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2015-16



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चम्बाघाट, सोलन-173 213 (हि.प्र.), भारत
ICAR-Directorate of Mushroom Research
Chambaghat, Solan-173 213 (H.P.), India



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2015-16



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ICAR-DIRECTORATE OF MUSHROOM RESEARCH
Chambaghat, Solan - 173 213 (H.P.), India



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iLrkouk@Preface

e> o" 2015&16 d fy, Hkkdvui&[kEc vul/kku fun'kky; dk okf'kd ifronu iLrr djr g, [k'kh dk vuHko gk jgk gA bl ifronu e fofHkUu {k=k e fun'kky; dh vul/kku miyfc/k; ij idk'k Mkyk x;k gA geu ik|kfxd;k dk fodkl dju vkj mUg fd lku lenk; rd igpku dh fn'kk e viu i;k l k dk c<k; gA ou dVu dh xfrfof/k; e of) d dkj.k vkuof'kd fof/krk dk gku okyk ud lku] [kEc d Hkfo"; d fy, xHkhj fpUr'k dk fo"k; gA vud itkr;k; igy gh foylr gk pdh g(dN foylr ik; g vkj mUg vkb; l h, u ¼ idfr l j{k.k d fy, vUrj'kVh; l ?k½ dh l dVkdkyhu l ph e j [kk x;k gA fun'kky; dk mnn'; n'k d 0; kid Hkxkfyd LFkkuk l [kEc tuun0; dk iklr dju vkj mldk j [k&j [kko dju e xHkhj i;k l djuk gA oreku o" e] n'k d fofHkUu jkT; k d ou; {k=k l dy 229 ou; [kEc tuun0; ikflr;k dk l dyu fd;k x;k vkj mud 'k) Ård lo/ku dk Hkkdvui&[kEc vul/kku fun'kky; d thu cd e ifjjfkr fd;k x;kA

[kEc ituu e fd, x, fof'k"V dk; d ifj.kkeLo: i cVu [kEc e nk Hkjkiu ifrjk/kh l dj k ¼, uch, l &1 rFkk , uch, l &5½ dk tkjh dju e enn feyhA blh idkj] l LFkk d thukfeD l gk; rkFk [kEc ituu dk; Øe l [kEc thuke e igyh ckj odh Mkeu ¼ ik/kk d fy, fof'k"V½ dk irk yxku e enn feyhA fofHkUu [kku ;kx; [kEc rFkk [kEc l u, eY; of/kr mRiknk dk r;kj dju dh mRiknu ik|kfxd;k d ifj"dj.k ij Hkh v/; ;u fd, x, A vif'k"V [kEc ik"kk/kkj }kjk xg d Hkl dk ifrLFkkui dju ij vk;kftr ijh{k.k d ifj.kkek u 100 Vu ifr o" dh mRiknu {kerk okyh [kEc bdkb d fy, 3-0 yk [k : i; dh fuoy cpr fl) dhA fun'kky; }kjk fodflr [kEc vk/kkfjr iof/kr lfo/kk tud [kk l u [kk l i l Ldj.k m|kx d fy, u, vol j mRiUu fd, gA [kEc dh [krh d ikuu; u igyv k vkj ik|kfxd h gLrrkrj.k e fun'kky; }kjk mYy [kuh; ixfr dh xb gA {k=h; ,o jk"Vh; Lrj ij jk"Vh; [kEc ey] vU; eyk rFkk inf'kuk e ifrHkfx;k dh yxkrkj c<rh Hkxhknkj h l [kEc dh yxkrkj c<rh ekx dk irk pyrk gA [kEc vul/kku fun'kky; }kjk fodflr

I am happy to present the Annual Report of ICAR-Directorate of Mushroom Research for the year 2015-16 which highlights our research achievements in different areas.



We have enhanced our efforts to develop technologies and deliver to the farming community. The loss of genetic diversity due to accelerated deforestation activities is a serious concern for the future of mushroom wealth. Many species have already become extinct; few are endangered and tagged in IUCN red list. The Directorate is aiming and putting serious efforts for acquiring and maintenance of mushroom germplasm from the vast geographical location of the country. In the present year 229 wild mushroom germplasm accessions were collected from the forest areas of different states and their pure tissue cultures were preserved in the Gene Bank of ICAR-DMR.

The conspicuous work done in mushroom breeding has led us to release two browning resistant hybrids (NBS-1 and NBS-5) in button mushroom. Similarly, Genomics aided mushroom breeding programme of the institute helped to report the WRKY domain (specific to plants) first time in mushroom genome. Studies on refinement of production technologies of different edible mushrooms and preparation of new value added products from mushrooms were also undertaken. The outcome of the experiments conducted on substitution of wheat straw by spent mushroom substrate, proved the net savings of Rs. 3.0 lakh for mushroom unit with production capacity of 100 Tons Per Annum. Mushroom based fortified convenience foods developed by the Directorate opens the new platform for the food processing industries. Significant progress has been made by the Directorate in Transfer of Technology and promotional aspects of mushroom cultivation. The continuous increase in the number of participants in National Mushroom



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 }kjk n'k d fofHkUu Hkxk e dy 14 fun'kky; e rFkk
 fun'kky; d ckgj if'k{k.k dk;Øe vk;kftr fd,
 x,A l kFk gh lLFkku e dk;'kkyk,] fo'o enk fnol
 vfhk;ku lekjpg] jk"Vh; v[k.Mrk fnol vkj fgUnh
 llrkg ,o lrdk llrkg vkfn t l h vU; ljdkjh
 xfrfok;k;k Hkh vk;kftr dh xBA geu u, mTToy
 ekuo l l k/ku dk Hkh 'kkfey fd;k vkj e> vk'kk g
 fd vxkeh dN o"kk e gekj depkfj;k dh lgk;rk
 l ge viu vul/kku dk icy djx vkj jk"V dh
 lok djr jgxA

vrri] e [kEc vul/kku fun'kky; d leLr
 depkfj;k] vul/kku ifj"kn ,o ic/k ifj"kn d lnl;k
 rFkk gekj eY;oku fgr/kkjdk d lei.k ,o lg;kx
 d ifr viuk vkHkkj idV djr gA l kFk gh e] bl
 f}Hkk"kh idk'ku dk le; l ldyu dju vkj bl
 idkf'kr dju d fy, liknu lnl;k dk Hkh c/kkb
 nrk gA vr e] e fun'kky; dh fofHkUu vul/kku o
 fodk l lc/kh xfrfok;k;k d lpkyu e fn, x, veY;
 ekxn'ku vkj fujrj lg;kx d fy, egkfun'kd]
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%oh-ih- 'kek%

(V.P. SHARMA)

Mela, fairs and exhibitions at regional and national level indicates the flourishing demand for mushrooms. In order to disseminate the technologies developed by DMR, 14 on and off farm training programmes were conducted at different parts of the country. The institute also organized workshops, celebrated World Soil Day campaign, National Science Day, National Unity Day and other official activities like Hindi Sapatah, Vigilance Awareness Week etc. We have also added new bright human resources and I am hopeful that in few years, with the help of all our staff, we will continue to strengthen our research and serve the nation.

Finally, I wish to acknowledge the devotion and cooperation of all staff of DMR, Research Advisory Council and Management Council members and our valuable stakeholders. I also congratulate the editorial team for timely compilation and bringing out this bilingual publication. At the end, I would like to express my gratitude to Director General (ICAR) and Deputy Director General (HS), ICAR for their treasured guidance and unceasing support in carrying out various R & D activities of the Directorate. I am sure that their confidence in us will take us forward in the coming years.



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fof'k"V I kjk'k@Executive Summary

[kEc vul/ku fun'kky; }kjk o'k 2015&16 d nkjku vul/ku ik|kfxdh gLrkrj.k rFkk ekua l l/ku fodk l d {k= e mYy[kuh; ixfr dh xb gA Qly mlu;u] Qly mRiknu] Qly l{j.k] Qlykrj ik|kfxdh ,o ik|kfxdh gLrkrj.k d {k= e fun'kky; dh miyfc/k;k dk ;gk l{ki e iLrr fd;k x;k gA

fgekpy in'k vkj f=i jk d ou; {k=k e dodh; lo{k.k fd, x,A fgekpy in'k l dy 205 ueu ,df=r fd, x, vkj 193 ueuk dh igpku mud o'k Lrj rd dh xBA iu% 79 ueuk d 'k) Ård lo/ku dk iklr dj d [kEc vul/ku fun'kky;] lkyu d thu cd e tek dj;k;k x;kA dN jkpd ueuk ;Fkk LVfcyj l itkfr lY;jv l itkfr] Qlbykij l itkfr] ØxLEQ l itkfr] dLvfufj; l itkfr] ,efuV l itkfr] vkfeyfj;k efy;] yfi;LV rFkk yfiLV l itkfr dh igpku d fy, lEi.k o.ku fd;k x;k gA blh idkj] f=i jk d [kkokbdkfju] dkyk [kkjh] lekbekjh rFkk cD l kuxj d ouk l o'kdky d nkjku dy pkch l ou; [kEc ueu ldfyr fd, x,A lHkh ueuk dh tkp mud eØLdkfid %LFk% y{k.kk d fy, dh xb vkj Ård lo/ku dk vyx dj d m l Hkdvui & [kEc vul/ku fun'kky;] lkyu vkj f=i jk fo'fo|ky; d thu cd e tek dj;k;k x;kA bue jkpd rFkk ie[k o'k 'kfeY Fk % ,xfjd l %rhu mi itkfr; % DykbV l kbc l kbukfid %Hkkrj l ,d ub nt % LVQfj; % LVjdfj; % yDVfj; l VfcM l] ,x l kbc Liyf.MMA dykf l jk itkfr] ,efuV l itkfr %othuVh leg % yf.Vul Ldoky l y l %rhu ueu % vkjhdyfj; % %rhu ueu % vkbu l kbc %nk vuB ueu % b.Vkyek % ,d ueuk % yf.Vul % ,d ueuk % rFkk ejfLe; l itkfrA

[kEc thuke e odh %ikV d fy, fof'k"V % dh mifLFkr dh ;g igyh fjiKV gA bl Vkl fØ l'ku dkjd d y{k.ko.ku d fy, fof'k"V LVuk l dy 51 ,Eiyhd l i tuu % rFkk c/; ,dy ch t.k. k foyxuk dk iFkd fd;k x;k vkj ih th, evh oDVj i.kkyh dk mi; % dx dj d b-dkyk b thok.k d Mh, p&5α LVu e Dykfux dh xb vkj vuØe.k d fy, lykfTeM dk vyx fd;k x;kA

cVu [kEc d ikp p;fur mPp mit'khy rFkk Hkjk iu ifrjk/h l dj k ;Fkk ,uch, l&1] ,uch, l&2] ,uch, l&3] ,uch, l&4 ,o ,uch, l&5 dk vkb, l , l vkj] , l , l vkj rFkk fjV&, yheUV vk/kkfj r ekdj k mi; %

The Directorate of Mushroom Research has made significant progress in research, transfer of technology and human resource development during 2015-16. The achievements of Directorate in the area of Crop Improvement, Crop Production, Crop Protection, Post Harvest Technology and Transfer of Technology are summarized here.

Fungal forays were undertaken in the forest areas of Himachal Pradesh and Tripura. A total number of 205 specimens were collected from Himachal Pradesh and 193 specimens identified up to genus level. Further, pure tissue cultures of 79 specimens were obtained and deposited in the Gene Bank of DMR, Solan. Some of the interesting specimens include *Strobilurus* sp., *Pleurotus* sp., *Phylloporus* sp., *Chrogomphus*, *Cortinarius* sp., *Amanita* sp., *Armillaria mellea*, *Lepiota* and *Lepista* sp. which were fully described for identification. Similarly, 24 wild mushroom specimens were collected during rainy season from the forests of Khovaicorin, Kola Khor, Sumaimori and Boxanagar of Tripura. All the specimens were examined for their macroscopic characters and tissue cultures were isolated and conserved in the Gene Bank of ICAR-DMR, Solan and Department of Botany, Tripura University. The interesting and important genera includes- *Agaricus* (three spp.), *Clitocybe sinopica* (a new record from India), *Stropharia stercoria*, *Lactarius tabidus*, *Agrocybe splendida*, *Calocera* sp., *Amanita* sp. (vaginatae group), *Lentinus squarrosulus*, (three specimens), *Auricularia* (three Specimens), *Inocybe* (2 – unique specimens), *Entoloma* (one specimen), *Lentinus* (one specimen) and a *Marasmius* sp.

WRKY domain (specific to plants) has been reported first time in mushroom genome. For the characterization of WRKY transcription factor a total of 51 amplicons from different strains, fertile and non-fertile single spore isolates of button mushroom were isolated and cloned in DH-5a strain of *E. coli* using PGMT vector system and plasmids were isolated for sequencing.



djr g, vk.kfod y{k.ko.ku fd;k x;kA dy ikp l dj fdLek vkj mud lcf/kr ird thuik: ik e cg:firk lo{k.k d fy, vdy rFkk vkbj i rFkk jhei ikbejk d l;k tu e dy 50 vkj, ihMh] 33 , l, l vkj] 7 vkb, l, l vkj] 34 vkbj i, o 14 jhei ikbejk dk t kpk x;kA l dj k , uch, l&1] , uch, l&2] , uch, l&3] , uch, l&4 rFkk , uch, l&5 l ch tk.k ifr ldfyr dh xb vkj 150 ch tk.kvk dk iR;d l dj l vyx fd;k x;k rkfd efix tul[; k fodflr dh tk l dA

cVu [kEc d nk Hkjkiu ifrj/kh l dj k , uch, l&1 , o , uch, l&5 dk eY;kdu fd;k x;k vkj mlg fnukd 29&30 tu] 2015 dk Hkdvui&[kEc vul/kku fun'kky;] lkyu e vk;kftr vf[ky Hkkjrh; leflor [kEc vul/kku ifj;k tuk dh 17oh okf'kd dk; 'kkyk e idkf'kr@t kjh fd;k x;kA

ik'P;jh dr xg d Hk l ij lrfyr rkieku %14&20 fMxh l-½ ij Qyu d fy, lY;jkV l mi i tkfr d dy murh l fofHkUu LVu dk eY;kdu fd;k x;kA LVu] Mh, evkji h&356 e vf/kdre tfod n{krk %chb% 155 ifr'kr vkj m l d ckn Mh, evkji h&339 e 105 ifr'kr chb nt dh xba b l h idkj] lY;jkV l l t j d k t d pkj fofHkUu ird LVu k l , dy ch tk.k dk lxe djkdj fodflr fd, x, 36 l dj LVu dk eY;kdu ik'P;jh dr xg Hk l ij fd;k x;kA V e ih, l l h, p&29 e vf/kdre chb %65-25 ifr'kr½ nt dh xb] t cfd Fkyk e ih, l l h, p&14 e vf/kdre chb %66 ifr'kr½ nt gbA

vkdfrofKku dh nFV l fHkUu o/- okYof l ;k LVu l iklr fd, x, , dy ch tk.k foyxuk % , l, l vkb% dk bLreky yxkrkj mPp mit 'khy , dy ch tk.k foyxuk dk p;u dju vkj en xfr l c<u oky , dy ch tk.k foyxuk l mPp mit 'khy l dj k dk fodflr dju gr fd;k x;kA b l idkj fodflr fd, x, , dy ch tk.k foyxuk vkj l dj k dk eY;kdu mudh Qyudk; mit , o ik'kf.kd ikQkby d fy, fd;k x;kA l dj k rFkk , dy ch tk.k foyxuk d mit in'ku dk eY;kdu bUMkj [krh ifjflFkr;k d rgr jklk;fud rjhd l mipkfjr /kku ivky d cMyk , o dik l vkvb fey d vif'k'V o /kku ivky d l M g, ik'kk/kkj dk mi ;lx dj d yxkrkj of) 'khy ijh{k.kk d ek ;e l fd;k x;kA yxkrkj [krh ijh{k.kk d mijkr] o/- okYof l ;k d l Qn@eVey LVu Mh, evkji v&484 l nk , dy ch tk.k foyxuk vkj LVu Mh, evkji v&185 %NKV vkdkj d Hkj jx d Qyudk; mRiUu dju oky½ rFkk LVu

The five selected high yielding and browning resistant hybrids NBS-1, NBS-2, NBS-3, NBS-4 and NBS-5 of button mushroom were molecularly characterized using ISSRs, SSRs, and retro-element based markers. All five hybrids and their respective parental genotypes have been tested for polymorphism using 50 RAPD, 33 SSR, 7 ISSR, 34 IRAP and 14 ReMAP primers singly and in combination of IRAP and ReMAP primers. Spore prints were collected from hybrids NBS-1, NBS-2, NBS-3, NBS-4, and NBS-5 and 150 spores were isolated from each hybrid to develop mapping population. The two browning resistant hybrids of button mushroom (NBS-1 and NBS-5) were evaluated and released during the XVII Annual Workshop of All India Coordinated Research Project on Mushrooms held at ICAR-DMR, Solan from 29th- 30th June, 2015.

Twenty nine different strains of *Pleurotus* spp. were evaluated for fruiting at moderate temperatures (14-20 °C) on pasteurized wheat straw. Highest Biological Efficiency (BE) of 155 % was recorded with the strain, DMRP-356 followed by DMRP-339 (105 % BE). Similarly, 36 hybrid strains developed by mating of single spores from four different parent strains of *Psajor caju* were evaluated on pasteurized wheat straw. Highest BE of 65.25 % was recorded with PSCH 29 in trays. Whereas, PSCH 14 gave the highest BE of 66 % in bags.

The single spore isolates obtained from three morphologically distinct *V. volvacea* strains were used for selecting consistently high yielding single spore isolates, and developing high yielding hybrids from the slow growing SSIs. The SSIs and the hybrids such developed were evaluated for their fruit body yield and nutritional profile. The yield performance of hybrids and SSIs was evaluated through successive growing trials using chemically treated paddy straw bundles and the composted substrate of cotton ginning mill waste and paddy straw under indoor cultivation conditions. After successive cultivation trials, two SSIs from a whitish/greyish strain DMRO-484 of *V. volvacea* and three hybrids obtained after crossing between the SSIs of strain DMRO-185 (giving small sized brown coloured fruit body) and



Mh, evkjk&247 %cM vkdkj d Hkj jx d Qyudk; mRiUu dju oky½ d ,dy chtk.k foyxuk d chp l dj.k d l kfk&l kfk LVu Mh, evkjk&247 %cM vkdkj d Hkj jx d Qyudk; mRiUu dju oky½ rFkk LVu Mh, evkjk&484 %cM vkdkj d l Qn jx d Qyudk; mRiUu oky½ d chp l dj.k l iklr rhu l dj k e mud ird LVu dh ryuk e dgh mPprj Qyudk; mit iklr gbA mPp mit 'khy l dj k l iklr Qyudk; fofVfeu&Mh rFkk dPpk j'kk ek=k d l kfk&l kfk iMf'k; e % l kfm; e vuikr e Hkh ird LVu dh ryuk e le) ik, x, A v/; ; u l fl) gkrk g fd , - ckbLi kj l dh rjg gh oh- okYof l ; k e Hkh mPp mit 'khy vkj ik'kf.kd nFV l J"B l dj fodflr dju dh l Hkkouk gA

f'kVkd [kEc d dy 35 LVu dk eY; kdu rhu fofHkuu rkiekuk ij fd; k x; kj ftue l doy 19 LVu e 15 fMxh l- rkiekuk ij Qyu inf'kr gvkA doy 12 LVu l gh chtk.k ifr ldfyr fd, x, vkj iR; d LVu d 100 l Hkh vf/kd chtk.kvk dk i tuu i; ktu d fy, vyx fd; k x; kA ; fuoly vkbVh, l & 1 , o vkbVh, l & 4 dk mi; kx djd l Hkh 35 LVu dh vk.kfod nFV l igpku dh xBA iof/kr ih l hvkj mRiknk dk vude.k , o fo'y'k.k fd; k x; kA ifj.kkek l yfVU; yk i tkfr; k e 0; kid thu iy inf'kr gvk tk fd tyok; fHkUurk vkj i tkfr; k d vudyu d dkj.k Hkh gk l drk gA

cVu [kEc vif'k'V ik'kk/kkj d ik'kf.kd l ; ktu ij fopkj djr g, bl dk i; kx cVu [kEc dh [kkn dk cuku d fy, xg Hkl dk vkf'kd rkj ij ifrLFkkiu dju e vk/ kkj l ?kVd d : i e dju gr db ij h{.k vk; kftr fd, x, A ij h{.k d ifj.kkek e inf'kr gvk fd ekud Qkey'ku d edkcy xg Hkl d LFku ij vif'k'V [kEc ik'kk/kkj }kjk fd, x, ifrLFkkiu mipkjk e ik'kd rRo ek=k vkj dEiLV inkokj@bdkb Hkkj dgh vf/kd FkkA xg d Hkl d LFku ij vif'k'V [kEc ik'kk/kkj dh fofHkuu ek=k dk ifrLFkkiu djd r; kj dh xb [kkn l dVko fd, x, Qyudk; e jk[k [kfut %ikVf'k; e] ykg] exuh] ftd] lyfu; e vkj dkij½ ikVf'k; e l kfm; e vuikr rFkk fofVfeu Mh t l vU; x.k Hkh dgh T; knk FkA xg d Hkl d LFku ij 30 ifr'kr vif'k'V [kEc ik'kk/kkj l r; kj [kkn e fofVfeu Mh] exuh t vkj ykg dh ek=k Hkh mYy[kuh; : i l dgh vf/kd ikb xBA xg Hkl d LFku ij vif'k'V [kEc ik'kk/kkj dk ifrLFkkiu dju ij [kkn dk mRiknu djd 100 rFkk 1000 Vu rktk [kEc mRiknu@o'k dh {kerk okyh [kEc mRiknu bdkb; k e

strain DMRO-247 (giving big sized brown coloured fruit body) as well as between strain DMRO-247 (giving big sized brown coloured fruit body) and strain DMRO-484 (giving big sized white coloured fruit body), were found to give higher fruit body yield compared to their parent strains. The fruit bodies from the high yielding hybrids were found richer in Vitamin-D and crude fibre content as well as in the potassium:sodium ratio compared with parent strains. The study proved the possibility of developing high yielding and nutritionally superior hybrids in *V. volvacea* just as in case of *A. bisporus*.

A total of 35 shiitake strains have been evaluated at three different temperatures and only 19 strains have shown fruiting at 15 °C. The spore prints were collected from 12 strains and more than 100 spores of each strain were isolated for breeding purpose. All the 35 strains were molecularly identified using universal ITS-1 and ITS-4 primers. The amplified PCR products were sequenced and analyzed. The results showed the wide gene pool in the *Lentinula* species, which may be due to the climatic variation and adaptation of the species.

Considering the nutritional composition of the button mushroom spent substrate, a series of experiments were carried out to use it as a basal ingredient in partial replacement of the wheat straw for button mushroom compost making. The experimental results revealed that, the nutrient content and compost output/unit weight of wheat straw were higher in treatments substituted with SMS at different levels compared to standard formulations. The quality attributes of fruit bodies such as ash, minerals (potassium, iron, manganese, zinc, selenium and copper), potassium/sodium ratio and Vitamin-D were also higher in fruit bodies harvested from the composts prepared with substitution of wheat straw with different quantities of SMS. Vitamin D, manganese and iron contents were significantly higher in compost received 30% SMS in replacement of wheat straw. Compost production by substitution of wheat straw with SMS led to the saving of Rs. 3.0 lakh and Rs 30.0 lakh for mushroom unit with mushroom production capacity of 100 and 1000 ton



[kEc mRiknu gr Øe'k 3-0 yk[k : i; vkj 30 yk[k : i; dh cpr dh xBA oreku fu"d"K vfrfjDr [kEc mRiknu dju] [kkn cuku e jktLo dh cpr dju vkj i; koj.k dh jfk dju d ekey e egROI.k gA

oh- okYofI; k d rhu LVu Mh, evkjk&185] Mh, evkjk&463 ,o Mh, evkjk&484½ e Ård lo/ku rFkk cg&cht.k.k lo/ku rduhdK d ek/;e l fodflr lo/kuk e dV g, /kku ivky ij ey lo/ku d l kFk ryuk dju ij ekblhfy; y of) fo'k'krkvk e fhkUrk n[ku dk feyA ey lo/ku rFkk Ård lo/ku l iklr cg&cht.k.k lo/ku dh ekblhfy; y of) fo'k'krk, de'kh *vIkeku; %atypical½ vkj *Ikeku; %typical½ idkj dh FkA fofhku LVu e Ård lo/ku dh Qyudk; ifrfd; k vyx&vyx FkA LVu Mh, evkjk&463 ej nk [krh ijhfk.k d rgr ey lo/ku %29-39 rFkk 23-01 fdxk-@fDo- 'k'd i'k'kk/kkj½ dh vi{kk Ård lo/ku d rgr vkf'kd : i l dgh vf/kd Qyudk; mit %31-85 ,o 31-84 fdxk-@fDo- 'k'd i'k'kk/kkj½ nt dh xb tcfD LVu Mh, evkjk&484 ej ey lo/ku %31-92 ,o 24-16 fdxk-@fDo- 'k'd i'k'kk/kkj½ e Ård lo/ku %31-51 ,o 23-64 fdxk-@fDo- 'k'd i'k'kk/kkj½ d edkcy vkf'kd rkj ij vf/kd Qyudk; mit nt dh xBA rhIj LVu Mh, evkjk&185 e vyx&vyx ifj.kke n[ku dk feyA igy ijhfk.k e tGk ey lo/ku d rgr Ård lo/ku d edkcy mYy[kuh; : i l dgh vf/kd Qyudk; mit nt dh xb ogh nIj ijhfk.k d nkjku Qyudk; mit nkuk idkj d lo/ku e lerY; FkA l Hkh ekeyk ej ey rFkk Ård lo/ku dh vi{kk cg&cht.k.k lo/ku e derj Qyudk; mit nt dh xBA

vkf'kd dEikLVx fof/k rFkk xje ty mipkj l r; kj i'k'kk/kkj dk eY; kdu of) 'khy lY; jkVI l t j d k t dh mi; Drrk tkuu d fy, fd; k x; kA fofhku le; vUrjkyk ij 65 fMxh l- rkieku ij xje ty e fhkxk; x, xg Hk l dh ryuk e 6 ?kV d fy, l knk ikuh e fhkxk; x; xg d Hk l }kj k r; kj i'k'kk/kkj e vf/kdre chb %44-1 ifr'kr½ nt dh xb tcfD fofhku le; vUrjkyk ij l Mh gb /kku ivky rFkk xg Hk l dh ryuk e nk fnu rd vkf'kd : i l l M g, xg d Hk l ij cgrj chb %77-76 ifr'kr½ nt gbA

o'k yfVU; yk l l Ec/kr 35 LVu dh ekblhfy; y of) dk v/; ; u LVu@i'k'kk/kkj l {kerk dk irk yxku d fy, fofhku i'k'kk/kkj l mRiUu fu"d"K.k dk mi; kx dj d fd; k x; kA bu i'k'kk/kkj e 'k'fey Fk % xg dk Hk l k

fresh mushroom production/year, respectively. The present findings are important in terms of additional mushroom production, saving of revenue in compost making and saving of the environment.

The mycelial growth characteristics of the three strains (DMRO-185, DMRO-463 and DMRO-484) of *V. volvacea* raised through tissue culture and multispore culture techniques were studied on pounded paddy straw. The mycelial growth characteristics of multispore cultures were of 'atypical' type while those obtained from original and tissue cultures were of 'typical' type. The fruit body yield response of tissue cultures varied in different strains. In strain DMRO-463, the tissue culture gave slightly higher fruit body yield (31.85 and 31.84 kg/q dry substrate) compared to original culture (29.39 and 23.01 kg/q dry substrate) in two cultivation trials, while in strain DMRO-484, the original culture gave slightly higher fruit body yield (31.92 and 24.16 kg/q dry substrate) than the tissue culture (31.51 and 23.64 kg/q dry substrate). The third strain DMRO-185 gave inconclusive results, where in 1st trial; the original culture gave significantly higher fruit body yield compared to tissue culture, while in 2nd trial the fruit body yield was at par in both types of cultures. In all cases the multispore cultures gave lower fruit body yield compared to the original and tissue cultures.

Substrate prepared by partial composting method and hot water treatment was evaluated for their suitability of growing *Pleurotus sajor caju*. Highest BE of 44.1 % was recorded in substrate prepared by wheat straw soaked in normal water for 6 hrs compared to wheat straw soaked in hot water at 65 °C at different time intervals. Whereas, wheat straw partially composted for two days was found to be better with the BE of 77.76 % compared to paddy straw and wheat straw composted at different time intervals.

Mycelial growth of 35 strains ascribed to the genus *Lentinula* was studied by using extracts derived from the substrates such as wheat straw, paddy straw, coir pith, sugarcane bagasse and mixed sawdust to establish



/kku dh ivky] dk; j fiFk ¼ukfj; y d j'kq xUu dh [kkb rFkk fefJr cjknkA nI fnu dh m'ek; u vof/k d mijjUr ekblhfy; k d vkI r 0; kI d vk/kkj ij] f'kVkd d I Hk 35 LVuk dk rhu legk ¼Rofjr of) > 5 feeh- 0; kI (e/; e of) 3&5 feeh- 0; kI vkj en of) LVu < 3 feeh- 0; kI ½ e ckVx; kA iR; d leg I rhu LVuk dk p; u tfod iHkko'khyrk dk vkdyu dju d fy, i; koj. k fu; f=r ifjflFkr; k d rgr Qyu ijh{k. kk d fy, fd; k x; kA

vxjfdI ckbLijI e ueh ccyk jkx dh jkdFkke d fy, fofHkuU dfj; j vk/kkfjr to Qkey'kuk dh iHkko'khyrk dk vkdyu fu; f=r ifjflFkr; k e fd; k x; kA [kfM; k vk/kkfjr ikmMj e 150 fnuk dk lcl vf/ kd thou&dky vFok fu/kkuh vk; ikb xb rFkk dEiLV vk/kkfjr Qkey'kuk e 90 fnuk rd dk U; ure thou&dky n[ku dk feykA Hk. Mkj. k d ikp ekg i'pkr vf/kdre tul[; k Hk kj [kfM; k vk/kkfjr 5×10^4 I h, Q; @ xke ¼1, ½ e vkj njiJR Øe'k, , evk ¼3×10⁴ I h, Q; @ xke ¼9, ¼2×10⁴ I h, Q; @ xke ¼, o 5ch] 20, ¼1×10⁴ I h, Q; @ xke ¼ e ik; k x; kA 3 Id. M dh idVu vof/ k d lFk ukd MkmU pEcj dk mi; kx dj d fl; kfjM efD[k; k d fo:) iHkko'khyrk dk irk yxku gr vk; kft r fd, x, eR; nj v/; ; u e irk pyk fd vU; dhVuk'kd dh ryuk e efD[k; k dh jkdFkke dju e behMkDyfiM dgh vf/kd iHkko ghA

[kEc vk/kkfjr iof/kr vFok fefJr lfo/kk tud [kk] dk fodkl fd; k x; k] ft le [kEc iof/kr uMYI rFkk [kEc vk/kkfjr 'kkdkgkj dckc 'kkfey gA [kEc ¼IY; jkV/ v/FLV; V/½ ikmMj d xfmM Lrjk d lFk rjr iddj r; kj gku oky uMYI dk v/; ; u budh ik'kf. kd , o lonh fo'k'krkvk d fy, fd; k x; k vkj uMYI vkV e 4 ifr'kr [kEc ikmMj d QkVhfQd'ku dk b"Vrehdj. k fd; k x; kA dckc dh x. kRed , o lonh fo'k'krkvk ij fofHkuU ckbFUMx , tUVk d iHkko dk eY; kdu fd; k x; kA djxhue lokf/kd l{ke ckbFUMx , tUV ik; k x; k vkj bld dkj. k cgrj lonh ljpuk vkj eg d Lokn d lFk&lFk i lLdj. k rFkk dfdx d nkjku U; ure ud lku n[ku dk feykA ik] kfxdh d rkj ij [kku ; kx; yiu dk eY; kdu Mckb vFok fHkxkb xb fof/k dk i; kx dj d LifMX ?kky e fofHkuU ifr&vkDlhdkj dk dk mi; kx djr g, rktk dVko fd, x, cVu [kEc d thou&dky e folrkj d fy, fd; k x; kA 12 fnu dk lcl vf/kd

the strain/substrate compatibility. Based on the average diameter of mycelia after 10 days of incubation period, all the 35 strains of shiitake were classified into three groups (fast growing strains with >5 mm radial dia; medium growing strains with 3-5 mm radial dia. and slow growing strains <3 mm radial dia.). Three strains from each group were selected for fruiting trials under controlled conditions to assess the biological efficiency.

The efficacy of different carrier based bioformulations in controlling wet bubble disease in button mushroom (*Agaricus bisporus*) was assessed under controlled conditions. The longer shelf up to 150 days was found with talc based bioformulation and the minimum shelf life was observed in compost based formulations up to 90 days. The maximum population load after five months of storage was found to be 5×10^4 cfu/g (1A) in talc based formulations followed by AMO (3×10^4 cfu/g), 9A (2×10^4 cfu/g) and 5B, 20A (1×10^4 cfu/g). The mortality studies conducted on sciarid flies using knock down chamber with an exposure period of 3 seconds revealed that, Imidacloprid is effective in controlling the flies compared to other insecticides.

Mushroom based fortified convenience foods viz. mushroom fortified noodles and mushroom based vegetarian sausages have been developed. Nutritional and sensory properties were studied in ready to cook instant noodles fortified with graded levels of mushroom (*Pleurotus ostreatus*) powder. Fortification of mushroom powder @ 4% to noodles dough was optimized.

Effect of different binding agents on nutritional properties and sensorial quality of sausages was evaluated. Carrageenan was found to be the most potent binding agent and resulted in minimum losses during processing and cooking along with better sensory texture and mouth feel. Edible coating as a technology was evaluated for shelf life extension of freshly harvested button mushrooms using various antioxidants in spreading solutions by dipping method. Samples coated with 0.5 % ascorbic acid in



thou&dKy I h,eI h ?kky e 0-5 ifr'kr ,Ldkfcd vEy
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fd, x, ueuk e ik;k x;KA

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oKkfud [krh ij dy 14] fun'kky; e rFkk fun'kky; d
ckgj if'k{k.k dk;Øe vk;kftr fd, x, ftue [kEc dh
[krh d fofHkuU igyvk ij dy 663 fd l ku] d f'kjr
efgykv] m|fe;k] d f'k foKku dUn d vf/kdkfj;k o
oKkfudk dk if'k{kfr fd;k x;KA ,d fnoIh; jk'Vh;
[kEc ey vkj {k=h; [kEc ey dk vk;ktu Øe'k 10
f l rEcj] 2015 ,o 1 ekp] 2016 dk fd;k x;KA jk'Vh;
[kEc ey dk mn?kkVu Jh Ij'k pUny] ekuuh; InL;]
'kkI h fudk;] Hkkjrh; d f'k vul/kku ifj'kn u fd;k vkj
bl ey e n'kHkj d yxHkx 700 fd l ku] [kEc mRikndk]
vul/kkudfe;k rFkk m|fe;k u Hkx fy;KA bl vol j
ij [kEc dh [krh e 0;ki d ieku ij uokUe"kh jhfr;k dk
viuku vkj vkenuh d lkr d : i e [kEc dh [krh dk
viuku gr vu; fd l ku dk iRl kfgr dju d fy, n'k
d fofHkuU Hkxk d ikp ixfr'khy [kEc mRikndk dk
lEekfur fd;k x;KA

fnukd 16 fnlEcj] 2015 dk Hkdvui & [kEc
vul/kku fun'kky;] lkyu e ,d fnoIh;
fd l ku&oKkfud&m|kx dh vke[k cBd vk;kftr dh
xbA LVu mUu;u] fdLeh; fodkl] tfod nko ic/ku]
u, [kEc dh [krh ik|kfxdh vkj fo'k'kr eY; o/ku d
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i;kx'kkyk l [kr rd dh ifØ;k e rth yku vkj
l kFk gh fd l ku dk Qke rduhdh exn'ku lyHk djku
d fy, Hkdvui&[kEc vul/kku fun'kky; d oKkfudk
}kjk ^{mej} xlo&ejk xkjo^{**};ktuk d rgr dy 12 xkok
dk vxhdr fd;k x;KA lcf/kr Vhek }kjk l Hkh vxhdr
xkok e ,d vk/kkjHkr lo{k.k fd;k x;k vkj [kEc
vul/kku fun'kky; e pfuUnk fd l ku d fy, [kEc [krh
ik|kfxdh ij vol j nkj o ,d fnoIh; if'k{k.k dk;Øe
vk;kftr fd;k x;KA

CMC solution kept in refrigerated conditions
extended shelf life up to 12 days.

During 2015-16, the Directorate has organized
a total number of 14 on and off campus training
programmes on scientific cultivation of mushrooms
and trained 663 farmers, farm women, entrepreneurs,
unemployed youth, officers and scientists of KVKs
in various facets mushroom cultivation. One day
National Mushroom Mela and Regional Mushroom
Mela were organized on 10th Sep, 2015 and 1st
March, 2016 respectively. The National Mushroom
Mela was inaugurated by Shri. Suresh Chandel,
Honorable Member, Governing Body, ICAR and it
was attended by about 700 farmers, mushroom
growers, researchers and entrepreneurs from all the
corners of the country. During this event five
progressive mushroom growers from different parts
of the country were felicitated for adopting innovative
practices in mushroom cultivation on larger scale and
motivated other farmers to adopt mushroom
cultivation as a source of additional income.

One day Farmers Scientists Industry Interface was
organized by ICAR-DMR, Solan on 16th December,
2015. The recent advances in the field of strain
improvement, varietal development, biotic stress
management, cultivation technology of new
mushrooms and value addition specifics made by
ICAR-DMR were shared with the farmers and
entrepreneurs.

To implement the 'Mera Gaon Mera Gaurav'
scheme, 12 villages were adopted by the scientists of
ICAR-DMR to hasten the lab to land process and
also to provide on farm technical guidance to the
farmers. A baseline survey was conducted in all the
adopted villages by respective teams and an exposure
visit cum one-day training programme on mushroom
cultivation technology for selected farmers was
organized at ICAR-DMR.



1.

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DMR- An Introduction

foKku vkj ik|kfxdh d {k= e fodkl d lkFk ekuo lH;rk d fodkl e Hkh igy l dgh vf/kd rho xfr l ixfr gb gA gkykfd] ekuo d lEe[k vHkh Hkh rhu eyHkr leL;k, g vkj ; leL;k, Hkfo"; e Hkh cuh jgxh ;Fkk [kk| dh deh] i;koj.k in"K.k vkj LokLF; x.koRrk e dehA 21oh lnh dk 'kHkkjHk lkr fcy;u l Hkh vf/kd fo'o tul[;k d lkFk gvk gA ;g dkb Hkh ugh tkurk fd gekjh yxkrkj c< jgh tul[;k dh leL;kvk dk lek/kku dju e nljh gfjr ØkfUr dk l=ikr dc vkj dgk gkxkA

mijkDr of.kr leL;kvk d lek/kku e rFkk oreku ncko;Dr fo'o e ekuo dY;k.k dk lfuf'pr dju d lc/k e ogn dod ¼fo'k"kdj [kEc½ e vk'kk tud lek/kku iLrr dju dh fn'kk e udkjRed egRo oky fyXuklyykftd toHkkj vif'k"V dk vi?kVu djd ikVhu l le) [kk| vkj dod vk"K/kh; mRiknk dk mRiUu dju dh {kerk fo|eku gA [kEc dh mRikndrk ,o ikVhu : ikrj.k iHkko'khyu ifr bdkb Hkfe {k=Qy rFkk le;kof/k] ik/kk vkj i'k lkrk l dgh cgrj gA bld vykok] [kEc vk/kkfjr df'k l u, jktxkj volj lftr fd, tk ldr gA gkfy;k o"kk e] Hkkjr e [kEc dh [krh e vud idkj d [kEc vkj mudh mRikndrk d lc/k e mYy[kuh; ixfr n[ku dk feyh gA [kEc d ikddyk] ik"kf.kd vkj LokLF; ykHkk d ifr c< jgh :fp d dkj.k [kEc cktkj dh ekx yxkrkj c< jgh gA df'k vif'k"V iupØ.k d fy, ,d i;koj.k vudy fodYi d : i e [kEc dh egRrk dk igpkur g,] 0;kid 'kdkgkjH tul[;k d fy, cgrj ik"K.k miyC/k dju vkj [kEc foKku ij u, jktxkj volj lftr dju rFkk i.kkYhc) vul/kku dju gr Hkkjr e HkkjrH; df'k vul/kku ifj"kn ¼Hkkdvui½ d rRoko/kku e o"K 1983 e lkyu] fgekpy in'k e jk"Vh; [kEc vul/kku dUn dh LFkkiuk dh igy dh xBA viuh 25 o"kk dh lQy ;k=k d ckn] [kEc vul/kku d {k= e mYy[kuh;

With the development of Science and Technology, the progress of human civilization develops faster than ever before. However, humans still face and will continue to face, three basic problems; shortage of food, environmental pollution and waning quality of health. The 21st century began with a world population of more than seven billion inhabitants. No one knows, when and where will happen another green revolution to combat these problems of ever increasing populace.

The ability of a macrofungi (especially mushrooms) to produce proteinaceous food and myco medicinal products by decomposing the negative value lignocellulosic biomass wastes provides promising solutions for the above listed problems and assures the human welfare in the present pressurized world. Protein conversion efficiency and productivity of mushrooms per unit land area and time is far superior to plant and animal sources. In addition, mushroom based farming can generate new employment opportunities. In the recent years, mushroom cultivation in India has witnessed a tremendous growth with respect to the type of mushrooms and their productivity. The mushroom market is growing continuously mainly due to increasing interest in their culinary, nutritional and health benefits. On recognizing the importance of mushroom as an eco-friendly alternative for agro-waste recycling, capability to provide better nutrition for the vast vegetarian population and potentiality to generate new employment opportunities, systematic research on mushroom science has been initiated in India with the establishment of National Research Centre for Mushroom in 1983 at Solan (HP) under the aegis of Indian Council of Agricultural Research (ICAR).



miyfC/k; k d l kFk jk"Vh; [kEc vul/kku dUn dk mPphdj.k fnukd 26 fnlEcj] 2008 dk [kEc vul/kku fun'kky; %Mh, evkj½ d : i e fd; k x; kA ; g n'k dk , dek= , lk fun'kky; g] tk fd li .k : i l [kEc vul/kku vkj fodkl d dk; d ifr lefir gA Hkkdvui&[kEc vul/kku fun'kky; d oKkfudk d lrr i; k l k l n'k e [kEc dh mRikndrk yxHkx nkxuh gk xb g] tcf d mRiknu e Hkh N% x.kk of) nt dh xb gA fun'kky; }kjk n'k d fofHkUu d f'k tyok; {k=k d fy, mi; Dr] fofHkUu [kEc dh [krh d fy, vud ik|kfxfd; k fodflr dh xb gA {k=h; Lrj ij Hkkdvui&[kEc vul/kku fun'kky; }kjk fodflr ik|kfxfd; k d iek.ku vkj mUu; u gr o" 1983 e vf[ky Hkkjrh; lefuor [kEc vul/kku ifj; ktuk uVod dh igy dh xb] ft l dk e[; ky; lkyu] fgekpy in'k e fLFkr gA oreku e vf[ky Hkkjrh; lefuor [kEc vul/kku ifj; ktuk n'k d 27 jkT; k e viu 23 lefuor rFkk 9 lg; kxh dUnk d ek/; e l pykb tk jgh gA

LFkku

[kEc vul/kku fun'kky; fgekpy in'k d lkyu 'kgj e fLFkr g tk fd fgekpy in'k dk io'k}kj Hkh dgykrk gA lkyu 'kgj d iorh; vtc viuh l kLdfrd Hk0; rk] mRd"V fidfud LFkyk] vfr ikphu efnjk vkj ekleh lCth Qlyk d fy, ifl) gA vk|kxhdj.k gku d dkj.k] lkyu viu [kEc mRiknu d fy, dkQh ykdfi; g vkj bl *Hkkjr dk [kEc 'kgj* Hkh dgk tkrk gA [kEc vul/kku] fodkl rFkk [kEc dh [krh vkj bl ykdfi; cuku e [kEc vul/kku fun'kky; }kjk fd, x, i; k l k vkj bl 'kgj d ; kx nku dk ekur g, fgekpy in'k d ekuuh; e[; e=h u fnukd 10 fl rEcj] 1997 dk [kEc vul/kku fun'kky; rFkk e'k: e l k l k; Vh vkQ bFM; k }kjk l; Dr : i l vk; k ftr Hkkjrh; [kEc lEeyu e lkyu 'kgj dk **Hkkjr dk [kEc 'kgj** ?kkf"kr fd; kA

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fun'kky; e 13 vk/kfud i; koj .k fu; f=r QlypØ dej vkj pkj bMkj cdjk rFkk pkj cYd pEcjk okyh vk/kfud dEikfLVx bdkb; k d l kFk , d ikyhgkm l dh lfo/kk LFkkr gA fun'kky; e vk/kfud midj.kk d l kFk to ik|kfxdh] tuun0; l j{k.k] [kEc ch t mRiknu] ikni l j{k.k vkj QlykRrj ik|kfxdh d

After 25 years, with remarkable achievements in mushroom research, National Research Centre was upgraded as Directorate of Mushroom Research (DMR) on 26th Dec, 2008. This Directorate is the only institute exclusively dedicated to mushroom research and development in the country. By the concerted efforts of the scientists of ICAR-DMR, mushroom productivity in the country has almost doubled while production has registered a six fold increase. The directorate has developed array of technologies for cultivation of different mushrooms suitable to diverse agro climatic regions of the country. To validate and promote the technologies developed by the ICAR-DMR at regional level, All India Coordinated Research Project network on Mushroom was initiated in the year 1983 with its head quarters at Solan. At present, AICRPM is running with 23 Coordinating and nine Cooperating Centres in 27 states across the country.

Location

The Directorate of Mushroom Research is located in Solan city of Himachal Pradesh, endeared as the gateway of Himachal Pradesh. The mountainous wonder of Solan city is famous for its cultural splendor, excellent picnic spots, numerous old temples and seasonal vegetable crops. Being quite industrialized, Solan is widely popular for its mushroom cultivation and bearing the title of "Mushroom City of India". Considering the contribution of this city and endeavour of DMR towards mushroom research, development, cultivation and popularization of mushroom, the Hon'ble Chief Minister of Himachal Pradesh declared Solan as the Mushroom City of India on 10th September, 1997 during the Indian Mushroom Conference organized jointly by the DMR and Mushroom Society of India.

Infrastructure

The directorate has 13 modern environment controlled cropping rooms and one poly house along with modern composting units comprising of four indoor bunkers and four bulk chambers. The centre has five well equipped laboratories for biotechnology,



fy, cg l l f t t r i p i ; k x ' k k y k , g A i k | k f x d h
g l r k r j . k % V h v k V h % l H k k x e , d g h l e ; i j 250 l
H k h v f / k d i f ' k { k v k d h { k e r k o k y k v f r v k / k f u d
l f o / k k v k l ; D r , d i f ' k { k . k d u n g A [k E c v u l / k k u
f u n ' k k y ; e [k E c f o K k u , o l c f / k r f o K k u l
l c f / k r { k = k e v u l / k k u , o i j k e ' k h l o k v k d k
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f i N y v d k d k l x g g A ; g H k k j r e [k E c l k f g R ;
g r , d v d y k l n H k i l r d k y ; g A

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x ; k A

ifjdYiuk

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l j { k k d f y , [k E c d k v u l / k k u , o f o d k l d j u k A

y{;

[k E c f o f o / k r k d k l j f { k r d j u r F k k
i k | k f x f d ; k @ f d L e k d k f o d f l r d j u d f y ,
v u l / k k u o f o d k l d j u k A [k E c d h x . k o R r k v k j
m R i k n d r k d k c < k u] d f ' k v i f ' k " V k @ v i f ' k " V [k E c
i k " k k / k k j d k m i ; k x d j u v k j j k t x k j m R i U u d j u
x j h c h d k f u o k j . k d j u r F k k i k " k f . k d l j { k k l f u f ' p r
d j u d f y , f } r h ; d d f ' k d k i k R l k f g r d j u g r
e y H k r v u l / k k u d j u A

germplasm conservation, spawn production, plant protection and post harvest technology with modern state of the art equipments. The TOT division has well sophisticated training centre with a capacity to accommodate more than 250 trainees at a time. The Directorate of Mushroom Research has a specialized library collection in mushroom science and related sciences to support research and consultancy in the relevant areas. The library has accessioned 2089 books, 2500 back volumes of journals. This is a sole referral library for Mushroom literature in India.

Personnel and finance

The Directorate has a sanctioned strength of 16 scientists + one director, 14 technical, 16 administrative and 11 supporting staff. The staff position as on 31.03.2016 was 10 scientists, 12 technical, 12 administrative and 5 skilled staff. The annual budget of the Directorate for the year 2015-16 was Rs. 393.10 lakh (Plan) and 518.96 lakh (Non plan) which was fully utilized. The institute earned Rs. 28.18 lakh as revenue during the year by sale of literature, mushroom cultures, commercial spawn, fresh mushrooms, value added products, consultancy, training and other services.

Vision

Mushroom research and development for economic growth, ecological sustainability and nutritional security.

Mission

R & D to undertake basic research, conserve mushroom diversity, develop technologies/ varieties to enhance mushroom quality and productivity, utilize agro-wastes / spent mushroom substrates and promote secondary agriculture for generating employment, ameliorating poverty and ensuring nutritional security.



vf/kn'k

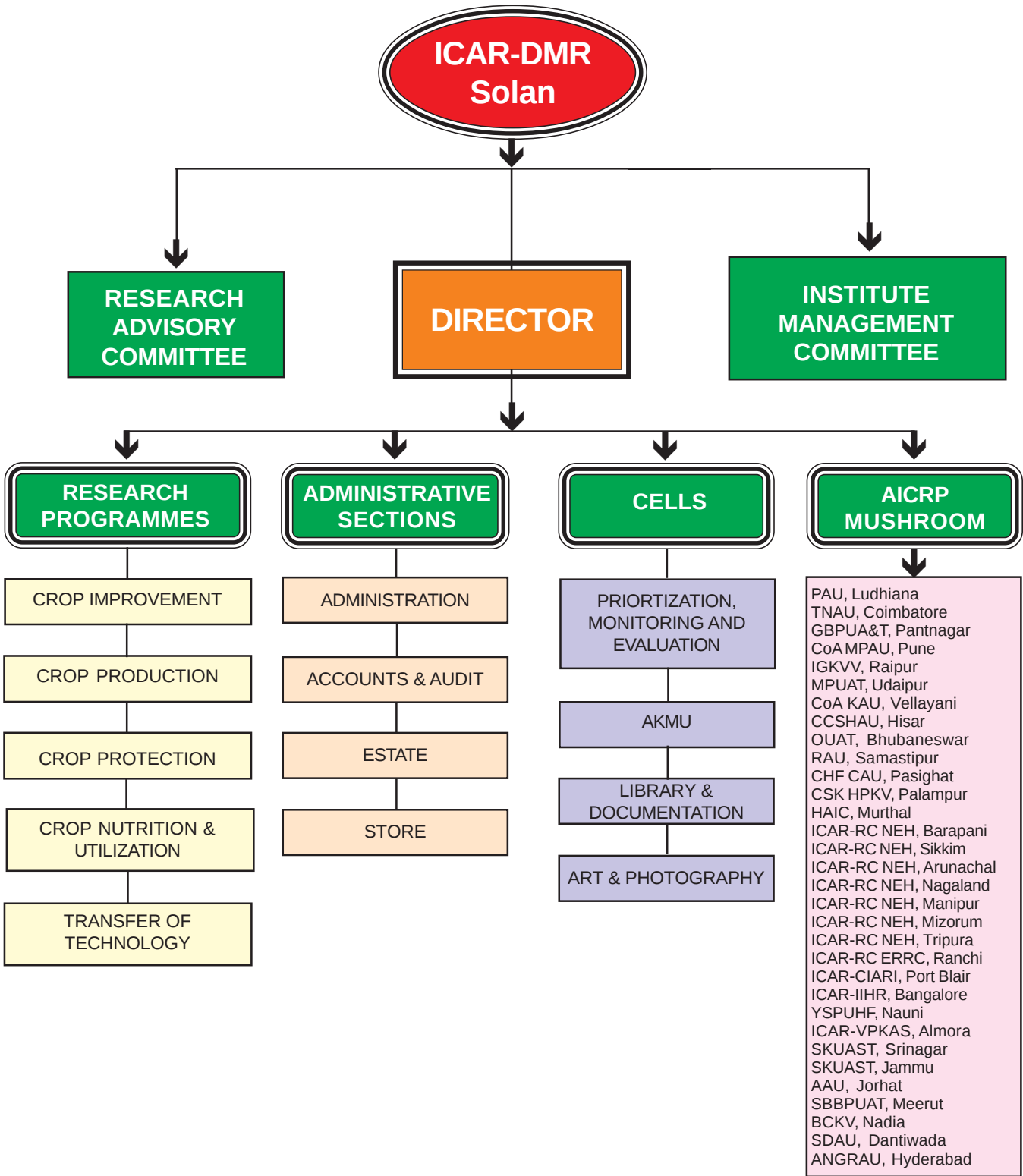
- 1- [kEc d l Hkh igyv k ij y{; mUe[k rFkk uokUe"kh vul/kku dk vk;k tu djuk(
- 2- 'k{kf.kd mRd"Vrk d dUn rFkk [kEc tuun0; d Hk.Mkj ?kj d :lk e dk; djuk(
- 3- mPprj mRiknu ,o mRikndrk dk iklr dju gr jk"Vh; egRo dh LFkku fof'k"V leL;kvk ij uVod vul/kku dk leUo; djuk(
- 4- ekuo l l k/ku fodk l ,o ik |kfxdh gLrkrj.k dk ikr l kfgR djuk(
- 5- xjhch fuokj.k d fy, [kEc m |kx d l kFk&l kFk xkeh.k tu l [;k dk rduhdh lg;kx inku djukA

Mandate

- 1. To conduct mission-oriented and innovative research on all aspects of mushrooms
- 2. To act as the centre of academic excellence and repository of mushroom germplasm and information
- 3. To coordinate network research on location specific problems of national importance to achieve higher production and productivity
- 4. To promote human resource development and transfer of technology
- 5. To provide technical support to the mushroom industry as well as to rural masses for poverty alleviation



ORGANOGRAM OF ICAR-DMR, SOLAN





2.

vul/kku miyfc/k;k RESEARCH ACHIEVEMENTS

d- QIy mUu;u

A. CROP IMPROVEMENT

[kEc to link

dod dk ldyu dju d fy, fgekpy in'k vkj f=i jk d ou {k=k e Hke.k fd;k x;kA dy 205 ueuk dk ldfyr fd;k x;k vkj 193 ueuk dh igpku mud o'k d Lrj rd dh xba lHkh ueuk dk Hkkdvui&[kEc vul/kku fun'kky;] lkyu d ouLifr l xgky; e ifjff{kr djd j[kk x;kA lHkh ueuk dk mudh {k=h; rLohjk d lFk mudh eØkLdkfid %LFky% fo'k"krkvk d fy, tkpk x;kA 79 ueuk d 'k) Ård lo/kuk dk iklr fd;k x;k vkj mUg Hkkdvui&[kEc vul/kku fun'kky;] lkyu d thu cd e tek dj;k x;kA dN jkpd ueuk ;Fkk LVkfcyjl itkfr] IY;jkVI itkfr] Qkbyikjl itkfr] ØxkEQI] dkfufj; l itkfr] ,efuV itkfr] vkfeyfj;k efy;] yfi;kV rFkk yfiLV itkfr dh igpku d fy, lEi.k o.ku fd;k x;k gA

1. Mushroom Genetic Resources

Germplasm collection and identification of mushroom specimens

Fungal forays were undertaken in the forest areas of Himachal Pradesh and Tripura states. A total No. of 205 specimens were collected and 193 specimens identified up to the genus level. All the specimens have been preserved in the Herbarium of ICAR-DMR, Solan and examined for their macroscopic features in the field along with their field photographs. Pure tissue cultures of 79 specimens were obtained and deposited in the Gene Bank of DMR, Solan. Some of the interesting specimens include *Strobilurus* sp., *Pleurotus* sp., *Phylloporus* sp., *Chrogomphus*, *Cortinarius* sp., *Amanita* sp., *Armillaria mellea*, *Lepiota* and *Lepista* sp. which were fully described for identification.



fp= % 2-1- LVkfcyjl rFkk IY;jkVI tej fdLe tej d oU; ueu

Fig. 2.1. Wild specimens of *Strobilurus* and *Pleurotus djamor* var. *djamor*



Fig. 2.2. Wild specimens of *Pisolithus tinctorius* and *Armillaria mellea*

Survey and collection of wild mushrooms from Tripura

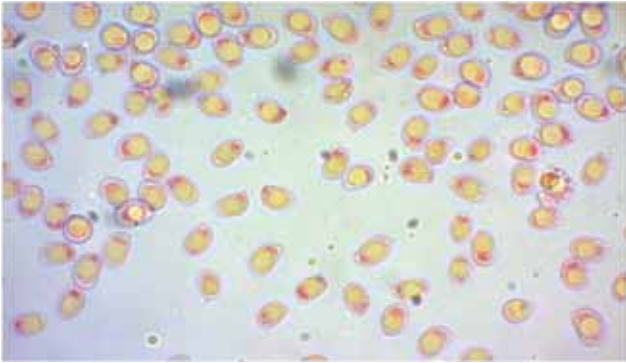
Twenty four wild mushroom specimens were collected during rainy season from the forests of Khovaicorin, Kola Khor, Sumaimori and Boxanagar of Tripura. All the specimens were examined for their macroscopic characters and tissue cultures were isolated and conserved along with the Herbarium of the specimens in the Gene Bank of ICAR-DMR, Solan and Department of Botany, Tripura University. The interesting and important genera includes- *Agaricus* (3 spp.), *Clitocybe sinopica* (a new record from India), *Stropharia stercorea*, *Lactarius tabidus*, *Agrocybe splendida*, *Calocera* sp., *Amanita* sp. (vaginatae group), *Lentinus squarrosulus*, (3 specimens), *Auricularia* (3 specimens), *Inocybe* (2 – unique specimens), *Entoloma* (one specimen), *Lentinus* (one specimen) and a *Marasmius* sp. The morphology and anatomical descriptions of interesting and new record is given below.

Clitocybe sinopica

Morphology - Basidiocarp large, growing in soil, solitary with a pungent smell. Pileus 20 cm in dia., margin creamish, centre light brown, irregular with striation, slightly hygrophanous, scales squarrose. Stipe very long (12 x 2 cm), solid, tough, creamish.



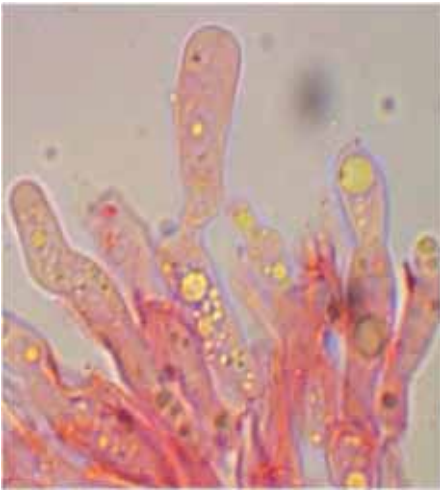
DykbV*k* I*kbc* I*kbukfidk&oU*; ueuk
Clitocybe sinopica - Wild Specimen



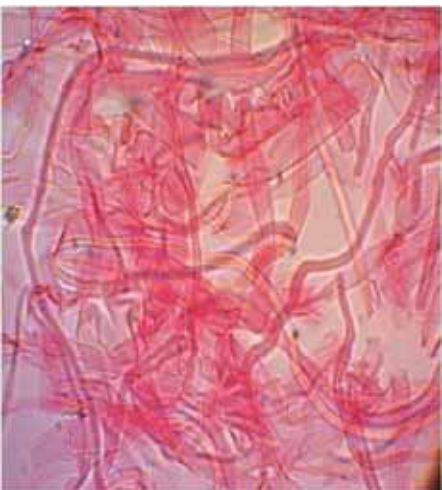
cl hfM;k *cht k.k*
Basidiospores



cl hfM;k
Basidia



IV;jkf LVhfM;k
Pleurocystidia



N= dodrr
Pileus hyphae

fp= 2-3- dyhV*k* I*kbc* I*kbuki hdk dk LkjpukRed v/; ;u*
Fig. 2.3. Anatomical studies of *Clitocybe sinopica*

yey;h d 8&9 IV okyh yeyh] nf/k;k] gYdh&I h
uhp dh vkj] fpduh] oy;] xfbdk rFkk v/kko Vu
vuifLFkrA

'kjhj jpuk foKku

cht k.k % *ikjn'kh*] *fcuk dyQ oky*] *uhy jx d /kCc*] *rh{.kkx*] *fpdu* ¼8½ 9-1 &¼10-9½ x ¼4-1½ 5-3 &¼6-8½
µm *cl hfM;k* % *VVklVfjxefVd*] *vk;y Xyky*
mifLFkr] *cl hfM;k d vk/kkj ij DyEi duD'ku ektn*] *ikxy vfr yEck* ¼4-5 x 1-5 µm½

Lamellae 8-9 sets of lamelluae, creamish, shortly
decurrent, smooth, annulus, veil and volva absent.

Anatomy

Spores - hyaline, non amyloid, cyanophilic, apiculate,
smooth (8) 9.1–(10.9) x (4.1) 5.3–(6.8) mm. **Basidia**
- tetrasterigmatic, oil globule present, clamp
connections present at the base of basidia. Sterigmata
very long (4.5x 1.5 mm).



[k- ,xk l kbc Liyf.MMk

/kku dh l Mh gb ivky ij c< jg gA e/;e vdkj] N= 3&4 leh] fdukj gYd eVey Hkj] e/; e xgjk dRFkb Hkj] mRry l vory] xj j[kk;Dr] N= fpifpi] xnnkj] N= Vkek vkQ&0gkbV ¼nf/k; k½ 3 feeh- ekV[k] MBy & e/;] 80 x 4&6 feeh- ygjn[k] xnnkj] [kk[ky d edkcy Hkj g,] yeyh v leku] dRFkb Hkj] fudV] ,MuV] 2&3 feeh- pkMhA

'kjhj jpuk foKku

cht.k.k % Hkj jx d] nkgjh nhokj vFkok fhkfr] jkxk.k j/k vuifLFkr] vk;y Xyky mifLFkr] l kbukfQfyd rFkk xj dyQ oky ¼11-1½ 12-2&¼13-1½ x ¼6-4½ 7-2&¼8-6 µm½ Qav&1-6- c l hfM;k % enxjuek] f}&LVfjxeVd] vk;y Xyky vuifLFkr] DyEi l Eid vuifLFkr ¼18-3½ 21-3&¼23-0½ x ¼5-9½ 7-5&¼9-1 µm½ Qav&2-8] Vkek fu;fer ¼2-6½ 4-2&¼6-4 µm½ f l LVhfM;k vk;y Xyky vuifLFkr] DyEi l Eid fn[kkb ugh fn;k ¼11-4½ 17-3&¼24-2½ x ¼6-1½ 7-1&¼8-7½] lyhvkiy l vfu;fer] 'kk[kk;Dr] iVye;] DyEi l Eid mifLFkr ¼4-5½ 5-3&¼6-6 µm½ MBy fu;fer] 'kk[kk;Dr] iVye;] DyEi l Eid mifLFkr ¼3-2½ 4-8&¼7-4 µm½



,xk l kbc Liyf.MMk
Agrocybe splendida – Wild specimen

Agrocybe splendida

Morphology - Basidiocarps growing on decomposed paddy straw. Medium sized, pileus 3-4 cm, margin light camel brown, centre dark tobacco brown, convex to conic, non striate, pileus glutinous, fleshy, pileus trama off white, 3 mm thick. Stipe - central, 80 x 4-6 mm, wavy, fleshy, stuffed than hollow, lamellae unequal, tobacco brown, close, adnate, 2-3 mm broad.

Anatomy

Spores - brown in colour, double walled, germ pore absent, oil globule present, cyanophillic and non-amylid (11.1)12.2-(13.1) x (6.4)7.2-(8.6)mm Qav-1.6. **Basidia**: clavate, bisterigmatocor tetrastregmatic, oil globule absent, clamp connection not seen (18.3) 21.3-(23.0) x (5.9)7.5-(9.1) mm Qav-2.8. Trama regular (2.6)4.2-(6.4) mm, cystidia oil globule absent, clamp connection not seen (11.4)17.3-(24.2) x (6.1)7.1-(8.7) Pileopellis irregular, branched, septate, clamp connection present (4.5)5.3-(6.6) mm, stipe regular, branched, septate, clamp connection present (3.2) 4.8-(7.4) mm.



c l hfMvk cht.k.k
Basidiospores

fp= 2-4- ,xk l kbc Liyf.MMk dk LkjpukRed vl; ;u
Fig. 2.4. Anatomical studies of Agrocybe splendida



x- LVkQfj;k LVjdfj;k

vkdf rfoKku % c l hfM;k dki NkVkj ijkuh lMh gb /kku ivky ij ,d cMk DyEi c< jgk g] N= 0;k l 2 &2-5 leh-] e/; e gYdk Hkj]k fdukj [kkdh] xj j [kk;Dr] MBy e/; e 4&4-5 leh- yc rFkk 0;k l e 2 feeh-] yeyh dRFkb Hkj]h mi njh] ,MuV] 3 feeh- pkmKa

'kjhj jpuk foKku

cht k.k % Hkj]k fpduk] ekVh nhokj] rh{.kkx] jkxk.k j/k mifLFkr] vk;y Xykcy mifLFkr] detkj l k;ukfQfyd rFkk xj dyQ oky 9-9% 11-6&12-7% x 5-6% 6-6&7-4% μm, Qav &1-8 c l hfM;k % enxjuek] f}&LVfjxevd] vk;y Xykcy vuifLFkr] DyEi lEid

Stropharia stercoria

Morphology - Basidiocarp small. A large clump growing on decomposed paddy straw. Pileus 2-2.5 cm in dia., centre light brown, margin khaki, non striate. Stipe central 4-4.5 cm in length and 2 mm in dia. Lamellae tobacco brown, sub distant, adnate, 3 mm broad.

Anatomy

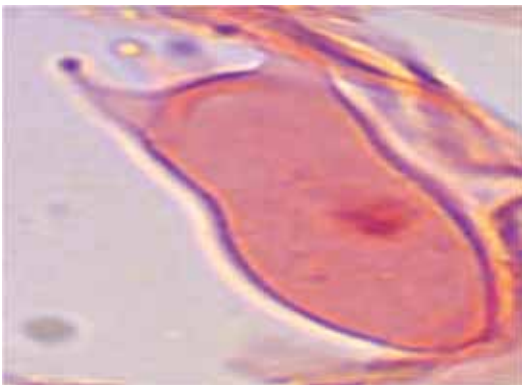
Spore - brown, smooth, thick walled, apiculate, germ pore present, oil globule present, weakly cyanophilic and non-amyloid, (9.9)11.6-(12.7)x(5.6)6.6-(7.4) mm, Qav-1.8. **Basidia** - clavate, bisterigmatic, tetrastigmatic, oil globule absent, clamp connection



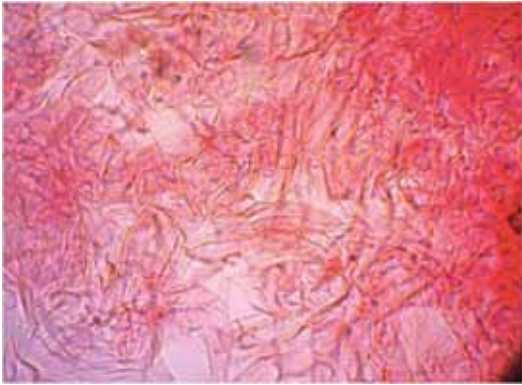
c l hfMvk dki
Basidiocarp



c l hfMvk cht k.k
Basidiospores



c l hfMvk
Basidia



N= dodrr
Pileus hyphae

fp= 2-5- LVkQfj;k LVjdfj;k dk LkjpukRed vl; ;u

Fig. 2.5. Anatomical studies of Stropharia stercoria



vuifLFkr ¼18-7½ 20-3&¼21-9½ x ¼7-1½ 7-4&¼8-0½ µm, Qav&2-7] gkbehfu; e&11-15 µm: lHk; ehfu; e&5-7 µm] fxy Vkek&fu; fer ¼2-1½ 3-0&¼4-1½] fllVhfM; k &¼8-2½ 12-8&¼17-4½ x ¼5-2½ 6-8&¼8-3½ µmA

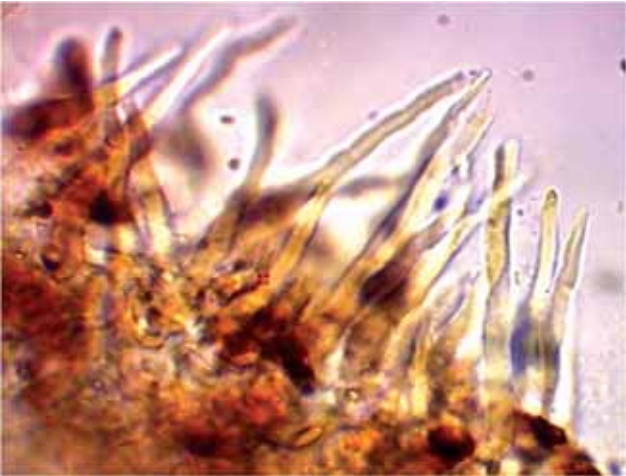
vkjhdyfj;k i tkfr

vkdfrrfoKku % cflfM; kdkil ydMh ij c< jg g] 0; k l e 6&10 leh] cgr iry rFkk eVey Hkj

'kjhj jpuk foKku % chtk.k ikjn'kh] le vFkok ykfc; k dh vkdfrr] rh{.kkx] jkxk.k j/k vuifLFkr] vk; y Xyky mifLFkr] lkbukfQfyd rFkk xj dyQ oky ¼10-1½10-7&¼11-6½x¼2-6½3-4&¼4-2µm½] Qav&3-1



ydMh ij of)'khy vkjhdyfj;k
Auricularia growing on wood



tkuk ikbytk
Zona pilosa

absent (18.7)20.3- (21.9)x(7.1)7.4-(8.0) mm, Qav- 2.7. Hymenium - 11-15 mm; Subhymenium - 5-7 mm. Gill trama - regular (2.1)3.0 - (4.1); cystidia - (8.2)12.8-(17.4) x (5.2)6.8-(8.3) mm.

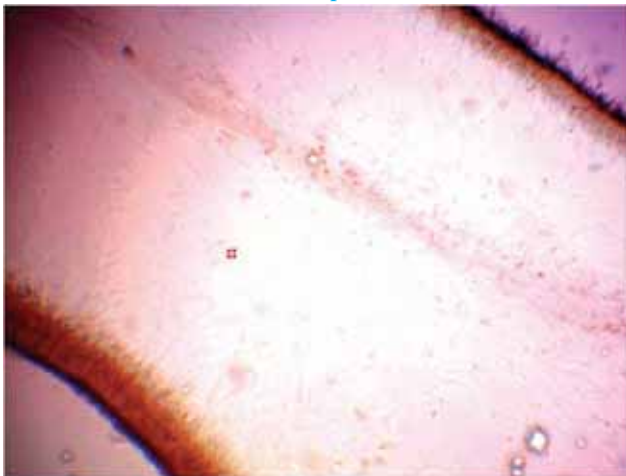
Auricularia sp.

Morphology: Basidiocarp growing on wood, 6-10 cm in dia., very thin, camel brown

Anatomy: Spores hyaline, bean shaped, apiculate, germ pore absent, oil globule present, cyanophilic and non amyloid, (10.1)10.7-(11.6)x(2.6)3.4-(4.2) µm, Qav- 3.1.



clhfMvk chtk.k
Basidiospores



clhfM;k dkiil dk [k.M
Section of Basidiocarp

fp= 2-6% vkfjd yfj;k i tkfr dk LkjpukRed vl; ; u

Fig. 2.6. Anatomical studies of Auricularia sp.



d% tkuk ikbykIk % dyxh vFkok xPNk leg e
cky k dh ektnxh] e/; fly.Mj mifLFkr] 25-35
µm dh {kerk e udhy fdukj] pkMkb 3-5&5-5 µm

[k% tkuk dkEiDVk % 12-20 µm

x% tkuk mi&dkEiDVk % 40-50 µm, pkMkb 0-1&
2-0 µm, DyEi IEid mifLFkr

?k% tkuk yDlk l|ifj;kfjI % 200-0&245-0 µm,
pkMkb 2-5&4-0 µm, DyEi IEid mifLFkr

M% eTtk % 140-0&180-0 µm, pkMkb 1-4&6-4 µm,
DyEi IEid mifLFkr

p% tkuk yDlk bUQfj;kfjI % 380-0&400-0 µm,
pkMkb 1-0&2-5 µm, DyEi IEid mifLFkr

N% tkuk lc&dkEiDVk bUQfj;kfjI % 30-0&
40-0 µm, pkMkb 1-0&2-0 µm, DyEi IEid
mifLFkr

t% gkbehfu;e % 60-0&70-0 µm, dodrr pkMkb 3-
5&4-5 µm

vHkh rd ldfyr fd, x, vkjhdyfj;k e ;g
lcl iry vkjhdyfj;k e l ,d gA bldh vk.kfod
igpku dk dk; ixfr ij gA fo'o d fy, ;g ,d
u;k dod vfHky[k gk l drk gA

vkuf'kd mUu;u

cVu [kEc %vxjfdI ckbLikjI%

d- odh VklfØl'ku dkjd dk y{k.ko.ku

odh VklfØl'ku dkjd] vuøe fof'k"V Mh,u,
ckbfUMx VklfØl'ku dkjdh dh ,d J.kh g] tk fd
yxHkx ijh rjg ik/kk e ik, tkr g vkj bue ie[k
fu;ked g % tfod rFkk vtfod nkuk nckok d
ldkjRed vkj udkjRed] ch t fodk l] ch t i l l r k
vof/k vkj vdj.k] fodk l] ikni gkeku flXufyx]
ld.Mjh mikip; rFkk l fB;koA odh thD;d flXupj
dk lokf/kd ipfyr : i g] gkykfd] ik/kk rFkk xj
ikni i tkfr;k e bl ekfVQ d de l de 35 ifjor
ik, tkr gA dN odh ikvhu ,uch, l&,yvkvkj
u;fDyvkVkbM ckbFUMx LFky&Y;flu l Hkji j

a) **Zona pilosa:** hairs present in tufts, central
cylinder present, with blunt ends ranges from 25-
35 µm, breath 3.5-5.5 µm.

b) **Zona compacta:** 12-20 µm.

c) **Zona subcompacta:** 40-50 µm, breadth 0.1-2.0
µm, clamp connection present.

d) **Zona laxa superioris:** 200.0-245.0 µm, breadth 2.5-
4.0 µm, clamp connection present.

e) **Medulla:** 140.0-180.0 µm, breath 1.4- 6.4 µm,
clamp connection present.

f) **Zona laxa inferioris:** 380.0-400.0 µm, breadth 1.0-
2.5 µm, clamp connection present.

g) **Zona subcompacta inferioris:** 30.0-40.0 µm,
breadth 1.0-2.0 µm, clamp connections present.

h) **Hymenium:** 60.0-70.0 µm, hyphae breadth 3.5-
4.5 µm.

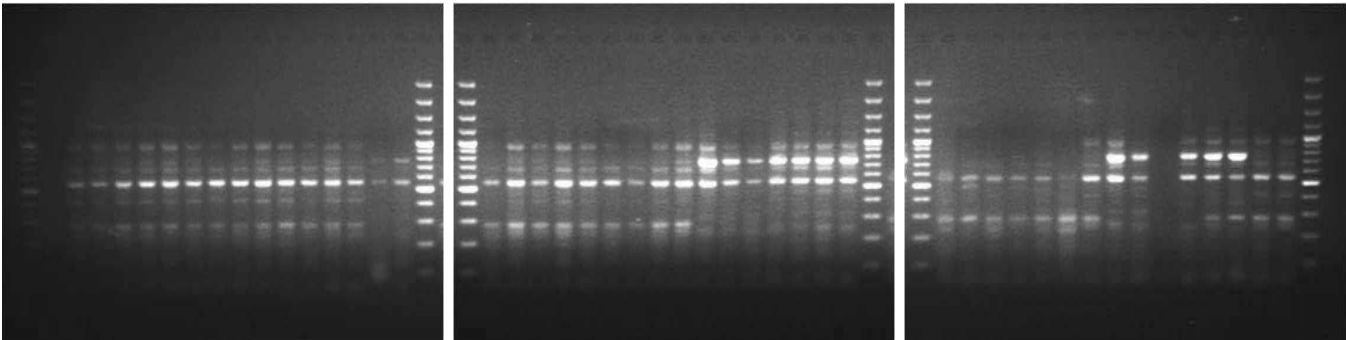
It is one of the thinnest *Auricularia* collected so
far. The molecular identity is under progress. **It could
be a new fungus record to the world.**

2. Genetic Improvement

Button mushroom (*Agaricus bisporus*)

a. Characterization of WRKY transcription factor

WRKY transcription factors are a class of
sequence-specific DNA binding transcription factors
found almost exclusively in plants and are key
regulators, both positive and negative, of both biotic
and abiotic stresses, seed development, seed dormancy
and germination, development, plant hormone
signalling, secondary metabolism and senescence. The
WRKYGQK is the most common form of the
signature however, there are at least 35 variants of
this motif are reported in plant and non-plant species.
Some WRKY proteins exist as chimeric proteins
combining NBS-LRR (nucleotide binding site -
leucine rich repeat) proteins and WRKY domains.



fp= % 2-7- %d½ cl; foyxuk(% [k½ i t uu{ke foyxuk(%x% vxfjd l ckbLi kj l d LVu e i of/kr odh Vkl fØl'ku dkjd

Fig. 2.7. WRKY transcription factors amplified in (A) Non-fertile isolates; (B) Fertile isolates; (C) Strains of *Agaricus bisporus*

iujkofUk½ ikVhuk vkj odh Mkeu dk lfefyr dj d
flefd ikVhuk d :i e fol eku gA vxfjd l
thuke d bu&lfydk v/; ;u d vk/kkj ij nk odh
rFkk ,d U;fDyvkVkbM ckbFUMx LFky ikbel dh
tkp 'or cVu [kEc e odh Mkeu d io/ku gr dh
xbA jkpd :i l vxfjd l thuke e cg LFkkuk ij
odh dh mifLFkr n[kh xb vkj l kFk gh fofHkUu idkj
d odh Mkeu dh igpku thuke e dh tk l dhA [kEc
e jlx ifrjk/kh thu iof/kr [k.M d fy, U;fDyvkVkbM
ckbfUMx LFky %odh Mkeu d l kFk l Ec)½ ikbej e
Hkh jkx ifrjk/kh thu dh ektnxh inf'kr gk jgh gA
[kEc thuke e odh Mkeu %ik/kk d fy, fof'k"V½ dh
ektnxh dh ;g igyh fjikV gA bl Vkl fØl'ku
dkjd d y{k.ko.ku d fy, fofHkUu LVuk] i tuu'ke
rFkk c/; ,dy ch tk.k foyxuk l dy 51 ,Eiyhdk l
dk iFkd fd;k x;k vkj i h th,eVh oDVj i.kkyh dk
mi;kx dj d b- dkyk b d Mh,p-5α LVu e Dykfux
dh xb vkj vuøe.k d fy, lykfTeM dk vyx
fd;k x;kA

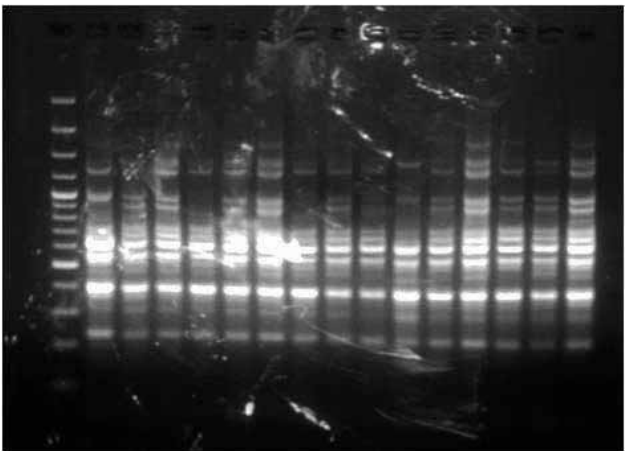
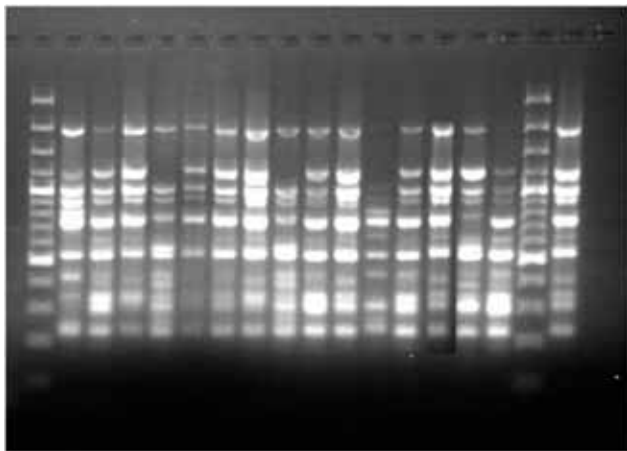
[k- vkb, l, l vkj] , l, l vkj rFkk fjVk&, yheUV
vk/kkfjr ekdj k dk mi;kx dj d xj Hkj
l dj k dk vk.kfod y{k.ko.ku

'or cVu [kEc e , tkbe }kj k mRifjr QlykRrj
Hkjkiu vkuk ,d ie[k l eL;k g] ft l l [kEc dh
x.koRrk vkj foi.ku ;kx; {kerk iHkkfor gkrh gA
oreku v/; ;u e] vkb, l, l vkj] , l, l vkj rFkk
fjVk&, yheUV vk/kkfjr ekdj k dk mi;kx dj d mPp
mi t'khy vkj Hkjkiu d ifrjk/kh ikp l dj k dk p;u
fd;k x;kA v/; ;u d vrxr] vkbji rdud d

On the basis of in silico study of *Agaricus* genome, two WRKY and one Nucleotide Binding Site primers were tested for amplification of WRKY domains in white button mushroom. Surprisingly, *Agaricus* genome showed the presence of WRKY domain at multiple sites and also different type of WRKY domains could be identified in the genome. Also the Nucleotide Binding Site (associated with WRKY domain) primer for disease resistance gene amplified fragment in the mushroom showing the presence of disease resistance gene. This is a first report of presence of WRKY domain (specific to plants) in mushroom genome. For the characterization of this transcription factor a total of 51 amplicons from different strains, fertile and non-fertile single spore isolates were isolated and cloned in DH-5a strain of *E. coli* using PGMT vector system and plasmids were isolated for sequencing.

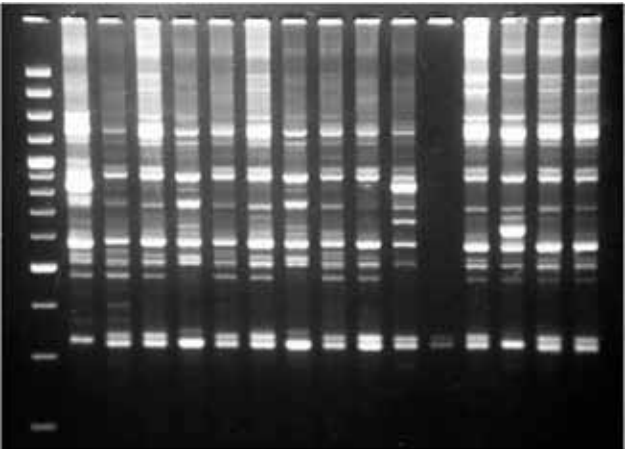
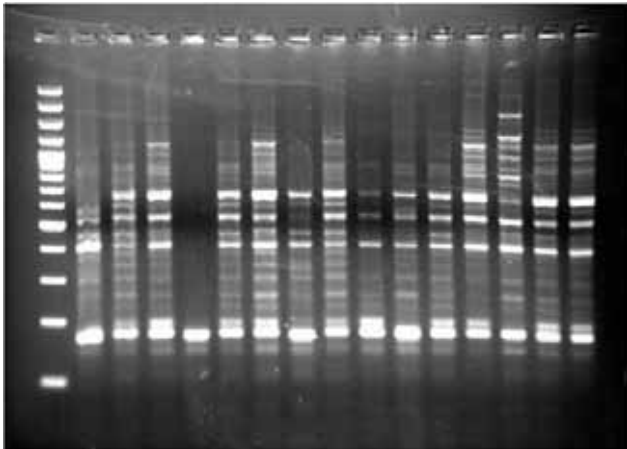
b. Molecular characterization of non-browning hybrids using ISSR, SSRs and Retroelement based markers

Enzyme catalyzed post-harvest browning in white button mushroom is a major problem affecting the quality and marketability of this mushroom. During the present study, the five selected high yielding and browning resistant hybrids were characterized using ISSRs, SSRs, and retro-element based markers. In the study, to amplify around pairs of insertion sites through IRAPs technique, we have used outward



fp= % 2-8- vkbjji ekdjkk dk mi ;kx djdi lldjkk dk vk.kfod fo'y'k.k %yu 1&ekdj(yu 2 ,o 3&i'rd(yu 4&ldj(yu 5 o 6&i'rd(yu 7&ldj(yu 8 o 9&i'rd(yu 10&ldj(yu 11 o 12 % i'rd(yu 13&ldj(yu 14 o 15&i'rd(yu 16&ldj%

Fig. 2.8 Molecular analysis of Hybrids using ISSR markers (Lane1 = marker; Lane 2&3= parents; Lane 4= hybrid; Lane 5&6= parents; Lane 7= hybrids; Lane 8&9= parents; Lane 10= hybrids; Lane11&12= parents; Lane 13= hybrid; Lane 14&15= parents; Lane 16= hybrid)

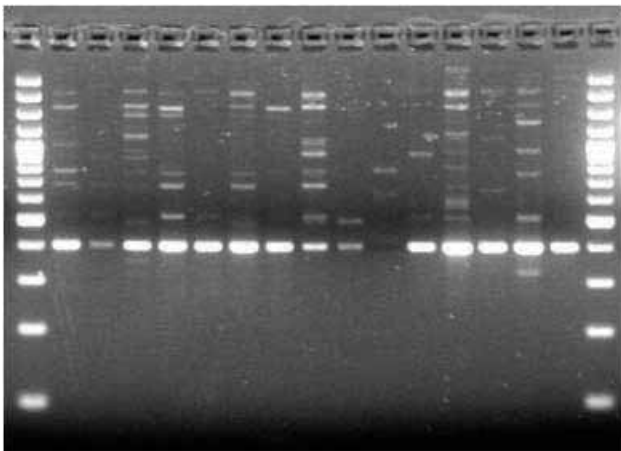
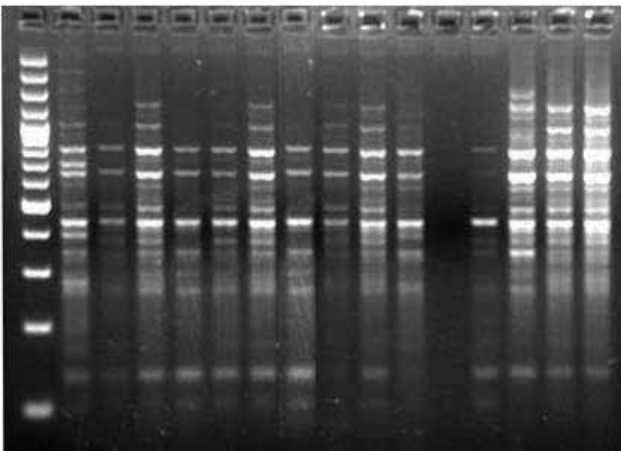


fp= % 2-9- , l , l vkj ekdjkk dk mi ;kx djdi lldjkk dk vk.kfod fo'y'k.k %yu 1&ekdj(yu 2 ,o 3&i'rd(yu 4&ldj(yu 5 o 6&i'rd(yu 7&ldj(yu 8 o 9&i'rd(yu 10&ldj(yu 11 o 12 % i'rd(yu 13&ldj(yu 14 o 15&i'rd(yu 16&ldj%

Fig. 2.9 Molecular analysis of Hybrids using SSR markers (Lane1 = marker; Lane 2&3= parents; Lane 4= hybrid; Lane 5&6= parents; Lane 7= hybrids; Lane 8&9= parents; Lane 10= hybrids; Lane11&12= parents; Lane 13= hybrid; Lane 14&15= parents; Lane 16= hybrid)

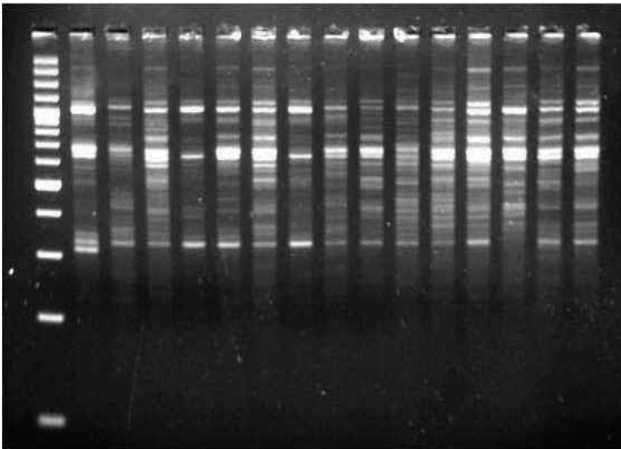
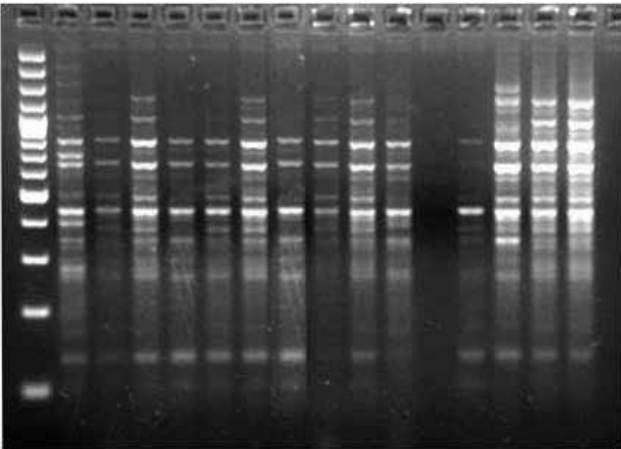
ek/;e l l eko'ku LFkyk d ;Xek dk io/ku dju d fy, geu nk yxkrkj fjV&,yheUV d cfgxkeh lEe[k ikbejk dk bLreky fd;kA fjei v/; ;u d fy,] geu l{e lVykbV ikbejk d lKf&lKf lQy vkbji ikbejk dk mi ;kx fd;kA fjV&,yheUV vk/kkfjr ekdj ;Fkk vrj&fjV&,yheUV iof/kr

facing primers of the two consecutive retro-elements. For ReMAP studies, we have used successful IRAP primers along with microsatellite primers. The hybrids were molecularly characterized along with their parents for developing markers for confirmation of hybrid using retro-element based markers *i.e.* Inter



fp= % 2-10- ftllh Vkbi rRo d i o/ku dk mi ;kx dj d l d j k d k v k . k f o d f o ' y ' k . k % y u 1 & e d j (y u 2 , o 3 & i r d (y u 4 & l d j (y u 5 o 6 & i r d (y u 7 & l d j (y u 8 o 9 & i r d (y u 10 & l d j (y u 11 o 12 % i r d (y u 13 & l d j (y u 14 o 15 & i r d (y u 16 & l d j %

Fig. 2.10. Molecular analysis of Hybrids using amplification of Gypsy type element (Lane1 = marker; Lane 2 & 3= parents; Lane 4= hybrid; Lane 5&6= parents; Lane 7= hybrids; Lane 8&9= parents; Lane 10= hybrids; Lane11&12= parents; Lane 13= hybrid; Lane 14&15= parents; Lane 16= hybrid)



fp= % 2-11- v k b j i d k m i ; k x d j d l d j k d i v k . k f o d f o ' y ' k . k e n k u k i r d k d i c l . M d i l k F k l k F k d o y l d j k e i H k h f o f ' k " V c l . M i n f ' k r g k j g k g l % y u 1 & e d j (y u 2 , o 3 & i r d (y u 4 & l d j (y u 5 o 6 & i r d (y u 7 & l d j (y u 8 o 9 & i r d (y u 10 & l d j (y u 11 o 12 % i r d (y u 13 & l d j (y u 14 o 15 & i r d (y u 16 & l d j %

Fig. 2.11. Molecular analysis of Hybrids using IRAPs showing bands of both the parents as well as distinct band in hybrids only (Lane1 = marker; Lane 2 & 3= parents; Lane 4= hybrid; Lane 5&6= parents; Lane 7= hybrids; Lane 8&9= parents; Lane 10= hybrids; Lane11&12= parents; Lane 13= hybrid; Lane 14&15= parents; Lane 16= hybrid)

cg : f i r k % b v j f j v k & , y h e U V , E i y h Q k b M i k y h e k f Q T e % v k b j i % r F k f j v k & , y h e U V l { e l V y k b V i o f / k r cg : f i r k % f j v k & , y h e U V e k b Ø k & l V y k b V , E i y h Q k b M i k y h e k f Q T e % v k b j i % d k m i ; k x d j r g , l d j k d h i f " V d j u d f y , e k d j k d k f o d f l r d j u g r m u d i r d k d l k F k & l k F k l d j k d k v k . k f o d y { k . k o . k u

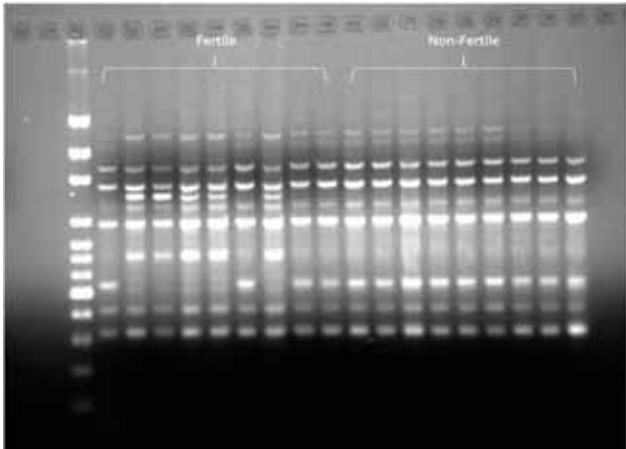
Retroelement Amplified Polymorphism (IRAPs) and Retroelement Microsatellite Amplified Polymorphism (ReMAPs). A total of 32 outward facing IRAP and 14 ReMAP primers were used in the study singly and in pairs. These retro-element based markers have shown very high resolution



fd;k x;kA bl v/;;u e vdy rFkk ;Xek e dy 32 cfxkeh Qflx vkbji rFkk 14 jhei ikbejk dk bLreky fd;k x;kA bu fjV&,yheUV vk/kkfjr ekdj e irdk vkj l dj fdLek d chp mPp fjtKY;'ku inf'kr gvka v/;;u l ;g vueku yxk;k tk ldrk g fd budk vxfdl ituu dk;Øe e l dj.k dh ifV dju e iHkkoh rjhd l bLreky fd;k tk ldrk gA fjV&,yheUV vk/kkfjr ekdj e vxfdl ckbLijl e mPp fofo/krk inf'kr gb] t gk fofo/krk ge'kk l vf/kdk'k vU; ekdj i.kkfy;k d l kFk cgr gh de inf'kr gkrh gA

x- fydt efix d fy, cVu [kEc e l okf/kd fofo/krk n'kku oky vk.kfod ekdjk dh igpu

dy ikp l dj fdLek vkj mud lcf/kr ird thui:ik e cg:firk lo{k.k d fy, vdy rFkk vkbji vkj jhei ikbejk d l;ktu e dy 50 vkj, ihMh] 33 , l , l vkj] 7 vkb, l , l vkj] 34 vkbji , o 14 jhei ikbejk dk tkpk x;kA ifj.kkek l irk pyk fd , l , l vkj] vkbji rFkk jhei ekdj e vPNh cg:firk inf'kr gk jgh gA vkj, ihMh d ifj.kkek e vfr l hfer vkuof'kd fofo/krk ¼11 ifr'kr½ inf'kr gbA gkykfd] vkb, l , l vkj] , l , l vkj vkj fjV&,yheUV vk/kkfjr ekdj ;Fkk vkbji rFkk jhei ekdj e mPprj vkuof'kd fofo/krk inf'kr gbA



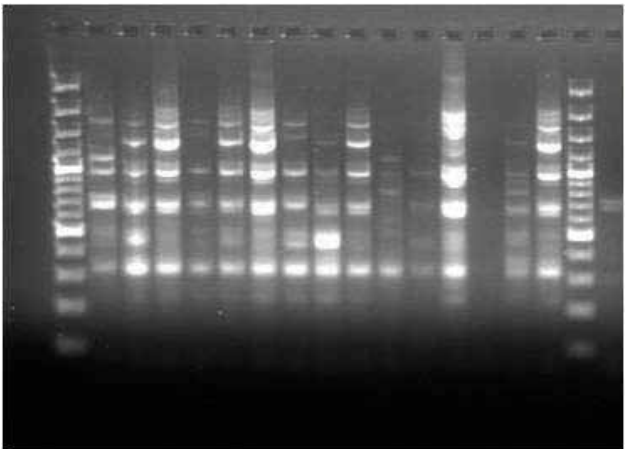
fp= % 2-12- iituufke rFkk c/; foyxuk dh vkj, ihMh ikQkby

Fig. 2.12. RAPD profile of fertile and non-fertile isolates

between the parents and hybrids. It can be inferred from the study that these can be effectively used in confirmation of hybridization in *Agaricus* breeding programme. Retro-element based markers showed high diversity in *Agaricus bisporus*, where diversity is always revealed to be very low with most of the other marker systems.

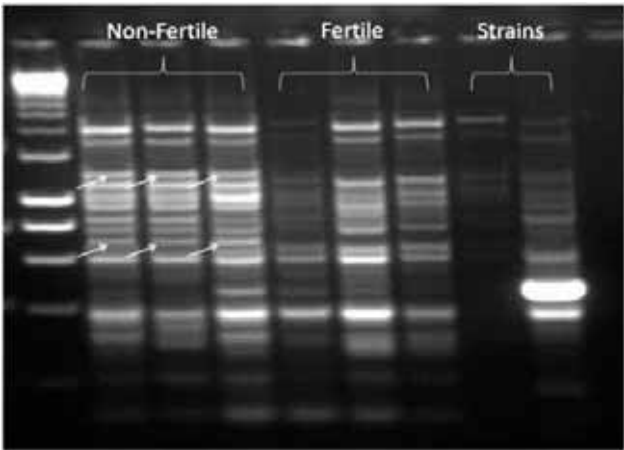
c. Identification of molecular markers showing maximum diversity in button mushroom for linkage mapping

A total of 50 RAPD, 33 SSR, 7 ISSR, 34 IRAP and 14 ReMAP primers were tested singly and in combination of IRAP and ReMAP primers for polymorphism survey in 5 hybrids and their respective parental genotypes. The results indicated that SSRs, IRAPs and ReMAPs are showing good polymorphism. Gel profiles were generated. The results of RAPD indicated very limited genetic diversity (11%). However, ISSR, SSR and retroelement based markers i.e. IRAPs and ReMAPs markers have shown higher genetic diversity. Spore prints were collected from hybrids NBS-1, NBS-2, NBS-3, NBS-4 and NBS-5 and 150 spores were isolated from each hybrid to develop mapping population.



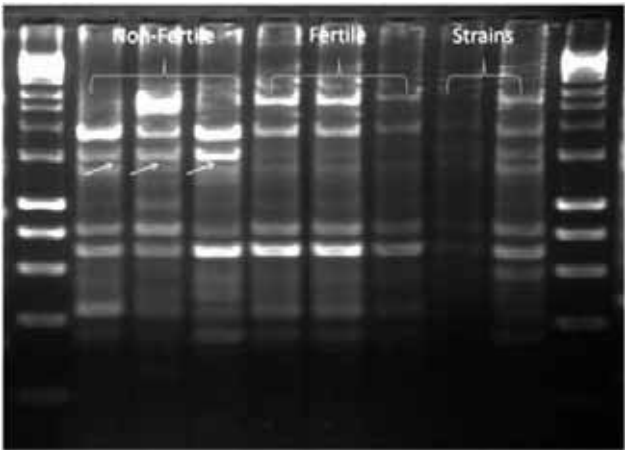
fp= % 2-13- vkb, l , l vkj ikQkby %yu 1 o 17& ekdj(yu 2 o 3(5 o 6(8 o 9(11 o 12(14 o 15&iir d(yu 4] 7] 10] 13] o 16&l dj½

Fig. 2.13. ISSR profile (Lane1 &17 = marker; Lane 2 & 3; 5&6; 8&9; 11&12; 14&15= parents; Lane 4, 7, 10, 13, 16= hybrids)



fp= % 2-14- c/;] i t u u { k e r F k k L V / u k d h v k b j i i
i k Q k b y e i c / ; f o y x u k e i f o f ' k " V c l . M i n f ' k r
g k j g k g l

Fig. 2.14. IRAP Profile of non-fertile, fertile and strains showing distinct band in non-fertile isolates



fp= % 2-15- c/;] i t u u { k e r F k k L V / u k d h j h e i
i k Q k b y e i c / ;] i t u u { k e f o y x u k e i f o f ' k " V
c l . M i n f ' k r g k j g k g l

Fig. 2.15. ReMAP Profile of non-fertile, fertile and strains showing distinct band in non-fertile isolates

l d j k , u c h , l & 1] , u c h , l & 2] , u c h , l & 3] , u c h , l & 4
r F k k , u c h , l & 5 l c h t k . k i f r l d f y r f d ; x ; v k j
150 c h t k . k v k d k i R ; d l d j l v y x f d ; k x ; k
r k f d e f i x t u l [; k f o d f l r d h t k l d A

?k- c V u [k E c d i n k g k f y ; k f o d f l r H k j k i u
i f r j k / k h l d j k % , u c h , l & 1 , o , u c h , l & 5 %
d k e Y ; k d u , o m l u g i t k j h d j u k

d y X ; k j g L V u k l v y x f d , x , c / ; f o y x u k
d k m i ; k x d j d d y 361 l d j f o d f l r f d , x ,
v k j d k v d k m i ; k x d j d M c y L V h d ; k f = d h { k f r
d k v i u k d j H k j k i u d h i f r f d ; k d f y , b u d k
e Y ; k d u f d ; k x ; k A f o f H k U u H k j k i u i f r j k f / k r k % ; k f = d h
{ k f r d n k ? k V c k n % r F k k m i t d v k / k k j i j d y 41
l d j k d k p ; u f d ; k x ; k A b u e l i k p e m P p
H k j k i u i f r j k f / k r k i k b x b f t u d k p ; u v r r % 0 ; k i d
L r j h ; e Y ; k d u d f y , f d ; k x ; k A v f [k y H k j j r h ;
l e f U o r v u l / k k u i f j ; k t u k d d U n k r F k k r h u f o f H k U u
0 ; k o l k f ; d Q k e i j 0 ; k o l k f ; d L r j i j e Y ; k d u d
i ' p k r n k l d j k u k e r % , u c h , l & 1 , o , u c h , l & 5
d k p u k x ; k A n k l d j k d k v f [k y H k j j r h ; l e f U o r
v u l / k k u i f j ; k t u k d h o k f " k d d k ; ' k k y k d n k j k u
t k j h f d ; k x ; k A

d. Evaluation and release of two recently developed browning resistant hybrids of button mushroom (NBS-1 and NBS-5)

A total of 361 hybrids developed using non-fertile isolates from 11 strains were evaluated for their browning reaction by applying double streak mechanical injury using a fork. Forty-one hybrids were selected on the basis of varying browning resistance (after two hours of mechanical injury) and yield. Five of these with high browning resistance have been finally selected for large scale evaluation. Two hybrids NBS-1 and NBS-5 were selected after evaluation at centres of All India Coordinated Research Project (AICRP) and commercial level at three different commercial farms. The two hybrids were released during the annual workshop of All India Coordinated Research Project.



fp= % 2-16- 0;kid Lrjh; ijh{k.k d nkjku ,uch, l&1 dh Qly
Fig. 2.16. Crop of NBS-1 during large scale trial



fp= % 2-17- 0;kid Lrjh; ijh{k.k d nkjku ,uch, l&5 dh Qly
Fig. 2.17. Crop of NBS-5 during large scale trial

I kj.kh % 2-1- Hkkd'vuji & [kEc vu|l/kku fun'kky; e o"k 2012 l 2015 d nkjku ;&3 fu;=d %vuipkfjr% d edkcy ,uch, l&1 ,o ,uch, l&5 dh mi t %fdxk-@100 fdxk- dEi kLV%

Table 2.1. Yield (kg/100kg compost) of NBS-1 and NBS-5 against U-3 control at ICAR-Directorate of Mushroom Research during 2012 to 2015

LViu	2012&13	2013&14	2014&15	2015&16	vkI r
Strain	2012-13	2013-14	2014-15	2015-16	Average
,uch, l&1@NBS-1	18.90	18.50	17.50	18.30	18.30
,uch, l&5@NBS-5	15.75	17.80	16.80	15.75	16.52
;&3@U-3	15.40	14.00	14.00	15.30	14.67

I kj.kh % 2-2- fofHkUu vf[ky Hkkjrh; lefUor vu|l/kku ifj;k tuk dUnk ij Mh,evkj&03 fu;=d %vuipkfjr% d edkcy ,uch, l&1 ,o ,uch, l&5 dh mi t %fdxk-@100 fdxk- dEi kLV%

Table 2.2. Yield (kg/100kg compost) of NBS-1 and NBS-5 against DMR-03 control at different AICRP centres

LViu	2013&14			2014&15			vkI r
Strain	2013-14			2014-15			Average
	iruxj Pantnagar	yflk;kuk Ludhiana	Ikyu Solan	i .k Pune	Ikyu Solan	ukuh Nauni	
,uch, l&1@NBS-1	20.27	16.35	18.19	17.17	17.90	20.50	18.40
,uch, l&5@NBS-5	19.79	—	15.50	20.69	18.17	16.27	18.08
;&3@U-3	18.81	—	17.06	20.36	21.28	17.01	18.90



Table 2.3. Yield (kg/100kg compost) of NBS-1 and NBS-5 against different control strains at different commercial units during 2013-15

Strain	2013&14		2014&15			Average
	2013-14		2014-15			
	fr : ifr ckykth ,xk ikMDVI] ckjkerh Tirupati Balaji Agro-products, Baramati	ohdQhYM e'k:e] i .k Weikfield Mushroom, Pune	fr : ifr ckykth ,xk ikMDVI] ckjkerh Tirupati Balaji Agro-products, Baramati	ohdQhYM e'k:e] i .k Weikfield Mushroom, Pune	QyDI QM] ngjknu Flex Food, Dehradun	
,uch, l&1@NBS-1	25.19	21.26	19.13	22.00	17.58	21.03
,uch, l&5@NBS-5	24.16	23.06	21.80	16.70		21.43
bVky;u LVu@ Italian strain	22.95	—	—	—	—	22.95
,&15@A-15	—	18.73	—	17.50	17.00	17.74
Mh,evkj&03@DMR-03	—		19.15	—	—	19.15
fIYoku Liku@ Sylvan spawn	—	—	—	17.15	—	17.15

Yield, kg/100kg

Yield (kg/100kg compost) of NBS-1 and NBS-5 against different control strains at different commercial units during 2013-15

Yield (kg/100kg compost) of NBS-1 and NBS-5 against different control strains at different commercial units during 2013-15

Oyster Mushroom

A. Strainal evaluation of *P.sajor caju* and *P.florida* and *Pleurotus* spp.

To evaluate the best culture of *Pleurotus* spp. during moderate temperatures (14-20 °C), different strains from the Gene Bank of ICAR-DMR were used for yield evaluation on pasteurized wheat straw. Out of 29 strains, there was no mycelial growth in 6 strains, while 3 strains did not give fruiting at low temperature. Among *Pleurotus ostreatus* strains culture no. DMRP-356 recorded 155 % B.E followed by DMRP-339 (105 % BE). Among *P.sajor-caju* strains, DMRP-337 gave maximum production with 121 % BE followed by DMRP-357 (117 % BE). Yield data were recorded for 30 days. The cultures are under further evaluation for summer trial.



I kj.kh % 2-4- IY;jkVI i tkfr d i'pjhd'r xgi d Hk l i j mit l c/kh vkdM

Table 2.4 Yield data of *Pleurotus spp.* on pasteurized wheat straw

Ø-I-	I o/ku I ;k	fdLe	mit@fdxk- 'k"d Hk l k %xke½	%chb%½
Sl. No.	Culture No.	Variety	Yield /kg dry straw(g)	(BE %)
1	IY;jkVI vkfLV;VI	Mh,evkji h&330	910	91
1	<i>Pleurotus ostreatus</i>	DMRP-330	910	91
2	IY;jkVI I t j d k t	Mh,evkji h&331	dkb ch t Qyko ugh	&
2	<i>P. sajor-caju</i>	DMRP-331	No spawn run	-
3	IY;jkVI vkfLV;VI	Mh,evkji h&332	dkb Qyu ugh	&
3	<i>P. ostreatus</i>	DMRP-332	No fruiting	-
4	IY;jkVI vkfLV;VI	Mh,evkji h&333	612	61.5
4	<i>P. ostreatus</i>	DMRP-333	612	61.5
5	IY;jkVI vkfLV;VI	Mh,evkji h&334	910	91
5	<i>P. ostreatus</i>	DMRP-334	910	91
6	IY;jkVI vkfLV;VI	Mh,evkji h&335	dkb ch t Qyko ugh	&
6	<i>P. ostreatus</i>	DMRP-335	No spawn run	-
7	IY;jkVI vkfLV;VI	Mh,evkji h&336	dkb ch t Qyko ugh	&
7	<i>P. ostreatus</i>	DMRP-336	No spawn run	-
8	IY;jkVI I t j d k t	Mh,evkji h&337	1212	121.1
8	<i>P. sajor-caju</i>	DMRP-337	1212	121.1
9	IY;jkVI i tkfr	Mh,evkji h&338	887	88.7
9	<i>Pleurotus sp.</i>	DMRP-338	887	88.7
10	IY;jkVI vkfLV;VI	Mh,evkji h&339	1050	105
10	<i>P. ostreatus</i>	DMRP-339	1050	105
11	IY;jkVI vkfLV;VI	Mh,evkji h&340	862	86.2
11	<i>P. ostreatus</i>	DMRP-340	862	86.2
12	IY;jkVI vkfLV;VI	Mh,evkji h&341	dkb ch t Qyko ugh	&
12	<i>P. ostreatus</i>	DMRP-341	No spawn run	-
13	IY;jkVI vkfLV;VI	Mh,evkji h&342	450	45
13	<i>P. ostreatus</i>	DMRP-342	450	45
14	IY;jkVI I t j d k t	Mh,evkji h&343	900	90
14	<i>P. sajor-caju</i>	DMRP-343	900	90
15	IY;jkVI I t j d k t	Mh,evkji h&344	937	93.7
15	<i>P. sajor-caju</i>	DMRP-344	937	93.7
16	IY;jkVI I t j d k t	Mh,evkji h&345	950	95
16	<i>P. sajor-caju</i>	DMRP-345	950	95
17	IY;jkVI i tkfr	Mh,evkji h&346	650	65
17	<i>Pleurotus sp.</i>	DMRP-346	650	65



Sl. No.	Culture No.	Variety	Yield /kg dry straw(g)	(BE %)
18	<i>P. ostreatus</i>	DMRP-347	No spawn run	-
19	<i>Pleurotus sp.</i>	DMRP-348	670	67
20	<i>Pleurotus sp.</i>	DMRP-349	432	43.2
21	<i>P. sajor-caju</i>	DMRP-350	No fruiting	-
22	<i>P. sajor-caju</i>	DMRP-351	No fruiting	-
23	<i>P. ostreatus</i>	DMRP-352	No spawn run	-
24	<i>P. ostreatus</i>	DMRP-353	677	67.7
25	<i>P. ostreatus</i>	DMRP-354	No fruiting	-
26	<i>P. sajor-caju</i>	DMRP-355	515	51.5
27	<i>P. ostreatus</i>	DMRP-356	1552	155
28	<i>P. sajor-caju</i>	DMRP-357	1170	117
29	<i>Pleurotus sp.</i>	DMRP-358	1112	111.2
Økfrd fhkUrk 5 %			148-1	
CD at 5 %			148.1	

ffe;k e ijh{k.k d fy, lo/ku dk iuh eY;kdu fd;k tk jgk gA

***IY;jkVI Itj dkt* Idj LVuk dk eY;kdu**

IY;jkVI Itj dkt d pkj fofhkuu LVuk I ,dy chtk.k dk lxe djkdj fodflr fd; x; NRrhI Idj LVu dk eY;kdu viy&eb d nkjku ikyhffku Fkyk vkj lykflVd dh V e ik"P;jhdr xg HkI ij fd;k x; kA iR;d LVu e ,d fdxk- xg HkI dh pkj ifrdfr;k j[kh xBA 30 fnuk d fy, mi t d vkdMk dk nt fd;k x; kA Fkyk e lkr loJ"B LVu

B. Evaluation of *P. sajor caju* hybrid strains

Thirty six hybrid strains developed by mating of single spores from 4 different parent strains of *P. sajor caju* were evaluated on pasteurized wheat straw in polythene bags and plastic trays during April and May, 2015. Bags were filled with one kg of dry wheat straw and inoculated with grain spawn of different strains. The experiment was done with four replications and yield data was recorded for 30 days. There were seven



Fk ftue mYy[kuh; :i l dg h mPprj mit iklr gb tk fd bl idkj Fk ih, l l h,p & 7] 14] 18] 19] 27] 29 ,o 35 vkj V e loJ"B LVu e ih, l l h,p & 7] 14] 18] 19] 21] 35 ,o 36 'kkfey Fk % l kj.kh % 2-5%A

vxLr&flrEcj d nkjku ik'P;jhdr xg Hkl ij Fkyk rFkk V e lHkh loJ"B uk LVu dk mud irdk d lFk mit x.kk d fy, eY;kdu fd;k x;kA V e iR;d LVu dh dy 10 ifrdfr;k vkj Fkyk e 6 ifrdfr;k FkA l dj ih, l l h,p & 18] 19] 29 ,o 35 e vf/kdre mit iklr gb vkj tkjh dju gr budk 0;kid Lrj ij iu% eY;kdu fd;k tk,xk % l kj.kh 2-6%A

best strains in bags which have given significantly higher yield viz., PSCH-7, 14, 18, 19, 27, 29, 35 and in trays best strains were PSCH-7, 14, 18, 19, 21, 35 and 36 (Table 2.5).

The best performing seven strains along with their parents were again evaluated for yield in bags and trays during August and September months of 2015 on pasteurized wheat straw as substrate. There were 10 replications in trays and 6 replications of each strain in bags. Maximum yield was obtained in the hybrids PSCH-18, 19, 29 and 35 and kept for further evaluation at larger scale for commercial release (Table 2.6).

l kj.kh % 2-5- viiy rFkk eb e ik'P;jhdr xg d Hkl ij irdk d lFk&lFk lY;jkVl l/tj dkt/ l dj k dk ryukRed in'ku

Table 2.5. Comparative performance of *P. sajor caju* hybrids along with parents on pasteurized wheat straw.

Ø- l- Sl. No.	LVu Strain	V e chb BE(%) in trays	Fkyk e chb BE (%) in bags	Ø- l- Sl. No.	LVu Strain	V e chb BE(%) in trays	Fkyk e chb BE(%) in bags
1	ih, l l h,p & 1	43-25	48-9	21	ih, l l h,p & 21	49-25	61-17
1	PSCH1	43.25	48.9	21	PSCH21	49.25	61.17
2	ih, l l h,p & 2	31-25	47-77	22	ih, l l h,p & 22	44-5	45-83
2	PSCH2	31.25	47.77	22	PSCH22	44.5	45.83
3	ih, l l h,p & 3	34	37-1	23	ih, l l h,p & 23	46-25	40
3	PSCH3	34	37.1	23	PSCH23	46.25	40
4	ih, l l h,p & 4	33-75	24-9	24	ih, l l h,p & 24	42-5	27-3
4	PSCH4	33.75	24.9	24	PSCH24	42.5	27.3
5	ih, l l h,p & 5	55-75	57-2	25	ih, l l h,p & 25	35	53-3
5	PSCH5	55.75	57.2	25	PSCH25	35	53.3
6	ih, l l h,p & 6	37-5	58-1	26	ih, l l h,p & 26	23	52
6	PSCH6	37.5	58.1	26	PSCH26	23	52
7	ih, l l h,p & 7	62	62-17	27	ih, l l h,p & 27	63-75	31-17
7	PSCH7	62	62.17	27	PSCH27	63.75	31.17
8	ih, l l h,p & 8	34-75	58-7	28	ih, l l h,p & 28	51	44-8
8	PSCH8	34.75	58.7	28	PSCH28	51	44.8
9	ih, l l h,p & 9	39-75	42-5	29	ih, l l h,p & 29	65-25	55-7
9	PSCH9	39.75	42.5	29	PSCH29	65.25	55.7



Ø- I- Sl. No.	LVu Strain	V e chb %½ BE(%) in trays	Fkyk e chb %½ BE (%) in bags	Ø- I- Sl. No.	LVu Strain	V e chb %½ BE(%) in trays	Fkyk e chb %½ BE(%) in bags
10	ih, l lh, p & 10	46-25	55-8	30	ih, l lh, p & 30	56-75	24-5
10	PSCH10	46.25	55.8	30	PSCH30	56.75	24.5
11	ih, l lh, p & 11	41	52-5	31	ih, l lh, p & 31	30	39-2
11	PSCH11	41	52.5	31	PSCH31	30	39.2
12	ih, l lh, p & 12	42	47-83	32	ih, l lh, p & 32	60	53-8
12	PSCH12	42	47.83	32	PSCH32	60	53.8
13	ih, l lh, p & 13	32	52	33	ih, l lh, p & 33	40	47-3
13	PSCH13	32	52	33	PSCH33	40	47.3
14	ih, l lh, p & 14	62-25	66	34	ih, l lh, p & 34	53-75	27-3
14	PSCH14	62.25	66	34	PSCH34	53.75	27.3
15	ih, l lh, p & 15	40-5	56-8	35	ih, l lh, p & 35	59-5	62-2
15	PSCH15	40.5	56.8	35	PSCH35	59.5	62.2
16	ih, l lh, p & 16	33-75	48-17	36	ih, l lh, p & 36	45-75	64-8
16	PSCH16	33.75	48.17	36	PSCH36	45.75	64.8
17	ih, l lh, p & 17	35-75	20	37	Mh, evkj ih -112	50	49-2
17	PSCH17	35.75	20	37	DMRP-112	50	49.2
18	ih, l lh, p & 18	61-75	61-17	38	Mh, evkj ih -214	47-5	28-5
18	PSCH18	61.75	61.17	38	DMRP-214	47.5	28.5
19	ih, l lh, p & 19	60	61	39	Mh, evkj ih -233	45-25	43-7
19	PSCH19	60	61	39	DMRP-233	45.25	43.7
20	ih, l lh, p & 20	52-5	55-3	40	Mh, evkj ih -255	28-25	30
20	PSCH20	52.5	55.3	40	DMRP-255	28.25	30
CD at 5%						109.3	125.1
Økfrd fhkUurk 5%						109-3	125-1

I kj.kh % 2-6- vxLr&f l rEcj] 2015 e ik'P; jhd'r xg d Hk l ij iir'dk d l kFk&l kFk lY; jkVI l/tj dkt/ d loJ'B l d j LVu dk r yuRed in'ku

Table 2.6. Comparative performance of best hybrid strains of *P. sajor caju* along with parents on pasteurized wheat straw during Aug-Sept, 2015

Ø- I- Sl. No	LVu Strain	V e chb %½ %10 ifrdfr; k dk v k l r½ BE (%) in trays (average of 10 replicates)	Fkyk e chb %½ %6 ifrdfr; k dk v k l r½ BE (%) in bags (average of 6 replicates)
1	ih, l lh, p & 7@PSCH7	66.4	47.5
2	ih, l lh, p & 14@PSCH14	66.4	40.67
3	ih, l lh, p & 18@PSCH18	71.6 (3 rd)	68.41 (1 st)



Ø- I- Sl. No	LVu Strain	V e i chb i %½ %10 ifrdfr;k dk v k l r½ BE (%) in trays (average of 10 replicates)	Fkyk e i chb i %½ %6 ifrdfr;k dk v k l r½ BE (%) in bags (average of 6 replicates)
4	ih, l lh, p & 19@PSCH19	79.1 (2 nd)	56 (4 th)
5	ih, l lh, p & 21@PSCH21	62.2	36.0
6	ih, l lh, p & 27@PSCH27	64.2	36.83
7	ih, l lh, p & 29@PSCH29	94.5 (1 st)	61.17 (3 rd)
8	ih, l lh, p & 35@PSCH35	68.5 (4 th)	63.92(2 nd)
9	ih, l lh, p & 36@PSCH36	45.4	50
10	Mh, evkji h & 112@DMRP-112	55.1	52.1
11	Mh, evkji h & 214@DMRP-214	55	40.03
12	Mh, evkji h & 233@DMRP-233	34	39.67
13	Mh, evkji h & 255@DMRP-255	54	24.0
	Økfrd fhkUurk 5%@CD at 5%	75.42	58.27

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oh- okYofl ; k d rhu LVu ; Fkk Mh, evkji h & 185
½vkb & 210½ Mh, evkji h & 463 ½chch, l v k j & 007½
r Fk Mh, evkji h & 484 t hfofo&01 dk m i ; kx ekYV
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Paddy Straw Mushroom

Evaluation of hybrids and single spore isolates of
Volvariella volvacea for fruit body yield and
nutritional profile

a. Isolation of single spore isolates, hybrid
development and their screening

Three strains of *V. volvacea* viz. DMRO-185
(OE-210), DMRO-463 (BBSR-007) and DMRO-
484 (GVv-01) with morphologically distinct fruit
bodies were used for the isolation of the single spore
isolates (SSIs) on Malt Extract Agar medium
following standard protocol. The SSIs were divided
in two types; a) fast growing with typical high
yielding mycelial growth characteristics and b) slow
growing with typical non fruiting types. The fast
growing SSIs with typical high yielding mycelial
growth characteristics were studied for their
downward mycelial growth on sterilized pounded
paddy straw filled in wide mouth test tubes. The



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ird LVu d edkcy dgh vf/kd v/kkxkeh ekbl hf; y
of) inf'kr gbA en of) dkjd , dy ch t k.k foyxuk
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fun'kky;] lkyu e ekudhr fof/k dk vuikyu
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x; kA ch t kb d fy, /kku d Hkl ij vk/kkfjr [kEc
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vk'kk tud ikp , dy ch t k.k foyxuk d lkFk&lkFk
rhu irdk dk eY; kdu Hkki l ik'P; jhdr ivky

SSIs exhibiting higher downward mycelial growth
compared to parent strains were selected for further
lignocellulolytic enzymes activity profile and the fruit
body yield potential. The slow growing SSIs were
used for developing hybrids using the conventional
breeding technique on MEA plates. The developed
hybrids along with the SSIs and the parent strains
were also screened for their downward mycelial
growth on sterilized pounded paddy straw filled in
wide mouth tubes and the lignocellulolytic enzymes
activity profile.

Cultivation trial

The cultivation trials were conducted at
environment controlled mushroom growing unit of
the Directorate. The trials were conducted during
summer months starting from May to October, 2015
by using both, the traditional bundle method and
the advanced compost method. The advanced level
evaluation trials were conducted by using 15 and 25
kg compost beds with 8 replications in Randomized
Block Design (RBD). Similarly by traditional
method the evaluation was done with beds prepared
with 6 kg dry substrate bundles with 6 replications.
The composted substrate was prepared with 1:1, w/
w combination of paddy straw (PS) and cotton
ginning mill waste (CGMW) by following the
method standardized at ICAR-DMR, Solan. The
paddy straw based spawn was used for spawning.
Standard package of practices were followed for spawn
run and crop raising. Data for time taken for first
harvest (days post-spawning), mushroom (fruit body)
yield (kg/q dry substrate) and mean wt. of fruit bodies
(g) were recorded for 15 days of cropping. The data
was subjected to statistical analysis by single factorial
ANOVA using AGRes software.

The promising five SSIs and six hybrids along
with three parents were evaluated for their yield



cMyk l r;kj D;kfj;k e mudh mi t {kerk d fy, fd;k x;kA iR;d D;kjh d fy, rhu ijr k e nl cMyk %iR;d yxHkx 600 xke% dk mi ;kx fd;k x;k vkj iR;d LVu@ldj@,dy chtk.k foyxuk d fy, N% dk vktek;k x;kA bue l nk ,dy chtk.k foyxuk rFkk ,d ird LVu e yxHkx ux.; Qyudk; mit gkfly gbA lHkh e l] ird LVu Mh,evkjb&185 ,o Mh,evkjb&247 l mRiUu ldjk

potential on beds prepared from steam pasteurized paddy straw bundles. Ten bundles (each approximately of 600 g) were used in three layers for each bed and six replications were kept for each strain/ hybrid/SSI. Out of these 2 SSIs and one parent strain gave almost negligible fruit body yield. Among all, the highest fruit body yield was obtained in hybrids

lkj.kh % 2-7- jkl;k;fud fof/k l mipkfjr /kku d: Hkl d: cMyk ij okYofj;yk okYofl;k d: fofHkUu ldjk rFkk ,dy chtk.k foyxuki dk Qyudk; mit in'ku

Table 2.7. Fruit body yield performance of different hybrids and single spore isolates of *Volvariella volvacea* on chemically treated paddy straw bundles

LVu@ldj	igyh dVkb: d: fy, yxu okyk le; %fnu%	Qyudk; mi t %fdxk-@fDoVy 'k"d i k"kk/kkj%	vk l r Qyudk; Hkkj %xke%
Strains/hybrids	Time taken for first harvest (days)	Fruit body yield (kg/q dry substrate)	Mean fruit body wt. (g)
vkb&210 %ird%@OE-210 (P)	18.0	1.16	28.9
t hohoh&01 %ird%@GVV-01 (P)	14.2	8.02	24.74
Vh lh&vkb&274 %ird%@TC-OE-274 (P)	0	0.31	19.5
vkb&274&88 %, l , l vkb%@OE-274-88 (SSI)	0	0.46	22.8
vkb&274&103 %, l , l vkb%@OE-274-103 (SSI)	15.75	4.50	22.52
t hohoh&01&08* %, l , l vkb%@GVV-01-08* (SSI)	14.2	2.57	18.88
t hohoh&01&94 %, l , l vkb%@GVV-01-94 (SSI)	18.0	2.31	20.64
vkb&210&123 %, l , l vkb%@OE-210-123 (SSI)	16.0	0.23	28.5
vkb&210&98+vkb&274&44 %ldj%@OE-210-98+OE-274-44 (H)	20.5	2.94	18.85
vkb&210&77+vkb&274&111 %ldj%@OE-210-77+OE-274-111 (H)	12.83	11.07	21.79
vkb&210&77+vkb&274&18 %ldj%@OE-210-77+OE-274-18 (H)	12.33	9.51	15.95
vkb&274&6+vkb&274&38 %ldj%@OE-274-6+OE-274-38 (H)	2.19	18.23	19.33
vkb&274&18+ t hohoh&01&113 %ldj%@OE-274-18+GVV-01-113 (H)	17.66	1.92	15.48
vkb&274&111+ t hohoh&01&69 %ldj%@OE-274-111+GVV-01-69 (H)	18.6	2.39	20.59



¼vkb&210&77 + vkb&274&111 ,o vkb&210& 77 +
vkb&274&18½ e vf/kdre Qyudk; mit gkfly
gbA ird LVu Mh, evkjk&484 e rh ljh lcl
T; knk Qyudk; mit gkfly gbA blh Øe e igyh
dVkb d fy, lcl de le; yxkA ;g lcl de
nk ldjk ¼12-33 ,o 12-83 fnu½ e vkj rnijkr ird
LVu Mh, evkjk&484 ¼14-2 fnu½ e ik; k x; kA mPp
mRikndk e l] vklr Qyudk; Hkkj ird LVu]
Mh, evkjk&484 vkj rnijkr nk ldjk e ik; k x; k
¼lkj.kh 2-7½A

dikl dh vkvb fey d vif'k"V rFkk /kku d
Hkl d lM g, ik"kk/kkj dk mi; kx djd {kerk'khy
o mPp mit'khy pkj ldjk] rhu ,dy chtk.k
foyxuk vkj rhu irdk d lkFk vk; kftr fd, x,
[krh ijh{k.kk e vyx&vyx ,dy chtk.k foyxuk

lkj.kh ¼ 2-8- /kku ivky d lM g, ik"kk/kkj rFkk dikl vkvb fey d vif'k"V ij okYofj; yk okYofl ;k d
fofhkUu ldjk rFkk ,dy chtk.k foyxuk dk Qyudk; mit in'ku

Table 2.8. Fruit body yield performance of selected hybrids and single spore isolates of *Volvariella volvacea* on composted substrate of paddy straw and cotton ginning mill waste

LVu@ldj	igyh dVkb d fy, yxu okyk le; ¼fnu½	Qyudk; mit ¼fdxk-@fDoVy 'k"d ik"kk/kkj½	vklr Qyudk; Hkkj ¼xke½
Strains/hybrids	Time taken for first harvest (days)	Fruit body yield (kg/q dry substrate)	Mean fruit body wt. (g)
vkb&210 ¼ird½@OE-210 (P)	11.83	6.44	12.82
t hohoh&01 ¼ird½@GVV-01 (P)	12.17	26.45	24.70
Vh lh&vkb&274 ¼ird½@TC-OE-274 (P)	14.6	4.59	17.26
vkb&274&103 ¼, l, l vkb½@OE-274-103 (SSI)	13.67	16.43	17.16
t hohoh&01&08* ¼, l, l vkb½@GVV-01-08* (SSI)	12.5	24.95	15.11
t hohoh&01&94 ¼, l, l vkb½@GVV-01-94 (SSI)	13.0	20.10	18.86
vkb&210&98+vkb&274&44 ¼ldj½@ OE-210-98+OE-274-44 (H)	—	—	—
vkb&210&77+vkb&274&111 ¼ldj½@ OE-210-77+OE-274-111 (H)	12.5	22.26	19.83
vkb&210&77+vkb&274&18 ¼ldj½@ OE-210-77+OE-274-18 (H)	12.0	32.40	15.51
vkb&274&111+ t hohoh&01&69 ¼ldj½@ OE-274-111+GVV-01-69 (H)	12.67	30.03	19.46



rFkk ljdk e vyx&vyx mit iVu n[ku dk feykA ,dy chtk.k foyxu thfofo&01&08 rFkk rhu ljdk %vkb&210&77 + vkb&274&111] vkb&210&77 + vkb&274&18 ,o vkb&210&111 + thfofo&01&69% e ird LVu dh ryuk e dgh mPprj Qyudk; mit nt dh xBA bu ,dy chtk.k foyxuk rFkk ljdk e igyh dVkb vxrh gb vkj ird LVu Mh, evkjk&484 %24-70 xke% e vf/kdre Qyudk; Hkkj dh ryuk e e/;e {kerk %16-94 l 21-89 xke% e vklr Qyudk; Hkkj iklr fd;k x;k %lkj.kh 2-8%A

ldjk] ,dy chtk.k foyxuk rFkk irdk d [Ec Qyudk; dk ik"kf.kd fo'y"n.k

lHkh ljdk] ,dy chtk.k foyxuk rFkk irdk l ;knfPNd fof/k l fy; x; ing l chl Qyudk;k dk fo'y"n.k ing fofHkuu ekinMk ;Fkk 'k"d inkFk] jk[k] dPpk j'kk] dkckgkbMV l ikVhu] olk] foVfku &Mh vkj lkr fofHkuu [kfutk %dfY l;e] lkm;e] ikVf'k;e] ykg] ftd] dkij] exuhf'k;e vkj lyfu;e% d fy, fd;k x;kA fo'y"n.k dk ;g dk; itkc ck;k&VDukykt h buD;cVj] ekgkyh] Hkkjr % ,d ,u, ch, y }kjk ekU;rk iklr df"n ,o [kk] ijh[k.k i ;x'kkkyk] itkc ljdkj] Hkkjr% e fd;k x;kA 'k"d inkFk] jk[k] dPpk j'kk] olk] dkckgkbMV rFkk ikVhu dh ek=k d fu/kkj.k gr ,vk, lh dh ekud dk;fof/k dk bLreky fd;k x;kA lcl igy ekbØk tyMky fof/k dk mi ;x djd ukbVktu dh ifr'rrk tkuu d fy, ikVhu dh ek=k dk fu/kkj.k fd;k x;k vkj bld ckn bl 6-25 d dkjd d lkFk x.kk fd;k x;kA iR;d ueu d fy, dy dkckgkbMV ifr'kr dk irk yxku d fy, dPpk ikVhu] dPph olk] [kfutk vkj jk[k d ifr'kr dk ,d lkFk feyk dj ml 100 e l ?kvk fn;k x;kA [kfut l?kVdk %ykg] dkij] ftd] lyfu;e rFkk exuhf'k;e% dk fu/kkj.k vkb l h t h & ,e, l fof/k 999-10 dk mi ;x djd fd;k x;k ;k tcf d lkm;e rFkk ikVf'k;e dk fu/kkj.k Qye QkVkehVj dk mi ;x djd fd;k x;kA dfY'k;e dk fu/kkj.k fVvhehVd eØk fof/k] 910-01 dk mi ;x djd] foVfku Mh₂ d : i e foVfku &Mh dk fu/kkj.k itkc ck;k&VDukykt h buD;cVj] ekgkyh }kjk

waste and paddy straw revealed different yielding pattern in different SSIs and the hybrids. SSI GVv-01-08 and three hybrids (OE-210-77+OE-274-111, OE-210-77+OE-274-18 and OE-274-111+GVV-01-69) gave significantly higher fruit body yield compared to the parent strains. These SSIs and hybrids also gave early first harvest and the mean fruit body wt. was of medium range (16.94 to 21.89 g) compared to highest in parent strain DMRO-484 (24.70 g). One hybrid did not give any fruit body (Table 2.8).

b. Nutritional analysis of the mushroom fruit bodies of hybrids, SSIs and parents

The randomly drawn fifteen to twenty fruit bodies from all hybrids, SSIs and parents were got analyzed for fifteen different parameters viz. dry matter, ash, crude fibre, carbohydrates, protein, fat, vitamin-D and 7 different minerals (calcium, sodium, potassium, iron, zinc, copper, magnesium and selenium) from Punjab Biotechnology Incubator, Mohali, India (a NABL accredited Agriculture and Food Testing Laboratory, Govt. of Punjab, India). Standard procedures of AOAC were used for the determination of dry matter, ash, crude fibre, fat, carbohydrate and protein content. The protein content was determined first by determination of nitrogen percentage using Micro-Kjeldahl method, followed by its multiplication with a factor of 6.25. The percentage of crude protein, crude fat, minerals and ash were combined and subtracted from 100 to obtain the total carbohydrate percentage for each sample. Mineral constituents (iron, copper, zinc, selenium and magnesium) were determined by using ICP-MS method 999.10, while sodium and potassium by using flame photometer. Calcium was determined by Titrimetric Macro method, 910.01.



ekudhdr ikVdky d vulkj ,pih,y l h dk mi ;kx
djd fd ;k x ;kA

Qyudk ;k dk fo'y" k.k 8 [kfut k lfgr dy 14
fofhkuu ekinMk d fy, fd ;k x ;kA ikVhu vkj jk[k
dh ek=k d lc/k e ldj ,d&nlj d lerY; FkA
gkykfd] ol[k] dPpk j'kk] foVkeu&Mh dh ek=k vkj
ikVf'k ;e% l k f M ;e vui kr ird LVu dh ryuk e
ldjk e dgh T ;knk ik ;k x ;kA [kfut k dh ek=k Hkh
ird LVu d yxHkx lerY; Fkh ¼ l k j .kh 2-9% A

vf[ky Hkkjrh; lefuor [kEc vu l /kku
ifj ;ktuk d rgr cg LFkkfud ijh{k.kk e
{kerk'khy ldjka rFkk ,dy cht k .k foyxuk
dk eY ;kdu

bl ijh{k.k d vrxr Qyudk ; dh mit] igyh
dVkb e yxu oky le ; rFkk vk l r Qyudk ; Hkkj
¼ xke ½ dk eY ;kdu] Hkki l ik'P ;jhdr /kku d cMyk
dk mi ;kx djd fd ;k x ;kA iR ;d LVu d fy, N
ifrdfr ;k vktekb xb vkj D ;kfj ;k dk ;knfPND
Cykd fMtkbu vkjchMh e 0 ;ofLFkr fd ;k x ;kA vkB
e l nk LVu e dkb Qyu ugh gvkA l Hkh Qyu nu
oky LVu@ldjk e igyh dVkb e yxu oky le ;
yxHkx , d leku Fkk] gkykfd doy LVu fof&15&08
e fhkuurk n[ku dk feyh ft le igyh dVkb d fy,
17 fnu dk le ; yxkA lcl vf/kd Qyudk ; mit
LVu fof&15-04 (8.09%) e ,o rnijkr Øe'k l LVu
fofo-15-03 (7.99) vkj LVu fof&15-01 (5.72%) e nt
dh xbA lcl vf/kd vk l r Qyudk ; Hkkj Øe'k l
LVu fof&15&03 e 19-02 xke ,o rnijku r LVu
fofo-15&01 e 17-88 xke nt fd ;k x ;k ¼ l k j .kh
2-10% A

oreku v/ ; ;u d rgr vkdf rfoKku dh nf"V l
fhkuu rhu oh okYof l ;k LVu l iklr ,dy cht k .k
foyuk dk mi ;kx yxkrkj mPp mit'khy ,dy
cht k .k foyuk dk p ;u dju vkj en of) dkjd
,dy cht k .k foyuk l mPp mit'khy ldjk dk
fodflr dju d fy, fd ;k x ;kA bl idkj fodflr
fd, x, ,dy cht k .k foyuk vkj ldjk dk eY ;kdu
mudh Qyudk ; mit vkj ik"kf.kd vfHky[k d fy,
fd ;k x ;kA bMkj [krh ifjLFkr ;k d rgr jklk ;fud
fof/k l mipfjr /kku ivky d cMyk vkj dil dh

Vitamin D as Vitamin D₂ was determined using
HPLC as per the protocol standardized at PBTI,
Mohali.

The fruit bodies were analysed for 14 different
parameters including 8 minerals. The hybrids were
at par in protein and ash contents. However, the
contents of fat, crude fibre, vitamin D and potassium:
sodium ratio was higher in the hybrids compared to
the parent strains. The contents of minerals were
almost at par with the parent strains (Table 2.9).

c. Evaluation of the potential hybrids and the SSIs
at multi location under AICRP-Mushroom

In this trial eight strains/hybrids were evaluated
for fruit body yield, time taken for first harvest and
the mean fruit body wt. (g) using the steam
pasteurized paddy straw bundles. Six replications were
kept for each strain and the beds were arranged in
Randomized Block Design (RBD). Out of eight, two
strains did not give fruiting. The time taken for first
harvest was equal in all fruiting strains/hybrids, except
of strain VV-15-08, which took 17 days for first
harvest. The highest fruit body yield was recorded
from strain Vv-15-04 (8.09%), followed by strain
Vv-15-03 (7.99 %) and strain Vv-15-01 (5.72%).
The mean fruit body wt. was highest of 19.02 g in
strain Vv-15-03, followed by 17.88 g in strain Vv-
15-01 (Table 2.10).

In present study the single spore isolates obtained
from three morphologically distinct *V. volvacea* strains
were used for selecting consistently high yielding single
spore isolates, and developing high yielding hybrids
from the slow growing SSIs. The SSIs and the hybrids
such developed were evaluated for their fruit body
yield and nutritional profile. The yield performance
of hybrids and SSIs was evaluated through successive



I kj.kh % 2-9- fofHkUu ,dy cht k.k foyxuk rFkk Idjk d Qyudk; dk lehiLFk I;ktu

Table 2.9. Proximate composition of the fruit bodies of different SSIs and hybrids

Parameters	Strains/hybrids									
	LVu@ Idj									
	ird &1	ird &2	ird &3	,dy cht k.k foyxu&1	,dy cht k.k foyxu&2	,dy cht k.k foyxu&3	Idj &1	Idj &2	Idj &3	Idj &4
	(P-1)	(P-2)	(P-3)	(SSI-1)	(SSI-2)	(SSI-3)	(H-1)	(H-2)	(H-3)	(H-4)
iMiu (%)@Protein (%)	37.34	34.27	41.55	40.11	33.52	33.78	35.75	34.95	34.13	37.14
dkcgbW (%)@Carbohydrates (%)	46.95	49.22	43.19	45.56	49.99	50.78	47.99	49.07	47.80	45.35
oIk (%)@Fat (%)	1.57	0.85	1.08	1.51	1.15	1.49	1.28	1.74	1.72	1.17
dPpk j'kk %xe@100	0.98	1.54	1.33	1.26	2.10	0.84	1.97	1.74	1.32	1.82
xe%@Crude fibre g/100 g)										
jk[k %xe@100 xe%@Ash (g/100 g)	10.20	8.93	9.08	9.51	9.48	9.13	9.13	10.32	9.54	8.76
foVfeU &Mh IU/g@Vitamin-D IU/g	86.3	8.9	59.9	49.1	61.2	42.8	152.5	67.7	82.6	55.8
dfY'k;e %fexk@fdxk%@Calcium (mg/kg)	1376	956.57	415.90	465.35	1203	2154	270.28	293.06	313.11	295.06
lM;e %fexk@fdxk%@Sodium (mg/kg)	229.81	179.63	186.02	398.51	168.51	169.24	130.18	151.26	142.56	116.28
iM'k;e (%)@Potassium (%)	4.57	3.2	3.13	3.58	4.05	3.70	3.31	3.90	3.67	2.88
iM'k;e lM;e@Na : K	198.86	178.14	168.26	89.83	240.34	218.62	254.24	257.83	257.44	247.68
ykg %fexk@fdxk-%@Iron (mg/kg)	270.38	138.72	146.36	178.55	100.90	112.47	127.52	159.78	135.44	70.64
eXuht %fexk@fdxk-%@12.31Manganese (mg/kg)	9.09	16.67	17.82	9.55	7.72	10.22	15.93	13.59	11.19	
ft d %fexk@fdxk-%@60.19Zinc (mg/kg)	56.23	82.18	81.52	52.09	46.88	49.53	61.04	62.30	56.40	
lyfu;e %fexk@fdxk-%@Selenium (mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dkij %fexk@fdxk-%@42.69Copper (mg/kg)	27.61	39.85	38.94	26.12	31.98	32.55	38.96	32.85	27.62	

P-1 - OE-210, P-2 - GVv-01, P-3 -OE-274, SSI-1 - OE-274-103, SSI-2 - GVv-01-08, SSI-3 - GVv-01-94, H-1 - OE-210-98 + OE-274-44, H-2 - OE-210-77 + OE-274-111, H-3 - OE-210-77 + OE-274-18, H-4 - OE-274-111 + GVv-01-69



Table 2.10. Fruit body yield performance of different hybrids and single spore isolates of *Volvariella volvacea* on steam pasteurized paddy straw bundles under AICRP-Mushroom multilocation trials.

Strains/hybrids	Time taken for first harvest (days)	Fruit body yield (kg/q dry substrate)	Mean fruit body wt. (g)
vk b-210 (ih) ird	—	—	—
fofo-15-01	14.0	5.72	17.88
t hfofo-01-94 (, l, l vkb) ¼, dy ch t k. k foyxu ½	—	—	—
fofo-15-02	14.0	4.87	16.23
fofo-15-03	14.0	7.99	19.02
fofo-15-04	14.0	8.09	14.63
fofo-15-07	14.0	2.27	11.35
fofo-15-08	17.0	30/4	—

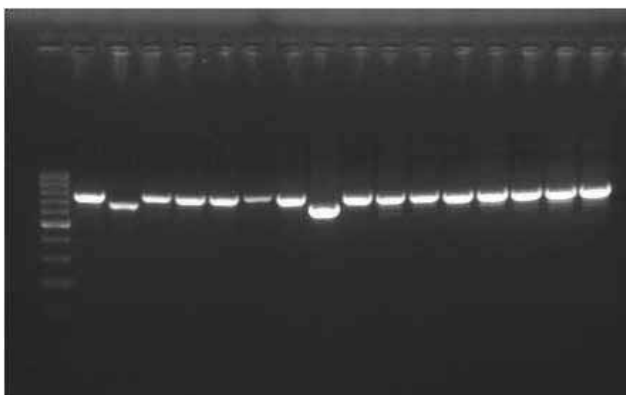
growing trials using chemically treated paddy straw bundles and the composted substrate of cotton ginning mill waste and paddy straw under indoor cultivation conditions. After successive cultivation trials, two SSIs from a whitish/greyish strain DMRO-484 of *V. volvacea* and three hybrids obtained after crossing between the SSIs of strain DMRO-185 (giving small sized brown coloured fruit body) and strain DMRO-247 (giving big sized brown coloured fruit body) as well as between strain DMRO-247 (giving big sized brown coloured fruit body) and strain DMRO-484 (giving big sized white coloured fruit body), were found to give higher fruit body yield compared to their parent strains. The fruit bodies from the high yielding hybrids were found richer in vitamin D and crude fibre content as well as in the potassium: sodium ratio compared with parent strains. The study proves the possibility of developing high yielding and nutritionally superior hybrids in *V. volvacea* just as in case of *A. bisporus*.



f'kVkd [kEc

fofhkUu rkieku ifjLFkfr e 35 f'kVkd LVu dk [krh ijh{k.k vkj chtk.k foyxu

f'kVkd [kEc d dy 35 LVu dk eY;kdu rhu fofhkuu rkieku ;Fkk 15° I, 20° I, o 25° I ij fd;k x;kA bu 35 LVu e I] doy 19 LVu e 15° I rkieku ij Qyu inf'kr gvka vU; I Hkh rkieku ifjLFkfr;k e fd I h idkj dk Qyu nt ugh gvka dy 19 Qyudk;k e I doy 12 LVu e I doy 12 LVu e I gh chtk.k Idfyr fd, tk I dA chtk.kvk dk 0-2 ifr'kr ekYV I r ,xkj ek/e ij vdfjr fd;k x;k vkj iR;d LVu d 100 I Hkh vf/kd chtk.kvk dk ituu i;kstu d fy, vyx fd;k x;kA



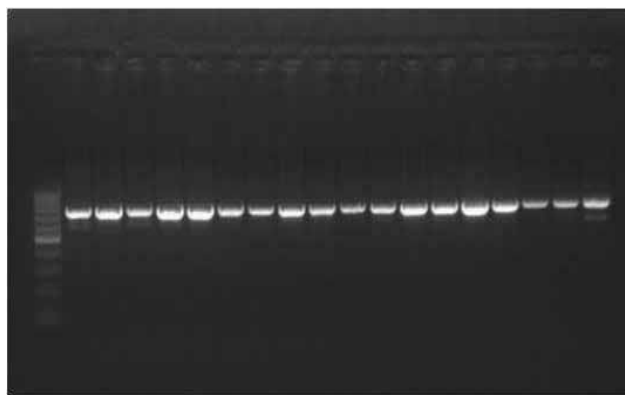
fp= % 2-18- yfUV;yk bMkM/I LVu %1&16% dk vkbVh, I io/ku

Fig. 2.18. ITS amplification of *Lentinula edodes* strains (1-16)

Shiitake Mushroom

a. Cultivation trial and spore isolation of 35 shiitake strains at different temperatures

A total of 35 strains of shiitake mushroom were evaluated at three different temperatures i.e., at 15 °C, 20 °C and 25 °C. Out of those 35 strains under evaluation, only 19 strains have shown fruiting at 15 °C. Remaining strains failed to give the basidiocarps at all other temperatures. Out of the 19 strains fruit bodies spore prints were collected from 12 strains could be collected. The spores were germinated on 0.2 % malt extract agar medium and more than 100 spores of each strain were isolated for breeding purpose.



fp= % 2-19- yfUV;yk bMkM/I LVu %17&32% dk vkbVh, I io/ku

Fig. 2.19. ITS amplification of *Lentinula edodes* strains (17-32)



fp= % 2-20- 35 yfUV;yk bMkM/I LVu dk [krh ijh{k.k

Fig. 2.20. Cultivation trial of 35 *Lentinula edodes* strains



fp= % 2-21- Qyu d rgr yfUV;yk bMkM/I LVu

Fig. 2.21. *Lentinula edodes* strains under fruitings



DMRO-25	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-119	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-23	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-56	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-8	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-51	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-329	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-35	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-12	AACTTA ATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-430	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-40	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-327	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-19	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-26	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-411	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-37	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-22	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-410	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-34	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-7	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-331	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-20	AACTTAATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCCCATCGATGAAGAACGCAGCG
DMRO-276	AATTATATACAACCTTTTCAGCAACGGATCTCTTGGCTCTCGCATCGATGAAGAACGCAGCG
	*** *****
DMRO-25	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-119	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-23	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-56	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-8	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-51	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-329	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-35	AA ATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-12	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-430	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-40	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-327	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-19	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-26	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-411	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-37	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-22	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-410	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-34	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-7	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-331	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-20	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC
DMRO-276	AAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAATCATCGAATCTTTGAACGCACC

fp= % 2-22- DyLVy x (v1.83) dk mi ;kx djdi fofHkUu yfVU; yk LVu di 5-8, l vkjMh, u, di l jf[kr
vuØek di Hkx e; ;gk rd fd 5-8, l vkjMh, u, thu {k= e; Hkh fhkUurk inf'kr gk jgh gA

Fig. 2.22. Part of aligned sequences of 5.8S rDNA of different *Lentinula* strains using Clustal X (v1.83) showing variation even in the 5.8s rRNA gene region

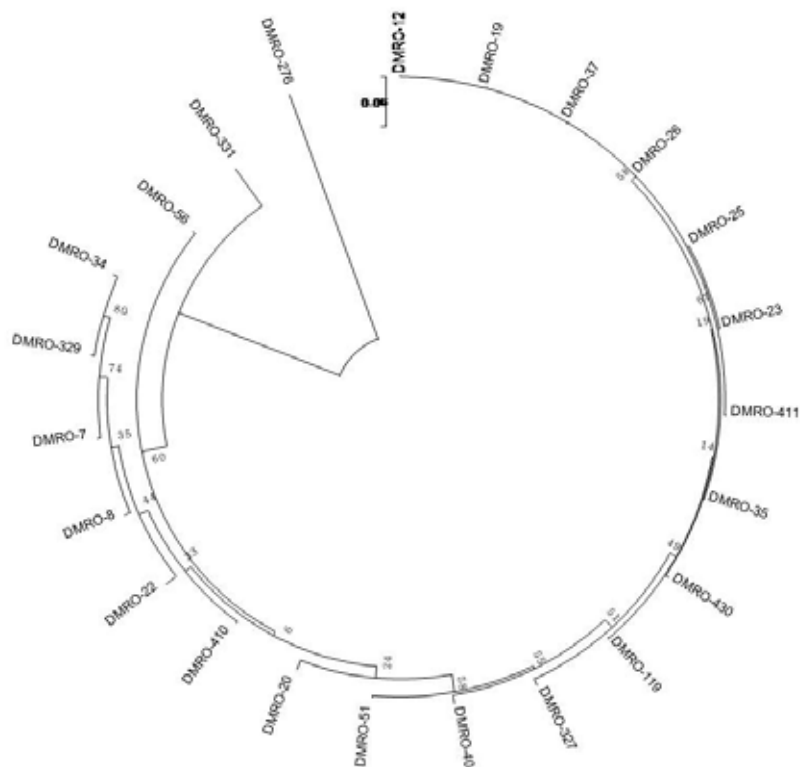


Fig. 2.23 Molecular Phylogenetic analysis of *Lentinula* strains by Maximum Likelihood method showing diversity among the 23 accession used for this analysis. The evolutionary history was inferred by using the Maximum Likelihood method based on the Tamura-Nei model. The tree with the highest log likelihood (-1677.8071) is shown. Initial tree(s) for the heuristic search were obtained automatically by applying Neighbor-Join and BioNJ algorithms to a matrix of pair wise distances estimated using the Maximum Composite Likelihood (MCL) approach, and then selecting the topology with superior log likelihood value. The tree is drawn to scale, with branch lengths measured in the number of substitutions per site. The analysis involved 23 nucleotide sequences. All positions containing gaps and missing data were eliminated. There were a total of 428 positions in the final dataset. Evolutionary analyses were conducted in MEGA6.

f'kVkd: [kEc LVu dk vk.kfod y{k.ko.ku

vkBVh, l&5-8, l vkjMh, u, {k= d vuØek dk mi; kx djd f'kVkd [kEc ¼yfUV; yk bMkMI ½ d lHkh 35 LVuk dh vk.kfod igpku dh xBA lo0; ih vkBVh, l&1 rFk vkBVh, l&4 ikbejk dk mi; kx djd vkBVh, l&5-8, l vkjMh, u, {k= dk io/ku

b. Molecular characterization of Shiitake mushroom strains

All the 35 strains of Shiitake mushroom (*Lentinula* spp.) were subjected to molecular identification using sequences of ITS-5.8S rDNA



[k- Qly mRiknu
B. CROP PRODUCTION

cVu [kEc

cVu [kEc d vif'k"V ik"kk/kkj dk cVu [kEc
dh [krh d fy, [kkn cuku gr mi ;kx

vif'k"V [kEc ik"kk/kkj dk mi ;kx djd Qjoh&eb]
2015 rFkk vDrcj] 2015 l tuojh] 2016 d nkjku
vuipkfjr mipkj d l?kVdk dk ekud l ;ktu
cuk; j [kr g, rhu fofHkUu vuikrk ;Fkk xg d Hk l
dk Hkkj@Hkkj 20 ifr'kr %ukbVktu lryu d l kFkz]

Button Mushroom

a. Use of button mushroom spent substrate for
compost making for button mushroom
cultivation

The trials were conducted during February-May,
2015 and October, 2015 to January, 2016 by using
SMS at three different proportions i.e. 20% (with

lkj.kh % 2-12- [kkn r ;kj dju d fofHkUu mipkjke ; kfxd feJ.kk dk l ;ktu %nljk ijh{k.k%
Table 2.12 Composition of compounding mixture in different composting treatments (2nd trial)

[kkn d l?kVd Compost ingredients	[kkn r ;kj dju d fofHkUu mipkjke dEikfLVx l?kVdk %fdxk-% dh ek=k Quantity of composting ingredients (kg) in different composting treatments			
	T ₁ %vuipkfjr vFkok fu ;f=r%	T ₂	T ₃	T ₄
	T ₁ (control)	T ₂	T ₃	T ₄
xg dk Hk l@Wheat straw	700	560	560	490
exh dh [kkn@Poultry manure	490	275	392	343
xg dk pkdj@Wheat bran	105	84	84	73.5
;fj ;k@Urea	10.5	8.4	8.4	7.4
ftlle@Gypsum	25	25	25	25
cVu [kEc vif'k"V [kkn %60 ifr'kr ueh ij% Button mushroom spent compost (at 60% moisture)	-	350	350	525
dEikfLVx d ikjHk e ukbVktu dk ifr'kr@ N % in the beginning of the composting	1.60	1.60	1.63	1.67
: ikrj.k nj %xg ivky l r ;kj [kkn rd% Conversion rate (wheat straw to ready compost)	3.04	3.54	3.59	4.35
fuo'k ykxr % : i ;%@Vu [kkn vkmViV@ Cost of inputs (Rs.)/ton of compost output	3131	2586	2667	2210
[kkn dh dPph lkexh@Vu ij fuoy cpr % : i ;% Net saving (Rs.) on raw materials/ton of compost	-	545.0	464.0	921.0



20 ifr'kr ¼ukbVktu lryu d fcuk½ rFkk 30 ifr'kr ¼ukbVktu lryu d fcuk½ ij ijh{k.k fd, x, ¼lkj.kh ½ 2-12½A [kkn cuku dh nk pj.kh; vYikof/k fof/k ¼f lMu ,o gkt j] 1950] 1953½ dk mi;kx dj d [kkn r;kj dh xBA rktk [kkn d 0-7 ifr'kr Hkkj@Hkkj dh nj ij gkLV ;&3 l dj d lkFk [kkn dh fctkb dh xb vkj Qly dk c<ku gr jhfr;k d ekud idt dk bLreky fd;k x;kA [kkn d cxx dk xkcj dh [kkn + dk;j fiFk ¼ukfj;y d j'k½ (1:1, v/v) vk/kkfjr Hkki l ik'P;jhdr dflx lkexh d lkFk Hkkj x;kA r;kj [kkn e xg d Hkl dk U;ure vuikr 3-04 fu;=d ¼ekud l=hdj.k½ e rFkk fcuk ukbVktu lryu d vif'k"V [kEc ik"kk/kkj d lkFk 30 ifr'kr xg Hklk ifrLFkkiu e vf/kdre 4-35 d e/; Fkka ,d Vu [kkn dk mRiknu dju e fuo'k dh n"V l vkb ykx e fhkUurk] tgg vuipkfjr e vf/kdre : i; 3]131@& Fkh ogh vif'k"V [kEc ik"kk/kkj d lkFk 30 ifr'kr xg Hklk ifrLFkkiu d ekey e ;g : i; 2]210@& FkhA 30 ifr'kr vif'k"V [kEc ik"kk/kkj ifrLFkkiu mipkj e mi;kx dh xb dPph lkexh d lnHk e 'k} cpr rktk [kkn dk vf/kdre : i; 921@& ifr Vu FkhA

[kkn dk fo'y"n.k

ekud ikVdky dk vuiky d jr g, ch tkb d le; pkj fofHkUu l=hdj.k d lkFk r;kj fd, x, [kkn d ueuk dk fy;k x;kA ueuk dk xe gok oky vkou e 55-60 fMxh l- rkieku ij l [kk;k x;k] ih lk x;k rFkk fo'y"n.k d fy, Hktk x;kA itkc ck;k&VDukykt h buD;cVj] ekgkyh] Hkkjr ¼,d ,u,ch,y }kjk eku;rk iklr d"n ,o [kk] ijh{k.k i;kx'kkjk] itkc ljdkj] Hkkjr½ e bu ueuk dk fo'y"n.k dy tfod dku] tfod inkFk] dy tyMky ukbVktu] QkLQkj l] ikvf'k;e rFkk dku ¼ ukbVktu vuikr d fy, fd;k x;kA vif'k"V [kEc ik"kk/kkj ifrLFkkiu mipkj d fofHkUu vuikr d lkFk r;kj dh xb [kkn e x.koRrk fo'k"krkvk dk ydj fhkUurk n[ku dk feyh ¼ lkj.kh 2-13½A fofHkUu [kkn mipkj e dy tfod dku vkj tfod inkFk d ekud e cgr

N balancing), 20% (without N balancing) and 30% (without N balancing) w/w to wheat straw, keeping standard composition of ingredients as the control treatment (Table 2.12). The compost was prepared using two phase short method of composting (Sinden and Hauser, 1950, 1953). Compost was spawned with Horst U₃ hybrid @ 0.7% w/w of the fresh compost and standard package of practices were used for raising the crop. The compost bags were cased with FYM + Coir pith (1:1, v/v) based steam pasteurized casing material. The ratio of wheat straw to ready compost ranged between lowest of 3.04 in control (standard formulation) to highest of 4.35 in 30% wheat straw substitution with SMS without N balancing. The difference in cost incurred towards the inputs for production of 1 ton of compost varied from highest of Rs. 3131 in case of control to lowest of Rs. 2210 in case of 30% wheat straw substitution with SMS. The net saving in terms of raw materials used was highest of Rs. 921/ton of fresh compost output in 30% SMS substitution treatment.

Compost analysis

The samples of composts prepared with four different formulations were drawn at the time of spawning by following the standard protocol. The samples were dried at 55-60 °C in a hot air oven, grinded and sent for analysis. The samples were got analysed for total organic carbon, organic matter, total kjeldahl nitrogen, phosphorus, potassium and carbon: nitrogen ratio from Punjab Biotechnology Incubator, Mohali, India (a NABL accredited Agriculture and Food Testing Laboratory, Govt. of Punjab, India). The composts prepared with different proportions of SMS substitution treatments were found to vary in their quality characteristics (Table 2.13). The values for total organic carbon and organic matter did not vary much in different compost treatments.



I kj.kh % 2-13- fofHkUu mipkjk e: [kkn dh x₁.kkRed fo'k"krk,₁ %rh I jk ijh{k.k%

Table 2.13. Quality characteristics of the compost in different compost treatments (3rd trial)

i jketVj Parameters	fofHkUu mipkjk e: [kkn dh x ₁ .kkRed fo'k"krk, ₁				
	Quality characteristics of compost in different treatments				
	cVu [kEc , l ,e, l	dEi kLV -I	dEi kLV -II	dEi kLV -III	dEi kLV -IV
	Button mushroom SMS	Compost -I	Compost -II	Compost -III	Compost -IV
dy tfod dkc u (%)@Total organic carbon (%)	38.8	37.3	37.4	36.8	36.7
tfod l kexh (%)@Organic matter (%)	67.0	64.2	64.4	63.4	63.2
dy ukbVkt u (%)@Total nitrogen (%)	1.91	1.90	1.90	2.18	2.17
QkLQkj l (%)@Phosphorus (%)	1.14	1.81	1.82	1.88	1.98
ikVf'k; e (%)@Potassium (%)	5.79	4.36	4.28	4.45	4.68
dkcu % ukbVkt c (%)@C:N (%)	20	20	20	17	17

vrj ugh n[kk x; kA gkykfd] bue xg Hk l d LFkku ij vif'k"V [kEc ik"kk/kkj dh ek=k e c<krjh dju d l kFk deh n[kh xba ukbVktu l ryu oky 20 ifr'kr vif'k"V [kEc ik"kk/kkj ifrLFkku rFkk ekud l=hdj.k Qkey'ku d [kkn dh ryuk e ukbVktu l ryu d fcuk 20 ,o 30 ifr'kr vif'k"V [kEc ik"kk/kkj ifrLFkku mipkjk e ukbVktu dh ek=k dgh T; knk FkA bl h idkj] ukbVktu l ryu d fcuk 20 ,o 30 ifr'kr xg Hk l dk cnyu e vif'k"V [kEc ik"kk/kkj okyh [kkn e QkLQkj l rFkk ikVf'k; e dh ek=k dgh T; knk FkA bld foijhr] bu mipkjk e dkcu % ukbVktu dk vuikr derj FkA 20 ,o 30 ifr'kr xg Hk l dk vif'k"V [kEc ik"kk/kkj d l kFk cnyu ij r; kj dh xb [kkn e dy 'kdjk] lyykt rFkk fyfxuu d eku Hkh T; knk FkA

Qyudk; mit

l Hkh mipkjk d fy, dVku d nk l lrrg d fy, Qyudk; mit dk nt fd;k x; k vkj fdxk-@100 fdxk- rktk [kkn d : i e iLrr fd;k x; kA nk ijh{k.k d fy, Hkh bl h idkj dV x, Qyudk; k dh l [; k@fDoVy [kkn dk Hkh nt fd;k x; kA l Hkh mipkjk d fy, ,d fDoVy [kkn l dVkb fd, x, Qyudk; dh l [; k e ,d fDoVy [kkn l iklr

However, these decreased with increasing quantity of SMS used to replace the wheat straw. The nitrogen content was higher in 20 and 30% SMS substitution treatments without nitrogen balancing compared with 20% SMS substitution with nitrogen balancing and compost from standard formulation. Similarly, the values for phosphorus and potassium were higher in compost received 20 and 30% SMS in replacement of wheat straw without nitrogen balancing. Contrary to this the carbon: nitrogen ratio was lower in these treatments. The values total sugars, cellulose and lignin were also higher in compost prepared with 20 and 30% wheat straw replaced with SMS treatments.

Fruit body yield

The fruit body yield was recorded for two weeks of cropping for all the treatments and presented in kg/100 kg fresh compost. Number of fruit bodies harvested/quintal compost was also recorded accordingly for the two trials. The mean fruit body weight was determined by dividing the fruit body yield obtained from one quintal compost to the



Qyudk; mit dk Hkkx ndj vk l r Qyudk; Hkkj dk fu/kkj.k fd;k x;kA Qyudk; mit e fofHkUu mipkjk d chp rFkk lFk gh [krh ijh{k.kkk d chp fHkUurk n[ku dk feyhA ijh{k.k&ll e] 20 ifr'kr xg d Hk l d LFkku ij vif'k"V [kEc ik"kk/kkj rFkk ukbVktu lryu d lFk r;kj dh xb [kkn e fHkUurk lcl T;knk FkhA 'k"nk nk mipkjk e] [kEc dh mit ekud fu;=.k dh ryuk e de FkhA ijh{k.k&ll e] 20 ifr'kr xg d Hk l d LFkku ij ukbVktu lryu d lFk vif'k"V [kEc ik"kk/kkj dk ifrLFkkiu dju ij Qyudk; mit lcl T;knk Fkh] tcfb bld mijkuR Øe'k 20 ifr'kr xg d Hk l d LFkku ij ukbVktu lryu d lFk vif'k"V [kEc ik"kk/kkj dk ifrLFkkiu dju vkj 30 ifr'kr xg d Hk l d LFkku ij fcuk ukbVktu lryu d lFk vif'k"V [kEc ik"kk/kkj dk ifrLFkkiu dju ij Qyudk; mit nt dh xBA ekud l=hdj.k d lFk r;kj dh xb [kkn e Qyudk; mit lcl de Fkh ¼ l k j.kh 2-14½A nk ijh{k.kkk e vf/kd mit nu oky ijh{k.k e vk l r Qyudk; Hkkj vf/kdre vkj de mit nu oky ijh{k.kkk e vk l r Qyudk; Hkkj U;ure Fkka ijh{k.k & l e 20 ifr'kr xg d Hk l d LFkku ij ukbVktu

numbers of fruit body harvested from one quintal compost for all the treatments. The fruit body yield varied between treatments as well as cultivation trials. In trial II, it was highest in compost prepared with 20% wheat straw replaced with SMS and balancing of nitrogen. In rest two treatments the mushroom yield was lesser than the standard control. In trial III the fruit body yield was highest in 20% wheat straw substituted with SMS without N balancing, followed by 20% wheat straw substituted with SMS with N balancing and 30% wheat straw substituted with SMS without N balancing. The fruit body yield was lowest in compost prepared with standard formulation (Table 2.14). The mean fruit body wt. was highest in highest yield giving treatments and lowest in low yield giving treatments in two trials. It was highest of 16.78 g in 20% wheat straw substituted with SMS with N balancing and lowest of 14.01 g in 30% wheat straw substituted with SMS without N balancing treatment in trial I. Similarly it

l k j.kh ¼ 2-14- xg d Hk l d fofHkUu vu i kr d LFkku ij cVu [kEc vif'k"V [kEc ik"kk/kkj dk ifrLFkkiu djd r;kj dh xb [kkn e Qyudk; mit ¼nljk o rh ljk ijh{k.kk%

Table 2.14. Fruit body yield in compost prepared with different proportions of wheat straw replaced with button mushroom SMS (trial 2nd and 3rd)

[kkn mipkj Compost treatments	Qyudk; mit ¼fdxk-@fDo- [kkn½ Fruit body yield (kg/q compost)		Qyudk; dh l i ;k @fDo- [kkn Nos. of fruit bodies/ q compost		Qyudk; vk l r Qyudk; Hkkj ¼xke½ Mean fruit body wt. (g)	
	ijh{k.k ll ijh{k.k ll		ijh{k.k ll ijh{k.k ll		ijh{k.k ll ijh{k.k ll	
	Trial II	Trial III	Trial II	Trial III	Trial II	Trial III
ekud l=hdj.k@Standard formulation	13.09	11.36	832	738	15.72	15.40
ukbVktu lryu d lFk 20% , l,e,l@ 20% SMS with N balancing	13.93	13.05	830	791	16.78	16.50
ukbVktu lryu d fcuk 20% , l,e,l@ 20% SMS without N balancing	11.09	13.24	772	812	14.37	16.30
ukbVktu lryu d fcuk 30% , l,e,l@ 30% SMS without N balancing	10.51	12.77	749	803	14.01	15.91
l h-Mh- 0.05@CD 0.05	1.68	1.70	59.43	75.24	2.01	1.94



Iryu oky vif'k"V [kEc ik"kk/kkj dk ifrLFkku dju ij ;g vf/kdre 16-78 xke Fkk tcf 30 ifr'kr xg d Hk l d LFkku ij ukbVktu Iryu d fuk vif'k"V [kEc ik"kk/kkj dk ifrLFkku dju e U;ure 14-01 xke FkA blh idkj] 20 ifr'kr xg d Hk l d LFkku ij ukbVktu Iryu oky vif'k"V [kEc ik"kk/kkj dk ifrLFkku dju ij ;g vf/kdre 16-50 xke vkj ekud l=hdj.k okyh [kkn e U;ure 15-40 xke FkA

Qyudk; fo'y"n.k

pkj fofHku idkj d [kkn l dkV x, ing l chl Qyudk;k dk ;knfPnd :i l p;u djd mudk fo'y"n.k dy ing ekunMk d fy, fd;k x;kA ; ekunM Fk % 'k"d inkFk(jk[k(dPpk j'kk(dkckgkbMV l(ikVhu(olk(foVkfue&Mh rFkk lkr fofHku [kfut %dfy'k;e] lfm;e] ikvf'k;e] ykg] ftd] dkij] exuhf'k;e rFkk lyfu;e% fo'y"n.k dk dk; i tk ck;k&VDukyt h bUD;cvj] ekgkyh Hkjr % ,d ,u,ch,y }kj ekU;rk iklr df'k ,o [kk] ijh{k.k i;kx'kkyk] itkc ljdkj] Hkjr% e fd;k x;kA 'k"d inkFk(jk[k] dPpk j'kk olk] dkckgkbMV vkj ikVhu ek=k d fu/kkj.k d fy, ,vk, l h dh ekud dk;fof/k;k dk mi;kx fd;k x;kA lcl igy ekbØk tYMky fof/k dk i;kx djd ukbVktu ifr'kr dk fu/kkj.k djd ikVhu dh ek=k dk fu/kkj.k fd;k x;k vkj mld mijUr 6-25 d dkjd d lFk bl dh x.kuhdj.k fd;k x;kA iR;d ueu d fy, dy dkckgkbMV ifr'kr rk gfly dju d fy, dPpk ikVhu dPph olk] [kfut vkj jk[k dk fefjr djd ml 100 e l ?kv fn;k x;kA [kfut l?kvdk %ykg] dkij] ftd] lyfu;e rFkk exuhf'k;e% dk fu/kkj.k vkb l h h&,e, l fof/k 999-10 dk mi;kx djd fd;k x;k tcf] lfm;e vkj ikvf'k;e dk fu/kkj.k %ye QvkehVj dk mi;kx djd fd;k x;kA dfy'k;e dk fu/kkj.k VkbVhefVd eØk fof/k] 910-01 }kj fd;k x;kA foVkfue Mh&2 d :i e foVkfue Mh dk fu/kkj.k ihchVhvk] ekgkyh e ekudhr ikVdky d vulkj ,pih,y l h dk mi;kx djd fd;k x;kA fofHku idkj dh [kkn e Qyudk; dh ik"kf.kd ikQkby e vf/kdk'k ekunMk ijkehVjk e fHkurk n[ku dk feyhA ekud l=hdj.k d lFk r;kj dh

was highest of 16.50 g in 20% wheat straw substituted with SMS with N balancing and lowest of 15.40 g in compost with standard formulation.

Fruit body analysis

The randomly drawn fifteen to twenty fruit bodies harvested from four different types of composts were got analyzed for fifteen different parameters viz., dry matter, ash, crude fibre, carbohydrates, protein, fat, vitamin-D and 7 different minerals (calcium, sodium, potassium, iron, zinc, copper, magnesium and selenium) from Punjab Biotechnology Incubator, Mohali, India (a NABL accredited Agriculture and Food Testing Laboratory, Govt. of Punjab, India). Standard procedures of AOAC were used for the determination of dry matter, ash, crude fibre, fat, carbohydrate and protein content. The protein content was determined first by determination of nitrogen percentage using Micro-Kjeldahl method, followed by its multiplication with a factor of 6.25. The percentage of crude protein, crude fat, minerals and ash were combined and subtracted from 100 to obtain the total carbohydrate percentage for each sample. Mineral constituents (iron, copper, zinc, selenium and magnesium) were determined by using ICP-MS method 999.10, while sodium and potassium by using flame photometer. Calcium was determined by Titrimetric Macro method, 910.01. Vitamin D as Vitamin D₂ was determined using HPLC as per the protocol standardized at PBTI, Mohali. The nutritional profile of the fruit bodies from different composts showed variations in majority of the parameters. Protein in 1st flush was highest in fruit bodies harvested from compost prepared with standard formulation while in 2nd flush it was significantly higher in SMS amended compost treatments. By in large the crude fibre content during two flushes was higher in fruit



xb [kkn l fy, x, Qyudk; e iFke dVko e ikVhu dh ek=k lcl T;knk Fkh tcf d nlij dVko e ;g vif'k"V [kEc ik"kk/kkj ¼, l, e, l ½ l'kkf/kr [kkn mipkjk e mYy[kuh; :i l T;knk FkhA vif'k"V [kEc ik"kk/kkj l ifrLFkkfir [kkn mipkjk dh ryuk e ekud l=hdj.k d lFk r;kj dh xb [kkn l gkfly fd, x, Qyudk; e nk dVko d nkjku dPpk j'kk ek=k dgh T;knk ikb xBA xg d Hkl d LFkku ij vif'k"V [kEc ik"kk/kkj dh fofHkUu ek=k dk ifrLFkku djd r;kj dh xb [kkn l dVko fd, x, Qyudk; e jk[k [kfut ¼ikVf'k;e] ykg] exuht] ftd] lyfu;e vkj dkij½ ikVf'k;e@lFM;e vuikr rFkk fofVfeu Mh t l vU; x.k Hkh dgh T;knk Fk ¼ l kJ.kh 2-15½A xg d Hkl d LFkku ij 30 ifr'kr vif'k"V [kEc ik"kk/kkj l r;kj [kkn e fofVfeu Mh dh ek=k Hkh mYy[kuh; :i l dgh T;knk ikb xBA exuht vkj ykg dh ek=k e Hkh blh idkj dk :>ku n[ku dk feyk tcf d ftd] lyfu;e rFkk dkij dh ek=k xg d Hkl d LFkku ij ukbVktu lryu d fcuk 20 ifr'kr vif'k"V [kEc ik"kk/kkj l r;kj dh xb [kkn e dgh T;knk FkhA

cVu [kEc vif'k"V ik"kk/kkj d ik"kf.kd l ;ktu ij fopkj djr g,] cVu [kEc [kkn cuku e xg d Hkl d vkf'kd ifrLFkku e ,d vk/kkj l?kVd d :i e bldk mi;kx dju d fy, db ijh{k.k fd, x,A oreku v/; ;u e] yxHkx 55&60 ifr'kr ueh oky rktk cVu [kEc vif'k"V ik"kk/kkj dk mi;kx rhu fofHkUu vuikrk e fd;k x;k ;Fkk exh dh [kkn d lFk ukbVktu d lryu ,o 20 ifr'kr Hkkj@Hkkj(ukbVktu lryu d fcuk 20 ifr'kr Hkkj@Hkkj(rFkk ukbVktu lryu d fcuk 30 ifr'kr Hkkj@HkkjA xg dk Hkl kJ exh dh [kkn] xg dk pkdj] ;fj;k vkj ftlle dk 'kkfey djd ekud l=hdj.k dk fu;=.k mipkj d rkj ij j[kk x;kA ijh{k.k dk nk ckj nkgjk;k x;kA bu ijh{k.kk e] xg d Hkl dh [kkn inkokj@bdkb Hkkj [kEc vif'k"V ik"kk/kkj l ifrLFkkfir mipkjk e ekud l=hdj.k dh ryuk e T;knk FkhA nlij ijh{k.k e] Qyudk; mit@fDoVy rktk [kkn l Hkh [kEc vif'k"V ik"kk/kkj ifrLFkkfir mipkjk e T;knk Fkh] tcf d igy ijh{k.k e ;g doy 20 ifr'kr Hkkj@Hkkj [kEc vif'k"V ik"kk/kkj l ifrLFkkfir mipkjk

bodies from compost prepared with standard formulation compared with SMS substituted compost treatments. The other attributes like the contents of ash, minerals (potassium, iron, manganese, zinc, selenium and copper), potassium/sodium ratio and vitamin D were also higher in fruit bodies harvested from the composts prepared with substitution of wheat straw with different quantities of SMS (Table 2.15). Vitamin D content was significantly higher in compost received 30% SMS in replacement of wheat straw. Manganese and iron content also showed similar trend, while zinc, selenium and copper contents were higher in compost received 20% SMS in replacement of wheat straw without N balancing.

Considering the nutritional composition of the button mushroom spent substrate, a series of experiments were carried out to use it as a basal ingredient in partial replacement of the wheat straw for button mushroom compost making. In present study, the fresh button mushroom spent substrate with around 55-60% moisture was used in three different proportions i.e. 20% w/w and balancing of nitrogen with poultry manure, 20% w/w without N balancing and 30% w/w without N balancing. Standard formulation comprised of wheat straw, poultry manure, wheat bran, urea and gypsum was kept as the control treatment. The experiment was repeated twice. In these trials, the compost output/unit wt. of wheat straw was higher in SMS substituted treatments compared with standard formulation. In second trial, the fruit body yield/q fresh compost was higher in all SMS substituted treatments, while in first trial it was significantly higher in 20% w/w SMS substituted treatment only and in rest it was at par with standard formulation. The compost prepared from different SMS substituted treatments was nutritional richer



I kj.kh % 2-15- xgi d Hk l d fofHkUu vu ikr d LFkku ij cVu [kEc vif'k"V ik"kk/kkj dk ifrLFkku dju l r i;kj dh xbl [kkn l dVko fd, x, Qyudk; dh x.kkRed fo'k"krk,l

Table 2.15. Quality characteristics of the fruit bodies harvested from compost prepared with different proportions of wheat straw replacement with button mushroom spent substrate

i jkeIVj Parameters	fofHkUu [kkn Qkey'ku Different compost formulations							
	ekud Qkey'ku		20% Hkkj@Hkkj xgi Hk l d LFkku ij ukbVktu lryu rFkk , l, e, l dk ifrLFkku 20% w/w wheat straw replacement with SMS and N balancing		20% Hkkj@Hkkj xgi Hk l d LFkku ij ukbVktu lryu d fcuk , l, e, l dk ifrLFkku 20% w/w wheat straw replacement with SMS without N balancing		30% Hkkj@Hkkj xgi Hk l d LFkku ij ukbVktu lryu d fcuk , l, e, l dk ifrLFkku 30% w/w wheat straw replacement with SMS without N balancing	
	iokg-I	iokg-II	iokg-I	iokg-II	iokg-I	iokg-II	iokg-I	iokg-II
	Flush-I	Flush-II	Flush-I	Flush-II	Flush-I	Flush-II	Flush-I	Flush-II
ikVhu (%)@ Protein (%)	40.71	36.57	33.80	39.52	39.15	44.19	31.68	41.68
dPpk j'k %xe@100 xke@ Crude fibre (g/100 g)	2.07	1.81	0.80	1.41	1.69	1.18	1.01	1.69
jk[k %xe@100 xke@ Ash (g/100 g)	10.23	11.05	10.35	11.44	11.20	11.47	9.98	11.83
foVfeu Mh %ug/100 xke@ Vitamin D (µg/100 g)	231.9	678	612.6	737.8	241.8	632.7	340.6	1285.7
ikVf'k; e (%)@ Potassium (%)	4.47	5.25	4.76	5.50	5.10	5.39	4.65	5.68
ikVf'k; e % l kfm; e@ Potassium: Sodium	88.87	71.82	89.64	83.59	91.23	80.33	82.45	82.80
ykg %fexk-@fdxk-½@ Iron (mg/kg)	98	89	104	98	107	179	132	173
exuh t %fexk-@fdxk-½@ Manganese (mg/kg)	8.45	7.44	7.60	9.07	8.72	9.81	9.73	10.28
ft d %fexk-@fdxk-½@ Zinc (mg/kg)	61	52.6	53.8	60	79.2	64.6	60.2	66.2
lyfu; e %fexk-@fdxk-½@ Selenium (mg/kg)	2.45	3.60	2.17	4.22	2.24	5.51	2.04	5.39
dkij %fexk-@fdxk-½@ Copper (mg/kg)	37.1	34.7	34.2	36.5	45.1	46.1	34.7	46.0



e gh mYy[kuh; :i l dgh vf/kd Fkk vkj 'k"m
mipkjk e ;g ekud Qkey'ku d lerY; FkA
fofHkUu [kEc vif'k"V ik"kk/kkj l ifrLFkfir mipkjk
l r;kj [kkn ekud l=hdj.k mipkjk l r;kj [kkn
dh ryuk e ik"kf.kd :i l dgh le) FkA dy
ukbVktu] lyykt] fyfxuu] dy tfod dkc] tfod
inkFk o ikVf'k;e ek=k fofHkUu [kEc vif'k"V ik"kk/kkj
mipkjk l r;kj [kkn e dgh T;knk FkA

fofHkUu idkj dh [kkn e Qyudk; d ik"kf.kd
iky[k e vf/kd'k ekunMk e fHkUurk n[ku dk feyhA
ekud l=hdj.k d lFk r;kj dh xb [kkn l dV
x, Qyudk; e iFke dVko e ikVhu dh ek=k lcl
T;knk Fkh] tcf d nlj dVko e ;g vif'k"V [kEc
ik"kk/kkj ¼, l, e, l ½ l'kkf/kr [kkn mipkjk e mYy[kuh;
:i l T;knk FkA vif'k"V [kEc ik"kk/kkj l ifrLFkfir
[kkn mipkjk dh ryuk e ekud l=hdj.k d lFk
r;kj dh xb [kkn l iklr fd, x, Qyudk; e nk
dVko d nkjku dPpk j'kk ek=k dgh T;knk ikb xBA
xg d Hkl d LFkku ij vif'k"V [kEc ik"kk/kkj dh
fofHkUu ek=k dk ifrLFkku djd r;kj dh xb [kkn
l dVko fd, x, Qyudk; e jk[k [kfut ¼ikVf'k;e]
ykg] exuh t] ft d] lyfu;e vkj dkij½
ikVf'k;e@lkfM;e vuiKr rFk foVfku Mh t l
vU; x.k Hkh dgh T;knk FkA xg d Hkl d LFkku ij
30 ifr'kr vif'k"V [kEc ik"kk/kkj l r;kj [kkn e
foVfku Mh dh ek=k Hkh mYy[kuh; :i l dgh
T;knk ikb xBA xg d Hkl d LFkku ij vif'k"V [kEc
ik"kk/kkj dk ifrLFkku dju ij [kkn dk mRiknu
djd 100 rFk 1000 Vu rktk [kEc mRiknu@o" dh
{kerk okyh [kEc mRiknu bdkb; k e [kEc mRiknu gr
Øe'kk 3-0 yk[k :i; vkj 30 yk[k :i; dh cpr dh
xBA oreku fu"d"k vfrfjDr [kEc mRiknu dju]
[kkn cuku e jktLo dh cpr dju vkj i;koj.k dh
j{kk dju d ekey e egroi.k gA

**cVu [kEc dh mit ij ty dk fulko dju
oky; ty dk feyku; dk iHkko**

cVu [kEc dh mit ij ty dk fulko dju oky
ty d iHkko dk vkdyu dju d fy, dflx d
le; iR;d cx e ty dh vyx&vyx ek=k ;Fkk 5]
10] 15] 20 ,o 25 xke feykb xBA iR;d mipkjk dk
ikp ifrdfr;k e fd;k x;kA ft l mipkjk e 5 xke

compared with standard formulation treatment. The total nitrogen, cellulose, lignin, total organic carbon, organic matter and potassium contents were higher in composts prepared with different SMS treatments. The nutritional profile of the fruit bodies from different composts showed variations in majority of the parameters. Protein in 1st flush was highest in fruit bodies harvested from compost prepared with standard formulation while in 2nd flush it was significantly higher in SMS amended compost treatments. By in large the crude fibre content during two flushes was higher in fruit bodies from compost prepared with standard formulation compared with SMS substituted compost treatments. The other attributed like the contents of ash, minerals (potassium, iron, manganese, zinc, selenium and copper), potassium/sodium ratio and vitamin D were also higher in fruit bodies harvested from the composts prepared with substitution of wheat straw with different quantities of SMS. Vitamin D, manganese and iron contents were significantly higher in compost received 30% SMS in replacement of wheat straw. Compost production by substitution of wheat straw with SMS led to the saving of Rs. 3.0 lakh and Rs 30.0 lakh for mushroom unit with mushroom production capacity of 100 and 1000 ton fresh mushroom production/year, respectively. The present findings are important in terms of additional mushroom production, saving of revenue in compost making and saving of the environment.

b. Effect of addition of water releasing gel on the yield of button mushroom

In order to assess the effect of water releasing gel on the yield of button mushroom, different quantities of gel viz. 5, 10, 15, 20 and 25g per bag was added at the time of casing. Each treatment was replicated five times. Maximum yield of 5.33 kg was



ty dk feyk;k x;k] ogk 5-33 fdxk- dh vf/kdre mit nt dh xBA t l&t l ty dh ek=k c<kb xb] mld lkn'; mit e deh vkbA 10 xke@cx l vf/kd ty dk feyku l 0;kid fifux rFkk v/kkHkfed fifux n[ku dk feyhA dflx ijr dk lhy dju l Hkh mPprj x.koRrk ikb xBA ueh ccyk jkx d Hkkjh vkiru d dkj.k iFke iokg d mijkuR Qly dk gVk fn;k x;kA

recorded in the treatment where 5g gel was added. Yield decreased correspondingly as the quantity of gel increased. Addition of gel more than 10g/ bag resulted in mass pinning and hypogeal pinning. Higher quantity also resulted in sealing of casing layer. Crop was terminated after first flush due to heavy incidence of wet bubble disease.

l kj.kh % 2-16- cVu [kEc dh mit ij ty dk fulko dju oky: tly dk feyku dk iHkko
Table 2.16. Effect of addition of water releasing gel on the yield of button mushroom

Ø-l- Sl. No	mi;kx fd, x, tly dh ek=k %xke½ Quantity of gel used (g)	dly mit %fdxk-@100 fdxk- [kkn½ Total yield (kg / 100 kg of compost)
1	5	5.33
2	10	3.73
3	15	2.84
4	20	2.31
5	25	2.07
6	fu;=d @Control	2.54

ivky [kEc

ekblhfy;y vFkok dodtky of) fo'k"krkvk ij lo/ku rduhdk dk iHkko vkj okYofj;yk okYofl;k dh fdLek e Qyudk; mit {kerk okYofj;yk okYofl;k LVu % Hkkdvui&[kEc vul/kku fun'kky;] lkyu] Hkkjr d lo/ku cd l iklr pkj LVuk ;Fkk Mh,evkjk&185 %vkb&210½] Mh,evkjk&245 %vkb&272½] Mh,evkjk&463 %chch, l vkj&007½] rFkk Mh,evkjk&484 %thfofo&01½ dk 34±2 fMxh l- ij ekYV fu"d"K.k ,xkj LykUVI ij o'k&of) fd;k x;kA bu LVuk l fcuk [ky ijh rjg l mx Qyudk;k dk bLreky ekud ikVkdkey dk mi;kx djr g, Ård rFkk cg&cht k.k lo/ku rduhdk d ek/e l lo/ku dju e fd;k x;kA

ekblhfy;y vFkok dodtky dh of) fo'k"krk, ey lo/ku d l kFk&l kFk fofHkUu rduhdk dk mi;kx dj d r;kj lo/kuk dk v/;;u 25 x 180 feeh-vkdj dh ij[kuyh rFkk 150 fefy- {kerk d bye;j

Paddy Straw Mushroom

- a. Effect of culture raising techniques on mycelial growth characteristics and the fruit body yield potential in strains of *Volvariella volvacea*
- Volvariella volvacea strains:** Four strains viz., DMRO-185 (OE-210), DMRO-245 (OE-272), DMRO-463 (BBSR-007) and DMRO-484 (GVv-01) obtained from the Culture Bank of the ICAR-Directorate of Mushroom Research, Solan, India and were multiplied on Malt Extract Agar (MEA) slants at 34 ± 2 °C. The unopened fully grown fruit bodies from these strains were used for raising cultures through tissue and multispore culture techniques using standard protocols.
- Mycelial growth characteristics:** The cultures raised using different techniques along with original cultures were studied for their mycelial growth characteristics



QyKd nkuk e dV g, futeh_{dr} /kku d; k Hk l d ik^{kk}/kkj ij mudh dodtky of) fo^kkrkvk dk tkuu d fy, fd; k x; kA dV g, /kku d Hk l dk jkrHkj ue fd; k x; k] ij[kuyh dk 2@3 Hkjk x; k vkj 1-30 ?kV d fy, 20 ih, l vkb nckc ij futehdj. k fd; k x; kA BMh ij[kuyhvk e 6 feeh- ¼0; k l ½@ ij[kuyh dh ,d ekblhfy; y fcV d lkFk ljkfir fd; k x; k vkj 7 fnuk d fy, 34±2 fMxh l- ij m^{ekf}; r fd; k x; kA blh idkj] dV g, /kku d Hk l dk 150 fefy- {kerk d 100 xke@QyKd dh nj ij Hkjk x; k vkj ij[kufy; k dh Hkkrf gh futeh_{dr} o ljkfir fd; k x; kA lo/kuk dk v/; ; u v/kkxkeh ¼feeh-½] jfM; y ¼feeh-½ rFkk ok; oh; ekblhfy; y of) ¼lhek rFkk ?kuRo½] vkj DyekbMkLi l xBu d fy, fd; k x; kA

fofHkUu rduhd_k l r; kj lo/ku e v/kkxkeh ekblhfy; y of) e fHkUurk n[ku dk feyhA ; g LVu Mh, evk_{jk}&484 e ey lo/ku rFkk Ård lo/ku e vf/kdre Øe^{kh} 68 feeh- ,o 68-11 feeh- Fkh tcf_d blh LVu d cg&ch t_k.k lo/ku e v/kkxkeh ekblhfy; y of) yxHkx 34-56 ifr^{kr} Fkh] tk fd ey lo/ku l de FkhA blh idkj] LVu Mh, evk_{jk}&463 e] v/kkxkeh ekblhfy; y vFkok dodtky of) Ård lo/ku ¼67 feeh-½ e lcl T; knk vkj mld ckn ey lo/ku ¼60-11 feeh-½ e FkhA cg&ch t_k.k lo/ku e of) yxHkx 31-61 ifr^{kr} Fkh] tk fd ey lo/ku l de FkhA LVu Mh, evk_{jk}&185 e v/kkxkeh ekblhfy; y of) Ård lo/ku ¼45 feeh-½ e lcl vf/kd vkj rnijkr ey lo/ku ¼43-11 feeh-½ e FkhA cg&ch t_k.k lo/ku e ; g yxHkx 45-88 ifr^{kr} Fkh] tk fd ey lo/ku dh ryuk e de Fkh ¼l kj. kh ¼ 2-17½A QyKd e ey lo/ku rFkk Ård lo/ku dh jfM; y ekblhfy; y of) LVu Mh, evk_{jk}&185] Mh, evk_{jk}&463 rFkk Mh, evk_{jk}&484 e ,d tllh Fkh] tcf_d LVu Mh, evk_{jk}&484 e ; g cg ch t_k.k lo/ku e 9-09 ifr^{kr} rd] Mh, evk_{jk}&463 e 18-92 ifr^{kr} vkj Mh, evk_{jk}&185 e 83-33 ifr^{kr} rd de FkhA LVu Mh, evk_{jk}&463 rFkk Mh, evk_{jk}&484 e ok; oh; ekblhfy; y of) Ård lo/ku e lcl cgrj FkhA cg ch t_k.k lo/ku dk c<ku okyh rduhd d ek/; e l fodflr lo/ku ok; oh; ekblhfy; y of) d lc/k e derj Fk vkj mue DyekbMkLi l xBu ugh ik; k x; kA

on pounded sterilized paddy straw substrate both in test tubes of 25 × 180 mm size and Erlenmeyer flasks of 150 ml capacity. The pounded paddy straw was wetted overnight, filled up to 2/3 length of the test tubes and sterilized at 20 psi for 1.30 h. The cooled tubes were inoculated with one mycelial bit of 6 mm (dia.)/tubes and incubated at 34 ± 2 °C for 7 days. Similarly the pounded paddy straw was filled @ 100 g/flask of 150 ml capacity, and sterilized and inoculated as was done in case of test tubes. The cultures were studied for downward (mm), radial (mm) and aerial mycelial growths (extent and density), and the chlamydospores formation.

The cultures raised through different techniques varied in downward mycelial growth. It was highest of 68 mm and 68.11 mm in original culture and tissue culture, respectively in strain DMRO-484 while in multi-spore culture of this strain, the downward mycelial growth was nearly 34.56% less than the original culture. Similarly in strain DMRO-463, the downward mycelial growth was highest in tissue culture (67 mm), followed by the original culture (60.11 mm). The growth in multispore culture was nearly 31.61% lesser than the original culture. The downward mycelial growth was again highest in tissue culture (45 mm), followed by original culture (43.11 mm) in strain DMRO-185. In multispore culture it was nearly 45.88 % lesser than the original culture (Table 2.17). The radial mycelial growth of original culture and tissue culture in flasks was similar in strains DMRO-185, DMRO-463 and DMRO-484 while, the growth was lesser in multispore culture by 9.09 % in strain DMRO-484, 18.92% in DMRO-463 and 83.33% in DMRO-185. In strains DMRO-463 and DMRO-484, the aerial mycelial growth was superior in tissue cultures. The cultures raised through multi-spore culture raising technique were inferior with respect to aerial mycelial growth and did not exhibit chlamydospores formation.



I kj.kh % 2-17- ij[kuyhv k vkj QykLd e /kku d Hk l ij okYofj ;yk okYof l ;k d LVu e fofHkUu lo/ku fodfl r dju okyh rduhd k d ek/;e l fodfl r lo/kuk dh ekbl hfy ;y vFkok dod tky of) fo'k"krk ,i

Table 2.17. Mycelial growth characteristics of cultures raised through different culture raising techniques in strains of *Volvariella volvacea* on paddy straw in tubes and flasks

V. volvacea strains	Type of cultures	Mycelial growth characteristics ekbl hfy ;y of) fo'k"krk ,i				Chlamydospores
		Downward mycelial growth in test tubes (mm)	Radial mycelial growth in flasks (dia. mm)	Aerial mycelial growth		
okYofj ;yk okYof l ;k LVu	lo/ku dh fdLe	ij[kufy ;k e v/kkxkeh ekbl hfy ;y of) %feeh-½	QykLd e jfm ;y ekbl hfy ;y of) %feeh-½	ok ; oh ; ekbl hfy ;y of)	Density ?kuRo	Growth of)
Mh,evk jvk&484 DMRO-484	ey	68-00	44 feeh-	2+	3+	gYdk Hkjk
	Original	68.00	44 mm	2+	3+	Light brownish
	Ård lo/ku	68-11	44 feeh-	3+	4+	gYdk ihyk
	Tissue culture	68.11	44 mm	3+	4+	Light yellowish
	cg&ch t k.k lo/ku	44-50	40 feeh-	2+	2+	&
	Multispore culture	44.50	40 mm	2+	2+	-
Mh,evk jvk&463 DMRO-463	ey	60-11	37 feeh-	2+	2+	Hkjk
	Original	60.11	37 mm	2+	2+	Brownish
	Ård lo/ku	67-00	37 feeh-	3+	3+	&
	Tissue culture	67.00	37 mm	3+	3+	-
	cg&ch t k.k lo/ku	41-11	30 feeh-	3+	2+	&
	Multispore culture	41.11	30 mm	3+	2+	-
Mh,evk jvk&185 DMRO-185	ey	43-11	30 feeh-	2+	2+	gYdk Hkjk xky
	Original	43.11	30 mm	2+	2+	Light Brownish circle
	Ård lo/ku	45-00	30 feeh-	2+	2+	&
	Tissue culture	45.00	30 mm	2+	2+	-
	cg&ch t k.k lo/ku	23-33	5 feeh-	+	+	&
	Multispore culture	23.33	5 mm	+	+	-

+ Ldj(6+ vf/kdre; & vui fLFkr
+ Scare; 6+ highest; - absent

[krh ijh{k.k

[krh ijh{k.k dk fun'kky; dh i ;koj.k fu;f=r [kEc mRiknu bdkb e vk;kftr fd;k x;kA [kEc vul/kku fun'kky;] lkyu e ekudhdr fof/k d vulkj Qly r;kj dju d fy, 1 % 1 d vui kr e

Cultivation trial

The cultivation trials were conducted at environment controlled mushroom growing unit of the Directorate. The paddy straw based ready to use spawn and substrate from 1:1, w/w combination of



mi;kx d fy, rjr r;kj /kku d Hkl ij vk/kkfjr
 l{k ch t rFkk ik"kk/kkj] ih, l l h t h, eMCY; dk
 Hkkj@Hkkj l ;ktu bLreky fd;k x; kA iR; d lo/ku
 d fy, 15 fdxk- lMk gvk ik"kk/kkj@D; kjh dh nj ij
 iR; d nk D; kfj; k e ikp ifrdr; k dh xb rFkk bu
 ijh{k.kk dk ;knfPNd Cykd fMt kbu e fd;k x; kA
 ik"kk/kkj dh ekbl hfy; y cl koV vkj Qyu d nkjku
 rkieu dk Øe'k 34±2 fMxh l- ,o 30±2 fMxh l-
 j[kk x; kA ekudhr rFkk [kEc vul/kku fun'kky;]
 lkyu e mi;kx dh tku okyh jhfr; k d ekud idt
 dk mi;kx v/; ;u d fy, fd;k x; kA QlypØ d
 15 fnuk d fy, igyh dVkb ¼cht kb d i'pkr fnu½
 e yxu oky le;] [kEc ¼Qyudk; ½ mit ¼fdxk-
 @fDo- 'k"d ik"kk/kkj½ rFkk vk l r Qyudk; Hkkj
 ¼xke½ d fy, vk dM ,df=r fd;k x; A ,xh l
 l kQVo; j dk mi;kx dj d ,dy Øexf.kr ,ukok
 }kj vk dMk dk l kf[; dh; fo'y" k.k fd;k x; kA

nk ijh{k.kk ej LVu Mh, evk jvk&484 e Qyudk;
 mit Ård lo/ku vkj ey lo/ku e lerY; FkhA
 gkykfd] LVu Mh, evk jvk&463 ej Qyudk; mit
 ey lo/ku e gkfly mit dh ryuk e Ård lo/ku
 e mYy[kuh; ; i l dgh T; knk ikb xba LVu
 Mh, evk jvk&185 ej Ård lo/ku dh ryuk e ey
 lo/ku e Qyudk; mit dgh T; knk n[kh xba l Hkh
 rhuk LVu ej ey o Ård lo/ku d edkcy cg&cht k.k
 lo/ku e ikl r Qyudk; mit mYy[kuh; ; i l de
 Fkh ¼ l kj.kh 2-18½ A l Hkh rhuk LVu ej ey lo/ku vkj
 cg&cht k.k lo/ku e r; kj fd, x, lo/ku d edkcy
 Ård lo/ku d rgr igyh ckj dVkb dju e de
 le; yxkA rhu fofHkUu LVu e fofHkUu idkj d lo/
 kuk d rgr ik"kk/kkj dh ekbl hfy; y cl koV vkj
 Qyudk; mit iVu d chp l dk jkRed lg&lc/k
 n[ku dk feykA vf/kdk'k ekeyk ej Ård lo/ku
 rduhd l c<k, x, lo/ku e vk l r Qyudk; Hkkj
 dgh T; knk FkhA

o/- okYofl ; k d rhu LVu e Ård lo/ku rFkk
 cg&cht k.k lo/ku rduhd d ek/; e l fodflr

PS + CGMW for raising crop were prepared as per
 the method standardized at DMR, Solan. Five
 replications each with two beds of 15 kg composted
 substrate/bed were used for each culture and the
 experiment was conducted in Randomized Block
 Design (RBD). The temperature during mycelial
 colonization of substrate and fruiting was kept 34 ± 2
 $^{\circ}\text{C}$ and 30 ± 2 $^{\circ}\text{C}$, respectively. Standard package
 of practices standardized and in use at DMR, Solan
 (HP) were used for the study. Data for time taken
 for first harvest (days post-spawning), mushroom
 (fruit body) yield (kg/q dry substrate) and mean fruit
 bodies wt. (g) were recorded for 15 days of cropping.
 The data was subjected to statistical analysis by single
 factorial ANOVA using AGRes software.

In two trials, the fruit body yield was at par in
 tissue culture and the original culture in strain
 DMRO-484. However, in strain DMRO-463, the
 fruit body yield was significantly higher in tissue
 culture compared with yield from the original
 culture. In strain DMRO-185, the fruit body yield
 was higher with original culture compared with tissue
 culture. In all three strains the fruit body yield from
 multispore cultures was significantly less than with
 original and tissue cultures (Table 2.18). In all three
 strains, the time taken for first harvest was less with
 tissue cultures than with original cultures and cultures
 raised with multi-spore culture. There was positive
 correlation between mycelial colonization of the
 substrate and the fruit body yielding pattern in
 different types of cultures in three different strains.
 In majority of the cases the mean fruit body wt. was
 higher from cultures raised through tissue culture
 raising technique.

The cultures raised through tissue culture and
 multispore culture techniques in three strains of *V.*
volvacea showed variations in mycelial growth



Ikj.kh % 2-18- dikl dh vkVkb| fey d vif'k"V + /kku d Hk l : d IM g|, ik"kk/kkj ij oh- okYofl ;k d fofHkUu LVu e| fofHkUu rduhdk d ek/;e l fodflr lo/ku e| [kEc dh mit

Table 2.18. Mushroom yield in cultures raised through different techniques in different strains of *V. volvacea* on composted substrate of cotton ginning mill waste + paddy straw

LVu Strains	ik"kk/kkj dh dod t ky cl koV Mycelial colonization of substrate	igyh dVkb e yxu okyk le; %cht kb i'pkr fno l % Time taken for first harvest (days post- spawning)	[kEc mit %fdxk-@fDo- 'k" d ik"kk/kkj % Mushroom yield (kg/q dry substrate)			vk r Qyudk; Hkkj %xke % Mean fruit body wt. (g)		
			ijh{k.k&1 Trial-1	ijh{k.k&2 Trial-2	vk r Mean	ijh{k.k&1 Trial-1	ijh{k.k&2 Trial-2	vk r Mean
Mh ,evkj vk&484 %Vkb @DMRO-484 (O)	4.0+	15.00	31.92	24.16	28.04	22.77	23.79	23.28
Mh ,evkj vk&484 %Vh l h% @DMRO-484 (TC)	4.0+	14.63	31.51	23.64	27.58	18.31	25.58	21.95
Mh ,evkj vk&484 %e l h% @DMRO-484 (MC)	2.0+	18.75	4.30	1.67	2.99	11.49	12.98	12.24
Mh ,evkj vk&463 %Vkb @DMRO-463 (O)	2.0+	16.25	29.39	23.01	26.20	13.77	15.13	14.45
Mh ,evkj vk&463 %Vh l h% @DMRO-463 (TC)	3.0+	15.50	31.85	31.84	31.85	17.06	17.48	17.27
Mh ,evkj vk&463 %e l h% @DMRO-463 (MC)	—	24.75	4.99	3.37	4.18	11.73	18.76	15.25
Mh ,evkj vk&185 %Vkb @DMRO-185 (O)	1.0+	20.87	22.35	5.62	13.99	11.10	11.78	11.44
Mh ,evkj vk&185 %Vh l h% @DMRO-185 (TC)	1.0+	18.00	12.89	5.83	9.36	11.44	13.11	12.28
Mh ,evkj vk&185 %e l h% @DMRO-185 (MC)	—	dkb Qyu ugh@ No fruiting	9.99	dkb Qyu ugh@No fruiting		13.58	dkb Qyu ugh@No fruiting	
I hMh _{0.05} @CD _{0.05}	1.86		3.04			2.37		

+ : n"V0;] — : n"V0; ugh] vk & ey] Vh l h & Ård lo/ku] ,e l h & cg&cht k.k lo/ku
+ : visible, — : not visible, O – original; TC – tissue culture; MC – multispore culture



lo/kuk e dV g, /kku d Hk l ij ey lo/ku d l kFk ryuk dju ij ekbl hfy; y of) fo'k"krkvk e fhkUurk n[ku dk feyhA ey lo/ku rFkk Ård lo/ku l i kir cg&cht k.k lo/ku dh ekbl hfy; y of) fo'k"rk, Øe'k" *v l keU; %atypical%* vkj *l keU; %typical% idkj dh FkhA fofhku LVu e Ård lo/ku dh Qyudk; ifrfd;k vyx&vyx FkhA LVu Mh, evkjk&463 e] nk [krh ijh{k.k d rgr ey lo/ku %29-39 rFkk 23-01 fdxk-@fDo- 'k"d ik"kk/kkj% d edkcy Ård lo/ku d rgr vkf'kd : i l dgh vf/kd Qyudk; mit %31-85 ,o 31-84 fdxk-@fDo- 'k"d ik"kk/kkj% nt dh xb] tcf d LVu Mh, evkjk&484 e] ey lo/ku %31-92 ,o 24-16 fdxk-@fDo- 'k"d ik"kk/kkj% e Ård lo/ku %31-51 ,o 23-64 fdxk-@fDo- 'k"d ik"kk/kkj% d edkcy vkf'kd rkj ij vf/kd Qyudk; mit nt dh xBA rh l j LVu Mh, evkjk&185 e vyx&vyx ifj.kke n[ku dk feyA igy ijh{k.k e t gk ey lo/ku d rgr Ård lo/ku d edkcy mYy[kuh; : i l dgh vf/kd Qyudk; mit nt dh xb ogh n l j ijh{k.k d nkjku Qyudk; mit nkuk idkj d lo/ku e lerY; FkhA l Hkh ekeyk e] ey rFkk Ård lo/ku d edkcy cg&cht k.k lo/ku e derj Qyudk; mit nt dh xBA

vk, LVj [kEc %f<xjh [kEc%

0; ko l k; hdj.k grj ou; lY; jkVl i tkfr dh [krh

mit dh ryuk dju d fy, ik'P; jh dr xg d Hk l ij df=e [krh dju gr lY; jkVl i tkfr d ch l lo/kuk dk vk tek; k x; kA ik'P; jkbt 'ku d mijkr xg d Hk l e ueh dh ek=k vkj ih, p eku Øe'k" 73-2 ifr'kr ,o 8-1 FkhA ik"kk/kkj vFkok lC lV d k lykfLVd V e Hkjk x; kA iR; d fdLe d fy, ikp ifr dfr; k j[kh xBA [krh d nkjku vf/kdre rFkk U; ure rkieku Øe'k" 22 fMxh l- rFkk 10 fMxh l- Fkk] tcf d vkif{k d vknrk 65 l 78 ifr'kr d chp FkhA l Hkh idkj d lo/ku e ekbl hfy; k dh of) dk n[kk x; k vkj Mh, evkji h&114 %80 ifr'kr chb% e

characteristics compared with the original cultures both on pounded paddy straw. The mycelial growth characteristics of multispore cultures were of 'atypical' type while those obtained from original and tissue cultures were of 'typical' type. The fruit body yield response of tissue cultures varied in different strains. In strain DMRO-463, the tissue culture gave slightly higher fruit body yield (31.85 and 31.84 kg/q dry substrate) compared to original culture (29.39 and 23.01 kg/q dry substrate) in two cultivation trials, while in strain DMRO-484, the original culture gave slightly higher fruit body yield (31.92 and 24.16 kg/q dry substrate) than the tissue culture (31.51 and 23.64 kg/q dry substrate). The third strain DMRO-185 gave inconclusive results, where in 1st trial; the original culture gave significantly higher fruit body yield compared to tissue culture, while in 2nd trial the fruit body yield was at par in both types of cultures. In all cases the multispore cultures gave lower fruit body yield compared to the original and tissue cultures.

Oyster Mushroom

a. Cultivation of wild *Pleurotus* spp. for their commercialization

Twenty cultures of *Pleurotus* spp. were attempted for their artificial domestication on pasteurized wheat straw for comparison of their yield. The moisture content and pH of the straw after pasteurization was 73.2% and 8.1 respectively. The substrate was filled in plastic trays and kept five replications for each strain. The maximum and minimum temperature during cultivation was 22 °C and 10 °C, while the relative humidity ranged between 65 to 78%. Mycelia growth was recorded in all the cultures and highest



fp= % 2-24- Mh, evkj ih&133 d' k) 'or jx d' Qyudk;
Fig. 2.24. Pure white colour fruit bodies of DMRP-133

Ikj.kh % 2-19- ou; IY;jkV/ i tkfr d' mit vkdM;
Table 2.19. Yield data of wild *Pleurotus* spp.

Ø- l -	l o/ku l [; k	mit % xke@fdxk 'k" d ik"kk/kkj½	lykfLVd V (chb) %
Sl. No.	Culture No.	Yield (g/kg dry substrate)	BE (%)
1.	Mh, evkj ih&20@DMRP-20	632.5	63.25
2.	Mh, evkj ih&22@DMRP-22	620.0	62.00
3.	Mh, evkj ih&23@DMRP-23	580.0	58.00
4.	Mh, evkj ih&40@DMRP-40	530.0	53.00
5.	Mh, evkj ih&41@DMRP-41	560.0	56.00
6.	Mh, evkj ih&45@DMRP-45	405.0	40.50
7.	Mh, evkj ih&46@DMRP-46	426.0	42.60
8.	Mh, evkj ih&104@DMRP-104	540.0	54.00
9.	Mh, evkj ih&106@DMRP-106	570.0	57.00
10.	Mh, evkj ih&111@DMRP-111	415.0	41.50
11.	Mh, evkj ih&114@DMRP-114	800.0	80.00
12.	Mh, evkj ih&119@DMRP-119	675.0	67.50
13.	Mh, evkj ih&131@DMRP-131	736.0	73.60
14.	Mh, evkj ih&133@DMRP-133	710.0	71.00
15.	Mh, evkj ih&134@DMRP-134	470.0	47.00
16.	Mh, evkj ih&200@DMRP-200	570.0	57.00
17.	Mh, evkj ih&239@DMRP-239	510.0	51.00
18.	Mh, evkj ih&261@DMRP-261	494.0	49.40
19.	Mh, evkj ih&328@DMRP-328	480.0	48.00
20.	Mh, evkj ih&329@DMRP-329	230.0	23.00

l h-Mh- 5%@CD at 5% =81.94



lcl vf/kd mit nt dh xb tcf d bld mijku
 Øe'k Mh, evkjh & 131 73.6 ifr'kr chb½, o
 Mh, evkjh & 133 71 ifr'kr chb½ e mit nt dh
 xba l Hkh rhuk LVu lfn; k d nkju [krh dju d
 fy, mi; Dr ga lcl de mit Mh, evkjh & 329]
 Mh, evkjh & 45 rFkk Mh, evkjh & 111 23]
 40-5, o 41.5 ifr'kr chb½ e nt dh xba

**f<xjh [kEc d fy, ik"kk/kkj r; kj dju dh
 odfYid fof/k; k**

xje ty mipkj

xfe; k d eghuk e vk, LVj [kEc dh [krh dju
 d fy, ik"kk/kkj dh jlk; u futehdj. k rduhd cgr
 vf/kd dkjxj ugh jgrhA bld vykok] bldh lokxh
 LoHkko rFkk vif'k"V fo"kkDrrk d dkj. k dkcUMkte
 dh flQkfj'k HkI vk/kkfjr ik"kk/kkj d fy, ugh dh
 tkrhA ge U; ure dkcUMkte vFkok fcuk jlk; fud
 mipkj d odfYid fof/k; k dh [kk t djuh gkxhA
 vkf'kd dEikfLVx rFkk xje ty mipkj dk eY; kdu
 IY; jkVI l tj dkt dh lQy c<okj d fy, budh
 mi; Drrk tkuu d fy, fd; k x; kA xje ty fof/
 k d rgr dy pkj mipkj T_1 & 30 feuV d fy,
 xje ikuh 65 fMxh l-½ e xg d HkI dk fHkxkuk(T_2
 & 60 feuV d fy, xje ikuh 65 fMxh l-½ e xg
 ivky vFkok HkI dk fHkxkuk(T_3 & xg dk lkeku;
 ikuh e fHkxkuk vkj rnijku 30 feuV d fy, xje
 ikuh 65 fMxh l-½ e fHkxkuk(, o T_4 & 6 ?kV d fy,
 lkeku; ikuh e xg ivky vFkok HkI dk fHkxkuk½ dk
 vktek; k x; kA vfrfjDr ikuh dk fudkyu d 2 ?kV
 i'pkr chtkb dh xba ueh HkI d vk/kkj ij IY; jkVI
 l tj dkt d ing fnu ijku [kEc cht dk mi; kx
 ik"kk/kkj d 2.5 ifr'kr dh nj ij fd; k x; kA iR; d
 mipkj e dy nl ifrdfr; k FkhA bl ijh{k. k dk
 tu&tykb e fd; k x; kA iR; d mipkj e dkb
 fo'k"k fHkUurk n[ku dk ugh feyhA ; g ik; k x; k fd
 ln" k. k d ekey e rkieku , d vfr egroi. k dkjd
 ga xfe; k d eghuk e yc le; rd vf/kd rkieku
 cu jguk vkj 75 fMxh l- l vf/kd rkieku gkuk
 ln" k. k dk dkj. k gk l drk g % l kj. kh 2-21½A

yield was observed in DMRP-114 (80% BE)
 followed by DMRP-131 and DMRP-133 (73.6%
 and 71% BE, respectively). All the three strains are
 suitable for cultivation during winter. Lowest yield
 was obtained in DMRP-329, 45 and DMRP-111
 (23, 40.5 and 41.5% BE)

b. Alternative methods for substrate preparation for oyster mushroom

Hot water treatment

Chemical sterilization technique of substrate for
 growing oyster mushroom is not very effective during
 summer months. Moreover, carbendazim is not
 recommended for straw based substrates due to its
 systemic in nature and residual toxicity. We have to
 search for alternative methods with minimum
 carbendazim or without chemical treatment. Partial
 composting and hot water treatment were evaluated
 for their suitability for successful growing of *Pleurotus
 sajor caju*. In hot water method there were 4
 treatments (T_1 - wheat straw directly soaked in hot
 water (65 °C) for 30 minutes; T_2 - wheat straw soaked
 in hot water (65 °C) for 60 minutes; T_3 - Wheat straw
 soaked in normal water for 6 hrs and then treated
 with hot water (65 °C) for 30 minutes and straw
 soaked in normal water for 6 hrs – T_4). Spawning
 was done 2 hrs after draining the excess water and
 fifteen days old spawn of *P. sajor-caju* was added @
 2.5 % of the substrate on wet wt. basis. There were
 10 replications in each treatment. The experiment
 was done during June – July, 2015. There was no
 significant difference in each treatment. It was
 observed that temperature is very critical factor in
 contamination. Prolonged and higher temperature
 more than 65 °C may cause contamination during
 summer months.



I kj.kh % 2-20- fofHkUu ik"kk/kkj mipkj e xg d Hk l ij IY;jkVI I/tj dkt/ dh vklr mit

Table 2.20. Average yield of *P. sajor caju* in wheat straw in different substrate treatment

Ø-I-	mipkj	mit %xke@fdxk 'k"d ik"kk/kkj%	chb BE%
Sl. No.	Treatment	Yield (g/kg substrate)	BE %
1.	30 feuV d fy, xje ikuh %65 fMxh I-½ e xg d Hk l dk fHkxkuk@ Wheat straw soaked in hot water (65 °C) for 30 min	385	38.5
2.	60 feuV d fy, xje ikuh %65 fMxh I-½ e xg d Hk l dk fHkxkuk@ Wheat straw soaked in hot water (65 °C) for 60 min	417	41.7
3.	xg d Hk l dk lkekU; ikuh e fHkxkuk vkj rnijkuR 30 feuV d fy, xje ikuh %65 fMxh I-½ e fHkxkuk@Wheat straw soaked in water & then hot water (65 °C) for 30 min	428	42.8
4.	6 ?kV d fy, lkekU; ikuh e xg d Hk l dk fHkxkuk@ Wheat straw soaked in normal water for 6 hrs	441	44.1
	Økfurd fHkUurk % I hMh% 5%@CD at 5%	46.7	

vkf'kd dEikfLVx

xg rFkk /kku d Hk l dh vyx&vyx ijr %300 fdxk- iR;d½ r;kj dh xb vkj mue ue ivky ;k Hk l e 1 fdxk-@100 fdxk- Hk l dh nj ij pu dk feyk;k x;k rFkk m l IMu fn;k x;kA nkj pkj vkj N% fnu d ckn ueu fy, x, vkj ue Hk l dh 2-5 ifr'kr nj ij chtkb dh xBA chtkb;Dr cxk dk m"ek;u dejk e j[kk x;kA 30 fnuk d fy, mit d vkdMk dk nt fd;k x;k tk fd I kj.kh 2-21 e iLrr g A

Partial composting

Separate plies of wheat and paddy straw were prepared (300 kg each) and lime @ 1kg /100kg of straw was mixed in wet straw and composted. Samples were drawn after 2, 4 and 6 days after addition of lime and spawning was done @ 2.5% of wet straw and then bags were kept in incubation room. Yield data was recorded for 30 days and presented in table 2.21.

I kj.kh % 2-21- IY;jkVI tej fdLe jkft;l e IMh gb xg o /kku d Hk l dk eY;kdu

Table 2.21. Evaluation of composted wheat and paddy straw in *P.djamor* var. *roseus*

Ø-I-	ik"kk/kkj vFkok I C I V V	chb (%)	
Sl. No.	Time interval for partial composting	Biological Efficiency (%)	
		Wheat straw xg d Hk l k	Paddy straw /kku Hk l k
1	2 fnuk dk dEikfLVM ik"kk/kkj@Substrate composted for 2 days	77.76	70.56
2	4 fnuk dk dEikfLVM ik"kk/kkj@Substrate composted for 4 days	77.20	70.48
3	6 fnuk dk dEikfLVM ik"kk/kkj@Substrate composted for 6 days	62.72	75.20
	5% Økfrd fHkUurk@CD at 5%	55.64	59.43



fof'k"V [kEc

fofHkUu d'f'k vif'k"Vki ij iHkkoh ekblhfy;k of) d fy, viuk; x, f'kVkd LVu dk p;u

fdlh fyXuklyykftd ik"kk/kkj e [kEc dk mxku dh {kerk dk lc/k bld ekblhfy;e dh vtrk d lFk&lFk ek/e dk i;klr ek=k e nkgu dju d fy, vko';d 'kkjhfd fØ;kfof/k;k dk lfØ; cuku dh bldh {kerk ij fuHkj djrk gA tc ifrjk/kh l{ethok dh mifLFkr d dkj.k ik'P;jhdr ik"kk/kkj dk mi;kx fd;k tkrk g] rc ikjfhkd clkov dh xfr dgh vf/kd egROI.k gkrh gA odFYid ik"kk/kj ij [krh dju d fy, f'kVkd LVu dk viuku e mi;kx fd, ie[k rRok e l ikjfhkd of) dh xfr Hkh 'kkfey gA vr% fofHkUu {k= d fof'k"V d'f'k vif'k"Vki ij Rofjr ikjfhkd clkov nj oky LVu dk p;u dju d fy, df=e ifjo'kh; v/;u i;kx'kkyk e ijh{k.k fd;k x;kA

o'k yfUVU;yk d 35 LVu dh ekblhfy;y of) dk v/;u] LVu@ik"kk/kkj l{kerk dk irk yxku d fy, fofHkUu ik"kk/kkj l mRiUu fu"d"k.k dk mi;kx djd fd;k x;kA bu ik"kk/kkj e 'kkfey Fk % xg dk Hk lq /kku dk Hk lq ukfj;y d j'k] xUu dh [kkb rFkk fefJr cjknkA fu"d"k.k vFkok l r e ty dk 50 xke ik"kk/kkj ifr yHvj feyk dj rFkk mkydj r;kj fd;k x;k vkj ble l r dk ,xkj ikmMj 15 xke ifryhvj feyk dj lo/ku ehfM;k r;kj fd;k x;kA lo/ku ehfM;k dk 15 ih, lvkb nckc ij ij 20 feuV d fy, 121 fMxh l- rkieku ij vkVkdyc fd;k x;kA 20 fefy- lo/ku ehfM;k e dk iVh fM'k %90 feeh- 0;k l½ e j[kk x;kA ,eb, ij ih&dYVhofVM ekblhfy;e fMLd %5 feeh- 0;k l½ d lFk LVu dk feyk;k x;kA iR;d lo/ku ehfM;k vkj iR;d LVu d fy, rhu ifrdfr;k r;kj dh xBA ueuk dk 25 fMxh l- rkieku ij v/kj e j[kdj 10 fnuk d fy, m"ekf;r fd;k x;kA nk yEcor v{k d lFk ekblhfy;k d 0;k l dk ekidj ekblhfy;y of) dk vkdyu fd;k x;kA

Speciality Mushrooms

Selection of shiitake strains adapted for efficient mycelia growth on various agro residues

The capacity of a mushroom to grow in a lignocellulosic substrate is related to the vigor of its mycelium, as well as to its capacity to activate physiological mechanisms necessary to adequately exploit the medium. Initial colonization speed is even more important when a pasteurized substrate is utilized because of the presence of antagonistic microorganisms. The speed of initial growth is one of the principal elements used to adapt shiitake strains to cultivate on alternate substrates. Hence, an *in vitro* study was conducted to select the strains with rapid initial colonization rate on different agro residues.

Mycelial growth of 35 strains ascribed to the genus *Lentinula* was studied by using extracts derived from the substrates such as wheat straw, paddy straw, coir pith, sugarcane bagasse and mixed sawdust to establish the strain/substrate compatibility. The extract was prepared by adding 50 g of substrate L⁻¹ of water and boiled rigorously and culture media was prepared by the addition of agar powder @ 15 g L⁻¹ of extract. The culture media was autoclaved at 121 °C for 20 minutes at 15psi. 20 ml of the culture medium was placed in Petri dishes (90 mm diameter). Strains were inoculated with mycelium disks (5 mm diameter) pre-cultivated on MEA. Three replications were prepared for each culture medium and for each strain. Samples were incubated in darkness at 25 °C. Mycelial growth was estimated by measuring the diameter of the mycelia along two perpendicular axes.



I kj.kh % 2-22- 25 fMxh l- rkieku ij m"ek;u d n l fnuk i 'pkr fofHkUu df"k vif'k"Vki d okLrfod fu"d"k.k vFkok l r ij mx yfUVU;yk bMkM l LVu d ekblhfy;k dk 0;k l %feeh-%

Table 2.22. Radial diameter (mm) of mycelia of *Lentinula spp.* strains cultured on true extracts of different agro residues, after ten days of incubation at 25 °C

f'kVkd LVu l i ;k Shiitake Strain No.	fuEu d l r vFkok fu"d"k.k ij f'kVkd LVu dh ekblhfy;k dk 0;k l %feeh-% Diameter (mm) of mycelia of Shiitake strains on extracts of				
	xgi dk Hk l k Wheat straw	/kku dk Hk l k Paddy straw	Ukfj; y d j i ' k Coir pith	xUu dh [kkb Sugarcane bagasse	fefJr cjkknk Mixed saw dust
Mh, evk j vk&2@DMRO - 2	4.43	5.00	5.07	6.58	3.97
Mh, evk j vk&7@DMRO -7	4.90	5.60	5.13	8.37	3.70
Mh, evk j vk&8@DMRO -8	4.90	4.87	5.07	8.00	4.10
Mh, evk j vk&12@DMRO -12	4.23	4.93	4.30	7.17	2.60
Mh, evk j vk&16@DMRO -16	5.07	5.63	4.83	7.60	4.03
Mh, evk j vk&18@DMRO -18	4.83	5.37	5.70	8.07	3.77
Mh, evk j vk&19@DMRO -19	4.93	5.23	4.43	7.93	2.60
Mh, evk j vk&20@DMRO -20	4.70	5.37	4.10	7.67	3.17
Mh, evk j vk&22@DMRO -22	3.77	4.90	3.50	8.17	2.27
Mh, evk j vk&23@DMRO -23	4.30	5.17	4.10	7.80	3.53
Mh, evk j vk&25@DMRO -25	1.93	2.83	NG	6.57	NG
Mh, evk j vk&36@DMRO -26	3.20	3.23	3.87	6.90	1.63
Mh, evk j vk&30@DMRO -30	5.10	6.20	NG	7.21	NG
Mh, evk j vk&34@DMRO -34	4.03	5.03	4.10	8.17	3.10
Mh, evk j vk&35@DMRO -35	4.07	5.00	4.40	8.20	3.40
Mh, evk j vk&37@DMRO -37	4.57	5.00	5.03	7.70	3.77
Mh, evk j vk&40@DMRO -40	4.87	5.27	4.60	7.70	3.30
Mh, evk j vk&51@DMRO -51	5.07	5.53	4.00	7.37	2.91
Mh, evk j vk&95@DMRO -95	4.67	5.07	4.43	7.87	3.10
Mh, evk j vk&101@DMRO -101	9.00	9.00	8.50	8.56	7.07
Mh, evk j vk&119@DMRO -119	4.47	4.70	5.40	6.87	4.53
Mh, evk j vk&276@DMRO -276	5.23	6.18	2.70	8.70	5.33



f'kVkd LVu I[;k Shiitake Strain No.	fuEu d l r vFkok fu"d"k.k ij f'kVkd LVu dh ekbl hfy; k dk 0; k l %feeh-½ Diameter (mm) of mycelia of Shiitake strains on extracts of				
	xg d k Hk l k	/kku dk Hk l k	Ukfj; y d j'k	xUu dh [kkb l	fefJr c jknk
	Wheat straw	Paddy straw	Coir pith	Sugarcane bagasse	Mixed saw dust
Mh, evk jvk&297@DMRO -297	4.57	5.57	4.13	8.27	3.30
Mh, evk jvk&327@DMRO -327	4.63	5.20	4.63	7.93	3.20
Mh, evk jvk&328@DMRO -328	3.80	5.17	4.10	7.70	3.73
Mh, evk jvk&329@DMRO -329	5.13	5.77	2.90	5.63	2.10
Mh, evk jvk&330@DMRO -330	4.97	4.97	4.97	6.97	2.87
Mh, evk jvk&331@DMRO -331	6.00	6.17	5.93	8.27	3.77
Mh, evk jvk&356@DMRO -356	5.03	5.80	5.07	7.53	4.17
Mh, evk jvk&410@DMRO -410	3.37	4.60	4.50	7.73	1.63
Mh, evk jvk&411@DMRO -411	3.77	4.70	3.70	7.63	2.37
Mh, evk jvk&412@DMRO -412	5.00	5.43	4.87	8.10	3.00
Mh, evk jvk&430@DMRO -430	5.27	5.27	4.63	8.40	3.87
Mh, evk jvk&455@DMRO -455	4.87	4.81	4.87	8.20	2.97
Mh, evk jvk&623@DMRO -623	5.10	5.10	5.80	7.73	4.30

n l fnu dh m"ek; u vof/k d mijku r ekbl hfy; k d vk l r 0; k l d vk/kkj ij f'kVkd d l Hkh 35 LVuk dk rhu legk %Rofjr of) > 5 feeh- 0; k l (e/; e of) 3 & 5 feeh- 0; k l vkj en of) LVu < 3 feeh- 0; k l ½ e ckV k x; kA i R; d leg l rhu LVuk dk p; u tfod n{krk dk vkdyu dju d fy, i; koj. k fu; f=r ifjLFkr; k d rgr Qyu ij h{k. kk d fy, fd; k x; kA

eØk l kbc t k b x f. V; k dh [krh

o" k 2012 e nf{k. kh j k t L F k k u l l d f y r n l h eØk l kbc t k b x f. V; k dk l Q y r k i o d i k' P; j h d r [k k n r F k k j k l k; f u d : i l f u t e h d r i k" k k / k k j i j m x k; k x; kA x e t y e f h k x k; x, x g d H k l i j b l d h [k r h i j v /; ; u d j u d f y, , d i j h { k. k f d; k x; kA x j e t y f o f / k d r g r] d y p k j m i p k j k

Based on the average diameter of mycelia after 10 days of incubation period, all the 35 strains of shiitake were classified into three groups (fast growing > 5 mm dia; medium growing 3-5 mm dia and slow growing strains <3 mm dia). Three strains from each group were selected for fruiting trails under controlled conditions to assess the biological efficiency.

Cultivation of *Macrocybe gigantea*

The indigenous *Macrocybe gigantea* collected from south Rajasthan in 2012 has been successfully cultivated on both pasteurized and chemically sterilized substrates. An experiment was laid out to study its cultivation on wheat straw soaked in hot water. In hot water method there were 4 treatments



¼Vh1& 30 feuV d fy, xje ikuh ¼65 fMxh l-½ e xg d Hk l dk fHkxkuk(Vh2& 60 feuV d fy, xje ikuh ¼65 fMxh l-½ e xg d Hk l dk fHkxkuk(Vh3& xg d Hk l dk lkekU; ikuh e fHkxkuk vkj rnijkuR 30 feuV d fy, xje ikuh ¼65 fMxh l-½ e fHkxkuk(,o Vh4& 6 ?kV d fy, lkekU; ikuh e xg d Hk l dk fHkxkuk½ dk vkt ek;k x;kA vfrfjDr ikuh dk fudkyu d 2 ?kV i'pkr ch t kb dh xBA ,e- t k b x f . V ; k d ing fnu ijku [kEc ch t dk mi ; kx ik"kk/kkj d ueh Hkkj dh 5 ifr'kr dh nj ij fd;k x;kA iR;d mipkj e dy nl ifrdfr;k FkhA bl ijh{k.k dk tu&tykb e fd;k x;kA 30 feuV rd xje ty e fHkxku oky mipkj e lcl vf/kd vkj rnijkr 60 feuV rd xje ty e fHkxku oky mipkj e vf/kd mit n[ku dk feyhA gkykfd] iR;d mipkj e dkb fo'k" fHkUurk n[ku dk ugh feyhA ;g fu"d" fudkyk tk ldrk g fd lkyj xhtj l xje ty dk mi ; kx [kEc mRikndk }kj k e Ø k l k b c t k b x f . V ; k dk c < ku gr fd;k tk ldrk gA

i.e. T₁ - wheat straw directly soaked in hot water (65 °C) for 30 minutes; T₂ - wheat straw soaked in hot water (65 °C) for 60 minutes; T₃ - Wheat straw soaked in normal water for 6 hrs and then treated with hot water (65 °C) for 30 minutes and straw soaked in normal water for 6 hrs (T₄). Spawning was done 2 hrs after draining excess water and fifteen days old spawn of *M. gigantea* was used @ 5 % of wet weight of the substrate. There were 10 replications in each treatment. The experiment was done during June –July, 2015. Highest yield was obtained in substrate treated with hot water soaked for 30 minutes followed by 60 minutes. However there was no significant difference in yield in all the treatments. It can be concluded that hot water from solar geyser can be used for growing *Macrocybe gigantea* by mushroom farmers.

I kj.kh % 2-20- eb l vkj t u d nkjku fofHkUu ik"kk/kkj mipkj e xg d Hk l e ,e- t k b x f . V ; k dh vk l r mit Table 2.23. Average yield of *M. gigantea* in wheat straw based substrate pasteurized at different time intervals

Ø- l -	mipkj	mit ¼xke@fdxk ik"kk/kkj½	chbl %
Sl. No.	Treatment	Yield (g/kg substrate)	BE %
1.	30 feuV d fy, xje ikuh ¼65 fMxh l-½ e xg d Hk l dk fHkxkuk@ Wheat straw soaked in hot water (65 °C) for 30 min	706	70.6
2.	60 feuV d fy, xje ikuh ¼65 fMxh l-½ e xg d Hk l dk fHkxkuk@ Wheat straw soaked in hot water (65 °C) for 60 min	704	70.4
3.	xg d Hk l dk lkekU; ikuh e fHkxkuk vkj rnijkuR 30 feuV d fy, xje ikuh ¼65 fMxh l-½ e fHkxkuk@Wheat straw soaked in water & then hot water (65 °C) for 30 min	645	64.5
4.	6 ?kV d fy, lkekU; ikuh e xg d Hk l dk fHkxkuk@ Wheat straw soaked in normal water for 6 hrs	664	66.4
	Økfurd fHkUurk ¼ l h m h ½ 5% @ CD at 5%	110.28	



vkfQ;kdkMh'III uh;kfo yfdvkuk dh [krh d fy, fofHkUu ehfM;k dk eY;kdu

ijhf{kr fd, x, vkB fofHkUu ehfM;k e l] ,eb, ehfM;e ij vkfQ;kdkMh'III uh;kfo yfdvkuk dh vf/kdre ekblhfy;k of) ¼77 feeh½ vkj rnijKur fdx ehfM;e ¼76 feeh½ nt dh xbA lHkh QykLd dk ikjHk e 25 fMxh l- rkieku e j[kk x;kA ekblhfy;k of) ijh gku d mijKur QykLd dk Qyu d fy, 33 fMxh l- rkieku ij j[kk x;kA oreku e Qyu dh irh{kk dh tk jgh gA

dkMh'III dh rhu i tkfr;k dh ekblhfy;k of) ij ckFk dk iHkko

dkMh'III dh rhu i tkfr;k ;Fkk vkfQ;kdkMh'III uh;kfo yfdvkuk dkMh'III cfI;kuk rFkk lh- fefyVI dh ekblhfy;k mit dk vkdyu dju d fy, ckFk dk mi;kx fd;k x;kA lh- fefyVI d ekey e vf/kdre ekblhfy;y leg nt fd;k x;kA

Evaluation of different media for cultivation of *Ophiocordyceps neovilkiana*

Among the eight different media tested, maximum mycelia growth of *Ophiocordyceps neovilkiana* (77 mm) was recorded on MEA medium followed by King's medium (76 mm). All the flasks were initially kept at 25 °C. After complete mycelia growth, flasks were kept at 33 °C for fruiting. Presently fruiting is awaited.

Effect of nutrient broth on the mycelia growth of three species of *Cordyceps*

Nutrient broth was used to assess the mycelia yield of three species of *Cordyceps* viz. *Ophiocordyceps neovilkiana*, *Cordyceps bassiana* and *C. militaris*. Maximum mycelial mass was recorded in case of *C. militaris*.



x- Qly Ij{k.k

C. CROP PROTECTION

j kx

d- vxjfdl ckbLikjl e ueh cycyk jkx
dh jkdFkke d fy, fofHkUu thokf.od to
Qkey'y'kuk dk rlyukRed eY;kdu

fofHkUu to Qkey'y'kuk dk fodflr dju d fy,
dy N% thokf.od foyxuk uker% 20,] 18,] 9,] 1,]
5ch rFkk ,,evk dk mi;kx fd;k x;kA thokf.od
foyxuk dh thou {kerk rFkk fu/kkuh vk; dk lgjk
nu d fy, dfj;j vFkok okgd d rkj ij ikmMj]
dkdk ihV] dEikLV vkj dflx lkexh t l h fofHkUu
dfj;j lkexh dk mi;kx fd;k x;kA 28 fMxh l-
rkieku ij 150 vkjih,e ij ' 'kdj bukdyVI e
'kd lo/ku d : i e thokf.od lo/ku dk 48 ?kV/d
fy, rjy ik" k.k oky ckFk e lof/kr fd;k x;kA ckFk
%10⁸ l h,Q;@feyh yhVj% e dkckDI h feFkby lyykt
%1 h,e l h%] dfj;j rFkk thokf.od ?kky dk 1 % 50 % 4
d vuikr e mi;kx fd;k x;kA to Qkey'y'kuk dk
5-0 xke dkckDI h feFkby lyykt \$ 250 xke
[kfM;k ikmMj %30 feuV d fy, 15 ih,lvkb nckc
ij 121 fMxh l- rkieku ij vkVkdYOM% \$ ckFk e
thokf.kod ?kky dk 20 fefy-(5-0 xke dkckDI h
feFkby lyykt \$ 250 xke dkdk ihV %30 feuV d
fy, 15 ih,lvkb ncko ij 121 fMxh l- rkieku ij
vkVkdYOM% \$ 'kkjck e thokf.kod ?kky dk 20 fefy-
(5-0 xke dkckDI h feFkby lyykt \$ 250 xke
dEikLV %30 feuV d fy, 15 ih,lvkb nckc ij 121
fMxh l- rkieku ij vkVkdYOM% \$ ckFk e thokf.kod
?kky dk 20 fefy-(5-0 xke dkckDI h feFkby
lyykt \$ 250 xke dflx enk %30 feuV d fy, 15
ih,lvkb ncko ij 121 fMxh l- rkieku ij vkVkdYOM%
\$ ckFk e thokf.kod ?kky dk 20 fefy- rFkk fu;=d
d : i e vdy thokf.od 'kkjck ?kky dk 20 fefy-
dk mi;kx dj d r;kj fd;k x;kA to Qkey'y'kuk
dk d{k rkieku ij jkrHkj dhVh.kjgr ifjflFkfr e
l [kk;k x;kA vxjfdl ckbLikjl e ueh cycyk jkx
dh jkdFkke d fy, fofHkUu dfj;j vk/kfjr to
Qkey'y'kuk dh iHkko'khyrk dk vkdyu fu;f=r

Diseases

A. Comparative evaluation of different bacterial bio formulations for the control of wet bubble in *Agaricus bisporus*

Total six bacterial isolates namely 20A, 18A, 9A,
1A, 5B and AMO were used for the development of
different bioformulations. Different carrier materials
such as talc, coco peat, compost and casing material
were used as carrier to support the viability and shelf
life of bacterial isolates. Bacterial cultures were grown
in liquid nutrient broth for 48h as shake culture in
shaker inoculators at 150 rpm at 28 °C temperature.
The carboxy methyl cellulose (CMC), carrier and
bacterial suspension in broth (10⁸ cfu ml⁻¹) were used
in 1:50:4 ratio. The bioformulations were prepared
as 5.0g carboxy methyl cellulose + 250g talc powder
(autoclaved at 121 °C at 15psi for 30 minute) + 20
ml of bacterial suspension in broth; 5.0g carboxy
methyl cellulose + 250g coco peat (autoclaved at 121
°C at 15psi for 30 minute) + 20 ml of bacterial
suspension in broth; 5.0g carboxy methyl cellulose +
250g compost (autoclaved at 121 °C at 15psi for 30
minute) + 20 ml of bacterial suspension in broth
and 5.0g carboxy methyl cellulose + 250g casing soil
(autoclaved at 121 °C at 15psi for 30 minute) + 20
ml of bacterial suspension in broth and 20 ml of
bacterial broth suspension alone as control. The
bioformulations were dried overnight aseptically at
room temperature. The efficacy of different carrier
based bioformulations in controlling wet bubble
disease in *Agaricus bisporus* was assessed under
controlled conditions. 30g of each bioformulations



ifjflFkfr;k e fd;k x;kA iR;d to Qkey'ku dk 30 xke [kEc d iR;d chthr Fky dh dflx enk e feyk;k x;kA fofHkUu le; vUrjkyk ¼10] 30] 60] 90] 120 ,o 150 fnuk dk vUrjkyk½ ij vyx&vyx dfj;j lkexh e N% thokf.od lo/kuk d tul[;k ?kuRo dk nt fd;k x;k tk fd lkj.kh 2-24 e iLrr gA

[kfM;k vk/kkfjr ikmMj e 150 fnuk dk lcl vf/kd thou&dky vFkok fu/kkuh vk; ikb xb rFkk dEikLV vk/kkfjr Qkey'kuk e 90 fnuk rd dk U;ure thou&dky n[ku dk feykA Hk.Mkj.k d ikp ekg i'pkr vf/kdre tul[;k Hkkj [kfM;k vk/kkfjr 5×10^4 lh,Q;@xke (1,) e vkj rnijkUr Øe'kh , ,evk (3×10^4 lh,Q;@xke), 9, (2×10^4 lh,Q;@xke) ,o 5ch] 20, (1×10^4 lh,Q;@xke) e ik;k x;kA thokf.od lo/ku 18, e de vFkok fud"V of) nt dh xb vkj 150 fnuk d mijkuR dkb of) inf'kr ugh gbA dkd ihV vk/kkfjr Qkey'ku Hkh dflx rFkk dEikLV vk/kkfjr to Qkey'kuk dh ryuk e cgrj ik;k x;kA

fofHkUu Qkey'kuk d fy, vktekb xb fofHkUu dfj;j vFkok okgd lkexh e l] 1-29 d U;ure jkx vkiru d lkFk dkd ihV dk mi;kx djr g, vf/kdre mit [kfM;k ikmMj ij 1, foyxu ¼3-10 fdxk-½ d lkFk nt dh xb tcf d bld mijkuR , ,evk e ikb xBA dflx enk e tc 2, foyxu dk feyk;k x;k rc ble jkx vkiru e 100 ifr'kr l Hkh vf/kd of) n[ku dk feyhA fu;=d-II e tgg ek;dkxku dk lkj.k ugh fd;k x;k Fkk] e 44-24 ifr'kr jkx vkiru nt fd;k x;k] ft l l chtk.kvk d ek;e l folrkj dk ldr feykA tcf d fu;=d&1 e tgg [kEc d Fkyk dk ikjHk e ek;dkxku l lkfir fd;k x;k Fkk] e 100 ifr'kr mit ud lku nt fd;k x;kA

were mixed with the casing soil. Population density of six bacterial cultures in different carrier materials at different time intervals (10, 30, 60, 90, 120 and 150 days interval) was recorded and presented in Table 2.24.

The talc based bioformulations was found to have the long shelf life of 150 days and the minimum shelf life up to 90 days was observed in compost based formulations. The maximum population load after five months of storage was found to be 5×10^4 cfu/g (1A) in talc based followed by AMO (3×10^4 cfu/g), 9A(2×10^4 cfu/g) and 5B, 20A (1×10^4 cfu/g). Bacterial culture 18A was found poor in growth and showed no growth after 150 days. Coco peat based formulation was also found better than casing and compost based bioformulations.

Among the different carrier materials tested for different formulations, maximum yield was recorded with 1A isolate on talc powder (3.10 Kg) followed by AMO using coco peat with minimum disease incidence of 1.29 %. When 2A isolate was added to casing soil, it resulted in more than 100% increase in disease incidence. Further, disease incidence of 44.24% was recorded in control –II where *Mycogone* was not inoculated indicating the spread through spores. Whereas, 100 % yield loss was recorded in Control I where mushroom bags were initially inoculated with *Mycogone*.



Table 2.24. Population density of six bacterial isolates in different carrier materials at different time interval (10, 30, 60, 90, 120 and 150 days)

Isolates	Type of formulations	Population density of bacterial isolates at different time intervals cfu/g(10 ⁴)					
		0	30	60	90	120	150
20, @20A	[kfM;k i kmMj@Talc powder	40	61	85	96	8	1
	dkdk ihV@Coco peat	35	55	70	90	1	-
	dEikLV@Compost	18	26	70	45	-	-
	df l x enk@Casing soil	10	20	50	-	-	-
18, @18A	[kfM;k i kmMj@Talc powder	25	40	73	80	5	-
	dkdk ihV@Coco peat	20	33	62	75	2	-
	dEikLV@Compost	13	30	59	40	1	-
	df l x enk@Casing soil	7	29	50	37	-	-
9, @9A	[kfM;k i kmMj@Talc powder	50	60	79	110	15	2
	dkdk ihV@Coco peat	45	57	98	103	4	1
	dEikLV@Compost	28	50	67	90	1	1
	df l x enk@Casing soil	8	20	50	60	1	-
1, @1A	[kfM;k i kmMj@Talc powder	50	90	120	140	30	5
	dkdk ihV@Coco peat	40	60	135	120	5	2
	dEikLV@Compost	20	39	100	90	-	-
	df l x enk@Casing soil	15	20	50	-	-	-
5ch@5B	[kfM;k i kmMj@Talc powder	41	59	85	100	7	1
	dkdk ihV@Coco peat	32	48	74	93	2	-
	dEikLV@Compost	26	41	67	84	1	-
	df l x enk@Casing soil	12	34	56	34	-	-
, , evk@AMO	[kfM;k i kmMj@Talc powder	45	58	90	105	5	3
	dkdk ihV@Coco peat	33	64	86	100	2	1
	dEikLV@Compost	15	40	75	90	-	-
	df l x enk@Casing soil	10	30	89	8	-	-

*(-) fofHkUu Qkey'ku dk thou&dKy in'ku %bu fnuk d mijkuR dkb dkykuh ugh ikb xb%
*(-) Showed shelf life of different formulations (after these days no colonies were observed)



Table 2.25- Evaluation of six bacterial isolates in different carrier materials (Talc, Compost, Coco peat and Casing soil) on the management of wet bubble disease

Table 2.25 Evaluation of six bacterial isolates in different carrier materials (Talc, Compost, Coco peat and Casing soil) on the management of wet bubble disease

Isolates	Types of formulations	Yield			% of) @deh
					% increase / decrease
		dy mi t	LoLFk Qyudk;	lØfer Qyudk;	
		$\frac{1}{2}fdxk-\frac{1}{2}$	$\frac{1}{2}fdxk-\frac{1}{2}$	$\frac{1}{2}fdxk-\frac{1}{2}$	
		Total yield (kg)	Healthy fruiting bodies (kg)	Infected fruiting bodies (kg)	
20, @20A	[kfM;k i kmMj@Talc powder	2.95	2.08	0.87	41.80
	dkdk ihV@Coco peat	2.77	1.87	0.90	48.23
	dEikLV@Compost	1.69	0.71	0.98	137.44
	df l x enk@Casing soil	2.05	1.14	0.91	79.75
18, @18A	[kfM;k i kmMj@Talc powder	1.97	1.67	0.30	17.95
	dkdk ihV@Coco peat	1.91	1.46	0.45	30.78
	dEikLV@Compost	1.05	0.50	0.50	99.60
	df l x enk@Casing soil	1.84	1.34	0.50	37.31
9, @9A	[kfM;k i kmMj@Talc powder	3.02	2.62	0.40	15.24
	dkdk ihV@Coco peat	2.31	1.76	0.54	30.72
	dEikLV@Compost	2.56	1.76	0.80	45.50
	df l x enk@Casing soil	1.61	0.76	0.81	112.92
1, @1A	[kfM;k i kmMj@Talc powder	3.23	3.10	0.20	1.29
	dkdk ihV@Coco peat	2.95	2.47	0.48	19.47
	dEikLV@Compost	2.22	1.52	0.70	46.14
	df l x enk@Casing soil	2.48	1.80	0.68	37.69
5ch@5B	[kfM;k i kmMj@Talc powder	2.90	2.55	0.35	13.73
	dkdk ihV@Coco peat	2.77	2.31	0.46	19.84
	dEikLV@Compost	2.00	1.02	0.98	96.07
	df l x enk@Casing soil	2.60	1.90	0.70	36.84
, , evk@AMO	[kfM;k i kmMj@Talc powder	3.03	2.75	0.28	10.02
	dkdk ihV@Coco peat	2.70	2.28	0.42	18.44
	dEikLV@Compost	2.14	1.26	0.88	69.33
	df l x enk@Casing soil	2.45	1.80	0.65	36.19
fu;=d i@ Control I	$\frac{1}{2}ek;d\backslash xku$ I l j k f i r $\frac{1}{2}$ (inoculated with <i>Mycogone</i>)	0.78	-	0.78	100
fu;=d ii@ Control II	$ek;d\backslash xku$ d fcuk Without <i>Mycogone</i>	4.01	2.78	1.23	44.24



dhV

flvkfjM efD[k;k d fo:) dhVuk'kdk dk eY;kdu

fofhkUu legk l tM ikp dhVuk'kdk (@ 0.01%) dk ijh{k.k 3 ld.M dh idVu vof/k d lFk ukd Mkm pEcj dk mi;kx djd fl;kfjM efD[k;k d fo:) iHkko'khyrk dk irk yxku d fy, fd;k x;kA efD[k;k e vf/kdre eR;nj behMkDykfiM %88-88 ifr'kr½ e vkj rnijr Øe'k MkbDykjok l %88-09 ifr'kr½ rFkk fFkvkfeFkD le %61-10 ifr'kr½ e nt dh xBA eykfFk;ku e lcl de eR;nj %35-71 ifr'kr½ nt dh xBA

Pests

Evaluation of insecticides against sciarid flies

Five insecticides (@ 0.01%) belonging to different groups were tested against sciarid flies using knock down chamber with an exposure period of 3 seconds. Maximum mortality was observed in case of Imidacloprid (88.88%) followed by Dichlorvos (88.09%) and Thiamethoxam (61.10%). Least mortality of 35.71 % was observed in case of Malathion.

lkj.kh 2-26- fofhUu dhVuk'kdk d fo:) fl;kfjM efD[k;k dh eR;nj

Table 2.26. Mortality rate of sciarid flies against different insecticides

Ø-I- Sl. No	dhVuk'kd Insecticide	% eR;nj % Mortality	l'kkf/kr eR;nj Corrected mortality
1	MkbDykjok l @Dichlorvos	90.00	88.09
2	behMkDykfiM@Imidacloprid	65.33	58.72
3	eykfFk;ku@Malathion	46.00	35.71
4	fFkvkfeFkD le@Thiamethaxam	67.33	61.10



Q- QlykÙrj@i'p Qly ic/ku
D. POST HARVEST MANAGEMENT

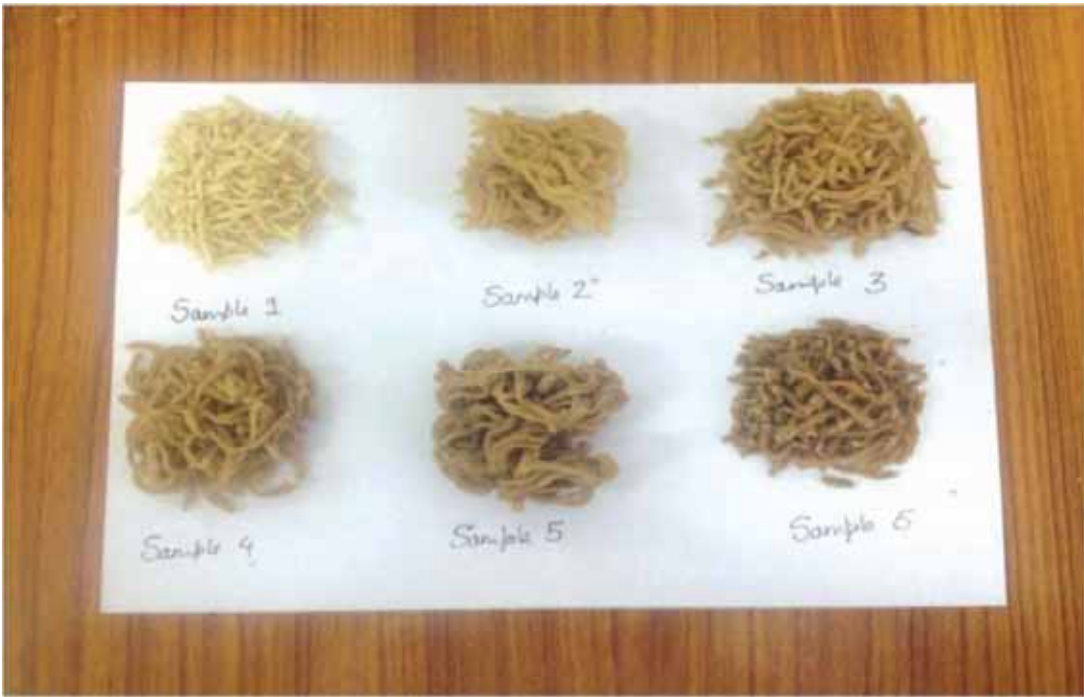
[kEc vk/kkfjr iof/kr vFkok fefJr lfo/kktud
[kk] dk fodkl fd;k x;k] ftle [kEc iof/kr
uMYI rFkk [kEc vk/kkfjr 'kkdkgkj dckc ¼ lkl t½
'kkfey gA [kEc ¼ IV; jkVl vkfLV; V/ ½ ikmMj d
xfMM Lrjk d lFk rjr iddj r;kj gku oky
uMYI dk v/; u budh ik"kf.kd ,o lonh fo'k"krkvk
d fy, fd;k x;k vkj uMYI vkV e 4 ifr'kr [kEc
ikmMj d QkvhfQd'ku dk b"Vrehdj.k fd;k x;kA
[kEc fefJr uMYI

[kku d fy, rjr r;kj gku oky uMYI d
ik"kf.kd] lonh vkj cukoV lc/kh x.koRrk ekinMk ij
[kEc d ikmMj dk fofHkUu ek=k e feyku ij ik"k.k
vuifr d iHkkok dk eY;kdu fd;k x;kA 2&10
ifr'kr vk,LVj [kEc ikmMj dk feyk;k x;k vkj
fu;=d ¼100 ifr'kr xg vkV uMYI½ d edkcy
ik"k.krk dk fo'y"k.k fd;k x;kA [kEc ikmMj dh

Mushroom based fortified convenience foods
such as mushroom fortified noodles and mushroom
based vegetarian sausages have been developed. Ready
to cook instant noodles fortified with graded levels
of mushroom (*Pleurotus ostreatus*) powder was
studied for their nutritional and sensory properties
and fortification of mushroom powder @ 4 % to
noodle dough was optimized.

Mushroom Fortified Noodles

Effects of nutrient supplementation from
mushroom powder at various levels were evaluated
on nutritional, sensory and textural quality parameters
of instant noodles. Supplementation was done
ranging from 2-10% of oyster mushroom powder
and analysis was done against control (100% wheat



fp= ¼ 2-25- [kEc fefJr uMYI
Fig. 2.25. Mushroom fortified noodles



vuifr e of) dju ij uMYI dk idkr le; idku d le;] ty vo'kk"K.k nj] rU; In<rk vkj Bkl ud lku d lc/k e of) 'khy :>ku n[ku dk feykA ;g :>ku 4 ifr'kr dh nj ij [kEc ikmMj dk feyku ij dgh vf/kd Li"V :i l nf"Vxkpj gvkA [kEc ikmMj dh ek=k e c<krjh dju ij ikVhu dh ek=k e Hkh of) gbA c<h gb ikVhu vkj j'kk ek=k oky [kEc l fefJr uMYI dk vudyure dfdx x.koRrk vkj lonh fo'k"krkvk d lkFk lQyrkiod r;kj fd;k x;kA

[kEc d ikmMj l tgg uMYI dh ikVhu] j'kk vkj jk[k dh ek=k e l/kkj vk;k ogh n l jh vkj bue olk dk Lrj fu;=d uMYI d lerY; gh cuk jgkA [kEc d ikmMj dk feJ.k dju l uMYI dh ty vo'kk"K.k rFkk rU; In<rk c<h yfdu lkFk gh ble idkr le; yxu oky le; vkj Bkl ud lku e Hkh of) n[ku dk feyha vfre xBu e 4 ifr'kr rd [kEc ikmMj dh lknrk dk lhfer j[kr g, cgrj Lohdk;r oky uMYI fodflr fd;k x;kA

[kEc vk/kkfjr 'kkdkgkjh dckc %lklt%

x.kkRed fo'k"krkvk vkj ik"kf.kd x.kk ij ckbFUMx ,tUVk %djkxhuu] lk;k ikVhu lkn] dftu rFkk tUFke xkn% dh fofHkuu ek=k d iHkko dk v/;;u 5 ifr'kr lrlr olk okyh [kEc vk/kkfjr dckc lkn'; ij fd;k x;kA ckbFUMx ,tV d :i e djkxhuu d lkFk cu ueuk e cgrj ljpukRed x.k %o/ku ifrjlf/krkj ifj'kk/ku ud lku] beY'ku fLFkjrkk ik, x,A djkxhuu l cu ueuk e mPprj mit vkmViV vkj derj dfdx ud lku Hkh inf'kr gvkA ljpukRed rFkk mit fo'k"krkvk d lc/k e djkxhuu ueuk d mijkr tUFke xkn l cu dckc d ueuk dk n l jk loJ"B vdkd x;kA djkxhuu dh ek=k e of) dju ij o/ku] ifj'kk/ku ud lku vkj dfdx ud lku e deh vkj] tcf d mit] beY'ku fLFkjr e l/kkj n[ku dk feykA

noodles). Increasing trend was observed with respect to cooking time, water absorption rate, tensile strength and solid loss while cooking along with the increase in mushroom powder supplementation. This trend was more conspicuous after supplementation of mushroom powder more than 4 %. Protein content increased remarkably with increasing fortification of mushroom powder. Mushroom fortified noodles with enhanced protein and fibre content were successfully produced with optimum cooking quality and sensory characteristics.

Mushroom powder improved the protein, fibre and ash content of noodles keeping fat levels at par with control. Fortification increased the water absorption and tensile strength of noodles but also simultaneously increased the cooking time and solid loss during cooking. Noodles with good acceptability were developed keeping the mushroom powder concentration limited to 4% in final formulation.

Mushroom Based Vegetarian Sausages

Effect of binding agents (carrageenan, soya protein concentrate, casein and xanthan gum) at different concentrations on quality characteristics and nutritional properties was studied on mushroom based sausage analogs made with 5% saturated fat. Better textural properties (penetration resistance, purge loss, emulsion stability) were observed in samples made with carrageenan as binding agent. Samples made with carrageenan also showed higher yield output and lower cooking loss. Sausage samples with xanthan gum were rated as second best after carrageenan samples in terms of textural and yield properties. With increasing carrageenan concentration penetration, purge loss and cook loss decreased while yield, emulsion stability improved in analog sausages.



ckbfUMx , tUVk dk feyku l [kEc vk/kkfjr dckc dh x.kkRed fo'k'krkvk ij mYy[kuh; : i l iHkko iMkA l Hkh ckbFUMx , tUVk }kjk ty ck/dkjh fo'k'krkvk rFkk beY'ku fLFkjr e l/kkj n[ku dk feykA ckbFUMx ;kx'khy dh lknrk e of) dju ij [kEc vk/kkfjr dckc dh ckbFUMx fo'k'krkvk e Hkh l/kkj vk;kA 0.8 ifr'kr dh nj ij djxhuu dk feyku l ifj'kk/ku ud lku rFkk dfdx ud lku dk de dju e rFkk beY'ku fLFkjr dk c<ku e loJ"B ifj.kke inf'kr g, ftll fd mit e l/kkj vk;kA tUFke xln dk feyku l Hkh ty ckbFUMx fo'k'krkvk d lck evk'kk tud ifj.kke iklr g, tcfd rnijkr cgrj ifj.kke , l i h l h vkj dftu dk feyku ij iklr g,A

cVu [kEc dk [kku; ;kX; yiu

yfir mRikn d thou&dKy vFkok fu/kkuh vk; dk fo'y"K.k dju gr fXyljky] dkbVkl u rFkk dkckDlhfeFkkby lyykt d LifMx ?kky e Nuk iKVhu] ,YQk VkdKfQjky ,o d,e,l dh rhu ek=kvk dk mi ;kx fd;k x;kA fcuk yfir mRikn dk mi ;kx udjkRed fu;=d rFkk gkbMktu ijkD lkbM l /ky [kEc dk mi ;kx ldkjRed fu;=d d : i e fd;k x;kA

Addition of binding agents significantly affected the quality characteristics of mushroom based sausage. All the binding agents demonstrated the improvement in water binding properties and emulsion stability. With an increase in the concentration of binding additives the binding properties of mushroom based sausages also improved. Carrageenan addition at 0.8% showed best results in reducing purge loss and cook loss and increasing emulsion stability thereby improving process yield. Xanthan gum also delivered promising results to provide water binding properties followed by SPC and casein.

Edible Coating of Button Mushroom

Three concentrations of whey protein, alpha-tocopherol and KMS have been used in spreading solutions of glycerol, chitosan and carboxymethyl cellulose to analyse the shelf life of coated product. Uncoated product was used as negative control and



fp= % 2-26- [kEc d: thou&dKy vFkok fu/kkuh vk;| ij fofHkUu [kku; ;kX; yiu mipkjk dk iHkko
Fig.2.26. Effect of different edible coating treatments on shelf life of mushrooms



[kEc dk mipkj fofHkUu idkj dh [kku ;kx; yiu l kexh d l kFk fd;k x;k vkj ml vudy ifjflFkfr;k e jYhtjVj e HkMkfjr fd;k x;kA nkuk idkj dh HkMkj.k ifjflFkfr;k d rgr , t kbe xfrfof/k %fd.od Hkjkiu] ihihv k l fØ;rk ,o V k;jkflut l fØ;r k½] dy ?kyu'khy Bkl inkFk v'k] jx e cnyko rFkk Hkkj e ud l ku dk ijh{k.k dju d fy, ckn e fo'y" k.k fd;k x;kA 12 fnu dk lcl vf/kd thou&d ky lh,e lh ?kky e 0-5 ifr'kr ,Ldkfcd vEy l yfir ueuk vkj jYhtjVjM ifjflFkfr;k e iu% HkMkfjr fd, x, ueuk e ik;k x;kA

jYhtjVjM rFkk vudy nkuk ifjflFkfr;k e , t kbe xfrfof/k %fd.od Hkjkiu] ihihv k l fØ;rk ,o V k;jkflut l fØ;r k½] dy ?kyu'khy Bkl inkFk v'k] jx e cnyko rFkk Hkkj e ud l ku dk ijh{k.k dju d fy, fo'y" k.k fd;k x;kA jYhtjVjM ifjflFkfr;k e j [k x; lh,e lh ?kky e 0-5 ifr'kr ,Ldkfcd vEy l yfir ueuk e 12 fnu dk thou&d ky ik;k x;kA

[kEc vif'k"V ik"kk/kkj %, l,e,l % l t o b/ku mRiknu ij eyHkr v/;;u

to b/ku d mRiknu d fy, [kEc vif'k"V ik"kk/kkj l lyykftd to Hkkj dh {kerk dh t k p dh xba ,xfjd l ckbLi kj l] okYofj;yk okYofl ;k]

H₂O₂ washed mushrooms were used as positive control.

Mushrooms were treated with different edible coating materials and stored at refrigerated and at ambient conditions. Later analysis was done to test the enzyme activity (enzymatic browning, PPO activity and tyrosinase activity), TSS, color change and weight loss under both the storage conditions. Maximum shelf life of 12 days was observed with the samples coated with 0.5 % ascorbic acid in CMC solution and further stored at refrigerated conditions. Analysis of enzyme activity (enzymatic browning, PPO activity and tyrosinase activity), TSS, color, weight loss was done in fruit bodies stored at both refrigerated and ambient conditions. Samples coated with 0.5% ascorbic acid in CMC solution kept in refrigerated conditions exhibited a maximum shelf life up to 12 days.

Basic Studies on Bio fuel Production from SMS

The potential of cellulosic biomass from spent mushroom substrate for biofuel production was investigated. The preliminary screening studies conducted on spent substrate of *Agaricus bisporus*, *Volvariella volvacea*, *Pleurotus ostreatus*, *Calocybe*

l kj.kh % 2-27- fofHkUu [kEc d vif'k"V [kkn e dy 'kdijk] ?kVh gb l 'kdijk vkj fyfxuu ek=k dh l knrk
Table 2.27. Concentration of total sugars, reducing sugars and lignin content in spent compost of different mushrooms

Sl. No.	Spent substrate	Total sugars (µg/ml) dy 'kdijk (µg/ml)	Reducing sugars (µg/ml) 'kdijk ek=k e deh (µg/ml)	Lignin (µg/mg) fyfxuu (µg/mg)
Ø-l-	vif'k"V ik"kk/kkj			
1	,xfjd l ckbLi kj l @ <i>Agaricus bisporus</i>	45	72	20
2	okYofj;yk okYofl ;k @ <i>Volvariella volvacea</i>	50	83	32
3	iY;jkVI vflLV;VI @ <i>Pleurotus ostreatus</i>	23	74	22
4	dyk l kbc bf.Mdk @ <i>Calocybe indica</i>	13.5	86	28
5	yfUVU;yk bMMI @ <i>Lentinula edodes</i>	28	71	18



ly;jkVI vflLV;VI] dykI kbc bf.Mdk] yfUVU;yk
bMkMI d vif'k"V ik"kk/kkj ij vk;kftr ikjfhkd
tkp d v/;;uk e irk pyk fd okYofj;yk okYofI;k
d [kEc vif'k"V ik"kk/kkj I dgh vf/kd dy 'kdjk
vkj fyfxuu ek=k feyh vkj budk p;u iu v/;;uk
d fy, fd;k x;kA

fyfxuu dk gVku dh ifØ;k dk b"Vrehdj.k
4×4×4 IhvkjMh fo'y"K.k dk mi;kx djd 30] 60]
90 rFkk 120 feuV d fy, rkieku 40] 50] 60 rFkk
70 fMxh I-½ ij NaOH (.25,e,.50,e,.75,e rFkk 1,e)
dk vui;kx djr g, fd;k x;kA b"Vre ueuk I vipk;h
'kdjk dk tkjh dju d fy, lyykt rFkk tk;ykut I
iu mipkfjr fd;k x;kA b"Vrehdj.k d fy, fMtkbu
fo'k"K I kQVo;j dk mi;kx fd;k x;kA

indica, Lentinula edodes revealed that SMS of
Volvariella volvacea gives the higher total sugars and
lignin content which is suitable for biofuel production
and selected for further studies.

Optimization of lignin removal was done by
using NaOH at different concentrations such as
0.25M, 0.50M, 0.75M and 1.0 M and at different
temperatures of 40, 50, 60 and 70 °C for 30, 60, 90
and 120 min using 4×4×4 CRD analysis. NaOH of
0.50M concentration for 90 min at 70 °C was
optimized. The optimized sample was further treated
with cellulase and xylanase for release of reducing
sugars. Design expert software was used for
optimization.

Ikj.kh % 2-28- fofHkUu le; vUrjky ij vipk;h 'kdjk dh lknrk dk b"Vrehdj.k

Table 2.28. Optimization of reducing sugars concentration at different time intervals

Ø-I-	ekud	ju	,tkbe lknrk	le;	rkieku	lknrk
Sl. No.	Std.	Run	Enzyme conc.	Time	Temp.	Conc.
1	12	1	6.00	80.18	37.5	464.18
2	18	2	6.00	60.00	37.5	531.48
3	15	3	6.00	60.00	37.5	456.96
4	1	4	4.00	48.00	25.0	358.75
5	19	5	6.00	60.00	37.5	495.67
6	3	6	4.00	72.00	25.0	347.78
7	10	7	9.36	60.00	37.5	737.72
8	6	8	8.00	48.00	50.0	533.22
9	14	9	6.00	60.00	58.5	370.48
10	17	10	6.00	60.00	37.5	558.64
11	16	11	6.00	60.00	37.5	681.40
12	9	12	2.64	60.00	37.5	435.01
13	11	13	6.00	39.82	37.5	801.27
14	2	14	8.00	48.00	25.0	1190.06
15	20	15	6.00	60.00	37.5	551.70
16	8	16	8.00	72.00	50.0	1212.88
17	7	17	4.00	72.00	50.0	1112.07
18	4	18	8.00	72.00	25.0	532.06
19	13	19	6.00	60.00	16.5	53.48
20	5	20	4.00	48.00	50.0	464.18



Training on post-harvest management of mushrooms

Product specific hands training programmes were designed to the farmers, farm women and entrepreneurs on the preparation of various value added products from mushrooms such as pickles, soups, cakes, biscuits and candies. Three such trainings were imparted during the reporting period.

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Fig. 2.27. Training on preparation of value added products from mushroom



3.

ik | kfxdh gLrkrj.k

Transfer of Technology

vk;kftr if'k{k.k dk;Øe

o" 2015 d nkjku] fun'kky; }kjk fd lkuk] df"kr efgykvk] m | fe;k] vf/kdkfj;k vkj df" foKku dUnk d oKkfudk d fy, dy feyk dj pkg] fun'kky; e rFkk fun'kky; d ckj if'k{k.k dk;de vk;kftr fd, x,A

Training programmes conducted

During 2015, the Directorate organized a total number of fourteen on and off campus training programmes for farmers, farmwomen, entrepreneurs, unemployed youth, officers and scientists of KVKs.

Ikj.kh % 3-1- Hkkdvui & [kEc vu l/kku fun'kky;] Ikyu %fgepy in'k% }kjk vk;kftr if'k{k.k dk;Øe dh lph
Table 3.1. List of training programmes organized by the ICAR-Directorate of Mushroom Research, Solan (HP)

Ø- I- Sl. No.	if'k{k.k dk;Øe dk fo"i; vkj vk;k tu LFky Topic and venue of the Training Programme	fnukd Date	if'k{k vk; dh l[;k Number of trainees	ikB;Øe fun'kd ,o l elo;d Course Director and Coordinator
1	m fe;k d fy, [kEc [krh ik kfxdh ij if'k{k.k- i] Hkkdvui&Mh,evkj] Ikyu	21 & 30 viy] 2015	60	Mk- oh-i-h- 'kek Mk- l rh'k dekj
1	Training on mushroom cultivation technology for entrepreneurs- I at ICAR - DMR, Solan.	21 st -30 th April, 2015	60	Dr. V. P. Sharma Dr. Satish Kumar
2	fd lkuk d fy, [kEc [krh ik kfxdh ij if'k{k.k- i] Hkkdvui&Mh,evkj] Ikyu	20&26 eb] 2015	110	Mk- vk-i-h- vgykor
2	Training on mushroom cultivation technology for farmers- I at ICAR - DMR, Solan.	20 th -26 th May, 2015	110	Dr. O. P. Ahlawat
3	fd lkuk d fy, [kEc [krh ik kfxdh ij if'k{k.k- ii] Hkkdvui&Mh,evkj] Ikyu	22 & 28 fl rEcj] 2015	87	Mk- ;x'k xkre Jh l/khj vui
3	Training on mushroom cultivation technology for farmers- II at ICAR - DMR, Solan.	22 nd -28 th September, 2015	87	Dr. Yogesh Gautam Sh. Sudheer Kumar Annepu
4	m fe;k d fy, [kEc [krh ik kfxdh ij if'k{k.k- ii] Hkkdvui&Mh,evkj] Ikyu	12 & 21 vDrcj] 2015	55	Mk- l rh'k dekj Mk- egur'k f'k: j
4	Training on mushroom cultivation technology for entrepreneurs – II ICAR - DMR, Solan.	12 th -21 st October, 2015	55	Dr. Satish Kumar Dr. Mahantesh Shirur
5	jkT; cixokuh foHkkx d vf/kdkfj;k d fy, [kEc dh [krh ik kfxdh ij ik;kftr if'k{k.k dk;Øe& Hkkdvui&Mh,evkj] Ikyu	27 uoEcj l 4 fn lEcj] 2015	23	Mk- ;x'k xkre
5	Sponsored training programme on mushroom cultivation technology for officials of state department of horticulture at ICAR - DMR, Solan.	27 th November – 4 th December, 2015	23	Dr. Yogesh Gautam



Ø- I- Sl. No.	if'k{k.k dk;Øe dk fo'k; vkj vk;ktu LFky Topic and venue of the Training Programme	fnukd Date	if'k{kvk dh I[;k Number of trainees	ikB;Øe fun'kd ,o l elo;d Course Director and Coordinator
6	Hkkdvui & [kEc vul/kku fun'kky:] Ikyu ½fg-i-½ e fdUukj ½fg-i-½ d tu tkrh; ykxk d fy, if'k{k.k	9 & 11 fn l Ecj] 2015	34	Mk- egUr'k f'k: j
6	Training on mushroom cultivation technology for tribal people from Kinnaur (HP) at ICAR - DMR, Solon.	09 th -11 th December, 2015	34	Dr. Mahantesh Shirur
7	xkok jkT; d tutkrh; lenk; d fy, [kEc dh [krh rduhd ij if'k{k.k	6 & 8 t u o j h] 2016	40	Mk- oh-ih- 'kek Mk- egUr'k f'k: j
7	Training on mushroom cultivation technology for tribals of Goa State.	06 th - 08 th January, 2016	40	Dr. V. P. Sharma Dr. Mahantesh Shirur
8	djy jkT; dh tutkrh; efgykvk d fy, [kEc [krh rduhd ij if'k{k.k	28 & 30 t u o j h] 2016	31	Mk- l rh'k dekj Mk- egUr'k f'k: j
8	Training on mushroom cultivation technology for tribal women of Kerala State.	28 th - 30 th January, 2016	31	Dr. Satish Kumar Dr. Mahantesh Shirur
9	egkj.k.k irki df'k o ik[kfxdh fo'ofokky:] mn;ij e jktLFkku d tutkrh; lenk; d fy, [kEc dh [krh rduhd ij if'k{k.k	4 & 5 ekp] 2016	30	Mk- vkj-lh- mik/;k; Mk- egUr'k f'k: j
9	Training on mushroom cultivation technology for tribals of Rajasthan at MPUAT, Udaipur.	04 th – 05 th March, 2016	30	Dr. R. C. Upadhyay Dr. Mahantesh Shirur
10	leLrhij e fcgkj d tutkrh; ykxk d fy, [kEc dh [krh rduhd ij if'k{k.k	8 & 10 ekp] 2016	30	Mk- 'or dey Mk- egUr'k f'k: j
10	Training on mushroom cultivation technology for tribals of Bihar at Samastipur.	08 th – 10 th March, 2016	30	Dr. Shwet Kamal Dr. Mahantesh Shirur
11	df'k foKku dUn] ukjk; .kxko] i.k e egkj"V d tutkrh; ykxk d fy, [kEc dh [krh rduhd ij if'k{k.k	17 & 19 ekp] 2016	30	Mk- vk-ih- vgykor Mk- ;kx'k xkre
11	Training on mushroom cultivation technology for tribals of Maharashtra at KVK, Narayanagaon, Pune.	17 th – 19 th March, 2016	30	Dr. O. P. Ahlawat Dr. Yogesh Gautam
12	fetkje fo'ofokky:] ,toky e mRrj ioh jkT;k d fuokfl;k d fy, tutkrh; ykxk d fy, [kEc dh [krh rduhd ij if'k{k.k dk;Øe	21 & 22 t u o j h] 2016	58	Mk- l rh'k dekj Mk- egUr'k f'k: j
12	A training programme on mushroom cultivation technology for the residents of North Eastern States at Mizoram University, Aizawl.	21 st – 22 nd January, 2016.	58	Dr. Satish Kumar Dr. Mahantesh Shirur
13	bEQy] ef.kij e mRrj ioh jkT;k d fuokfl;k d fy, tutkrh; ykxk d fy, [kEc dh [krh rduhd ij if'k{k.k dk;Øe	14 & 15 ekp] 2016	30	Mk- egUr'k f'k: j Jh l/kh] dekj vui
13	A training programme on mushroom cultivation technology for the residents of North Eastern States at Imphal, Manipur.	14 th – 15 th March, 2016	30	Dr. Mahantesh Shirur Sh. Sudheer Kumar Annepu
14	bEQy] ef.kij e mRrj ioh jkT;k d fuokfl;k d fy, tutkrh; ykxk d fy, [kEc dh [krh rduhd ij if'k{k.k dk;Øe	16 & 17 ekp] 2016	45	Mk- egUr'k f'k: j Jh l/kh] dekj vui
14	A training programme on mushroom cultivation technology for the residents of North Eastern States at Imphal, Manipur.	16 th - 17 th March, 2016	45	Dr. Mahantesh Shirur Sh. Sudheer Kumar Annepu



Fig. 3.1. Interaction with the entrepreneurs during the training programme



Fig. 3.2. Practical demonstration of compost preparation during the training programme



[kEc eyk&2015

fun'kky; dh fu;fer xfrfof/k d : i e fnukd 10 fl rEcj] 2015 dk ,d fno l h; **jk"Vh; [kEc eyk** vk; kft r fd;k x; kA bl ey dk mn?kkVu Jh Ij'k pny] ekuuh; InL;] 'kk l h fudk;] Hkkjrh; df"kvu l/kku ifj"kn] ub fnYyh u fd;kA bl ey e fofHkUu jkT;k ; Fkk fgeky in'k] gfj;k.kk] itkc] vkfM'kk] egkj"V] jkt LFkkU] vku/k in'k] fnYyh] duVd] vle] fcgkj] djy o rfey ukM l dy feykdj 700 l Hkh vf/kd fd l kuk] df"kr efgykvk] [kEc mRikndk] vu l/kkudfe;k] i l kj dkfedk rFkk m|fe;k u Hkkx fy;kA bl ey e Hkkjrh d 14 l Hkh vf/kd jkT;k d ifrfuf/k; k u Hkkx fy;kA

ey e [kEc dh [krh ij mUur ik] kfxfd;k rFkk vU; lcf/kr igyv k dk inf'kr fd;k x;k ft le fofHkUu ljdkjh lxBuk(Hkkdvui d lLFkkuk@ fo'fo|ky;k(ljdkjh foRrh; lxBuk(dEiLV ,o [kEc cht mRikndk(,;j gMfyx i.kkyh] 'khyu i.kkyh] okrkoj.k fu;f=r QlypØ d{kk d fuek.kdrkvk(cht o dhVuk'kd rFkk jlk;uk d mRikndk vkj xj ljdkjh lxBuk u viu eY;oku mRiknk@lpukvk@ik] kfxfd;k dk inf'kr fd;k vkj viuh lok, [kEc ey d ifrHkkfx;k dk miyC/k djkbA e[; vfrfFk Jh Ij'k pny u in'kuh dk mn?kkVu fd;kA Mk- Vh-,u- y[ku iky] ifr"Br [kEc fo'k"K] jk"Vh; [kEc eyk&2015 d fof'k"V vfrfFk FkA

ey e Hkkx yu oky vxUrdk e [kEc dh [krh dh fofHkUu mUur ik] kfxfd;k@ [krh dh jhfr;k d ckj e tkx:drk mRiUu dju d mnn'; l mUg fun'kky; dh Qly mRiknu d{k@bdkb;k dk nkjk dj;k;k x;k vkj [kEc ey e vk, ifrHkkfx;k d lEe[k mUur ik] kfxfd;k dk inf'kr fd;k x;k; kA

[kEc ey e nkigj mijkur l= e ,d fd l ku xk"Bh vk; kft r dh xb ft le [kEc mRikndk }kj

Mushroom Mela-2015

One day 'National Mushroom Mela' was organized on 10th September, 2015 as regular activity of the Directorate. It was inaugurated by Shri. Suresh Chandel, Honorable Member, Governing body, ICAR. It was attended by about 700 farmers, farmwomen, mushroom growers, researchers, extension workers and businessmen from various states viz, Himachal Pradesh, Haryana, Punjab, Odisha, Maharashtra, Rajasthan, Andhra Pradesh, Delhi, Karnataka, Assam, Bihar, Kerala, Tamil Nadu. The representatives from more than 14 states of India attended the mela.

An exhibition on improved technologies of mushroom cultivation and other related aspects was organized in which various Govt. Organizations, ICAR Institutes/Universities, Govt. financial organization, compost and spawn producers, manufacturers of Air handling system, chilling system, environment controlled cropping rooms, mushroom product, seed and pesticides and chemical producers and NGOs displayed their valuable information/technologies/products and provided their services to the participants of the *Mushroom Mela*. Chief guest Shri. Suresh Chandel inaugurated the Exhibition. Dr. T. N. Lakhan Pal, eminent mushroom expert was the guest of honour during the National Mushroom Mela-2015.

In order to create awareness on various improved technologies / practices of mushroom cultivation to the participants, farm visit of the growing units of the Directorate was conducted and demonstrations on improved technologies were given in front of the participants of *Mushroom Mela*.

In the afternoon session of *Mushroom Mela*, a *Kisan Goshthi* was held to answer the problems in



fp= 3-3- [kEc ey&2015 dk mn?kkVu
Fig. 3.3. Inauguration of Mushroom Mela 2015



fp= 3-4- [kEc eyk&2015 d nkjku ifrf"Br
vfrffk;k }kjk in'kfu;k dk Hke.k
Fig. 3.4- Distinguished guest visiting exhibition during
Mushroom Mela 2015



fp= 3-5- jk"Vh; [kEc eyk 2015 d nkjku ixfr'khy mRikndk dk lEeku
Fig 3.5. Felicitation of progressive mushroom growers during National Mushroom Mela-2015

[kEc dh [krh e egll dh tk jgh leL;kvk d mRrj fn, x,A [kEc mRikndk vkj fd lkuk }kjk iN x, i'uk d mRrj ;ktuk) rjhd l fo'k"K iuy u fn,A

mushroom cultivation faced by mushroom growers. The problems raised by mushroom growers and farmers were replied by panel of experts in a very systematic manner.



[kEc ey d nkjku] fun'kky; }kjk 0;kid ieku ij [kEc dh [krh e uokUe"kh jhfr;k dk viuku vkj vkenuh d lkr d : i e [kEc dh [krh viuku d fy, rFkk vU; fd lkuk dk ifjr dju d fy, ikp ixfr'khy@uokUe"kh [kEc mRikndk dk ijLdkj inku fd, x,A lex Hkkjr l uhp of.kr ikp fd lkuk dk p;u fd;k x;kA

During the Mushroom Mela, the directorate awarded five progressive / innovative mushroom growers for adopting innovative practices in mushroom cultivation on larger scale and mobilizing other farmers to adopt mushroom cultivation as source of income. The five farmers mentioned below were selected across India.

I kj.kh% 3-2- l i i .k Hkkjr l i ixfr'khy [kEc mRiknd ijLdkj d fy, p;fur fd l ku

Table 3.2. Farmers selected for progressive mushroom growers award from all over India

Ø- l i -	fd l ku dk uke	mRikndk dh miyfC/k;k
Sl. No.	Name of the farmer	Achievements of growers
1	Jh inhi dlf'kd l i = Jh Hkhe lu] ohihvk x<h d'kjh] ihvk xUukj] rgl hy % xUukj] ft yk % l kuhir] gfj;k.kk	bUgku o"k 2004&05 e nk 'kMk e y?k Lrj ij ikjHk dh xb ek leh [krh dk /khj&/khj c<kdj 21 'kMk e dj fy;k ft l dh iR;d dh dEikLV vFkok [kkn dh {kerk 5 Vu gA o"k 2014&15 e budk 'k) ykHk : i; 17]00]000-00 jgk] tk fd vk; l tu rFkk dy jktxkj mRiUu dju d ekey e ljkguh; gA
1	Shri Pardeep Kaushik, S/o Shri Bhim Sain, VPO Garhi Keshri, P.O. Gannaur, Tehsil - Gannaur, Dist - Sonipat, Haryana.	Beginning in 2004-05 with a small scale seasonal cultivation in two sheds he has gradually increased to 21 sheds having capacity to hold 5 tons each of compost. His net profit of Rs.17.00 Lacs in the year 2014-15 was praiseworthy in terms of income generation and the total employment opportunities created.
2	Jh Mh- ;ojkt] ic/kdh; fun'kd] e l l uhyxfj Qke ikM; l fy-] 3@46 b] efdukj xko] vkVVj iyk;e] ikLV % vUuj & 641 653] ft yk % dk;EcVj] rfey ukM	Jh ;ojkt] nf{k.k Hkkjr d lcl cM cVu [kEc rFkk to&dEikLV@[kkn d mRikndk e l ,d gA Jh ;ojkt }kjk pykb tk jgh bdkb e 60]000 cx dh {kerk oky vPNh fMtkbu d Økfix@Qly mRiknu dejk d l kFk 4 Vu {kerk okyh ,d vk/kfud 'khr d{k lfo/kk gA bdkb e mRiUu to dEikLV vFkok [kkn l u doy bud viu l ;= dh t : jr ijh gkrh g oju rfey ukM e [kEc dh [krh dju oky vud fd l ku Hkh b l l ykHk mBkr gA Jh ;ojkt 1-7 fdxk- ifr cx dh vklr l ifrfnu 1500 fdxk- [kEc dk mRiknu dju e leFk gA ifr ekG 6000 [kEc cht cx mRiUu dju dh {kerk okyh budh viuh [kEc cht i ;kx'kkkyk gA budh dEiuh vc viu [kEc m]e e yxHkx 180 ykxk dk jktxkj miyC/k djkrh gA
2	Shri D.Yuvaraj, Managing Director M/S Nilgiri Farm Produce Limited, 3/46 E, Mekinar Village, Ottar Palayam, Post- Annur - 641653, Coimbatore Dt., Tamil Nadu	One of the South India's largest button mushroom and bio-compost producers. The unit owned by Mr. Yuvraj has a modern cold room facility with 4 tons capacity with well-designed copping rooms of 60,000 bags capacity. The bio-compost produced from the unit besides meeting the requirement of his own plant, enables several farmers to take up mushroom cultivation in Tamil Nadu. Mr. Yuvaraj is able to produce 1500kg button mushroom per day with an average of 1.7 Kg per bag. He has his own spawn laboratory having the capacity to produce 6000 spawn bags per month. His company now offers employment to nearly 180 people in his mushroom enterprise.



Sl. No.	Name of the farmer	Achievements of growers
3	Jh I jUn gMk I i= Jh cuh fIlg ikuhi r] gfj;k.kk	ikjHk e Jh I jUn gMk u 150 fDoVy xg d HkI d doy 5 'kM d I kFk y?k Lrj ij dk; ikjHk fd;kA oreku e] bud }kjk cM ieku ij [kEc dh [krh dh t k jgh g ft le xg d HkI dk 2000 fDoVy I vf/kd ek=k e j[k j[kko fd;k tkrk g vkj mI dk bLreky yxHkx 45 'kMk e fd;k tkrk gA buGku dEikfLVx vFkok [kkn r;kj dju dh nh?k fof/k I x.koRrk;Dr dEikLV@[kkn r;kj fd;kA Jh gMk ek leh mRiknu d fy, yxHkx 30 yk[k : i; dk fuo'k djr g vkj N% eghuk d fy, 25 etnj k dk jktxkj inku djr gA iR;d ek le budk 'k) ykHk 20 yk[k : i; gA budh IQyrk I ifjr gkdj cMh I [;k e ykx [kEc dh [krh dk viuku d fy, vkx vk, gA
3	Shri Surender Hooda, S/o Sh. Bani Singh, Panipat, Haryana	Initially he started at low scale by putting only 5 sheds of 150 qt. wheat straw. Presently, he is cultivating at large scale, handling more than 2000 quintals of wheat straw and puts around 45 sheds. He prepares quality compost by long method of composting. Mr. Hooda invests around Rs. 30 lacs for seasonal growing & employs 25 labourers for six months. His net income is Rs.20 lacs per season. His success has made many people to adopt mushroom cultivation in a large way.
4	Jh vfuy dekj Iuh I i= Jh ejyh eukgj Iuh] fgI kj] gfj;k.kk	ikjHk e Jh vfuy dekj Iuh u nh?k fof/k I [kkn r;kj djuk vFkok dEikfLVx djuk 'k: fd;k yfdu o"k 1997 d ckn I buGku ik'Pkjhdr@futehdr I jxk dk fuek.k dj d de le; okyh fof/k d ek/;e I [kkn r;kj dju dk dke ikjHk fd;kA fgI kj d fudV viuh ub [kEc bdkb e] buGku rhu ik'Pkjhdr I jx vkj rhu cdj cuk; gA bud ikI okrkoy.k fu;f=r I fo/kk oky N% QI y d{k g] ftue iR;d e 50 Vu [kkn vFkok dEikLV dh {kerk g vkj ek leh [krh d fy, 12 vLFk kb 'kM Hkh gA o"k 2014 I buGku [kEc dh xFMx rFkk Mfy;k idftx djuk vkj mRrj Hkjr d ie[k 'kgjk e mI dh vkifr djuk Hkh 'k: dj fn;k gA Jh Iuh] fgI kj [kEc mRiknd dkijVo d I LFk ki d Hkh gA buGku 25 ykxk dk LFk kb jktxkj vkj ek leh [krh d nkjku jktkuk 15&20 vkdfled etnj k dk jktxkj inku fd;k gA
4	Shri. Anil Kumar Saini S/o Sh. Murli Manohar Saini Hisar, Haryana	Initially he was preparing compost by long method but after 1997 he started preparing compost by short method by constructing the pasteurized tunnels. In his new mushroom unit near Hissar, he has constructed three pasteurized tunnels and three bunkers. He has six growing rooms with the facility of environment control each holding 50 tons of compost and 12 temporary sheds for seasonal cultivation. Since 2014 he has adopted grading and punnet packaging and sending the mushroom to major towns of North India. He is also the founder of Hissar district mushroom growers cooperative. He offers permanent employment to 25 persons and 15-20 casual labours are engaged daily for the seasonal cultivation.



Ø-I- Sl. No.	fd l ku dk uke Name of the farmer	mRikndk dh miyfc/k;k Achievements of growers
5	Jh idk'k otukFk] ykrj vkfn ,xk ekBQy] ftyk ykrj] egkj'k"V	Jh idk'k u viuh bthfu;fjx d Kku dk Ini;kx viu [kEc m e dk LFkcfir dju e fd;k t gk bUgku Åtk dh cpr dju vkj bdkb dh iHkko'khyrk e l/kkj yku d fy, co ₂ rFkk rkieku lUljk dk mi;kx djd uohure rkiojk/ku rduhd vkj vkVkekb't'ku d l kFk viuk [kEc m e yxk;kA Jh idk'k u okrkoj.k fu;f=r lfo/kk oky 18 Qly dejk okyh LVV vkQ fn vkV %mRd"V lfo/kkvk l l lfttr½ [kEc bdkb LFkcfir dh g] ft le ifr ekg 45&50 Vu rk tk cVu [kEc dk mRiknu gkrk g vkj l kFk gh bMkj fof/k l [kkn vFkok dEikLV Hkh r;kj fd;k tkrk gA viu [kEc Qke e 80 ykxk dk iR;{k rkj ij jktxkj nu d vykok Jh idk'k viu fty e vud NkV ek leh [kEc mRikndk dh vkt hfodk e Hkh enn djr gA
5	Shri Prakash Vaijinath Lature Aadi Agro Mathephal Latur district, Maharashtra	Shri Prakash Lature has made use of his engineering background to set up his mushroom enterprise with the latest insulation technology and atomization by using CO ₂ and temperature sensors for saving energy and improving efficiency of the unit. He has set up the state of the art mushroom unit with 18 growing rooms having environment control facility to produce 45-50 tonnes of fresh button mushroom per month and the facility to produce the compost by indoor method. Besides giving direct employment to more than 80 person in his mushroom farm, he supports the livelihood of many small seasonal mushroom growers in his district.

fcyk l ij %fg-i-½ e {k=h; [kEc eyk

Hkkdvui & [kEc vul/kku fun'kky;] lkyu %fgekpy in'k½ }kjk fnukd 1 ekp] 2016 dk fd l ku Hkou] fcyk l ij %fg-i-½ e ,d fno l h; {k=h; [kEc eyk vk;kftr fd;k x;kA bl ey e 400 l Hkh vf/kd fd l kuk] d f'kjr efgyk vk rFkk m|fe;k u Hkx fy;kA Jh l j'k pny bl lek jkg d e[; vfrfFk FkA viu ikjfhkd lck/ku e fun'kd egkn; u ykxk d chp [kEc dh [krh l lcf/kr rduhd d ckj e tkudkj h dk foLrkj dju vkj [kEc dh [kir dk c<ku d ckj e {k=h; ey d mnn'; ij l f{klr tkudkj h nhA Jh l j'k pny u bl fn'kk e fun'kky; }kjk fd, x, i;k l k dh l jkguk dh vkj ey d vk;k tu d fy, fun'kky; dk vkHkkj 0;Dr fd;kA bl vol j ij Mk- vkj-lh- mik/;k;] Mk- l rh'k dek ,o Mk- egUr'k f'k:j u mifLFkr ykxk dk fofHkUu idkj d [kEc rFkk mudh mRiknu rduhdk d ckj e lcf/kr fd;kA

Regional Mushroom Mela at Bilaspur

One day Regional Mushroom Mela was organised by the ICAR-Directorate of Mushroom Research, Solan (HP) at Kisan Bhavan, Bilaspur (HP) on 1st March, 2016. More than 400 farmers, farmwomen and entrepreneurs attended the mushroom mela. An exhibition and demonstration was also arranged for the benefit of visitors. Shri. Suresh Chandel was the chief guest of the function. In the inaugural session, the Director briefed about the idea of the regional mela for spreading the knowhow on mushroom cultivation technology and promotes the mushroom consumption among the people. Shri. Suresh Chandel thanked and appreciated the efforts of the Directorate in this direction. Dr. R. C. Upadhyay, Dr. Satish Kumar and Dr. Mahantesh Shirur delivered lectures on different mushrooms and their growing technologies to the gathering.



fp= 3-6- fcyk l ij e {k=h; [kEc eyk

Fig. 3.6. Regional Mushroom Mela at Bilaspur

ey d nkjku] , d fd l ku xk" Bh Hkh vk; kft r dh
xb ft le fd l kuk] df" kjr efgyk vkj m| fe; k u
[kEc dh [krh e ckj&ckj vku okyh leL; kvk d ckj
e Hkdvui & [kEc vul/ku fun'kky;] Ikyu %fgeky
in'kz d oKkfudk l ppk dhA fun'kd] Hkdvui &
[kEc vul/ku fun'kky;] Ikyu %fgeky in'kz u
Hkj l k fnyk; k fd {k= e [kEc dh [krh dk c<kok nu
e fun'kky; } kjk ; Fkk l Hko vf/kdre enn nh tk, xhA

jk"Vh; @jkT; Lrjh; in'kfu; k e Hkxhnhkj

Hkdvui & [kEc vul/ku fun'kky;] Ikyu %fgeky
in'kz } kjk [kEc dh [krh dk ikr l kfg r dju vkj
fd l kuk] m| fe; k rFkk l keku; tuk d chp [kEc dh
[krh rFkk [kir d ckj e tkudkj dh i l k dju gr
fu; fer : i l in'kfu; k vkj foKku eyk e viuh
Hkxhnhkj dh tkrh gA bu i l k xfrfof/k; k d vrxr
Hkdvui & [kEc vul/ku fun'kky;] Ikyu %fgeky
in'kz } kjk l kfgR; dk fu'kYd forj. k fd; k tkrk g]
eY; oky idk'kuk dh fcØh dh tkrh g vkj fun'kky;
} kjk iLrr lokvk d ckj e lpuk dk i l k fd; k
tkrk gA o" k 2015 e Hkdvui & [kEc vul/ku
fun'kky;] Ikyu %fgeky in'kz u fuEufyf[kr
in'kfu; k @ in'kuk e Hkx fy; kA

During the *mela*, a *kisan goshti* was also held in which the farmers, farmwomen and entrepreneurs discussed with the scientists from DMR about the problems they frequently encountered during the mushroom cultivation. The Director, ICAR-DMR, Solan assured that, DMR will extend maximum possible help to promote mushroom cultivation in the region.

Participation in National / State Level Exhibitions

The ICAR-Directorate of Mushroom Research, Solan (HP) participates regularly in exhibitions, science fairs to promote the mushroom cultivation and spread the information about mushroom cultivation, consumption among the farmers, entrepreneurs and the general public. Distribution of free literature, sale of priced publications, information dissemination about the services offered by the ICAR- DMR were undertaken in these outreach extension activities. The ICAR- DMR, Solan participated in the following Exhibitions/ Demonstrations in the year 2015.



3.2. Participation in exhibitions and regional fairs

Table 3.3. Participation in exhibitions and regional fairs

Sl. No.	Name of the Event participated	Date	Place
1.	Eastern Zone Regional Agriculture Fair, CPRS, Patna	19 th -21 st Feb, 2015	CPRS, Patna
2.	Kisan Mela organized at Sabji Mandi, Solan by Divya Himachal	10 th – 11 th March, 2015	APMC Market yard, Solan
3.	Kisan Mela, KVK, Muzzaffarnagar	27 th June, 2015	Muzzaffarnagar
4.	Shree Deen Dayal Upadhyay Smriti Mahotsav, Krishi Evam Gramya Vikas Pradarshani. Gramyotsava – 2015	9 th - 11 th October, 2015	Farah, Dist. Mathura (Uttar Pradesh)
5.	Farmers Fair	30 th Jan, 2016	IIVR, Varanasi (UP)
6.	Krishi Unnati Mela –2016	19 th – 21 st March, 2016	IARI, PUSA Campus, New Delhi

3.2.1. Participation in exhibitions and regional fairs

- Participation in Eastern Zone Regional Agriculture Fair, CPRS, Patna
- Participation in Kisan Mela organized at Sabji Mandi, Solan by Divya Himachal
- Participation in Kisan Mela, KVK, Muzzaffarnagar
- Participation in Shree Deen Dayal Upadhyay Smriti Mahotsav, Krishi Evam Gramya Vikas Pradarshani. Gramyotsava – 2015
- Participation in Farmers Fair
- Participation in Krishi Unnati Mela –2016

3.2.2. Training Programmes and Achievements under TSP and NEH

- A spawn laboratory has been set up at KVK, Sharbo, Kinnaur (HP) under TSP. The spawn lab is established with an intention to cater the demand for spawn from tribal people around Kinnaur district.
- Training for tribal people from Kinnaur (HP) was conducted at ICAR-Directorate of Mushroom Research, Chambaghat, Solan (HP) from 09-11th December, 2015. Total 34 tribal farmers participated from 8 villages of Dist.



ftyk fdUukj ¼fgeky in'k½ d vkB xkok d dy 34 tu&tkrh; fd lkuk u Hkkx fy; kA if'k{k fd lkuk dk Qly ic/ku d fy, vko'; d e'khujh dk forj.k fd;k x; kA l kFk gh if'k{k fd lkuk dk Hkkdvui & [kEc vul/kku fun'kky;] pEck?kkV lkyu d idk'kuk dk ,d ijk lV Hkh fn;k x; kA

- xkok jkT; d tu&tkrh; lenk; d fy, p[kEc dh [krh ik|kfxdh ij ,d if'k{k.k dk; Øe dk vk;ktu fnukd 6&8 tuojh] 2016 dk fd;k x; k ft le nk tu&tkrh; Cykd d ikp xkok l dy 40 fd lkuk u Hkkx fy; kA if'k{k fd lkuk dk Hkkdvui & [kEc vul/kku fun'kky;] pEck?kkV lkyu d idk'kuk dk ,d ijk lV fn;k x; kA
- djy jkT; dh tu&tkrh; efgykvk d fy, p[kEc dh [krh ik|kfxdh ij fnukd 28&30 tuojh] 2016 dk ,d if'k{k.k dk; Øe pyk; k x; kA bl if'k{k.k dk; Øe e dy 31 tu&tkrh; efgykvk u Hkkx fy; kA if'k{k.k dk; Øe d ifrHkkfx; k dk Qly d dejk e Qly ic/ku d fy, gkFk l pyku oky t:jh NKV Li;j fn, x,A if'k{k efgykvk dk Hkkdvui&[kEc vul/kku fun'kky;] pEck?kkV lkyu d idk'kuk dk ,d ijk lV Hkh fn;k x; kA
- mijkDr if'k{k.k dk; Øek d vykok] tu&tkrh; mi&ktuk d vrxr ekp] 2016 d nkjku i.l] leLrhij ¼fcgkj½ rFk mn; ij fLFkr vf[ky Hkkjrh; lefUor [kEc vul/kku ifj;ktuk dUnk d lg;kx l ogk rhu if'k{k.k dk; Øe vk;ktftr fd, x,A
- mRrj&ioh jkT; k d fuokfl;k d fy, [kEc dh [krh ik|kfxdh ij ,d if'k{k.k dk; Øe dk fnukd 21&22 tuojh] 2016 dk fetkje fo'ofokiy;] ,toky e vk;ktftr fd;k x; kA
- Hkkdvui&[kEc vul/kku fun'kky;] lkyu }kj mRrj&ioh iorh; {k= d fy, Hkkdvui dk vul/kku ifjlj] ef.kij dUnk d lg;kx l ekp] 2016 e bEQky e if'k{k.k dk; Øe d nk cp pyk, x,A

Kinnaur (HP). The machinery required for crop management was distributed to the farmers attending the training programme. A complete set of literature of ICAR-DMR, Solan was also given to the trainees.

- Training on "Mushroom Cultivation Technology" for tribals of Goa State was conducted from 06-08th January, 2016. Total 40 farmers participated from five villages of two tribal blocks. A complete set of literature of ICAR-DMR, Solan was given to the trainees.
- Training on "Mushroom Cultivation Technology" for tribal women of Kerala State was held on 28-30th January, 2016. Totally 31 tribal women attended the training. The small hand sprayers required for crop management in the growing rooms were distributed to the women attending the training programme along with a complete set of literature of ICAR-DMR, Solan.
- Besides the above training programmes, three training programmes under TSP were conducted with coordination from AICRP Mushroom centers at Pune, Samastipur and Udaipur during March, 2016.
- A training programme on "Mushroom Cultivation Technology" for the residents of North Eastern States has been conducted at Mizoram University, Aizawl from 21st -22nd January, 2016.
- Two batches of training programmes were organized by ICAR-DMR, Solan in collaboration with ICAR- Research Complex for NEH Region, Manipur centre at Imphal during March, 2016.



ejk xko&ejk xkjo ;ktuk

ekuuh; i/kkue=h }kjk Hkkjr; df"vul/kku ifj"kn d 87o LFkkiuk fnoI lekjg e ikjHk dh xb *ejk xko&ejk xkjo* ;ktuk u lHkh oKkfudk dk xkok dk vxhDr dju vkj i;kx'kkyk l [kr rd ik|kfxdh gLrkrj.k dh ifØ;k e rth yku e vxhDr xkok d fdlkuk d lEid e cu jgu d fy, ifrKkc) fd;k gA bl ;ktuk dk ykx dju e Hkkdvui & [kEc vul/kku fun'kky;] lkyu %fgekpy in'k% }kjk 5&5 oKkfudk dh nk ny cuk, x, gA bl ;ktuk dk ykx dju d fy, lkyu d vkl ikl d ckjg xkok dh igpku dj yH xb gA lcf/kr nyk }kjk bu lHkh xkok e vk/kkjHkr lo{k.k fd;k x;kA fun'kky; }kjk bl ;ktuk dk ykx dju d fy, igpku x; 12 xkok d pfuUnk fdlkuk d fy, [kEc dh [krh rduhd ij vukoj.k nkjk o ,d fnoIh; if'k{k.k dk;de vk;kftr fd;k x;kA



fp= 3-7- Ekjk xko&ejk xkjo ;ktuk d rgr fdlkuk d fy, [kEc mRiknu ik|kfxdh ij if'k{k.k o tkudkjh
Fig. 3.7 Exposure visit cum training programme on mushroom production technology for farmers under Mera Gaon Mera Gaurav scheme

fd lku&oKkfud&m|kx vke[k cBd

Hkkdvui&[kEc vul/kku fun'kky;] lkyu %fgekpy in'k% }kjk fnukd 16 fnlEcj] 2015 dk fd lku&oKkfud&m|kx d chip ,dfnoIh; vke[k cBd vk;kftr dh xbA [kEc dh [krh e 'kkfey vx.kh fdlkuk o m|fe;k rFkk Hkkdvui&[kEc vul/kku fun'kky;] lkyu %fgekpy in'k% ,p,vkblh]

Mera Gaon, Mera Gaurav Scheme

'Mera Gaon Mera Gaurav' scheme launched by Hon'ble Prime Minister during the 87th Foundation day of ICAR, stipulate all the scientists to adopt the villages and remain in touch with farmers of the adopted villages to hasten the lab to land process. To implement the scheme from the ICAR-Directorate of Mushroom Research, two teams were constituted consisting of 5 scientists in each team. Twelve villages around Solan were identified for implementation of the scheme.

A baseline survey was conducted in all the villages by respective teams. The institute organized an exposure visit cum one-day training programme on mushroom cultivation technology for selected farmers from 12 villages identified for implementing the scheme.



Farmer Scientist Industry Interface

One day Farmers Scientists Industry Interface was organized by ICAR-DMR, Solan on 16th December, 2015. Leading farmers, entrepreneurs involved in mushroom cultivation and scientists from DMR, Solan; HAIC, Murthal and Dr. Y S Parmar University



ejFky(rFkk Mk- okb-, l- ijeKj vk | kfudh ,o okfudh fo'ofok |ky;) ukuh d oKkfudk u b l dk; Øe e Hkkx fy ;kA

Mk- oh-ih- 'kek] fun'kd] Hkkdvui&[kEc vul/kku fun'kky;] Ikyu %fgekpy in'k% u fdLek d mUu;u] fdLeH; fodk l] tfod ruko ic/ku] u, [kEc dh [krh l lcf/kr rduhd vkj eY; o/ku d {k= e fun'kky; }kjk fd, x, gkfy;k vul/kku ;kxnu ij idk'k MkykA lcf/kr oKkfudk u 'or cVu [kEc d u, LVu] f'kVkd [kEc dh vYikof/k [krh rduhd] edh gM [kEc eØk l/bc/] fdx vk, LVj rFkk oh- c/Echf/uk d fy, [krh dh fof/k;k ij foLrkjiod ppk dhA

vke[k cBd e [kEc m |kx l tM vud egRoi.k ennk ij ppk dh xBA m |fe;k rFkk fd l kuk u O;kolkf;d Lrj ij fofHkUu idkj d [kEc dh [krh d fy, [kkn r;kj dju e {k= fof'k"V df"k vif'k"Vk dh mi;kfxrk gr l Hkkoukvk dk ryk'ku dh t : jr ij viu fopkj idV fd, vkj O;kolkf;d [kEc ch t d fy, x.koRrk ekudk dk ykx dju dk vujk/k fd;kA [kEc dh ekdfVx vkj QlykRrj ic/ku e vku okyh l eL;kvk ij Hkh foLrr ppk dh xBA

Mk- oh-ih- 'kek] fun'kd] Hkkdvui&[kEc vul/kku fun'kky;] Ikyu %fgekpy in'k% u l Hkh ifrHkkfx;k dk fo'okl fnyk;k fd fun'kky; }kjk fodflr l Hkh uohure ik |kfxd;k dk Qke ij h{k.kk dk vk;k tu

of Horticulture and Forestry, Nauni participated in the programme.

The recent research contributions of ICAR-DMR in the field of strain improvement, varietal development, biotic stress management, cultivation technology of new mushrooms and value addition specifics were highlighted by Dr. V.P. Sharma, Director, ICAR-DMR. New strains of white button mushroom, short duration cultivation technology of shiitake mushroom, cultivation methods for monkey head mushroom, *Macrocybe*, King Oyster and *V. bombycina* were discussed in detail by the concerned scientists.

Several important issues concerned with mushroom industry were discussed during the interface. Entrepreneurs and farmers expressed their views on development of viable production technologies by utilizing the region specific agro residues for different mushrooms. Possibilities involved in marketing of dried and processed products and marketing channels were also discussed in detail.

Dr. V.P Sharma, Director assured that, all the latest technologies developed by the ICAR-DMR,



fp=- 3-8- e'k : e mRikndk o Hkkdvui&[kEc vul/kku fun'kky; d oKkfudk d chp vke[k cBd d nkjku [kEc dh ubi fodflr rduhdk ij ppk

Fig. 3.8. Discussions held on new technologies developed by ICAR-DMR in Farmers Scientists Industry Interface



dju gr fd lkuk d lkFk lk>k fd;k tk,xk vkj
bll vU; [kEc mRiknd Hkh fun'kky; dh lokvk dk
cgrj mi;kx dju d fy, ifjr gkxA Mk- 'kek u
iu% nkgjk;k fd fun'kky; }kjk vkt hfodk fuokg gr
y?k fd lkuk d fy, ,d 0;kogkfjd m|e'khyrk d
: i e vkj cM m|fe;k d fy, df"k 0;olk;
xfrfof/k d : i e [kEc dk c<kok nu e fujUj dk;
fd;k tkrk jgxkA

**fd lkuk@[kEc mRikndki@m|fe;k@c|jkt xkj
;okvk dk ijke'kh lok,i**

[kEc dh [krh] if'k{k.k ,o foi.ku l lcf/kr
fofhkUu igyvk ij Mkd ilkj i=k d ek/e l
ijke'kh lok, inku dh xbA [kEc dh [krh rFkk
if'k{k.k l tM i'uk d mRrj njHkk" ,o b&ey }kjk
fn, x,A ifrfnu vklru 6&8 i'u vk,] ftudk
mRrj njHkk" @b&ey@i=k d ek/e l fn;k x;kA
fofhkUu jkT;k d fd lkuk rFkk fofhUu egkfo|ky;k d
Nk= legk u lLFkku dk nkjk fd;k ftUg Hkkdvui&[kEc
vu l/kku fun'kky;] lkyu }kjk nh tku okyh fofhUu
lfo/kkvk vkj lokvk d ckj e fu;fer : i l lfklr
tkudkj nh xbA

Solan will be shared with the farmers for conducting
on farm trials and this would motivate other
mushroom growers to make best use of the services
of directorate. He also restated that, the DMR shall
continue to work for the promotion of mushroom
cultivation as a viable entrepreneurship for small and
marginal farmers and as a means of agri business
activity for the large entrepreneurs.

Advisory Service to Farmers/ Mushroom Growers/ Businessman/ Unemployed Youth

Advisory services through postal extension letters
on various aspects of mushroom cultivation, training
programmes and marketing were provided. Queries
on mushroom cultivation, training were replied
through telephone and e-mail. On an average 6-8
queries per day were received either by phone/ mail/
letters and were replied. The groups of farmers from
different states and students of various colleges visiting
the institute were briefed regularly about the various
facilities and services rendered by ICAR-DMR, Solan.



4.

vf[ky Hkkjrh; leflor [kEc vul/kku ifj;ktuk dUn AICRPM Centres

n'k d fofHkUu df"k tyok; {k=k e [kEc vul/kku fun'kky; rFkk bld dUnk }kjk fodflr dh xb ik|kfxd;k dk ijh{k.k dju vkj mudk ilkj dju rFkk lFk gh oreku df"k i.kkyh d lFk&lFk f}rh;d df"k d : i e [kEc dk ipfyr dju d mnn'; l fnukd 01-04-1983 dk NBh ipo"kh; ;ktuk d nkju vf[ky Hkkjrh; leflor [kEc vul/kku ifj;ktuk dk ikjHk fd;k x;k FkA bldk e[;ky; [kEc vul/kku fun'kky;] lkyu %fgekpy in'k½ e j[kk x;k FkA fun'kd] Hkdvui&[kEc vul/kku fun'kky; }kjk ifj;ktuk leUo;d d : i e Hk dk; fd;k tkrk gA vf[ky Hkkjrh; leflor [kEc vul/kku ifj;ktuk d vf/kn'kk e mUur [kEc fdLek@ldj fdLek] Qly mRiknu] Qly l{j.k.k mik;k ,o Qlykrj ik|kfxdh l tMh df"k jhfr;k dk leUo; djuk vkj cg LFkxfud ijh{k.k dh fuxjkuh djuk g ftudk mnn'; n'k e [kEc dk mRiknu] mRikndrk vkj mi;fxxrk dk c<kuk gA

ikjHk e] vf[ky Hkkjrh; leflor [kEc l/kkj ifj;ktuk dk dy N% dUnk d lFk ikjHk fd;k x;k FkA ckjgoh ipo"kh; ;ktuk d nkju] bl ifj;ktuk e X;kjg u, leflor dUnk vkj uk lg;kxh dUnk dk 'kkfey fd;k x;k vkj Qtckn dUn dk gVf fn;k x;kA oreku e] vf[ky Hkkjrh; leflor [kEc vul/kku ifj;ktuk d vxr dy 24 leflor dUn rFkk 9 lg;kxh dUn dk;jr g tk fd bl idkj g&

leflor dUn

- 1- mRrj ioh iorh; {k= d fy, Hkdvui dk vul/kku ifj lj ckjkikuh
- 2- ioh {k= d fy, Hkdvui dk vul/kku ifj lj vul/kku dUn] jkph

With a view to test and disseminate the technology developed at Directorate of Mushroom Research, Solan and its Centres in different agro-climatic regions of the country and 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. The mandate of AICRP (Mushroom) is to coordinate and monitor multi-location 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.

Initially, the All India Coordinated Mushroom Improvement Project started with six centres. During the XII five year plan 11 more coordinating and 9 cooperating centres were added and Faizabad centre was dropped. At present, 23 Coordinating and 9 Co-operating Centres are working under AICRPM, with its head quarters at ICAR-DMR, Solan which are listed below.

Coordinating Centres

- 1. ICAR- Research Complex for NEH Region, Barapani.
- 2. ICAR-Research Complex for Eastern Region Research Centre, Ranchi.



- 3- i t kc d f'k fo'of o | ky ;] y f / k ; kuk
- 4- r f e y ukM d f'k fo'of o | ky ;] d k ; EcVj
- 5- t h - c h - i r d f'k o i k | k f x d h fo'of o | ky ;] i r u x j
- 6- d f'k e g k f o | ky ;] e g k R e k Q y d f'k fo'of o | ky ;]
i . k
- 7- b f U n j k x k / k h d f'k fo'of o | ky ;] j k ; i j
- 8- e g k j k . k k i r k i d f'k , o i k | k f x d h fo'of o | ky ;]
m n ; i j
- 9- d f'k e g k f o | ky ;] d j y d f'k fo'of o | ky ;]
o Y y k ; u h
- 10- p k / k j h p j . k f l g g f j ; k . k k d f'k fo'of o | ky ;]
f g l k j
- 11- v k f M ' k k d f'k o i k | k f x d h fo'of o | ky ;] H k o u ' o j
- 12- j k t U n d f'k fo'of o | ky ;] l e L r h i j] i l k] f c g k j
- 13- c k x o k u h , o o k f u d h e g k f o | ky ;] d U n h ; d f'k
fo'of o | ky ;] i k l h ? k k V
- 14- , p , v k b l h] e j F k y & % 1 2 o h ; k t u k e l e f l o r
d U n d : i e i k U r %

I g ; k x h d U n i

- 15- M k - o k b - , l - i j e k j v k | k f u d h , o o k f u d h
fo'of o | ky ;] u k u h] l k y u % f g e k p y i n ' k %

12 o h ; k t u k d i n k j k u ' k k f e y u , d U n i

I e f l o r d U n i

- 16- m R r j i o h i o r h ; { k = d f y , H k k d v u i d k
v u l / k k u i f j l j] f l f D d e
- 17- m R r j i o h i o r h ; { k = d f y , H k k d v u i d k
v u l / k k u i f j l j] v : . k k p y i n ' k

3. Punjab Agricultural University, Ludhiana.
4. Tamil Nadu Agricultural University, Coimbatore.
5. G.B. Pant University of Agriculture and Technology, Pantnagar.
6. CoA, Mahatma Phule Krishi Vidyapeeth, Pune.
7. Indira Gandhi Krishi Vishwa Vidyalaya, Raipur.
8. Maharana Pratap University of Agriculture and Technology, Udaipur.
9. CoA, Kerala Agricultural University, Vellayani.
10. C.C.S. Haryana Agricultural University, Hisar.
11. Orissa University of Agriculture and Technology, Bhubaneswar.
12. Rajendra Agricultural University, Samastipur, Pusa.
13. College of Hort. and Forestry, Central Agril. Univ., Pasighat
14. HAIC, Murthal – (Upgraded to Coordinating Centre in XII Plan)

Cooperating Centres

15. Dr. Y. S. Parmar University of Horticulture & Forestry, Nauni, Solan (HP).

New Centres Included During XII Plan

Coordinating Centres

16. ICAR- Research Complex for NEH Region, Sikkim.
17. ICAR- Research Complex for NEH Region, Arunachal Pradesh.



- 18- mRrj ioh iorh; {k= d fy, Hkkdvui dk vul/kku ifj l j] ukxky.M
- 19- mRrj ioh iorh; {k= d fy, Hkkdvui dk vul/kku ifj l j] ef.kij
- 20- mRrj ioh iorh; {k= d fy, Hkkdvui dk vul/kku ifj l j] fetkje
- 21- mRrj ioh iorh; {k= d fy, Hkkdvui dk vul/kku ifj l j] f=ijk
- 22- Hkkdvui & dUnh; }hih; df"k vul/kku lLFkku] ikV Cy; j] vMeku o fudkckj
- 23- Hkkdvui & Hkkjrh; cKxokuh vul/kku lLFkku] cxy:
- 24- Ih, Id ,pihdoh] ikyeij

Ig;kxh dUn:

- 25- Hkkdvui & foodkuUn iorh; df"k vul/kku lLFkku] vYekMk
- 26- 'kj&, &d'ehj df"k foKku o ik|kfxdh fo'ofokky;] Jhuxj
- 27- 'kj&, &d'ehj df"k foKku o ik|kfxdh fo'ofokky;] tEe
- 28- vle df"k fo'ofokky;] tkjgkV ¼vHkh if"V iklr dh tkuh g½
- 29- l jnkj oYyHk Hkkb iVy df"k o ik|kfxdh fo'ofokky;] ejB
- 30- fc/kku pUn df"k fo'ofokky;] ukfM;k] if'pe cxky
- 31- l jnkj df"kuxj nroKkMk df"k fo'ofokky;] nroKkMk ¼vHkh if"V iklr dh tkuh g½
- 32- vkpk; , u-t-h- jxk df"k fo'ofokky;] jk tUnuxj

18. ICAR- Research Complex for NEH Region, Nagaland.
19. ICAR- Research Complex for NEH Region, Manipur.
20. ICAR- Research Complex for NEH Region, Mizorum.
21. ICAR- Research Complex for NEH Region, Tripura.
22. ICAR- Central Inland Agri. Res. Institute, Port Blair.
23. ICAR- Indian Institute of Horticultural Research, Bangalore.
24. CSK HPKV, Palampur.

Co-operating Centres

25. ICAR-VPKAS, Almora.
26. Sher-e- Kashmir Uni. of Agri. Sci. & Technology, Srinagar.
27. Sher-e- Kashmir Uni. of Agri. Sci. & Technology, Jammu.
28. Assam Agri. University, Jorhat (Confirmation yet to be received).
29. Sardar Ballabh Bhai Patel Uni. Of Agri & Tech., Meerut.
30. Bidhan Chandra Krishi Vishwa Vidyalaya, Nadia, West Bengal.
31. Sardarkrushinagar- Dantiwada Agri. Uni., Dantiwada (Confirmation yet to be received).
32. Acharya NG Ranga Agri. Uni., Rajendranagar.



5.

i:dk'kuk dh Iph

List of Publications

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vgykor] vk-ih- ,o efudnu] d- ¼2014½A bQDV vkQ dEikLV dEiDVuI] ijQkj'ku bu dEikLV fQYM ikyhcXI ,M okVfjx fjtkbe vkQVj dftx vku QV ckMh ;hYM vkQ OgkbV cVu e'k:e] ,xfjdI fcLijIA **e'k:e fjlp/** 23¼2½ 145&151-

fcUnoh vjkMk ,o enyk Mh- ¼2014½A IUljh ,M U;fV'kuy ijkehVI vkQ e'k:e QkVhQkbM dku ,DLVMVl] **e'k:e fjlp/** 23 ¼1½ 89 & 97-

fcUnoh vjkMk] 'or dey ,o ethr flg ¼2015½A ikikTM LV.MMI vkQ bfM;u e'k:e ,M bVI ikMDVl] **e'k:e fjlp/** 23 ¼2½ 247&253-

eerK xlrk] fodkI 'kek] luhY d- flg] jkd'k d- pgkVk ,o fryd vkj- 'kek ¼2016½A ,ukfyfI I vkQ ftufVd MkbofIVh ,M LVDpj bu , thucd dyD'ku vkQ jM Dykoj ¼VkbQkfy;e iVU/ ,y-½ ;ftx ,I,lvkj ekdI] **lykV ftufVd fjlkfI/t** doi:10.1017/S1479262116000034: 1-4.

Irh'k dekj] oh-ih- 'kek ,o 'or dey ¼2015½A , fj0; vku bu IDV QxI bUVjD'kuI fon Li'ky bEQfII vku dkmhIII mi itkfr] **e'k:e fjlp/** 24 ¼1½ 1&8-

f'k:j egr'k] vgykor] vk-ih- ,o efudnu] d- ¼2014½A ikQkby djDVfjLVdI ,M bUVjiU;fj;y ,VhC;VI vkQ Vuh t vkQ u'kuy Vfux ikxke vku e'k:e dYVho'ku] **e'k:e fjlp/** 23 ¼1½ 99&104-

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f'k : j egr'k] f'kokfyxxkMk] ,u-, l- %2015%A e'k : e
ekdfVx puYI ,M dUT;ej fcgfc;j % ,
fdfVdy ,ukfyfI l] **e/lj t- ,fxd lkbU l**
49 %2% 390&393-

f'k : j egr'k] f'kokfyxxkMk] ,u-, l-] pUnxkMk] ,e-t
,o jkt dek] ch- t- %2015%A e'k : e bUVj iU;fj; y
fcgfo;j % MkbefI U l ,M eht jeUV] **bVju'kuy**
tuy vkQ ,xhdYpj LVfVfLVDI lkbU l
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f'k : j egr'k] vgykor] vk-ih- ,o efudnu] d-
%2014%A e'k : e dutEi'ku ,M ijpftx fcgfo;j
bu bfM;k % , LVMh ,ekX lyfDVM fjLi kUMUV l]
e'k : e fj l p/ 23 %2% 225&231-

f'k : j egr'k] xxk/kjli k] ,u-vkj- ,o fcjknj] t h- , l-
%2015%A l'k'ky ehfM;k ,fmd'ku ,ekx xt ,VI
vkQ ,xhdYpjy lkbU l t] **bVju'kuy tuy**
vkQ ,xhdYpjy lkbU l 11%1% 189&195-

Vh- v : exkukFku] 'or dey] vkj-Mh- jk;] jkt 'k
dek] ,o vkj-ih- frokj h %2015%A bQDV vkQ
ih&VhVeUV l vku fn DokfyVh vkQ fn dfcuV
MkbM OgkbV cVu e'k : e % ,xfjd l fcl i k j l %2]
e'k : e fj l p/ 24 %1% 41&47-

oh-ih- 'kek] je'k pUn mik;/k;] 'or dey] l rh'k
dek] dyk'k fcgkj h egki= ,o et 'kek %2015%A
djDVjkb t'ku] dYVho'ku] U;fV'kuy ,M
efMfluy ikiVh t vkQ dyuj h bMhcy e'k : e
yf.vul dkuV l l k;Mkfo;k 67%1% 167&
174-

oh-ih- 'kek] ethr flg] l rh'k dek] 'or dey ,o
jktUn flg %2014%A Qkbyktuh ,M fQft ;kykt h
vkQ Qykfjfu;k Li- % , Myhd l h vkQ bfM;u
MtV] **bVju'kuy fj l p/ tuy vkQ upjy**
,M ,lykBM lkbU l 2%4% 1&17-

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oh-ih- 'kek] l rh'k dek] ,o 'or dey %2015%A
dkijhuy l ,M dkijhukfll l % vxflo dEihfVvj
vkQ cVu e'k : u Mfjx juh l h tu dYVho'ku]
bVju'kuy fjlp/ tuy vkQ upjy ,M
,lykBM lkbU l 2%3% 155&163-

oh-ih- 'kek] 'or dey] vkj- l h- mik/ ; k ;] l rh'k dek]
 , l -d- l ku ; ky ,o et hr flg %2015%A VDI kukeh]
Qkbyk tuh] dYVho'ku ,M ck ; kykft dy
 , DVhfoVh t vkQ yf. Vu l Li- Qke vMeku
 ,M fudkckj vkby. M l %bfM ; k%] **behjV l tuy**
vkQ QM ,M ,xhdYpj 27 %7% 570&576-

oh-ih- 'kek] 'or dey ,o l rh'k dek] %2014%A
 , EiyhQkbM jkbc l key Mh , u , fjfLVD'ku
 , ukfyfll ,M vkchVjh ikbej cLM vkj , ihMh %
 ; tQy ftufVd ekdj Qkj ekbdki jk l kbV
 MkbXukfLVD l bu bMhcy e'k : e] **e'k : e fjlp/**
23 %2% 211&217-

oh-ih- 'kek] et hr flg] jkt dek] l rh'k dek] 'or
dey ,o et 'kek %2014%A bQDV vkQ Liku V
Liku eYVhlyhd'ku vku ikMDVhfoVh vkQ
 , xfd l fcLij l **e'k : e fjlp/** 23 %1% 17&20-

oh-ih- 'kek] 'or dey ,o l rh'k dek] %2014%A
ekY ; dyj djDVjkb t'ku] , DLV k l yyj , t kbe
ikQkby ,M ; hYM yk l M ; V **DyMkckV kbe**
vkb l kyV l , l k f l , fVM fon dkc oc Mh f t t
vkQ bMhcy e'k : e] **l kbMkfo ; k** %67% 65&74-

I Eeyu@ l xk" Bh e i l Rr i =

fcUnoh vj kMk %2015%A ikfy l h bEiDV Qkj QM l D ; fjVh
vxULV DykbeV pt] 11oh t -d- foKku dkx l]
ihih 342-

fcUnoh vj kMk] 'or dey] , y -vkj- jk. kk ,o oh-ih-
'kek %2016%- ik l l vk l Vhekbt 'ku vkQ jMh V
dd Qk tu e'k : e fVDDh] [kk] foKku ,o

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to cook frozen mushroom tikki. Proceedings
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ik|kfxdh e ixfr ij vk;kftr jk"Vh; I Eeyu
dk dk;orR ¼1½ 199&205-

vkj-lh- mik/;k; ,o vKLFkk f=iKBh ¼2015½- bQDV
vkQ bu&vkxfud dehdYI vku ,DLVl lyyj
fyXuhukykbFvD ,tkbEl vkQ bUMhthfu; I
okbYM QyEefyuk LiIht- vkb, l, e, l dk
vrj"Vh; I Eeyu&2016-

vkj-lh- mik/;k; ¼2015½- ck;k&Mkbof lVh vkQ okbYM
bmhcy e'k : e vkQ bFM; k Qkj nvj U; fV'kuy]
efMfluy ,M bmFLV; y ,lyhd'ku IA iknij
jkxtudk ,o vketu fo"K; ij vk;kftr NB
vrj"Vh; I Eeyu e vx.kh 0; k[; kuA

vkj-lh- mik/;k; ¼2015½A Ldki vkQ okbYM Qy'kh
Qxh Qkj MkeLVhd'ku] U; Vkl; fVdYI ,M
bmFLV; y ,lyhd'ku IA fnukd 10 vDrcj] 2015
dk xkok e vk;kftr ,f'k; u ekbdkykftdy
dkxI e iij iLrfrdj.kA

okb- xkre] ,u vkbVh cLM bUVjfdVo fllVe Qkj
e'k : e LVdgkYMI A fnukd 21&23 viy] 2015
dk ; ,p, Q] ukuh] Ikyu e ik"kf.kd Ij{kk ,o
LokLF; d fy, vk/kfud df"K ik|kfxfd; k fo"K;
ij vk;kftr jk"Vh; Ixk"Bh e iLrfrdj.kA

okb xkre & bUVjuV ,t ,u vYVjufVo Qkj
ikiyjbftx ,M ekdfVx e'k : eA fnukd 28&29
fI rEcj] 2015 dk ; ,p, Q] ukuh] Ikyu e **ikni
LokLF; ic/ku gr IE; d nF"Vdk.k** fo"K; ij
vk;kftr jk"Vh; Ixk"Bh e iLrfrdj.kA

ykdfii; y[k

;kx'k xkre ¼ foVkfue Mh dh ikflr d fy, [kk;
e'k : e] 'kfyuh Iekpkj 10&16 fI rEcj] 2015-

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September 2015.



6.

vuekfnr pky vu|/kku ifj;k tuk,|

Approved On-Going Research Projects

ILFkku dM	'kh"ki d	vu /kkudrk vFkok vUo"kd	vof/k@fVli.kh
Institute Code	Title	Researchers	Period/Remarks
1	[kEc dk vkuof'kd mUu;u	Mk- vkj-lh- mik/;k;] ifj;k tuk v/;{k	viy] 2015 l ekp] 2018
	i) cVu [kEc	Mk- 'or dey] i/kku vUo"kd lJh eer k xlrk] lg i/kku vUo"kd	
	ii) vk,LVj [kEc	Mk- l rh'k dek] lg i/kku vUo"kd Mk- vkj-lh- mik/;k;] i/kku vUo"kd	
	iii) ivky [kEc	Mk- lYokdek] vkj- lg i/kku vUo"kd Mk- vk-ih- vgykor] i/kku vUo"kd	
	iv) f'kVkd [kEc	Mk- 'or dey] lg i/kku vUo"kd Mk- oh-ih- 'kek] i/kku vUo"kd	
	v) lfyd t efix	lJh eer k xlrk] lg i/kku vUo"kd lJh eer k xlrk] i/kku vUo"kd Mk- 'or dey] lg i/kku vUo"kd Mk- ;kx'k xkre] lg i/kku vUo"kd	
1	Genetic Improvement of Mushrooms	Dr. R.C. Upadhyay, Project Leader	April, 2015 to March, 2018
	i) Button Mushroom	Dr.Shwet Kamal, PI Ms.Mamta Gupta, Co-PI Dr. Satish Kumar, Co-PI	
	ii) Oyster Mushroom	Dr.R.C. Upadhyay, PI Dr. Anupam Barah, Co-PI	
	iii) Paddy Straw Mushroom	Dr.O.P. Ahlawat, PI Dr. Shwet Kamal, Co-PI	
	iv) Shiitake Mushroom	Dr. V.P. Sharma, PI Ms. Mamta Gupta, Co-PI	
	v) Linkage Mapping	Ms. Mamta Gupta, PI Dr. Shwet Kamal, Co-PI Dr. Yogesh Gautam, Co-PI	



ILFku dkM Institute Code	'kh"ki'd Title	vu /kkud rki vFkok vUo"kd Researchers	vof/k@fVli .kh Period/ Remarks
2-d-	fofhkUu idkj d [kEc d fy, ik"kk/kkj Qkey'ku i) [kEc dh [krh d fy, ik"kk/kkj Qkey'ku vkj cVu [kEc d vof'k"V [kEc ik"kk/kkj dk mi ;kx ii) f'kVd [kEc d fy, 0;kol kf;d Lrj ij mRiknu ik kfxdh dk fodk l	Mk- oh-ih- 'kek] ifj ;ktuk v/;{k Mk- vk-ih- vgykor] i/kku vUo"kd Mk- l/khj dek] ,.] lg i/kku vUo"kd Mk- l rh'k dek] lg i/kku vUo"kd Mk- l/khj dek] ,.] i/kku vUo"kd Mk- l rh'k dek] lg i/kku vUo"kd	viy] 2015 l ekp] 2018
2.a)	Substrate formulation for different mushrooms i) Substrate formulation for mushroom cultivation and utilization of spent mushroom substrate (Button Mushroom) ii) Development of commercial scale production technology for shiitake mushroom.	Dr. V.P. Sharma, Project Leader Dr. O.P. Ahlawat, PI Mr. Sudheer Kumar A, Co-PI Dr. Satish Kumar, Co-PI Mr. Sudheer Kumar A, PI Dr. Satish Kumar, Co-PI	April, 2015 to March, 2018
3	[kEc d dhV&uk'kh t hok vkj jkxk d ic/ku gr i ;koj.k vudy lefdr ik kfxdh dk fodk l	Mk- l rh'k dek] i/kku vUo"kd Mk- oh-ih- 'kek] lg i/kku vUo"kd l Jh eer k xlrk] lg i/kku vUo"kd Mk- ;kx'k xkre] lg i/kku vUo"kd	viy] 2015 l ekp] 2018
3	Development of eco-friendly integrated technology for management of mushroom insect-pests and diseases	Dr. Satish Kumar, PI Dr. V.P. Sharma, Co-PI Ms. Mamta Gupta, Co-PI Dr. Yogesh Gautam, Co-PI	April, 2015 to March, 2018
4	Hkkdvui&[kEc vu l/kku fun'kky; dh ekudhr ik kfxd;k vkj ub fdLek d vku& Qke ij h{k.k	Mk- egUr'k f'k : j] i/kku vUo"kd Mk- oh-ih- 'kek] lg i/kku vUo"kd Mk- vkj-lh- mik/;k;] lg i/kku vUo"kd Mk- vk-ih- vgykor] lg i/kku vUo"kd Mk- l rh'k dek] lg i/kku vUo"kd Mk- 'or dey] lg i/kku vUo"kd	fn l Ecj] 2015 l uo Ecj] 2017
4	On farm trials of standardized technologies and new varieties of ICAR-DMR	Dr. Mahantesh Shirur, PI Dr. V.P. Sharma, Co-PI Dr. R.C. Upadhyay, Co-PI Dr. O.P. Ahlawat, Co-PI Dr. Satish Kumar, Co-PI Dr. Shwet Kamal, Co-PI	December, 2015 to November, 2017
5	fofhkUu idkj d [kEc rFkk mudh vkfFkd 0;ogk;rk d fy, oc vk/kkfjr ekM;y dk lpuk iy[ku ,o fodk l	Mk- ;kx'k xkre] i/kku vUo"kd Mk- egUr'k f'k : j] lg i/kku vUo"kd	viy] 2015 l ekp] 2018
5	Information documentation and develop- ment of web based modules for different mushrooms and their economic viability.	Dr. Yogesh Gautam, PI Dr. Mahantesh Shirur, Co-PI	April, 2015 to March, 2018



ckg; foRr ikf"kr ifj;ktuk, i %
Externally Funded Projects

ifj;ktuk dk 'kh"kd	ifj;ktuk d i/kku vUo"kd	ifj;ktuk dh vuekfur ykxr ¼ : i ; ½	vof/k@ fMi.kh	foRrh; , tUl h
Title of the Project	PI of the Project	Tentative cost of the Project	Period/ Remarks	Funding Agency
1- **fetkje dh [Ec to&fofo/krk dk y{k.ko.ku vkj mi ;kfxrk** 'kh"kd l mRrj io d fy, to ik kfxdh foHkx ¼DBT½ dk fVofux dk;Øe	Mk vkj-lh- mik/;k;	: i ; 72.97 yk[k	21-03-2013 l 20-03-2016	to & ik kfxdh foHkx] ub fnYyh
1. DBT's Twinning Programme for the NE titled "Characterization and Utilization of Mushrooms biodiversity of Mizoram"	Dr. R.C. Upadhyay	Rs. 72.97 lakhs	21.03.2013 to 20.03.2016	DBT, New Delhi
2- **f=ijk d dN oU; [Ec dh igpku] ifr&l{etho] "	Mk vkj-lh- mik/;k;	: i ; 28.35 yk[k	01-04-2014 l 31-12-2016	to & ik kfxdh foHkx] ub fnYyh
ifr&vDlhdjd rFk ikkf.kd lpdkd d lKf lKf [krh d ekudhdj.k ij v/; ;u	Dr. R.C. Upadhyay	Rs. 28.35 lakhs	01.04.2014 to 31.12.2016	DBT, New Delhi
2."Studies on identification, antimicrobial, antioxidant and nutritional index as well as standardization of cultivation of some wild mushrooms of Tripura"	Dr. R.C. Upadhyay	Rs. 28.35 lakhs	01.04.2014 to 31.12.2016	DBT, New Delhi
3- fu/kkuh vk; vkj mi t d fy, oYofj;yk oYofl;k ¼kku ivky [Ec½ dk vkdyu ,o vkuof"kd ifjpkYu	Mk vki-h- vgykor	: i ; 22.52 yk[k	01-09-2013 l 31-08-2016	, l bv kjch] foKku ,o ik kfxdh foHkx] ub fnYyh
3. Assessment and genetic manipulation of <i>Volvariella volvacea</i> (paddy straw mushroom) for shelf life and yield	Dr. O.P. Ahlawat	Rs. 22.52 lakhs	01.09.2013 to 31.08.2016	SERB, DST, New Delhi



7.

ijke'kh rFkk Iykgdkj Lok, Consultancy and Advisory Services

Hkkdvui&[kEc vul/kku fun'kky; }kjk o"K 2015&2016 d nkjku fuEufyf[kr [kEc bdkb;k dk rduhdh&vkfFkd lHkkO; rk fjiKV %Vhb, Qvkj% r;kj dju vkj [kEc dh [krh ij ijk'kh Lok, inku dh xBA

- 1- Jherh vk'kk Bkdj iRuh Jh peu yky] xko o Mkd?kj % ckly] rglhy ,o ftyk & lkyu fgekpy in'k
- 2- Jh foØe /kheku li= Jh je'k pUn] xko d lki] Mkd?kj % vyhij] rglhy cjkj] ftyk % vEcky] gfj;k.kk
- 3- Jh geiHk /kheku] xko o Mkd?kj cjekuk] rglhy o ftyk % fcyklij] fgekpy in'k
- 4- Jh enu yky 'kek li= Jh iju uln 'kek] xko o Mkd?kj % egUnk ckx] rglhy % iPNkn] ftyk fljekj] fgekpy in'k
- 5- Jh dey d".k iky li= Jh dnu yky ikr] xko % tCcj] Mkd?kj % nxkij] rglhy % lUuh] ftyk % f'keyk] fgekpy in'k
- 6- Jh nhid uxh] xko % Fkkuk] Mkd?kj % Mklk] rglhy % jkeij c'kkj] ftyk % f'keyk] fgekpy in'k
- 7- Jherh dey'k Bkdj iRuh Jh jke dek] xko o Mkd?kj % /kkjh] rglhy o ftyk % f'keyk] fg-i-
- 8- Jherh ifo=k noh iRuh Jh lR;k flg] xko % jkuhi k[k] Mkd?kj % Hkfu;kokyk] rglhy % _f'kd'k] ngjknu] mRrjk[kM
- 9- Jh ikj l jke li= Jh ryk jke] xko % peV Hkkjhp] Mkd?kj % fnvkBh] rglhy o ftyk % lkyu & 173 211] fgekpy in'k
- 10- Jh dgj flg li= Jh ie nk l] xko % pkdh] Mkd?kj % vkYok] rglhy % vkuh] ftyk % dYy] fgekpy in'k
- 11- Jh ukd flg li= Jh txr jke] xko % ljh] Mkd?kj % nx<] vkuh] ftyk % dYy] fgekpy in'k
- 12- Jh lt; dek] li= Jh yk;d jke] xko o Mkd?kj % ckly] rglhy o ftyk % lkyu] fgekpy in'k
- 13- Jh vej'k dek] ;kno] xko o Mkd?kj % e>koyh] rglhy % cYyHkx<] Qjhinkcn] gfj;k.kk
- 14- Jh oh- jMMh HkLdj] vk@,u] 36@15&3] fpUuk pkd] dMli] vku/k in'k & 516 002

Consultancy was provided to the following mushroom units in the form of preparation of Techno-Economic Feasibility Reports (TEFR) and advice on mushroom cultivation during the year 2015-2016.

1. Mrs. Asha Thakur, W/o Sh. Chaman Lal, VPO Basal, Tehsil & Distt. Solan (HP).
2. Mr. Vikram Dhiman S/o Sh. Ramesh Chand, Village Kansapur, PO Alipur, Tehsil Barara, Distt. Ambala (Haryana).
3. Mr. Hemprabh Dhiman, VPO Barmana, Tehsil & Distt. Bilaspur (HP)
4. Mr. Madan Lal Sharma, S/o Sh. Puran Nand Sharma, VPO Mehando Bagh, Tehsil Pachhad, Distt. Sirmour (HP).
5. Mr. Kamal Krishan Pal, S/o Sh. Kundal Lal Pal, Village Jubber, PO Durgapur, Tehsil Sunni, Distt. Shimla (HP).
6. Mr. Deepak Negi, Village Thana, PO Dansa, Tehsil Rampur Bushar, Distt. Shimla (HP)
7. Mrs. Kamlesh Thakur, W/o Sh. Ram Kumar, VPO Dhari, Tehsil & Distt. Shimla (HP).
8. Mrs. Pavitra Devi W/o Sh. Satya Singh, Village Ranipokhi, PO Bhaniawala, Tehsil Rishikesh, Dehradun (UK)
9. Mr. Paras Ram S/o Sh. Tula Ram, Village Chamat Bhareach, PO Deothi, Tehsil & Distt. Solan (HP) – 173211.
10. Mr. Kehr Singh S/o Sh. Prem Dass, Village Chowki, PO Olwa, Tehsil Aani, Distt. Kullu (HP).
11. Mr. Nok Singh S/o Sh. Jagat Ram, Village Seri, PO Degarh, Aani, Distt. Kullu (HP).
12. Mr. Sanjay Kumar S/o Sh. Laiq Ram, VPO Basal, Tehsil & Distt. Solan (HP).
13. Mr. Amresh Kumar Yadav, VPO Manjhawali, Tehsil Ballabgarh, Faridabad (Haryana).
14. Mr. V. Reddy Bhaskar, O/N, 36/15-3, Chinna Chowk, Kadapa, AP – 516002.



- 15- Jh dnu yky 'kek li= Jh tkye jke] xko o Mkd?kj % ukU t] rglhy % d l l x] ftyk % eMh] fg-i-
- 16- Jherh luhrk noh iRuh Jh vfuy dekij] xko o Mkd?kj % ikxij] rglhy % ngjk] ftyk dxxMk & 177 107] fgeky in'k
- 17- Jh gjon] xko % njkMh] Mkd?kj % xflgij] Q: [kckn & 209 602] mRrj in'k
- 18- d- jt : xh] l j {kk if'k{k.k dUn d fudV] feyu ekj] Mkd % pEik l kjh] fl yhxMh] ftyk % nkftfyx] if'pe cxy
- 19- Jh ikj l jke] xko % peV Hkjh] Mkd % fnvkBh] lkyu] fgeky in'k
- 20- Jh l k b f d j . k c e k j 5 & 43] t h n h e r y k x k o] e M N y j k M] g n j k c k n] f t y k % j x k j M M h & 500 067] r y x k u k
- 21- Jh bikjh cy jko] ell t-i-h- e'k:e Qke] Nrjij] ftyk % xte] v k f M ' k k
- 22- Jh fot ; iky flg li= Jh veh yky] xko % ekVyk [kn] Mkd % ekVyk dyk] ftyk % fjokMh & 123 411] gfj ; k . k k
- 23- Jh jkgy ej?kM] 41@ch] gkmflx ckM dkykuh] ukFk pØ/kj uxj] LVfM;e d fudV] ftyk % jk;x<] Nrhlx< & 496 001
- 24- l Jh T ; k f r B k d j] U ; d F k j] f u d V l U V y o ; j g k m l] M k d % p E c k ? k k V] l k y u & 173 213] f g e k y i n ' k % n k l [; k k
- 25- Jh f'ko dek] li= Jh iju pn] xko dkBku] Mkd % cojh] lkyu] fgeky in'k
- 26- Jherh 'ork xko] iRuh Jh ekfgr In] lkb dkykuh] xko % cgjokyk] ikvBk l k f g c] f t y k % f l j e k j & 173 025] fgeky in'k
- 27- Jh ,p- t k l Q gujh li= Jh vkj-MCY;-vkj-gujh] 191] gkflivY LVhV] t ; u d k M e] f t y k % v f j ; k y j & 621 802] rfey ukM
- 28- Jh inhi 'kek li= Jh vkj-vkj- 'kek] xko o Mkd % 'kEHkokyk] rglhy % ugku] ftyk % fljekj] fg-i-
- 29- Jh fnu'k 'kek li= Jh on idk'k 'kek] edku uEcj 542] xko o Mkd?kj % jk; ij jkuh] ftyk % ipdyk & 134 204] gfj ; k . k k
- 30- Jh gfj fd'ku 'kek li= Jh Qdhj pUn 'kek] xko % iyk l h dyk] rglhy % ukykx<] ftyk % lkyu] fgeky in'k
- 31- el l d-d- e'k : e Qke] xko o Mkd?kj % M?khyx] rglhy o ftyk % dYy & 175 102] fgeky in'k
- 32- Jh fj'kHk l k g h o k y l i = J h l n ' k l k g h o k y] 61] o k M u E c j 7] e t f j ; u e k g Y y k] d F k M j k M] i g o k] f t y k] d : { k =] g f j ; k . k k % n k u E c j ½
15. Mr. Kundan Lal Sharma S/o Sh. Jalam Ram, VPO Nanj, Tehsil Karsog, Distt. Mandi (HP).
16. Mrs. Sunita Devi, W/o Sh. Anil Kumar, VPO Pragpur, Tehsil Dehra, Distt. Kangra – 177107.
17. Mr. Harved, Village Daraudi, Post Gaisinghpur, Farrukhabad (UP) – 209602.
18. Ms. Ranju Ruegy, Near Security Training Centre, Milan More, PO Champasari, Siliguri, Distt. Darjeeling (WB).
19. Mr. Paras Ram, Village Chamat Bhareah, PO Deothi, Solan (HP).
20. Mr. Saikiran Burma, # 5-43, Jeedimatla Vilalge, Medchal Road, Hyderabad, Ranga Reddy Distt. Telangana – 500 067.
21. Mr. Epari Bulu Rao, M/s. J.P. Mushroom Farm, Chatrapur, Distt. Ganjam, Odisha.
22. Mr. Vijay Pal Singh S/o Sh. Ami Lal, Village Motla Khurd, PO Motla Kalan, Distt. Rewari (Haryana) - 123411.
23. Mr. Rahul Marghade, 41/B, Housing Board Colony, North Chakradhar Nagar, Near Stadium, Distt. Raigarh, Chattisgarh – 496001.
24. Ms. Jyoti Thakur, New Kather, Near Central Ware House, PO Chambaghat, Solan (HP) – 173213. (Two Nos.).
25. Mr. Shiv Kumar S/o Sh. Puran Chand, Village Kothon, PO Brewery, Solan (HP).
26. Mrs. Shweta Grover, W/o Mr. Mohit Sood, Sai Colony, Village Behrewala, Paonta Sahib, Distt. Sirmour (HP) – 173025.
27. Mr. H. Joseph Henry S/o R.W.R. Henry, 191, Hospital Street, Jayankondam, Distt. Ariyalur, Tamil Nadu – 621802.
28. Mr. Pardeep Sharma S/o Sh. R.R. Sharma, VPO Shambuwala, Tehsil Nahan, Distt. Sirmour (HP)
29. Mr. Dinesh Sharma S/o Sh. Ved Parkash Sharma, House No.542, VPO Raipur Rani, Distt. Panchkula (Haryana) – 134204.
30. Mr. Hari Kisan Sharma S/o Sh. Faquir Chand Sharma, Village Plassi Kalan, Tehsil Nalagarh, Distt. Solan (HP).
31. M/s. K.K. Mushroom Farm, VPO Dughilag, Tehsil & Distt. Kullu (HP) – 175102.
32. Mr. Rishabh Sahewal S/o Sh. Sudesh Sahewal, # 61, Ward No.7, Mungarian Mohalla, Kaithad Road, Pehewa, Distt. Kurukshetra (Haryana). (Two Nos.)



- 33- Jh vfu:) dekj c/o Jh 'kdj ykt] fcxgij
%cl LVM d ikl½] ck; ikl jkM] iVuk & 800
001] fcgkj
- 34- Jh gueku li= Jh jke flg] xko flgk] Mkd?kj
% ykgkuk] ftyk % fjokMh] gfj; k.kk & 123 411
- 35- Jh dey fd'kkj iky li= Jh dnu yky ikr]
xko % tCcj] Mkd?kj % nxkij] rglhy % lUuh]
ftyk % f'keyk & 171 007] fgekpy in'k
- 36- Jh dfiy flg Hkfj; k] el l dufjx Qkel iM; l l
dEiuh fy-] dkjikV dk; ky; 62@2] ijkuh eMh
lnj] ftyk % eMh % fgekpy in'k & 175 001
- 37- Jh pUnthr ;kno li= Jh ctukFk ;kno] xko %
rjklMk] Mkd?kj % dkBhjo] cMkxko] ftyk % okjk.k l h
& 221 207] mRrj in'k
- 38- Jh lfpu li= Jh thr jke] xko % jku] ftyk %
lkyu] fgekpy in'k
- 39- Jh d"rkFk mfu; ky] ell rRo ,xk ikMDVI]
c/o xs dE; uhd'ku l ik- fy-] iFke ry] 84]
u'kfoyk jkM] ngjknu & 248 001] mRrjk[kM
- 40- Jh vjfoUn d- lroYyh] ld ekdfVx] i-C fox
% xknkojh½] QyV u- 83@8ok ry] dYir: fjoj
lkbM] VDdk iuoy & 410 206] ftyk jk; x<]
egkj"V
- 41- Jh fot; flg li= Jh c/k jke] xko o Mkd?kj
nok euy] rglhy % l xkg] ftyk % fljekj]
fgekpy in'k
- 42- Jh uhjt dekj li= Jh flg jke] xko % uUgjk]
Mkd?kj % vEcky] rglhy % ukjk; .kx<] ftyk %
vEcky & 134 203] gfj; k.kk
- 43- Jh iou dekj] fd lku e'k : e Qke] xko % nknij
% l uhh½] Mkd?kj % yMh] ftyk % ;eukuxj % gfj; k.kk½
- 44- Jh oh- l h- Hkrku] Hkrku fuok l] VklQkej fleVh
jkM d fudV] ltkyh] f'keyk] fgekpy in'k
- 45- Jh pUnj xkiky Hkrku li= Lo- Jh no dju] xko
% yEch /kkj % <yh½] Mkd?kj % ltkyh] f'keyk]
fgekpy in'k
- 46- Jh jru pUnj xko % vkn'k uxj] Mkd?kj % i=; ky]
rglhy % uknu] ftyk % gehjij] fgekpy in'k
- 47- Jh fot; iky HkMkj] xko o Mkd?kj % ekxhuUn]
rglhy % ugku] ftyk % fljekj & 173 030
% fg-i-½
- 48- Jh lkb fdj.k cel] 5 & 43] thnheryk xko]
eMpy jkM] gnjkcn] jxk jMMh ftyk & 500 067]
ryxkuk
- 49- Jh HkfiUnj flg] xko o Mkd?kj % iMMj] rglhy
% /ke'kky] ftyk % dkxMk & 176 052] fgekpy
in'k
33. Mr. Anirudh Kumar C/o Sh. Shankar lodge,
Bighrapur (Near Bus Stand), Bye Pass Road,
Patna – 800 001 (Bihar).
34. Mr. Hanuman S/o Sh. Ram Singh, Village Siha,
PO Lohana, Distt. Rewari, Haryana – 123411.
35. Mr. Kamal Kishore Pal, S/o Sh. Kundal Lal
Pal, Village Jubber, PO Durgapur, Tehsil Sunni,
Distt. Shimla (HP) – 171007.
36. Mr. Kapil Singh Bhuria, M/s. Kanrig Farmers
Producer Company Limited, Corp. Office 62/
2, Purani Mandi Sadar, Distt. Mandi (HP) –
175001.
37. Mr. Chanderjit Yadav S/o Sh. Baijnath Yadav,
Village Trasada, PO Kathirav, Badagaon, Distt.
Varanasi (UP) – 221207.
38. Mr. Sachin S/o Sh. Jeet Ram, Village Rabon,
Solan (HP).
39. Mr. Kritartha Uniyal, M/s. Tatva Agro
Products, C/o XS Communications Private
Limited, 1st Floor, 84, Neshvilla Road,
Dehradun – 248001 (UK).
40. Mr. Aravinda K. Satavalli, Sak Marketing, I-C
Wing (Godavari), Flat No.83/8th Floor,
Kalpataru River Side, Takka, Panvel 410206,
Distt. Raigad (Maharashtra).
41. Mr. Vijay Singh S/o Sh. Budh Ram, Village
& PO Deva Manal, Tehsil Sangrah, Distt.
Sirmour (HP).
42. Mr. Neeraj Kumar S/o Sh. Singh Ram, Village
Nanhera, PO Ambali, Tehsil Naraingarh, Distt.
Ambala (Haryana) – 134203.
43. Mr. Pawan Kumar, Kisan Mushroom Farm,
Village Dadupur (Saini), PO Ledi, Distt.
Yamunanagar (Haryana).
44. Mr. V.C. Bhetan, Bhetan Niwas, Near
Transformer Cemetry Road, Sanjauli, Shimla
(HP).
45. Mr. Chander Gopal Bhetan S/o Late Sh. Dev
Karan, Village Lambi Dhar (Dhalli), PO
Sanjauli, Shimla (HP).
46. Mr. Rattan Chand, Village Adarash Nagar, PO
Putryal, Tehsil Naudan, Distt. Hamirpur (HP).
47. Mr. Vijay Pal Bhandari, VPO Moginand, Tehsil
Nahan, Distt. Sirmour (HP) – 173030.
48. Mr. Saikiran Burma # 5-43, Jeedimetla Village,
Medchal Road Hyderabad, Ranga Reddy
Distt., Telangana – 500 067.
49. Mr. Bhupinder Singh, VPO Paddar, Tehsil
Dharamshala, Distt. Kangra (HP) - 176052.



- 50- Jh pne egrk] xko % unu] fudV vkN?kkV] rglhy o ftyk % lkyu] fgeky in'k
- 51- Jh v'kkd dek] xlrk] c lkgV Nyk dUnh] rglhy fFkvix] ftyk % f'keyk] fgeky in'k
- 52- Jherh fgerk noh iRuh Jh tlor flg] fuokl] xko % du] Mkd?kj % 'kEHkoky] rglhy % ugku] ftyk % fljekj] fgeky in'k %nk ckj½
- 53- Jh vfuy dek] li= Jh gjh pUn] xko % /kunjk'kh] Mkd?kj % dkykgkM] rglhy % lUnj uxj] ftyk % eMh] fgeky in'k
- 54- Jh jkt fd'kkj cgx.kk li= Jh l;kj yky cgx.kk] xko % dfn;ky] Mkd?kj % Fkkuk] ftyk % ngjnu & 248 143] mRrjk[kM
- 55- Jh ine flg] xko % uA] Mkd?kj % fnvkBh] rglhy o ftyk % lkyu] fgeky in'k
- 56- Jherh itk pkgu] xko % Mlx xlk] iVh xlk] Mkd?kj % cfx;ky] fodkl [kM Fky/kj] rglhy % dk.Mh lkm] ftyk % fvgh x<oky & 249 132] mRrjk[kM
- 57- Jh tkfdj glu , - 'k[k] ell 'k[k tkfdjglu vCny jghe] e-u- 547@1] f'kokth dkuj] QDVh jkM] l kFuxj dcuj & bNydjth & 416 129] rkydk % grduxy] ftyk % dkYgkij] egkj'kV
- 58- Jh yky flg li= Jh gjno flg] xko o Mkd?kj % vdknj] rglhy o ftyk % egUnx<] gfj;k.kk
- 59- Jh flejuthr flg] xko o Mkd?kj % fhkMj dyk] ikVh ufj;k] ftyk & exk & 142 041] itk
- 60- Jh vfer dek] li= Jh idk'k pUn] xko o Mkd?kj % jh] rglhy % ltkuij] ftyk & gehij] %fg-i½
- 61- Jh jkfcu xkre li= Jh 'ke'kj pUn xkre] xko o Mkd?kj % itxb] rglhy % lnj] ftyk % fcykl ij & 174 012] fgeky in'k
- 62- Jherh lhek d';i] d';e e'k:e Qke] xko % dykx] Mkd?kj % efV;kuk] rglhy % fFk;lx] ftyk % f'keyk & 171 212] fgeky in'k
- 63- Jh jkftUn flg li= Lo- Jh l;/k nk l] xko % gjoky] Mkd?kj % ukxy tfj;kye] rglhy % vEc] ftyk % Åuk] fgeky in'k
- 64- ell veu e'k:e ikMDVI] Jh dyor flg li= Jh egUn flg] xko % mtjkj] Mkd?kj % ckj] rglhy o ftyk % vEc] gfj;k.kk
- 65- Jh egkohj flg li= Jh ekx jke] xko o Mkd?kj % dMyk] rglhy o ftyk % thn & 126 101] gfj;k.kk
- 66- Jh ftrUn flg li= Jh no jkt Hkkj}kt] xko % ctkuh] Mkd?kj % py] rglhy % d.Mk?kkV] ftyk % lkyu] fgeky in'k
50. Mr. Chandan Mehta, Village Nandon, Near Oachghat, Tehsil & Distt. Solan (HP).
51. Mr. Ashok Kumar Gupta, Basahat Chaila Kaindi, Tehsil Theog, Distt. Shimla (HP).
52. Mrs. Himta Devi W/o Sh. Jaswant Singh, R/o Village Koon, PO Shambhuwala, Tehsil Nahan, Distt. Sirmour (HP). (Two Nos.)
53. Mr. Anil Kumar S/o Sh. Hari Chand, Village Dhandrashi, PO Kalahod, Tehsil Sunder Nagar, Distt. Mandi (HP).
54. Mr. Raj Kishore Bahuguna S/o Sh. Pyare Lal Bahuguna, Village Kudiya, PO Thano, Distt. Dehradun (UK) – 248143.
55. Mr. Padam Singh, Village Nau, PO Deothi, Tehsil & Distt. Solan (HP).
56. Mrs. Pooja Chauhan, Village Dang Gusai, Patti Gusai, PO Bangiyal, Vikas Khand Tholdhar, Tehsil Kandisod, Distt. Tehri Garhwal (UK) – 249132.
57. Mr. Zakirhusen A. Shaikh, M/s. Shaikh Zakirusen Abdulrahim, H.No.547/1, Shivaji Corner, Factory Road, Sathenagar Kabnoor-Ichalkaranji-416129, Tal Hatkanangale, Distt. Kolhapur (MS).
58. Mr. Lal Singh S/o Sh. Hardev Singh, V&PO Akodar, Tehsil & Distt. Mohinderagar (Haryana).
59. Mr. Simranjeet Singh, V&PO Bhinder Kalan, Pati Nariya, Distt. Moga (Punjab) – 142041.
60. Mr. Amit Kumar S/o Sh. Parkash Chand, V&PO Ree, Tehsil Sujampur, Distt. Hamirpur (HP).
61. Mr. Robin Gautam, S/o Sh. Shamsheer Chand Gautam, Village & PO Panjgai, Tehsil Sadar, Distt. Bilaspur (HP) – 174012.
62. Mrs. Seema Kashyap, Kashyap Mushroom Farm, Village Kaelong, PO Matiana, Tehsil Theog, Distt. Shimla (HP) - 171212.
63. Mr. Rajinder Singh S/o Late Sh. Sandhya Dass, Village Harwal, PO Nangal Jarialam, Tehsil Amb, Distt. Una (HP).
64. M/s. Aman Mushroom Products, Mr. Kulwant Singh S/o Sh. Mahinder Singh, Village Ugara, PO Bara, Tehsil & Distt. Ambala (Haryana).
65. Mr. Mahavir Singh, S/o Sh. Mange Ram, Village & PO Kandela, Tehsil & Distt. Jind (Haryana) – 126102.
66. Mr. Jitender Singh S/o Sh. Dev Raj Bhardwaj, Village Banjani, PO Chail, Tehsil Kandaghat, Distt. Solan (HP).



- 67- Jh ck/k jkt li= Jh xkiky jke] xko o Mkd?kj % xkYoku] rglhy % ujij] ftyk % dlxMk & 176 022] fgekpy in'k
- 68- Jh Mkju vkj-d-] FkxehcM dkcjkce ydkb] bEQky & 795 004] ef.kij
- 69- Jh xkfoun ilkn iKM] eII dlo Qke] xko % iB: Mk dyk] Mkd?kj % ub x<h] ftyk % jhok & 486 340] e/; in'k %rhu uEcj%
- 70- Jh bun flg li= Jh e'kk jke] xko % jRrk fVCh] Mkd?kj % jk; ij jkuh] ftyk % ipdyk & 134 204] gfj; k.kk
- 71- Jherh uhfyek Bkdj iRuh Jh /kelN Bkdj] eI I rifLoh e'k: e Qke] ijn'kh iKM] , Iih vkfQI d ihN] Mkd?kj % HkokuhiVuk] ftyk % dkykgk.Mh & 766 001] vkfM'kk
- 72- Jh fxjh'k pUn e[kjh] xko o Mkd?kj % djckjh] eud fl} ekx] f'keyk ck; ikl jKM] ftyk % ngjknu] mRrjk[kM
- 73- Jh /khjUn pkgu li= Jh rt flg] xko % Jhuxj] Mkd?kj % vkjxckn] rglhy % gkMy] ftyk % iyoy & 121 102] gfj; k.kk
- 74- Jh ;kxUn flg] xko o Mkd?kj VMy] rglhy % d.Mk?kkV] ftyk % lkyu & 173 215] fgekpy in'k
- 75- Jh uj'k nRr 'kel] xko % xxk; k] Mkd?kj % ckxik'kkx] rglhy % ipkM] ftyk % fljekj & 173 024] fgekpy in'k
- 76- Jh fnu'k oek] xko % vUth lukj] ok; k oduk?kkV] rglhy % d.Mk?kkV] ftyk % lkyu & 173 234] fg-i-
- 77- Jh fuUtece jkfyUnk uhyy ck'kh[kk;] fdVuk iuh] bEQky ioh ef.kij & 795 008] , IMh Ih ck'kh[kkj d fudV
- 78- IJh itk HkVVkM] 1@9] eDleyj ikFk] uku dEiuh gkmfLx dkykuh] nxkij % if'pe cxky% & 713 216
- 79- IJh dkeuk oek iRuh Jh jkt oek] xko o Mkd?kj % >ktk] rglhy % d.Mk?kkV] ftyk % lkyu & 173 217] fgekpy in'k
- 80- Jh uhjt luh li= Jh noh pn luh] xko % [ktjh] Mkd?kj % ukxy] rglhy % txk/kjh] ftyk % ;eukuxj & 135 001] gfj; k.kk
- 81- Jh uhjt oek] pUuh dkFkkyh %fjvkj% Ijkj ugj] cuh cgeuk] lkeck] tEe o d'ehj
- 82- Jh ch-, e ferriy] ferriy ikjftXI , M dEikuV I ik- fy-] lykV u- ch & 1125] Qt&3] RIICO bMfLV; y , fj; k] fhokMh] jktLFku & 301 019] ifj; ktuk LFky % vpkrh] jk; ij] NRrh l x<
67. Mr. Bodh Raj S/o Sh. Gopala Ram, VPO Golwan, Tehsil Nurpur, Distt. Kangra (HP) – 176022.
68. Mr. Doren RK, Thangmeiband Kabrabam Leikai, Imphal – 795004.
69. Mr. Govind Prasad Pandey, M/s. Kesav Farms, Village Pathruda Kala, PO Naigarhi, Distt. Rewa (MP) - 486340. (Three Nos.)
70. Mr. Inder Singh S/o Sh. Mansha Ram, Village Ratta Tibbi, PO Raipur Rani, Distt. Panchkula (Haryana) – 134204.
71. Mrs. Neelima Thakur W/o Sh. Dharmendra Thakur, M/s. Tapaswani Mushroom Farm, At Pardesi Pada, Backside of SP Office, PO Bhawanipatna, Distt. Kalahandi – 766001 (Odisha).
72. Mr. Girish Chandra Maikhuri, V&PO Karbari, Manak Sidh Marg, Shimla Bye Pass Road, Distt. Dehradun (UK).
73. Mr. Dhirender Chauhan S/o Sh. Tej Singh, Village Srinagar, PO Aurangabad, Tehsil Hodel, Distt. Palwal (Haryana) – 121102.
74. Mr. Yoginder Singh, VPO Tundal, Tehsil Kandaghat, Distt. Solan (HP) - 173215.
75. Mr. Naresh Dutt Sharma, Village Gagayo, PO Bagpashog, Tehsil Pachad, Distt. Sirmour (HP) – 173024.
76. Mr. Dinesh Verma, Village Anji Sunara, Via Vaknaghat, Tehsil Kandaghat, Distt. Solan (HP) - 173234.
77. Mr. Ninjombam Rolindro Neilei Bashikhoy, Kitna Panuvy, Imphal East Manipur – 795008, Near SDC Bashikhor.
78. Ms. Pooja Bhattad, 1/9 Maxmullar Path, Non Company Housing Colony, Durgapur (W.B.) – 713216.
79. Ms. Kamna Verma W/o Sh. Raj Verma, VPO Jhaja, Tehsil Kandaghat, Distt. Solan (HP) - 173217.
80. Mr. Neeraj Saini S/o Sh. Devi Chand Saini, Village Khujri, PO Nangal, Tehsil Jagadari, Distt. Yamunanagar (Haryana) – 135001.
81. Mr. Neeraj Verma, Channi Kartholi (Reoar), Saroar Nehar, Bani Brahmana, Samba (J&K).
82. Mr. B.M. Mittal, Mittal Porgings & Components (P) Limited, Plot No.B-1125, Phase-III RIICO Industrial Area, Bhiwadi, Rajasthan – 301019. Project site: Achoti, Raipur (Chattisgarh).



- 83- Jh onk'k lkgu xk;y] x.kifr lYl dkjik'ku] Mk- egjk fcfYMX] flfoy ykbUl] ukxij jkM] pUnij & 442 401] egkj'V
- 84- Jherh ,drk 'kek] xko % tjb] Mkd?kj % cojh] rglhy o ftyk % lkyu] fgeky in'k
- 85- ekEen elyhu li= Jh euhtj vyh] xko % dkroky vkyeij] Mkd?kj % >cjjk] ftyk % gfj}kj & 247 665] mRrjk[kM
- 86- Jh :eh jke t loky] xko o Mkd?kj % Njck] ftyk % ngjknu & 298 197] mRrjk[kM
- 87- Jh ichu dek] li= Jh jke flg] xko o Mkd?kj % Njck] rglhy % fodkl uxj] ftyk % ngjknu] mRrjk[kM
- 88- Jh jfoun dek] xko % lgyh] Mkd?kj % djlkbl rglhy % cjlj] ftyk % gehij & 174 312] fg-i-
- 89- Jh nyhi Bkdj] xko % lokx] Mkd?kj % ?kUukx?kkV] rglhy % vjdj] ftyk % lkyu] fgeky in'k
- 90- Jh jtu'h'k dek] li= Jh no jkt] xko % DokV] Mkd?kj % >yku] rglhy % uknu] ftyk % gehij & 177 301] fgeky in'k
- 91- Jh lj'k ljue] Mh-u- 9&20] fluek gky d fudV] Ncj k %Mkd?kj % ,o %eMy % xUV] %ft yk % vkU/k in'k & 522 212
- 92- Jh cfNRrj flg] xko o Mkd?kj % mjykuk dyk] rglhy % eVykk] ftyk % ikuhir & 132 103] gfj ;k.kk
- 93- Jherh jhrk noh iRuh Jh dey'k pUn] xko % lj fpjx] Mkd?kj % tkukth] rglhy o ftyk % lkyu & 173 212] fgeky in'k
- 94- l Jh xxu pk/kjh ,o Jherh f'kokuh pk/kjh] 858] lDVj&2] ipdyk] gfj ;k.kk
- 95- Jh gl jkt li= Jh Hki flg] xko % iV;kuh] Mkd?kj % fcj[kkekuh] rglhy % cYg] ftyk % eMh & 175 027] fgeky in'k
- 96- Jh iohu dek] li= Jh lriky] xko % ikVu] Mkd?kj % cykleM jkM] fg l k] gfj ;k.kk
- 97- Jh txnh'k pUn li= Lo- Jh ie nk l] xko % ijkg] Mkd?kj % cyxkj] rglhy % >MBk] ftyk % fcykl ij & 174 031] fgeky in'k
- 98- Jh fjfru Bkdj li= Jh nfounj Bkdj] xko % dkBh] Mkd?kj % Ap?kkV] rglhy o ftyk % lkyu & 173 233] fgeky in'k
- 99- Jh lke nRr] xko o Mkd?kj % lukj] rglhy % jktx<] ftyk % fljekj] fgeky in'k
- 100- Jherh l'kek noh iRuh Jh luhyy xx] ndku u-4] fdBokjh pkd] 'k[kij] iyoy] gfj ;k.kk
83. Mr. Vedanshu Sohan Goel, Ganpati Sales Corporation, Dr. Mehra Building, Civil Lines, Nagpur Road, Chandrapur (MS) – 442401.
84. Mrs. Ekta Sharma, Village Jarai, PO Brewery, Tehsil & Distt. Solan (HP).
85. Mr. Mohd. Mursleen S/o Sh. Munizir Ali, Village Kotwal Alampur, PO Jhabrera, Distt. Haridwar (UK) – 247665.
86. Mr. Rumi Ram Jaswal, VPO Charba, Distt. Dehradun (UK) – 298197.
87. Mr. Parbin Kumar S/o Sh. Ram Singh VPO Chhrba, Tehsil Vikas Nagar, Distt. Dehradun (UK).
88. Mr. Ravinder Kumar, Village Saheli, PO Karsai, Tehsil Barsar, Distt. Hamirpur (HP) – 174312.
89. Mr. Dalip Thakur, Village Sawag, PO Ghannagughat, Tehsil Arki, Distt. Solan (HP).
90. Mr. Rajneesh Kumar S/o Sh. Dev Raj, Village Quant, PO Jhallan, Tehsil Nadaun, Distt. Hamirpur (HP) – 177301.
91. Mr. Suresh Saranam, D.No.9-20, Near Cinema Hall, Chebra (PO) & (Mandal), Guntur (Distt.), Andhra Pradesh – 522212.
92. Mr. Bachitar Singh, VPO Uralana Kalan, Tehsil Matlodha, Distt. Panipat (Haryana) – 132103.
93. Mrs. Rita Devi, W/o Mr. Kamlesh Chand, Village Sar Chirag, PO Jaunaji, Tehsil & Distt. Solan (HP) – 173212.
94. Ms. Gagan Choudhary & Mrs. Shivani Choudhary # 858, Sector-2, Panchkula (Haryana).
95. Mr. Hans Raj S/o Sh. Bhup Singh, Village Patyani, PO Brikhamani, Tehsil Balh, Distt. Mandi (HP) – 175027.
96. Mr. Praveen Kumar S/o Sh. Satpal, Village Patan, Balasmand Road, Hisar (Haryana).
97. Mr. Jagdish Chand S/o Late Sh. Prem Dass, Village Prahua, PO Balgar, Tehsil Jhundtha, Distt. Bilaspur (HP) – 174031.
98. Mr. Ritin Thakur S/o Sh. Devinder Thakur, Village Kothi, PO Ochghat, Tehsil & Distt. Solan (HP) – 173233.
99. Mr. Som Dutt, Village & PO Sanora, Tehsil Rajgarh, Distt. Sirmour (HP).
100. Mrs. Sushma Devi, W/o Sh. Sunil Garg, Shop No.4, Kithwari Chowk, Sekhpura, Palwal (Haryana).



- 101- Jh lfpu pkgku lfpo] xk;=h fo |kihB
lklk;Vh] xko % dMdk lUrj] ieuxj] ngjknul
mRrjk[kM %nk ckj½
- 102- Jh fuf[ky] ih-oh- li= Jh okY lU] ih-oh- f=pj]
djj
- 103- Jherh f'kokuh pk/kjh] xko % x.k'kij] jk; ij jkuh
d fudV] ftyk % ipdyk & 134 204] gfj;k.kk
- 104- Jh euh'k dekj li= Jh ihre nk l] xko o
Mkd?kj % e>kyh] rglhy % ukykx<] ftyk %
lkyu & 174 101] fgeky in'k
- 105- Jh foukn dekj Hkygk.Mh li= Jh xkfoUn jke]
xko % yNeij] Mkd?kj % dYy?kkVh dKv]kj]
ikMh x<oky] mRrjk[kM %nk ckj½
- 106- Jh fxjh'k pUn ek[kkj] xko o Mkd?kj djoifn; k]
ftyk % ngjknul mRrjk[kM
- 107- Jh jkt'k dekj li= Jh ikj l jke] xko % lkb]
Mkd?kj % ldjgk] rglhy % lnj] ftyk %
fcyklij & 174 032] fgeky in'k
- 108- Jh jk/kk d".k li= Jh lju jke] xko % Fkkuk
cMky] Mkd?kj % VMky] rglhy d.Mk?kkV] ftyk
% lkyu] fgeky in'k %nk ckj½
- 109- Jh vefjUn flg li= Jh jktUn flg] 122] ihr
fogkj] uok] iFv;kyk] itkc
- 110- Jh eukt Mxj] C/o , l-, l-, lkl, VI] ub
fnYyh & 110 049
- 111- Jh jru pUn li= Jh cjxh jke] xko % vkn'k
uxj] Mkd?kj % irn;ky] rglhy % uknu] ftyk
% gehij] fgeky in'k
- 112- Jherh ekfudk pkgku iRuh Jh lfpu pkgku]
xko % uUnk dh pkdh] dKvnk lRj] ngjknul
mRrjk[kM
- 113- Jh vut dekj li= Jh ck lno pkgku] xko %
lyheij] egen cgjknckn] gfj}kj] mRrjk[kM
- 114- Jh txnh'k pkoyk] 181] Nkv exyij] vkbVhvk
d lkeu] dtijk ex] djujy & 132 001]
gfj;k.kk
- 115- Jh iju flg] xko % lukoy] Mkd?kj % Åpk?kkV]
rglhy o ftyk % lkyu] fgeky in'k
- 116- Jherh lykpuk 'kek iRuh Jh lj'k 'kek] xko o
Mkd?kj % egUnk ckx] rglhy % iNkM] ftyk %
fljekj] fgeky in'k
- 117- Jh dkdj jke li= Jh ekFk jke] xko % Hkkyt k]
Mkd?kj % cluh] rglhy % iNkM] ftyk % fljekj]
fgeky in'k
- 118- Jh jktho c['kh] xko % VMk Hkxey] ftyk %
gfj}kj] mRrjk[kM

101. Mr. Sachin Chauhan, Secretary Gayatri
Vidyapeeth Society, Village Kodka Santoor,
Premnagar, Dehradun (UK). (Two Nos.)
102. Mr. Nikhil P.V. S/o Sh. Walsan P.V.,
Thirussur, Kerala.
103. Mrs. Shivani Choudhary, Village Ganeshpur,
Near Raipur Rani, Distt. Panchkula
(Haryana) – 134204.
104. Mr. Manish Kumar S/o Sh. Preetam Dass,
Village & PO Majholi, Tehsil Nalagarh,
Distt. Solan (HP) – 174101.
105. Mr. Vinod Kumar Bhulhandi S/o Sh.
Govind Ram, Village Lachampur, PO
Kallaghati Kotdwara, Pauri Garhwal (UK).
(Two Nos.)
106. Mr. Girish Chandra Maukhari, Village & PO
Karwardiyo, Distt. Dehradun (UK).
107. Mr. Rajesh Kumar S/o Sh. Paras Ram, Village
Sai, PO Sakroha, Tehsil Sadar, Distt. Bilaspur
(HP) – 174032.
108. Mr. Radha Krishan S/o Sh. Sarnu Ram,
Village Thana Badol, PO Tundal, Tehsil
Kandaghat, Distt. Solan (HP). (Two Nos.)
109. Mr. Amrinder Singh S/o Sh. Rajendra Singh,
122, Preet Vihar, Nava, Patiala (Punjab).
110. Mr. Manoj Duggar, C/o SS Associates, New
Delhi – 110 049.
111. Mr. Rattan Chand S/o Sh. Bargi Ram, Village
Adarash Nagar, PO Putdyal, Tehsil Naudan,
Distt. Himarpur (HP).
112. Mrs. Monika Chauhan, W/o Sh. Sachin
Chauhan, Village Nanda Ki Chowki, Kotda
Santoor, Dehradun (UK).
113. Mr. Anuj Kumar S/o Sh. Basudev Chauhan,
Village Salimpur, Mehmud Bahradabad,
Haridwar (Uttarakhand).
114. Mr. Jagdish Chawla, 181, Chotta Mangalpur,
Infront of ITI, Kunjpura Marg, Karnal
(Haryana) – 132001.
115. Mr. Puran Singh, Village Sanawal, PO
Ochghat, Tehsil & Distt. Solan (HP).
116. Mrs. Sulchona Sharma W/o Sh. Suresh
Sharma, Village & PO Mehandro Bagh,
Tehsil Pachhad, Distt. Sirmour (HP).
117. Mr. Kaka Ram S/o Sh. Mathu Ram, Village
Bhalja, PO Basni, Tehsil Pachhad, Distt.
Sirmour (HP).
118. Mr. Rajiv Bakshi, Village Tanda Bhagmal,
Distt. Haridwar (UK).



8.

I fefr dh cBd
Committee Meetings

ILFkku ic/ku I fefr %vkb,eI h%

Institute Management Committee

Hkkdvui & [kEc vul/kku fun'kky;] Ikyu e fnukd
26-10-2015 dk ILFkku ic/ku I fefr dh ,d cBd
vk; kft r dh xb A

One meeting of IMC was held at ICAR-DMR, Solan
on 26.10.2015

1	Mk- oh-i-h- 'kek] fun'kd] Hkkdvui&[kEc vul/kku fun'kky;] Ikyu	v/; {k
1	Dr. V. P. Sharma, Director, ICAR-DMR, Solan	Chairman
2	Igk; d egkfun'kd %ckxokuh&2% Hkkdvui] dc &2] i l k] ub fnYyh	I nL;
2	Assistant Director General (Hort. II), ICAR, KAB-II, Pusa, New Delhi	Member
3	vul/kku fun'kd] fgekpy in'k df'k fo'ofokky;] ikyeiij fg-i-	I nL;
3	Director of Research, Himachal Pradesh Krishi Vishwavidyalaya, Palampur (HP)	Member
4	fun'kd] ckxokuh foHkkx] i tkc I jdkj] p.MhX<	I nL;
4	Director, Deptt. of Horticulture, Govt. of Punjab, Chandigarh	Member
5	vul/kku fun'kd] Mk- okb-, I- i jekj vk kfudh ,o okfudh fo'ofokky;] ukuh] Ikyu %fg0i0%	I nL;
5	Director of Research, Dr. Y. S. Parmar UHF, Nauni, Solan (HP)	Member
6	Mk- jkt 'k jk.kk] i/kku oKkfud %vFk'kkL=] Hkkdvui&dUnh; vky vul/kku ILFkku] f'keyk %fg0i0%	I nL;
6	Dr. Rajesh Rana, Principal Scientist (Economics), ICAR-Central Potato Research Institute, Shimla (HP)	Member
7	Mk- ehjk ik.M] i/kku oKkfud] Hkkdvui&Hkkjrh; ckxokuh vul/kku ILFkku] cxy: %dukVd%	I nL;
7	Dr. Meera Pande, Principal Scientist, ICAR-Indian Institute of Horticultural Research, Bangalore	Member
8	Mk- d-d- feJk] ofj"B oKkfud %ikni jkxfoKku%] Hkkdvui&foodkuUn iorh; df'k vul/kku ILFkku] vYekMk %mUkj k%KM%	I nL;
8	Dr. K. K. Mishra, Senior Scientist (Plant Pathology), ICAR-Vivekanand Parvatiya Krishi Anusandhan Sansthan, Almora	Member
9	Mk- 'or dey] ofj"B oKkfud] Hkkdvui&[kEc vul/kku fun'kky;] Ikyu %fg0i0%	I nL;
9	Dr. Shwet Kamal, Sr.Scientist, ICAR-DMR, Solan	Member
10	foRr o y[kk vf/kdkjh] Hkkjrh; df'k vul/kku ifj"kn] df'k Hkou] ub fnYyh	I nL;
10	Finance & Accounts Officer, Indian Council of Agricultural Research, Krishi Bhavan, New Delhi	Member
11	Jh foukn Bkdj] Bkdj e'k: e Qke] pEck?kkV] Ikyu %fg0i0%	I nL;
11	Shri.Vinod Thakur, Thakur Mushroom Farm, Chambaghat, Solan	Member
12	Jh jkt 'k Bkdj] xko cj dh I j] pEck?kkV] Ikyu %fg0i0%	I nL;
12	Shri. Rajesh Thakur, Village Ber-ki-Ser, Chambaghat, Solan.	Member
13	i'kk Ifud vf/kdkjh] Hkkdvui&[kEc vul/kku fun'kky;] Ikyu %fg0i0%	I nL; I fpo
13	Administrative Officer, ICAR-DMR, Solan	Member Secretary



Figure 8.1. IMC and RAC meetings held at ICAR-DMR, Solan

Research Advisory Committee (RAC)

Research Advisory Committee (RAC) meeting was held on 8th - 9th August, 2015. The Members of RAC were as under for the period 2013-2016.

Sl. No	Address	Designation
1-	Mk- , l-, l- pgy io dyifr] egkj.kk irki d'k ,o ik kfxdh fo'ofok ky;] mn; ij 43&,p] Hkkb j/kh] flg uxj] yf/k; kuk %i t kc%141 012	v/; {k
1.	Dr. S.S. Chahal, Former Vice Chancellor, MPUAT, Udaipur 43-H, Bhai Randhir Singh Nagar, Ludhiana (Punjab)–141012.	Chairman
2-	Mk- Vh- tkudhjke] lgk;d egkfun'kd %ckxokuh foKku&1%] Hkkjrh; d'k vul/kku ifj"kn] ckxokuh iHkkx] dejk l [;k 426] d'k vul/kku Hkou&2] i l k] ub fnYyh&110 012	InL;
2.	Dr. T. Jankiram, Asstt. Director General (Hort. Science-I), Indian Council of Agricultural Research, Horticulture Division, Krishi Anusandhan Bhavan-II, Pusa, New Delhi – 110 012.	Member



Ø-I-	uke o i rk	i nuke
Sl. No	Address	Designation
3-	Mk- ,e-i h- Bkdj] i l kj fun'kd] bfUnjk xk/kh df"k fo'ofok y; %vkb t hdo h%] d"kd uxj] jk; ij&492012	I nL ;
3.	Dr. M.P. Thakur, Director of Extension, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Krishak Nagar, Raipur - 492012	Member
4-	Mk- vkj-Mh- flg] %io ikQl j ,o v/;{k] ikni jkxfoKku] egkj.k.kk irki df"k ,o ik kfxdh fo'ofok y;] mn; ij% 276] xk;=h uxj&,] nxki jk] t ; ij&302018 %jk t LFkku%	I nL ;
4.	Dr. R.D. Singh, (Former Prof. & Head, Plant Pathology, MPUAT, Udaipur) 276, Gayatri Nagar-A,Durgapura, Jaipur – 302018 (Rajasthan)	Member
5-	Mk- ch-,e- 'kek] %ofj"B ik/;kid ,o dk;Øe fun'kd %lokfuorR%] x.k'k fogkj %f[ky : %] ikLV fcUnku] , l ,lch pkd d fudV] ikyei j&176 061 %fgekpy in'k%	I nL ;
5.	Dr. B.M. Sharma, (Sr. Prof. & Programme Director (Retd.), Ganesh Vihar (Khilru), P.O. Bindraban, Near SSB Chowk, Palampur - 176061 (H.P.)	Member
6-	Mk- vkj-I h- mik/;k;] fun'kd %dk; dkj h%] Hkkdvui&[kEc vul/kku fun'kky;] pEck?kkV] Ikyu %fgekpy in'k%&173 213	I nL ;
6.	Dr. R.C. Uapdhyay, Director (Acting), ICAR-Directorate of Mushroom Research,Chambaghat, Solan (H.P.)–173213.	Member
7-	Jh foukn dekj Bkdj] Bkdj e'k : e Qke] pEck?kkV] Ikyu %fgekpy in'k%&173 213	I nL ;
7.	Sh. Vinod Kumar Thakur, Thakur Mushroom Farm, Chambaghat, Solan (HP)-173213	Member
8-	Jh jk t 'k Bkdj] xko cj dh l j] ikLV pEck?kkV] Ikyu %fgekpy in'k%&173 213	I nL ;
8.	Sh. Rajesh Thakur, Village Ber-Ki- Ser, Post Chambaghat, Solan (HP)-173213	Member
9-	Mk- oh-i h- 'kek] i/kku oKkfud] Hkkdvui&[kEc vul/kku fun'kky;] pEck?kkV] Ikyu %fgekpy in'k%&173 213	I nL ; I fpo
9.	Dr. V.P. Sharma, Principal Scientist ICAR-Directorate of Mushroom Research,Chambaghat, Solan (HP) – 173213.	Member Secretary



ILFkku vul/kku ifj"kn %vkbvkj l h%

ILFkku vul/kku ifj"kn %vkbvkj l h% dh cBdk dk vk;k tu fnukd 9 viy] 2015] 9&10 tykb] 2015] 7 uoEcj] 2015] 18&19 fn l Ecj] 2015 rFkk 22 fn l Ecj] 2015 dk fd;k x;kA ILFkku vul/kku ifj"kn d lnL; bl idkj g %

- 1- Mk- oh-i-h- 'kek] fun'kd ,o v/;{k %vkbvkj l h%
- 2- Mk- vkj-l-h- mik/;k;] i/kku oKkfud
- 3- Mk- vk-i-h- vgykor] i/kku oKkfud
- 4- Mk- l rh'k dek] i/kku oKkfud
- 5- Mk- 'or dey] ofj"B oKkfud
- 6- Mk- ;kx'k xkre] oKkfud %ofj"B orueku%
- 7- Mk- egUr'k f'k: j] oKkfud
- 8- l Jh fclnoh vjkMk] oKkfud
- 9- l Jh eer k xlrk] oKkfud
- 10- Jh l/kh] dek] vui] oKkfud
- 11- Mk- l Yodekj jeu] oKkfud

oKkfud&rduhdh dkfed cBd

oKkfud&rduhdh dkfed cBdk dk vk;k tu 29 eb] 2015] 12 tu] 2015] 22 tykb] 2015] 21 vxLr] 2015] 18 fl rEcj] 2015] 30 vDrcj] 2015] 21 uoEcj] 2015 %rduhdh&, l, l, l % 28 uoEcj] 2015] 14 fn l Ecj] 2015] 29 tuo] 2016] 9 Qjo] 2016 rFkk 29 ekp] 2016 dk fd;k x;kA bl l fefr d lnL; Fk

Institute Research Council (IRC)

Institute Research Committee (IRC) meetings were held on 09.04.2015, 9-10th July, 2015, 07.11.2015, 18-19th December, 2015 & 22nd December, 2015 under the chairmanship of Dr. V.P. Sharma, Director and the Members were as under:

1. Dr. V.P. Sharma, Director – Chairman (IRC)
2. Dr. R.C. Upadhyay, Principal Scientist
3. Dr. O.P. Ahlawat, Principal Scientist
4. Dr. Satish Kumar, Principal Scientist
5. Dr. Shwet Kamal, Senior Scientist
6. Dr. Yogesh Gautam, Scientist
7. Dr. Mahantesh Shirur, Scientist
8. Ms. Bindvi Arora, Scientist
9. Ms. Mamta Gupta, Scientist
10. Mr. Sudheer Kumar Annepu, Scientist
11. Mr. Selvakumar Raman, Scientist

Scientists-Technical Personnel Meeting

Scientists-Technical Personnel meetings were held on 29.05.2015, 12.06.2015, 22.07.2015, 21.08.2015, 18.09.2015, 30.10.2015, 21.11.2015 (Technical-SSS), 28.11.2015, 14.12.2015, 29.01.2016, 09.02.2016 and 29.03.2016 and the Members were as under:



Ø- I-@ Sl. No.	uke@Name of employee	inuke@Designation
oKkfud@Scientific		
1	Mk- oh-ih- 'kek@Dr. V.P. Sharma	fun'kd@Director
2	Mk- vkj-ih- mik/;k;@Dr. R.C. Upadhyay	i/kku oKkfud@Principal Scientist
3	Mk- vk-ih- vgykor@Dr. O.P. Ahlawat	i/kku oKkfud@Principal Scientist
4	Mk- I rh'k dekj@Dr. Satish Kumar	i/kku oKkfud@Principal Scientist
5	Mk- 'or dey@Dr. Shwet Kamal	ofj"B oKkfud@Senior Scientist
6	Mk- ;kx'k xkre@Dr. Yogesh Gautam	oKkfud %ofj"B orueku%@Scientist
7	Mk- egUr'k f'k: j@Dr. Mahantesh Shirur	oKkfud@Scientist
8	I Jh fcUnoh vjkMk@Ms. Bindvi Arora	oKkfud@Scientist
9	I Jh eerK xlrk@Ms. Mamta Gupta	oKkfud@Scientist
10	Jh I/khj dekj vui@Mr. Sudheer Kumar Annepu	oKkfud@Scientist
11	Mk- IYodekj jEU@Mr. Selvakumar Raman	oKkfud@Scientist
rduhdh@Technical		
1	Jh IuhY oek@Sh. Sunil Verma	I gk; d e-r-v- %Qke%@Astt. CTO (Farm)
2	Jherh jhrk@Smt. Reeta	I gk; d e-r-v- %iLrdky; %@Astt. CTO (Lib)
3	Jherh 'ky tk oek@Smt. Shailja Verma	o-r-v- %dyk%@STO (Art)
4	Jh Kku pln@Sh. Gian Chand	r-v- %Qke%@TO (Farm)
5	Jh Mkyk jke@Sh. Dala Ram	o-r-l- %okgu%@STA (Vehicle)
6	Jh jke yky@Sh. Ram Lal	o-r-l- %okgu%@STA (Vehicle)
7	Jh nhid 'kek@Sh. Deepak Sharma	o-r-l- %dEl; Vj%@STA (Computer)
8	Jh thr jke@Sh. Jeet Ram	r-l- %Qke%@TA (Farm)
9	Jh jke Lo: i@Sh. Ram Swaroop	r-l- %Qke%@TA (Farm)
10	Jh xyj flg jk.kk@Sh. Guler Singh Rana	r-l- %byDVhf'k; u%@TA (Electrician)
11	Jh y[k jkt jk.kk@Sh. Lekh Raj Rana	r-l- %Qke%@TA (Farm)
12	Jh jkt dekj@Sh. Raj Kumar	r-l- %Qke%@TA (Farm)

e-r-v-&e[; rduhdh vf/kdkjh] o-r-v-&ofj"B rduhdh vf/kdkjh] r-v-& rduhdh vf/kdkjh] o-r-l-&ofj"B rduhdh
I gk; d] r-l-&rduhdh I gk; d]

CTO-Chief Technical Officer, STO-Senior Technical Officer, TO-Technical Officer, STA-Senior Technical Assistant, TA-
Technical Assistant



ih,eb] Iy dh cBd]

vul/kku iKkfedrK LFkkiuk ,o ekuhVfjx %ih,eb%
lfefr;k dh cBdk dk vk;ktu 29 eb] 2015] 21
tykb] 2016] 31 vxLr] 2015] 26 uoEcj] 2015] 18
fnlEcj] 2015] 4 Qjojh] 2016] 3 ekp] 2016 rFkk 9
ekp] 2016 dk fd;k x;kA lfefr d lnl; bl idkj
Fk %

- 1- Mk- vk-i-h- vgykor] i/kku oKkfud] v/;{k
- 2- Mk- l rh'k dek] i/kku oKkfud] lg v/;{k
- 3- Mk- ;kx'k xkre] oKkfud %ofj"B orueku%
- 4- Jh l/kh] dek] vui] oKkfud] lnl; lfpo
- 5- Jh nhi dek] Bkdj] vk'kyfid

vkj,QMh lfefr dh cBd]

ifj.kke #ij[kk nLrkot %vkj,QMh lfefr;k
dh cBdk dk vk;ktu fnukd 1 viy] 2015] 24 viy]
2015] 21 tykb] 2015] 1 vDrcj] 2015] 30 vDrcj] 2015]
4 tuo]h] 2016] 4 Qjojh] 2016 rFkk 3 ekp] 2016 dk
fd;k x;kA lfefr d lnl; bl idkj Fk %

- 1- Mk- oh-i-h- 'kek] fun'kd] v/;{k
- 2- Mk- vk-i-h- vgykor] i/kku oKkfud] ukMy
vf/kdkjh
- 3- Mk- l rh'k dek] i/kku oKkfud] lg ukMy
vf/kdkjh
- 4- Mk- ;kx'k xkre] oKkfud %ofj"B orueku% lnl;
- 5- Jh l/kh] dek] vui] oKkfud] lnl;
- 6- Jh vejno 'kek] i'kk lfud vf/kdkjh] lnl;
- 7- Jh t-vkj- exky] lgk;d foRr o y[kk vf/kdkjh]
lnl;

idk'ku lfefr dh cBd]

lLFkku dh idk'ku lfefr dh cBdk dk vk;ktu
fnukd 26 uoEoj] 2015] 30 uoEoj] 2015] 1 fnlEcj]
2015] 8 fnlEcj] 2015] 18 fnlEcj] 2015] 1 tuo]h]
2016] 28 tuo]h] 2016 rFkk 3 ekp] 2016 dk fd;k
x;kA bl lfefr d lnl; bl idkj Fk %

- 1- Mk- vk-i-h- vgykor] i/kku oKkfud
- 2- Mk- l rh'k dek] i/kku oKkfud
- 3- Mk- 'or dey] ofj"B oKkfud
- 4- Mk- egUr'k f'k:] oKkfud

PME Cell Meetings

Research Priority Setting & Monitoring (PME)
Committee meetings were held on 29.05.2015,
21.07.2015, 31.08.2015, 26.11.2015, 18.12.2015,
04.02.2016, 03.03.2016 and 09.03.2016 and
Members were as under:

1. Dr. O.P. Ahlawat, Principal Scientist, Chairman
2. Dr. Satish Kumar, Principal Scientist, Co-
Chairman
3. Dr. Yogesh Gautam, Scientist, Member
4. Mr. Sudheer Kumar Annepu, Scientist, Member
Secretary
5. Mr. Deep Kumar Thakur, Stenographer

RFD Committee Meeting

Results Frame-work Document (RFD)
committee meetings were held on 01.04.2015,
24.04.2015, 21.07.2015, 01.10.2015, 30.10.2015,
04.12.2015, 4.1.2016, 04.02.2016 & 03.03.2016
and the Members were as under:

1. Dr. V.P. Sharma, Director/Chairman
2. Dr. O.P. Ahlawat, Principal Scientist, Nodal
Officer
3. Dr. Satish Kumar, Principal Scientist, Co-Nodal
Officer
4. Dr. Yogesh Gautam, Scientist, Member
5. Mr. Sudheer Kumar Annepu, Scientist, Member
6. Sh. Amardev Sharma, Admn. Officer, Member
7. Sh. J.R. Mangale, AF&AO, Member

Publication Committee Meetings

Publication committee meetings were held on
26.11.2015, 30.11.2015, 1.12.2015, 08.12.2015,
18.12.2015, 1.1.2016, 28.01.2016 and 3.3.2016
and the Members were as under:

1. Dr. O.P. Ahlawat, Principal Scientist
2. Dr. Satish Kumar, Principal Scientist
3. Dr. Shwet Kamal, Senior Scientist
4. Dr. Mahantesh Shirur, Scientist



I LFkku I ;Dr depkjh ifj"kn %vkb't, I I h%

I LFkku I ;Dr depkjh ifj"kn dh cBdk dk vk;ktu fnukd 14 tuojuh] 2015] 27 eb] 2015] 22 tykb] 2015 rFkk 9 uoEoj] 2015 dk fd;k x;kA I LFkku I ;Dr depkjh ifj"kn dk xBu bl idkj g%&

I LFkku I ;Dr depkjh ifj"kn d LVkQ dh vkj I ukfer InL;

- 1- Jh jk'ku yky uxh] dfu"B fyfid] InL; I ht, I I h
- 2- Jh /ke nkI] ofj"B fyfid
- 3- Jh xyj flg jk.kk] rduhdh Igk;d] Ifpo %vkb't, I I h %
- 4- Jh nhid 'kek] ofj"B rduhdh Igk;d
- 5- Jh vthr flg] d'ky Igk;h LVkQ
- 6- Jh fou; 'kek] d'ky Igk;h LVkQ

I LFkku I ;Dr depkjh ifj"kn e dk;ky; dh vkj I ukfer InL;

- 1- Mk- vkj-I h- mik/;k;] i/kku oKkfud
- 2- Mk- 'or dey] ofj"B oKkfud
- 3- Mk- ;kx'k xkre] oKkfud
- 4- i'kk Ifud vf/kdkjh
- 5- Lkgk;d foRr o y[kk vf/kdkjh

f'kd; r Iy

f'kd; r IfeFr dh cBdk dk vk;ktu fnukd 5 tuojuh] 2015] 29 eb] 2015] 8 tykb] 2015 rFkk 31 vDrcj] 2015 dk fd;k x;kA f'kd; r IfeFr dk xBu bl idkj g %

f'kd; r IfeFr d fuokfpr InL;

Elected members of grievance committee

Ø-I-	uke o i nuke	Ji.kh	{kerk
Sl. No.	Name & designation	Category	Capacity
1	Mk- ;kx'k xkre] oKkfud	oKkfud	InL;
1	Dr. Yogesh Gautam, Scientist	Scientific	Member
2	Jherh 'k'kh iue] dfu"B fyfid@	i'kk Ifud	InL;
	Smt. Shashi Poonam, LDC	Administrative	Member
3	Jh jke Lo : i] rduhdh Igk;d@	rduhdh	InL;
	Sh. Ram Swaroop, Tech.Asstt.	Technical	Member
4	Jh rt jke] d'ky Igk;h LVkQ@	d'ky Igk;h LVkQ	InL;
	Sh. Tej Ram, SSS	Skilled Support Staff	Member

Institute Joint Staff Council

Meetings of Institute Joint Staff Council held on 14.01.2015, 27.05.2015, 22.07.2015 and 09.11.2015

Staff side members of IJSC

- 1. Sh.Roshan Lal Negi, LDC (Member CJSC)
- 2. Sh.Dharam Dass, UDC
- 3. Sh.Guler Singh Rana, Technical Assistant (Secretary IJSC)
- 4. Sh.Deepak Sharma, Sr.Technical Assistant
- 5. Sh.Ajeet Kumar, SSS
- 6. Sh.Vinay Sharma, SSS

Office side members of IJSC

- 1. Dr.R.C. Upadhyay, Principal Scientist
- 2. Dr.Shwet Kamal, Sr.Scientist
- 3. Dr.Yogesh Gautam, Scientist
- 4. Administrative Officer
- 5. AF&AO

Grievance Cell

Meetings of Grievance Committee held on 05.01.2015, 29.05.2015, 08.07.2015 and 31.10.2015



dk;ky; dh vkj I f'kd; r I febr e ukferh
Nominated office side members of grievance committee

Ø-I-	uke o inuke	Ji.kh	{kerk
Sl. No.	Name & designation	Category	Capacity
1- 1.	Mk- oh-i-h- 'kek Dr.V.P. Sharma	fun'kd Director	v/; {k Chairman
2- 2.	Mk- 'or dey] ofj"B oKkfud Dr. Shwet Kamal, Sr.Scientist	oKkfud Scientific	I nL; Member (Office side)
3- 3.	i 'kk I fud vf/kdkjh Administrative Officer	i 'kk I fud Administrative	I nL; Member (Office side)
4- 4.	I gk;d foRr o y[kk vf/kdkjh Asstt.Finance & A/Cs Officer	vkfMV Audit	I nL; Member (Office side)
5- 5.	I gk;d i 'kk I fud vf/kdkjh Asstt.Admn.Officer	i 'kk I fud Administrative	I nL; I fpo Member Secretary

efgyk Iy rFkk efgyk f'kd; r I febr

efgyk I febr dh rhu cBd 22-06-2015] 23-09-2015 rFkk 04-03-2016 dk vk;kft r dh xBA

efgyk Iy rFkk efgyk f'kd; r I febr d I nL; fuEu fyf[kr gA

dekjh eerK xlrk] oKkfud	v/; {k
i 'kk I fud vf/kdkjh	I nL;
Jherh jhrk HkkfV;k] I -e-r-v-	I nL;
Jherh 'kyt k oek] o-r-v-	I nL;
Jherh 'k'kh iue] d- fyfid	I nL;
Jherh Iuhyk Bkdj] fu th I gk;d	I nL;
	I fpo

dekjh fcUnoh vjkMk] oKkfud@v/; {k dk] fn I Ecj 2015 ekg e LFkkukUrj.k gku dh otg I dekjh eerK xlrk] oKkfud dk efgyk f'kd; r I febr rFkk efgyk Iy dk v/; {k cuk;k x;kA

Women Cell and Women Grievance Committee

Three meetings of women committee were held on 22.06.2015, 23.09.2015 and 04.03.2016.

Members of Women Cell and Women Grievance Committee were as under:

Ms. Mamta Gupta, Scientist	Chairman
Administrative Officer	Member
Smt. Reeta, ACTO	Member
Smt. Shailja Verma, Sr. TO	Member
Smt. Shashi Poonam, LDC	Member
Smt. Sunila Thakur, PA	Member
	Secretary

Ms. Mamta Gupta, Scientist was nominated as Chairman of Women Cell and Women Grievance Committee due to transfer of Ms. Bindvi Arora, Scientist in December, 2015.



9.

jk t Hkk"kk dk; kUo; u

Implementation of Official Language

jk t Hkk"kk dk; kUo; u IfeFr %fgUnh IfeFr%

Mk- oh-i-h- 'kek] fun'kd	&	v/; {k
Mk- l r'h'k dek] i/kku oKkfud@i'kk l fud vf/kdkjh	&	l nL;
Mk- ;kx'k xkre] oKkfud%, l t h%	&	l nL;
Jherh l uhyk Bkdj] vk'kfyfid	&	l nL; k
Jh nhi dek] Bkdj] vk'kfyfid	&	l nL; Lkfpo

jk t Hkk"kk dk; kUo; u IfeFr }kjk o"K 2015&16 d nkjku fd; x, dk; k dk l f{klr fooj.k

Hkkjr l jdkj dh jk t Hkk"kk uhfr d dk; kUo; u dk l fuf'pr dju rFkk fun'kky; }kjk l i fnr fd; tku oky dkedkt e fgUnh dk i; kx l fuf'pr dju d m' ; l fun'kky; e jk t Hkk"kk dk; kUo; u IfeFr dk xBu fd; k x; k gA jk t Hkk"kk dk; kUo; u d fy, fun'kky; e vyx l dkb vf/kdkjh o depkj u gku d cto n jk t Hkk"kk dk; kUo; u IfeFr }kjk fd, x; i; k l k d QyLo: l fun'kky; e fgUnh d dkedkt o ipkj&i l k e vi f{kr l Qyrk iklr gb gA fun'kky; }kjk o"K 2015&16 d nkjku fd; x; dk; k dk l f{klr fooj.k fuEuku l k g&

jk t Hkk"kk okf"kd dk; Øe ij dk; kUo; u

jk t Hkk"kk foHkkx] xg e=ky;] Hkkjr l jdkj }kjk t kjh jk t Hkk"kk okf"kd dk; Øe ij fun'kky; dh jk t Hkk"kk dk; kUo; u IfeFr dh =ekf l d cBdk e ppk gb rFkk fn, x, fn'kk&fun'kk d vu: l k fy, x, fu.k; k d vul kj dkjokb dh xb rFkk fun'kky; d l Hkh vf/kdkj; k o dePkkfj; k dk okf"kd dk; Øe d vul kj fu/kkjr y{; iklr dju gr l k=kpkj fd; k x; kA

jk t Hkk"kk foHkkx] ubi fnYyh ,o Hkkjrh; d f"K vul/kku ifj"kn] ubi fnYyh l iklr l k=k@ifji=k ij dkjokkb

bl vof/k e jk t Hkk"kk dk; kUo; u l Ecu/kh uohure fun'kk@fu;ek l l Ecu/kr foHkku idkj d l k=k@ifji= vkfn jk t Hkk"kk foHkkx] Hkkjrh; d f"K vul/kku ifj"kn l iklr g, ftu ij dkjokb okfNr Fkh] d Åij dkjokb dh xb rFkk mUg l Hkh l cf/kr vf/kdkj; k o dePkkfj; k dk mudh tkudkj o vko'; d dkjokb gr ifjpkfyr fd; k x; kA

frekgh fgUnh ixfr fjikV dk l dyu rFkk l eh{k

fun'kky; e jk t Hkk"kk dk; kUo; u l Ecu/kh ixfr d vkdM iklr dj t kjh =ekf l d fjikV ikQkek e l Hkh vkdMk dk l dfyr dj fun'kky; dh l fdr fgUnh ixfr fjikV r; kj dh xBA bl l fdr fjikV dk Hkkjrh; d f"K vul/kku ifj"kn] ubi fnYyh o uxj jk t Hkk"kk dk; kUo; u IfeFr] l kyu dk Hkh Hk t kA bl fjikV dh l eh{k dh xb rFkk ikb xb dfe; k dk bfxr dj nj dju d fy, l Hkh vf/kdkj; k o dePkkfj; k dk if"kr fd; k x; kA

fgUnh iR l kgu ;ktuk dk dk; kUo; u

jk t Hkk"kk foHkkx }kjk t kjh fun'kk d vu: l k fun'kky; e l jdkj dkedkt ey : l k e fgUnh e dju d fy, iR l kgu ;ktuk l Hkh vf/kdkj; k o dePkkfj; k d fy, ykx dh gA ij o"K e fd, x, dk; k dk e/; ut j j[kr g, ,d eY; kdu l feFr dk xBu fd; k tkrk g t k Qkbyk o vU; dk; k dk voykdu dj iFke] f}rh; o rrrh; ij Ldkj dk fu.k; djrh gA



=ekfld cBdk dk vk;ktu

jktHkk"kk dk;W;u lfeFr dh =ekfld cBdk dk fu;fer vk;ktu fd;k x;kA cBdk e jktHkk"kk okF"kd dk;Øe e fu/kkFjr fd, x, y{;k dk iklr dju] le;≤ ij jktHkk"kk foHkkx ,o Hkkjrh; dFk vul/kku ifj"kn l iklr fun'kk@vkn'kk d vuiky u ij ppk dh xb rFkk bu cBdk e fy, x, fu.k;k dk ykx dju d fy, dkjokb dh xbA

=ekfld jktHkk"kk dk;'kkykvk dk vk;ktu

fun'kky; e =ekfld jktHkk"kk dk;'kkykvk dk fu;fer vk;ktu fd;k x;kA bu dk;'kkykvk e fgUnh e dk; dju e vk jgh ck/kkvk ij ppk dh xb rFkk mudk fujkdj.k dju d fy, mik, l>k, x,A

fun'kky; d lHkh vf/kdkfj;k o dePkkfj;k d fy, lHkh idkj d ii=f}Hkk"kh :lk e r;kj fd, x, o lHkh d dl;Vjk ij MkmuykM fd, x, rkfd o fnu&ifrfnu dk;ky; i;kx e bu ii=k dk i;kx e yk,A

fgUnh lIrkg dk vk;ktu

14&21 fl rEcj] 2015 rd 'fgUnh lIrkg^ d nkjku fgUnh e vk;kft r ifr;kfxrkvk o o"k %vDVcj] 2014 l 13 fl rEcj] 2015% e lokf/kd dk; dju oky vf/kdkfj;k@dePkkfj;k d fnukd 21-09-2015 dk udn ijLdkj fn, x, ft l dk fooj.k fuEu fyf[kr gk&

1- Jry[ku ifr;kfxrk %DICTATION% %dy 11 ifrHkkxh%

iFke & Mk- 'or dey] ofj"B oKkfud
f}rh; & Jherh 'k'kh iue] dfu"B fyfid
rrh; & dekjh eerK xlrk] oKkfud

2- ly[k ifr;kfxrk %LkUnj fy[kkb% %dy 9 ifrHkkxh%

iFke & Jh thr jke] rduhdh lgk;d %Qke%
f}rh; & Mk- 'or dey] ofj"B oKkfud
rrh; & dekjh eerK xlrk] oKkfud

3- fuc/k ifr;kfxrk %dy 7 ifrHkkxh%

%fo"k;% jktHkk"kk fgUnh Hkk"kk n'k dh v[k.Mrk cuk, j[ku e fdruh l{ke%
iFke & Jh nhi dekj Bkdj] vk'kyfid %xM&u%
f}rh; & Mk- l rh'k dekj] i/kku oKkfud
rrh; & dekjh eerK xlrk] oKkfud
lkrouk ijLdkj & Jh l/hj dekj vUui] oKkfud

4- fVli.kh ifr;kfxrk %dy 5 ifrHkkxh%

%fo"k;% ft l dk fo"k; Fkk Jherh ehj] , l-, l-, l- }kj k fpfdRlk i.k gku l io efMdy fcy dk Hkxrk%
iFke & Jh l j thr flg] futh lfpo
f}rh; & Jh nhid 'kek] rduhdh lgk;d %dl;Vj%
rrh; & Mk- egUr'k f'k : j] oKkfud

5- lkekU; o rduhdh Kku ifr;kfxrk %5 ifrHkkxh%

iFke & Jh xyj flg] rduhdh lgk;d %fo| r%
f}rh; & Jh jke Lo : lk] rduhdh lgk;d %Qke%
rrh; & Jh thr jke] rduhdh lgk;d %Qke%



6- dEl;Vj ij Vd.k ifr;kfxxrk %3 ifrHkxh%

iFke & Jherh 'k'kh iue] dfu"B fyfid

7- Ik= y[ku ifr;kfxxrk

;g ifr;kfxxrk ,l,l,l ox d depkfj;k d fy, FkhA bl ifr;kfxxrk e fd l h Hkh depkj h u Hkx ugh fy;kA

8- oKkfud miyfc/k;k fy[kuk %8 ifrHkxh%

;g ifr;kfxxrk oKkfud d fy, Fkh ft l dk fo"K; Fkh fun'kky; dh fiNy ,d l ky dh oKkfud miyfc/k;k fy[kukA

iFke & Mk- l rh'k dekj] i/kku oKkfud

f}rh; & Mk- oh-i-h- 'kek] i/kku oKkfud

rrh; & dekj h eerK xlrk] oKkfud

l krouk ijLdkj & Mk- ;kx'k xkre] oKkfud

9- i'ukùkj ifr;kfxxrk& bl ifr;kfxxrk e 36 ifrHkfx;k u Hkx fy;kA ble 'kcn vuokn] e'k:e d ckj e i'u] oKkfud o xj oKkfud] [kyk lc/kh tkudkj h] uohure tkudkj h bR;kfn lc/kh tkudkj h i'u iN tk;xA

Lkhkh 36 ifrHkfx;k dk l gh mùkj nu ij fotrkvk dk udn ijLdkj fn, x,A

Hkjr ljdkj] xg e=ky;] jktHk"kk foHkx] ,uMh l h&u Hkou] Tk;flg jkM] ub fnYyh d dk;ky; Kkiu lO u@2013@01@2011&jkOHkO%uifr@d0vu0C;jk fnuKd 30 vDVcj] 2012 d vulkj ljdkj h dkedt ey :lk l fgUnh e dju d fy, iR l kgu ;ktuk d rgr ijLdkj fn, tku dk Hkh iko/kku g ft l fgUnh l lrg ij gh fn;k tkrk jgk gA

bl ifr;kfxxrk d fy, doy ikp depkfj;k u gh viU dk; dk fooj.k fu/kfjr ii= e Hkj dj fn;k FkhA

1- iFke ijLdkj %1 ijLdkj iR;d 1600@& : i;%

1½ Jh nhi dekj] vk'kfyyfid %xM&u%

2- f}rh; ijLdkj %2 ijLdkj iR;d 800@& : i;%

1½ Jh jk'ku yky uxh] dfu"B fyfid

2½ Jh y[k jkt jk.kk] rdudh l gk;d %Qke%

3- rrrh; ijLdkj %1 ijLdkj iR;d 600@& : i;%

1½ Jh jktUn 'kek] l gk;d i'kk lfud vf/kdkj h

bu lcd QyLo:lk fun'kky; d oKkfud@vf/kdkfj;k@depkfj;k e fgUnh e dk; dju dh iofùk c<h g vkj oreku e dkQh i'kk lfud dkedt fgUnh e l ikfnr gk jgk gA ble fun'kky; d oKkfudkj vf/kdkfj;k o depkfj;k dk lrr l g;lx iklr gvK g ft l d ifj.kkeLo:lk ge y{; dk iklr dju dh vkj vxlj gk jg gA bl d fy, ge fun'kd egkn; dk mfrpr elxn'ku rFkk l g;lx ge'kk gh iklr gvK gA

fun'kky; dh okf"kd fgUnh ixfr lc/kh e[; xfrfof/k;k ,o miyfc/k;k

jk tHk"kk dk;WJo;u l febr dh ie[k&ie[k xfrfof/k;k vkj miyfc/k;k dk l kj&xfrkr l fklr&fooj.k okf"kd fgUnh ixfr fjikV d :lk e iLrr fd;k tkrk gA

1- fun'kky; d 80 ifr'kr l vf/kd dkfed fgUnh e ioh.krk@dk;l k/d Kku iklr g bl fy, ;g fun'kky; jk tHk"kk fu;e 10%4½ d vrxxr Hkjr ljdkj d xtV e fgUnh dk;ky; d :lk e vf/k l fpr fd;k t k pdk gA



- 2- fnukd 27-05-2015] 07-07-2015] 27-10-2015 o 15-01-2016 dk jkt Hkk"kk dk; kUo;u lfebr dh cBd lKJuu gbA lHkh cBdk dh dk; lph okf"kd dk; kUo;u dh vi{kkvk d vulkj ,o v/;{k egkn;] jkt Hkk"kk dk; kUo;u lfebr d vueknu d ckn gh r; dh xbA
- 3- fnukd 08-06-2015] 21-09-2015] 23-12-2015 o 29-01-2016 dk jkt Hkk"kk dk; k'kkykvk dk vk;ktu fd;k x;k ft le fun'kky; d lHkh vf/kdkfj;k o depkfkfj;k u LoPNk l Hkkx ydj dk; 'kkykvk d y{;k dk lQyrkiod iklr fd;kA
- 4- fgUnh e iklr ;k fgUnh e gLrk{xfjr lHkh lk=k e l ftu lk=k dk mRrj nuk vi{kr le>k x;k] mu lk=k dk mRrj doy fgUnh e vFkok fgUnh&vxth f}Hkk"kh; : lk e fn;k x;kA
- 5- fun'kky; dh vf/kdrj cBdk dk dk;oRr fgUnh e r;kj fd, x,A
- 6- jkt Hkk"kk vf/kfu;e] 1963 dh /kkjk 3¼3½ rFkk vU; fu;ek dh vuikyuk d lHkh e fun'kky; d iR;d vf/kdkjh o depkjh dk le;≤ ij dk;ky; vkn'k tkjh fd, x, o budh 'kr&ifr'kr vuikyu lfuf'pr djoku d i;k l fd, tk jg gA
- 7- fgUnh lk=kpkj d fu/kkfjr y{;k dk iklr dju dh fn'kk e lrr&i;k l tkjh gA
- 8- lHkh 52 ekud Qkek dk f}Hkk"kh : lk e r;kj dj fy;k x;k g rFkk lrr dnf'k'k dh tk jgh g dh lHkh dkfed bug fgUnh e gh Hkja
- 9- fun'kky; d lHkh 30 dEi;Vjk e fgUnh lQVo;j dk MkmuykM fd;k x;k gA bl l dElk;Vj ij dke dju oky iR;d vf/kdkjh o depkjh dk viuh bPNkul kj fgUnh e vFkok fgUnh vkj vxth nuk e fd lHkh Hkk"kk e ,d lFk dke dj ldr gA
- 10- fun'kky; d lHkh vf/kdkfj;k dk fgUnh dh tkudkjh lc/kh jkLVj r;kj fd;k x;k gA
- 11- fun'kky; d lHkh lkbu ckM] lpuk ckM] uke iW o vU; blh idkj d ckM f}Hkk"kh : lk e r;kj djok, x, gA
- 12- fun'kky; d if'k{k.k dk;Øek d fy, if'k{k.k lk&l xg ¼Mfux dEifM;e½ fgUnh o vxth nuk Hkk"kkvk e miyC/ k gA
- 13- dkm euvyk vkj vU; dk;fof/k l kfgR; fgUnh e miyC/ k gA
- 14- fun'kky; d vf/kdkfj;k rFkk depkfkfj;k d fgUnh 'kcn Kku dk c<ku d mí'; l';keiW ¼Cy d ckM½ ij *vkt dk fopkj* 'kh"kd d vUrxr ifrfnu fgUnh d okD; fy[k tkr g r kfd vf/kdkfj;k o depkfkfj;k d 'kcn Kku e of) gk l dA
- 15- fun'kky; e iR;d o"k dh Hkfr bl o"k Hkh e'k : e ey dk vk;ktu 10 fl rEcj] 2015 dk vk;kt r fd;k x;kA bl volj ij e[; iMky d lHkh fp=k d 'kh"kd] xkQ] fgLVxkQ vkfn fgUnh e inf'kr fd, x,A eVhehfm;k d ek/ ;e l e'k : e lc/kh tkudkjh vkd"kd <x l iLrr dh xb rFkk fd l kul] Nk=k o vU; vxrdk dk e'k : e l kfgR; fgUnh e miyC/ k dj;k x;kA
- 16- fgUnh iLrdk dh [kjhn d fy, ,d lfebr cukb xb g tk fgUnh iLrdky; d fy, iLrd [kjhn dh flQkfj'k d jrh gA iLrdky; e iR;d o"k jkt Hkk"kk foHkx }kj fu/kkfjr y{; d vulkj iLrd [kjhn dk i;k l fd;k tk jgk gA fun'kky; dh iLrdky; e fgUnh e miyC/ k lHkh idk'kuk dh lph e fun'kky; dh oclkbv ij miyC/ k djkb xb gA
- 17- njn'ku rFkk vdk'kok.kh ij Hkh fun'kky; d okkfudk o rduhdh vf/kdkfj;k dh e'k : e fo"k; ij fgUnh e okrk, i l kfrj gkrh jgrh g ftul e'k : e mRikndk dh leL;vk dk lek'ku gkrk gA
- 18- bld vfrfjDr Mk- oh-ih- 'kek] fun'kd ,o v/;{k jkt Hkk"kk dk; kUo;u lfebr d lrr futh&l g;xx vkj exn'ku d rgr fgUnh dh frekgh cBdk o dk;k'kkykvk dk le; ij vk;ktu o fun'kky; e dk;jr lHkh vf/kdkfj;k o depkfkfj;k d vki l h l g;xx vkj eyfeyki d lFk jkt Hkk"kk dk; kUo;u lc/kh xfrfof/k;k fujrj ixfr dh vkj vx l j gk jgh gA



10.

I LFkxr xfrfof/k;k Institutional Activities

vf[ky Hkkjrh; IefUor [kEc vul/kku ifj;ktuk dh xvii okf"kd dk;'kkyk

vf[ky Hkkjrh; IefUor [kEc vul/kku ifj;ktuk dh 17oh okf"kd dk;'kkyk dk vk;ktu fnukd 29&30 tu] 2015 dk Hkkdvui&[kEc vul/kku fun'kky;] pEck?kkV] Ikyu e fd;k x;kA bl dk;'kkyk e 60 l vf/kd [kEc vul/kku l tM g, depkfj;k u Hkkx fy;kA [kEc m]kx df"k foKku dUn ,o jkT; df"k foHkkx d ifrfuf/k;k u Hkh bl dk;'kkyk e fopkj&foe'k e Hkkx fy;kA bl dk;'kkyk dk mn?kkVu Mk- fot; flg Bkdj] dyifr] Mk- ; 'kor flg iekj vk|kfudh ,o okfudh fo'ofok;] uk.kh] Ikyu %fg0i0% }kjk fd;k x;kA Mk- vkj-lh- mik/;k;] dk;dkjh fun'kd }kjk [kEc ij vf[ky Hkkjrh; IefUor bdkb&[kEc dh ixfr fjiKV iLrr dh xBA bl dk;'kkyk d nkjku [;kfr iklr fo'k"Kk dh v/;{krk ,o lg&v/;{krk e ikp rduhdh l=k dk vk;ktu fd;k x;kA

fofHkUu uVod cgLFkkuh; ijh{k.kk ij lcf/kr i/kku vUo"kd }kjk foLrr fjiKV iLrr dh xBA iR;d iLrr d lk'pkr fopkj&foe'k fd;k x;k] ft l d QyLo: lk rduhdh dk;de e egRoik l/kkj gvkA Mk- ,u-d- d".k dekj] mi egkfun'kd %ckxokuh

1. XVII Annual Workshop of AICRP on mushrooms

The XVII Annual Workshop of All India Coordinated Research Project on Mushroom was organized by ICAR-DMR, Solan from 29 – 30th June, 2015. The meeting was attended by more than 60 mushroom researchers. Representatives from mushroom industry, KVKs and state Agriculture departments along with some progressive farmers also participated in the deliberation.

The inaugural session was chaired by Dr. Vijay Singh Thakur, Vice Chancellor, Dr. YS Parmar University of Horticulture & Forestry, Nauni. Dr. R.C. Upadhyay, Director (Acting) presented the progress made in AICRP on mushrooms. Five technical sessions were held, which were chaired and co-chaired by renowned experts. Detailed reports on various network multilocation trials were presented by the concerned Principal Investigators. Each presentation was followed by discussions which led



fp= 10-1- vf[ky Hkkjrh; IefUor [kEc vul/kku ifj;ktuk dh l=goh dk;'kkyk
Fig. 10.1. XVII Annual workshop of AICRP on mushrooms



foKku^{1/2} Hkkjr; d¹k vul/kku ifj¹kn] ub fnYyh u
i.k l= dh v/;{krk dh rFkk fofHkUu vul¹kkvk ,o
dk; fcnvk ij xgjk b l fopkj foe¹k fd; kA bl
l=goh ok¹k¹d dk; ¹kkyk d nkjku ifr cVu [kEc d
nk Hkkj jx ifrjk/kh l dj¹k ^{1/4}, u-ch-, l-&1 rFkk ,u-ch-
, l-&5^{1/2} dk idkf¹kr@tkjh fd; k x; kA

LoPN Hkkjr vfhk;ku

LoPN Hkkjr dh lkp vkj fe¹ku dk ijk dju d
fy, iR; d egHu d rh l j ¹kfuokj dk Hkkdvui&
[kEc vul/kku fun¹kk;] pEc¹?kkV] lkyu d ifj l j
e LoPN Hkkjr vfhk;ku pyk; k t k jgk gA l Hkh LVkQ
InL; bl fe¹ku e LoPNk l Hkkx yr g vkj
Mh, evkj dk ¹xhu Mh, evkj¹ cuku e viuk ; kx nku
nr gA

xfrfof/k; k

- Hkkdvui&[kEc vul/kku fun¹kk;] ; kjk vk; kft r
l Hkh if¹k{k.k dk; dek e m|fe; k] fd l kuk vkj
; okvk e LoPN Hkkjr vfhk;ku d ifr tkx: drk
dk l tu fd; k x; kA
- ykxk dk LoPNrk d ifr tkx: d cuku d fy,
vxh¹dr xkok e tkx: drk vfhk;ku pyk, x, A
- fu; fer vUrjky ij ijk fjd¹kM dh NVkb] ijk
rFkk cd¹kj Quhpj] tx yxh l kexh vkj xj lok
; kx; oLrvk dk fuiVku fd; k x; kA

lrdrk tkx: drk lirkg

¹cgrj fu.k; vkj mUg iHkkoh rjhd l fØ; kfuor
dju dh ifØ; k cgrj ¹kklu&i.kkyh gkrh gA¹
cgrj ¹kklu i.kkyh d , d l/ku d : i e io&lrdk
dk ykx dju d fy, Hkkdvui&[kEc vul/kku
fun¹kk;] e ¹cgrj ¹kklu&i.kkyh d l/ku d : i
e io&lrdk¹ fo¹k; ij fnukd 26 l 31 vDrcj]
2015 d nkjku lrdk tkx: drk lirkg euk; k
x; kA bl volj ij] Mk- egr¹k f¹k: j] lrdk
vf/kdkjh u Hkkdvui&[kEc vul/kku fun¹kk;] d
leLr LVkQ dk ¹kiFk fnykBA vketuk e tkx: drk
ink dju d fy, fun¹kk;] d e[; ; k j ij cuj , o
iLVj yxk, x, A

to significant improvement in the technical
programme. Dr. NK Krishna Kumar, DDG (HS),
chaired the plenary session and had in depth
deliberations on various recommendations and action
points. The two browning resistant hybrids of button
mushroom (NBS-1 and NBS-5) developed by
ICAR-DMR were evaluated and released during the
XVII Annual Workshop.

2. Swachh Bharat Abhiyan

Clean India Drive is being implemented in the
ICAR- DMR campus on every third Saturday of the
month to fulfill the vision and mission of clean India
a day. All staff members participated voluntarily in
the mission and made the DMR as “Green DMR”.

Activities held in Swachh Bharat Abhiyan

- Awareness for cleanliness in day to day life was
passed on to entrepreneurs, farmers and youth in
all the training programmes organized by ICAR-
DMR.
- Awareness campaigns were conducted in the
adapted villages for spreading cleanliness
awareness among the people.
- Weeding of old records, disposing of old and
obsolete furniture, junk material and
unserviceable items has been done on regular basis.

3. Vigilance Awareness Week

“Good governance is about the processes for
making good decisions and their effective
implementation”. To implement the preventive
vigilance needs as a tool of good governance, ICAR-
DMR observed the vigilance awareness week from
26th to 31st October, 2015 with a theme “preventive
vigilance as a tool of good governance”. On this
occasion Dr. Mahantesh Shirur, Vigilance Officer
administered pledge to all staff of ICAR-DMR.
Further, to create the awareness in the public, banners
and posters were displayed at the main gate of institute.



fp= 10-2- [kEc vul /kku fun'kky; ifj l j ei
l Qkbi vfhk; ku

Fig. 10.2. Cleanliness drive in DMR campus



fp= 10-3- l r'drk t'lx: drk l l'rk g d' nkjku
'ki Fk xg.k d j'r fun'kky; d' d'kf'e'd

Fig. 10.3. Oath taking on closing ceremony of Vigilance Awareness week

jk"Vh; , drk fno l

Hkkjr dh ,drk d ie[k l=/kkj ykg i:"k
l jnkj oYyHkHkkb ivy dh t;rh d miy{; e
Hkkdvui&[kEc vul /kku fun'kky;] lkyu e fnukd
31 vDrcj] 2015 dk jk"Vh; ,drk fno l euk;k
x;kA bl volj ij Hkkdvui&[kEc vul /kku
fun'kky;] lkyu d leLr depkfj;k u jk"V dh
,drk vkj v[k.Mrk dk cuk, j[ku dh 'ki Fk yhA

l k i n k f ; d l n H k k o l l r k g

jk"Vh; l kenkf; d l n H k k o u k Q k m . M ' k u
¼, u, Q, Q l h, p½ ub fnYyh l i k l r v u n ' k k d v u l k j
Hkkdvui & [kEc vul /kku fun'kky; e fnukd 19 l



fp= 10-4- jk"Vh; , drk o l k i n k f ; d l n H k k o l l r k g d' nkjku 'ki Fk y'r fun'kky; d' d'kf'e'd

Fig. 10.4. Oath taking on National Unity Day and Communal Harmony Week Celebrations

4. National Unity Day

To commemorate the birth anniversary of the Iron Man of India, “Sardar Vallabhbhai Patel” who was instrumental in keeping India united, ICAR-DMR observed the Rashtriya Ekta Diwas (National Unity Day) on 31st October, 2015. A pledge to maintain the unity and integrity of the country was taken by all the staff of ICAR-DMR on this occasion.

5. Communal Harmony Week

As per the guidelines received from National Foundation for Communal Harmony (NFFCH),





25 November 2015 d n k j k u l k e n k f ; d l n H k k o u k l l r k g e u k ; k x ; k A H k k d v u i & [k E c v u l / k k u f u n ' k k y ; d l H k h d e p k f j ; k u > M k f n o l i j j k " V h ; l k e n k f ; d l n H k k o u k Q k m . M ' k u ¼ , u , Q , Q l h , p ½ d f y , , d f = r Q M e v i u k v ' k n k u f n ; k v k j b l Q M d k l f p o j j k " V h ; l k e n k f ; d l n H k k o u k Q k m . M ' k u ¼ , u , Q , Q l h , p ½ d i k l t e k d j k ; k x ; k A

fo'o enk fno l

f p j L F k ; h d f ' k e e n k d e g R o d l c / k e f d l k u k d c h p 0 ; k i d t k x : d r k d k l t u d j u d m n n ' ; l f n u k d 5 f n l E c j j 2015 d k * f o ' o e n k f n o l v f h k ; k u * p y k ; k x ; k A i k Q l j o h j u n d ' ; i j e k u u h ; l k l n j f ' k e y k ¼ f g e k p y i n ' k ½ u v f h k ; k u d k m n ? k k V u f d ; k v k j f d l k u k d k m P p r j d f ' k m R i k n d r k d f y , e n k d h t k p i j v k / k k f j r m o j r k i c / k u d e g R o i j l { k i e t k u d k j h n h A d y 250 f d l k u k d [k r k l ; k t u k c) r j h d l f e V V h d u e u f y , x , v k j m u d k o g n , o l { e i k ' k d r R o f L F k r d f y , f o ' y " k . k f d ; k x ; k A b l v o l j i j l E i . k f o ' y " k . k R e d f o o j . k d l k F k d y 250 e n k L o k L F ; d k M l f d l k u k d k f o r f j r f d , x , A



New Delhi, Communal Harmony week was observed during 19th to 25th November, 2015. All staff of ICAR-DMR contributed for the National Foundation for Communal Harmony fund on the Flag Day and it was submitted to Secretary, NFFCH.

6. World Soil Day

The “World Soil Day campaign” was conducted on 5th December, 2015 with an aim to create the mass awareness among the farmers regarding the importance of soils in sustainable agriculture. Prof. Virender Kashyap, Honorable Member of Parliament, Shimla (H.P) inaugurated the campaign and briefed to the farmers about the importance of soil test based fertility management for higher agricultural productivity. The soil samples were collected systematically from the fields of 250 farmers and were analyzed for their macro and micro nutrient status. The soil health cards containing the complete analytical details along with the site specific fertilizer recommendations were distributed to 250 farmers on this occasion.



fp= 10-5- fo'o enk fno l d i v o l j i j f d l k u k d k e n k L o k L F ; d k M l f o r f j r f d , x ,

Fig. 10.5. Distribution of Soil Health Cards on World Soil Day Campagin

j k " V h ; f o K k u f n o l l e k j k g

o " k 1928 e v k t g h d f n u H k k j r h ; H k k f r d ' k k L = h l j p u n ' k [k j o d V j e u } k j k H k k j r e j e u i H k k o d h [k k t f d , t k u d m i y { ; e f n u k d 28 Q j o j h] 2016 d k H k k d v u i & [k E c v u l / k k u f u n ' k k y ;] l k y u e

7. National Science Day Celebrations

National Science Day was celebrated in ICAR-DMR (Theme: Make In India; Science & Technology driven innovations) on 28th February, 2016 with great enthusiasm in order to commemorate the invention



fp= 10-6- Hkkd'vui&[kEc vu l/kku fun'kky; e: jk"Vh; foKku fno l dh >yfd;k
Fig. 10.6. Glimpses of National Science day celebrations at ICAR-DMR

fo"K; % ed bu bfM;k(foKku ,o ik|kfxdh pkfyr
ub [kk t½ jk"Vh; foKku fno l euk;k x;kA bl
dk;de e 11 LFkkuh; Ldyk d 400 l Hkh vf/kd
Nk=&Nk=kvk u fun'kky; dk Hke.k fd;kA Ldyh
cPpk dk [kEc dh [krh d fofHkuu igyvkh dh tkudkjh
nh xba

Nk= lenk; e foKku o ik|kfxdh dk ykdfi;
cuku d fy, Hkkd'vui&[kEc vu l/kku fun'kky;
}jkj foKku in'kuh] thor in'ku] okn&fookn o
i'ukRrjh ifr;kfxrkvk] oKkfud o ij.kkRed o;k[;ku
t l h vud xfrfof/k;k dk vk;kft r fd;k x;kA

of the Raman Effect by the Indian physicist, Sir Chandrasekhara Venkata Raman on the same day in the year 1928. More than 400 students from 11 local schools visited ICAR-DMR and they were exposed to various facets of mushroom cultivation.

Variety of activities such as science exhibition, live demonstrations, debates, quiz competitions, scientific & motivational lectures and many more were organized by the ICAR-DMR to popularize the science and technology among the student community.



11.

if'k{k.k ,o {kerk fuek.k Training and Capacity Building

d- if'k{k.k

Mk- ;kx'k xkre

- 1- fnukd 4&5 vxLr] 2015 dk **Kku ic/ku d fy, Hkkdvui vul/kku MkVf fjkftVh** fo"k; ij ukMy vf/kdfj;k d fy, ,u,, l l h ifj l j ub fnYyh e vk;kftr dk;'kkyk e Hkkx fy;kA

I Jh fcUnoh vjkMk

- 2- fnukd 16 tykb l 5 vxLr] 2015 d nkjku **df" e fu.k; yu d fy, fo'y" k.kRed rduhd** fo"k; ij Hkkdvui & ,u,vkbi h ub fnYyh e vk;kftr xh"edkyhu if'k{k.k dk;Øe e Hkkx fy;kA

I Jh eer k xlrk

- 3- fnukd 21 l 30 viy] 2015 dk **m|fe;k d fy, [kEc mRiknu ik|kfxdh** fo"k; ij Hkkdvui & [kEc vul/kku fun'kky;] Ikyu %fgepy in'kz e vk;kftr if'k{k.k ikB;Øe e Hkkx fy;kA
- 4- fnukd 6 l 26 eb] 2015 dk **ikni dk;'khy thukfeDl ,o Qly l/kkj d fy, Vy d : i e vkj,u, & buVjQjUl** fo"k; ij Hkkdvui & jk"Vh; ikni to ik|kfxdh vul/kku dUn] ilkj ub fnYyh e vk;kftr xh"edkyhu if'k{k.k e Hkkx fy;kA

Jh l/khj dekj vui

- 5- fnukd 10 viy l 8 eb] 2015 d nkjku Hkkdvui & [kEc vul/kku fun'kky;] Ikyu e vk;kftr ,d ekd d vfhk&mUe[krk if'k{k.k dk;Øe e Hkkx fy;kA
- 6- fnukd 21 l 30 viy] 2015 dk **m|fe;k d fy, [kEc mRiknu ik|kfxdh** fo"k; ij Hkkdvui & [kEc vul/kku fun'kky;] Ikyu %fgepy in'kz e vk;kftr if'k{k.k ikB;Øe e Hkkx fy;kA

A. Trainings

Dr. Yogesh Gautam

1. Attended the "Workshop on Nodal Officers of ICAR Research Data Respository for Knowledge Management" at NASC Complex, New Delhi from 4th – 5th August, 2015.

Ms. Bindvi Arora

2. Attended summer school on "Analytical Techniques for Decision Making in Agriculture" held at ICAR-NIAP, New Delhi from 16th July to 5th August, 2015.

Ms. Mamta Gupta

3. Attended training course on "Mushroom Proudction Technology for Entrepreneurs" held at ICAR-DMR, Solan (HP) from 21st – 30th April, 2015.
4. Attended Summer School on "RNA-Interference as a tool for Plant Functional Genomics and Crop Improvement at NRC on Plant Biotechnology, Pusa, New Delhi from 6th – 26th May, 2015.

Mr. Sudheer Kumar Annepu

5. Attended one month orientation training at ICAR-DMR, Solan from 10th April to 8th May, 2015.
6. Attended training course on "Mushroom Proudction Technology for Entrepreneurs" held at ICAR-DMR, Solan (HP) from 21st – 30th April, 2015.



- 7- fnukd 26 eb l 25 vxLr] 2015 d nkjku Hkkdvui & Hkkjrh; cxxokuh vul/kku lLFkku] cxy: e Qkdkl d l'kkf/kr ekM;y d Hkkx d rkj ij vul/kku {k= e rhu ekg d ikQ'kuy lEc) rk if'k{k.k dk;Øe e Hkkx fy;kA
- 8- fnukd 10&12 Qjoj] 2016 dk **Hkkdvui d ekuo l l k/ku fodkl ukMy vf/kdkfj;k d fy, n{krk fodkl dk;Øe** ij Hkkdvui & uke] gnjkcn e vk;kftr if'k{k.k dk;'kkyk e Hkkx fy;kA

Jh lYodekj jeu

- 9- fnukd 12 vDrcj l 12 uoEcj] 2015 dk Hkkdvui & [kEc vul/kku fun'kky;] lkyu e vk;kftr ,d ekg d vfHk&mUe[krk if'k{k.k dk;Øe e Hkkx fy;kA
- 10- fnukd 16 uoEcj] 2015 l 20 Qjoj] 2016 dh vof/k e enj dkejt fo'ofokky;] enj e rhu ekg d **vul/kku {k= e ikQ'kuy lEc) rk if'k{k.k** dk;Øe e Hkkx fy;kA

rduhdh ,o i'kklfud dkfed

- 11- Jherh jhrk HkkfV;k u fnukd 20&25 viy] 2015 dk **ijh{k.kk dh fm t kbfux ,o fo'y" k.k** fo" k; ij ,u,, l l h ifj l j] ub fnYyh e vk;kftr if'k{k.k dk;Øe e Hkkx fy;kA
- 12- Jherh jhrk HkkfV;k u fnukd 26&27 uoEcj] 2015 dk **b&xFk dk ln<hdj.k ,o l/kkj.kh;rk** fo" k; ij ,u,, l l h ifj l j] ub fnYyh e vk;kftr jk"Vh; dk;'kkyk e Hkkx fy;kA

[k- l xk" Bh@ l Eeyu@dk;'kkyk vkfn e Hkkxhnhkj

Mk- oh-ih- 'kek

- 1- fnukd 28&29 fl rEcj] 2015 dk **ikni LokLF; ic/ku d fy, lex nf"Vdk.k** fo" k; ij Mk- okb- , l- ijekj cxxokuh o okfudh fo'ofokky;] ukuh] lkyu %fgekpy in'kz e vk;kftr jk"Vh; l xk" Bh e HkkxhnhkjA

7. Attended three months professional attachment training in the research area as a part of the revised module of FOCARS at ICAR-Indian Institute of Horticultural Research, Bengaluru from 26th May to 25th August, 2015.
8. Attended training workshop on "Competency Development Programme for HRD Nodal Officers of ICAR" held at ICAR-NAARM, Hyderabad from 10-12th February, 2016.

Mr. Selvakumar Raman

9. Attended one month orientation training at ICAR-DMR, Solan from 12th October to 12th November, 2015.
10. Attended three months 'Professional attachment training in the research area' at Madurai Kamraj University, Madurai and TNAU, Coimbatore from 16th November, 2015 to 20th February, 2016.

Technical & Administration Personnel

11. Mrs. Reeta Bhatia attended training programme on "Designing and Analysis of Experiments" held at NASC Complex, New Delhi organized by ICAR-IARI, New Delhi from 20th – 25th April, 2015.
12. Mrs. Reeta Bhatia attended National Workshop on "Strengthening and Sustainability of E-Granth" at NASC Complex, New Delhi from 26th - 27th February, 2016.

B. Participation in Symposia / Conferences / Workshops / Events

Dr. V.P. Sharma

1. Participated in the Natinoal Symposium on "Holistic Approaches for Plant Health Management" held at Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni, Solan (HP) from 28th – 29th September, 2015.



Mk- vkj-lh- mik;/k;

- 2- fnukd 13&15 eb] 2015 dk ,u,, l l h ifj l j] ub fnYyh e vk; kft r fun'kd l Eeyu e HkxhnhkjA
- 3- fnukd 22 eb] 2015 dk l h, l d, pihdoh] ikyei j %fgekpy in'k% e HkxhnhkjA {k=h; l fefr l [; k 1 dh jkT; Lrjh; l ;Dr cBd e HkxhnhkjA
- 4- fnukd 6 tykb] 2015 dk ,u,, l l h ifj l j] ub fnYyh e HkxhnhkjA l rdrk vf/kdfj; k dh cBd e HkxhnhkjA
- 5- fnukd 25&26 tykb] 2015 dk iVuk e HkxhnhkjA LFkkiuk fno l ,o d'k foKku dUnk d ok'kd l Eeyu e HkxhnhkjA
- 6- fnukd 3 vxLr] 2015 dk **HkxhnhkjA l {etho lo/ku d uVod dk fodkl djuk** fo'k; ij ,uch,vkb,e] eÅ e vk; kft r ,d fno l h; leg cBd e HkxhnhkjA
- 7- fnukd 7&10 vDrcj] 2015 dk xkok fo'fo |ky;] xkok e vk; kft r ,f'k;u dodfoKku d x l & 2015 e HkxhnhkjA
- 8- fnukd 2 Qjoj] 2016 dk VDukykt h Hkou] egjkyh] fnYyh e ifj;kt uk dk eY; kdu dju gr foKku o ik |kfxdh e=ky;] oKkfud ,o vk |kfxd vu l /kku foHkx] ub fnYyh dh rduhdh l ykgdkj l fefr dh cBd e HkxhnhkjA
- 9- fnukd 6 ekp] 2016 dk egjk.kk irki d'k ,o ik |kfxdh fo'fo |ky;] mn; ij %jkt LFkku% e jkt LFkku dkyt vkQ ,xhdYpj , l k f l , 'ku cBd e crkj e[; vfrfFk d : i e HkxhnhkjA fy; k vkj **ikVfDVM dYVho'ku ,M okVj dU tjo'ku** fo'k; ij 0; k [; ku fn; kA

Mk- l rh'k dekj

- 10- fnukd 28&29 fl rEcj] 2015 dk **ikni LokLF; ic/ku d fy, lex n'Vdk.k** fo'k; ij Mk-okb-, l- i jekj cxxokuh o okfudh fo'fo |ky;] ukuh] l kyu %fgekpy in'k% e vk; kft r jk'Vh; l xk'Bh e HkxhnhkjA

Dr. R.C. Upadhyay

2. Participated in the Director's Conference held at NASC, New Delhi from 13th - 15th May, 2015.
3. Attended State level Joint meeting of ICAR Regional Committee No.1 at CSKHPKV, Palampur (HP) on 22nd May, 2015.
4. Attended ICAR vigilance officers meet at NASC, New Delhi on 6th July, 2015.
5. Attended ICAR foundation day and Annual conference of KVK on 25th- 26th July, 2015 at Patna.
6. Attended one day group meeting on "Developing Network of Microbial culture collections of India" at NBAIM, Mau on 3rd August, 2015.
7. Attended Asian Mycological Congress - 2015 at Goa University, Goa from 7th - 10th October, 2015.
8. Attended Technical Advisory Committee of the Ministry of Science and Technology, Dept. of Scientific and Industrial Research, New Delhi to evaluate project on 2nd Feb, 2016 at Technology Bhawan, Mehrauli, Delhi.
9. Attended as Chief Guest for Rajasthan College of Agriculture Association meeting at MPAUT, Udaipur (Rajasthan) on 6th March, 2016 and delivered lecture on "Protected cultivation and water conservation."

Dr. Satish Kumar

10. Participated in the National Symposium on "Holistic Approaches for Plant Health Management" held at Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni, Solan (HP) from 28th - 29th September, 2015.



Mk- ;kx'k xkre

- 11- fnukd 21&23 viy] 2015 dk **ekuo ,o idfr dh ixfr gr ik"kf.kd lj{kk ,o ekuo lekt d fy, vk/kfud df"k ik|kfxfd;k** fo"k; ij Mk- okb-, l- ijejk cxxokuh o okfudh fo'ofok|ky;] ukuh] lkyu %fgekpy in'k½ e vk;kftr jk"Vh; lxxk"bh e HkkxhinkjhA
- 12- fnukd 28&29 flrEcj] 2015 dk **ikni LokLF; ic/ku d fy, lex nf"Vdk.k** fo"k; ij Mk- okb-, l- ijejk cxxokuh o okfudh fo'ofok|ky;] ukuh] lkyu %fgekpy in'k½ e vk;kftr jk"Vh; lxxk"bh e HkkxhinkjhA
- 13- fnukd 28&30 ekp] 2016 dk ^Hkkdvui&df"kk** %df"k e uokUe"k d fy, Kku vk/kkfjr l l k/ku lpuk i.kkyh gc½ ij ,uch, l, l ,M ,y; ih] ukxij e vk;kftr ;tj if'k{k.k dk; 'kkyk e HkkxhinkjhA
- 14- fnukd 16&17 tykb] 2015 dk **jk"Vh; vkink ic/ku** ij Mh l h dk;ky;] lkyu e vk;kftr nk fnol h; dk; ; 'kkyk e HkkxhinkjhA
- 15- fnukd 7 uoEcj] 2015 dk ub fnYyh e vk;kftr ,d fnol h; jkt Hkk"kk dk;kUo;u lfebr dh dk; 'kkyk e HkkxhinkjhA

IjH fcUnoh vjkMk

- 16- fnukd 18 eb] 2015 dk ,u,, l l h ifj l j] ub fnYyh e Hkkjr h; df"k vul/kku ifj"kn] ub fnYyh }kjk *,xh lp&2050* e HkkxhinkjhA

IjH eer k xlrk

- 17- fnukd 18 eb] 2015 dk ,u,, l l h ifj l j] ub fnYyh e Hkkjr h; df"k vul/kku ifj"kn] ub fnYyh }kjk *,xh lp & 2050* e HkkxhinkjhA

Dr. Yogesh Gautam

11. Attended the National Symposium on "Modern Agro-Technologies for Nutritional Security and Health Society for Advancement of Human and Nature" held at Dr.Y.S. Parmar UHF, Nauni, Solan (HP) from 21st - 23rd April, 2015.
12. Participated in the Natinoal Symposium on "Holistic Approaches for Plant Health Management" at Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni, Solan (HP) from 28th – 29th September, 2015
13. Participated in the User's training workshop on "ICAR KRISHI" (Knowledge Based Resources Information System Hub for Innovations in Agriculture) Geoportal held at NBSS & LUP, Nagpur from 28th - 30th March, 2016.
14. Participated in two days workshop on "National Disaster Management" at DC Office Solan from 16th – 17th July 2015.
15. Participated in the one day Workshop of the Rajbhasha Karyanvayan Samiti held at New Delhi on 7th November 2015.

Ms. Bindvi Arora

16. Participated in 'AGRI SEARCH - 2050' on 18th May, 2015 at NASC Complex, Pusa organized by ICAR, New Delhi.

Ms. Mamta Gupta

17. Participated in 'AGRI SEARCH - 2050' on 18th May, 2015 at NASC Complex, Pusa organized by ICAR, New Delhi.



12.

fof'k"V vkxrd

Distinguished Visitors

fjikV/khu vof/k d nkjku dy 16 vkxUrdk u Hkkdvui&[kEc vul/kku fun'kky; dk nkjk fd;k ftue l dN egRoi.k vkxUrdk dk fooj.k uhp iLrr g %

In total 16 visitors visited ICAR-DMR, Solan during this period. Few important visitors are as follows:

Ø- l- Sl. No.	uke o irk Name & Address	Mh, evkj] l kyue nkjk dju dh rkjh[k Date of visit to DMR, Solan
1.	Mk- ,p-i- flg@Dr. H.P. Singh io mi egkfun'kd %ckxokuh% Hkkdvui ,o v/; {k] l h, p, vkb@ Former DDG (Hort.) ICAR & Chairman CHAI	25.06.2015
2.	Mk- fot ; flg Bkdj@Dr. Vijay Singh Thakur dyifr] ;-,p-,Q-] ukuh] l kyU@Vice Chancellor, UHF, Nauni, Solan	29.06.2015
3.	Mk- ,u-d- d".k dek] mi egkfun'kd %ckxokuh foKku%@ Dr. NK Krishna Kumar, DDG (HS), ICAR Hkkdvui-] df'k Hkou] ub fnYyh@Krishi Bhavan, New Delhi.	30.06.2015
4.	Mk- jke'oj flg@Dr. Rameshwar Singh ifj;kt uk fun'kd] df'k Kku ic/k fun'kky;] Hkkdvui] ub fnYyh@ Project Director, DKMA, ICAR, New Delhi	06.07.2015
5.	Jh l j'k pny@Shri. Suresh Chandel io l k l n ,o l n L;] 'kk l h fudk;] Hkkdvui] ub fnYyh Former MP and Member Governing Body, ICAR	30.07.2015 & 10.09.2015
6.	Jh ohjUn d' ; i@Shri. Virender Kashyap ekuuh; l k l n] f'keyk@Member of Parliament Shimla Constituency	05.12.2015
7.	Jh NfcyUn jkÅy@Shri. Chhabilendra Roul vij l fpo %M; j% ,o l fpo %Hkkdvui-%@ Additional Secretary (DARE) & Secretary (ICAR) df'k Hkou] ub fnYyh@Krishi Bhavan, New Delhi.	23.03.2016
8.	Jh l fuy dek] flg@Shri. Sunil Kumar Singh vij l fpo ,o foRrh; l ykgdkj %M; j@Hkkdvui-%@ Additional Secretary & Financial Advisor (DARE/ICAR) df'k Hkou] ub fnYyh@Krishi Bhavan, New Delhi.	27.03.2015

fjikV/khu vof/k d nkjku [kEc dh [krh d fofHkUu igyv d ckj e tkudkjh iklr dju d fy, dy feyk d j 2650 fd l kuk] m l fe; k] Nk=k vkj futh o l jdkjh vf/kdkfj; k u fun'kky; dk nkjk fd;kA

A total No. of 2650 farmers, entrepreneurs, students and private and Govt. officials also visited the Directorate during this period to know about the different facets of the mushroom cultivation.



fp= 12-1- Jh Nfoyn jkmy] vij lfpo %M; j o lfpo] Hkkd'vuji rFkk Mk- , l-, l- pgy] Hkr io' dyifr] eid',ovkfo-] mn; ij Hkkd'vuji&[kEc vu l/kku funi'kky; ei Hke.k d nkjku %ck, l nk, %

Fig. 12.1. Shri. Chhabilendra Roul Additional Secretary (DARE) & Secretary (ICAR) and Dr. S.S. Chahal, former VC, MPUAT, Udaipur on their visit to ICAR-DMR (Left to right)



fp= 12-2- Hkkd'vuji&[kEc vu l/kku funi'kky;] lkyu ei ,di,e; dk mn?kkVu djr Mk-,u-d- d".kk dekj] mi egkfun'kd %ckxokuh foKku%

Fig. 12.2. Inauguration of AKMU cell of ICAR-DMR by Dr. N.K. Krishna Kumar, DDG (Hort. Science)



vuc/k & 1
dkfed ,o lfo/kk,l
Annexure - 1
Personnel of ICAR-DMR

fnukd 31-03-2016 d vu|lkj Hkkd'vui&[kEc vu|l/kku fun'kky;] pEck?kkV] lkyu %fg-i-% e oKkfudk dh lox' l; ;k

Cadre strength of scientists at the ICAR-Directorate of Mushroom Research, Chambaghat, Solan (HP) 173213 as on 31.03.2016

fo"k; dk uke oru cM ,o xM i	Pay band and grade pay	oKkfud			ofj"B oKkfud			i/kku oKkfud			dy		
		, ch lh			, ch lh			, ch lh			, ch lh		
		Scientist			Sr. Scientist			Principal Scientist			Total		
discipline		A	B	C	A	B	C	A	B	C	A	B	C
dfk vfk;f=dh %, l i h d k	15600&39100 + xM i 6000/-	-	1	1	-	-	-	-	-	-	-	1	1
Agri.Engg. (ASPE)	15600-39100 + GP 6000/-	-	1	1	-	-	-	-	-	-	-	1	1
dfk to ik fkdh	15600&39100 + xM i 6000 ,o 8000/-	1	-	1	1	-	1	-	-	-	2	-	2
Agri Biotech- nology	15600-39100 + GP 6000 & 8000/-	1	-	1	1	-	1	-	-	-	2	-	2
dfk dhvfoKku	15600&39100 + xM i 6000/-	1	-	1	-	-	-	-	-	-	1	-	1
Agri Entomology	15600-39100 + GP 6000/-	1	-	1	-	-	-	-	-	-	1	-	1
dfk i lkj	15600&39100 + xM i 6000/-	1	-	1	-	-	-	-	-	-	1	-	1
Agri Extension	15600-39100 + GP 6000/-	1	-	1	-	-	-	-	-	-	1	-	1
QyD lh fo"k; %dEl;Vj vui ;kx	15600-39100 + xM i 6000/-	1	-	1	-	-	-	-	-	-	1	-	1
Flexi discipline (Computer Application)	15600-39100 + GP 6000/-	1	-	1	-	-	-	-	-	-	1	-	1
[kk] ik fkdh	15600&39100 + xM i 6000/-	-	1	1	-	-	-	-	-	-	-	1	1
Food Technology	15600-39100 + GP 6000/-	-	1	1	-	-	-	-	-	-	-	1	1
vkuf'kdh ,o ikni ituu	15600&39100 + xM i 6000/-	1	1	2	-	-	-	-	-	-	1	1	2
Genetics & PI breeding	15600-39100 + GP 6000/-	1	1	2	-	-	-	-	-	-	1	2	2
ikni jkx foKku	15600&39100 + xM i 6000/- ,o 8000/- 37400&67000 + xM i 10000/-	1	-	1	1	1	2	-	1	1	2	2	4
Plant Pathology	15600-39100 + GP 6000/- & 8000/- 37400-67000 + GP 10000/-	1	-	1	1	1	2	-	1	1	2	2	4
enk foKku	15600&39100 + xM i 6000/-	-	1	1	-	-	-	-	-	-	-	1	1
Soil Science	15600-39100 + GP 6000/-	-	1	1	-	-	-	-	-	-	-	1	1
l C th foKku	15600&39100 + xM i 6000/-	1	-	1	1	-	1	-	-	-	2	-	2
Vegetable Science	15600-39100 + GP 6000/- & 8000/-	1	-	1	1	-	1	-	-	-	2	-	2
dy ;kx		7	4	11	3	1	4	-	1	1	10	6	16
G. Total		7	4	11	3	1	4	-	1	1	10	6	16

, & Hkj g, in(ch & fjDr in(lh & dy in
A - In position; B – Vacant; C – Total



rduhdh] i'kk Ifud ,o Igk;h J.kh dh lox l[;k
Cadre strength of technical, administrative and supporting category

Ø-I- inuke	oru cM ,o xM i	Lohdr in	Hkj g, in	fjDr in	dy	
SN	Designation	Pay band and Grade Pay	Sanctioned posts	In position posts	Vacant posts	Total
rduhdh in@Technical posts						
1	Vh&4@T-4	9300-34800 + GP 4200/-	2	2	-	2
2	Vh&II&3@T-II-3	5200-20200 + GP 2800/-	2	1	1	2
3	Vh&2@T-2	5200-20200 + GP 2400/-	1	1	-	1
4	Vh&1@T-1	5200-20200 + GP 2000/-	8	8	-	8
dy ;kx@Grand total			13	12	1	13
Administrative posts						
1	i'kk Ifud vf/kdkjh@ Administrative Officer	15600-39100 + GP 5400/-	1	-	1	1
2	Igk; d i'kk Ifud vf/kdkjh@ Asstt.Admn.Officer	9300-34800 + GP 4600/-	1	1	-	1
3	Igk; d foRr o y[k vf/kdkjh@ Asstt.Fin. & A/Cs Officer	9300-34800 + GP 4600/-	1	1	-	1
4	fu t h l fpo@ Private Secretary	9300-34800 + GP 4600/-	1	1	-	1
5	Igk; d@Assistant	9300-34800 + GP 4200/-	4	3	1	4
6	o; fDr d Igk; d@ Personal Assistant	9300-34800 + GP 4200/-	1	1	-	1
7	ofj"B fyfi d@UDC	5200-20200 + GP 2400/-	2	2	-	2
8	vk'kyfyfi d xM&III@ Stenographer Gr.III	5200-20200 + GP 2400/-	1	1	-	1
9	dfu"B fyfi d@LDC	5200-20200 + GP 1900/-	2	3	-	3*
dy ;kx@Grand total			14	13	2	15
1	d'ky Igk; h LVkQ@ Skilled support staff (Supporting staff)	Rs.5200-20200 + GP 1800/-	10	5	5	10

*i'kk Ifud LVkQ dh l'kkf/kr lox l[;k d dkj.k dfu"B fyfid dk ,d in vf/kd g ft l fudV Hkfo"; e lek; kft r dj fy;k tk,xkA
*Due to revised Cadre Strength of Administrative Staff one post of LDC is excess which will be adjusted in near future.

Hkkd'vui & [kEc vu l /kku fun'kky; %fg-i-% e LVkQ dh fLFkr
Staff in position at ICAR-DMR (HP)

Ø-I- inuke	depkjh dk uke	i nuke	b&ey
Sl. No	Name of employee	Designation	Email
1	Mk- oh-i-h 'kek@Dr. V.P. Sharma	fun'kd@Director	vpsharma93.icar@gov.in
2	Mk- vkj-l-h mik/;k; @Dr. R.C. Upadhyay	i/kku oKkfud@Principal Scientist	rcupadhyay.icar@gov.in
3	Mk- vk-i-h vgykor@Dr. O.P. Ahlawat	i/kku oKkfud@Principal Scientist	ahlawat22.icar@gov.in
4	Mk- ch-, y- v=h@Dr. B.L. Attri	i/kku oKkfud@Principal Scientist	attribl_cith@rediffmail.com
5	Mk- l r h'k dekj@Dr. Satish Kumar	i/kku oKkfud@Principal Scientist	satish132.icar@gov.in
6	Mk- 'or dey@Dr. Shwet Kamal	ofj"B oKkfud@Senior Scientist	shwetkamal.icar@gov.in
7	Mk- ;kx'k xkre@Dr. Yogesh Gautam	oKkfud %ofj"B orueku% Scientist (SS)	ygautamdmr.icar@gov.in



Sl. No	Name of employee	Designation	Email
8	Mk- egr'k f'k : j@Dr. Mahentesh Shirur	oKkfud@Scientist	mshirur.icar@gov.in
9	I Jh eer'k xlrk@Ms. Mamta Gupta	oKkfud@Scientist	mamtagupta.icar@gov.in
10	Jh I/khj dek j , -@Mr. Sudheer Kumar A	oKkfud@Scientist	sudheerannepu@gmail.com
i'kk I fud LVkQ@Administrative Staff			
1	Jh t-vkj- ekxy@Sh. J.R. Mangle	Igk; d foRrr ,o y[kk vf/kdkjh@ AF&AO	afacodmr.icar@gov.in
2	Jh jktUn 'kek@Sh. Rajinder Sharma	Igk; d i'kk I fud vf/kdkjh@AAO	rajinder1.icar@gov.in
3	Jh I j thr flg@Sh. Surjit Singh	fu t h I fpo@PS	skanwar.icar@gov.in
4	Jherh I uhy Bkdj@Smt. Sunila Thakur	fu t h Igk; d@PA	sunilathakur.icar@gov.in
5	Jh Hkhe flg@Sh. Bhim Singh	Igk; d@Assistant	bhim.icar@gov.in
6	Jh Vh-Mh- 'kek@Sh. T.D. Sharma	Igk; d@Assistant	tdsharma.icar@gov.in
7	Jh nhi dek j@Sh. Deep Kumar	vk'kf yfi d xM&III@Steno Gr.III	deep.icar@gov.in
8	Jh ,u-i h- uxh@Sh. N.P. Negi	Igk; d@Assistant	npnegi.icar@gov.in
9	Jh I frUn Bkdj@Sh. Satinder Thakur	ofj"B fyfi d@UDC	satenderk.icar@gov.in
10	Jh /ke nk l @Sh. Dharam Dass	ofj"B fyfi d@UDC	dharmadass.icar@gov.in
11	Jherh 'k'kh iue@Smt. Shashi Poonam	dfu"B fyfi d@LDC	shashipoonam.icar@gov.in
12	Jh jk'ku yky uxh@Sh. Roshan Lal Negi	dfu"B fyfi d@LDC	roshanlalnegi.icar@gov.in
13	Jh I tho 'kek@Sh. Sanjeev Sharma	dfu"B fyfi d@LDC	sanjeevs.icar@gov.in
rduhdh LVkQ@Technical staff			
1	Jh I uhy oek@Sh. Sunil Verma	Igk- e[; rd- vf/kdkjh %Qke% @ Assistant chief technical officer (Farm)	sunilv.icar@gov.in
2	Jherh jhrk@Smt. Reeta	Igk- e[; rd- vf/kdkjh %iLr-% @ Assistant chief technical officer (Library)	reeta30.icar@gov.in
3	Jherh 'ky t k oek@Smt. Shailja Verma	ofj"B rd- vf/kdkjh %dyk% @ Sr. Technical Officer (Art)	shailjav1.icar@gov.in
4	Jh Kku pUn@Sh. Gian Chand	rduhdh vf/kdkjh %ck; yj% @ Technical Officer (Boiler)	gianchand1.icar@gov.in
5	Jh Mkyk jke@Sh. Dala Ram	ofj"B rd- Igk; d %Mkboj% @ Sr.Technical Assistant (Driver)	dalaram.icar@gov.in
6	Jh jke yky@Sh. Ram Lal	ofj"B rd- Igk; d %Mkboj% @ Sr.Technical Assistant (Driver)	ramlal.icar@gov.in
7	Jh y[k jkt jk.kk@Sh. Lekh Raj Rana	rduhdh Igk; d %Qke% @ Technical Assistant (Farm)	lekhraj.icar@gov.in
8	Jh jke Lo : i@Sh. Ram Swaroop	rduhdh Igk; d %Qke% @ Technical Assistant (Farm)	ramswaroop.icar@gov.in
9	Jh thr jke@Sh. Jeet Ram	rduhdh Igk; d %Qke% @ Technical Assistant (Farm)	jeetram.icar@gov.in
10	Jh xyj flg jk.kk@Sh. Guler Singh Rana	rduhdh Igk; d %byDVhf'k; u% @ Technical Assistant (Electrician)	gulerrana.icar@gov.in
11	Jh nhi d 'kek@Sh. Deepak Sharma	rduhdh Igk; d %dEl; Vj% @ Technical Assistant (Computer)	depsun.icar@gov.in
12	Jh jkt dek j@Sh. Raj Kumar	rduhdh Igk; d %Qke% @ Technical Assistant (Farm)	rajkumar1.icar@gov.in
d'ky Igk; h LVkQ@Skilled Supporting Staff			
1	Jh uj'k dek j@Sh. Naresh Kumar	d'ky Igk; h LVkQ@sss	nareshkumar.icar@gov.in
2	Jh r t jke@Sh. Tej Ram	d'ky Igk; h LVkQ@sss	tejram.icar@gov.in
3	Jherh ehjk noh@Smt. Meera Devi	d'ky Igk; h LVkQ@sss	meeradevi.icar@gov.in
4	Jh v thr dek j@Sh. Ajeet Kumar	d'ky Igk; h LVkQ@sss	ajeetkumar.icar@gov.in
5	Jh fou; 'kek@Sh. Vinay Sharma	d'ky Igk; h LVkQ@sss	vinaysharma.icar@gov.in



dk;Hkkj xg.k

- 1- Mk- oh-ih- 'kek] i/kku oKkfud] Hkkdvui &Mh, evkj u fnukd 07-10-2015 ¼iokgu½ I fun'kd] Hkkdvui &[kEc vu l/kku fun'kky; dk inHkkj xg.k fd;kA
- 2- Jh l/khj dekj vui u fnukd 10-04-2015 ¼iokgu½ dk bl fun'kky; e oKkfud ¼lCth foKku½ dk inHkkj xg.k fd;kA
- 3- Jh t-vkj- exky u fnukd 21-04-2015 ¼iokgu½ dk bl fun'kky; e lgk;d foRr o y[kk vf/kdkjh dk inHkkj xg.k fd;kA
- 4- Jh lYodekj vkj- u fnukd 12-10-2015 ¼iokgu½ dk bl fun'kky; e oKkfud ¼lCth foKku½ dk inHkkj xg.k fd;kA
- 5- Mk- ch-, y- v=h u fnukd 12-02-2016 ¼iokgu½ dk bl fun'kky; e i/kku oKkfud ¼ckxokuh & Qy foKku½ dk inHkkj xg.k fd;kA

Joining

1. Dr. V.P. Sharma, Principal Scientist, ICAR-DMR, Solan has joined as Director, ICAR-DMR, Solan on 07.10.2015 (FN).
2. Mr. Sudheer Kumar Annepu has joined at this Directorate on 10.04.2015 (FN) as Scientist (Vegetable Sceince).
3. Mr. J.R. Mangale has joined as Assistant Finance & Account Officer at this Directorate on 21.04.2015 (FN)
4. Mr. Selvakumar Raman has joined at this Directorate on 12.10.2015 (FN) as Scientist (Vegetable Science).
5. Dr. B.L. Attri has joined at this Directorate on 12.02.2016 (FN) as Principal Scientist (Hort – Fruit Science)



Mk- oh-ih- 'kek] i/kku oKkfud] Hkkdvui &[kEc vu l/kku fun'kky;] lkyu e fun'kd dk inHkkj xg.k djr g, Dr. V.P. Sharma, Principal Scientist, ICAR-DMR joined as Director, ICAR- DMR



inkUufr

- 1- Jh nhid 'kek] rduhdh lgk;d dk fnukd 27-10-2014 l ofj"B rduhdh lgk;d d in ij inkUur fd;k x;kA
- 2- Jh Kku pUn] ofj"B rduhdh lgk;d dh fnukd 23-04-2014 l rduhdh vf/kdkjh d : i e inkUufr dh xbA
- 3- Jh jke Lo: ij] rduhdh lgk;d dk fnukd 13-10-2015 l ofj"B rduhdh lgk;d d in ij inkUur fd;k x;kA
- 4- Jh thr jke] rduhdh lgk;d dk fnukd 13-10-2015 l ofj"B rduhdh lgk;d d in ij inkUur fd;k x;kA
- 5- Jh xyj flg jk.kk] rduhdh lgk;d dk fnukd 27-10-2015 l ofj"B rduhdh lgk;d d in ij inkUur fd;k x;kA
- 6- Mk- ;kx'k xkre] oKkfud dk fnukd 08-01-2010 l : i; 8]000@& d vxy mPprj xM e j[kk x;kA
- 7- Mk- egr'k f'k: j] oKkfud dk fnukd 21-04-2014 l : i; 7]000@& d vxy mPprj xM e j[kk x;kA

lokfuofRr

- 1- Jh fudk jke] d'ky lgk;h LVkQ fnukd 31-05-2015 l ifj"kn dh lok l lokfuofRr g,A

LFkkukUrfj.k

- 1- l Jh fcUnoh vjkMk] oKkfud dk Hkkdvui&Hkkjrh; df"k vul/kku lLFkku] ub fnYyh e dk;Hkkj xg.k dju d fy, fnukd 23-12-2015 ¼vijkgu½ l bl fun'kky; l LFkkukUrfj fd;k x;kA
- 2- Jh lYodekj jeu dk Hkkdvui&lhvkbVh,p] Jhuxj e dk;Hkkj xg.k dju d fy, fnukd 04-03-2016 ¼vijkgu½ l bl fun'kky; l LFkkukUrfj fd;k x;kA

[kydn lc/kh xfrfof/k;k

Hkkdvui&[kEc vul/kku fun'kky;] lkyu dh 26 lnL;h; Vhe u fnukd 18 l 21 viy] 2015 d nkjku Hkkdvui&Hkkjrh; enk ,o ty l j[k.k lLFkku] ngjknu e vk;kftr Hkkjrh; df"k vul/kku ifj"kn vrj&{k=h; [kydn ifr;fxxrk e Hkkx fy;kA

Promotion

1. Dr. Yogesh Gautam, Scientist has been placed in the next higher grade pay of Rs. 8000/- w.e.f. 08.01.2010.
2. Dr. Mahantesh Shirur, Scientist has been placed in the next higher grade pay of Rs. 7000/- w.e.f. 21.04.2014.
3. Sh. Deepak Sharma, Technical Assistant was promoted as Sr. Technical Assistant w.e.f. 27.10.2014.
4. Sh. Gian Chand, Sr. Technical Assistant was promoted as Technical Officer w.e.f. 23.04.2014.
5. Sh. Ram Swaroop, Technical Assistant was promoted as Sr. Technical Assistant w.e.f. 13.10.2015.
6. Sh. Jeet Ram, Technical Assistant was promoted as Sr. Technical Assistant w.e.f. 13.10.2015.
7. Sh. Guler Singh Rana, Technical Assistant was promoted as Sr. Technical Assistant w.e.f. 27.10.2015.

Superannuation

1. Sh. Nika Ram, Skilled Support Staff superannuated from council services w.e.f. 31.05.2015.

Transfer

1. Ms. Bindvi Arora, Scientist was transferred from this Directorate on 23.12.2015 (AN) to join her duty at ICAR-Indian Agricultural Research Institute, New Delhi.
2. Sh. Selvakumar Raman was transferred from this Directorate on 04.03.2016 (AN) to join his duties at ICAR-CITH, Srinagar.

Sports

A contingent of 26 men from Directorate of Mushroom Research, Solan participated in ICAR Inter-Zonal sports meet held at ICAR- Indian Institute of Soil and Water Conservation, Dehradun from 18th to 21st April, 2015.



vuc/k & 2

foÙkh; o"k 2015&16 d fy, foÙkh; fooj.k

Annexure - 2

Financial Statement for the FY 2015-16

o"k 2015&16 d fy, xj&;ktuk o ;ktuk d rgr ctV dh fLFkr %: i; yk[k e%

Budget position under Non-Plan and Plan for the year 2015-16 (Rs. in Lakhs)

Ø-I- y[kk 'kh"K	xj ;ktuk vkoVu 2015&16	xj ;ktuk 0;; 2015&16	;ktuk vkoVu 2015&16	;ktuk 0;; 2015&16
S. No. Head of Accounts	Non-Plan Allocation 2015-16	Non-Plan Exp. 2015-16	Plan Allocation 2015-16	Plan Exp. 2015-16
d- iith@A. Capital				
i Hkfe@Land	-	-	-	-
ii dk;@Works	-	-	197.10	197.09
iii midj.k@Equipment	3.15	3.14	85.00	84.85
iv lpuk ik kfxdh@Information Technology	-	-	5.00	5.17
v iLrdky;@Library	-	-	5.00	4.95
vi Quhpj o fQDIpj@Furniture & Fixture	-	-	-	-
vii vU; %tutkrh; mi ;ktuk & midj.k@Others (TSP – Equipment)	-	-	5.00	4.99
dy xj ;ktuk ith ifjIeifr@Total- Non-Plan Capital Assets	3.15	3.14	297.10	297.08
[k- jktLo@B. Revenue				
I Lfkkiuk 0;; @Establishment Expenses				
i Lfkkiuk 'kyd@Establishment Charges	310.00	308.85	-	-
ii etnjh@Wages	-	-	-	-
iii le;kifj HkRrk@O.T.A	0.06	0.06	-	-
dy Lfkkiuk 'kyd@Total Estt. Charges	310.06	308.85	-	-
II lkeU; jktLo@General Revenue				
1 i'ku ,o vU; lokuorr ykk@Pension & Other Retirement Benefits	82.00	81.94	-	-
2 ;k=k 0;; @Travelling Expenses	-	-	-	-
;k=k HkRrk ?kjj@LFkkukUj.k ;k=k HkRrk@TA Domestic/Transfer TA	2.00	1.98	4.00	3.99
dy ;k=k HkRrk@Total Travelling Allowance	2.00	1.98	4.00	3.99



Ø-I- y[kk 'kh"ki	xj ;ktuk vkoVu 2015&16	xj ;ktuk 0;; 2015&16	;ktuk vkoVu 2015&16	;ktuk 0;; 2015&16
S. No. Head of Accounts	Non-Plan Allocation 2015-16	Non-Plan Exp. 2015-16	Plan Allocation 2015-16	Plan Exp. 2015-16
3 vul/ku ,o vkij'kuy 0;;@Research & Operational Expenses	10.00	9.99	33.00	32.99
4 i'kk lfud 0;;@Administrative Expenses	106.50	106.48	44.50	44.49
5 fofo/k 0;;@Misc. Expenses	5.25	5.25	7.50	7.49
dy&jktLo@Total- Revenue	515.81	514.58	89.00	88.99
,u b ,p@NEH	-	-	2.00	2.00
tu tkrh; mi ;ktuk@TSP	-	-	5.00	4.99
lex ;kx % %iith o jktLo%@Grand Total: (Capital & Revenue)	518.96	517.73	393.10	393.06

Ø-I- Sl. No.	y[kk 'kh"ki Head of Account	vkoVu Allocation	0;; Expenditure
1	Xj ;ktuk@Non-Plan	518.96	517.73
2	;ktuk@Plan	393.10	393.06
3	v-Hkk- l-[kEc vu ifj ;ktuk@AICRP on Mushroom	395.19	395.19
		y{; Target	gkfly Achieved
4	jktLo ikflr@Revenue Receipt	27.56	28.18



vuc/k & 3

Annexure - 3

**[kEc vu l/kku fun'kky ;
d fy,
ifj.kke&#i j[kk nLrko t ¼vkj ,QMh½
RESULTS-FRAMEWORK DOCUMENT (RFD)
for
DIRECTORATE OF MUSHROOM RESEARCH**

(2014-15)



**pEck?kkV] I kyu&173 213 ¼fgekpy i:n'k½
oc I kbV % www.nrcmushroom.org**

Chambaghat, Solan -173213, (Himachal Pradesh)
Website: www.nrcmushroom.org



[k.M 1% ifjdYiuk] y{;} mnn'; ,o dk;|

Section 1: Vision, Mission, Objectives and Functions

ifjdYiuk

- vkfFkd ixfr] ikfjLFkfrdh; l/kkj.kh;rk ,o ik"kf.kd lj{kk d fy, [kEc dk vul/kku ,o fodkl djukA

y{;

- [kEc dh x.koRrk vkj mRikndrk dk c<ku] df"k vif'k"V@vif'k"V [kEc ik"kk/kkj dk mi; kx dju vkj jktxkj mRiUu dju] xjhch dk fuokj.k dju rFkk ik"kf.kd lj{kk lfuf'pr dju d fy, f}rh; d df"k dk ikRlkfgr dju gr eyHkr vul/kku dju] [kEc fofo/krk dk lj{kr dju rFkk ik|kfxd;k@fdLek dk fodflr dju d fy, vul/kku o fodkl djukA

mnn';

- [kEc to fofo/krk dk ldyu ,o lj{k.k djuk
- mUur x.koRrk vkj mPprj mRikndrk d fy, [kEc vkuof'kd l l k/kuk dk ic/ku ,o mi; kfxrk
- df"k vif'k"V dk mi; kx dj [kEc dh mRiknu ik|kfxd;k fodflr djuk
- tfod vkbih,e ik|kfxd;k dk mi; kx dj uk'ktho ic/ku d fy, ikVdky dk fodkl djuk
- ykHkin mi; kx rFkk i;koj.k in"n.k dk de dju d fy, vif'k"V [kEc ik"kk/kkj dh iupd.k
- [kEc@ [kEc mRiknk d thou&dky dk c<ku vkj o"n Hkj miyC/krk cuk; j[ku d fy, Qlykrj ik|kfxdh ,o eY; o/ku
- {kerk fuek.k d fy, ekuo l l k/kuk fodkl
- [kEc dk ipfyr dju d fy, ik|kfxdh gLrkrj.k

Vision

- Mushroom research and development for economic growth, ecological sustainability and nutritional security

Mission

- R&D to undertake basic research, conserve mushroom diversity, develop technologies/variety to enhance mushroom quality and productivity, utilize agro-wastes/spent mushroom substrates, and promote secondary agriculture for generating employment, ameliorating poverty and ensuring nutritional security.

Objectives

- To collect and conserve mushroom biodiversity
- Management and utilization of mushroom genetic resources for improved quality and higher productivity
- To develop mushroom production technologies by utilizing agrowastes
- To develop protocol for pest management using biologicals/IPM technologies
- Recycling of spent mushroom substrates for beneficial uses and reducing environmental pollution
- PHT and value addition for enhanced shelf life and round the year availability of mushroom / mushroom products
- Human resource development for capacity building
- Transfer of technology for popularization of mushroom



dk;|

- [kEc d mRiknu vkj x.koRrk dk c<ku d fy, vul/kku ,o fodkl djuk(
- [kEc tuu n0; rFkk lcf/kr lpuk d 'k{kf.kd Hk.Mkjxg d :lk e dk; djuk(
- mPprj mRiknu ,o mRikndrk dk gkfly dju rFkk LFkkuh; :i l miyC/k df"vif"V ik"kk/kkj dk mi;kx dju gr LFkku fof"V leL;kvk ij uVod vul/kku dk lelo; djuk(
- ekuo l l k/ku fodkl ,o ik |kfxdh gLrkrj.k dk iR l kfgR djuk vkj [kEc m |kx dk rdudh lg;kx inku djuk(
- c< g, thou dky rFkk cgrj vkenuh d fy, QlykrRj ik |kfxdh ,o eY;o/ku djukA

Functions

- R&D for enhancing mushroom production and quality
- To act as repository of mushroom germplasm and information
- To coordinate network research on location specific problems to achieve higher productivity and utilized locally available agrowastes substrate.
- To promote human resource development and transfer of technology and to provide technical support to the mushroom industry.
- PHT and value addition for enhanced shelf life and better income

[k.M 2 % ie[k mnn';k] IQyrk ldrdk rFk y{;k d: chp ijLij ikFfedrk,]

Section 2: Inter Se Priorities among Key Objectives, Success indicators and Targets

Ø mnn'; I:-	egRo	dkjokb	IQyrk ldrd	bdlk	egRo	y{;@ekun.M elu mRd"V cgir vPNk Bhd&?fV;k vPNk Bkd 100% 90% 80% 70% 60%
Sl. Objectives No	Weight	Action(s)	Success indicator(s)	Unit	Weight	Target/Criteria Value Excellent Very Good Fair Poor 100% 90% 80% 70% 60%
1 [Ec to fofokrk dk l dyu ,o l j{k.k djuk	10	[Ec tuun'; l dyu d fy, v'i v'of"kr {=k dk lq{k.k	ldfyr @fpfgr@ l of/r ol; [Ec	l[:k	10	170 160 150 140 130
1 To collect and conserve mushroom biodiversity	10	Survey of unexplored areas for mushroom/germplasm collection	Wild mushroom collected/identified/cultured	Number	10	170 160 150 140 130
2 mlur x.korrk ,o mPprj mRindrk d fy, [Ec v'uf'kd l l'uk dk ic'lu ,o mi ;f'xrk	10	mPprj mit vj mlur x.korrk d fy, [ku ;k; [Ec e thofoklu dk le>uk rFk mldk i tuu o p;u	fodflr ,o ey ;fdr [Ec mi itf'r;k d foyxu@ldj rFk v/;u fd, x, [Ec dk thofoklu	l[:k	10	22 20 18 16 14
2 Management and utilization of mushroom genetic resources for improved quality and higher productivity.	10	Understanding biology, breeding and selection in edible mushrooms for higher yield and improved quality	Isolates/hybrids of mushroom spp. developed and evaluated, biology of mushroom spp. studied	Number	10	22 20 18 16 14
3 dFk v i f'k"V dk mi ;x dj d [Ec dh mRinu ik l f'xrd ;k dk fodflr djuk	20	mRinu ik l f'xrd ;k Qle midj. [I MVo; j vj iMdky dk fodk l	fpfgr @fodflr mlur mRinu ik l f'xrd ;k Qle midj. [I MVo; j vj iMdky	l[:k	20	7 6 5 4 3
3 To develop mushroom production technologies by utilizing agro-wastes	20	Development of production technologies, farm implements, software, protocols	Improved production technologies, farm implements, software, protocols identified/developed	Number	20	7 6 5 4 3
4 tfod vbiil,e ik l f'xrd ;k dk mi ;x dj d uk"ht to ic'lu d fy, iMdky dk fodk l djuk		fof'lu idkj d [Ec e dMv ,o jix fu;=k d fy, iMkoti ik l f'xrd ;k dk fodk l	dMv ,o jix fu;=k d fy, fodflr ik l f'xrd ;k	l[:k	10	2 2 1 0 0





Ø mnñ' ; I-	egRo	dljoklbi	I Qyrk Idird	bdlkbi	egRo	y{;@ekun.M eku mRd"V cgr vPNk Bhd&?ñV;k vPNk Bkd 100% 90% 80% 70% 60%
SL	Objectives	Weight	Action(s)	Unit	Weight	Target/Criteria Value Excellent Very Good Fair Poor 100% 90% 80% 70% 60%
No						
4	To develop protocol for pest management using biologicals/ IPM technologies	10	Development of efficient technologies for pest and disease control in different mushrooms	Technologies developed for control of pest and disease	Number	10 2 1 0 0
5	c-g, thou dky rFk [Ec@ [Ec mRink dh o"kkj mi yCkrk d fy, QI yRr j ik lfxdh, o eY; o/lu	10	idftx] HMKj .k rFk eY; ofkr mRink d fy, ik lfxdh;k dk fodkl	idftx] [k] mRink d fy, fodf l r miur ik lfxdh;k	I [;k	10 1 0 0 0 0
5	PHT and value addition for enhanced shelf life and round the year availability of mushroom / mushroom products	10	Development of technologies for packaging, storage and value added products	Improved technologies, packaging, food products developed	Number	10 1 0 0 0 0
6	y/kkin mi ;lx rFk i ;lj.k in"K.k de dju d fy, vif"V [Ec i"kk/kj dk iupd.k	5	vif"V [Ec i"kk/kj dh iupØ.k ,o ic/lu	vif"V [Ec i"kk/kj ic/lu d fy, fodf l r ik lfxdh;k ,o ifr :k	I [;k	5 1 0 0 0 0
6	Recycling of spent mushroom substrates for beneficial uses and reducing environmental pollution	5	Recycling and management of SMS	Technologies and models developed for spent mushroom substrate management	Number	5 1 0 0 0 0
7	eluo l l/lu fodkl	10	ßerK fuek.k d fy, eluo"ñDr dk if"kr djuk	[Ec [rh ik lfxdh ij vK;ñt r if"kk.k	I [;k	10 5 4 3 2 1
7	Human resource development	10	To train the manpower for capacity building	Trainings on mushroom cultivation technology conducted	Number	10 5 4 3 2 1
8	[Ec dk yldfi; culu d fy, ik lfxdh glr/rj.k	5	tlx: drk l tu d fy, eyk dk vK;ktu djuk vij in"lu;k e"kkxinkjh djuk	vK;ñt r@kkxinkjh oky eyk o in"lu	I [;k	5 3 2 1 0 0
8	Transfer of technology for popularization of mushroom	5	To conduct melas and participation in exhibition for awareness generation	Mushroom mela/exhibitions organized / attended	Number	5 3 2 1 0 0



Ø- mnn'; I-	egRo	dkjokb	IQyrk Idird	bd/ba	egRo	mf;@ekun.M eku mRd"V cgir vPNk Bhd&?kV;k vPNk Bkd 100% 90% 80% 70% 60%
Sl. Objectives No	Weight	Action(s)	Success indicator(s)	Unit	Weight	Target/Criteria Value Excellent Very Good Fair Poor 100% 90% 80% 70% 60%
* idk'lu@iy[lu	5	60 rFk m l l vfk d dh ,u,, l jfx okyh if=dkvke vul/ku y[k dk idk'lu ILFku dh ok'ld fj iV 2013&14% dk le; l idk'lu	idk'kr 'l/k i =	l ;k	3	2 1 0 0 0
* Publication/Documentation	5	Publication of the research articles in the journals having the NAAAS rating of 6.0 and above.	ok'ld fj iV idk'kr	fnuld	2	3006- 2014 0207- 2014 0407- 2014 0707- 2014 0907- 2014
* forrh; l l lku idku	2	Timely publication of the Institute Annual Report (2013-14)	Research articles published	No.	3	2 1 0 0 0
* Fiscal resource management	2	Utilization of released plan fund	Annual Report published	Date	2	30.06. 2014 02.07. 2014 04.07. 2014 07.07. 2014 09.07. 2014
* vkj, QMh i .kkyh dh iHkoh dk;i.kyh	3	vuehu gr o" 2014&15 d fy, e lmk vkj, QMh dh le; l ilrfr 2013&14 d fy, ifj .kek dh le; l ilrfr	mi ;x dh xb ;kt uk fufk	ifrr'kr	2	98 96 94 92 90
* Efficient Functioning of the RFD System	3	Timely submission of draft RFD (2014-15) for approval	Plan fund utilized	%	2	98 96 94 92 90
			le; l ilrfr	fnuld	2	15 ebj 2014 16 ebj 2014 19 ebj 20 ebj 21 ebj
			le; l ilrfr	fnuld	1	1 ebj 2 ebj 5 ebj 6 ebj 7 ebj
			On-time submission	Date	2	May, 15, May, 16, May, 19, May, 20, May, 21, May, 2014 2014 2014 2014 2014

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Ø mnñ'; I+	egRo	dkjoklb	IQyrk Idird	bdkb	egRo	y{;@ekun.M eku mRd"V cgr vPNk Bld&?kV;k vPNk Bkd 100% 90% 80% 70% 60%
Sl. Objectives No	Weight	Action(s)	Success indicator(s)	Unit	Weight	Target/Criteria Value Excellent Very Good Fair Poor 100% 90% 80% 70% 60%
* Administrative Reforms	7	v/b, l vk 9001 d fy, l ger ekbyLVu dk fd;k/o;u	fd;k/o;u dk ifr'kr	ifr'kr	2	100 95 90 85 80
		vuelfnr buko'ku ;ktukvk v/b, iik d ekbyLVu dk fd;k/o;u	fd;k/o;u dk ifr'kr	ifr'kr	1	100 90 80 70 60
			Lor= vRmV vRok llotfud f'ldk; r leVku i.kyh dk y/x dduk	ifr'kr	1	100 95 90 85 80
		Update organizational Strategy to align with revised priorities	Date	Date	2	Nov. 1, 2014 Nov. 2, 2014 Nov. 3, 2014 Nov. 4, 2014 Nov. 7, 2014
		Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC)	% of Implementation	%	1	100 90 80 70 60
		Implementation of agreed milestones for ISO 9001	% of Implementation	%	2	100 95 90 85 80
		Implementation of milestones of approved innovation Action Plans (IAPs).	% of implementation	%	1	100 90 80 70 60
		Independent Audit of implementation of public grievance redressal system		%	1	100 95 90 85 80



[k.M 3 % IQyrk ldrdk d iofr eku
Section 3: Trend Values of the success indicators

Ø- mnñ'; l- Sl. No.	Objective(s)	dkjold	IQyrk ldrd	bdkb	for o% 2011 & 12 d fy, oklrfod eku	for o% 2012 & 13 d fy, oklrfod eku	for o% 2013 & 14 d fy, oklrfod eku	for o% 2014 & 15 d fy, oklrfod eku	for o% 2015 & 16 d fy, oklrfod eku
		Action(s)	Success indicator(s)	Unit	Actual value for FY 2011-12	Actual value for FY 2012-13	Target value for FY 2013-14	Projected value for FY 2014-15	Projected value for FY 2015-16
1	[Éc to fofokrk dk ldyu , o ljk.dk dju	[Éc tuun; l dyu d fy, vyi vlof'kr fÉt dk lqk.k	ldfyr @fpfgr@lofkr ol; [Éc	I [;k	&	&	&	170	180
1	To collect and conserve mushroom biodiversity	Survey of unexplored areas for mushroom/germplasm collection	Wild mushroom collected/identified/cultured	Number	-	-	-	170	180
2	mlur x.lof'rk , o mPprj mriindrk d fy, [Éc vlof'kd l l'ok dk oku , o mi ;f'rk	mPprj mi t vij mlur x.lof'rk d fy, [ku ;k; [Éc e t'ofokku dk le>uk rFk ml dk i tuu o p;u	fodfl r , o el ;fdr [Éc mi i t'f'r ;k d foyxu@ldj rFk v/ ; u fd , x , [Éc dk t'ofokku	I [;k	14	16	18	22	26
2	Management and utilization of mushroom genetic resources for improved quality and higher productivity.	Understanding biology, breeding and selection in edible mushrooms for higher yield and improved quality	Isolates/hybrids of mushroom spp. developed and evaluated, biology of mushroom spp. studied	Number	14	15	18	22	26
3	dff'k vif'V dk mi ;x djd [Éc dhi mriinu ik l'f'kd ;k dk fodfl r dju	mriinu ik l'f'kd ;j Qle midj .j I'Vo; j vij iMdy dk fodl	fpfgr @fodfl r mlur mriinu ik l'f'kd ;j Qle midj .j I'Vo; j vij iMdy	I [;k	5	5	6	7	7
3	To develop mushroom production technologies by utilizing agro-wastes	Development of production technologies, farm implements, software, protocols	Improved production technologies, farm implements, software, protocols identified/developed	Number	5	5	6	7	7



Ø mnñ'; I-	dkjoldb	I Qyrk I dird	bdkb	forR o"K 2011 &12 d fy, okLrfod eku	forR o"K 2012 &13 d fy, okLrfod eku	forR o"K 2013 &14 d fy, y{; vuekfur vuelfur eku	forR o"K 2014 &15 d fy, vuelfur vuelfur eku	forR o"K 2015 &16 d fy, vuelfur vuelfur eku
SL No.	Objective(s)	Action(s)	Unit	Actual value for FY 2011- 12	Actual value for FY 2012- 13	Target value for FY 2013- 14	Projected value for FY 2014- 15	Projected value for FY 2015- 16
4	tfod vbiñ,e ik lxfdd;k dk mi;lx djd uk'ñt ho ic/ku d fy, iñdly dk fodl dduk To develop protocol for pest management using biologicals/ IPM technologies	fodfku idkj d [fē e dñV ,o jix fu;=,k d fy, iñkñ ik lxfdd;k dk fodl Development of efficient technologies for pest and disease control in different mushrooms	I[;k	0	1	1	2	2
4		Technologies developed for control of pest and disease	Number	0	1	1	2	2
5	c<g, tiou dky rFk [fē@ [fē mñiñk dh o"ñkj miy@rk d fy, QlyRrj ik lxfdd, o e'; o/ku PHT and value addition for enhanced shelf life and round the year availability of mushroom / mushroom products	idftx [k mñiñk d fy, fodfl r mñur ik lxfdd;k Improved technologies, packaging, food products developed	I[;k	0	0	0	1	2
5			Number	0	0	0	1	2
6	yñkin mi;lx rFk i;oj.k in"ñk de dju d fy, vif"ñV [fē iñññkj dk iupd.k Recycling of spent mushroom substrates for beneficial uses and reducing environmental pollution	vif"ñV [fē iñññkj dh iupø.k, o ic/ku Technologies and models developed for spent mushroom substrate management	I[;k	0	0	0	1	2
6			Number	0	0	0	1	2
7	ekuo l lku fodl {erñ fuek.k d fy, ekuo'ñdr dk if'ññr dduk	[fē [ññ ik lxfddh ij vt;ñt r if'ññk.k	I[;k	4	4	4	5	5

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Ø mn n' ; I-	dkjold	I Qyrk l dird	bdkb:	forR o" % 2011 &12 d fy, okLrfod oku	forR o" % 2012 &13 d fy, okLrfod oku	forR o" % 2013 &14 d fy, y{; vuekfur vuel fur	forR o" % 2014 &15 d fy, vuel fur vuel fur	forR o" % 2015 &16 d fy, vuel fur vuel fur
Sl. Objective(s) No.	Action(s)	Success indicator(s)	Unit	Actual value for FY 2011-12	Actual value for FY 2012-13	Target value for FY 2013-14	Projected value for FY 2014-15	Projected value for FY 2015-16
* Enhanced Transparency/ Improved Service delivery of Ministry/Department	Rating from Independent Audit of implementation of Citizens'/Client's Charter (CCC)	Degree of implementation of commitments in CCC	%	2	100	95	90	85
* i'k l fud l/kj	Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	1	100	95	90	85
	I'k/kr ilRfedrvkd vu: i.k e v ru lxBuRRed j.kuifr H'Vkpj d lHkfor t'f'le e dei yku d fy, vuekfur U;uhdj.k j.kuifr;k%,e, l lhl d lger elbylLVlu dk fd;:k;u vib, l v'k 9001 d fy, lger elbylLVlu dk fd;:k;u vuekfur bulo'lu ;ktukvk	fnuld fd;:k;u dk ifr'kr fd;:k;u dk ifr'kr fd;:k;u dk ifr'kr fd;:k;u dk ifr'kr fd;:k;u dk ifr'kr Lor= v'f'fV v'Rok llotfud f'ldk; r lef'ku i.ky' dk y'x djuk	fnuld ifr'kr ifr'kr ifr'kr ifr'kr ifr'kr	2 1 2 1 2 1	1 100 100 100 100 100	2 2014 2014 2014 2014 2014	3 2014 2014 2014 2014 2014	4 uofcj] uofcj] uofcj] uofcj] uofcj] uofcj]



Ø. mnn'; l+;	dkjokb	IQyrk ldrd	bdkbi	forR o"K 2011 &12 d fy, d okLrfod	forR o"K 2012 &13 d fy, d okLrfod	forR o"K 2013 &14 d fy, d okLrfod	forR o"K 2014 &15 d fy, d okLrfod	forR o"K 2015 &16 d fy, d okLrfod
Sl. No.	Objective(s)	Action(s)	Unit	Actual value for FY 2011-12	Actual value for FY 2012-13	Target value for FY 2013-14	Projected value for FY 2014-15	Projected value for FY 2015-16
*	Administrative Reforms	Update organizational Strategy to align with revised priorities	Date	2	Nov. 1, 2014	Nov. 2, 2014	Nov. 3, 2014	Nov. 4, 2014
		Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC)	% of Implementation	1	100	90	80	70
		Implementation of agreed milestones for ISO 9001	% of Implementation	2	100	95	90	85
		Implementation of milestones of approved innovation Action Plans (IAPs).	% of implementation	1	100	90	80	70
		Independent Audit of implementation of public grievance redressal system	%	100	95	90	85	80



Section 4. Acronyms

S. No.	Acronym	Description
1.	IDM	Integrated Disease Management
2.	DMR	Directorate of Mushroom Research
3.	IAPs	Innovation Action Plans
4.	MSC	Mitigating Strategies for Reduction of potential risk of corruption
5.	CCC	Citizens'/Client's Charter
6.	GRM	Grievance Redress Management system

[k.M 5 % I Qyrk l d r d k d k f o o j . k , o i f j H k k r F k i L r f o r e k i u d k ; i . k y h

Section 5: Description and definition of success indicators and proposed measurement methodology

Ø-I- S.No.	I Qyrk l d r d Success indicator	f o o j . k Description	i f j H k k r F k Definition	e k i u Measurement	I k e l u ; f i i . k h General comments
1-	I d f y r @ f p l g r @ i o f k r o l ; [l e c	i j H k j r e o l ; [l e c d k l d y u f d ; k t k , x l i g p k u d h t k , x h v k j m i ; D r m x l u o k y e l ; e e l o / u d k g f l y f d ; k t k , x k	m i ; D r r j l d k l o l ; [l e c t u u n 0 ; d k l j k . k	I d f y r [f p l g r r F k ' k) l o / u e y k ; x ; o l ; [l e c d h l [; k	I k l r ' k) l o / u d k m i ; l x t u u n 0 ; l k e x h d : i e f d ; k t k , x l i f t l d k l n i ; l x H k f o " ; e [l e c d v k u o f ' k d m l u ; u d k ; d e k e f d ; k t k , x k
1	Wild mushroom collected/identified/ cultured	Wild mushrooms across India will be collected, identified and culture obtained in suitable growing mediums	Conservation of wild mushroom germplasm through suitable means	Number of wild mushrooms collected, identified and brought into pure culture	The pure cultures obtained will serve as a germplasm materials which will be used for future mushroom genetic improvement programme
2-	f o d f l r r F k e Y ; k f d r [l e c m i i t k f r d f o y x u @ l d j] v / ; ; u d h x b [l e c i t k f r d k t i o f o k l u	c V u [l e c e m p p r j m r i i n d r k v k j c g r j x . k o r k d f y , c g r j f o y x u @ l d j] v / ; ; u f y , i t u u r d u i d k d k m i ; l x f d ; k t k r k g	i k j E i f j d r F k v k . k f o d ; f d r ; k d k m i ; l x d j d J " B t l u i : i f o d f l r d j u d f y , t u u n 0 ; d k m i ; l x f d ; k t k r k g	f o d f l r f d , x , v k ' k t u d f o y x u @ l d j k d h l [; k	f o d f l r f d l e k d k f g r / k j d k r d g L r k r f j r f d ; k t k , x k
2	Isolates/hybrids of mushroom spp. developed and evaluated, biology of mushroom spp. studied.	Breeding techniques are exploited to produce better isolates/hybrids for higher productivity and better quality in button mushroom	Exploitation of germplasm for developing superior genotypes using convent- ional and molecular approaches	Number of promising isolates/hybrids developed	Developed varieties will be passed on to the stakeholders
3-	f p l g r f o d f l r m l u r m r i k n u i k l k f x f d ; k Q i e m i d j . k l I k V o ; j r F k i v k d k y	u b m l u r l o / u j i f r ; k @ r d u i d k l m i t e o f } g k r h g f t l d Q y & L o : l k f o f k l u [l e c k d m r l k n u e o f } g k r h g A d f k d k ; k e e g u r d k d e d j u v j Q i e i f j p k y u d h l f o k l i n k u d j u g r u , Q i e m i d j . k l I k V o ; j r F k i v k d k y d k f o d k l f d ; k t k , x k	[l e c d h m i t , o x . k o l k d k c k l u g r i k V k k j c u k u v k i f r d j u r F k Q l y k k j i c / u e l / k j d j u k A d f k o ; o l k ; d k v k l u c u k u d f y , u , Q i e l k / u l I k V o ; j r F k i v k d k y d k f o d k l d j u k	v u d u b [k r h r d u i d k @ Q i e m i d j . k l I k V o ; j @ 0 ; k o l k f ; d m r i i n d k d k g L r k r f j r i v k d k y d k f o d k l f d ; k x ; k	f o d f l r i k l k f x f d ; k d k e k l e h , o Q i e m i d j . k l I k V o ; j @ 0 ; k o l k f ; d m r i i n d k d k g L r k r f j r i v k d k y d k f o d k l f d ; k f d ; k t k , x k





Ø-I- S. No.	IQyrk l dird Success indicator	fooj.k Description	ifjHk'rk Definition	eki u Measurement	I kekl; fvi .kh General comments
3	Improved production technologies, farm implements, software, protocols identified/ developed	New improved cultural practices/ techniques enhance yield and thereby increase production of different mushrooms. New farm implements, software and protocol for drudgery reduction and facilitating farm operation	Intervention in substrate preparation, supply and post harvest with the aim to increase yield and quality of mushrooms. Development of new farm tools, software and protocols for ease operation of farm business	Numbers of new cultivation technologies/ farm implements/ software/protocols developed	Developed technologies will be passed on to the seasonal and commercial growers
4	dihV k o jixk dh jkdFke d fy, fodfl r ik kxf d; k	Xh yk c ycyk vkj ihyh QQn [kEc d fy, vR; r ud lkun k; d gkrh g ft l dh jkdFke, dhdr jix ic/ku }kj k dju dh t : jr g	ueh c ycyk vkj ihyh QQn d dkj.k gku oky ud lku dh jkdFke d fy, fdQk; ri] l jf{r iHkko h ; fDr ; k	fodfl r ,dhdr jix ic/ku ; fDr ; k dh l [; k	u, ,dhdr jix ic/ku l mit ud lku dk de dju e enn feyxh vkj lFk gh ; g i ; koj .k vkj ekuo d fy, l jf{r gxxk
4	Technologies developed for control of pest and disease	Wet bubble and yellow moulds are extremely harmful to mushroom which need to be controlled through IDM	Low cost, safe, effective, approaches to check the losses due to wet bubble and yellow moulds	Numbers of IDM approaches developed	New IDM will help to reduce the yield losses and also would be safe for environment and human beings
5	fodfl r mlur ik kxf d; k idft x [k mRi kn	Q l yRrj ud lku e mlur ik kxf d; k d ek/; e l de h ykb t k, xh vkj idft x rFk c < g, mRi knu l [kEc dk eY; o/ku fd ; k t k, xkA	[kEc d cgrj HkMkj .k rFk ifjogu , o [kEc l r ; kj mPp eY; of/kr mRi knk d fy, mi ; Dr idft x rFk Q l yRrj ud lku e de h yku d fy, mlur ik kxf d; k	fpflgr@fodfl r ik kxf d; k idft x@ [k mRi knk dh l [; k	ub mlur ik kxf d; k rFk idft x l Q l yRrj volFk rFk ifjogu d nkjku gku oky ud lku e de h yku e enn feyxhA [kEc vk/krj r [k mRi knk l cgrj jktLo vft r dju vkj o'kHkj [kEc dh miyCkrk cuk ; j [ku e enn feyrh gA
5	Improved technologies, packaging, food products developed	Post harvest losses will be reduced through improved technologies and values added to mushrooms through packaging and enhanced production	Improved technologies to reduce post harvest losses, apt packaging for better storage and transport and high value product developed from mushroom	Number of technologies/ packaging/food products identified/developed	The new technologies and packaging helps to reduce losses during post harvest stage and transport. Mushroom based food products helps better revenue generation and availability of mushroom throughout the year



Section 6: Specific Performance Requirements from other Departments

Location Type	State	Organisation Type	Organisation Name	Relevant Success Indicator	What is your requirement from this organisation	Justification for this requirement	Please quantify your requirement from this organisation	What happens if your requirement is not met
Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Section 7: Outcome/Impact of activities of Organization/Ministry

Sl. No.	Outcome/Impact of organization	Jointly responsible for influencing this outcome/impact with the following organization(s)/departments/ministry(s)	Success Indicators	Unit	2011-12	2012-13	2013-14	2014-15	2015-16
1-	n'k e fofHkUu idkj & d [kEc d mRiknu d IkFk IkFk mRikn& drk e lof)	fuEufyf[kr IxBuk@ I Qyrk I d r d bdkb	dy [kEc mRiknu e ifr'kr of)	ifr'kr	2	3	5	7	10
1.	Enhancement of production as well as productivity of different mushrooms in the country	—	mRikndrk e ifr'kr of)	ifr'kr	1	1	2	3	4
			Percent increase in the total mushroom production	Percent	2	3	5	7	10
			Percent increase in the productivity	Percent	1	1	2	3	4



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भारतीय कृषि अनुसंधान परिषद

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