis</i>	08.40	7.39	12.06	17.86	18.30	14.4	13.04	13.06
Coir pith	06.33	7.23	11.65	15.37	17.60	14.8	15.86	12.69
CD (0.05)	01.02	0.9	1.11	1.80	0.69	0.5	2.36	

Table 13. Effect of bacterium *Alcaligenes faecalis* on time taken for first harvest and average fruit body weight

Casing treatments	Time taken for first harvest (days) and average fruit body weight (g)										
	Ludhiana		Faizabad		Udaipur		Pantnagar	Hisar		Average	
	a	b	a	b	a	b	b	a	b	a	b
FYM + SC (1:1; v/v), both two year old well rotted + <i>A. faecalis</i>	24	15.1	23	11.82	36	12.37	14.08	37	11.97	30.00	13.06
FYM + SC (1:1; v/v), both two year old well rotted	24	11.7	22	18.08	36	8.90	14.46	38	12.80	30.00	13.18
Spent compost (2 year old) + culture of <i>A. faecalis</i>	24	09.9	20	22.86	35	12.28	14.81	36	12.52	28.75	14.47
Spent compost (2 year old)	24	15.6	24	17.24	34	9.95	14.36	35	12.20	29.25	13.87
Coir pith + FYM (1:1; v/v) + culture of <i>A. faecalis</i>	24	15.1	22	18.57	35	10.16	14.36	37	14.22	29.50	14.48
Coir pith + FYM (1:1; v/v)	24	16.2	26	17.39	34	11.60	13.66	36	11.70	30.00	14.11
Coir pith + culture of <i>A. faecalis</i>	24	17.6	27	19.58	35	11.32	14.48	37	12.31	30.75	15.05
Coir pith	24	16.1	28	19.69	35	11.06	12.62	38	13.10	31.25	14.51
CD (0.05)			3.8					1.3			

a – Time taken for first harvest; b – Average fruit body weight



treatments at Ludhiana instead of yield enhancement, a decrease in yield was recorded. At Faizabad and Hisar centre also no yield enhancement was noticed. However at Pune centre slight yield enhancement was noticed. Overall average showed yield enhancement by inoculation of bacterium *Alcaligenes faecalis*.

Time taken in first harvest (days post casing) was recorded to be the minimum of 20 days in spent compost with bacterial inoculation at Faizabad centre while the maximum time of 38 days was recorded in FYM + SC without bacterial inoculation at Hisar centre. At Ludhiana, Hisar and Udaipur Centre no decrease in time to first harvest was recorded due to bacterial inoculations. Overall average of all centre showed no significant reduction in time taken to first harvest. On the hand, average fruit body weight was recorded to be the maximum 22.86 g in spent compost + *Alcaligenes faecalis* at Faizabad centre while the minimum (8.90 g) was in FYM + SC treatment at Udaipur centre. The average fruit body weight varied at different

centre and no correlation could be found with the casing material and treatment as one of the minimum fruit body weight of 9.09 g was obtained in FYM + SC treatment.

2.2. Standardization of the cultivation technology of *Agrocybe aegerita*

The trial was assigned to eight different centres but only four centres successfully carried out the experiment. A total of four treatments were given to the centres except the Coimbatore centre where instead of wheat straw use of paddy straw was assigned due to unavailability of wheat straw and abundance of paddy straw in the region. Maximum yield efficiency of 54.54 kg /100kg dry substrate was recorded at Pantnagar centre in wheat straw +5% wheat bran treatment while a minimum of 11.6 kg was recorded at Ludhiana centre in the same treatment. At Coimbatore the higher yield of 21.20 kg was obtained in paddy straw + 5% wheat bran treatment. In overall average maximum bio-efficiency was recorded in wheat straw + 5% wheat bran treatment.



Fig. 10. Crop of *Agrocybe aegarita* on wheat straw and wheat bran (5%) at Pantnagar (left) and Coimbatore (right)



Table 14. Evaluation of different substrate for cultivation of *Agrocybe aegerita*

Substrate	Mushroom yield kg/100 kg compost from 6 weeks of crooping			
	Pantnagar	Coimbatore	Ludhiana	Average
Wheat straw	34.42	—	19.7	27.06
WS+WB (5%)	54.54	—	11.6	33.07
Saw dust	12.60	—	—	12.60
SD+WB (5%)	13.22	—	—	13.22
Paddy straw	—	19.21	—	19.21
PS + WB (5%)	—	21.20	—	21.20
CD (0.05)	0.47		4.4	

The time taken for first harvest was recorded to be the least of 38 days in WS+WB (5%) treatment at Pantnagar centre while maximum of 85 days in sawdust treatment at the same centre. Overall average showed the minimum time taken for first harvest is also the WS+WB (5%) treatment. The average fruit body weight ranged between 6.8 g to 22.6 g. The maximum (22.6 g) was recorded in paddy straw treatment at Coimbatore centre while the minimum (6.8 g) was recorded in wheat straw treatment at Ludhiana centre.

2.3. Cultivation of shiitake mushroom, *Lentinula edodes*

The cultivation trial was conducted at 5 centres. A total of 12 substrates, their combinations and supplements were tested to obtain maximum yield of shiitake mushroom. Out of different substrates and supplements tested, maximum productivity of 43.37 kg /100 kg dry substrate was obtained in combination of wheat straw and wheat bran (20%) at Pantnagar closely followed by saw dust with

Table 15. Evaluation of different substrate for cultivation of *Agrocybe aegerita*

Substrate	Time taken for first harvest (days) and average fruit body weight (g)									
	Pantnagar		Coimbatore		Udaipur		Ludhiana		Average	
	a	b	a	b	a	b	a	b	a	b
Wheat straw	47	3.13	—	—	65	—	49	6.8	53.66	9.96
WS+WB (5%)	38	10.29	—	—	65	—	53	6.9	52.00	8.59
Saw dust	85	14.00	—	—	72	—	60	—	72.33	14.00
SD+WB (5%)	67	10.33	—	—	68	—	60	—	65.00	10.33
Paddy straw	—	—	64	22.6	—	—	—	—	64.00	22.6
PS + WB (5%)	—	—	60	22.4	—	—	—	—	60.00	22.4
CD (0.05)										

a-Time taken for first harvest; b – Average fruit body weight



Table 16. Evaluation of different substrate for yield of shiitake mushroom *Lentinula edodes*

Substrate	Mushroom yield (kg/100 kg substrate)					
	Pantnagar	Coimbatore	Pune	Udaipur	Ludhiana	Average
WS + WB 10%	27.63	—	7.695	—	31.4	22.24
WS + WB 20%	43.37	—	8.955	—	19.6	23.97
WS alone	24.04	—	—	—	—	24.04
SD + WB 10%	36.95	21.0	11.2	28.16	—	24.33
SD + WB 20%	35.22	18.0	14.26	40.97	—	27.11
SD alone	24.41	19.6	—	22.11	—	22.04
SD+WC+WB10%	39.08	—	—	24.90	—	31.99
SD+WC+WB20%	38.12	30.0	9.35	30.84	—	27.08
SD+WC alone	23.02	—	—	—	—	23.02
PS alone	—	7.5	—	—	—	7.5
PS+WB10%	—	13.9	—	—	—	13.9
PS+WB 20%	—	15.0	—	—	—	15
PS+WC+WB 20%	—	22.5	—	—	—	22.5
CD at 5%	11.03		1.49	2.05		

WS = wheat straw; WB = wheat bran; WC = wood chips; PS = paddy straw;



Fig. 11. Shiitake crop at Udaipur centre

wheat bran (40.97 kg) at Udaipur centre whereas the minimum yield of 7.5 kg was obtained in paddy straw substrate at Coimbatore centre. The lowest yiled potential of the mushroom was obtained at Pune centre

in all the treatments. Overall average of all the centres showed that maximum yield was obtained in SD+WC+WB20% treatment. This is due to the uniform yield of the treatment at all the centre except at Pune centre while WS+WB20% treatment showed lesser yield in overall average because of the low productivity of the treatment at Pune and Ludhiana centres.

The average fruit body weight varied at different centres and the maximum of 50.70 and 49.91 was recorded in WS+WB10% and WS+WB20% treatments, respectively at Pantnagar centre. Lowest fruit body weight was obtained in the paady straw treatment at Coimbatore centre. The maximum fruit body weight of 40.06 g in SD+WC treatment at Pantnagar centre.

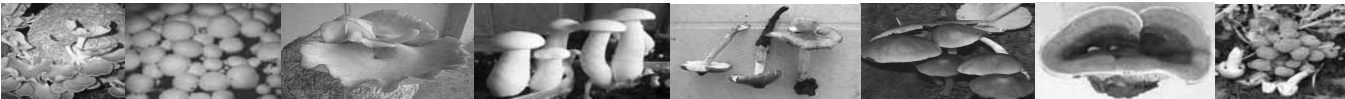


Table 17. Evaluation of different substrate for fruit body weight of shiitake mushroom *Lentinula edodes*

Substrate	Average fruit body weight (g)				
	Pantnagar	Coimbatore	Udaipur	Ludhiana	Average
WS + WB 10%	50.70	—	—	23.7	37.2
WS + WB 20%	49.91	—	—	16.6	33.26
WS alone	37.16	—	—	—	37.16
SD + WB 10%	37.10	21.0	17.28	—	25.13
SD + WB 20%	41.61	18.0	24.10	—	27.90
SD alone	37.15	19.6	16.02	—	24.26
SD+WC+WB10%	37.41	—	16.17	—	26.79
SD+WC+WB20%	38.84	30.0	19.28	—	29.37
SD+WC alone	40.06	—	—	—	40.06
PS alone	—	7.5	—	—	7.50
PS+WB10%	—	13.9	—	—	13.90
PS+WB 20%	—	15.0	—	—	15.00
PS+WC+WB 20%	—	22.5	—	—	22.50
CD at 5%					

WS = wheat straw; WB = wheat bran; WC = wood chips; PS = paddy straw

2.4. Evaluation of substrate for *P. ostreatus* at Nauni centre, Solan

At Nauni centre, Solan, different substrates were evaluated for production of *Pleurotus ostreatus* mushroom and a total of

ten substrate combinations were tried to obtain maximum yield of the mushroom. Amongst the substrate tested, the maximum yield of 99.8 kg /100 kg of dry substrate was recorded in cotton spinning waste followed by traditional wheat straw substrate. Cotton

Table 18. Evaluation of different substrate for cultivation of oyster mushroom (*Pleurotus ostreatus*)

Substrates	Dry wt. of substrates (kg)	Primordia Initiation (days)	First harvest (days)	Total yield (g)	Biological efficiency (%)
Wheat straw (control)	1	24	28	993.3	99.5
Wheat straw + wheat bran	1	29	33	833.3	83.3
Paddy straw	1	24	28	991.6	91.1
Paddy straw + wheat bran	1	29	33	801.6	80.1
Cotton spinning waste	1	22	26	998.0	99.8
Cotton zinning waste	1	23	26	945.0	94.5
Sugarcane bagasse	1	25	30	500.0	50.0
Coir pith	1	31	35	183.3	18.3
Saw dust	1	32	—	—	—
Saw dust +Coir pith	1	31	31	100.0	10.0
CD (0.05)	—	—	—	0.073	—



ginning waste also showed good results with 94.5 kg yield.

3. POST HARVEST TECHNOLOGY

3.1. Drying of oyster (*Pleurotus spp.*), milky (*C. indica*) and paddy straw mushroom (*V. volvacea*)

The trial was assigned to two centres i.e. Solan and Hisar Centre. In addition, Raipur centre has also conducted the trial. Five pretreatments were to be tested in this trial before sun drying of the mushroom and their quality and consumer acceptability has to be assessed. For this, the set parameters were whiteness, weight loss, brittleness, keeping qualities and rehydration properties of the mushrooms. In the drying pretreatments of oyster mushroom at Raipur centre, maximum whiteness was recorded when no pretreatment was given before sun drying whereas maximum weight loss was recorded in cabinet drying at 40°C. The keeping quality

was best when cabinet drying was used at 60°C temperature. Keeping qualities up to three month was good in all the treatments.

At Hisar centre the whiteness was found to be the maximum in blanching pretreatment as well as in cabinet drying whereas the weight loss was the maximum in cabinet drying. The brittleness and keeping quality was best in cabinet drying at 60°C. Rehydration properties of dried mushroom were recorded to be the best in blanched and cabinet dried samples.

In milky mushroom, three centres conducted the trials. Whiteness of the mushroom was observed to be the maximum in the blanched and dipping treatment followed by sun drying at Raipur centre while cabinet drying did not have good whiteness properties. The maximum water loss and brittleness was observed in cabinet drying treatments. Keeping qualities were good in all the treatments. At Pune centre also similar

Table 19. Effect of different drying treatments on quality characteristics of dried oyster mushroom

Treatments	Quality characteristics (whiteness, % wt loss, brittleness and keeping quality) of dried oyster mushroom					
	Raipur			Hisar		
	Whiteness	Weight loss (%)	Brittleness	Whiteness	Weight loss (%)	Brittleness
Blanching(0.2% salt+ 0.1% CA for 2 minutes)	3+	91.80	1+	3+	25.0	2+
Simple dipping(0.2% salt +0.1% CA for 2 minutes)	3+	91.96	1+	2+	+5.5	2+
No pre treatment simple Sun drying	4+	91.82	3+	1+	78.5	1+
Cabinet drying at 40°C	2+	93.41	1+	3+	89.0	3+
Cabinet drying at 60° C	1+	93.39	4+	3+	91.0	3+

Whiteness: 4+ snow white; 3+ white; 2+ half white; 1+ pale
Brittleness: 4+ maximum; 3+ medium; 2+ moderate; 1+ minimum

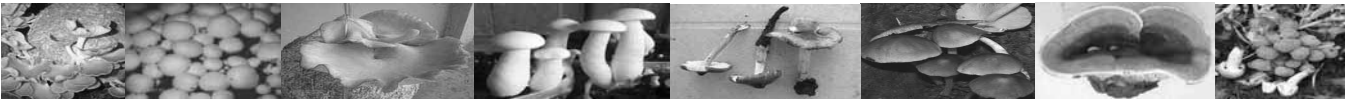


Table 20. Effect of different drying treatments on quality characteristics of dried milky mushroom

Treatments	Quality characteristics (whiteness, % wt loss, brittleness and keeping quality) of dried milky mushroom								
	Raipur			Pune			Hisar		
	a	b	c	a	b	c	a	b	c
Blanching(0.2% salt+ 0.1% CA for 2 minutes)	3+	88.11	1+	3+	82	2+	3+	-25.0	1+
Simple dipping(0.2% salt +0.1% CA for 2 minutes)	3+	86.30	1+	2+	83	3+	2+	+7.0	1+
No pre treatment simple Sun drying	3+	87.07	3+	2+	83	3+	1+	-71.0	2+
Cabinet drying at 40°C	2+	92.69	2+	3+	84	2+	2+	-85.0	2+
Cabinet drying at 60° C	1+	93.24	4+	2+	86	4+	2+	-91.0	3+

a- whiteness; b- weight loss (%); c- brittleness
Whiteness: 4+ snow white; 3+ white; 2+ half white; 1+ pale
Brittleness: 4+ maximum; 3+ medium; 2+ moderate; 1+ minimum

Table 21. Effect of different drying treatments on quality characteristics of dried paddy straw mushroom

Treatments	Quality characteristics (whiteness, % wt loss, brittleness and keeping quality) of dried paddy straw mushroom								
	Bhuvaneshwar						Ranchi		
	a	b	c	d	e	f	a	b	c
Pp bag open (Room conditions)	100	2.84	N	P	Y	N	O	65.5	N
Pp bag open (Refrigerated)	-	30.0	N	P	Y	N	N	41.4	N
Pp bag open (Freezer)	-	-	N	P	Y	N	—	—	—
Pp bag sealed (Room conditions)	50	-	N	F	Y	Y	O	22.1	Y
Pp bag sealed (Refrigerated)	-	-	N	F	Y	N	N	4.8	Y
Pp bag sealed (Freezer)	-	-	N	P	N	N	—	—	—
Paper envelop (Room conditions)	75	21.81	N	F	Y	Y	N	52.4	N
Paper envelop (Refrigerated)	-	5.90	N	P	Y	N	N	86.2	N
Paper envelop (Freezer)	-	-	N	P	N	N	—	—	—
Air tight container (Room conditions)	50	2.85	N	F	Y	Y	—	—	—
Air tight container (Refrigerated)	-	-	N	P	Y	N	—	—	—
Air tight container (Freezer)	-	-	N	P	N	N	—	—	—
Pun net packing (Room condition)	—	—	—	—	—	—	N	85.3	N
Pun net packing (Refrigerated)	—	—	—	—	—	—	N	75.0	Y

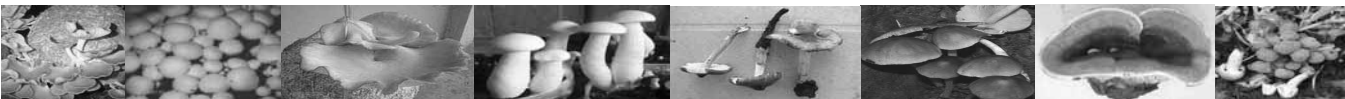
a- veil opening (%); b – moisture loss; c- liquifaction; d – change of odour; e – loss of texture; f - spoilage
Y - yes; N – no; O – open; P - pleasant, F - foul



results were obtained but the keeping quality was moderate in treatments where dipping treatment or no treatment was given before sun drying. Rehydration properties were good in all the treatments. At Hisar centre also similar results were obtained in respect of whiteness and brittleness. The rehydration properties were best in blanching and cabinet drying treatments.

For storage of paddy straw mushroom a total of 14 treatments were designed and the parameters to be recorded were veil opening, moisture loss, liquefaction, change of colour, loss of texture and spoilage. This experiment was done at two centres Bhubaneswar and Ranchi. Maximum veil opening (100%) was

recorded when the mushroom was kept at room temperature in open PP bags while maxim moisture loss was recorded in open PP bag treatment in refrigerated conditions at Bhubaneswar centre. Liqifaction and change of odour were not recorded in any of the treatment up to 48 hrs except in sealed PP bags treatment where foul odour could be observed. At Ranchi centre in most of the treatment the veil opening was not noticed however it was noticed that under room conditions the veil opening was faster than in refrigerated conditions. Moisture loss was maximum in case of paper envelop under refrigerated condition and liquefaction was recorded mostly in the sealed pp bag treatments.



5. COLLECTION, IDENTIFICATION AND CONSERVATION OF WILD EDIBLE GERmplasm

The work on wild germplasm collection has taken up by most of the Centres. The surveys carried out at different Centres have helped in collection of 763 specimens of wild edible mushrooms over the years and some of the new collections have also been deposited at the DMR, Gene Bank. During the last workshop of AICRPM, it has been decided that different mushroom has been collected and consumed locally by the people of different regions. Hence we should take advantage of the ITK available in regard of mushroom and utilize those germplasm before going for random collection of wild germplasm. In this regard it has been decided that the Centres will survey the local markets for collecting the germplasm in addition to forest forays.

Udaipur Centre

Seven districts of Rajasthan namely Barmer, Jalore, Pali, Jaisalmer, Bikaner, Nagore and Udaipur inhabiting variable mushroom flora were surveyed for collection, identification and conservation of wild edible mushrooms from local market in the month of July, August and September 2010. It was observed that Khumbi mushroom (*Phellorinia inquinense*) synonym *Phellorinia herculea* was collected in tones and sold in the market in fresh as well as in dried form (Fig.12) at the rate of Rs 40-100/kg depending upon the quality of mushroom.

During pre-, post- and monsoon season of 2010 a total 6 forays were conducted in



Fig. 12. Wild mushroom collected from wild and sold in local market at Udaipur



Table 22. Collection, identification and conservation of wild edible mushrooms from local market

S. No.	Name of Mushroom	Date of Collection	Locality	Substrate
Ud-01/10	<i>Calvatia</i> sp.	8.7.10	Sissarma	On soil
Ud-02/10	<i>Pleurotus</i> sp.	8.7.10	Jamar kotada	Dead wood
Ud-03/10	<i>Podaxis pistillaris</i>	18.7.10	Udaipur	Soil
Ud-04/10	<i>Agaricus</i> sp.	4.8.10	Agronomy farm	Sandy loam
Ud-05/10	<i>Termitomyces</i>	10.8.10	Agronomy farm	Soil
Ud-06/10	<i>Agaricus</i>	16.8.10	Seed processing unit	Sandy loam soil
Ud-07/10	<i>Lepiota</i>	17.8.10	Barmer & Jalore	Sandy soil
Ud-08/10	<i>Agaricus</i>	17.8.10	Jalore	Sandy soil
Ud-09/10	<i>Phellorinia inquinens</i>	17.8.10	Jalore & Barmer	Sandy soil
Ud-10/10	<i>Agaricus</i>	17.8.10	Mokalsar	Sand
Ud-11/10	<i>Coprinus</i>	17.8.10	Sivana	Sandy soil/Dung
Ud-12/10	<i>Battarraea phalloides</i>	19.8.10	Ummedabad	Sandy soil
Ud-13/10	<i>Tulostoma campestre</i>	19.8.10	Ummedabad	Sandy soil
Ud-14/10	<i>Agaricus</i>	19.8.10	Ummedabad	Sandy soil
Ud-15/10	<i>Lepiota</i>	15.9.10	Bikaner	Sandy soil
Ud-16/10	<i>Coprinus</i> sp.	15.9.10	Beechwal farm	Dry grass
Ud-17/10	<i>Coprinus</i> sp.	15.9.10	Beechwal farm	Dry grass
Ud-18/10	<i>Tricholoma flavovirens</i>	16.9.10	Mandor farm, Jodhpur	Neem plant
Ud-19/10	<i>Volvariella</i> sp.	16.9.10	Mandor farm, Jodhpur	Soil
Ud-20/10	<i>Dictylocephalus</i>	16.9.10	Mandor farm, Jodhpur	Sandy soil
Ud-21/10	<i>Leucocoprinus brebbisonii</i>	16.9.10	Mandor farm, Jodhpur	Soil
Ud-22/10	<i>Schizophyllum commune</i>	16.9.10	Mandor farm, Jodhpur	Dead wood
Ud-23/10	<i>Xylaria</i>	21.9.10	Rajsamand	Soil
Ud-24/10	<i>Pisolithus tinctorius</i>	21.9.10	Rajsamand	Eucalyptus
Ud-25/10	<i>Ganoderma appliletnatum</i>	21.9.10	Rajsamand	Dead wood
Ud-26/10	<i>Cyathus</i>	21.9.10	Udaipur	On decaying rops
Ud-27/10	<i>Clavaria</i>	21.9.10	Rajsamand	On Soil
Ud-28/10	<i>Shalin</i>	21.9.10	Rajsamand	On dead wood
Ud-29/10	<i>Sulphur colour</i>	21.9.10	Rajsamand	On living Bamboo
Ud-30/10	<i>Bovista</i> sp	21.9.10	Rajsamand	On soil
Ud-31/10	<i>Clitocybe nuda</i>	21.9.10	Rajsamand	On soil
Ud-32/10	<i>Microglossum viridae</i>	21.9.10	Udaipur,Rajasamand	On dead wood
Ud-33/10	<i>Polypore</i>	21.9.10	Rajsamand	Rotting wood
Ud-34/10		21.9.10	Rajsamand	On dead wood
Ud-35/10	<i>Ramaria</i> spp	21.9.10	Kalwara	On dead wood
Ud-36/10	<i>Tube bearing fungi</i>	21.9.10	Kumbalgarh,Rajsamand	On dead wood
Ud-37/10	<i>Hericius</i> spp	21.9.10	Rajsamand	On dead wood
Ud-38/10	<i>Macrolapiota procera</i>	21.9.10	Rajsamand	On soil
Ud-39/10	<i>Sprassis cystidiosa</i>	21.9.10	Rajsamand	On soil
Ud-40/10	<i>Stemonitis</i>	19.9.10	Udaipur	Dead wood
Ud-41/10	<i>Hemitrichi</i>	19.9.10	Udaipur	Dead wood
Ud-42/10	<i>Lycogola</i>	19.9.10	Udaipur	Dead wood
Ud-43/10	<i>Clavaria</i> sp.	19.9.10	Udaipur	Dead wood
Ud-44/10	<i>Boletus</i> sp.	19.9.10	Udaipur	Dead wood
Ud-45/10	<i>Phallus impudicus</i>	19.9.10	Udaipur	Dead wood
Ud-46/10	<i>Geaster</i>	19.9.10	Udaipur	Dead wood
Ud-47/10	<i>Fistulina hepatica</i>	19.9.10	Udaipur	Dead wood
Ud-48/10	<i>Cerporia lacerate</i>	19.9.10	Udaipur	Dead wood
Ud-49/10	<i>Ganoderma tsugae</i>	19.9.10	Udaipur	Dead wood
Ud-50/10	<i>Hexagonia hirata</i>	19.9.10	Udaipur	Dead wood
Ud-51/10	<i>Mycenia</i>	19.9.10	Udaipur	Dead wood



Barmer, Jaisalmer, Pali, Jalore, Bikaner, Rajsamand and Udaipur districts of Rajasthan. Total of 51 different samples of wild fleshy fungi were collected, cultured, preserved and identified on the basis of morphology. Collected mushroom specimens are listed in Table 22.

Bhubaneshwar Centre

Surveys were conducted at different locations of the state during the rainy season of 2010-11 and a total number of 20 specimens of wild fleshy fungi were collected. The specimens were identified up to genus level based on morphological characteristics. The wild fleshy fungi collected are listed in Table 23.



Fig. 13. Wild collection of Boletes from Orissa

Table 23. Collection, identification and conservation of wild edible mushrooms

S. No.	Fungus	Date of collection	Place	Habitat/substrate
1	<i>Agaricus campestris</i>	Aug.'10	Mayurbhanj	Leaf litter
2	<i>Boletus</i> sp.	Sept.'10	Jeypore	Under Jamun tree shade
3	<i>Coprinus</i> spp.	July'10	Bhubaneswar	OUAT mushroom farm and farmers' field
4.	<i>Cantharellus</i> sp.	Sept.'10	Nayagarh	Bamboo bushes
5.	<i>Ganoderma lucidum</i>	Sept.'10	OUAT campus	Gulmohar tree
6.	<i>Termitomyces</i> spp.	Sept..'10	OUAT Campus	Grass lands and Termitorium
7.	<i>T. cartilaginius</i>	Sept., 10	OUAT Campus	Termitorium
8.	<i>Lycoperdon</i> sp. (White)	Aug., 10	Mayurbhanj	Sal forest
9.	<i>Lycopardon</i> Sp. (Black)	Aug., 10	Mayurbhanj	Sal forest
10.	<i>Calocybe</i> sp.	August'10	Bhubaneswar	Central Research Station, OUAT
11.	<i>Volvariella volvacea</i> (10 isolates)	July-Aug., 10	Six agro-climatic zones of Orissa	Straw heaps



Pasighat Centre

Wild edible mushroom from Ranaghat forest were collected. During these periods oyster mushrooms wrapped in the leaf are sold in the local market (Fig. 14). Average maximum temp, min temp and RH is 19.2°C, 15°C, 79.9%, respectively. Mushroom collected from edible fruit tree Cesar (local name), Kotas (local name) are edible. Consumption and cooking of oyster mushroom with pork have created some health problems. Wild oyster mushrooms were surveyed and collected during rainy season in jungle, deep forest and decayed wooden trees of east Siang district. A total of 11 edible specimens were collected (Table 24).



Fig. 14. Mushroom collected from wild and sold in local market of Arunachal Pradesh

Table 24. Mushroom specimens collected from Arunachal forest

S.No	Species	Colour	Spore print colour	Habitat
CHFPR1	<i>Pleurotus</i> sp	White	White	Edible fruit tree
CHFPR2	<i>Pleurotus eous</i>	Pink	Light pink colour	„
CHFPR3	Shiitake	Light brown yellow	Light yellowish white	„
CHFPR4	<i>Pleurotus</i> sp	White	White	„
CHFPR5	<i>Shizophyllum commune</i>	Grey	Light white	
CHFPR6	Jews ear	Brown	Nil	„
CHFPR7	<i>Shizophyllum commune</i>	Grey	White	„
CHFPR8	Jews ear	Brown	Nil	„
CHFPR9	Jews ear	Brown	Nil	„
CHFPR10	<i>Shizophyllum commune</i>	Grey	White	„
CHFPR11	Oyster	Creamy white	White	„

Pune Centre

Total 15 samples of wild fleshy fungi were collected from different location of Pune and Satara districts of Maharashtra during monsoon of year 2010-11. The collected

specimens were identified as *Agaricus* sp., *Pleurotus* sp, *Tricholoma* sp, *Calocybe* sp, *Ganoderma* spp., *Grifola* sp., *Geastrum* sp., *Rammaria* sp., *Laccaria* sp., *Schizophyllum* sp., *Polyporus*, *Coltricia* sp, and *Boletus* sp (Fig.15).

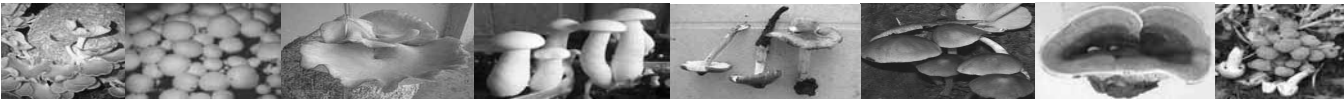




Fig. 15. The mushroom specimens collected from Maharashtra

Samastipur Centre

A total of 10 mushroom specimens were collected locally and identified as *Calocybe*

indica on the basis of morphological and molecular level. The feed back information from local people at growing sites revealed that all stains were edible (Fig 16).



Fig. 16. Mushroom specimens collected from Pusa, Samastipur (Bihar)



Ranchi Centre

Surveys were conducted in local market of Ranchi and Khuti distt. of Jharkhand in monsoon season of 2010. The following local

germplasms were collected and preserved. Some of view of the local mushroom sale in market is shown in fig.17. The details are shown in Table 25 and 26.



Fig. 17. Tecnus, khukhri and Rugra Mushroom on sale in local market of Ranchi

Table 25. Showing details of collections from local market of Ranchi

Local Name	Scientific Name	Locality	Date of collection	Habitat	Temp. range
Rugra	<i>Lycoperdon</i> sp	Ranchi	17.08	Sal	20-25
Tecnas	<i>Cococybe cyanopus</i>	Ranchi	17.08	Soil	20-25
Jamun Khukhri	<i>Boletus</i> sp	Lalpur	28.08	leaf	20-25
Patra (Red) Khukhri	<i>Trocholoma</i> sp.	Khuti	25.08	leaf	20-25
Patra (White) Khukhri	<i>Rassula</i> sp	Khuti	25.08	leaf	20-25
Patra (yellow) Khukhri	<i>Rassula</i> sp	Khuti	25.08	leaf	20-25
Lohra (Black) Khukhri	<i>Rassula</i> sp	Khuti	25.08	leaf	20-25
Gane Khukhri		Khuti	25.08	leaf	20-25

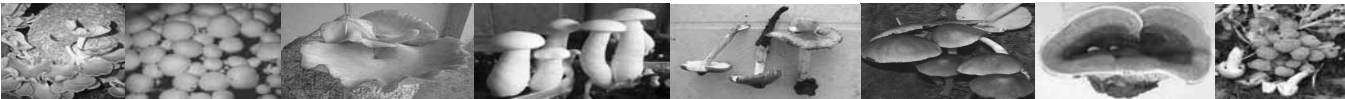


Table 26. Collection of mushroom from wild from nearby Ranchi area

Local/scientific name of Mushroom	Habitat	Date of collection	Locality
<i>Bada Khukhri (Termitomycetes sp.)</i>	Palash Tree	Aug –Sept, 10	Hesapiri
<i>Bada Khukhri (Termitomycetes sp.)</i>	Palash Tree	Aug –Sept, 10	Hesapiri
<i>Bada Khukhri (Termitomycetes sp.)</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Ganoderma sp.</i>	Tree	Aug –Sept, 10	Namkum
<i>Ganoderma sp.</i>	Tree	Aug –Sept, 10	Namkum
<i>Agaricus sp.</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Ganoderma sp.</i>	Tree	Aug –Sept, 10	Plandu
<i>Ganoderma sp.</i>	Tree	Aug –Sept, 10	Namkum
<i>Bada Khukhri (Termitomycetes sp.)</i>	Palash Tree	Aug –Sept, 10	Hesapiri
<i>Polypore sp.</i>	Wood Log	Aug –Sept, 10	Hesapiri
<i>Auricularia sp.</i>	Wood Log	Aug –Sept, 10	Hesapiri
<i>Macrolepiota sp.</i>	Grass land Soil	Aug –Sept, 10	Hesapiri
<i>Chlorophyllum sp.(Poisonous)</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Russula sp.</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Jamun Khukhri (Boletus sp.)</i>	Trunk	Aug –Sept, 10	Hesapiri
<i>Patra (Red) (Russula sp.)</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Patra (White round) (Russula sp.)</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Patra (Voilet round) (Russula sp.)</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Patra (White) (Lactarius sp.)</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Amanita vegenatae</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Patra (yellow) (Russula sp.)</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Amanita sp.</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Lohra Khukhri</i>	Soil	Aug –Sept, 10	Hesapiri
<i>Ganoderma sp.</i>	Wood log	Aug –Sept, 10	Hesapiri

Barapani Centre

Two wild mushroom specimens from Umiam, Meghalaya were collected, photographed and preserved but could not be

identified as only one fruit body of each was found (Fig 18). Market survey was done in Sep 2010 and *Cantharellus cibarius* was collected, photographed and preserved.





Fig. 18. Mushroom specimens collected from wild at Umiam, Meghalaya

Faizabad Centre

Market surveys were made in Sultanpur, Bahraich, Gonda, Mirzapur, Barabanki, Kanpur, Faizabad and Varanasi districts of Uttar Pradesh to collect locally consumed mushroom varieties. So far only one mushroom species *Termitomyces* was found occasionally available in local market.

Raipur Centre

Chhattishgarh forest is full of variability in mushroom genotype hence extensive survey were made to harvest various kind of mushroom available in the region. The area explored were Achanakmar, Bilaspur, Katghora, Deobhog, Gariaband, Korla, Dhamtari, Katghora, Pendra, Chhappariva, Ghatarani forest etc (Table.27 and Fig.18A). The mushroom specimens were collected and identified on basis of local information.



Fig.18A. Sale of *Termitomyces* in local market of Raipur

Pantnagar Centre

Survey was conducted during rainy season (July, August, 2010) in local markets of Haldwani, Ramnagar, Nanakmatta, Sitargang, Rudrapur and Khatima areas of Uttarakhand. Only two mushroom species namely *Tuber* and *Termitomyces* were available in the local market.

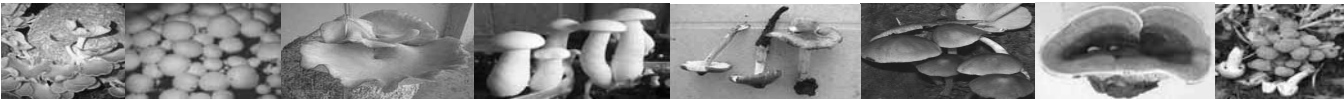


Table 28. Mushroom available in the local market of CG state.

Local name	Scientific name	Market (place of collection)
Bhimbora futu	<i>Termitomyces</i> spp.	Raipur, Dhamtari ,Gariaband, Chura, Bagbahera Kanker, Bilaspur, Kawardha etc
Kanaki futu	<i>Termitomyces</i> spp.	————do————
Dudhia futu	<i>Calocybe indica</i>	Ratanpur Pali Katghora
Parafutu	<i>Volvariella volvacea</i>	Raigurh, Pusur, Chandarpur
Safed parafutu	<i>Volvariella</i> spp.	Raigurh, Pusur, Chandarpur
Saraiboda white	<i>Astreatus hygrometricus</i>	Raipur, Dhamtari, Gariaband, Chura, Bagbahera Kanker, etc
Saraiboda black	<i>Astreatus</i> spp.	Raipur, Dhamtari, Gariaband, Chura, Bagbahera Kanker, Katghora, Ambikpur etc
Bans Futu	<i>Cantherallus</i> spp.	Chhaparva, Lamani, Pendra, Chauki
Dhela futu	<i>Bovista vigrescens</i>	Dhamdha, Gandai, Sahashpur lohara
Patera futu (Oyster)	<i>Pleurotus</i> spp	Amarkantak, Raipur, Jagdalpur, Bilaspur
Jamuni futu	<i>Russula</i> spp	Amarkantak, Jagdalpur, Katghora
Hardia futu	<i>Russula</i> spp	Bastar, Deobhod, Gariaband etc

Coimbatore Centre

A total of 16 mushroom flora belonging to the genus *Pleurotus*, *Calocybe*, *Ganoderma*, *Polyporus*, *Lycoperdon*, *Volvariella*, *Russula*,

Schizophyllum, *Auricularia* were collected from various regions of Tamil Nadu (Table. 29 & Fig.19). They were pure cultured and maintained.



Fig. 19. Wild germplasm collected at Coimbatore centre



Table 29. Collection, Identification and conservation of wild edible mushroom flora from local market

Wild mushrooms collected	Place of collection	Habitat	Month of collection
<i>Lycoperdon sp.</i>	Siruvani	On the decomposed leaf litter	August
<i>Volvariella</i>	Sathymangalam	Bamboo plantations	August
<i>Polyporus</i>	Thondamuthur	Dead woods	August
<i>Ganoderma- I</i>	Narasipuraum	Dead woods	August
<i>Ganoderma- II</i>	Narasipuraum	Dead woods	August
<i>Pleurotus eous</i>	Anaikatti	Dead woods	September
<i>Calocybe sp.-I</i>	Thondamuthur	<i>Delonix regia</i> tree roots	September
<i>Ganoderma-III</i>	Vellore	Felled Tree trunk	October
<i>Schizophyllum commune</i>	Yercaud	Felled trees	October
<i>Tramella</i>	Yercaud	Silver oak trees	October
<i>Auricularia sp.</i>	Yercaud	Dried twigs/ trunks	October
<i>Rusulla sp.</i>	Coimbatore	TNAU campus	November
<i>Calocybe sp.-II</i>	Soil from where tree was felled 3 years earlier	Sirumugai	November
Un identified	Leaf litter /Soil	Nilgiris	December
<i>Calocybe sp.-III</i>	Tree roots	Thanjavur	February
<i>Calocybe sp.-Iv.</i>	Tree roots	Thanjavur	March

Vellayani Centre

Five districts viz. Thiruvananthapuram, Kollam, Pathanamthitta, Alappuzha and

Kottayam were selected for survey. A total of 86 mushroom spemiens were collected and avoiding duplication, 46 mushrooms were selected, observations recorded as far as



Fig. 20. Tramella and Tricholoma mushrooms collected at Vellayani Centre

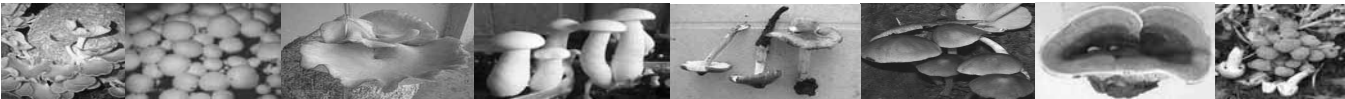


Table 30. Details of Mushroom Flora Collected at Vellayani centre

Mushroom	Temp	Habitat
Thiruvananthapuram District		
<i>Agaricus</i> sp	29	Humus rich soil
<i>Auricularia</i>	29	Dried mango tree
<i>Boletus</i>	29	Soil
<i>Tremella</i> sp	28	Dried fallen Coconut tree
<i>Calvatia</i>	29	Soil
<i>Calocybe indica</i>	28	Base of coconut tree
<i>Collybia</i>	29	Fertile soil
<i>Ganoderma</i>	30	Dried Anjili tree
<i>Mycena</i>	28	Coir pith
<i>Macrolepiota</i>	28	Humus rich soil
<i>Lepiota</i>	28	Humus rich soil
<i>Lentinus squarrosulus</i>	29	Dried fallen tree
<i>Schizophyllum</i>	30	Dried tree
<i>Volvariella volvaceae</i>	30	Banana field
<i>Termitomyces</i> sp	28	Soil
<i>Clitocybe</i> sp	29	Banana field
<i>Tricholoma</i>	29	Base of Arecanut Palm
<i>Leucocoprinus</i> (Yellow)	28	Soil
<i>Collybia</i> (Yellow)	28	Soil
Alappuzha District		
<i>Clitocybe</i> (Violet)	28	Banana Field
<i>Lactarius</i>	29	Base of trees

Mushroom	Temp	Habitat
<i>Collybia</i>	29	Soil
<i>Lepiota</i>	29	Soil
<i>Dictyophora</i>	29	Soil
Kollam District		
<i>Sphaerobolus</i>	28	Rotten trees, beneath bark
<i>Termitomyces</i>	28	Soil
<i>Russula</i>	28	Humus rich soil
<i>Peous</i>	28	Bamboo Plant
<i>Popuntiae</i>	28	Dried branches of tree
<i>Peziza</i>	29	Dried tree
<i>Marasmius</i>	29	Coconut Petiole
Pathanamthitta District		
<i>Ganoderma</i>	30	Dried branches of tree
<i>Macrolepiota</i>	29	Humus rich soil
<i>Lycoperdon</i>	29	Humus rich soil
<i>Leucocoprinus</i> (White)	28	Humus rich soil
Kottayam District		
<i>Tricholoma</i>	28	Base of trees
<i>Ganoderma</i>	29	Dried branches of tree
<i>Clavaria</i>	29	Dried branches of tree
<i>Auricularia</i>	29	Dried branches of tree
<i>Agaricus</i> sp	28	Humus rich soil

possible based on data sheet and preserved both by dry method and wet method (Table

30 & Fig. 20). Forty-six mushroom specimens were identified at genera level.



6. SURVEY AND SURVEILLANCE OF DISEASES AND INSECT PESTS

Mushrooms are affected by various biotic and abiotic agents/factors. Among the biotic agents, fungi, bacteria, viruses, nematodes, insects and mites cause damage to mushrooms directly or indirectly. At times there is complete crop failure depending upon the stage of infection, quality of substrate and environmental conditions. To assess the appearance of these competitors/pathogens in various parts of country is essential to plan a strategy to control or avoid the appearance of this disease for the benefit of the mushroom farming. A survey was conducted in this regard through out the country by the AICRP centres.

Bhubaneshwar Centre

Surveys were conducted in mushroom farms located in Khurda and Puri districts and the university farm. Paddy straw mushroom beds were found to be infected with *Coprinus* sp, *Sclerotium rolfsii*, *Aspergillus* spp., *Rhizopus oryzae* and bacterial bud rot. Oyster bags were found infected with *Coprinus* sp., *Trichoderma* sp., *Aspergillus niger* and bacterial blotch. Besides, Bacterial blotch were also found in button mushroom (Table 31).

Table 31. Survey and surveillance of contaminant/diseases at Bhubaneshwar centre

Locality	Mushroom	Contaminants and diseases	Scale
Mushroom farms of Khurda District and OUAT growing room	Paddy straw mushroom	<i>Coprinus</i> sp.	4
		<i>Sclerotium rolfsii</i>	Sporadic
		<i>Aspergillus</i> spp.	Sporadic
		<i>Rhizopus oryzae</i>	Sporadic
		<i>Pseudomonas tolasii</i>	6
		Unidentified fungal disease	5
		Swollen stipe (Unknown etiology)	Sporadic
Mushroom unit of OUAT and adjoining farms of Khurda districts	Oyster mushroom	<i>Coprinus</i> sp.	4
		<i>Trichoderma</i> sp.	2
		<i>Aspergillus niger</i>	Sporadic
		Fungal infection of pileus	Sporadic
		<i>Pseudomonas</i> sp.	4
Mushroom unit of OUAT	Button mushroom	Bacterial blotch (<i>Pseudomonas</i> sp.)	5

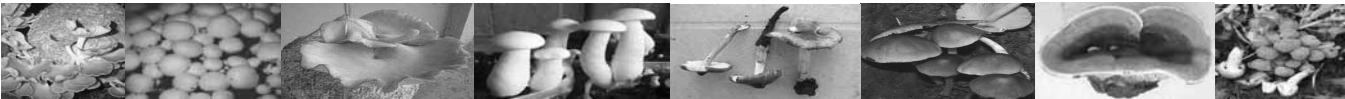




Fig. 21. Swollen stipe in Paddy straw mushroom (left) and *Coprinus* in Oyster mushroom (right)

Pasighat Centre

During monthly visit to the production unit of progressive farmer Mr Taimur Jamoh, some pests and diseases were noticed and incidence was calculated. The incidence of *Trichoderma* (10%), *Coprinus* (30%), and Beetle (25%) infestation was observed.

Pune Centre

Three private button mushroom farms located at Hadapsar, Nimbut and Bakori in Pune district were surveyed and therein 3200 beds were observed for incidence of diseases and infestation of insect pest if any. It was observed that all the button mushroom beds were free from any disease and pests. While a total of 2500 beds of oyster mushroom were surveyed on five private farms located at Mundhekarwadi (A’Nagar), Loni (A’Nagar), Hanumantgaon (A’Nagar), Kasbesukene (Nashik) and Belha (Pune). Out of these only 148 beds were found to be contaminated up to 5% with green mould disease (*Trichoderma* sp.).

The disease and pest was also recorded in the trials conducted at AICRP centre, Pune and only 5 beds were found to have contamination amongst 300 beds checked. Among the insects, mainly phorid fly (5/bed) were recorded. The green mould disease incidence was recorded up to 5% and clusters of *Coprinus* sp. were observed in bed. In oyster mushroom experiment trial, 350 beds were observed in which 20 were found to be contaminated with green mould disease to the extent of 5% on substrate.

Ludhiana Centre

Surveys were conducted to record the disease/ pest incidence in the mushroom farms in Punjab. Mostly the incidence of *Coprinus*, *Trichoderma* and *Papulaspora byssina* were detected in the button mushroom crop during winter months. However, pest infestation could not be recorded in the crop. On the other hand, in abiotic disorder most farms faced the problem of open veil and crocodile mushroom at the end of the crop (Table. 32).



Table 32. Incidence of different diseases/moulds/insects/pests at mushroom farms in Punjab

Disease	Stage of crop	Scale
(A) Biotic disorders		
<i>Trichoderma</i> spp.	Over cased beds	Less than 2% fruit bodies affected
<i>Coprinus</i> spp.	During spawn run and after casing	Upto 3% yield was affected
<i>Papulaspora byssina</i>	During spawn run	Upto 2% yield was affected
(B) Abiotic disorders		
Open veil	At the end of crop	Less than 3%
Scales or crocodiles	Seen at the end of crop	Less than 3%

Samastipur Centre

Survey of diseases resulted that *Aspergillus* sp., *Trichoderma* species, *Mucor/Rhizopus* and *Coprinus* were frequently observed in oyster and button mushroom. They were easily encountered by substrate treatment.

Ranchi Centre

In summer season of 2010, *Coprinus* sp. was found to be a major problem in oyster mushroom cultivation in farm as well as farmers field, which spoil the filled up bags. *Sclerotium rolfsaii* was found in paddy straw mushroom farms.

Hisar Centre

The mushroom farms in the state were surveyed for the diseases/pests incidence during seasonal cultivation of button mushroom. The majority of growers prepared compost by long method and the composting floor was not brick layered. Yellow mould (*Sepedonium* spp.) and wet bubble (*Mycogone perniciosa*) were the most dominant diseases recorded in Sonapat, Panipat, Kaithal, Yamuna Nagar, Kurukshetra and Sirsa districts. There was serious problem of mites in one farm in the village Rohat of Sonapat

district. The mushroom flies incidence was higher during the end of January.

Raipur Centre

An extensive survey was done to record various diseases and insect pests incidence in different mushroom at various farms at Raipur, and Dhamtari, Dantewada, Naraynpur Kanker Korla, Korba Bilaspur, Janjgir, Kabirdham districts. In all the cases bags were contaminated with *Coprinus* sp., Patchy growth of *Trichderma* sp., *Aspergillus* spp., *Penicillium* spp, *Rhizctonia* spp. and *Sclerotium rolfsii* were observed in summer and kharif season. The pests like Phorid fly, Cecid fly and mites posed serious threat to cultivated mushroom at various locations (Table. 33).

Coimbatore Centre

In oyster mushroom farms visited, *Coprinus comatus* was observed from spawn running till harvest, which is mainly due to chemical method of sterilization. The moulds viz., *Trichoderma viride* and *Aspergillus niger* was also observed in oyster beds. Phorid flies were commonly observed pest in beds after second harvest in some of the mushroom farms.

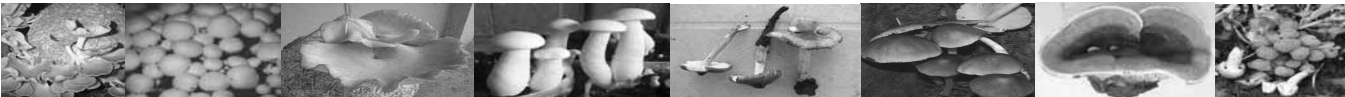


Table 33. Survey and surveillance of diseases and insect pests of mushrooms

Farmers name	Crop grown	Contaminants			Insects infestation
		Fungal	Bacterial	Nematode	
Mushroom laboratory CoA Raipur	<i>P. florida</i> , <i>P. sajor caju</i> , <i>P. eous</i> , <i>P. fossulatus</i> , <i>C. indica</i> , <i>V. ovacea</i> , <i>Agrocybe spp.</i> , <i>Hypsizygus spp.</i> , <i>Agaricus spp.</i>	+	+	+	+
CoA and KVK Jagdalpur	<i>P. florida</i> , <i>P. sajor caju</i> ,	+	+		+
KVK Dantewada	<i>P. florida</i> , <i>P. sajor caju</i> ,	+	-	-	+
Ramkrishna ashram Narayanpur	<i>P. florida</i> , <i>P. sajor caju</i> , <i>C. indica</i>	+	+	-	+
KVK Kanker	<i>P. florida</i> , <i>P. sajor caju</i> ,	+			+
CoA Bilaspur	<i>P. florida</i> , <i>P. sajor caju</i> ,	+	+		+
Harivansh Devangan Dhamtari	<i>P. florida</i> , <i>P. sajor caju</i>	+	+	-	+
Ajai masih Bhatapara	<i>P. florida</i>	+	-	+	+
Yoges Nirmalkar Dhamtari	<i>P. florida</i> , <i>Hypsizygus spp.</i>	+	+	+	+
M. L. Rajput Bilaspur	<i>P. florida</i>	+	-	+	+
KVK Janjgir	<i>P. florida</i>	+	+	-	+
Shikha Tiwari Korla	<i>P. florida</i>	+	-	+	+
Ajai vishwakarma Korba	<i>P. florida</i>	+	-	+	+
RARs and KVK Raigarh	<i>P. florida</i> , <i>Volvariella spp</i>	+	+	-	+
Biotechnology Deptt Ambikapur	<i>P. florida</i> , <i>P. sajor caju</i>	+	-	-	+
Shukhdeo Cherbeda Kanker	<i>P. florida</i>	+	-	-	-
Mahasamund	<i>P. florida</i>	+	-	-	-
Thakur Parsadih	<i>P. florida</i>	+	-	+	+
Gariaband	<i>P. florida</i> , <i>P. sajor caju</i>	+	-	-	-
Deobhog	<i>P. florida</i>	+	-	-	-





Fig. 22. Contaminated oyster mushroom bags at Raipur Centre

In milky mushroom farms mostly scaling of mushrooms and malformed mushrooms were observed and that too only in summer months. Almost, all the farms are following clean and hygienic method of cultivation.

Vellayani Centre

Surveys of spawn production units and mushroom production units at Aruvikkara, Kattakada, Karakonam, Parassala, Nalanchira and Pattom (Thiruvananthapuram District), Kottarakkara and Kollam (Kollam District) were conducted to record disease and pest incidences in mushroom farms.

The major contaminant observed in spawn production units was bacteria and some fungal species like *Trichoderma*, *Aspergillus*, *Rhizopus* and *Pencillium*. While in Mushroom

production units *Trichoderma*, *Coprinus*, *Colletotrichum* were observed. The major pests encountered were sciarids (28%), springtails and mites (60%). The farmers were recommended to install insect proof netting (35 mesh) at the openings of mushroom house, spraying neem oil/ soap-garlic mixture at weekly interval, fumigation and light traps.

Solan Centre

Survey of different farms in Sonapat, Panipat, Rohtak, Kurukshetra and Yamunanagar revealed wide spread incidence of brown plaster mould. However it never results in serious losses. However, the most serious mould i.e yellow mould was present in few farms. Wet bubble was also present in few farms Table 34.

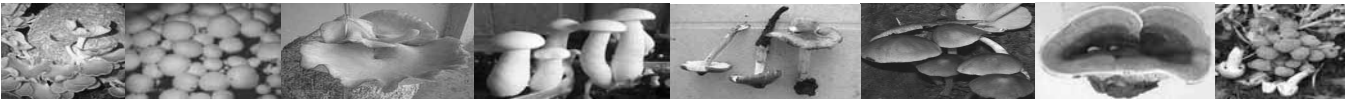


Table 34. Incidence of various diseases and moulds

Village	No. of farms	No. of huts	Incidence of			
			Yellow mould	Wet bubble	Brown plaster mould	Green mould
Rajmajra, Sbd	3	6	-	-	+	1
Khubru, Sonapat	17	182	-	-	+	-
Aaheermajra	2	15	-	2	+	-
Ghumard	1	12	-	-	+	-
Aterna	14	114	10	2	+	-
Manauli	1	12	2	-	+	1
Shaershah	6	186	-	-	+	-
Tjiggipur, Delhi	2	14	-	-	+	-
Gannaur, Sonapat	4	89	12	2	+	4
Bhapra	5	55	2	-	+	-
Puthar	17	17	-	-	+	-
Aasan, Rohtak	2	2	-	-	+	-
Mokhara, Rohtak	12	64	-	-	+	-
Rohak	1	10	-	-	+	-
Kakroi, Sonapat	11	25	10	-	+	-
Badana	7	8	1	-	+	4
Harsanakalan	13	24	2	1	+	
Baianpur	14	167	-	2	+	2
Rohat	15	21			+	
*Shehmalpur, Panipat	30	107	-	8	+	-
Samalakha	1	2	-	-	+	-
Taharpur	2	7	-	2	+	-
Malikpur, Kurukshetra	12	18	-	4	+	-
Kainthla	1	1	-	-	+	-
Bhorsaida	2	10	-	-	+	
Jyotisar	4	5				-
**Mundakhera	6	15	-	-	+	-
Samaspudera	5	6	-	2	+	-
Haripur	7	13	-	-	+	-
Bhukri, Yamunanagar	4	6	-	2	+	-
Alhar, Radaur	12	26	-	2	+	-

* False truffle at one farm, ** Olive green mould at two farms, + = Present, - = Absent



7. EXTENSION ACTIVITIES

Udaipur Centre

a. Training

- During the year 2010-2011 a total of seven three days training courses on oyster mushroom cultivation was conducted, in which a total of 47 farmers/entrepreneurs/students were trained (Fig.23).
- The trainees belonged to various areas of Rajasthan viz. Dungarpur, Jodhpur, Bhilwara, Baran, Udaipur, Bijolia, Mandsoor, Jaipur, Rajsam, Banswara, Jhalawar, Dholpur and Ajmer.
- A seven days training program was organized by the centre on white button mushroom cultivation during 27-01-11 to 02-02-11 and a total of 8 farmers and farmwomen have taken part in the training.



b. Revenue Generation

- The centre has generated revenue of Rs 25923.00 from sale of a total of 423.5 kg spawn. While a total of Rs. 8700.00 has been generated by imparting training to 23 trainees and Rs. 3000.00 from sale of culture.

Bhubaneshwar Centre

a. Training and exhibition

- During the year 2010-2011, the centre has done tremendous extension activities and conducted a total of 17 training programs on spawn and mushroom production and processing (Fig.24).
- A total of 276 participants from various areas of Orissa has taken part in the training programs.



Fig. 23. Training for oyster and button mushroom organized by Udaipur centre





Fig. 24. Training programs conducted by Bhubaneswar centre

Table 35. Details of Trainings programs organized by Bhubaneswar centre

Date	No. of participants
May 11 - 15, 2010	20
May 17 - 21, 2010	13
May 24 - 28, 2010	33
June 21 - 25, 2010	7
July 15 – 24, 2010	9
July 27 – 31, 2010	13
August 2 – 11, 2010	12
September 14-18, 2010	17
September 21-30, 2010	11
November 1-5, 2010	10
November 8-12, 2010	20
November 18-27, 2010	10
December 6-10, 2010	26
December 27-31, 2010	23
January 18-27, 2011	8
Feb 24-March 5, 2011	1
March 7-11, 2011	43

Table 36. Details of exhibition conducted by Bhubaneswar centre

Date	Venue of exhibition
May 16, 2010	Itipur, Khurda
August 24,2010	College of Agril. OUAT
April 8 2010	College of Agril., OUAT

- Besides training, the centre has also conducted three exhibitions for popularizing mushrooms amongst public.
- The centre has also conducted four radio talks on quality maintenance in spawn, oyster mushroom cultivation, and increasing bio-efficiency of paddy straw mushroom.
- Eight hundred twenty three farmers from all over the state and neighbouring states visited the centre during 2010-11.

b. Visit of VIPs to Mushroom Lab

- Dr. A.P. Srivastava, National Coordinator, NAIP, New Delhi visited the Bhubaneswar Centre on 2nd August 2010.



- Vice Chancellor Agricultural University, Parbhani (MS) visited the lab on 10th December 2010.

c. TV/Radio Talks delivered

- Mohapatra K.B. (2010). TV talk on “Maintenance of spawn quality in mushroom” broadcasted on Orissa TV on August 11, 2010.
- Mohapatra K.B. (2011). TV talk on “Oyster mushroom cultivation (Phone-in-programme)” broadcasted on DD – 6, Bhubaneshwar on January 14, 2011.
- Mohapatra K.B. (2011). TV talk on “Importance and method of cultivation of pink mushroom” broadcasted on ETV, Oriya on February 15, 2011.
- Mohapatra K.B. (2011). TV talk on “Tips for increasing bioefficiency of paddy straw mushroom” broadcasted on ETV, Oriya on February 15, 2011.

d. Revenue Generation

- A quantity of 2173 packets of spawn (200 g each) of paddy straw and oyster mushroom were distributed to the farmers @ Rs.8.50/packet with a resource generation of Rs.18470.50.

Pasighat Centre

a. Trainings and exhibitions

- Six training was conducted to village people during 2010–11, in which a total of 239 farmers participated (Table 37 & Fig. 25).

Table 37. Details of training conducted by Pasighat centre

Date	Place/Village	No of participants
11 th Mar 10	Mebo	29
13 th Mar 10	Yaglung	41
18 th Mar 10	Renging	19
26 th Feb 11	Ayeng	50
1 st Mar 11	Mirbuk	50
9 th Mar 11	Miglung	50



Fig. 25. Self help group created by Pasighat centre

- One self-help group has been created in Ayang village that have been actively involved in mushroom production.
- Exhibition of mushroom production technology was conducted in north east Agri Expo held during 15-19th December 2010 and north east regional Agri Fair during 28th Feb to 2nd March 2011.
- Mushroom museum was developed with collection 402 species of wild edible and poisonous mushrooms of Arunachal Pradesh.



b. Revenue Generation

- A total of 95 kg of quality mushroom spawn was supplied to growers.

Pune Centre

a. Trainings and exhibitions

- The centre conducted a total of nine training programmes on first Saturday of every month.
- Total 115 trainees were participated in these trainings (Table 38 & Fig. 26).
- For transfer of technology, pamphlets were distributed by post as well as through exhibitions and attending farmers rallies.
- Three mass demonstration were organized to popularize oyster mushroom among women’s Self Help Group members at Narayangaon, Dist: Pune; Khed Shivapur, Dist –Pune and Mundhekarwadi, Dist : Ahmednagar.

Table 38. Extension activities of AICRPM, Pune centre

Activities	Number	Beneficiaries
Participation in Krishi Exhibition/s	05	-
Oyster mushroom cultivation training/s	09	115
Mass demonstration/s	03	-
Postal quires	40	40
T. V. programme/s	1	-
Visitors to mushroom project (including school/college students, farmers/mushroom growers/ research workers, teachers etc.)	46Groups	1452

- The International Training Programme on “Mushroom technology and farming for livelihood security of small and marginal farmers of Khartoum State-Sudan” was successfully conducted to the participants of Al Zaiem Al Azhari University, Sudan w.e.f. 11th Oct. 2010 to 30th Oct. 2011.



Fig. 26. Training conducted at Pune centre



Ludhiana Centre

a. Trainings and exhibitions

- A total of seven training programmes were conducted in which a total of 211 farmers/entrepreneurs have participated (Table 39 & Fig. 27).

Table 39. Training courses conducted by Ludhiana centre

Date	No. of participants
26.04.10 to 4.05.10	35
11-13.05.10	25
27.09.10	07
06-10.09.10	53
18-19.11.10	09
22.03.11	32
24.03.11	50

- Nine lectures cum demonstration have been organized for school and college students/farmers/unemployed youth for popularizing the mushrooms.



b. Kisan melas/demonstration

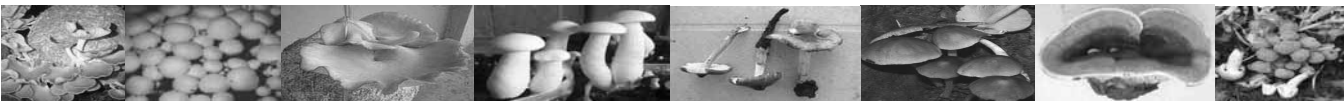
- During the year twelve one/two day Kisan melas/demonstrations were organized at different places in Punjab including Rauni, Ballawal, Ludhiana, Gurdaspur, Bhatinda, Faridkot, etc.
- Field day organized by DMR, Solan at Thiara Estate Mushroom Farm, Khanpura, Hoshiarpur on 3.2.11.

c. Visits

- Visit of ICAR Accreditation Team on 06.04.10.
- Visit of Delegation from the University of Wisconsin, USA on 20.10.10
- Visit of Director, DMR, Solan on 07.12.10
- Visit of QRT team to assess five years of work under ICAR project on 20-21.12.10



Fig. 27. Trainings conducted at Ludhiana centre



d. TV/Radio Talks

- Khumban di kasht, DDK, Jalandhar on 28.10.10

Samastipur Centre

a. Training

- Three, 6 days training programmes and nine, 1 day training programmes were organized (Fig. 28).



Fig. 28. Oyster Mushroom Production by Trainees

- A total of 471 farmers/unemployed youths/women attended the training programmes.
- Women had formed a total of 19 self-help groups and they have opened bank accounts.
- The distribution of self-help groups are Samastipur (04), Muzaffarpur (02), Nalanda (08), Jamui (03), Munger (01), Darbhanga (01).

b. Visitors

- Dr. C. Prasad, Ex-DDG (Extension Education), ICAR, New Delhi
- Dr R.P. Tewari, Ex- Director DMR Solan
- Dr. David Berg Winson, Global Manager Bill Millinada, Gates foundation America



Fig. 29. Mushroom Diwas Celebration and Jhanki on Republic day to creat awareness among masses



c. Mushroom Diwas/Mela

- Mushroom Diwas was organized on 3.3.11 in Pokhrara village of Samastipur. More than 2000 growers from all over Bihar were participated and 100 mushroom stalls were displayed (Fig. 29).

d. TV talk

- DD Muzaffarpur on 28.05.2010.

e. Revenue generation

- A total of 15.80 q spawn was sold.

f. Recognition

- Mushroom Jhanki bagged first prize on republic day.

Ranchi Centre

a. Training

- Seven training programmes were conducted for one to three days

programme during the year in which a total of 144 farmers were trained in oyster /milky mushroom cultivation (Table 40).

b. Revenue Generation

- Total of 4540 kg mushroom spawn, 536 kg oyster, 31.25kg paddy straw mushroom, 164 kg milky mushroom and 25 bags oyster mushroom bags were sold and total revenue of Rs 306691 was generated

Barapani Centre

a. Training

- Delivered lecture on mushroom cultivation during 12 day programme (30 Jul-10Aug, 2010) organized by KVK, Ri Bhoi Meghalaya.
- Delivered lecture on ‘Cultivation of Edible Mushrooms’ during 12 day programme (2-14 Aug, 2010) organized by KVK, East Khasi Hills, Upper Shillong, Meghalaya.

Table 40. Mushroom Training conducted at ICAR RCER, RC Ranchi during 2010-11

Sponsored by (days)	Subject	Training Dates	Period	Trainees
Project Officer, ATMA Jamtara	Mushroom cultivation (Oyster/Milky)	22-24 Nov., 2010	3	17
Art of Living, Doranda,Ranchi	Oyster Mushroom cultivation	10-11 Jan., 2011	2	15
Project Officer, Diara Vikash Pariyogna Patna, Bihar	Oyster Mushroom cultivation	18-22 Jan., 2011	1	26
Project Officer, ATMA , East Singhbhoom	Oyster Mushroom cultivation	14-18 Feb., 2011	1	14
Project Officer, ATMA, Chaibasa, Singhbhoom	Oyster Mushroom cultivation	1-5 March, 2011	1	25
NAIP, Dumka	Post harvest Technology	10-11 March, 2011	1	25
NAIP, Jamtara	Post harvest Technology	14-15 March, 2011	1	22

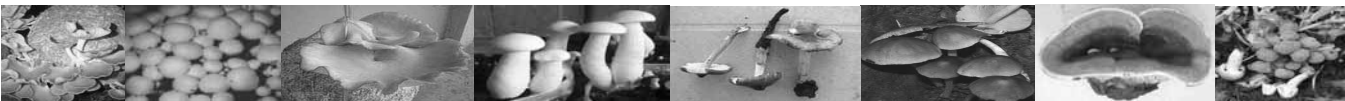




Fig. 30. Training on oyster mushroom cultivation at Umiam, Meghalaya

- Practical demonstration of mushroom cultivation on 14th Feb, 2011 in a training course at ICAR RC Umiam Meghalaya (Fig. 30)
- Mushroom Production-A boon for land less farmer on 17th Feb, 2011 in training programme for AGRI/Hort/Fishery officers under SWPAL project at ICAR RC Umiam, Meghalaya

Resource generation

- A sum Rs. 18,980.00 has been generated through sale of spawn, fresh mushroom and mushroom culture.

Faizabad Centre

a. Training, demonstrations and Kisan mela

- In order to promote mushroom cultivation in Uttar Pradesh two trainings were organized during the year in which a total of 100 farmers were trained.

- During the year two Kisan goshtis, two kisan melas and 5 demonstrations were organized.
- A total of 650 farmers have visited the centre during the year.

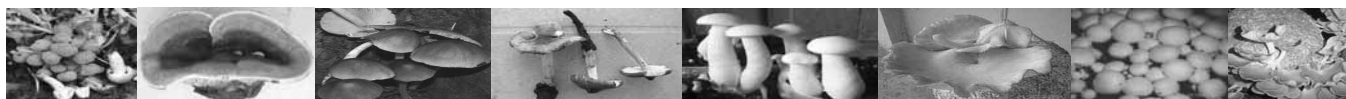
b. Revenue generation

- In total 339 kg of mushroom spawn was supplied to the growers and 202.92 kg fresh mushroom was sold.
- By the sale, revenue of a total Rs 2,21,682.00 has been generated.

Hisar Centre

a. Training and lectures

- Two trainings (12 days each) on mushroom production technology with special emphasis on commercial spawn production were conducted and one was exclusively for SC and ST.
- Three days training was conducted for unemployed youth, women and farmers at CCSHAU, Hisar.
- Trainings and demonstration on oyster and milky mushroom cultivation was conducted at PNB Farmers' training Centre, Sachakhara (Jind).
- Lecture and demonstration on button, oyster and milky mushroom cultivation at HAIC, Murthal (Sonapat).
- Lecture and demonstration on mushroom cultivation at KVKs, Rohtak, Fatehabad and Kurukshetra.



- Farm Advisory service both at the campus as well as mushroom growers farm.
- Extension literature for mushroom cultivation was provided to the farmers.
- Duty at ATIC (free help line of the university)
- Radio talk on mushroom cultivation.

b. Revenue generation

- 650 kg of commercial spawn of different mushrooms was supplied to the growers.

Raipur Centre

a. Training

- A total of four trainings on mushroom production technology was conducted in which a total of 150 women and 22 men were participated (Table 41).
- More than 50 lectures have been delivered in various training programmes organized during the year at various places in Chattishgarh.

b. News Items

- Parirachhan takniki ka pradarshan Khidakitola, Dhamtari Haribhumi 20.03.2010
- Phal sabji bachane diye tips, Khidakitola, Dhamtari, Haribhumi 20.03.2010
- Kheti ko dhandhe ke roop men apnane ki salah, Hari Bhoomi 14.03.11.
- Phal –sabji ko bachane diye tips; Hari Bhoomi 20.03.11.
- Naye jamane ke naye kisan, Hari Bhoomi 20.02.11
- Wheat crop demonstration par prasetra diwas ka aayojan Nawabharat 12.03.11

c. Visits

- Shri Chandrasekhar Sahu Agriculture Minister, Chattishgarh, visited Mushroom Pradarshni during Kisan Mela Feb-2011
- Dr. Raman Singh, Ho'nable Chief Minister, Chattishgarh, visited Mushroom Pradarshni on 20th January, 2011.

Table 41. Trainings conducted by Raipur centre

Training/ demonstration	Duration	Participation number
Mushroom spawn production technology	22- 24 July 10	30 women
Oyster mushroom Utpadan Takneeki Prashikshan	26-28 October, 10	32 men/women
Demonstration on mushroom production techniques	12-15 February, 10	50 women
Oyster Mushroom Utpadan Takneeki Prashikshan	21-25 February, 10	60 women





Fig. 31. Trainings and exhibition at Raipur centre

- Shri Rames Bais, MP, Raipur visited Mushroom Research Lab on October 14-15th, 2011
- Director of IFFCO visited Mushroom Research Lab on December, 2010,
- Shri M.L, Adil, Board Member of IGKV, visited Mushroom Research Lab January, 2011.
- Dr. M.P. Pandey Hon'able V.C. IGKV Raipur visited Mushroom Research Lab May, 2011
- Dr. S.S Patil, DRS, IGKV, Raipur, visited Mushroom Research Lab on March, 2011
- Dr. Pursotam Chandrakar, Director, Sparsh Samajik Shaichhdik Sansthan, Raipur visited Mushroom Research Lab. on April, 2010.
- A group of Scientists of Veterinary of different parts of India visited mushroom research lab on February, 2011.

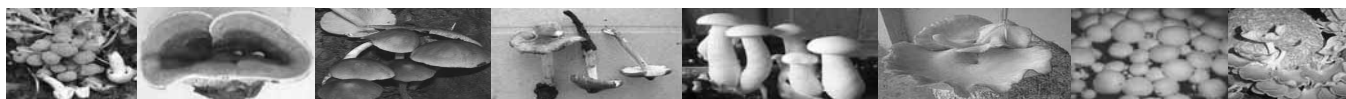
- A number of farmers/farm women/ college & school students visited the mushroom lab.

d. Kisan mela/Kisan Sammelan

- Participated in Rajyotsava 2011 being organized by Chhattisgarh Govt at Pt. RSU Campus Raipur from 25-31st October 2010.
- Participated in two-day Krishi Pradarshini cum Kisan Mela being organised by IGAU and Department of Agriculture at College campus, IGAU, Raipur on October 2010
- Participated in two-days Krishi Pradarshini cum Kharif Kisan Mela diwas of University being organised by IGKV at College Campus, IGAU, Raipur on Feb 2011.

e. TV / Radio Talks

- Awadhiya G.K (2011). 'Oyster Mushroom ki kheti kaise karen'



telecasted in three district i.e. Bilaspur, Janjgir korba by All India Television Feb, 2011.

- Awadhiya G.K (2011). “Oyster mushroom beej (Spawn) utpandan taknik” telecasted in three district i.e. Bilaspur, Janjgir korba by All India Television Feb, 2011.
- Awadhiya G.K (2011). A talk on oyster mushroom ka utpandan labh evan sambhavanayen” was telecasted by Doordarshan Kendra, Raipur under ‘Bhuiya Ke Goth’ in August, 2010.
- Awadhiya G.K (2010). A radio talk on ‘Mushroom ki kheti’ was broadcasted by All India Radio Raipur September, 2010.
- Awadhiya G.K& Chandravanshi S.S. (2011). A TV talk on “Oyster futu ki kheti kaisen kare” was telecasted by Doordarshan Kendra, Raipur in March 2011
- Chandravanshi S.S. (2011). A T.V. talk on Dudhiya mushroom ka utpandan

main samansyaen’ was telecasted by by Doordarshan Kendra, Raipur under ‘Bhuiya Ke Goth’ in October, 2010.

- Chandravanshi S.S. (2010). A TV talk on ‘Mushroom utpandan ka arthik vishleshan was telecasted by Doordarshan Kendra, Raipur under ‘Bhuiya Ke Goth’ in August, 2010.
- Chandravanshi S.S. (2010). A TV talk on ‘Button Mushroom ka utpandan kaise kare Doordarshan Kendra, Raipur under ‘Bhuiya Ke Goth’ September, 2010.

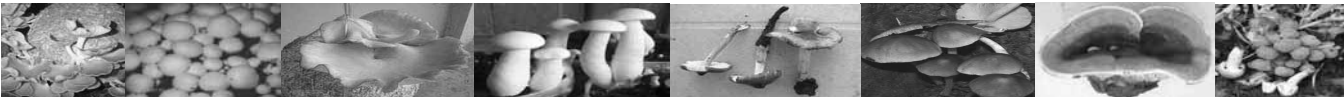
Pantnagar Centre

a. Training

- In all six training programmes were organized by the centre during the year at various places like Uttarkashi, Chamoli and Bageshwar of Uttarakhand and also in Patna (Bihar).
- A total of 158 farmers were trained and out of which 77 were male and 81 were female candidates (Table. 42).

Table 42. List of trainings conducted at pantnagar centre

Date of training	No. of farmers	No. of male/ female	Place
July 12-17, 2010	27	21-male/06-female	Uttarkashi, Uttarakhand
July 19-23, 2010	16	12-male/04-female	Chamoli, Uttarakhand
July 26-30, 2010	15	08-male/07-female	Chamoli, Uttarakhand
Aug. 03-09, 2010	41	09-male/32-female	Patna, Bihar
Aug. 24-30, 2010	43	14-male/29-female	Patna, Bihar
Oct. 25-30, 2010	16	13-male/03-female	Bageshwar, Uttarakhand
Total	158	male-77/female-81	



b. Revenue generation

- Mushroom spawn (1702 kg), master spawn (33 bottles) and culture tubes (19 Nos.) of different species/ strains supplied to the growers and spawn producers during the year
- The centre has supplied 321 q of compost to farmers during the year 2010-11.

Vellyani Centre

a. Activities

- Six on-campus Training Programmes were organized to different categories of people, viz. students, kudumbasree units, senior citizens and educated unemployed youths.
- NARP Workshop—1st and 2nd February 2011 and presented the progress report of AICRP Mushrooms and WGDP “Collection, identification, cultivation and popularization of edible/ medicinal mushrooms of western ghats of Kerala”.
- Tissue culture, mother spawn, spawn, mushroom beds and dried mushroom powder were distributed to the public.
- QRT meeting on 17th and 18th February 2011. Presented the research findings from 2005 to 2010 and visited mushroom farms.
- Attended one-day seminar on National Conference on "Propelling women scientists and technocrats for social reformation" organized by Shakthi Academy of Science, Technology and Research on 4th March 2011.

- Attended one-day seminar on "Mushroom, prospects and problems at NIST", Thiruvananthapuram on 8th February 2011.

Coimbatore Centre

a. Training

- During the year 2010-2011 twelve “One day training programmes” on mushroom cultivation were conducted and a total 841 farmers were trained.
- Six five day-training programmes were organized on advanced mushroom cultivation techniques and 41 people were benefited. Also short trainings (64 number) were organized and 3005 people were benefited.
- About 2286 students from various colleges, schools, self help groups, framers from different parts of Tamil Nadu, Kerala, Andhra visited and they were explained with the activities and the mushroom cultivation techniques.
- Open and distance learning certificate, course on "Mushroom Cultivation" was also offered to 14 participants.

b. Revenue generation

- During the report period, about 1,651.5 spawn bags ie., 495.45 kgs were supplied to the growers of Tamil Nadu.

c. Exhibition/ Seminars

- Participated in the State level farmers day at TNAU, Coimbatore (9-10th June 2010)





Fig. 32. Training programme organized by Coimbatore centre

- Participated in the AGRI INTEX Regional Agri Fair for Southern zone by GOI, Ministry of Agriculture where mushroom activities were explained (30th September 2010)
- Participated in the exhibition conducted during the inauguration of new campus of the affiliated college,

Vanavarayar Insitute of Agriculture at Pollachi (29th October 2010)

- Participated in the Agri Expo exhibition conducted by the Dept. of agriculture at Chennai where mushroom activities were explained (22nd November 2010)



8. PUBLICATIONS

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- Doshi Anila, and Vikram Singh Meena 2010. Gramin Shatro ma Organic Mushroom Cultivation: Ek Vardan. Organic Farming Ka Principles and Management, Himanshu Publications Delhi and Udaipur 196-202.
- Doshi Anila and Manjit Singh. 2010. Mushroom diversity and their conservation in Rajasthan, India. National seminar on characterization and conservation of biodiversity for sustainable agriculture, MPUA&T, Udaipur 90-91 dated 12-13 November.
- Mehta B.K., S.K. Jain, G.P. Sharma, Anila Doshi, H.K. Jain. 2011. Cultivation of button mushroom and its processing: An Techno-Economic Feasibility. International Journal of Advanced Biotechnology and Research. Vol2, 1 pp201-207

Bhubaneshwar Centre

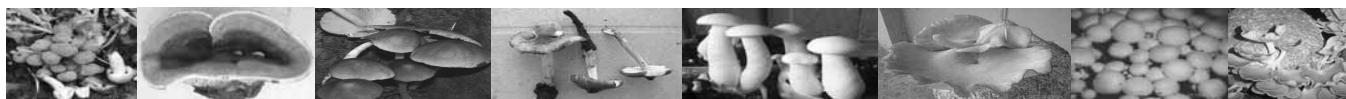
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- Mohapatra, K.B., Behera, B. and Mohapatra, S.S. 2010. Effect of substrate management on biological

efficiency of paddy straw mushroom (*Volvariella volvacea*). National seminar on Sustainable Agriculture and Food Security-Challenges and Opportunities. 29-30 Nov. 2010 at OUAT, Bhubaneswar.

- Mohapatra, K.B., Behera, B. and Acharya, P.K. 2010. Effect of substrate pasteurization methods on bag contamination in oyster mushroom. National seminar on Emerging Trends in Pest Management Strategies under changing climatic scenario from 20-21st Dec. 2010 at OUAT, Bhubaneswar.
- Behera, B., Mohapatra, K.B. and Kumari, K. 2010. Competitor moulds of paddy straw mushroom and their management. National Seminar on Emerging Trends in Pest Management Strategies under changing climatic scenario from 20-21st Dec. 2010 at OUAT, Bhubaneswar.
- Mohapatra, K.B., Behera, B. and Mohapatra, S.S. 2010. Influence of spawn quality on biological efficiency of paddy straw mushroom (*Volvariella volvacea*). National Symposium on Diversification for sustaining profitability in mushroom production from 26-27th Nov. 2010 at UHF, Nauni, Solan (HP).

Popular articles

- Mohapatra, K.B. 2010. Problems associated with summer paddy straw mushroom cultivation. Krushak Bandhu Annapurna XVIII (III): 18-19.



- Mohapatra, K.B. 2010. Cultivation of paddy straw mushroom in controlled environment. *Krushak Bandhu Annapurna XVIII (XII)*: 13-15.

Theses

- Performance study of *Pleurotus florida* under diverse management practices.
- Improvement of biological efficiency of paddy straw mushroom through substrate management.

Technical Bulletin

- Mohapatra, K.B. 2010. Mushroom cultivation (Part I to VI), Directorate of Extension, OUAT, Bhubaneswar (Local language)

Pasighat Centre

- **P. Raja***, Y. Tamut, J. Mohanty, R. Saravanan. 2010. Exploitation of wild edible fungi for commercial cultivation by tribal people for traditional food security and rural development International mycological conference 9 Edinburgh, August 1-6, 2010 UK

Samastipur Centre

- दयाराम 2011. मशरूम उत्पादन विस्तार पुस्तिका-2
- दयाराम 2011. मशरूम बीज उत्पादन
- मशरूम समाचार

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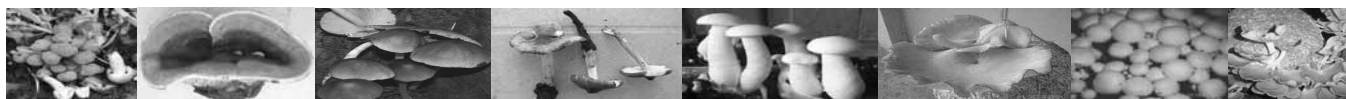
9. PERSONNELIA

Staff position at various AICMIP centres during 2010-11

Sl.No	AICRP Centre	Name of staff	Designation
A.	ICAR Institute based Centre		
1.	ICAR Research Complex for NEH Region, Umiam 793 103, Meghalaya	Dr Satish Chandra	Principal Scientist, Plant Pathology
2.	ICAR Research Complex for Eastern Region, Research Centre, Plandu, Ranchi 834010 (Jharkhand)	Dr. J.P. Sharma	Principal Scientist, Plant Pathology
B.	SAU based Centre		
1.	Dept. of Plant Pathology, Centre for Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore - 641 003	Dr. V. Prakasam Dr. G. Thiribhuvanamala Th. P. Arumugam Th. P. Karuppusamy Th. C. Sundararajan Th. Venkatesan Th. P. Selvaraj	Professor Assistant Professor Laboratory Assistant Lab. Assistant Lab. Technician Skilled mazdoor
2.	Centre for Tropical Mushroom Research and Training, Dept. of Plant Pathology, Orissa Agricultural University, Bhubaneswar, Orissa	Dr. K.B. Mohapatra	Associate Professor
3.	Department of Plant Pathology, N. D. University of Agriculture & Technology, Kumarganj, Faizabad – 224 229 (U.P.) Indis	Dr. S.K.Pande Sri Vijay Kant Sri G.P. Gautam Sri Brij Bhushan Sri Lalta Prasad	Mycologist Fieldman Technician L.D.C./Typist Beldar
4.	Dept. of Plant Pathology, College of Agriculture, CCS Haryana Agricultural University, Hissar - 124 005	Dr. Surjit Singh	Professor
5.	Department of Microbiology, College of Basic Sciences and Humanities, Punjab Agricultural University, Ludhiana – 144 001.	Dr (Mrs) S. Dhanda Dr. H. S. Sodhi Dalip Singh Mr. Gurdev Singh Har minder Kr Ram Kumar	Sr. Mycologist Sr. Mycologist Sr Laboratory Assist. (Technician) Fieldman Typist-cum-Clerk Beldar
6.	Mushroom Research and Training Centre, G.B. Pant University of Agri. & Tech., Pantnagar – 263 145 (Uttarakhand)	Dr. K.P.S. Khushwaha Mr. Himanshu Joshi Sh. Ramakant Singh Sh. Santosh Kumar Sh. Deo Kumar	Mycologist Technical Assist. Jr. Assist./Fieldman Typist/clerk Beldar



Sl.No	AICRP Centre	Name of staff	Designation
7.	Dept of Plant Pathology, Collage of Horticulture and Forestry, Central Agricultural University, Pasighat – 791 102 (Arunachal Pradesh)	Dr. P. Raja	Assistant Professor
8.	Plant Pathology Section, College of Agriculture, Mahatma Phule Krishi Vidyapeeth, Pune-411 005	Dr. R.T. Sapkal Dr. A.M. Tirmali Shri V.K. Bhalerao Shri. N.G. Desai Shri S.G. Hingmire Shri. Y.S. Bhavne	Mycologist Jr. Mycologist Jr. Res. Asstt. Agril. Asstt. LDC/Typist Beldar
9.	Mushroom Research Laboratory, Dept. of Plant Pathology, Indira Gandhi Krishi Vishwavidyalaya, Raipur – 492 006 (Chhattisgarh)	Dr. G.K. Awadhiya Dr. S.S. Chandravanshi Shri B.L. Sinha Shri R.K. Pandey Shri A.R. Sahu	Mycologist Assistant Mycologist Field Assistant LDC Peon (Beldar)
10.	Department of Microbiology, Faculty of Basic Sciences and Humanities, Rajendra Agricultural University, Pusa (Samastipur) - 848 125 (Bihar)	Dr. Dayaram	Associate Professor
11.	Dept. of Plant Pathology, Rajasthan Collage of Agriculture, Maharana Pratap University of Agric. & Tech., Udaipur – 313 001(Rajasthan)	Dr. Anila Doshi Mrs. Kala Nath Mr. Nathu Singh Mr. Kishan Singh	Mycologist Field Supervisor L.D.C. Beldar
12.	Department of Plant Pathology, College of Agriculture, KAU, Vellayani – 695 522 Thiruvananthapuram, (Kerala)	Dr. D. Geetha Ms. Deepa Rani	Mycologist Technical Assistant
C. Cooperating Centre			
1.	Mushroom Research & Production Unit, Department of Mycology and Plant Pathology, Dr. Y.S. Parmar Univ. of Horticulture and Forestry, Nauni – 173 230, Solan (HP)	Dr. Dharmesh Gupta	Jr. Mycologist
2.	Haryana Agro Industrial Corporation R & D Centre, Opp. DCR University, G.T. Road, Murthal, Sonapat (Haryana)	Dr. Ajay Yadav	Scientist



10. BUDGET / RELEASED 2010-11

Centre	Recurring Contingency (Rs. Lakh)						Non-Recurring Contingency (Rs. Lakh)						Total (Rs. Lakh)	
	Esstt. charges		T.A.		Contingency including FLD		Equipments		Vehicle		Works		a	b
	a	b	a	b	a	b	a	b	a	b	a	b		
ICAR RC NER, Barapani	-	-	0.20	0.10	3.00	1.50	5.00	2.50	-	-	25.00	12.50		
ICAR RC ER, Ranchi	-	-	0.20	.20	0.90	0.90	-	-	-	-	-	-		
OUAT, Bhubaneswar	8.00	4.00	0.10	.10	1.00	1.00	3.00	3.00	-	-	-	-		
TNAU, Coimbatore	8.00	8.00	0.10	0.10	1.00	0.75	3.00	3.00	-	-	5.00	5.00		
NDUA&T, Faizabad	8.00	8.00	0.10	0.10	1.00	1.00	2.00	2.00	-	-	5.00	5.00		
CCSHAU, Hissar	8.00	4.00	0.10	0.10	1.00	1.00	3.00	3.00	-	-	5.00	5.00		
PAU, Ludhiana	15.00	24.90	0.20	0.20	1.00	1.00	2.00	2.00	-	-	5.00	5.00		
GBPUA&T, Pantnagar	8.00	8.00	0.10	0.10	1.00	1.00	3.00	3.00	-	-	-	-		
CAU, Pasighat	10.68	10.68	0.12	0.12	1.35	1.35	2.65	2.65	-	-	6.65	6.65		
MPKV, Pune	15.00	15.00	0.20	0.20	1.00	1.00	3.00	3.00	-	-	5.00	5.00		
IGKV, Raipur	15.00	15.00	0.20	0.20	1.00	1.00	3.00	3.00	-	-	5.00	5.00		
RAU, Samastipur	8.00	8.00	0.10	0.10	1.00	1.00	3.00	3.00	-	-	5.00	5.00		
MPUA&T, Udaipur	8.00	18.00	0.10	0.10	1.00	1.00	3.00	3.00	-	-	5.00	5.00		
KAU, Vellayani	8.00	8.00	0.10	0.10	1.00	1.00	3.00	3.00	-	-	5.00	5.00		
UHF, Nauni	-	-	0.10	0.05	1.00	1.00	-	-	-	-	-	-		
HAIC, Murthal	-	-	0.10	0.10	1.00	0.80	-	-	-	-	-	-		

a- sanctioned amount

b- actual expenditure



