भा.कृ.अनु.प.–केन्द्रीय कटाई–उपरान्त
अभियान्त्रिकी एवं प्रौद्योगिकी संस्थान

CIPHET

ICAR- Central Institute of
Post-Harvest Engineering &Technology

ABOUT CIPHET

The ICAR-Central Institute of Post-Harvest Engineering and Technology (CIPHET) was established on 3rd October, 1989 at Ludhiana, Punjab, India as a nodal institute to undertake lead researches in the area of the Post-Harvest Engineering and Technology appropriate to agricultural production catchment and agro-industries.

The institute's second campus was established on 19 March 1993 at Abohar, Punjab, India that is primarily responsible for conducting research and development activities on fruits and vegetables, and commercial horticultural crops. ICAR-CIPHET is also the headquarter for two All India Coordinated Research Projects (AICRPs) viz. AICRP on Post-Harvest Engineering and Technology (PHET) with 31 Centres and AICRP on Plasticulture Engineering & Technology (PET) with 14 Centres across the country.

वार्षिक प्रतिवेदन

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Annual Report 2018-19

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Preface

Our Mandate is to reduce Post-Harvest Losses of Agricultural Produce through Engineering & Processing Interventions

Food processing has a vital role to play in linking agriculture with manufacturing which are two crucial sectors for growth of any agriculture based country like India. This linkage between farm and industry is deemed as a pivot for doubling farmers' income by 2022 and thereby helping to mitigate farm distress. Food processing which primarily includes post-harvest management and value addition of produced commodities is crucial in reducing the wastage and losses of agricultural produce. I feel honoured and privileged to serve and direct ICAR-CIPHET which is a premiere institute entrusted with responsibilities of developing post-harvest technologies, protocols, novel machineries & products with aim to reduce post-harvest losses and enhancing farmers' income. Our institute is committed towards contributing substantially to the national goal of food, nutritional and economic security of our people through innovative post-harvest engineering and technological interventions.

Although we have sufficiently improved the production of main food commodities but post-harvest management of agricultural produce is still a challenge for us. The post-harvest losses are to the tune of 6% in cereals, 8% in pulse, 10% in oilseeds and 15% in fruits and vegetables. The estimated annual value of total losses is about Rs 1 lakh crore. These losses can be reduced by proper post-harvest management of agricultural and livestock produce to improve the income and livelihood of the farmers. In this scenario, post-harvest processing is one of the major intervention to ensure the doubling farmers income by 2022.

I feel delighted to place before you Annual Report (2018-19) of our institute to give you insights about our R&D activities, outreach programmes and our significant accomplishments during the past year. During 2018-19, our institute made concerted efforts to develop various machines, storage and fumigation structures, process protocols and different value added products in line with our central mission of realizing higher value of agricultural produce. Our efforts are reflected through our IPR portfolio. Three patents were granted and two more filed during 2018-19. The granted patents pertain to innovative process for milling different millets, dehulling guar seed and predicting maturity stage and eating quality of mango. A technology namely 'mechanized system for popping and decortications of makhana seeds' was also licensed. In pursuance to the identified thrust areas of research in reducing post-harvest losses, a Memorandum of Understanding (MoU) with Department of Consumer Affairs, Ministry of Consumer Affairs, Food and Public Distribution, Government of India, New Delhi was signed. This MoU is related to development of protocols for enhancing shelf-life, safe storage, milling outrun and indicative norms for procurement of major pulses. A total amount of about Rs. 2.40 crores is approved under this project and ten major partner institute are involved with ICAR-CIPHET as lead institute.

I feel pleasure to share that under AICRP on PHET, 52 post-harvest tools/equipment, 49 process protocols and products were developed among which 50 were transferred to farmers and entrepreneurs. AICRP on PHET added one new centre at Andaman and Nicobar Islands and also established 25 new agro-processing centres during 2018-19. Eighteen success stories emerged from AICRP on PHET during the reported period. Under AICRP on PET, 12 plasticulture technologies were developed and 3 successful technologies were transferred to farmers' field. Besides, 400 persons were trained as Greenhouse Operators; 56 trainings, outreach activities, FLDs/Melas etc were organized to train farmers and other interested personnel for Plastic line pond installation, FRP carp hatchery installation and maintenance. AICRP on PET also commercialized the technology for 'roof top nutritional garden model for urban agriculture'. This technology was licensed to two private firms during 2018-19. Greenhouse design to withstand 178 Kmh^{-1} wind speed has been standardized and constructed.

ICAR-CIPHET is committed for human resource development in the field of food processing and post-harvest management through imparting trainings to different stakeholders. We have made it a regular feature of our in-house research projects to conduct regular training programs in line with 'Skill India' initiative, to empower budding entrepreneurs and workmen with requisite skill sets to help them establish their food processing units. We also endeavor to help already working food processing workforce to make them more productive and to generate employment. We also focus on nurturing innovation in post-harvest processing sector for holistic incubation of start-ups and rendering them all our services until they establish a profitable unit. During the reported period, total of 648 participants were trained for post-harvest management of agricultural and livestock produce through three ICAR sponsored summer/ winter schools, one model training course, seventeen entrepreneurship development programs (EDP), eleven farmers training, and two workshops. A total of 182 students were trained during this period in the area of post-harvest engineering and management.

Our scientists were conferred with many awards and honours like NRDC Societal Innovation Award, Eminent Scientist Award, Fellow of National Academy of Dairy Sciences (India), Jawaharlal Nehru Award for PG Outstanding Doctoral Thesis Research, etc. in recognition of their contributions in research and development in post-harvest sector. One of our scientist got Best Ph.D Student Award by Faculty of Agriculture, University Putra Malaysia. We have also won six best research presentation awards at International research conferences.

In our continuing efforts to reach out to farmers and other stakeholders, we showcased and demonstrated our technologies at different exhibitions and *melas* such as *Krishi Kumbh*, 106th Session of the Indian Science Congress 2019, 14th Science Congress, National Eat Right Mela along with the National Street Food Festival, 13th edition of Agro Tech India 2018, Coastal Agri. Expo 2019, *Kisan Mela* etc. The farmer welfare schemes of the government were implemented through organizing Soil Health Card Scheme, World Soil Day and *Mahila Kisan Divas*. Several other important extension activities were carried out at Ludhiana and Abohar campus through *Pradhan Mantri Kisan Samman Nidhi, Swacchh Bharat* and *Mera Gaon Mera Gaurav* programme, etc.

I take this opportunity to place on record my sincere thanks and gratitude to Hon'ble Director General, ICAR and Secretary, DARE; Chairman, ASRB; Additional Secretary, DARE; DDG (Agricultural Engineering); ADG (Process Engineering) and ADG (Farm Engineering) for their continued guidance, encouragement and support in executing the mandate of the Institute. I thank all the Head of Divisions, Project Coordinators, Section/Unit in-charges, scientists, technical, administrative, audit and supporting staff of the institute for their constant support, teamwork and dedication towards research as well as other assigned activities to achieve the goal of this premier institute.

R K Singh
Director

प्रभागीय भवन आईसीएआर–सीफेट, लुधियाना

कार्यकारी सारांश

भा.कृ.अनु.प.–सीफेट (लुधियाना) कृषि प्रसंस्करण से जुड़ा एक प्रमुख संस्थान है जो कि कटाई उपरान्त फसलोत्तर अभियांत्रिकी और प्रौद्योगिकी के क्षेत्र में अनुसंधान करता है। वर्ष 2018–19 के दौरान संस्थान ने बहु–विषयक अनुसंधान को विभिन्न परियोजनाओं के माध्यम से निष्पादित किया। संस्थान ने कटाई उपरान्त फसलोत्तर अभियांत्रिकी और प्रौद्योगिकी सम्बन्धी व्यापक क्षेत्रों में काम किया, जिसमें उपयोगी यंत्र, उपकरण और मशीनरी, उत्पाद और प्रक्रिया प्रोटोकॉल, खाद्य गुणवत्ता और सुरक्षा शामिल हैं। प्रशिक्षण, प्रौद्योगिकी अनुज्ञप्ति और अनुसंधान विस्तार गतिविधियों के माध्यम से अनुसंधान का हस्तांतरण किया। वर्ष 2018–19 के दौरान चिह्नित महत्वपूर्ण उपलब्धियाँ निम्न है।

पोहा बनाने की मशीन

छोटे पैमाने पर उत्पादन के लिए 80 कि.ग्रा./घंटा क्षमता वाली चावल से पोहा बनाने की मशीन को विकसित किया गया। मशीन में ब्लोअर की दक्षता 91.25 प्रतिशत पायी गयी। धान (किस्मः एम.टी.यू.–1010 में 22 प्रतिशत भूसी पर की गयी गणना के अनुसार) में 64.25 प्रतिशत ब्राउन पोहे की रिकवरी पायी गयी। दूसरी बार पुनः प्रयोग करने से रिकवरी बढ़कर 68.12 प्रतिशत हो गयी। टूटा पोहा 8 प्रतिशत पाया गया।

सूखी मिर्च के डंठल को काटने वाली मशीन

सूखी मिर्च के डंठल को काटने की प्रक्रिया के यांत्रिकीकरण के लिए इसे विकसित किया गया है। इस विकसित प्रणाली में सुखी मिर्च को डालने के लिए एक हॉपर, घूमता हुआ ड्रम, डंठल को काटने के लिए धारदार यंत्र, त्रिकोणीय सेतु, आयताकार खांचा, डंठल को संग्रह करने के लिए कलेक्टर और डंठल–मुक्त मिर्च के निकास का प्रावधान बनाया गया है। अनुकूलित मापदंडो पर सूखी मिर्च के डंठल को काटने की क्षमता 85–87 प्रतिशत पायी गयी। मशीन की कार्यकारी क्षमता मिर्च की नमी, घूर्णन गति, ड्रम के झुकाव, मिर्च को मशीन में डालने की दर और मिर्च की विविधता पर निर्भर करती है।

हरे मटर की फली से दाना निकालने की मशीन

हरे मटर की फली से दाना निकालने के लिए मशीन को विकसित किया गया है। इसकी क्षमता 20–25 कि.ग्रा./घंटा है। इसकी दक्षता 90–95 प्रतिशत है। इसकी क्षमता को बढ़ाने के लिए स्वचालित फीडिंग प्रणाली लगायी गयी है।

मीट बॉल बनाने की मशीन

यह मशीन कच्चे मांस के मिश्रण से मीट बॉल बनाने की प्रक्रिया के यांत्रिकीकरण के लिए विकसित की गयी है। एक

फीट लंबे बेलनाकार आकार में कच्चे मांस के मिश्रण को स्वचालित रूप से काटने का यंत्र अलग–अलग गति के साथ एक ही दिशा में घूमने वाले रोलर्स के ऊपर फिट किया गया। मीट बॉल को बनाने के लिए 1: 2.6 का गति अनुपात उपयुक्त पाया गया है। 10 मीट बॉल (प्रत्येक 15–17 ग्राम) को बनाने में लगभग आधा मिनट लगता है। मशीन की क्षमता 10–12 कि.ग्रा./घंटा है।

हरी किशमिश के उत्पादन के लिए छायादार, बलकृत वायुसंचार कुशल व्यवस्था

हरी किशमिश के अँधेरे में उत्पादन के लिए एक छायादार, बलकृत वायुसंचार व्यवस्था एवं सुखाने की कुशल प्रणाली विकसित की गयी है। अँधेरे में सुखाये गये किशमिश की गुणवत्ता छाया में सुखाये गये किशमिश की तुलना में उत्तम पायी गयी। बलकृत वायुसंचार व्यवस्था का शुष्क बल्ब तापमान 25–27 डिग्री पाया गया और इसकी सापेक्ष आद्रता 35.2 से 50 प्रतिशत। 6 दिनों तक सुखाने के बाद किशमिश में 22 प्रतिशत नमीं पायी गयी।

प्याज के भंडारण के लिए कम लागत वाली वायु संशोधन प्रणाली

प्याज के भंडारण के लिए एक कम लागत वाली वायु संशोधन प्रणाली विकसित की गयी है जो कि आवश्यकता के अनुसार भंडारण के वातावरण को संतुलित कर सकती है। यह सापेक्ष्य आद्रता को बढ़ाकर अधिकतम 5 प्रतिशत तथा तापमान को अधिकतम 7 डिग्री सेल्सियस तक कम करने में सक्षम है। इस संसोधन प्रणाली में, सामान्यतः तीन महीने तक सुरक्षित रहने वाले प्याज को, पांच महीने तक सुरक्षित रखा जा सकता है।

खाद्य उत्पादों में विभिन्न रंगों की मिलावट का पता लगाने की विधि

खाद्य उत्पादों में विभिन्न रंगों की मिलावट का पता लगाने के लिए विधियों को विकसित किया गया है। लाल मिर्च पाउडर में रोडामाईन डाई का एक ही चरण में पता लगाया जा सकता है। मिर्च के नमूनों में, सूडान डाई की पहचान की सीमा (200 पीपीएम) लाल रंग देखी गयी। हल्दी में डाई का पता लगाने के लिए विकसित विधि, 50 पीपीएम तक डाई का पता लगाने में सक्षम है।

अत्यधिक टूटे हुए मखाना का उपयोग करके मखाना चिक्की का विकास

मखाना पॉपिंग का सह–उत्पाद जो कि अत्यधिक टूटे हुए मखाने के रूप में होते हैं से मखाना चिक्की बनायी गयी है। चिक्की को 50:25:25 के अनुपात में गुड़, भुनी हुई मूंगफली और टूटे हुए मखाने का उपयोग करके बनाया गया। उपस्थिति, रंग, बनावट, स्वाद और समग्र स्वीकार्यता के लिए मखाना चिक्की की स्वीकार्यता 9 अंक हेडोनिक पैमाने पर 7.5 से 7. 9 पायी गयी।

अंकुरित चना और पुदीना के साथ पोशणयुक्त खाद्य उत्पाद

अंकुरित चना (बंगाल ग्राम), गेहूं का आटा और पुदीना का उपयोग करके, एक सुविधाजनक खाद्य उत्पाद को तैयार किया गया है। वर्तमान आबादी द्वारा आवश्यक पोषण और सुविधा दोनों के उद्देश्यों को पूरा करने के लिए एक बेहतर विकल्प प्रदान करता है।

प्याज का पाउडर बनाने की विधि

अत्यधिक प्याज उत्पादन, भंडारण, पैकेजिंग और परिवहन की बाधाओं से राहत पाने के लिए प्याज को पाउडर में परिवर्तित करना एक उत्तम विकल्प हैं। प्याज के निर्जलीकरण के लिये प्रयोग पांच अलग–अलग तापमानों (50, 60, 70, 80 और 90 डिग्री सेल्सियस) और सौर ऊर्जा से सुखाने की विधि का उपयोग करके किया गया। निर्जलीकरण और पीसने के तापमान ने पाउडर गुणों जैसे कि एस्कॉर्बिक एसिड की मात्रा, थायोसल्फेट की मात्रा, गैर–एन्ज़ाइमेटिक ब्राउनिंग, विलेयता, फैलाव, नमी, और थोक घनत्व को प्रभावित किया। कुल मिलाकर, सभी अवस्थओं में कम तापमान पर पीसे गये प्याज को बेहतर गुणवत्ता वाला पाया गया।

काले गाजर से एंथोसायनिन का निष्कर्षण, शुद्धिकरण, स्थिरीकरण और उपयोग

काली गाजर से रस के निष्कर्षण के लिए एक एंजाइम–सहायक प्रक्रिया को पेक्टिनेज एंजाइम के विभिन्न स्तरों का उपयोग करके मानकीकृत किया गया। रस निकालने के बाद काली गाजर के गूदे (पोमेश) से एंथोसायनिन को निकाला गया। पालक (2.5 और 5.0 प्रतिशत) के साथ काली गाजर का रंग (5, 10 और 15 प्रतिशत) का उपयोग कार्यात्मक ब्रेड को विकसित करने के लिए किया गया। काली गाजर का रंग आलू के स्लाइस में मिलाकर कार्यात्मक आलू के चिप्स विकसित किये गये हैं।

गुलाब की पंखुड़ियों को सुखाने की विधि

सूखी गुलाब की पंखुड़ियां अच्छा बाजार मूल्य प्राप्त करती हैं क्योंकि इसका उपयोग मिष्ठान, दवा आदि में किया जाता है। गुलाब की पंखुड़ियों को सुखाने के दौरान रंग, सुगंध और विभिन्न फाइटो–रासायनिक घटकों जैसे कि फेनिलएथेनॉल, सिट्रोनेलोल और फ्लेवोनोइड को संरक्षित करने के लिए मानकीकृत प्रयोग किया गये हैं। सुखाने के दौरान तापमान और समयावधि का अत्यधिक प्रभाव होता है। सबसे अत्युत्तम सुखाने का तापमान (80 डिग्री सेल्सियस) और सुखाने की अवधि (9–10 मिनट) पाया गया।

आम के एंथ्रेकोनोज और स्टेम एंड रोट रोगों के खिलाफ अंगूर और लौंग के तेल की रोगाणुरोधी क्षमता

लौंग और अंगूर से निकाले गये तेल को इन विट्रो शोध द्वारा फसलोत्तर कवक रोगजनकों (*कलेटोट्रिचुम ग्लोईओस्पोरीओइड्स*

और *बोटरयोडिप्लोडिअ थेओब्रोमाए*) के खिलाफ परखा गया जो कि आम के भंडारण के दौरान एंथ्रेकोनोज और स्टेम एंड रोट रोगों के लिए जिम्मेदार हैं। प्रत्येक तेल के लिए चार अलग–अलग स्तरों (500, 1000, 1500 और 2000 पीपीएम) का उपयोग करते हुए मूल्यांकन किया गया। *लेटोट्रिचुम ग्लोईओस्पोरीओइड्स* की अधिकतम वृद्धि निषेध 2000 पीपीएम लौंग तेल (86.3 प्रतिशत) की उपस्थिति के बाद अंगूर के तेल (68.1 प्रतिशत) में दर्ज की गयी। इसी तरह, *टरयोडिप्लोडिअ थेओब्रोमाए* का अधिकतम विकास निषेध लौंग के तेल (94.2 प्रतिशत) के साथ देखा गया।

अमरूद फलों की फसलोत्तर रोग उपचार के लिए पादप अर्क का मूल्यांकन

इन विट्रो शोध के निष्कर्षों के आधार पर, अमरुद के फलों पर पादप अर्क का इन विवो मूल्यांकन किया गया जिसके लिए लौंग का तेल, अंगूर का तेल, कैसिया छाल का अर्क और अर्जुन की छाल के अर्क का चयन किया गया। भंडारण के 9 दिनों के बाद, सबसे कम रोग का घाव (18.25 $\pm$ 0.14 मिमी) लौंग के तेल की उपस्थिति में देखा गया, इसके बाद अंगूर तेल (25.50 $\pm$ 0.29 मि.मी.), जबकि बिना किसी पादप अर्क से उपचारित फल उच्चतम रोग घाव (47.25 $\pm$ 0.14 मि. मी.) से ग्रसित पाये गये।

लाल मिर्च और लाल मिर्च पाउडर के लिए अनुकूलित पैकेजिंग विधि एवं सामग्री

जूट बैग, बुने हुए पॉलीप्रोपाइलीन (डब्ल्यूपीपी), पॉलीप्रोपाइलीन (पीपी) और लैमिनेटेड पाउच (एलपी) को लाल मिर्च की पैकेजिंग के लिए चुना गया। लाल मिर्च पाउडर के भंडारण के लिए, दो पैकेजिंग सामग्री अर्थात् पॉलीप्रोपाइलीन (पीपी) और लैमिनेटेड पाउच (एलपी) का उपयोग निर्वति के साथ और बिना निर्वति किया गया। अध्ययन किए गए विभिन्न पैकेजिंग सामग्रियों में से, लाल मिर्च पाउडर की गुणवत्ता लैमिनेटेड पाउच (एलपी) में अन्य पैकेजिंग सामग्री की तुलना में रंग प्रतिधारण के मामले में बेहतर थी। उच्च जीवनावधि और मिर्च पाउडर के बेहतर रंग की गुणवत्ता के लिए, निर्वति पैकेजिंग बेहतर तकनीक पायी गयी ।

अंगूर के उपचार के लिए स्वचालित धूमन कक्ष

स्वचालित धूमन (फ्यूमिगेशन चैंबर) को करीब 1500 किलोग्राम अंगूर के उपचार के लिए डिज़ाइन किया गया। धूमन उपचार को, पैक हाउस ऑपरेशंस के पूरा होने (प्राप्त करने, तोलने, छाँटने, पन्नेट पैकेजिंग, वजन करने और डिब्बों में भरने) के बाद किया जाता है। धूमन प्रणाली का संचालन एक इलेक्ट्रॉनिक नियंत्रण कक्ष से होता हैं, जिसे कक्ष के बाहर फिट किया गया है। गैस सांद्रता, तापमान, संचालन का समय, सोलेनोइड वाल्वों का संचालन, दरवाजों की स्थिति, निकास पंखे का संचालन, प्रत्येक गैस के लिए समय आदि, एलईडी डिस्प्ले के माध्यम से प्रदर्शित किए गये हैं। मूल्यांकन में यह पाया गया कि सभी कीट कार्बन डाईआक्साइड और सल्फर डाईआक्साइड गैसों से उपचारित करने के पश्चात मारे गये।

एफसीआई द्वारा वित्तीय पोषित खाद्यान्न गोदामों में भंडारण क्षति का निर्धारण

वैज्ञानिक मानदंडों के अभाव में गोदामों में भंडारण के दौरान खाद्यान्न क्षति चिंता का विषय है। व्यवस्थित आंकड़ों के संग्रह के माध्यम से उचित नुकसान का आकलन और इसके विश्लेषण से मानदंडों की बेहतर समझ और मानकीकरण में मदद मिलती है। इस दिशा में, एफसीआई की आर्थिक मदद से एक अध्ययन किया गया है जिसे जुलाई 2013 से चार साल की अवधि के लिए किया गया। एफसीआई/सीडब्ल्यूसी के अलग–अलग डिपो से 20 राज्यों से आंकड़ों को दर्ज किया गया है। आंकड़ों का विश्लेषण करने के लिए डेटा विश्लेषणात्मक उपकरण और अन्य तकनीकों का उपयोग किया गया। विशिष्ट सिफारिशों के साथ एक विस्तृत रिपोर्ट तैयार की गयी।

अखिल भारतीय समन्वित अनुसंधान परियोजना (फसलोत्तर अभियांत्रिकी एवं प्रौद्योगिकी) के तहत विकसित मशीनें/उपकरण

प्रकाशीय संवेदक आधारित मखाना कटाई मशीन

प्रकाशीय संवेदक आधारित मखाना कटाई मशीन विकसित की गयी है। इसमें एक मॉनीटर, बोरोस्कोप/पॉइंट कैमरा और एक कटिंग ब्लेड लगाया गया है। मशीन की क्षमता 50–60 फल/घंटा है तथा फील्ड क्षमता (फलों की कटाई के बगैर) पारंपरिक विधि से कटाई की तुलना में लगभग दोगुनी है। मशीन की लागत 12,000/– रुपये है।

हस्त और विद्युत् संचालित सिंघाड़ा छीलने की मशीन

यह मशीन फली से सूखे सिंघाड़ा के दाने (गिरी) निकालने के लिए विकसित की गयी है। हस्त और विद्युत् संचालित सिंघाड़ा छीलने की मशीन की क्षमता क्रमशः 12 और 60 कि.ग्रा./घंटा और प्रति इकाई लागत मूल्य क्रमशः 10000/– तथा 30000/– रुपये है।

अखरोट के छीलने व धोने की मशीन

हरी अखरोट के छिलके को हटाने और धोने के लिए इस मशीन का उपयोग किया जाता है। इसकी कार्यकारी दक्षता 90.60 प्रतिशत है। इस मशीन की क्षमता 335–345 कि.ग्रा./घंटा और मशीन की अनुमानित लागत लगभग 98000/– रुपये है।

ताड़ के बीज को निकालने की मशीन

ताड़ फल के गूदे से बीज को अलग करने के लिए इसका उपयोग किया जाता है। इस मशीन की क्षमता 60 फल/घंटा है और मशीन की लागत 6000/– रुपये है।

कटहल के बीज व छिलके को हटाने की मशीन

इस मशीन का उपयोग कटहल को तेजी से छीलने और बीज को निकालने के लिए किया जाता है। इस मशीन में कटिंग मेकेनिज्म, पॉवर असेंबली, पावर ट्रांसमिशन यूनिट और फ्रेम असेंबली के साथ फ्रूटहोल्डर असेंबली लगी हुई है। इस मशीन की क्षमता 40 कि.ग्रा./घंटा और मशीन की लागत 51,000/– रुपये है।

प्रतिवर्ती वायु प्रवाह द्वारा धान को सुखाने की मशीन

मशीन में ड्रायर की क्षमता 3 टन/घंटा है। मशीन की लागत 8.5 लाख रुपये है ।

हल्दी को धोने की मशीन

मशीन में फीड हॉपर, बेलनाकार रोटरी ड्रम, पानी स्प्रे करने का संयंत्र, धोयी हुई हल्दी के लिए आउटलेट, मोटर, पंप, फ्रेम और जल संग्रह ट्रे शामिल हैं। एकत्रित अपशिष्ट जल को एक पंप की सहायता से फ़िल्टर किया जाता है और फिर से परिचालित किया जाता है। मशीन की क्षमता 300 कि.ग्रा./घंटा है और लागत 181000/– रुपये है।

अखिल भारतीय समन्वित अनुसंधान परियोजना (प्लास्टिक अभियांत्रिकी एवं प्रौद्योगिकी) के तहत विकसित मशीनें/उपकरण

पीसीएम आधारित गतिशील शीतल कक्ष

एक क्विंटल क्षमता का एक पीसीएम आधारित मोबाइल कूल चैम्बर विकसित किया गया। पीसीएम आधारित गतिशील शीतल कक्ष का उष्मीय विश्लेषण एनसिस सॉफ्टवेयर का उपयोग करके किया गया। शीतल कक्ष के मूल्यांकन में पाया गया कि 31–40°C बाहरी तापमान के बावजूद पीसीएम के अंदर तापमान को लगभग 20 डिग्री सेल्सियस पर बनाए रखने में सक्षम था।

पॉलीहाउस ऊर्ध्वाधर स्थान के उपयोग लिए जलसंवर्धन (हाइड्रोपोनिक्स) प्रक्रिया

इस प्रणाली को पॉलीहाउस के अंदर ऊर्ध्वाधर स्थान के उपयोग के लिए विकसित किया गया क्योंकि पॉलीहाउस के अंदर यह स्थान अप्रयुक्त रहता है तथा इसका उपयोग सब्जियों के उगाने के लिए किया जा सकता है। यह हाइड्रोपोनिक्स प्रणाली छोटी ऊंचाई की फसलों और पत्तेदार सब्जियों (उदाहरण के लिएः सलाद, पालक, धनिया) उगाने के लिए उपयोगी पायी गयी है।

शहरी और अर्ध–शहरी आबादी के लिए मृदा–रहित सब्जी पोषण उद्यान

इस उद्यान में उत्पादित सब्जी 2–4 व्यक्तियों के परिवार के लिए पर्याप्त है। टमाटर, शिमला मिर्च, ककड़ी, धनिया, ब्रोकोली, पालक, मटर, लेट्यूस, मेथी और चन्नी सरसों जैसी दस सब्जियाँ खड़ी बुवाई/रोपाई के साथ उगायी जा सकती हैं। यह सब्जियाँ साल भर उपलब्ध रहेंगी। इस मॉडल की अनुमानित लागत लगभग 40000/– रुपये है।

सिक्किम में बिन मौसम मैं जैविक खाद द्वारा पॉली–हाउस में शिमला मिर्च की खेती

इस शोध में जैविक खाद द्वारा पॉली–हाउस में 35–40 प्रतिशत की उत्पादन वृद्धि पायी गयी। खुली स्थितियों की तुलना में पॉलीहाउस के अंदर दैनिक अधिकतम तापमान का साप्ताहिक औसत (32.88 डिग्री सेल्सियस) और सापेक्ष आद्रता (91.48 प्रतिशत) में क्रमशः 4.9 डिग्री सेल्सियस और 1.8 प्रतिशत की वृद्धि पायी गयी। इसी तरह, बाहर की तुलना में पॉली–हाउस के अंदर दैनिक न्यूनतम तापमान का साप्ताहिक औसत (16.04 डिग्री सेल्सियस) 0.07 डिग्री सेल्सियस बढ़ा और दैनिक न्यूनतम सापेक्ष आद्रता (42.25 प्रतिशत) पॉली–हाउस की तुलना में 8.4 प्रतिशत कम हुई।

उच्च पहाड़ियों के लिए कम लागत वाले बहु–उपयोगी उठाने योग्य पॉलीटनल पॉलीहाउस

इस संरचना की मुख्य विशेषता यह है कि इसे पहाड़ियों में आवश्यकतानुसार नए स्थान पर आसानी से विघटित, इकट्ठा और स्थानांतरित किया जा सकता है। 50 और 62.5 वर्ग मीटर आकार की दो संरचनाएं विकसित की गई हैं जिसकी लागत क्रमशः 50000/– और 62000/– रुपये है। इस संरचना को चार व्यक्ति 3 घंटे में स्थानांतरित कर सकते हैं।

प्लास्टिक लाइन से बने तालाब में अपवाहित जल को जमा कर अर्द्ध–शुष्क क्षेत्र में फसल उत्पादन के लिए उपयोग

मिर्च की चयनित फसल *कैप्सिकम एनम* (वेरायटी गुंटूर) को सींचने के लिए अपवाहित जल और बोरवेल के पानी को एकत्र करने के लिए प्लास्टिक लाइन वाला एक तालाब विकसित किया गया है। पौधे की ऊँचाई (77.07 से.मी.), प्राथमिक शाखाओं की संख्या (13.13), माध्यमिक शाखाओं की संख्या (47.40), फूल 50 प्रतिशत (39.91 दिन), फलों की लंबाई (8.97 से.मी.) और व्यास (1.73 से.मी.) और उपज (19.99 टन/हेक्टेयर) पायी गयी है जो सभी विकास पैरामीटर, आरडीएफ (100 प्रतिशत) और सिंचाई स्तरों (80 प्रतिशत) से अधिक उपयुक्त है। मिर्च की फसल उगाने के लिए 100 प्रतिशत आरडीएफ और 80 प्रतिशत सिंचाई का स्तर सबसे उपयुक्त है।

पाबडा हैचरी यूनिट

एक पाबडा हैचरी इकाई को विकसित किया गया है। इसमें 3 प्रजनन पूल (आयताकार टैंक, 3 मीटर लंबाई, 1.1 मीटर चौड़ाई और 0.65 मीटर ऊंचाई) और 3 ऊष्मायन पूल (0.35 मीटर की ऊंचाई वाले 1.2 मीटर, 1.1 मीटर और 1.0 मीटर व्यास में) शामिल हैं। प्रत्येक ऊष्मायन पूल में पानी के प्रवाह को बनाए रखने के लिए 4 बतख–मुख (0.75 इंच व्यास) लगाये गये हैं।

बकरियों के लिए प्लास्टिक की नाँद

व्यस्क बकरियों के लिए आयताकार प्लास्टिक का नाँद विकसित की गयी है। इसमें स्टाल–फेड स्थितियों की तुलना में चारे का कम नुकसान होता है। यह कुल 10 व्यस्क बकरियों (पाँच एक व पाँच दूसरी तरफ) को खिलाने के लिए उपयुक्त है। इसमें चारे का नुकसान काफी कम होता है।

सांद्रित चारे में लगभग शून्य तथा सूखे व हरे चारे में 5–10 प्रतिशत का ही नुकसान होता है।

राजस्व उत्पत्ति

संस्थान ने 2018–19 के दौरान लगभग अट्ठासी लाख इक्यासी हजार रुपये (88.81 लाख) का राजस्व उत्पन्न किया। भा.कृ.अनु.प.–सीफेट ने 2018–19 के तहत आवंटन बजट का 99.65 प्रतिशत उपयोग किया।

पुरस्कार और सम्मान

संस्थान के वैज्ञानिकों को फसलोत्तर क्षेत्र में शोध एवं विकास के लिए कई पुरस्कारों और सम्मानों से सम्मानित किया गया है, जिनमें एनआरडीसी सोसाइटल इनोवेशन अवार्ड, विशिष्ट वैज्ञानिक पुरस्कार, नेशनल एकेडमी ऑफ डेयरी साइंसेज (भारत) के फैलो, जवाहरलाल नेहरू पुरस्कार, पीजी आउटस्टैंडिंग डॉक्टोरल थीसिस रिसर्च, अखिल भारतीय उत्तम लेख के लिए पुरस्कार, आदि मुख्य हैं। हमारे एक वैज्ञानिक को कृषि संकाय, यूनिवर्सिटी पुत्रा मलेशिया द्वारा सर्वश्रेष्ठ पीएचडी छात्र का पुरस्कार मिला। हमने अंतर्राष्ट्रीय अनुसंधान सम्मेलनों में छह सर्वश्रेष्ठ शोध प्रस्तुति पुरस्कार भी जीते हैं।

प्रौद्योगिकी अनुज्ञप्ति और एकस्व अधिकार पत्र (पेटेंट)

हमारे अनुसंधान प्रयास और उनके परिणाम आईपीआर पोर्टफोलियो, प्रौद्योगिकी लाइसेंसिंग और व्यावसायीकरण से परिलक्षित होते हैं। गत वर्ष संस्थान को तीन पेटेंट प्रदान किये गये तथा संस्थान ने दो नये पेटेंट और दायर किये। प्रदान किये गये पेटेंट मिलेट्स को पीसने के लिए नवीन प्रक्रिया, ग्वार सीड का छिलका हटाने के लिए नवीन प्रक्रिया और आम की परिपक्वता अवस्था का पुर्वानुमान करने की प्रौद्योगिकी से संबंधित हैं। मखाना बीजों की पॉपिंग और अपघटन की एक तकनीक भी हस्तांतरित की गयी है। फसलोत्तर अभियांत्रिकी और प्रौद्योगिकी सम्बन्धी अखिल भारतीय समन्वित शोध परियोजना ने किसानों और उद्यमियों को 50 प्रौद्योगिकियाँ हस्तांतरित की और 3 सफल प्रौद्योगिकियाँ प्लास्टिक अभियांत्रिकी और प्रौद्योगिकी सम्बन्धी अखिल भारतीय समन्वित शोध परियोजना के तहत किसानों के क्षेत्र में स्थानांतरित की गयी। प्लास्टिक अभियांत्रिकी और प्रौद्योगिकी सम्बन्धी अखिल भारतीय समन्वित शोध परियोजना ने 2018–19 के दौरान दो निजी फर्मों को 'शहरी कृषि के लिए' रूफ टॉप न्यूट्रीशनल गार्डन मॉडल की तकनीक का लाइसेंस प्रदान किया।

समझौता ज्ञापन

उपभोक्ता मामलों के विभाग, उपभोक्ता मामले, खाद्य और सार्वजनिक वितरण मंत्रालय, भारत सरकार, नई दिल्ली के साथ एक समझौता ज्ञापन (एमओयू) स्थापित किया गया है। यह एमओयू प्रमुख दालों की खरीद के लिए जीवनावधि, सुरक्षित भंडारण, मिलिंग आउटर्न और सांकेतिक मानदंडों को बढ़ाने के लिए प्रोटोकॉल के विकास से संबंधित है। इस परियोजना में 2.40 करोड़ रुपये राशि स्वीकृत की गयी है। भा.कृ.अनु.प.–सीफेट संस्थान के साथ दस अन्य संस्थान इस परियोजना में कार्य कर रहें हैं।

फसलोत्तर उपयोगी यंत्र एवं उपकरण जाँच केंद्र

कटाई उपरान्त फसलो के लिये उपयोगी यंत्र एवं उपकरण जाँच केंद्र ने 2018–19 के दौरान 25 मशीनों का परीक्षण किया। जिसमें परीक्षण शुल्क के रूप में कुल 29.76 लाख रुपये प्राप्त हुऐ।

प्रशिक्षण, मानव संसाधन विकास और विस्तार

भा.कृ.अनु.प.–सीफेट, कटाई के बाद फसल प्रबंधन और खाद्य प्रसंस्करण के क्षेत्रों में मानव संसाधन विकास और विभिन्न हितधारकों को प्रशिक्षण देने के लिए प्रतिबद्ध है। वित्तीय वर्ष 2018–19 में कुल 648 प्रतिभागियों को तीन आईसीएआर प्रायोजित ग्रीष्म व शीतकालीन पाठ्यक्रम, एक मॉडल प्रशिक्षण पाठ्यक्रम, सत्रह उद्यमिता विकास कार्यक्रम (ईडीपी), ग्यारह किसानों के प्रशिक्षण, दो कार्यशालाओं के माध्यम से फसलोत्तर प्रबंधन के लिए प्रशिक्षित किया गया। इसके अलावा कुल 182 छात्रों को भी प्रशिक्षित किया गया। विभिन्न हितधारकों को संस्थान प्रौद्योगिकियों से अवगत कराने के लिए संस्थान ने देश भर में कई प्रदर्शनियों में भाग लिया जिसमें कृषि कुंभ, भारतीय विज्ञान कांग्रेस, 14वीं विज्ञान कांग्रेस, नेशनल स्ट्रीट राइट मेला के साथ राष्ट्रीय स्ट्रीट–फूड उत्सव, एग्रो टेक इंडिया का 13वां संस्करण, तटीय कृषि–एक्सपो, किसान मेला इत्यादि मुख्य हैं।

प्रकाशन तथा उद्धरण (साइटेशन)

वर्ष के दौरान, 40 शोध पत्रों को राष्ट्रीय और अंतर्राष्ट्रीय शोध पत्रिकाओं में प्रकाशित किया गया है। पिछलें वर्षों में अंतर्राष्ट्रीय शोध पत्रिकाओं में प्रकाशित पत्रों में से 22 को 100 से अधिक (प्रत्येक) उद्धरण (साइटेशन) मिले हैं। संस्थान के अन्य प्रमुख प्रकाशनों में कम्पेंडियम (6), बुक चैप्टर (11), लोकप्रिय/तकनीकी लेख (212), तकनीकी बुलेटिन (2), वार्षिक रिपोर्ट (1), समाचार पत्र (4) और पत्रक (12) शामिल हैं।

जय जवान, जय किसान
जय विज्ञान, जय अनुसंधान

Aerial view of Divisional Building at ICAR-CIPHET, Ludhiana

Executive Summary

ICAR-CIPHET is a premier institute entrusted to undertake lead research in the area of post-harvest engineering and technology suitable to agricultural production catchment and agro-processing industries. During the reported period (2018-19), the Institute executed its multidisciplinary research through various in-house and externally funded projects. The Institute worked in broad areas of post-harvest engineering and technology including post-harvest equipment and machinery, products and process protocols, food quality and safety, including transfer of research findings through technology licensing, trainings, capacity building and extension activities. The significant achievements marked during the year 2018-19 are presented below.

Rice Flaking Machine

Rice flaking machine of capacity 80 kg/h was designed and developed for small scale production of rice flakes. The machine is designed to perform two operations: dehusking of paddy and flaking of brown rice. The efficiency of the blower was found to be 91.25%. The recovery of brown rice flakes from MTU-1010 paddy variety was found to be 64.25% (considering 22% husk in MTU-1010 variety) after single pass which increased to 68.12% after 2nd pass. Besides, the percentage broken of rice flakes was found to be 8%.

Dried Chilli Destalking Prototype

Chilli destalking prototype was designed and developed in order to mechanize destalking operation. The developed system consists of a feeding hopper, rotating drum, cutting blades, triangular bridges, rectangular slots, stalk collector, destalked chilli outlet. The machine has destalking efficiency of 85-87% while the machine was operated on the optimized parameters. The machine performance depends significantly on the moisture content of chilli, speed and inclination of the rotating drum, feed rate and variety of chilli.

Machine for De-podding of Green Peas

The green pea de-podder prototype was developed for shelling green peas. The developed prototype performed well with manual feeding of pea pods. The capacity of the prototype is around 20-25 kg/h and the seed damage is 5-10%. Automatic feeding mechanism was fitted in order to increase its capacity. The performance evaluation of machine at different pre-treatment parameters, roller speed, feed rate and gap between the two rollers were established.

Meat Ball Making Machine

Meat Ball Making Machine is developed for making of meat balls from raw meat formulation. The main working components are two horizontal rollers fixed on a frame powered by electric motor and rotated by 4 differential diameter pulleys. It takes about half minute to make 10 balls each of 15-17 g. The capacity of the machine is worked out to be 10-12 kg per hour.

Low-cost Air Modification System

A low-cost air modification system for storage of onions in the ply-board storage structure was developed which can humidify and dehumidify the storage atmosphere as per the storage requirement. The system is capable of lowering the storage temperature maximal by 7 °C parallel raising RH of storage environment nearly by 5%. The storability of the onions in the structure was close to five months compared to three and a half months in ambient condition.

Automated Fumigation Chamber for Treatment of Grapes (APEDA-funded)

An automated fumigation chamber was designed for treatment of 1500 kg grapes against *Drosophila Suzukii* which is a fruit fly. All the operations of the fumigation system are controlled from an electronic control panel, which is fitted outside the chamber. The gas concentration, temperature, operation time, operation of solenoid valves, status of doors, operation of exhaust fans, run time for each gas, etc. are displayed through LED displays and controlled by a BMCS (Building management and control system) program specifically prepared for this fumigation system. The fumigation chamber was evaluated for treatment of grapes. It was found that all the insects were killed after the treatment with CO_2 and SO_2 gases. The chamber is ready for commercial exploitation.

Study on Determining Storage Losses in Food Grains and Recommending Norms for Storage Losses (FCI-funded)

The storage losses of food grains during storage in warehouses becomes an issue of concern in the absence of any scientific norms for losses. Proper loss assessment through the systematic data collection and its analysis help in better understanding and standardization of the norms. In this direction, the FCI supported a study, which was initiated in July 2013 for a period of four years. The data was recorded from different depots of FCI/CWC covering 20 states across the country. The observations on physical parameters of the commodity were recorded fortnightly. Besides, environment data inside the godown were recorded on daily basis and ambient environmental data of the locality were collected from the nearby meteorological station. A detailed report with specific recommendations was prepared.

Mechanized De-stoner for Peeled Litchi Fruit

Five different types of vibratory bowl, channelized feeding mechanism were fabricated and evaluated for systematic orientation of peeled litchi for the purpose of de-stoning. Based on the preliminary trials, U shaped channelized feeding mechanism was selected for further fabrication of the prototype. In this, the feed cups of fibre sheet (20×20 mm) with distance between two cups (20 mm) were fitted on the roller. Considering the physical properties of peeled litchi, the feed cups were fabricated using nylon material.

UV–VIS Spectroscopy and Chemometrics for Detection of Pork Meat in Minced Goat Meat

UV–visible (UV–VIS) spectroscopic method was developed for detection of pork meat in

minced goat meat. The spectral data, standardized by different pre-treatments, were processed, separately or fused, using Principal Component Analysis (PCA). UV-VIS spectroscopic techniques was able to detect minimum 10% pork meat adulteration correctly.

An Efficient Forced Ventilated Shade Drying System for Production of Green Raisins in Dark

An efficient force ventilated shade drying system was developed for production of green raisins. Berries dried in the dark remain more green and lighter in color than shade-dried fruits. The dry bulb temperature inside force ventilated shade drying system varied from 25-27 °C. The relative humidity inside this system varied from 35.2 to 50.0%. Final moisture content of the raisins was about 22% and the drying duration was 6 days.

Edible Fat Replacers for Development of Low-fat, High-fibre Meat Products

Edible fat replacers from natural ingredients was developed for manufacturing of low-fat meat products. A substantial fat reduction ($P < 0.05$) up to 38% and increase in the fibre content up to 4% level as compared to full fat control meat samples was recorded. The developed health meat products had significantly similar or better technological properties in comparison to full-fat meat products.

Process for Preparation of Onion Powder

In this work the influence of dehydration and grinding temperatures on particle and physico-chemical characteristics of onion powder prepared by 2 mm thick dehydrated onion slices was studied. The dehydration was performed using (a) hot air dryer method at five different temperatures (50 °C, 60 °C, 70 °C, 80 °C, and 90°C) and (b) sun drying method. The dehydrated onion slices were ground at two different conditions: (a) ambient grinding at 45 °C and (b) low-temperature/ice jacketed grinding at 37 °C to obtain the powders. Overall, in all the cases, the low-temperature ground powders were found to be of better quality compared to ambient ground powders.

Process Optimization for Drying of Loose Rose Petals

The dry rose petals fetches good market value as it is used in confectioneries, medicine *etc.* This study was aimed to optimize drying conditions for rose petals as a function of drying temperature (70-100 °C) and holding time in continuous tunnel dryer. The initial moisture content of fresh rose petals was 82.31 ± 2 % (w.b) and the moisture content subsequent to drying was 10.02 ± 2 % (w.b). With the increase in drying temperature, the degradation in L^* and b^* values was observed. The optimized drying conditions with respect to final product quality were 80 °C drying temperature and 9-10 min of holding time in drying tunnel.

Improved Methods for Detection of Different Dyes from Food Products

A simple method was developed for the detection of rhodamine dye from red chilli powder. The method has a single step rather than multiple steps as followed by FSSAI for detection of rhodamine. The detection limit for rhodamine dye was observed to be 20-25 ppm with pink color and 50 ppm with red color. Similarly an improved method was developed for detection of Sudan dye in chilli powder. The appearance of red color in the samples indicates the test to be positive for Sudan dye. The detection limit for Sudan dye was observed to be 200 ppm with red color.

Extraction, Purification, Stabilization and Utilization of Anthocyanins from Black Carrots

An enzyme-assisted process for extraction of juice from black carrots was optimized using different levels of pectinase enzyme. The anthocyanins were extracted from the black carrot pomace after juice extraction. The extracted color filtrate was adsorbed on XAD-7 adsorbent via column chromatography. The yield of color ranged between 1.0-1.5% of black carrot pomace. Total five anthocyanins, cyanidin derivatives have been identified from the extracted color from black carrot using LC-DAD-ESI-MS analysis. It was found that there was less degradation of color

intensity at 350 mg gallic acid compared to 175 mg gallic acid. Also, the color was more stable at pH 1 during storage compared to pH 2 and 3. A lesser degradation was observed at less pH at both gallic acid concentrations.

Antimicrobial Effects of Natural Extracts against Microbes (Anthracnose and Stem End Rot Diseases) of Mango

The antimicrobial effects of clove and grapefruit essential oil were evaluated against post-harvest fungal pathogens *viz. Colletotrichum gloeosporioides* and *Botryodiplodia theobromae* which are responsible for development of anthracnose and stem end rot diseases during storage of mango. Maximum growth inhibition of *C. gloeosporioides* was reported in presence of 2000 ppm clove oil (86.3%) followed by grapefruit oil (68.1%). Similarly, maximum growth inhibition of *B. theobromae* was observed with clove oil (94.2%), followed by grapefruit essential oil (92.3%).

Improved Method for Extraction of Collagen Hydrolysates from Buffalo Skin

An improved method is in the process of development for extraction of collagen hydrolysates from buffalo skin. The method will be useful for industrial application for manufacturing of this high value compound. Based on FAA estimation and SDS-PAGE images, it was arrived that papain enzyme degraded the proteins most effectively at level 20 and 30 units of enzyme per gram of skin and bromelain was most effective at level 30 and 50 units of enzyme/gram of skin to hydrolyse the skin collagen.

In vivo Evaluation of Plant Extracts against Post-harvest Disease of Guava Fruits

The lowest disease lesion (18.25 ± 0.14 mm) was observed in the presence of clove oil, followed grapefruit EO (25.50 ± 0.29 mm) while control fruits treated with sterile water has highest disease lesion (47.25 ± 0.14 mm). In terms of pathogen growth inhibition, clove oil was able inhibit pathogen development by 61.38 %, followed by followed grapefruit EO 46.03 percent. In case of anthracnose disease, lowest disease lesion (19.50 ± 0.29 mm) was observed in the presence of clove oil, followed grapefruit EO (21.00 ± 0.00 mm) while control fruits treated with sterile water has highest disease lesion (36.75 ± 0.43 mm) after 9 days of storage. In terms of pathogen growth inhibition, clove oil was able inhibit pathogen development by 46.94 %, followed by followed grapefruit EO 42.86 percent.

Optimized Packaging Method and Packaging Material for Destalked Red Chilli and Red Chilli Powder

Three different packging materials *viz.,* jute bags, woven polypropylene (WPP), polypropylene (PP) and laminated pouches (L) were selected for packaging of destalked red chillies with and without vacuum. Among the different packaging materials studied, quality of red chilli powder packed in laminated pouches was better in terms of color retention when compared to other packaging materials. Also, for higher shelf life and better color quality of chilli powder, vacuum packaging proves to be a safe and better technology.

Development of Makhana Chikki using Over-popped Makhana

Makhana chikki was developed utilizing the over-popped makhana, which is a by-product of makhana popping. The chikki was formulated using jaggery, roasted groundnuts and over-popped makhana in the ratio of 50:25:25. Organoleptic evaluation of makhana chikki for appearance, color, texture, flavor and overall acceptability scored 7.5-7.9 on a nine point hedonic scale.

Nutritious Noodles Containing Sprouted Bengal Gram and Mint

Sprouted Bengal gram, wheat flour and mint were utilized for preparation of noodles, a convenient food. Optimization of noodles with different combinations of wheat flour (70-80 g), sprouted Bengal gram flour (20-30 g) and mint paste (10-20 g) using box behnken design of response surface methodology was carried out. Noodles with combination of wheat flour:

sprouted Bengal gram: mint paste in a ratio of 65:21:14 was found to be of optimum acceptance on the basis of nutritional parameters, water absorption, cooking quality, in vitro protein digestibility, free fatty acid, DPPH activity and sensory parameters.

Machines/Equipment/Process developed under AICRP on PHET

Optical Sensor Based Makhana Harvester

An optical sensor based makhana harvester was developed which consists of a monitor, boroscope/point camera and a cutting blade. The capacity of the machine is 50-60 fruits/h and field capacity (number of fruits harvested) are almost doubled as compared to conventional harvesting. The cost of the machine is Rs 12000/-.

Hand and Power Operated Water Chestnut Decorticator

Hand and power operated water chestnut decorticator was developed for decortication of dried water chestnut kernels from pods. Capacity of the hand and power operated water chestnut decorticator is 12 and 60 Kg/h, respectively and the cost is Rs. 10000/- and Rs. 30000/-, respectively.

Walnut Dehuller Cum Washer

Walnut dehuller cum washer was developed for dehulling and washing of green walnuts. The capacity of this machine is 335-345 kg/h and the overall efficiency is 90.60%. The cost of this machine is Rs. 98000/-.

Toddy Palm Fruit Seed Separator

A toddy palm fruit seed separator is used to separate the pulp from toddy palm fruit. Capacity of this machine is 60 nuts/h and cost of the machine is Rs. 6000/-.

Jackfruit Corer Cum Peeler

A jackfruit corer cum peeler is developed which consists of fruit holder, peeler assembly, corer assembly along with cutting mechanism, power transmission unit and frame assembly. It is designed as a rotating disc that can carry the jackfruit on a horizontal plane. Capacity of this machine is 40 kg/h and cost of the machine is Rs. 51000/-.

Rotary Onion Grading Machine

A rotary onion grading machine was developed. The capacity of the machine is 2.5 tonne/h and grading efficiency is 89%. It grades onion on the basis of their size into 3 to 4 grades. The cost of operation is Rs. 90.38/tonne.

Reversible Air Flow Flat-bed Dryer

This dryer is used for drying of freshly harvested paddy. The capacity of the dryer is 3 tonnes. The dryer consists of 10 HP Diesel engine motor for blowing air, an LPG based combustion chamber for heating air and an automatic temperature control system. The cost of the machine is Rs. 8.5 lakh.

Turmeric Washer

The washer consists of feed hopper, cylindrical rotary drum, water spray assembly, washed turmeric outlet, motor, pump, frame and water collecting tray. The collected waste water is filtered and recirculated with the help of a pump. Capacity of the machine is 300 kg/h and cost is Rs. 181000/-.

Machines/Equipment Developed under AICRP on PET

PCM Based Mobile Cool Chamber

A PCM based mobile cool chamber of one quintal capacity was developed. Thermal analysis of PCM based cool chamber was done using ANSYS software. Performance evaluation of the chamber revealed PCM was able to maintain the inside temperature at about 20 °C although outside temperature varied from 31-40 °C.

Hydroponics System for Vertical Space Utilization

This system was developed for utilization of vertical space inside polyhouse, as some vertical space inside polyhouse remains unutilized which can be used for growing of vegetables. This hydroponics system was found useful for growing of small height crops and leafy vegetables viz. lettuce, spinach, coriander.

Soil-less Media Rooftop/Terrace Vegetable Nutrition Garden for Urban and Peri-urban Population

In this garden, the vegetable produced is sufficient for a family of 2-4 persons. Ten vegetables like Tomato, Bell Pepper, Cucumber, Coriander, Broccoli, Spinach, Pea, Lettuce, Fenugreek and Chinni sarson can be grown with staggered sowing/transplanting, the vegetables would be available round the year. The approximate cost of this model is around Rs. 40000/-.

Off-season Capsicum Cultivation under Poly-house in Organic Manures and Different Moisture Depletion Levels in Sikkim

In this work, 35- 40% increase in the yield was found under organic conditions in poly-house over open conditions. The weekly average daily maximum temperature (32.88 °C) and RH (91.48%) increased by 4.9 °C and 1.8%, respectively inside the polyhouse compared to the outside. Similarly, the weekly average daily minimum temperature (16.04 °C) increased by 0.07 °C inside the poly-house in comparison to the outside values and the daily minimum RH (42.25%) decreased by 8.4% inside the poly-house compared to the outside.

Portable Low-cost Multiple use Portable Poly-tunnel Cum Polyhouse for Higher Hills

The main feature of this structure is that it can be easily dismantled, assembled and relocate to a new location as per the need in the hills. Two structures of size 50 m^2 and 62.5 m were developed and cost of the structures were Rs. 50000/- and 62000/- respectively. For shifting of this structure only four persons are required who can shift this in 3 h.

Conjunctive Use of Runoff Harvested Water from Plastic Lined Farm Pond and Groundwater for Crop Production in Semi-arid Region

A plastic lined pond for collected of runoff water and bore well water was developed to irrigate the selected crop of chilli (*Capsicum annum* L.) var Guntur. All the growth parameters like plant height (77.07 cm), no of primary branches (13.13), no of secondary branches (47.40), 50 % flowering (39.91 days), fruit length (8.97) and diameter (1.73) and yield (19.99 t/ha) were observed to be maximum in 100% RDF and 80% irrigation levels. The interactions between 100% RDF and 80% irrigation levels is best suitable for growing of chilli crop.

Pabda Hatchery Unit

A Pabda hatchery unit has designed and developed. It comprises of 3 breeding pools (rectangular tanks, the bigger one with 3 m length, 1.1 m width and 0.65 m height) and 3 incubation pools (circular tanks, of 1.2 m, 1.1 m and 1.0 m diameters having a water height of 0.35 m). In each of the incubation pool, 4 numbers of duck mouths (0.75 inch diameter) are provided to maintain a circular flow of water.

Rectangular Plastic Feeder

Rectangular plastic feeder for adult goats to reduce feed wastage under stall-fed conditions was developed. It is suitable for feeding 10 adult goats, five on each side. It reduces feed wastage in goat farm i.e. almost nil wastage in concentrate feed, 5-10 percent wastage in case of dry and green fodder.

Revenue Generation

During 2018-19, our institute generated a revenue of around Eighty eight lakh eighty one thousand rupees (Rs 88.81 Lacs). ICAR-CIPHET also utilized 99.65% of budget with respect to allocation under Plan RE 2018-19.

Awards and Recognition

Our scientists were conferred with NRDC Societal Innovation Award, Eminent Scientist Award, Fellow of National Academy of Dairy Sciences (India), Jawaharlal Nehru Award for PG Outstanding Doctoral Thesis Research, All India Best Publication Award etc. in recognition of their contributions in research and development in post-harvest sector. One of our scientist got Best Ph.D Student Award by Faculty of Agriculture, University Putra Malaysia. We have also won six best research presentation awards at International research conferences.

Technology Licensing and Patents

Three patents were granted during the reported period and two more were filed. A technology namely 'mechanized system for popping and decortications of makhana seeds' was also transferred. Besides, AICRP on PHET transferred 50 technologies to farmers and entrepreneurs and 3 successful technologies were transferred by AICRP on PET to farmers' field. AICRP on PET also licensed the technology for 'roof top nutritional garden model for urban agriculture' to two private firms during 2018-19.

Memorandum of Understanding

A Memorandum of Understanding (MoU) with Department of Consumer Affairs, Ministry of Consumer Affairs, Food and Public Distribution, Government of India, New Delhi was signed. The MoU is related to development of protocols for enhancing shelf-life, safe storage, milling outrun and indicative norms for procurement of major pulses. A total amount of about Rs. 2.40 crores is approved under this project and ten major partner institute are involved with ICAR-CIPHET as lead institute.

PHMETC

Post-Harvest Machinery and Equipment testing Centre (PHMETC) has tested 25 machines during 2018-19. We received a total of Rs. Twenty Nine Lakh Seventy Six (Rs. 29.76 Lakh) towards testing fee.

Training, Capacity Building and Extension

During the reported period, total of 648 participants were trained for post-harvest management of agricultural and livestock produce through three ICAR sponsored summer/winter schools, one model training course, seventeen EDP, eleven farmers' training, and two workshops. A total of 182 students were also trained during this period. We participated in several exhibitions across the country such as *Krishi Kumbh*, 106th Session of the Indian Science Congress 2019, 14th Science Congress, National Eat Right Mela along with the National Street Food Festival, 13th edition of Agro Tech India 2018, Coastal Agricultural Expo 2019, Kisan Mela etc.

Publications and Citations

More than 40 research papers were published in high quality national and international peer reviewed journals. The other major publications of the institute include Compendiums (6), Book Chapters (11), Popular/Technical Articles (212), Technical Bulletins (2), Annual Reports (1), News Letters (4) and Leaflets (12). More than 22 peer reviewed papers published from ICAR-CIPHET during last years have received > 100 citations each.

Introduction

Indian agriculture is characterized by a large number of tiny, marginal, and small farm holders who are unable to derive adequate monetary benefits from production activities alone. Most of the farmers are employed only for 100-150 days in a year in farm activities. Therefore, while their incomes are not only abysmally low but they remain inadequately employed also. Supply chain from farm gate to markets is highly fragmented. There is inadequate infrastructure for storage, packaging, handling and transport from the place of production to markets and processors. As a result, huge post-harvest losses take place, which reduce the farmers' income and processors get poor quality of the raw materials. The accounted post-harvest losses in the country are still in the range of 3-16% for all food commodities and the level of value addition and processing is still below 10% in fruits and vegetables. Because of the higher post-harvest losses, monetary loss is nearly Rs. 1 Lakh crores. Thus, there is an essential requirement of post-harvest management and appropriate value addition in production catchments to minimize the quantitative and qualitative losses. Agricultural produce management and appropriate level of value addition in production catchments could meet these twin objectives of providing additional off-farm employment and income.

ICAR-Central Institute of Post-Harvest Engineering and Technology (ICAR-CIPHET) was established on 29 December 1989 at PAU Campus, Ludhiana, Punjab, India. It is a nodal institute that undertakes lead researches in the area of the postharvest engineering and value addition technologies appropriate to agricultural production catchments and agro-processing industries. Another campus of the Institute was established on 19 March 1993 at Abohar, Punjab, India that is primarily responsible to undertake research and development activities for processing and value addition of fruits, vegetables and commercial crops. ICAR-CIPHET is also headquarters of two All India Coordinated

Research Projects (AICRPs) viz. AICRP on Post-Harvest Engineering and Technology (PHET) with 31 Centres and AICRP on Plasticulture Engineering and Technology (PET) with 14 Centres across the country.

ICAR-CIPHET is the only institute in India which works entirely on applied post-harvest technology and value addition of all commodities for farmers, orchardists, rural youth and entrepreneurs directly as well as generates basic knowledge by taking various basic and strategic research projects in the mandated areas. At present the institute has four divisions: 1. Food Grains and Oilseeds Processing, 2. Agricultural Structures and Environmental Control, 3. Transfer of Technology, and 4. Horticultural Crop Processing (Abohar).

The Institute has developed nearly 120 technologies containing several equipment for food processing, structures for safe handling and shelf-life enhancement of farm produce, process protocols for value added products, novel products and technologies for farmers and processors. Out of theses developed technologies, 45 technologies have been licensed/ commercialized to about 126 entrepreneurs/end users. The technologies developed by ICAR-CIPHET helped the farming community in reduction in post-harvest losses, value addition to the farm produce, development of functional foods and food safety through interventions in the arena of protected cultivation, threshing, milling, processing, improved storage, preservation, non-destructive quality evaluation, enhancement of shelf life for crops and livestock produce and by-product utilization. These technologies have helped the relevant stakeholders in augmenting the income and employment generation. ICAR-CIPHET has filed 58 patents out of which 9 have been granted to its credit. ICAR-CIPHET has established Food Testing Laboratory, Agri-Business Incubation Centre, and Post-Harvest Machinery and Equipment Testing Centre.

OUR VISION

Higher profitability of agricultural production systems ensuring better income to farmers and increased employment opportunities in rural sector through efficient post-harvest engineering and technological interventions for loss reduction and value addition to agricultural produce and by-products resulting in high quality and safe food and feed at competitive prices for domestic and export markets.

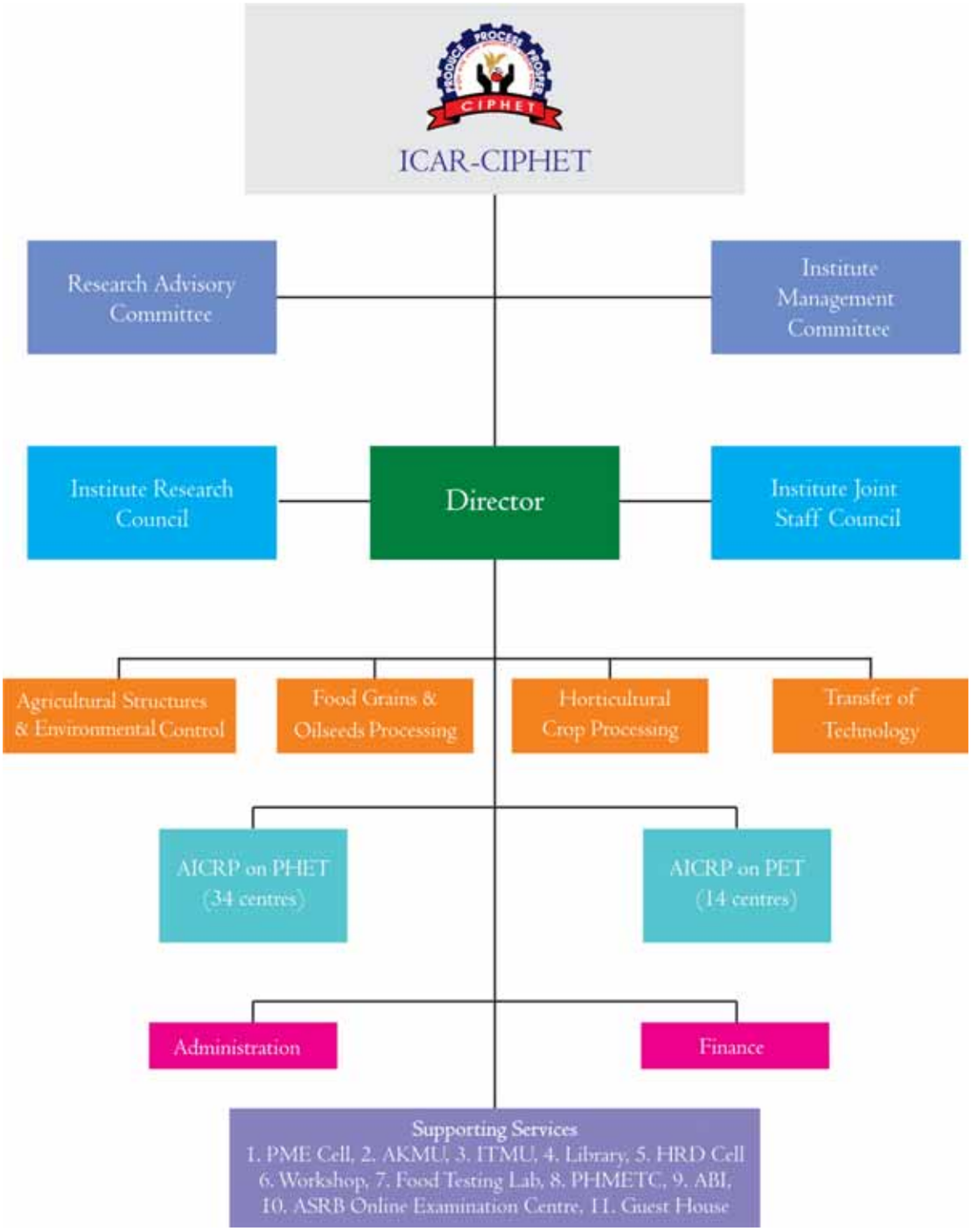
OUR MISSION

Creating prosperity through minimization of post-harvest losses from 15% to 5% and increase in value addition from present level of 10% to 30% to produce and by-products from crops, horticulture, livestock and fisheries sectors.

Mandates

- Research for solving problems and identifying technologies related to post-harvest loss assessment and prevention, processing, value addition and storage of agricultural, horticultural, livestock, and aquaculture produce targeted to achieve food safety and quality assurance
- Human resource and entrepreneurship development in post-harvest engineering and technology

Organizational Structure



Aerial view of Workshop Building at ICAR-CIPHET, Ludhiana

Infrastructure

Workshop

The workshops at ICAR-CIPHET, Ludhiana and Abhor manage fabrication and modification of post-harvest machineries, designed and developed under different research projects. Workshops also extend service support to repair and maintenance of institute facilities/ work etc. from time to time. Workshops have machines/ equipment such as lathe machines, drilling machine, gas welding set, arc welding set, sheet bending machine etc. to deliver its services. Besides, various measuring instruments are also available in the workshops, which are useful in day to day research work.

Agro Processing Centre (APC)

Agro-processing centre is designed to process the agricultural produce in production catchment with a view to enhance employment and income opportunities in rural areas. At ICAR-CIPHET, modest agro-processing centre has been established for processing of Bengal gram, green gram, pigeon pea, maize, black pepper, turmeric, coriander etc. The processed products are being regularly sold to customers in and around ICAR-CIPHET. The net profit amount was Rs 24383/ - against the sale of processed products like *dal*, *besan*, ground spices etc. Besides, the APC facilities are also used to impart training to potential small rural entrepreneurs.

Food Testing Laboratory

The well-equipped Food Testing Laboratory funded by Ministry of Food Processing Industries (MoFPI) has been established. The laboratory houses basic and some of the semi-advanced equipment for food analysis and evaluating the safety aspects of food products. This laboratory will cater to the food testing and quality analysis requirements of different stake holders, entrepreneurs in getting their samples tested. Testing protocols for certain parameters like water quality testing, fat, protein and fibre analysis, mineral contents etc. have been validated. This facility will enable the institute to answer the need based test requirement of processers, entrepreneurs, small and medium enterprises and industry at reasonable testing charges.

Library

ICAR- CIPHET library plays an important role and act as a centre for knowledge and information related to the Institute's mandate. It has a good collection of books and journals in the area of post-harvest engineering, food processing, engineering, microbiology, biochemistry, biotechnology etc. During the reported year, the total number of books and standards in the library were 4284. The library as a member of consortium for e-Resources in Agriculture (CeRA) is getting access to online full text journals and e-books. In addition of these, a number of national and international serial publications, annual reports, newsletters and research bulletins were received on gratis. Current content service of journals and list of new arrivals is also being circulated among the ICAR-CIPHET staff. Library received one Punjabi, two Hindi and three English Newspapers namely Ajit, Dainik Jagran, Amar Ujala, Hindustan Times, The Tribune and The Economic Times, respectively and also received Frontline and India Today magazine (both Hindi and English). Student Trainees coming from different Universities avail this facility.

Guest House

Both Ludhiana and Abohar campus has guesthouse facilities for providing accommodation to ICAR/SAUs/Government employees and farmers. One International Training Centre with 08 AC-rooms and dining hall with kitchen is also available at Ludhiana campus.

Units

Prioritization, Monitoring and Evaluation (PME) Cell

Prioritization, Monitoring and Evaluation concept is the key management tool in R&D system to enhance scientific productivity. It helps in setting a unified priority and monitoring of externally funded and in house projects. PME cell of the institute conducts Institute Research Council meeting and maintains the record of research projects. The monthly and quarterly reports of individual scientist are collected and compiled into progress reports, results framework document, quarterly and half yearly performance review reports. It also acts as link between various regional committee meetings, directors' conferences etc. and the institute scientists. The exchange of information takes place through PME cell. The database of parliament questions and their answers, action taken reports and issues related to scientific activities of the institute are dealt by PME cell. The research information related to ongoing and completed research projects is uploaded through Project Information and Management System (PIMS) software to avoid duplication in research.

International Trainee's Centre & Guest House

Agricultural Knowledge & Management Unit

Institute Technology Management Unit (ITMU)

The Institute Technology Management Unit is responsible for IP protection, Management and Transfer/Commercialization of technologies developed by the Institute. ITMU plays a crucial role in management of technologies. The role of ITMU is to encourage and accelerate the efforts towards development of technologies in the field of post-harvest management and to facilitate the transformation of ideas, inventions and technologies developed by the Institute into commercial ventures to serve the society. ITMU since its inception has been involved in protection, management and commercialization of Intellectual property generated by the Institute. A total of 48 patent applications have been filed through ITMU out of which nine patents have been granted. Vigorous efforts of ITMU lead to commercialization of 50 technologies developed by ICAR-CIPHET.

Agricultural Knowledge Management Unit (AKMU)

The Institute has an Agricultural Knowledge Management Unit (AKMU) for the scientists and staff for data analysis and electronic communication. The unit has latest eighteen desktop computers including three servers. More than 100 desktop computers of the institute are well connected through Local Area Network (LAN). Wi-Fi connectivity is available through 100 mbps line provided by National Knowledge Network (NKN). All the computers are protected by the server based Symantec Anti-virus. Internet is provided to different nodes through proxy server Nebero. The Nebero facility provides the information of internet bandwidth; user details, firewall security and stability on the network. Besides, AKMU houses a number of analysis and design software such as Front Page 2003, Corel draw graphics Suite, Adobe Professional, SAS, Design Expert Software, Leap Office 2000 (Hindi Software). The Institute's website *www.ciphet.in* is also being maintained by AKMU.

Services are provided by AKMU

- Electronic communication to all institute staff and trainees
- Data analysis facility

- Assistance in software application in different research works
- Internet browsing
- Software and computer hardware support
- Assistance in online patent search through various databases

Post-Harvest Machine and Equipment Testing Centre (PHMETC)

The Post-Harvest Machine and Equipment Testing Centre (PHTMETC), ICAR-CIPHET, Ludhiana is approved by Mechanization & Technology Division, Department of Agriculture & Cooperation, Ministry of Agriculture and Farmers' Welfare, Govt. of India. The institute is authorized for testing of all types of Post-Harvest Equipment and Machinery to ensure supply of quality post-harvest equipment & machinery by processing equipment & machinery manufactures to the end users. This is a unique facility in the country available at ICAR-CIPHET for testing of post-harvest technology equipment & machinery. Purpose of establishment of "PHMETC" at ICAR-CIPHET, Ludhiana (Punjab) is to provide platform and develop confidence in PHT machine and equipment manufacturers and also buyers / entrepreneurs who is going to start his business. PHMETC at ICAR-CIPHET will test all machines related to processing of agricultural and allied produces.

All India Co-ordinated Research Projects (AICRP)

AICRP on Post-harvest Engineering and Technology (PHET)

The All India Coordinated Research Project on Post-harvest Engineering and Technology was launched by the Indian Council of Agricultural Research in September 1972. The Project is currently operating at 31 centres covering almost all the states and agro-climatic zones of the country. The aim is to develop location and crop specific post-harvest technologies and equipment to minimize quantitative and qualitative post-harvest losses and to produce value added products from agricultural crops including livestock and their by-products. The major activities are: (i) Adoption/development of equipment/technologies for reduction in post-harvest losses during critical stages/operations, (ii) Development of need based agro-processing centres (APCs) in different production catchments for income augmentation and employment generation, (iii) Value added products from agricultural crops/commodities, (iv) Prototype development and process refinement with a view to develop complete packages for post-harvest utilization of crops/commodities and their by-products, (v) Multi-location trail and demonstration of the post-harvest technologies.

AICRP on Plasticulture Engineering and Technology

The AICRP on Plasticulture Engineering and Technology is operational since 1988 and has 14 centres in different agro-climatic zones. The project has contributed in the development and modification of Plasticulture technology in the area of water harvesting and management, surface cover cultivation, irrigation systems, plastic mulching, animal shelters, aquaculture technology and use of plastics in farm tools, machinery, post-harvest handling and packaging processes.

Staff Position

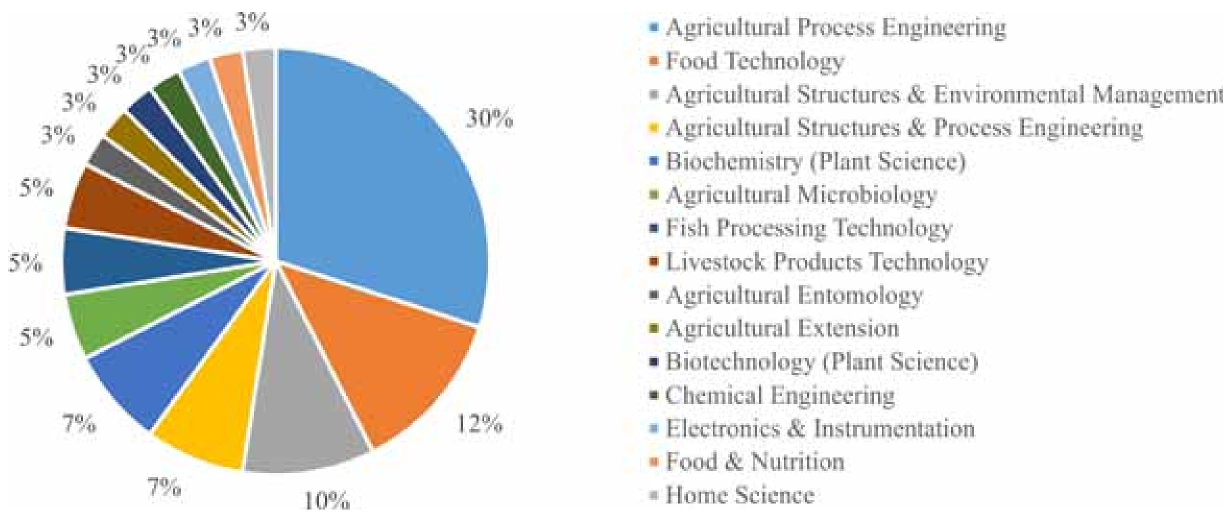
(31 March, 2019)

Category	Sanctioned	Filled		Total Filled	Vacant
		Ludhiana	Abohar		
Scientific	76*	37	08	45	31
Administrative	21#	16	03	19	03
Technical	29	18	07	25	04
Supporting	04	03	01	04	—
Total	130	74	19	93	38

*Excluding Director, #Including SAO

Discipline-wise distribution of scientific strength

Discipline	Principal Scientist	Senior Scientist	Scientist	Total
Agricultural Process Engineering	-	1	11	12
Food Technology	1	-	4	5
Agricultural Structures & Environmental Management	1	-	3	4
Agricultural Structures & Process Engineering	2	-	1	3
Biochemistry (Plant Science)	2	-	1	3
Agricultural Microbiology	-	-	2	2
Fish Processing Technology	1	-	1	2
Livestock Product Technology	-	-	2	2
Agricultural Entomology	-	-	1	1
Agricultural Extension	-	-	1	1
Biotechnology (Plant Science)	-	-	1	1
Chemical Engineering	1	-	-	1
Electronics & Instrumentation	-	-	1	1
Food & Nutrition	1	-	-	1
Home Science	-	-	1	1
Horticulture	1	-	-	1
Vegetable Science	-	-	1	1
Microbiology-Plant Science	-	-	-	-
			Total	42



Discipline-wise percent distribution of scientific strength

Budget and Expenditure
(2018-19)

ICAR-CIPHET (Amount in Lakh)

Approved allocation Plan RE (2018-19)	Total remittance Plan (2018-19)	Total Expenditure	% Utilization with respect to allocation under Plan RE 2018-19	% age utilization with respect of remittance
1671.79 (1714.97 - 19.03-24.15)	1671.79 (1714.97 - 19.03-24.15)	1665.90	99.65	99.65

AICRP-PHET (Amount in Lakh)

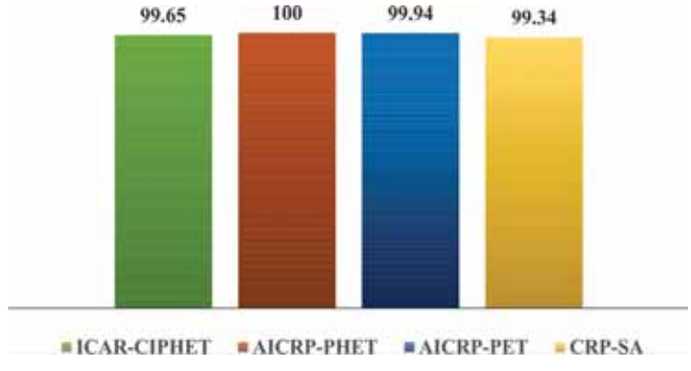
Approved allocation Plan RE (2018-19)	Total remittance Plan (2018-19)	Total Expenditure	% Utilization with respect to allocation under Plan RE 2018-19	% age utilization with respect of remittance
2290.43	2290.43	2290.37	100	100

AICRP-PET (Amount in Lakh)

Approved allocation Plan RE (2018-19)	Total remittance Plan (2018-19)	Total Expenditure	% Utilization with respect to allocation under Plan RE 2018-19	% age utilization with respect of remittance
677.57	677.57	677.18	99.94	99.94

CRP-SA (Amount in Lakh)

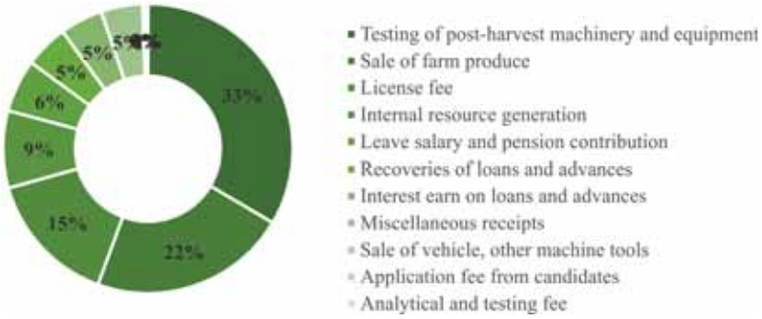
Approved allocation Plan RE (2018-19)	Total remittance Plan (2018-19)	Total Expenditure	% Utilization with respect to allocation under Plan RE 2018-19	% age utilization with respect of remittance
98.30	98.30	97.65	99.34	99.34



Percent Utilization with respect to allocation under Plan RE 2018-19

Revenue Generated
(2018-19)

Particulars	Amount (Rs.)
Testing of post-harvest machinery and equipment	2975990.00
Sale of farm produce	1963371.00
License fee	1334753.95
Internal resource generation	760195.73
Leave salary and pension contribution	523909.00
Recoveries of loans and advances	433530.00
Interest earn on loans and advances	424343.00
Miscellaneous receipts	409672.05
Sale of vehicle, other machine tools	34700.00
Application fee from candidates	12000.00
Analytical and testing fee	8623.00
Grand total	8881087.73



Percent contribution in Revenue Generation during 2018-19

Ongoing Research Projects

Institute Projects

Sr. No.	Project Name	Leader & Associates		Period
		(as on 31.03.2019)		
1.	Development of continuous primary processing and shrink packaging line for cauliflower and cabbage	PI Co-PI	Dr. R. K. Vishwakarma Dr. Manoj Kumar	10-2013 03-2019
2.	Design and development of Wonder Bag for wheat storage	PI Co-PI	Dr. Sandeep Mann Er. A. A. Bashir	07-2014 06-2019
3.	Design development and evaluation of equipment/machine and storage structures for primary processing and low temperature storage of onions in bulk.	PI Co-PI	Dr. B. M. Ghodki Dr. Dukare Ajinath Dr. P. K. Kannaujia	01-07-2015 31-03-2019
4.	Development and evaluation of active ethylene absorbing packaging film material for selected climacteric fruits.	PI Co-PI	Dr. R. K. Anurag Dr. Tanweer Alam, IIP New Delhi	01-07-2015 30-06-2019
5.	Development of quality sensing system for mushroom and minimally processed pomegranate arils	PI Co-PI	Dr. R. K. Anurag Dr. Th. Bidyalakshmi	01-07-2015 30-06-2019
6.	Development and mechanization of low fat high fibre functional meat products	PI Co-PI	Dr. Yogesh Kumar Dr Nitin Mehta, GADVASU Dr. Sandeep Mann Er. A. A. Bashir	01-07-2015 31-03-2019
7.	Development of improved Process and Machinery for enhanced Dhal Recovery from Pigeon Pea	PI Co-PI	Dr. R. K. Vishwakarma Dr. D. N. Yadav	01-07-2015 31-12-2018
8.	Newer methods for energy efficient oil extraction and novel product development from mustard seed	PI Co-PI	Dr. S. K. Tyagi Dr. Manju Bala Dr. A. U. Muzaddadi Dr. Yogesh Kumar	01-07-2015 30-06-2019
9.	Development of technology for destalking and packaging of dried chillies	PI Co-PI	Er. K. R. Jalgaonkar Dr. M. K. Mahawar Ms. Prerna Nath	01-07-2015 30-06-2018
10.	Process Protocol for production of quality Green Raisins	PI Co-PI	Ms. Prerna Nath Er. S. J. Kale	01-07-2015 30-06-2018
11.	Development of National Database on NARES Technologies in Post-Harvest Sector	PI Co-PI	Dr. Sandeep Mann Dr. Renu Balakrishnan Er. P. S. Dawange	01-07-2015 31-03-2019
12.	Development and Evaluation of Eco-Friendly mustard based antimicrobial formulation using other botanicals for eradication of bacterial blight in pomegranate	PI Co-PI	Dr. S. K. Tyagi Dr. J. Sharma Dr. Manju Bala Dr. K. Dhinesh Babu, Mr. Mallikarjun Harsur	01-04-2016 31-03-2019
13.	Development of spectroscopic techniques for instant detection of honey adulteration	PI Co-PI	Dr. R. K. Anurag Dr. Poonam Choudhary	01-04-2016 31-03-2019
14.	Development of rapid spectroscopic and molecular techniques for detection of animal species in meat products	PI Co-PI	Dr. Yogesh Kumar Mr. Vikas Kumar	01-04-2016 31-03-2019

Sr. No.	Project Name	Leader & Associates (as on 31.03.2019)		Period
15.	Development of real time monitoring system for transportation of perishables	PI Co-PI 	Dr. B. M. Ghodki Dr. Manoj Kumar Dr. P. K. Kannaujia	01-04-2016 29-09-2018
16.	Design and development of dehumidified hot air dryer for maize	PI Co-PI	Dr. Pankaj Kumar Er. Dhritiman Saha	01-04-2016 31-03-2019
17.	Design and development of microwave assisted continuous popping system for selected food grains	PI Co-PI	Er. Chandan Solanki Er. Navnath Indore	01-04-2016 31-12-2018
18.	Development of improved flaking system for small scale production of rice flakes	PI Co-PI	Er. Dhritiman Saha Dr. Swati Sethi	01-04-2016 31-03-2019
19.	Development of convenient breakfast products using sprouting and extrusion technology	PI Co-PI	Dr. Swati Sethi Dr. Mridula D.	01-04-2016 30.06.2019
20.	Utilization of fruit waste and plant extracts in developing antimicrobial coatings for extending shelf-life of fruits. Word vegetables should be omitted	PI Co-PI 	Dr. Sunil Kumar Er. Dukare Ajinath Dr. Ramesh Kumar Dr. B. B. Ratnakar	01-04-2016 31-03-2019
21.	Design and Development of Mechanized System for Fruit Bar Manufacturing	PI Co-PI 	Er. Kirti Jalgaonkar Mrs. Prerna Nath Dr. Manoj K. M.	01-04-2016 30-09-2019
22.	Development of technology for de-ponding of green pea & cowpea' Development of technology for de-poding and preservation of cowpea & green pea'	PI Co-PI	Dr. B. B. Ratnakar Dr. Kirti Jalgaonkar	01-04-2016 31-03-2019
23.	Development of user friendly android based mobile application (Mobile app) for technology dissemination and outreach program on postharvest processing and value addition	PI	Dr. Ranjeet Singh	01-04-2016 31-03-2019
24.	Development of smart device for automatic detection and identification of insects in stored grains using machine vision technology	PI Co-PI	Dr. Ranjeet Singh Er. B. B. Ratnakar	01-04-2016 31-03-2019
25.	Development of hermetically sealed storage structure of 1 Tonne capacity for pulses	PI Co-PI	Er. A. A. Bashir Dr. V. Chandrasekar	01-04-2017 31-03-2019
26.	Development of process for color extraction from black carrot and its by-products and its utilization in value added product	PI Co-PI 	Dr. Prerna Nath Dr. Sunil Kumar Mr. Ajinath Dukare	01-04-2017 31-03-2019
27.	Development of mechanized litchi de-stoner.	PI Co-PI	Dr. B. B. Ratnakar Dr. Kirti Jalgaonkar	01-04-2017 31-03-2020
28.	Designing Extension Strategies for Wider Adoption of Post-Harvest Technologies based on Adoption Behaviour of End Users	PI Co-PI 	Dr. Renu Balakrishnan Dr. Sandeep Mann Dr. Arvind Kumar, ICAR-ATARI, Ludhiana	01-04-2017 31-03-2020
29.	Development of pigmented cereals based expanded/ extruded products and their nutritional evaluation	PI Co-PI	Dr. K. Bembem, Dr. Pankaj Kumar	01-04-2017 31-03-2019

Sr. No.	Project Name	Leader & Associates		Period
		(as on 31.03.2019)		
30.	Development of automatic Sorter/ Grader for Pomegranate and Tomato	PI Co-PI	Er. Yogesh Kalnar Er. P. S. Dawange	01-04-2017 31-03-2020
31.	Design and analysis of greenhouse structures for selected Regions of India	PI Co-PI	Er. I. S. Navnath Dr. Sakharam Kale Er. A. A. Bashir	01-04-2017 31-03-2020
32.	Development of collagen hydrolysate from buffalo (*Bubalus bubalis*) skin and its effect on osteoarthritis.	PI Co-PI	Dr. Tanbir Ahmad Dr A. U. Muzzadadi Dr. Yogesh Kumar	01-10-2018 30-09-2020
33.	Development of process protocol for cryogenic grinding of selected medicinal plants/herbs (Curry leaf, Nutmeg and Safed Musli)	PI Co-PI	Dr. Pankaj Kumar Dr. Manju Bala	01-10-2018 30-09-2021
34.	Production of bio-active ingredients from mango seed kernels Mega-Project: Value chain improvement through post-harvest handling, storage and processing of mango.	PI Co-PI	Dr. Poonam Dr. Th. Bidyalakshmi Er. S. P. Dawange	01-10-2018 30-09-2021
35.	Development of ACE-Inhibitory Peptides from Fish and Livestock Processing Waste	PI Co-PI	Sh. Vikas Kumar Dr. Yogesh Kumar Dr. Tanbir Ahmad	01-10-2018 30-09-2020

Externally Funded Projects

Sr. No.	Project Name	Leader & Associates		Period
		(as on 31.03.2019)		
1.	Studies and refinement of live-fish carrier system for mass transportation of table fish, brooders, fingerlings and aquarium fishes.	PI	Dr. A. U. Muzaddadi	08-08-2014 30-06-2019
2.	Development of food bio-polymer based micro- & nano-scale delivery systems for bioactive ingredients in functional foods	PI	Dr. K. Narsaiah	02-01-2015 01-01-2020
3.	Establishment of modern fruits and vegetables Agro Processing Centre (APC)	PI Co-PI	Dr. R. K. Vishwakarma Er. A. A. Bashir Er. I. S. Navnath Dr. Deepika Goswami	01-04-2015 31-03-2020
4.	CIPHET-Post-Harvest Technology Machine and Equipment Testing Centre at ICAR-CIPHET, Ludhiana	Nodal Officer Officer In charge Testing Engineer Member	Dr. R. K. Singh, Director (Acting), ICAR-CIPHET Dr. Pankaj Kumar Er. S. P. Dawange Dr. Ranjeet Singh	01-08-2015 31-07-2018

Sr. No.	Project Name	Leader & Associates		Period
		(as on 31.03.2019)		
5.	Establishment of Agri-Business Incubation (ABI) Centre under XII Plan Scheme for National Agriculture Innovation Fund (NAIF) at ICAR-CIPHET, Ludhiana	PI Co-PI	Dr. Ranjeet Singh Mr. Vikas Kumar Dr. Renu Balakrishnan	01-01-2016 31-03-2020
6.	Value addition of Makhana and its by-products	PI Co-PI	Dr. R.K. Vishwakarma Dr. Ranjeet Singh Dr. Khwairakpam Bembem Dr. D. Mridula	01-04-2016 31-03-2020
7.	Processing and Value Addition of Agricultural Produce for Enhancing Farmers income and Employment in Production Catchment	PI Co-PI	Dr. Sandeep Mann Dr. R. K. Anurag Dr. Renu Balakrishnan Er. Yogesh Kalnar Dr. B. V. C. Mahajan	30-01-2017 31-03-2020
8.	Refinement of process protocol for preparation of traditional fermented fish products of Northeast India by using biotechnological tools and its process mechanization	PI Co-PI	Dr. A. U. Muzaddadi Er. Dhritiman Saha	23-03-2018 22-03-2020
9.	Valorization of industrially produced soybean and groundnut de-oiled meals/cakes by extraction, purification and production of protein isolates	PI Co-PI	Dr. D. N. Yadav Dr. R. K. Vishwakarma Dr. Swati Sethi	01-08-2018 31-07-2021
10.	Design and Development of protective structures for high valued crops to reduce damage from hail and frost	PI Co-PI	Er. I. S. Navnath Dr. R. K. Singh,	23-08-2018 31-03-2020
11.	Development of rapid quality monitoring system for wheat flour and its primary milled products	PI Co-PI	Dr. D. N. Yadav Dr. V. Chandrasekar	02-05-2018 01-05-2021
12.	Development of protocols for shelf life, safe storage and milling outturn and indicative norms for procurement of major pulses	PI Co-PI	Dr. R. K. Vishwakarma Dr. D. Mridula Dr. D. N. Yadav Dr. Deepika Goswami Er. I. S. Navnath	27-03-2019 26-03-2021
13.	Studies of mulching on growth, yield and quality of pulse (Cow pea) under drip irrigation system	PI Co-PI	Dr. P. K. Kannaujia Dr. Sakharam Kale Dr. Ajinath Dukare	01-04-2017 31-03-2019
14.	Development of phase change material based mobile cool chamber for transportation of fruits and vegetables	PI Co-PI	Dr. P. K. Kannaujia Dr. Sakharam Kale Er. I. S. Navnath	01-04-2017 31-03-2019
15.	Assessment of soil microbial activities and post-harvest quality of tomato cultivated under plastic and organic mulches in arid regions	PI Co-PI	Dr. Ajinath Dukare Dr. P. K. Kannaujia	01-04-2018 31-03-2020
16.	Strategies for maximum vertical space utilization in growing of selected vegetables inside polyhouse in hot and arid region	PI Co-PI	Dr. P. K. Kannaujia Dr. Sakharam Kale Er. I. S. Navnath	01-04-2018 31-03-2020

High-end research facilities at ICAR-CIPHET, Ludhiana

Research Highlights

Rice Flaking Machine for Small Scale Production

Rice flaking machine of capacity 80 kg/h is designed and developed for small scale production of rice flakes. The process of flaking involves soaking of paddy at 60 °C for 4 h to obtain desired moisture content 26.48% (wet basis) of paddy. Next, roasting is carried out at 250-260 °C for 120-150 s to obtain desired moisture content 17% (wet basis) of paddy. The hot roasted paddy is then fed to the roller flaking machine. The machine is designed to perform two operations: dehusking of paddy and flaking of brown rice. The overall dimension of the machine is 125×50×50 mm. The machine consists of three sets of rollers: Ist set of rubber rollers with diameter of 50.8 mm, 2nd set of stainless steel rollers with diameter of 50.8 mm and 3rd set of stainless steel rollers with diameter of 90 mm mounted on shaft of diameter 2.5 mm. Besides, stainless steel plates of diameter 152 mm have been fitted on the side of rollers to prevent the dropping of paddy during the operation. The recovery of brown rice flakes from MTU-1010 paddy variety was found to be 64.25% (considering 22% husk in MTU-1010 variety) after single pass which increased to 68.12% after 2nd pass. Besides, the percentage broken of rice flakes was found to be 8%.

Rice flaking machine

Dried-Chillies Destalking Prototype

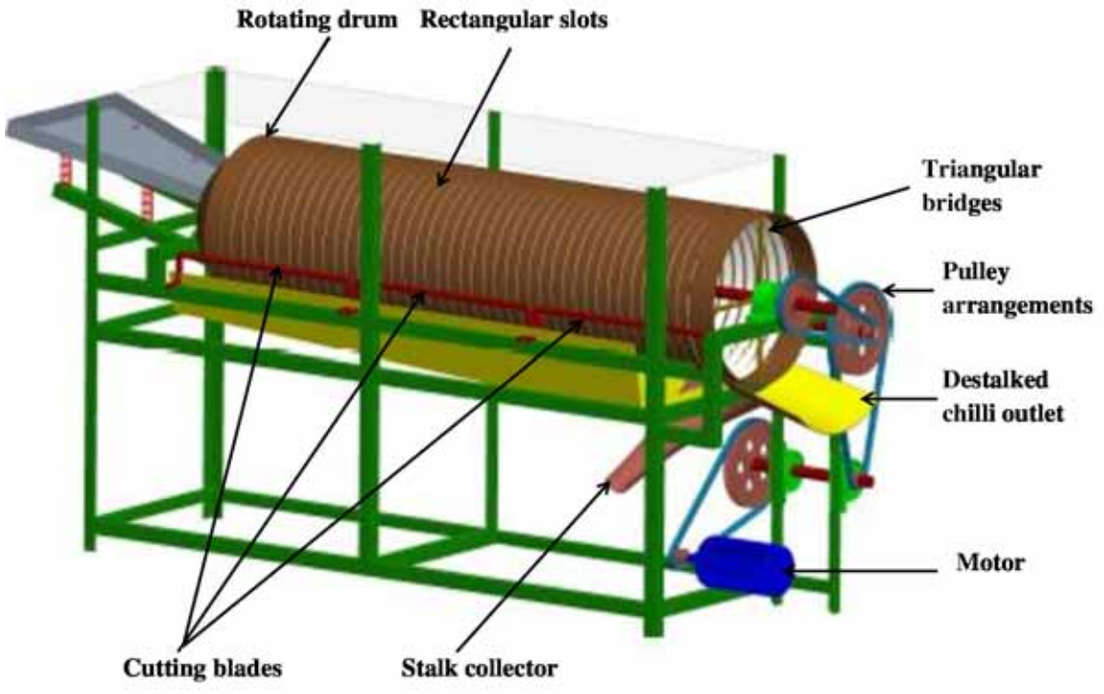
Chilli destalking prototype is designed and developed in order to mechanize destalking operation. The developed system consists of a feeding hopper, rotating drum, cutting blades, triangular bridges, rectangular slots, stalk collector, and destalked chilli outlet. The best performance of machine was achieved when the chillies with moisture content of 8-10% are destalked with feed rate of 6.5-7 kg/h, drum speed (20 rpm) and drum inclination (3°). Performance evaluation of the machine reported the destalking efficiency of 85-87% along with 5-10 % un-stalked chillies was observed while the machine was operated on the optimized parameters. The machine performance depends significantly on the moisture content of chilli, speed and inclination of the rotating drum, feed rate and variety of chilli, however the spatial dimensions of chillies didn't affect the efficiency of the machine.

Machine for De-podding of Green Peas

A green pea de-podder prototype is developed which consists of single set of roller type pea shelling mechanism. The developed prototype performed well with manual feeding of pea pods. The capacity of the prototype is around 20-25 kg/h and seed damage is 5-10%. Automatic feeding mechanism is fitted in order to increase its capacity. The performance evaluation of machine was carried out at different pre-treatment parameters (temperature and time) roller speed, feed rate and gap between the two rollers.

Indigenous Meat Ball Making Machine for Small-Medium Scale Entrepreneurs

Meat Ball Making Machine is developed for making of meat balls from raw meat formulation. The main working components are two horizontal rollers fixed on a frame powered by electric motor and rotated by 4 differential



Dried-Chillies Destalking Prototype

Indigenous Meat Ball Making Machine

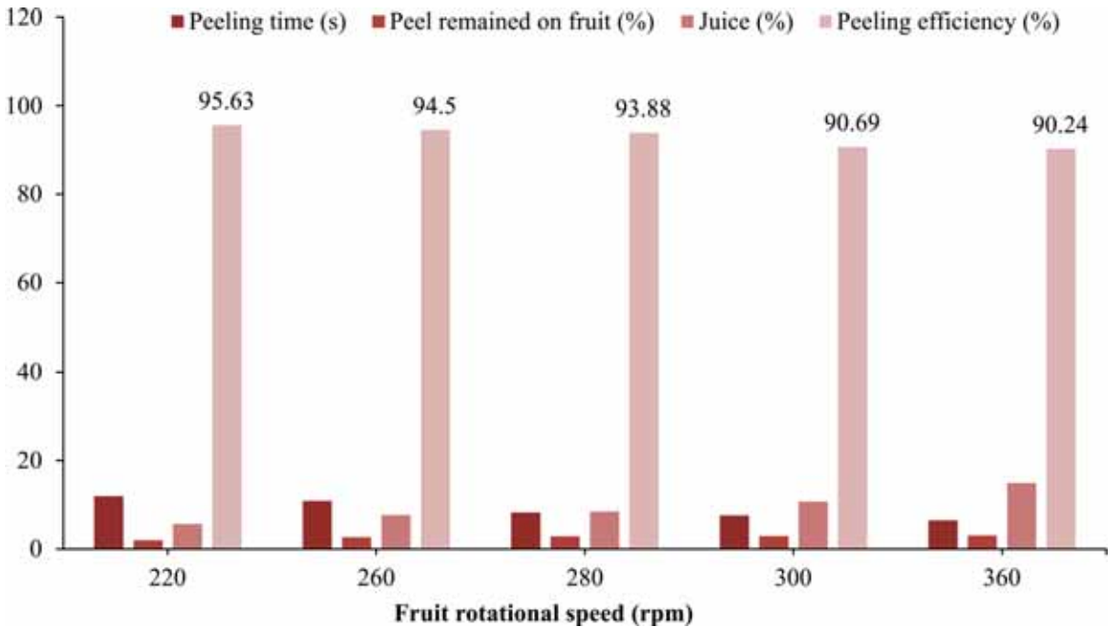
diameter pulleys. The frame is made of mild steel angle, the height of the main frame is 65 cm, and length is 50 cm with a width of 30 cm. The rollers are made of nylon material, one feet in length, with teeth to teeth spacing of 2.5 cm. The height of the teeth is 1.25 cm from the roller perimeter. The Teflon rollers are 1 feet long with 2.7 cm diameter in which the teeth are engraved. The rollers are fixed on a MS shaft supported on the frame by two housing bearings (UC 204) attached through long shaft with gear box operated by 0.5 HP motor. A screw was fabricated to press the raw meat in the shape of a pipe through a circular opening having dimension about one inch. The speed ratio of 1:2.6 was found suitable for making meat balls. It takes about half minute to make 10 balls each of 15-17 g. The capacity of the machine is worked out to be 10-12 kg per hour.

Composite Peeler cum Juice Extractor for Sweet Orange and Kinnow

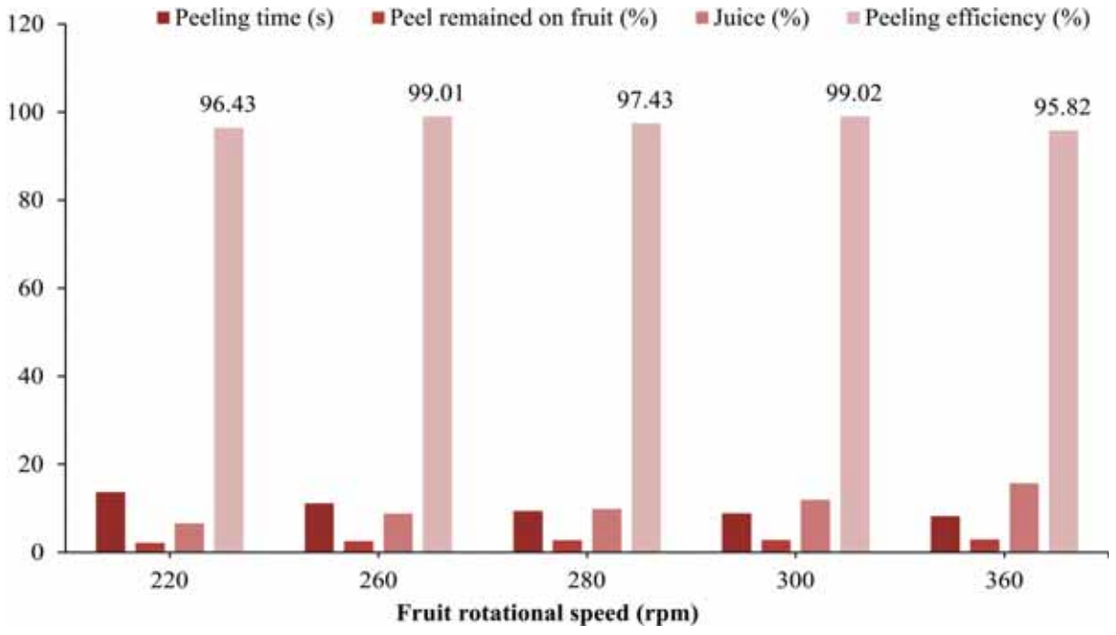
A composite peeler cum juice extractor for sweet orange and kinnow is developed with peeling and juicing capacity of kinnow and sweet orange as 60-90 kg/h (kinnow) and 50-60 kg/h (sweet orange), respectively. Considering all the parameters, the optimum fruit rotation speed for kinnow and sweet orange were 220 rpm and 260 rpm respectively. For both the fruits, the approximate weight proportion of peeled fruit (55-57 %), peel (35-37 %) and juice (6-10 %) was obtained. Considering the expenditure towards raw material and fabrication, the approximate cost of the machine is estimated to be Rs. 34000/-.

Mechanized System for Fruit Bar Manufacturing

Mechanized/continuous system for Refractive Window (RW) drying of fruit pulp includes, gear box, external frame, internal frame, pulp feeder, hot water circulation tank of 150 L capacity, hot water bath of 60 L capacity, Mylar film, nylon rollers for movement of Mylar film and self-rotating nylon bushes for keeping the Mylar film in contact with hot water. Two electric heaters were fitted for heating water in water bath. Also, the inlets for supply of hot and cold water were made with an opening of 150 mm for inspection and water filling.



Variation of peeling time, peel remained on fruit, juice percentage and peeling efficiency at different rotational speeds for kinnow

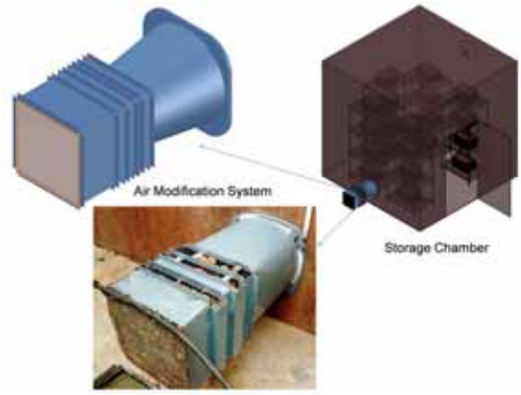


Variation of peeling time, peel remained on fruit, juice percentage and peeling efficiency at different rotational speeds for sweet orange

Mechanized System for Fruit Bar Manufacturing

Low-cost Air Modification System

A low-cost air modification system for storage of onions in the ply-board storage structure (3×3×3 m^3) was developed which can humidify and dehumidify the storage atmosphere as per the storage requirement. The unit has two functional parts: (a) evaporative cooling cum humidification; (b) dehumidification by gaur balls. The system was tested from June-November, 2018 at HCP Division, CIPHET, Abohar for maintaining the storage environment of onions. The system is capable of lowering the storage temperature by 7°C and raising the relative humidity (RH) of storage environment nearly by 5% using 0.01 m thick cooling pad of 0.32 m length and 0.32 m width. Further, guar balls of nearly 25 mm diameter with 5-6% moisture level (dry basis) were placed in three separate channels 0.32×0.32×0.05 m^3 (100 balls/channel) for reducing the RH. The maximum reduction (4.95%) in RH was observed after 40 h calculated from placement of guar balls in the channels. After that, the balls became saturated, *i.e.*, attained 18% moisture level; hence, the wet balls needed to be replaced by the dry balls for maintaining the recommended RH level of 60-70% for storage of onions. The storability of onions in the structure was close to five months compared to three and a half months in ambient condition.



Low cost air modification system for storage of onions in ply-board structure/chamber

Mechanized De-stoner for Peeled Litchi Fruit

Five different types of vibratory bowl channelized feeding mechanism were fabricated and evaluated for systematic orientation of peeled litchi for the purpose of de-stoning. The different feeding mechanisms were designed using plaster of paris, aluminium, stainless steel, mild steel. Based on the preliminary trials, U shaped channelized feeding mechanism was selected for further fabrication of the prototype. In this, the feed cups of fibre sheet (20×20 mm) with distance between two cups (20 mm) were fitted on the roller. Considering the physical properties of peeled litchi, the feed cups were fabricated using nylon material.

UV–VIS Spectroscopy and Chemometrics for Detection of Pork Meat in Minced Goat Meat

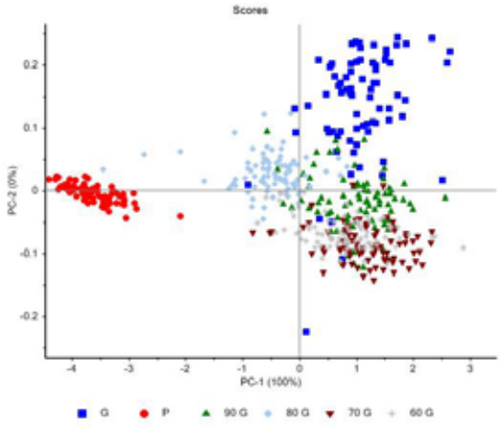
The aim of this work was to investigate the potential of UV–visible (UV–VIS) spectroscopy coupled with chemometrics techniques to detect minced goat meat adulteration with pork meat. Besides 48 minced meat samples of pure goat and 48 of pure pork, 240 binary mixtures of minced goat adulterated with pork meat in the range 10–40% (w/w) were prepared and analyzed. The spectral data, standardized by different pre-treatments, were processed, separately or fused, using Principal Component Analysis (PCA). UV-VIS spectroscopic technique was able to detect minimum 10% pork meat adulteration correctly.

Development of Micro-scale Delivery System for Curcumin

Corn cob is an agricultural waste and is very rich in cellulose, hemi cellulose, and lignin. This work exploits the adsorption ability of corn cob to adsorb a very useful dye curcumin which has immense medicinal value. Native corn cob and alkali treated corn cob have been used to adsorb curcumin and their adsorption abilities have been compared. The cellulose, hemicellulose and lignin content of native corn cob were 32%, 27%, and 12%, respectively whereas in alkali treated corn cob these contents were 50%, 35% and 8% respectively.

Effect of Initial Curcumin Concentration and Temperature on Adsorption and Sorption of Curcumin on Corn Cob

The effect of different initial concentration of curcumin (0.1478 µg/ml, 0.3164 µg/ml, 0.5332 µg/ml, 0.7812 µg/ml, 0.9327 µg/ml) on adsorption (%) and sorption capacity were studied at different temperatures (20°C, 25°C, 30°C, 35°C, 40°C, and 45°C) for both types of corn cob. Maximum percentage adsorption in case of native corn cob was 52.17% and was achieved at 0.5332 µg/ml and in case of alkali treated corn cob, it was 65.12 % and was achieved at 0.5332 µg/ml at 30 °C. Percentage

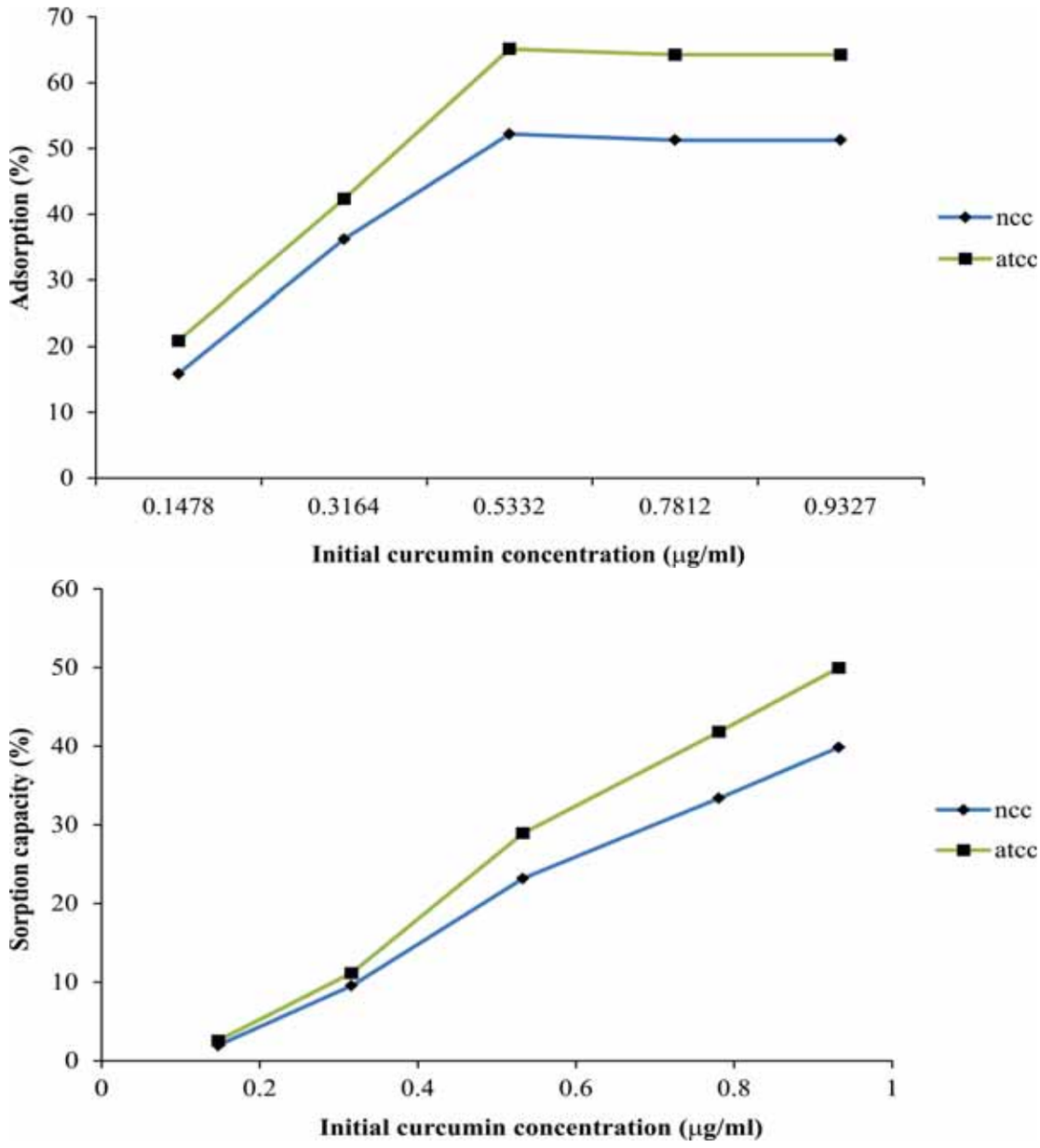


PCA analysis of UV-VIS data

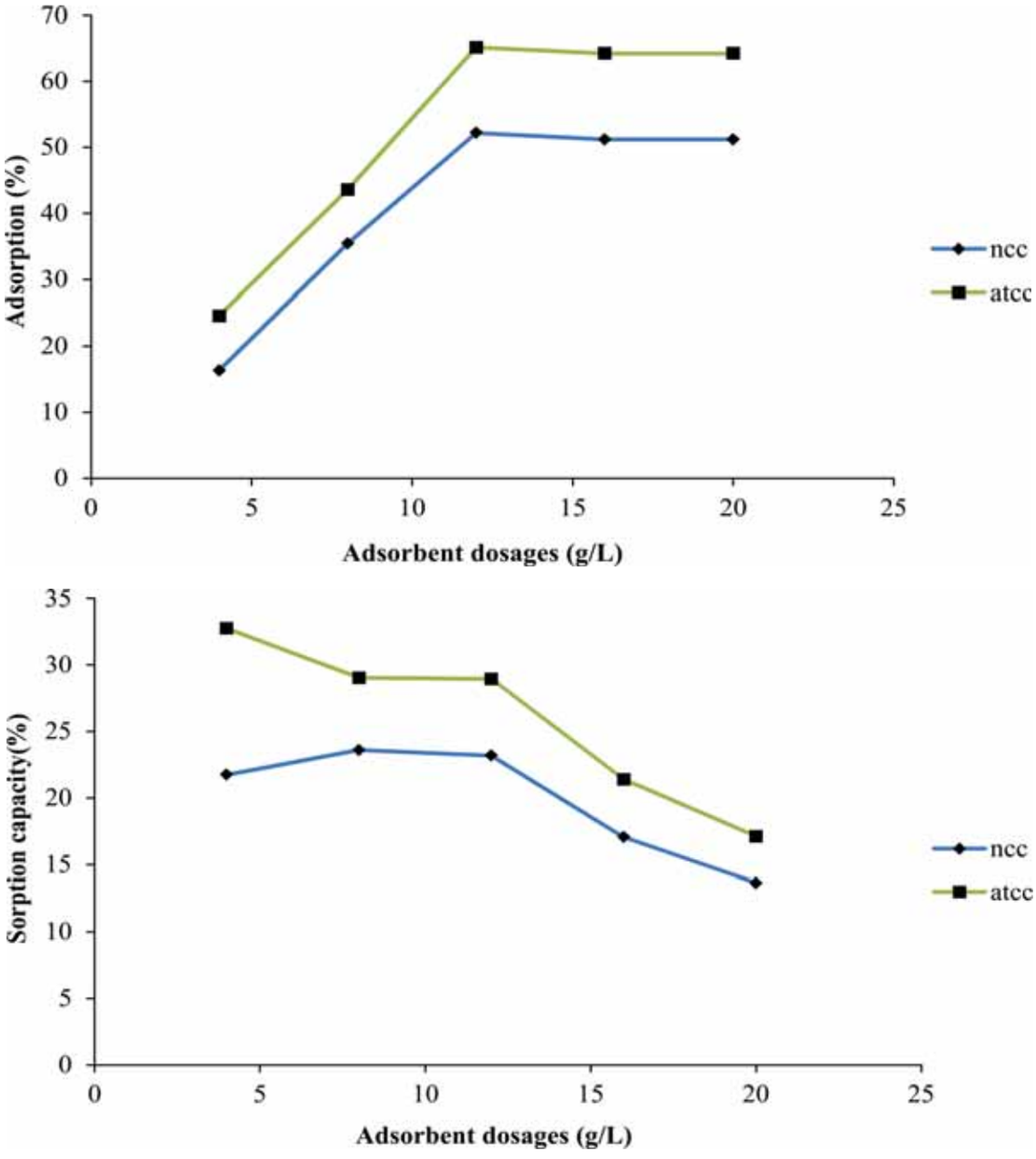
adsorption increases with increasing initial concentration and after initial concentration of 0.5332 µg/ml is reached, it slightly decreases and then becomes constant.

Effect of Adsorbent Dosages on Adsorption and Sorption of Curcumin on Corn Cob

Adsorbent dosages of 4 -20 g/L were taken. Maximum percentage adsorption value was achieved at 12 g/L of adsorbent dosage for both types of corn cob. With increasing corn cob dosage, percentage adsorption of curcumin increased till adsorbent dosage of 12 g/L and then becomes constant. The same trend was observed in both types of corn cob. Sorption capacity (%) is inversely proportional to adsorbent dosage.



Effect of initial curcumin concentration and temperature on adsorption and sorption of curcumin on native and alkali treated corn cob



Effect of adsorbent dosages on adsorption and sorption of curcumin on native corn cob and alkali treated corn cob

An Efficient Forced Ventilated Shade Drying System for Production of Green Raisins in Dark

Force ventilated shade drying system is developed for production of green raisins. This dryer comprised of forced ventilation system and shade dryer having dark chamber. It was hypothesized that shade dryer would not allow the air temperature to rise above 35 °C (temperature > 35°C causes browning) and forced ventilation would increase the drying rate at higher humidity also. Further, berries dried in the dark remained more green and lighter in color than shade-dried fruits. Results indicated that dry bulb temperature inside force ventilated shade drying system varied from 25-27 °C. The relative humidity inside this system varied from 35.2 to 50.0%. Final moisture content of the raisins was

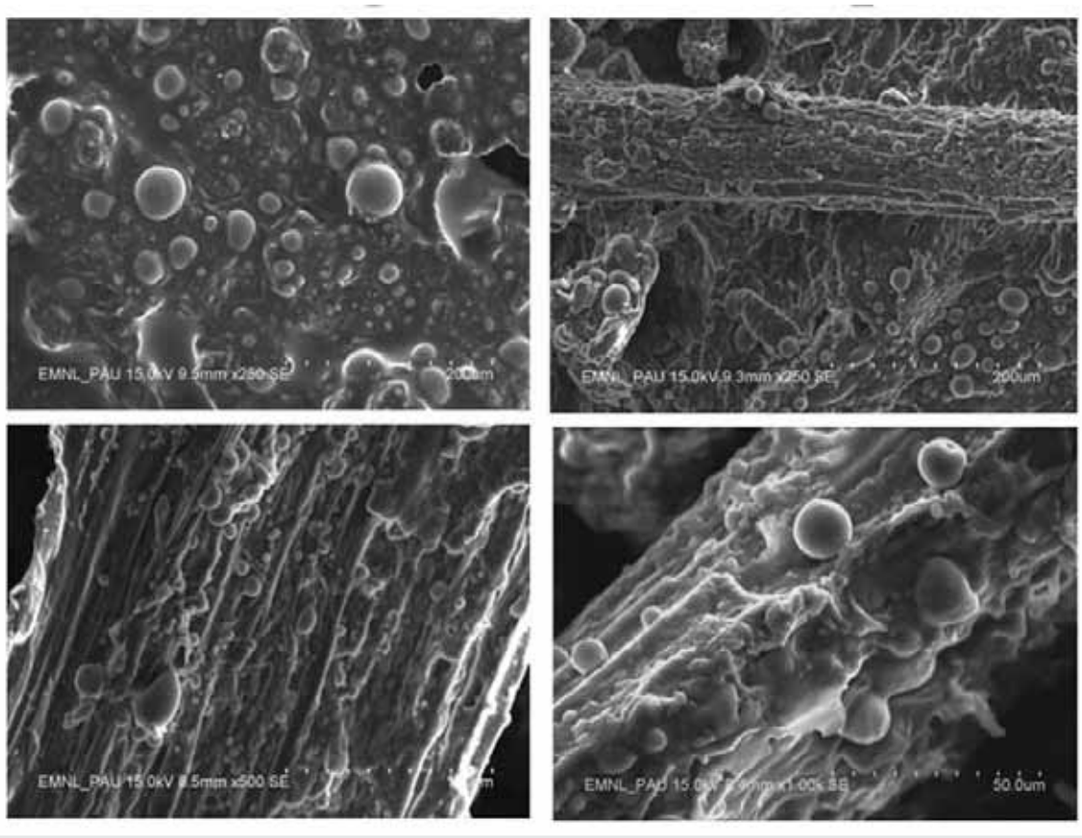
about 22% and the drying duration was 6 days. Force ventilated shade drying (in dark) system was found efficient in production of green raisins.

Development of Edible Fat Replacers for Development of Low-fat, High-fibre Meat Products

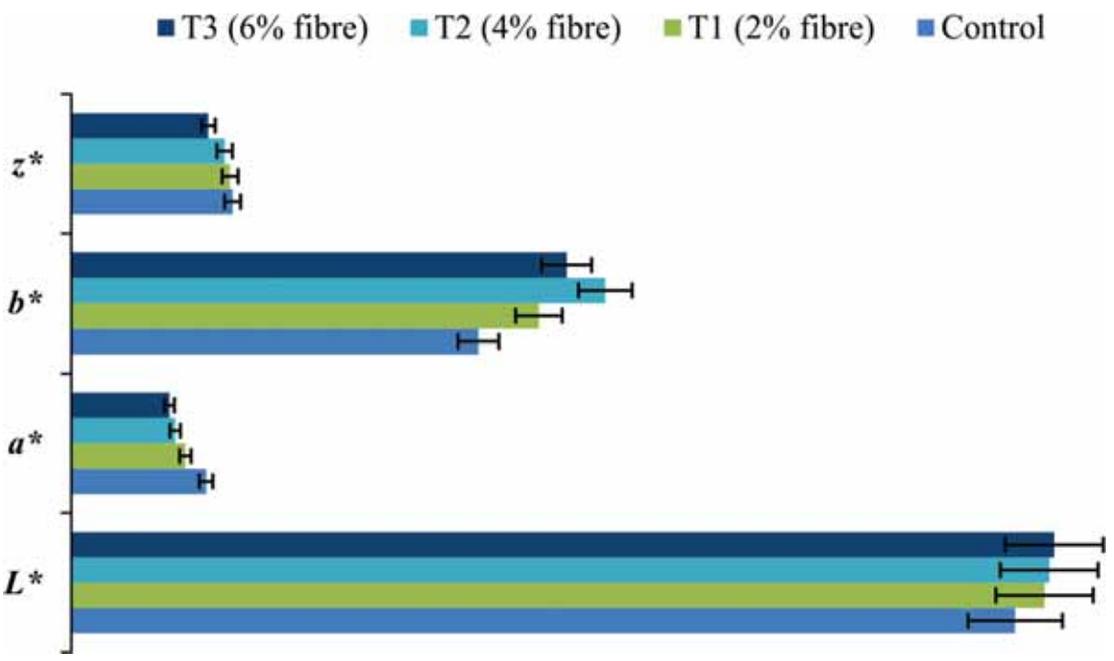
Edible fat replacers from natural ingredients were developed for manufacturing of low-fat meat products. The effect of edible double emulsion as an edible fat replacer on technological properties of low-fat goat meat batter was also evaluated. A substantial fat reduction ($p < 0.05$) up to 38% and increase in the fibre content up to 4% level as compared to full fat control meat samples was recorded. In rheological properties, the G2 values were much higher than G3 values with a small frequency dependency in all the studied raw batter samples. The scanning electron microscopic images of low-fat meat product showed more compact and dense continuous phase. Cooking yield was significantly higher ($p < 0.05$) in treated meat batter samples in comparison to the control. The emulsion stability attributed (TEF% and EFAT%) were also significantly higher ($p < 0.05$) in the treated samples which suggested that fat replacers stabilized the meat matrix. Color attributes (L^*, a^*, b^*, z^*, h_{ab}, ΔE, C^* and browning index) were non-significant among cooked meat batter samples. The TBARs values were significantly lower in the treated samples containing edible double emulsion and fat replacers.

Process for Preparation of Onion Powder

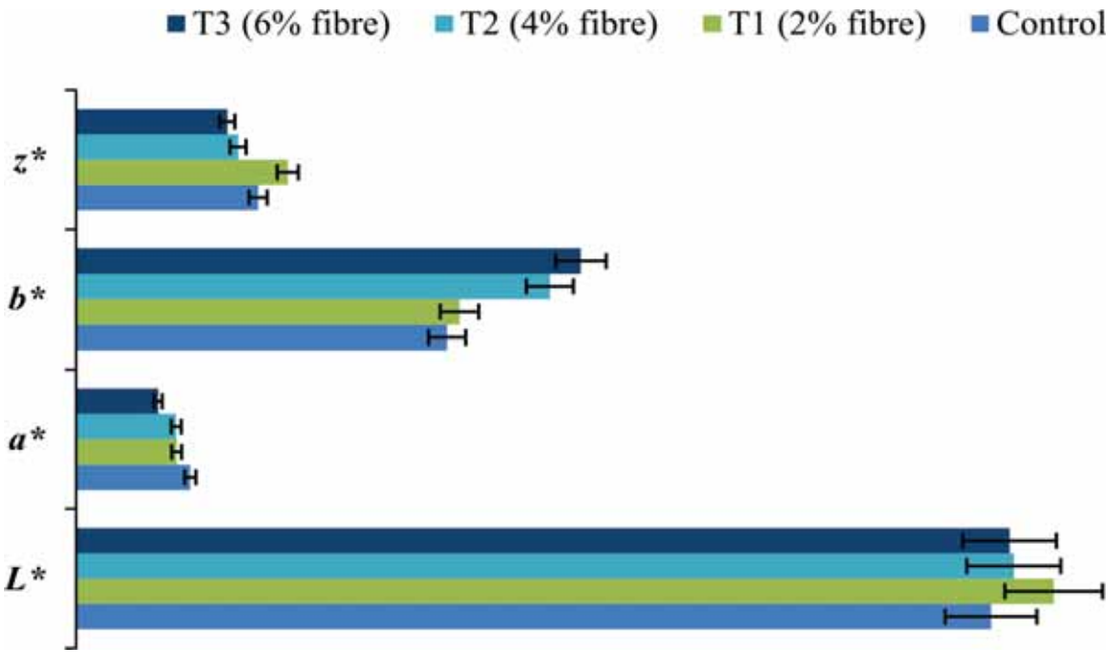
Onion powder has immense potential in overcoming the wastage and losses during glut onion production, storage, packaging, and transportation. In this work the influence of dehydration and grinding temperatures on particle and physico-chemical characteristics of onion powder prepared by 2 mm thick dehydrated onion slices were studied. The dehydration was performed using (a) hot air dryer



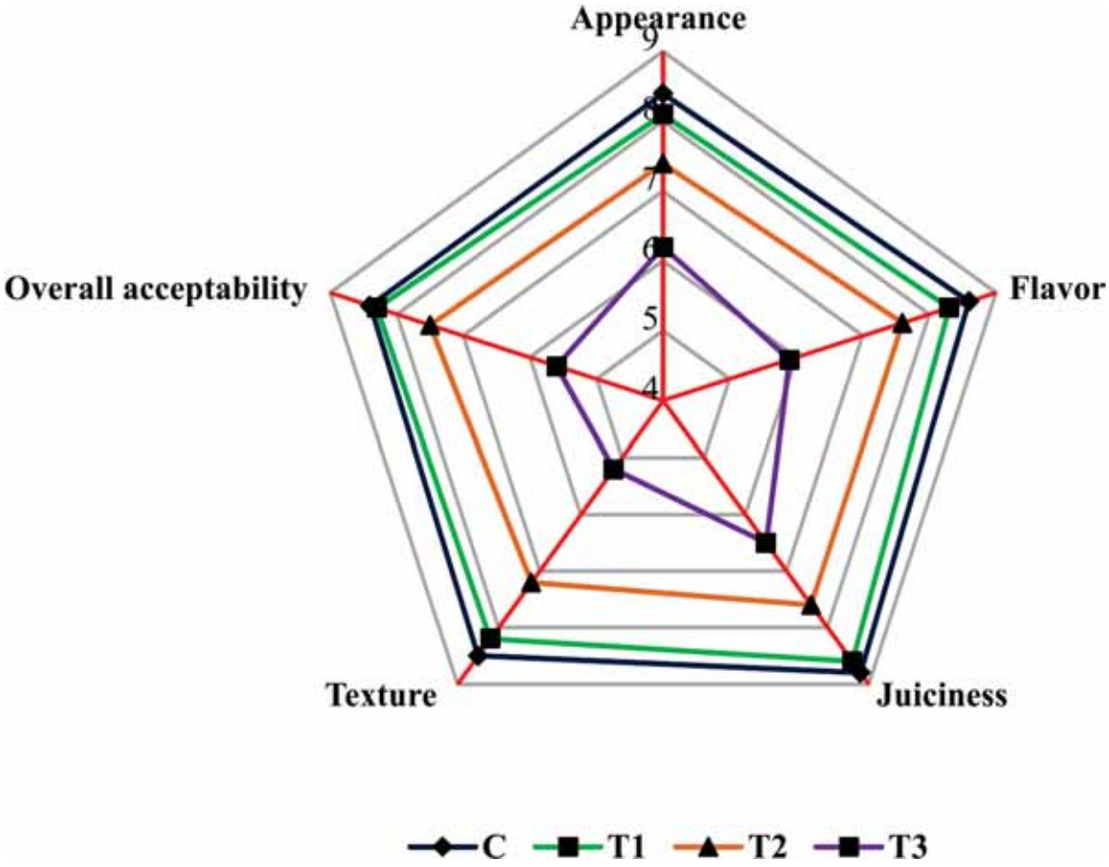
Microstructural images of low-fat, high-fibre meat products



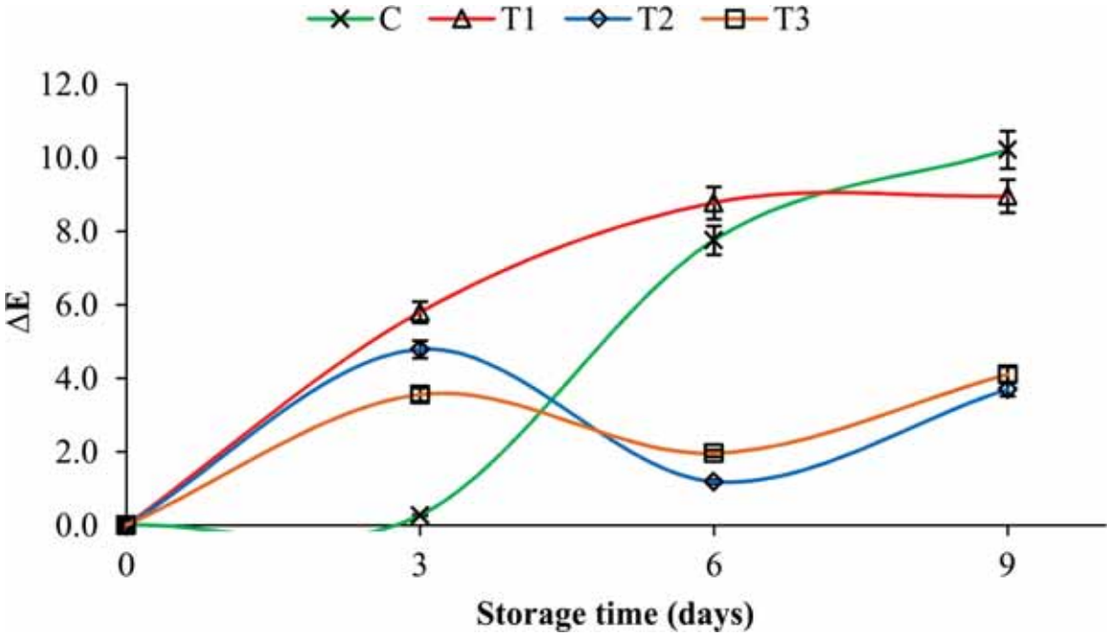
Surface color attributes of low-fat, high-fibre meat product



Internal color attributes of low-fat, high-fibre meat product

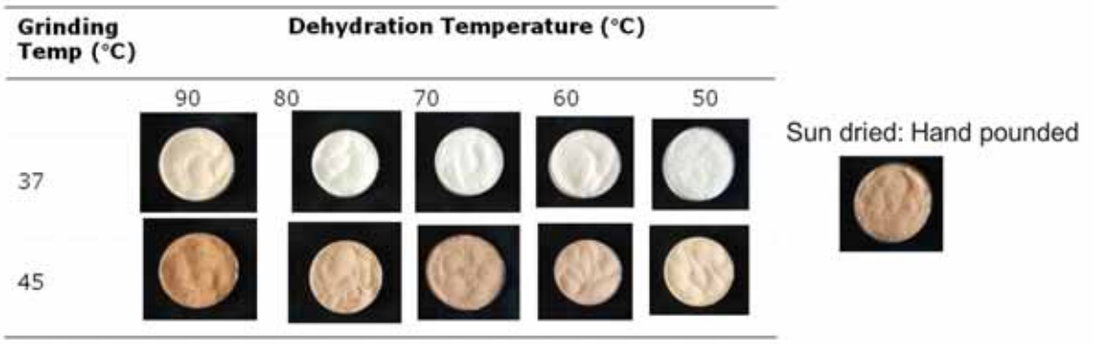


Sensory attributes of low-fat, high-fibre meat product



Change in color during refrigerated storage of low-fat, high-fibre meat product

method at five different temperatures (50 °C, 60 °C, 70 °C, 80 °C, and 90°C) and (b) sun drying method. The dehydrated onion slices were ground at two different conditions: (a) ambient grinding at 45 °C and (b) low-temperature/ice jacketed grinding at 37 °C to obtain the powders. After grinding, different particle and physico-chemical parameters of samples were determined using standard methods. The dehydration and grinding temperatures had significantly affected the powder properties such as ascorbic acid content, thio-sulphate content, non-enzymatic browning, product yield, turbidity, solubility, wettability, dispersibility, moisture content, tapped density, bulk density, particle density, and angle of repose of the samples. Overall, in all the cases, the low-temperature ground powders were found to be of better quality compared to powders ground at ambient temperature.



Onion powder obtained under different sets of grinding and dehydration temperatures

Process Optimization for Drying of Loose Rose Petals

Rose (*Rosa indica* L.) belongs to the family of Rosaceae and is well known for its beauty, color, fragrance and various phyto-chemical constituents like phenylethanol, citronellol and flavonoids. The dry rose petals fetches good market value as it is used in confectioneries, medicine *etc*. The quality of rose petals is highly affected by air temperature and holding time during drying, hence, the drying process must be conducted adequately in a short period. This study was aimed to optimize drying conditions for rose petals as a function of drying temperature (70-100 °C) and holding time in continuous tunnel dryer. The rose petal bed was kept constant at 2-3 cm during all drying experiments. The initial moisture content of fresh rose petals was 82.31 ± 2% (w.b) and the moisture content subsequent to drying was 10.02 ± 2% (w.b). With the increase in drying temperature, the degradation in L^* and b^* values was observed. The optimized drying conditions with respect to final product quality were 80 °C drying temperature and 9-10 min of holding time in drying tunnel.

Improved Method for Detection of Rhodamine and Sudan Dye in Red Chilli Powder

A simple method was developed for the detection of rhodamine dye from red chilli powder. The method has a single step rather than multiple steps as followed by FSSAI for detection of rhodamine. The appearance of red color in the samples indicates the test to be positive for rhodamine. Among the spiked chilli samples, detection limit for rhodamine dye was observed to be 20-25 ppm with pink color and 50 ppm with red color. Besides, visible spectroscopy-based method for quantification of rhodamine dye from chilli sample was also developed. Similarly an improved method was developed for detection of Sudan dye in chilli powder. The appearance of red color in the samples indicates the test to be positive for Sudan dye. Among the spiked chilli samples, detection limit for

Sudan dye was observed to be 200 ppm with red color.

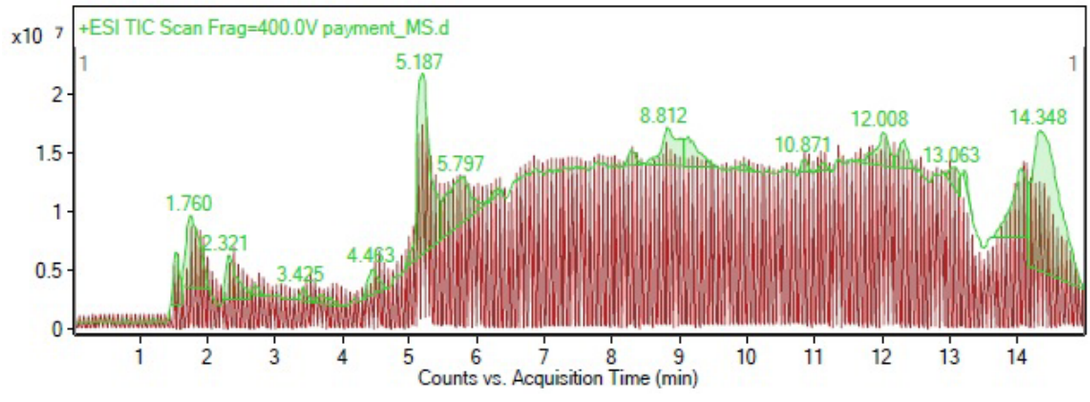
Extraction, Purification, Stabilization and Utilization of Anthocyanins from Black Carrots

An enzyme-assisted process for extraction of juice from black carrots was optimized using different levels of pectinase enzyme. The anthocyanins were extracted from the black carrot pomace after juice extraction. The extracted color filtrate was adsorbed on XAD-7 adsorbent via column chromatography. The yield of color ranged between 1.0-1.5% of black carrot pomace. Total five anthocyanins, cyanidin derivatives have been identified from the extracted color from black carrot using LC-DAD-ESI-MS analysis. The most prominent cyaniding derivative exhibited a molecular ion peak [M^+] at *m/z* 581. A product ion peak at *m/z* 287 was identified as cyaniding-3-xylogalactoside. The effect of light and gallic acid on storage stability of color from black carrot pomace was studied and it was found that there was less degradation of color intensity at 350 mg gallic acid compared to 175 mg gallic acid. Also, the color was more stable at pH 1 during storage compared to pH 2 and 3. A lesser degradation was observed at less pH at both gallic acid concentrations.

Antimicrobial Effects of Natural Extracts Against Microbes (Anthracnose and Stem End Rot Diseases) of Mango

In this study, the maximum growth inhibition of *Colletotrichum gloeosporioides* was recorded in the presence of 2000 ppm clove oil (86.3%) followed by grapefruit oil (68.1%). Arjun bark alcoholic extract showed 47.6% while Cassia bark alcoholic extract showed 32% inhibition with same dose. A significant inhibition of *C. gloeosporioides* was observed at various concentrations after 3 days of incubation at 27 ± 1°C. Similarly, the maximum growth inhibition of *Botryodiplodia theobromae* was observed with clove oil (94.2%), followed by grapefruit essential oil (92.3%). However, Arjun bark extract had very low (2.7%) rate of inhibition while *Cassia* bark and ethanol failed completely to inhibit *B. theobromae*.

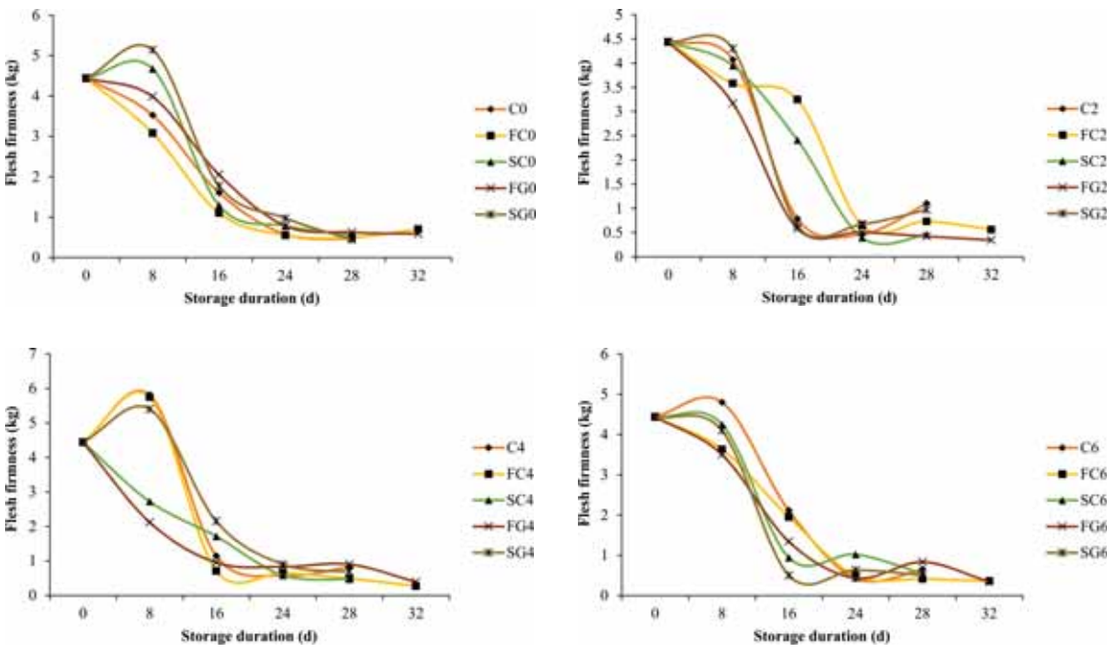
Further, edible coatings for mango were formulated using clove and grapefruit essential oils (0.2%/2000 ppm) and their performance was tested under ambient (30-36 °C) and low temperature storage (12±1 °C). The result showed that essential oil (0.2%) from clove and grapefruit significantly reduces the decay loss. Among essential oils, clove was more effective in



MSMS Spectra for extracted and purified color from black carrots

Growth inhibition of various extracts against *Colletotrichum gloeosporioides* ITCC 7753 (anthracnose) and *Botryodiplodia theobromae* ITCC 7740 (stem end rot-SER) by well diffusion assay

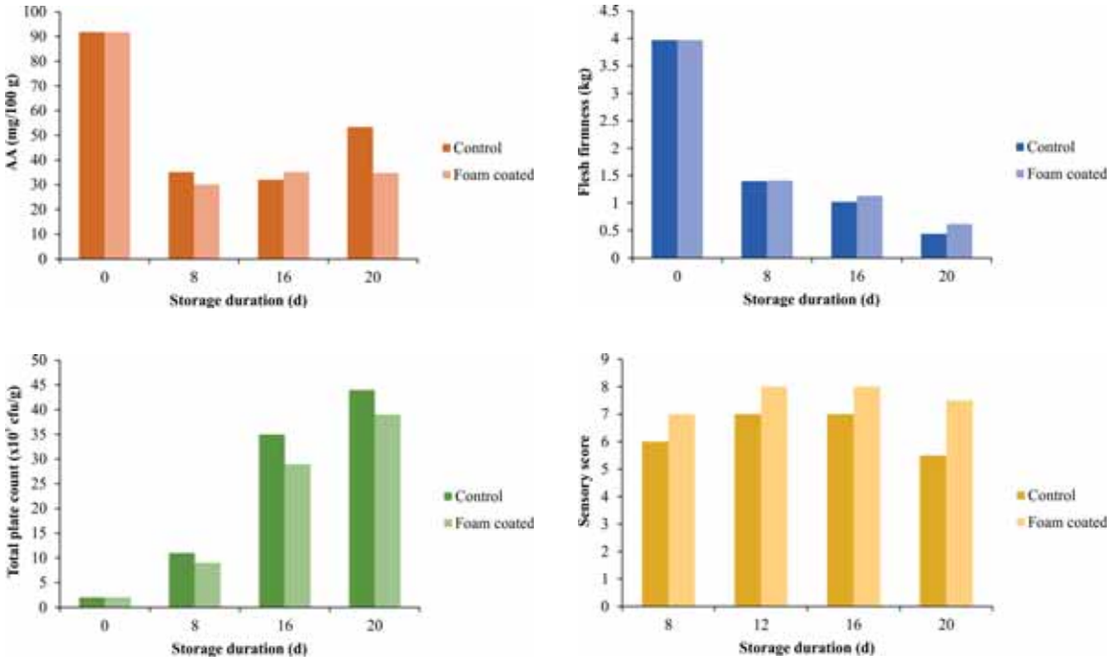
Concentration (ppm)	Percentage inhibition									
	Grape fruit extract		Clove oil extract		Arjun bark extract		Cassia bark extract		Ethanol	
	Anthracnose	SER	Anthracnose	SER	Anthracnose	SER	Anthracnose	SER	Anthracnose	SER
500	59.0	89.7	85.7	88.5	-	2.7	4.0	-	-	-
1000	59.0	89.7	85.7	88.5	-	2.7	4.0	-	-	-
1500	68.1	92.3	86.3	94.2	47.6	2.7	32.0	-	-	-
2000	68.1	92.3	86.3	94.2	47.6	2.7	32.0	-	-	-



Flesh firmness of cold stored mango with various coating combinations and perforation types (0, 2, 4 and 6 perforations)

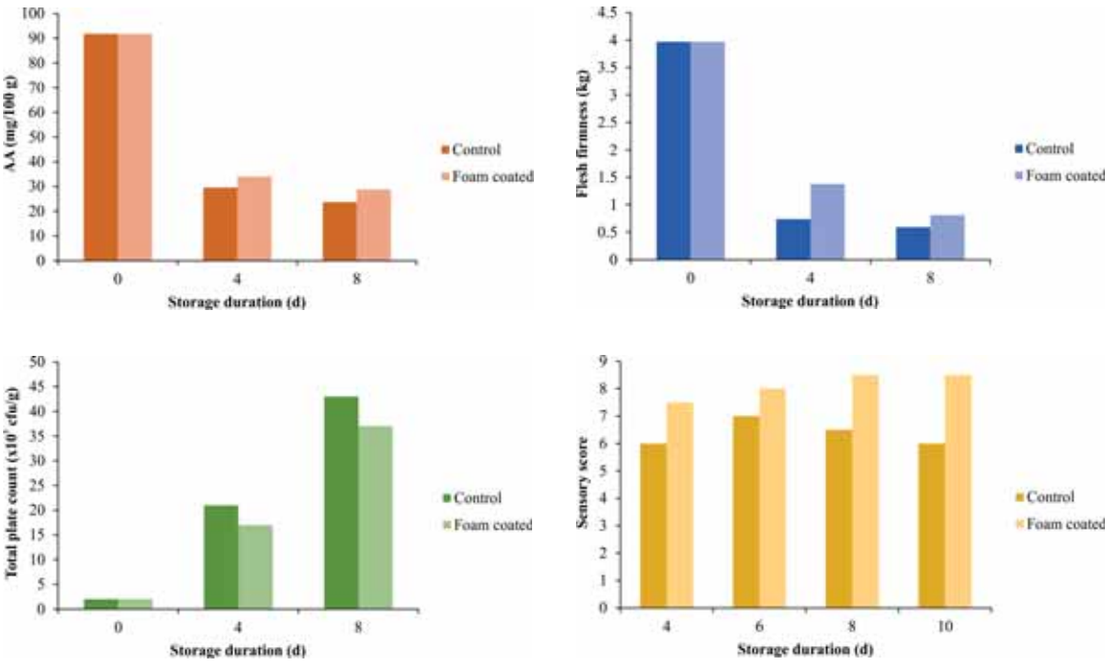
reducing the decay loss, but it also resulted in slightly low sensory quality.

Various coating formulations comprising of 20% shellac with clove and grapefruit essential oils as antimicrobial compounds were prepared and evaluated using two different coating methods (Foam and Spray) and four levels of package perforation (0, 2, 4 and 6 holes of 1 cm diameter) during low temperature (12±1 °C) storage of mango fruits in corrugated fiber boxes (CFB). Various physico-chemical parameters were recorded up to 32 days after storage and the results revealed that the physiological loss in weight (PLW) increased with increase in storage duration. These losses were much higher in control samples as compared to treated ones. However, PLW did not cross the threshold limit of 10% in all coated fruits after 24 days of storage irrespective of their method of application and perforation level. Shellac with foam coated mangoes crossed 10% decay loss at 28th day of cold storage while control and spray coated samples had 35-50% decay loss during the same period under different perforation levels. It was also notable that there was no decay loss



Ascorbic acid contents, flesh firmness, total plate count and sensory score of cold stored mango coated with 10% shellac

upto 24th day in foam coated samples. Although decay loss increased beyond 24 days of storage in all treated and untreated samples; but even then the decay loss was comparatively low as compared to control as well as spray coated samples.



Ascorbic acid contents, flesh firmness, total plate count and sensory score of ambient stored mango coated with 10% shellac

Mango coated with 10% shellac after 20 d of cold storage conditions (12 °C)

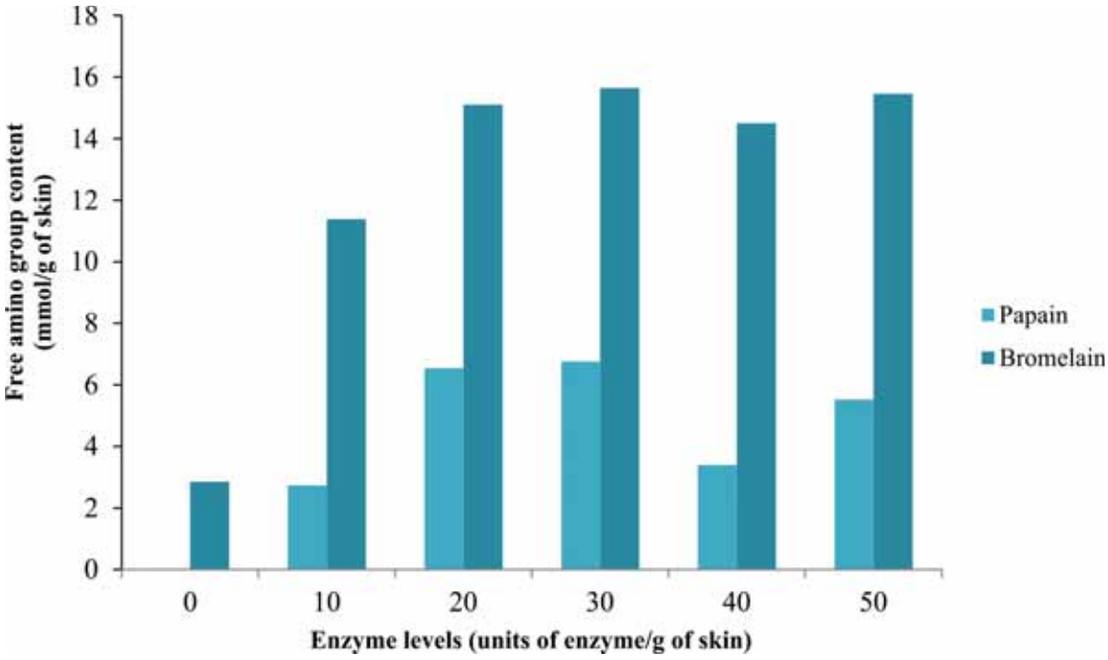
Based on the overall biochemical profile, the shelf-life of shellac-based foam coated mangoes was found to be 24 d as against 16 d for uncoated mango under low temperature storage conditions. Though 20% shellac coated mangoes were found to have better visual appearance and biochemical and physico-chemical profile but these fruits developed off-flavor due to cessation of proper gaseous exchange. Thereby suggesting a lower dose of 10% shellac to overcome such adverse effect of coated material on gaseous exchange.

Improved Method for Extraction of Collagen Hydrolysates from Buffalo Skin

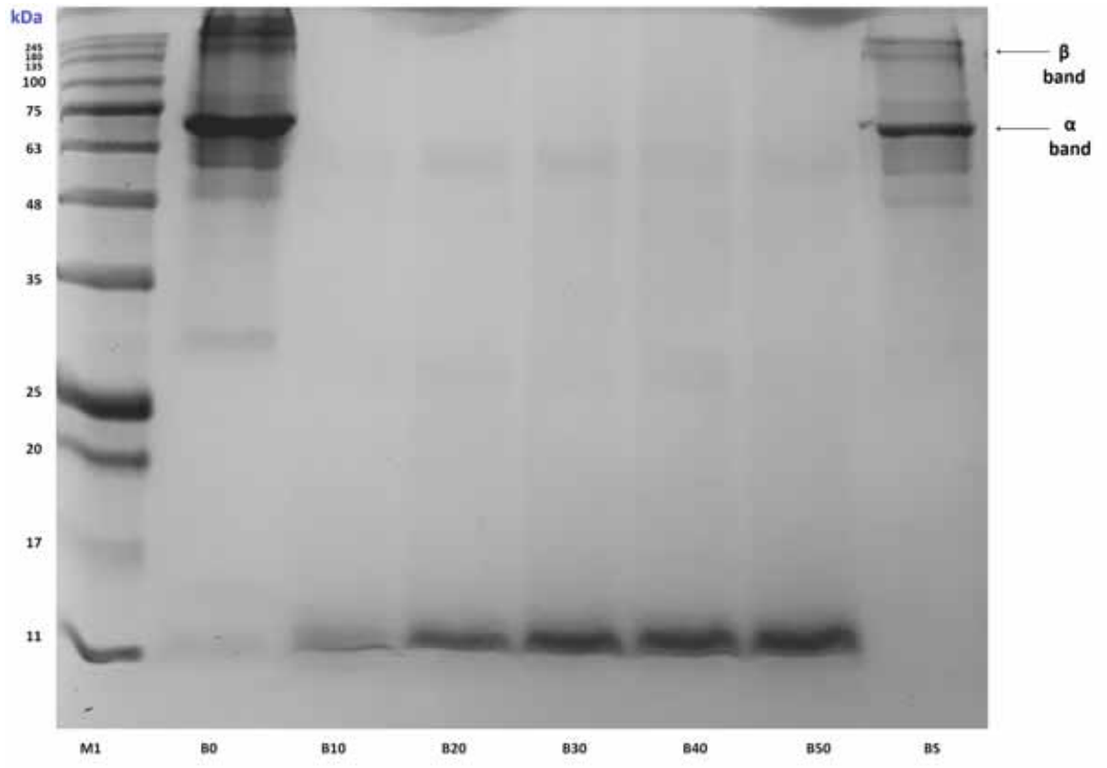
Collagen hydrolysate (CH), a polypeptide composite derived from further hydrolysis of denatured collagen (gelatin), is a nutritional product derived from animal collagenous tissues having molecular weights varying from 3 to 10 kDa. It is bioavailable source of peptides and amino acids possessing curative properties on cartilage and bone matrix synthesis resulting in desirable effects on bone, joint disorders and osteoarthritis. An improved method is in the process of development for extraction of collagen hydrolysates from buffalo skin. The method will be useful for industrial application for manufacturing of this high value compound. Based on FAA estimation and SDS-PAGE images, it was concluded that papain enzyme degraded the proteins most effectively at level 20 and 30 units of enzyme per gram of skin and bromelain was most effective at level 30 and 50 units of enzyme/gram of skin to hydrolyse the skin collagen.

In vivo Evaluation of Plant Extracts against Post-Harvest Disease of Guava Fruits

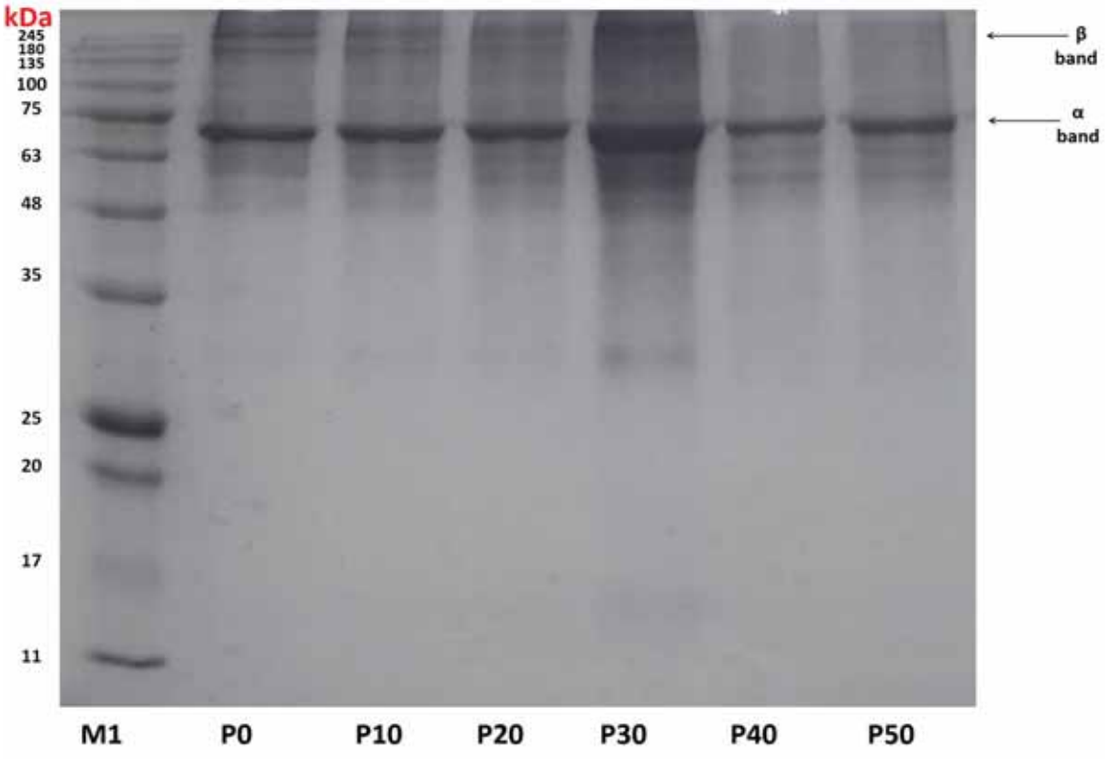
Based on the findings of in vitro trials, most effective plant extracts such as clove oil, grapefruit essential oil, cassia bark extract and Arjun bark extracts were selected and evaluated for their antimicrobial potential against stem end rot



Free amino group content (mmol/g of skin) in the degraded skin sample incubated with various levels of papain and bromelain enzymes for 3 h at temperature 40 and 25 °C



SDS-PAGE of buffalo skin samples incubated at 0, 10, 20, 30, 40 and 50 units of bromelain (designated as B0, B10, B20, B30, B40 and B50, respectively) at 40 °C for 3 h. M1 denotes the marker and BS indicate buffalo skin sample without incubation



SDS-PAGE of buffalo skin samples incubated with papain enzyme at 0, 10, 20, 30, 40 and 50 units of papain (designated as P0, P10, P20, P30, P40 and P50, respectively) at 40 °C for 3 h. M1 denotes the marker. Maximum degradation of skin protein was observed at P30

Freeze drying of sample using lyophilizer

Freeze dried collagen hydrolysate

disease of guava in vivo. After 9 days of storage, lowest disease lesion (18.25 ± 0.14 mm) was observed in the presence of clove oil, followed by grapefruit EO (25.50 ± 0.29 mm) while control fruits treated with sterile water had highest disease lesion (47.25 ± 0.14 mm). In terms of pathogen growth inhibition, clove oil was able to inhibit pathogen development by 61.38%, followed by grapefruit EO by 46.03%. This study reveals potential role of such botanicals in safer management of post-harvest fruits disease. In case of anthracnose disease, lowest disease lesion (19.50 ± 0.29 mm) was observed in the presence of clove oil, followed by

grapefruit EO (21.00 ± 0.00 mm) while control fruits treated with sterile water had highest disease lesion (36.75 ± 0.43 mm) after 9 days of storage. In terms of pathogen growth inhibition, clove oil was able to inhibit pathogen development by 46.94%, followed by grapefruit EO by 42.86%. This study has immense potential for exploring such botanicals in healthier management of post-harvest diseases.

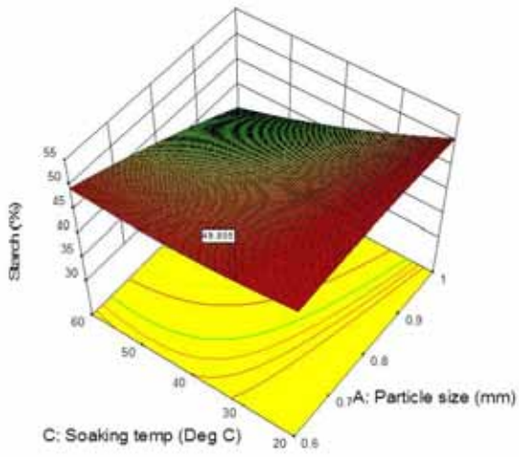
Process for Extraction of Starch from Mango Seed Kernel

Experiments were carried out to screen the important factors influencing starch extraction process using Plackett-Burman Design (PBD). Eight independent factors at two levels with two central points were used to conduct the experiment. The independent factors were: particle size (0.7 and 1.00 mm), solid-liquid ratio (1:3 and 1:5), concentration of NaOH (0.02 and 0.05 N), soaking temperature (30 and 60 °C), soaking time (15 and 30 min), stirring rate (75 and 150 rpm), sonication time (3 and 8 min), and mixing solid-liquid ratio (1:3 and 1:5). Statistical analysis of PBD design showed that particle size, soaking temperature, soaking time and mixing solid-liquid ratio had a significant ($p < 0.05$) effect on starch extraction process.

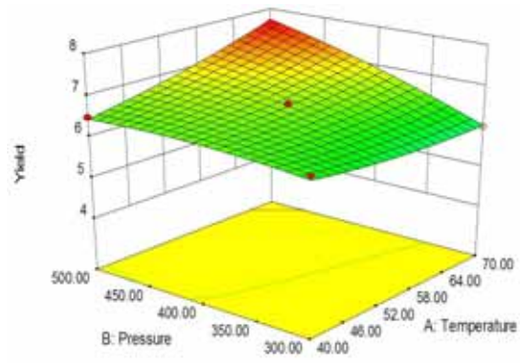
Response surface methodology (RSM- Box-Behnken Design) was used to optimize the starch extraction process with following significant factors obtained by PBD *i.e.* A: particle size (0.6 mm-1.0 mm), B: soaking time (10 min-50 min), C: soaking temperature (20-60 °C) and D: mixing solid-liquid ratio (1:2-1:6) with three central points. The model revealed that the linear terms particle size, soaking time, soaking temperature, mixing solid-liquid ratio and interaction effect between particle size and soaking temperature showed significant effect on starch yield. The optimum conditions for maximum starch yield were as follows: particle size 0.6 mm, soaking time 41.27 min, soaking temperature 30.60 °C and mixing solid-liquid ratio 1:5.98.

Process for Extraction of Oil from Oat using Supercritical Fluid Extraction Method

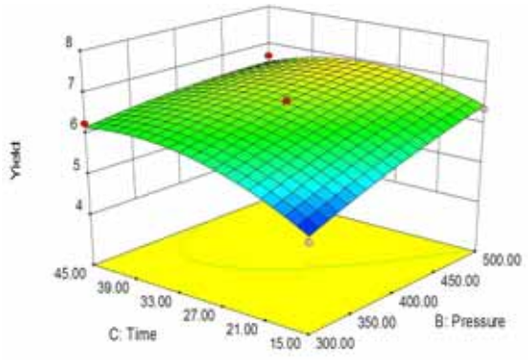
Response surface methodology was undertaken using three independent variables viz., temperature (40-70°C), pressure (300-500 bar) and extraction time (15-45min) involving 17 experimental runs to extract oil from KENT variety of oat. Results revealed that the oil content in oat ranged from 4.83 to 7.63%. The linear term of temperature ($p < 0.01$), pressure, and time ($p < 0.001$) followed by the quadratic term of temperature and interaction effect of temperature and pressure ($p < 0.01$), had significant effects on the oil yield. Optimum yield of oat oil using mathematical model was predicted to be 7.64% on dry basis under the condition of pressure 495.52 bar, temperature 69.22 °C and time of 27.92 min.



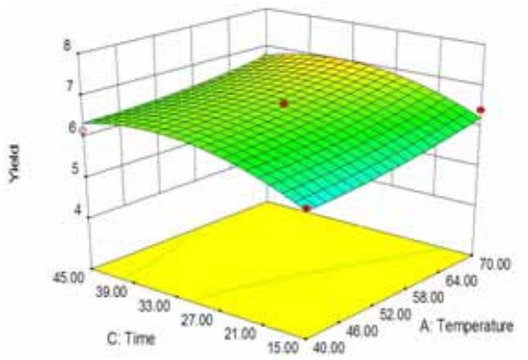
The interaction effects of particle size and soaking temperature on starch yield



Response surface plot of oil yield as a function of pressure and temperature



Response surface plot of oil yield as a function of time and pressure



Response surface plot of oil yield as a function of time and temperature

Packaging for Destalked Red Chilli and Red Chilli Powder

Four different packging materials *viz.,* jute bags, woven polypropylene (WPP), polypropylene (PP) and laminated pouches (L) were selected for packaging of destalked red chillies with and without vacuum. All the samples were stored at two different temperature conditions 1) cold storage (4±1 °C); 2) ambient temperature (25±2 °C). Samples were withdrawn subsequently at an interval of 30 days to study the effect of packaging material and storage conditions on the shelf life of destalked red chillies up to 10 months. It was observed that vacuum packaging is a better technology to slow down the deterioration of Total Extractable Colour, Oleoresin Extractable Colour and Total Carotenoid Content in stored destalked red chillies. For storing red chilli powder, two packaging materials namely polypropylene (PP) and laminated pouches (L) were used with and without vacuum. Among the different packaging materials studied, quality of red chilli powder packed in laminated pouches was better in terms of color retention when compared to other packaging materials. Also, for higher shelf life and better color quality of chilli powder, vacuum packaging proves to be a safe and better technology.

Nutritious Noodles containing Sprouted Bengal Gram and Mint

Convenient food products, preferred by urban population, are generally high in starch but low in dietary fibre, minerals, vitamins, phenolic compounds, etc. Hence, nutritionally balanced, energy-dense, easily digestible foods with functional benefits is in great demand. Germinated cereals and legumes are receiving increasing attention due to their enhanced palatability and flavor, better nutritional qualities, reduction in anti-nutritional factors and increased digestibility. In this work, sprouted Bengal gram, wheat flour and mint were utilized for preparation of noodles, a convenient food. Optimization of noodles with different combinations of wheat flour (70-80 g), sprouted Bengal gram flour (20-30 g) and mint paste (10-20 g) using Box Behnken design of response surface methodology was carried out. Noodles with combination of wheat flour, sprouted Bengal gram and mint paste in a ratio of 65:21:14 was found to be of optimum acceptance on the basis of nutritional parameters, water absorption, cooking quality, in vitro protein digestibility, free fatty acid, DPPH activity and sensory parameters. The optimized product prepared with combination of traditional germination/ sprouting technology with popular extrusion processing could be a great medium for satisfying both the objectives of nutrition and convenience as required by present population.

Process for Development of Sprouted Green Gram Flakes

Green gram is rich in protein, vitamins and minerals but is bitter in taste due to its outer covering and presence of anti-nutritional factors

which makes it less palatable and hence limits its use as a whole grain. Therefore, to diversify its uses, present study was attempted to prepare flakes after sprouting, drying and toasting of green gram. For this, response surface methodology's Box Behnken design was used to optimize the levels of moisture content (20-28%), baking temperature (180-200 °C) and baking time (2-4 min). Green gram was washed, soaked for 6 h and kept for sprouting for 24 h at 30 °C at 88% RH. The sprouted green gram was then dried at 50 °C to attain specific moisture content (20-28%). The dried sprouts were then baked at 160-200 °C for 2-4 min to remove raw taste. The sprouts were then subjected to flaking by rollers. After flaking, the flakes were toasted in an open pan for 5-7 min and then coated with spices. The dependent variables (quality parameters) such as water absorption capacity (164-220%), free fatty acid content (0.28 - 1.21%), protein content (20.08-24.51%), pasting characteristics (peak viscosity 176-366 cP, breakdown value 8-75 cP, final viscosity 289-491 cP, setback value 138-208 and pasting temperature 80.4 to 85.4 °C), in vitro protein digestibility (85.1 to 92.3%), sensory parameters (color/appearance, texture, taste, flavor/aroma and overall acceptability varied between 7.1-7.8, 7.1-7.6, 6.9-7.6, 6.9-7.5 and 7.1-7.8, respectively) were analysed. The optimized green gram flakes prepared with sprouted green gram with 24.5% moisture, 160 °C baking temperature and 3 min baking time were found to be most acceptable.

Process for Extraction of Protein from De-Oiled Cakes/Meals

Experiments were conducted to optimize the process parameters for the extraction of protein from de-oiled soy and groundnut meal/cake based on solubilization and precipitation yield of protein isolate. Response surface methodology was applied taking four independent variables: salt (sodium sulphite) concentration (0.1-0.3%), extraction temperature (40-60 °C), extraction duration (40-80 min), and extraction pH (8-10). The flour water ratio (1:10) was kept constant. The dependent variables were: protein extraction (%), Recovery of protein (%), yield of protein isolate (%) and purity of protein isolate (%).

Process for Production of Protein Powder from *Khesari dhal*

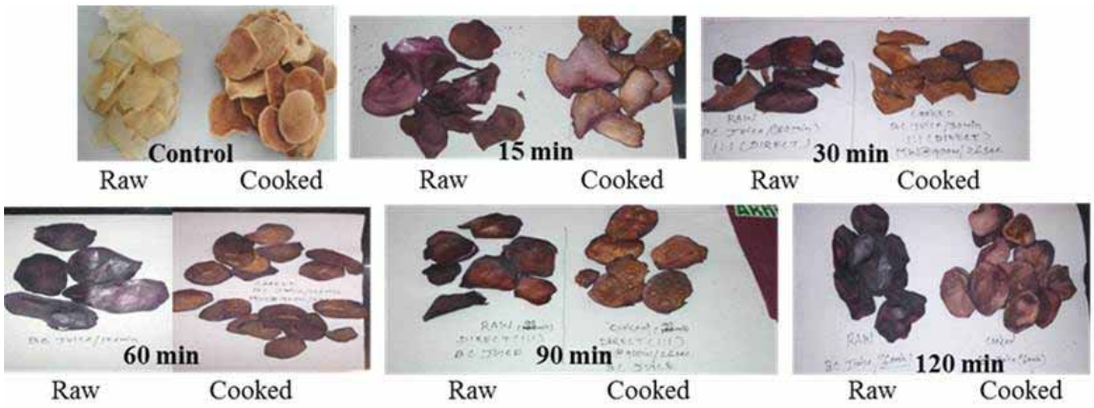
Toxic amino acids (BOAA) present in *Khesari dhal* is readily soluble in water and can be leached during processing. There is need to develop a suitable technology for the processing of *Khesari dhal* in order to utilize its potential as protein source. Production of protein isolates may be one such way as the process involve aqueous extraction of protein followed by its concentration using precipitation or ultra-filtration techniques. Studies were conducted in order to optimize the process parameters for production of protein isolates from *Khesari dhal* (var. Mahateroa). Four process parameters: extraction pH (8-10), duration (40-80 min), temperature (40-60 °C) and salt (sodium sulphite) concentration (0.10-0.30%) were selected. Experiments were designed using response surface methodology (RSM) and protein extraction efficiency, yield of protein isolates and BOAA contents were measured. Maximum protein extraction (98.6%) was found at alkaline condition, pH 10; extraction duration, 60 min; temperature, 60 °C and salt concentration of 0.10% at *Khesari dhal:* water ratio of 1:10.

Development of Functional Breads and Potato Chips

Black carrot color (BCC) (5, 10, and 15%) in combination with spinach (2.5 and 5.0%) was used to develop six formulations of functional breads. Fortified breads with BCC and spinach at 10% and 2.5% respectively had higher overall acceptability score. Black carrot color was also infused into potato slices at ambient temperature (25±2 °C) at two ratios: 1:1 and 1:2 (potato chips: black carrot juice). Dried potato chips were subjected to two types of cooking methods; 1) microwave cooking, 2) Oil cooking. The biochemical composition of BC fortified potato chips was significantly ($p < 0.05$) influenced upon oil cooking and their antioxidant content

Functional breads containing BCC and spinach: a) Control (1) BCC 5%: spinach 2.5% (2), BCC 10%: spinach 2.5% (3), BCC 15%: spinach 2.5% (4); b) Control (1) BCC 5%: spinach 5.0% (2), BCC 10%: spinach 5.0% (3), BCC 15%: spinach 5.0% (4)

Functional breads using BCPP and spinach: a) Control (1) BCPP 10%: spinach 2.5% (2) and BCPP 20%: spinach 2.5% (3); b) Control (1) BCPP 10%: spinach 5.0% (2), BCPP 20%: spinach 5.0% (3)



Anthocyanin infused raw and microwave cooked potato chips

was drastically reduced and the content ranged from 0.20 to 0.56 µmol TE/100 g and so were anthocyanin content and ascorbic acid content. Microwave cooking of potato chips was acceptable by the panel of judges and proves to be a better technology in comparison to oil cooking.

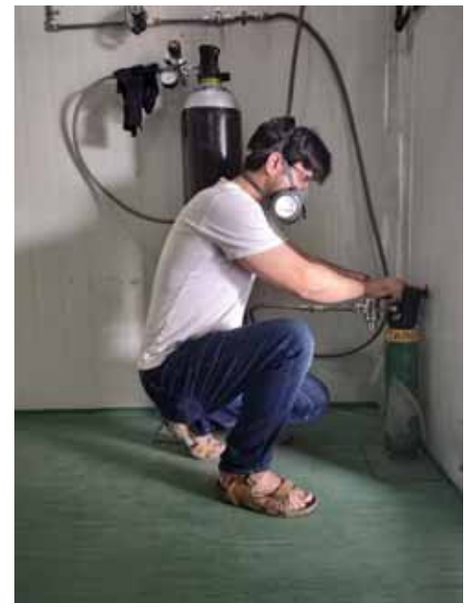
APEDA Project

Development of Automated Fumigation Chamber for Treatment of Grapes with SO_2 and CO_2 and Standardization of Treatment Protocol for Export of Grapes to New Zealand and Australia

The fumigation chamber in this project was established at M/s Sahyadri Farmers Producer Company Limited, Survey No. 314/1 & 314/2, A/P Mohadi, Nashik - 422206.

The fumigation chamber was designed for treatment of 1500 kg grapes (one pellet) at a time. The fumigation treatment has to be done after completion of pack house operations (Receiving, weighing, sorting, punnet packaging, weighing, and filling in cartons). The basic data for the design of fumigation chamber were taken and design calculations were made. The complete chamber is divided into two parts namely fumigation chamber and Ante room (small room for placing the gas cylinders and gas release system). The fumigation chamber and ante room are connected by an electronically controlled door.

All the operations of the fumigation system are controlled from an electronic control panel, which is fitted outside the chamber. The gas concentration, temperature, operation time, operation of solenoid valves, status of doors, operation of exhaust fans, run time for each gas, etc. are displayed through LED displays and controlled by a BMCS (Building management and control system) program specifically prepared for this fumigation system. The fumigation chamber was evaluated for treatment of grapes. It was found that all the insects were killed after the treatment with CO_2 and SO_2 gases. The chamber is ready for commercial exploitation.



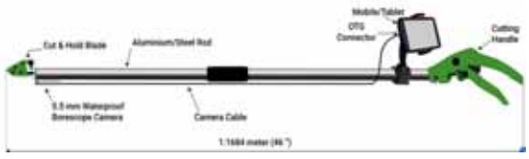
Automated fumigation chamber and its testing at site

Research Highlights of AICRP

Post-Harvest Engineering & Technology

Optical Sensor-based Makhana (*Euryale ferox*) Harvester

An optical sensor-based Makhana harvester was developed by AICRP (PHET), CAU, Imphal centre. It consists of a monitor, borescope/point camera and a cutting blade. The camera takes the image of the fruit inside the water and is displayed on the monitor outside the water. By seeing the monitor, the operator can easily locate and cut the fruits inside the water. Thereby reduces the drudgery of harvesting. The capacity of the machine is 50-60 fruits/h and field capacity (Number of fruits harvested) is almost double as compared to the conventional harvesting method. The cost of the machine is Rs 12000/-.



Makhana (*Euryale ferox*) Harvester

Water Chestnut Decorticator

Hand and power operated water chestnut decorticator was developed by AICRP (PHET), SKUAST-K, Srinagar. This machine is developed for decortication of dried water chestnut kernels from pods. Capacity of the hand and power operated water chestnut decorticator is 12 and 60 kg/h, respectively and the cost is Rs. 10000/- and Rs. 30000/-, respectively.

Hand and power operated Water chestnut decorticator

Walnut Dehuller cum Washer

Walnut Dehuller cum washer was developed by AICRP (PHET), SKUAST-K, Srinagar. It is used for dehulling and washing of green walnuts. The capacity of this machine is 335-345 kg/h and the overall efficiency is 90.60%. The cost of this machine is Rs 98000/-.

Walnut dehuller cum washer

Toddy Palm Fruit Seed Separator

AICRP (PHET), KAU, Tavanur developed a toddy palm fruit seed Separator. It consists of a base, cutting knife, holding platforms and a U-shaped blade. Cutting knife and holders are mounted on a rectangular base made up of 302

Toddy palm fruit seed separator

SS. It is used to separate the pulp from toddy palm fruit. Capacity of this machine is 60 nuts/h and cost of the machine is Rs. 6000/-.

Jackfruit Corer cum Peeler

A Jackfruit corer cum peeler is used for faster peeling, coring and cutting of jackfruit. It was developed by AICRP (PHET), KAU, Tavanur. This machine consists of fruit holder, peeler assembly, corer assembly along with cutting mechanism, power transmission unit and frame assembly. The fruit holder consists of disc and blade. It is designed as a rotating disc that can carry the jackfruit on a horizontal plane. Capacity of this machine is 40 kg/h and cost of the machine is Rs. 51000/-.

Rotary Onion Grading Machine

A rotary onion grading machine was developed by AICRP (PHET), PDKV, Akola. The capacity of the machine is 2.5 tonne/h and grading efficiency is 89%. It grades onion on the basis of their size into 3 to 4 grades. An inclined bed conveyor is given with hopper for automatic feeding. The machine is movable. The cost of operation is Rs. 90.38/tonne.

On-farm Dry-Aeration Bin

On-farm dry-aeration bin was developed by AICRP (PHET), ANGRAU, Bapatla for drying and storage of high moisture paddy. The capacity of the bin is 2.5 tonnes.

Turmeric Washer

The turmeric washer was developed by AICRP (PHET), TNAU, Coimbatore. It consists of feed hopper, cylindrical rotary drum, water spray assembly, washed turmeric outlet, motor, pump, frame and water collecting tray. The collected waste water was filtered and re-circulated with the help of a pump. The capacity of the machine is 300 kg/h and cost is Rs. 181000/-.

Rotary onion grader

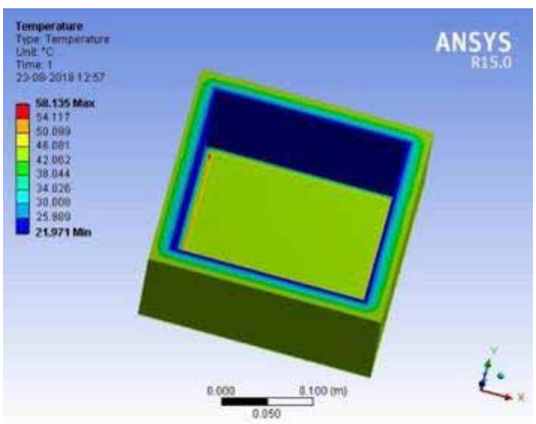
Turmeric washer

Plasticulture Engineering & Technology

PCM-based Mobile Cool Chamber

A PCM-based mobile cool chamber of 100 kg capacity was developed under AICRP (PET), ICAR-CIPHET Abohar. Prior to develop a Phase Change Materials (PCM)-based mobile cool chamber, an insulated box of size 0.46 m× 0.46 m× 0.46 m was fabricated and its thermal analysis was carried out under steady state idealized conditions using ANSYS software. Heat of fusion of PCM was 200 kJ/kg and thermal conductivity of insulation was 0.02 W/m-°C. After thermal modelling, inside temperature was found to be 21.97 °C which confirmed that a cool chamber can be developed using PCM. PCM requirement for this box was determined as 2.25 kg.

Prototype of PCM-based cool chamber



Thermal analysis of PCM-based cool chamber

Following assumptions were made during development of the cool chamber.

Assumptions for operating conditions

Chamber capacity	100 kg
Season	May - July
Inside temperature	20 °C
Outside temperature	40 °C
Loading period	12 h (8 am to 8 pm)

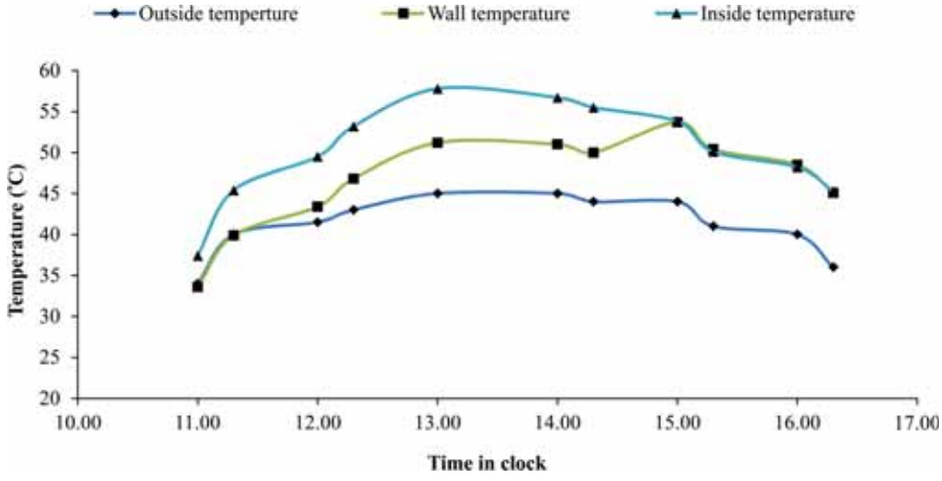
Materials used	Thermal conductivity (W/m°C)	Thickness (mm)
Plastic tank (p)	0.25	3
Insulation (ins)	0.047	30
GI sheet (gi)	50	1
PCM (OM 18)	0.1785	28

Fruit vegetable properties

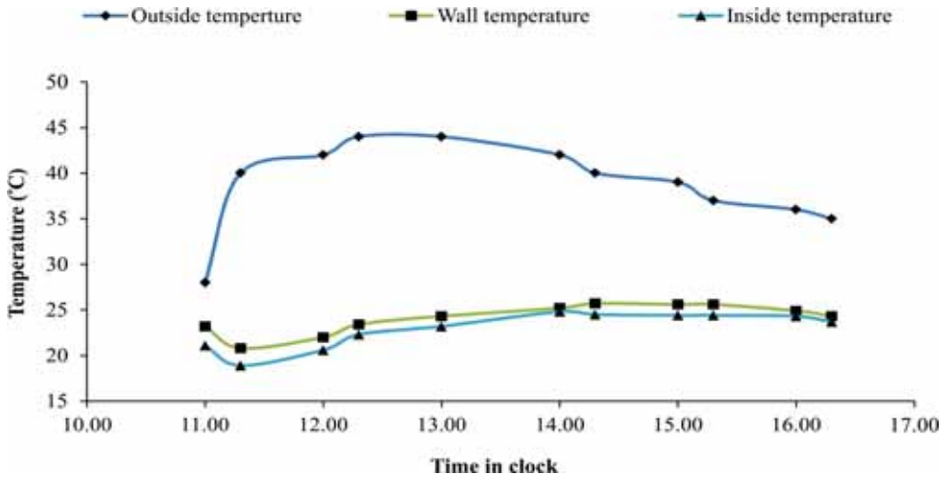
Average heat of respiration	1224 kCal/ton/24 h
Specific heat	0.524 kCal/kg°C

PCM requirement was found as 150.56 kg when transparent acrylic sheet cover was provided from the top of the chamber and no roof was provided. On the other hand, PCM requirement was 33.29 kg when composite cover of ply-board and acrylic sheet was provided from the top of the chamber and insulated roof was provided over the chamber. Thus, insulated roof and composite top cover significantly reduced the PCM requirement of the cool chamber.

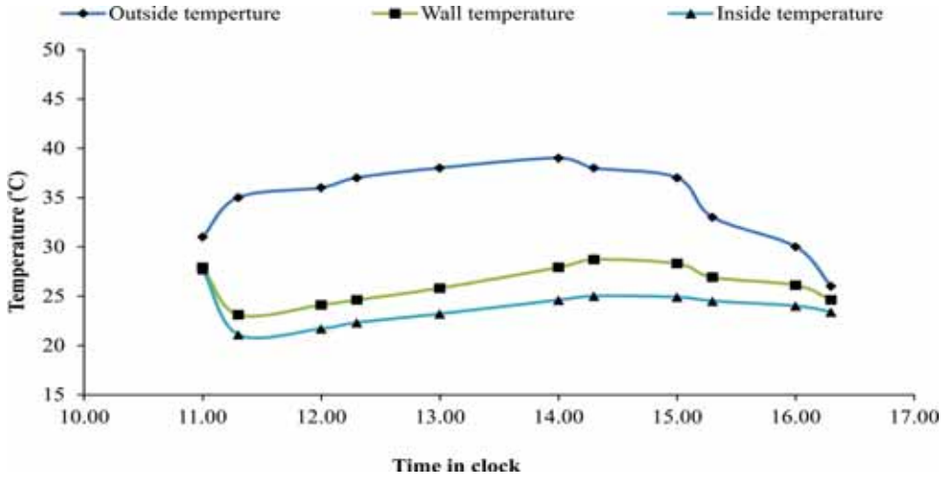
PCM based mobile cool chamber



Variation in outside, wall and inside temperatures (without PCM)



Variation in outside, wall and inside temperatures (with PCM but no load)



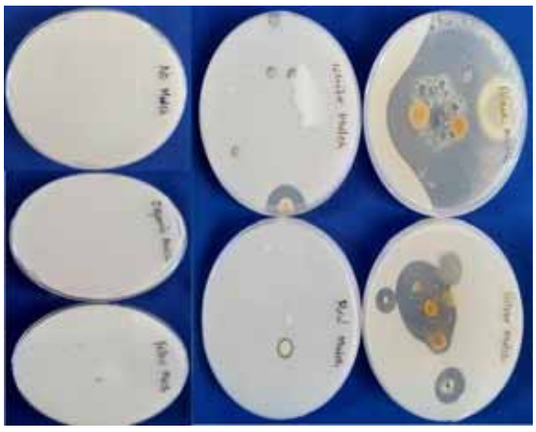
Variation in outside, wall and inside temperatures (with PCM under load of 43 kg vegetables)

Under no load condition and providing PCM panels, inside temperature was lower by 13-20 °C than the outside temperature (varied from 28-46 °C). When no PCM panels were provided, inside temperature increased by 3-13 °C above the outside temperature (varied form 32-41°C).

PCM was able to maintain the inside temperature at about 20 °C although outside temperature varied from 31-40 °C. Under full load condition, average outside temperature was 35 °C while average wall and inside temperatures were 26 and 24 °C, respectively. Vegetables kept in a cool chamber for four consecutive days were fresher than those kept outside the chamber. Daily average physiological loss in weight (% PLW) in radish was 9.98 and 1.98% when kept outside and inside the chamber, respectively. Similarly, daily average PLW in *palak* was 11.19 and 1.37% when kept outside and inside the chamber, respectively.

Assessment of Soil Microbial Activities and Post-Harvest Quality oIf Tomato Cultivated under Plastic and Organic Mulches in Arid Regions

Effect of various plastic (black, silver, red, white and yellow) and organic mulches on agriculturally important microorganisms such as phosphorus, potassium, and zinc solubilizing bacteria and iron and sulphur metabolizing bacteria in tomato rhizosphere were examined. These microbes play an important role in mineralization of soil nutrients and their availability to crop plant. It was found that different mulching has positive influence on the population of such organisms, especially during winter season. Although results were variable, but, in most of the case, organisms population were found better in plastic mulch treatments when compared to no mulch treatment. For example, highest population of P-solubilizing bacteria ($68.5 \pm 8.95 \times 10^{-6}$) was found in black mulch treatment followed by white mulch.



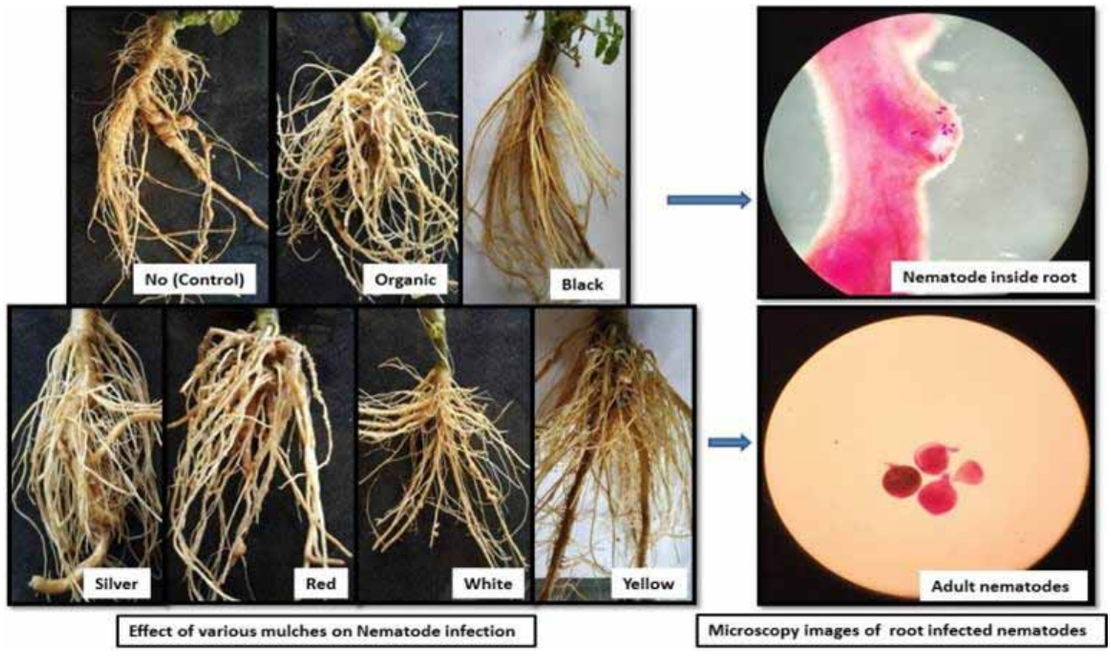
Zinc solubilisation zone formed on zinc solubilizing agar media by isolated zinc bacteria from tomato rhizosphere grown under various mulching

Impact of Various Colored Plastic Mulching and Organic Mulches on the Soil Nematode

Tomato crop is very susceptible to the wilting caused by the soil borne root knot nematode. Hence, one of the purposes of this study was to

Influence of different plastic and organic mulches on population of agriculturally important soil microorganisms

Type of Mulches	Important soil microbes associated with soil nutrient mineralization and its uptake by plant			
	P-Solubilizers (cfu $g^{-1} \times 10^{-6}$)	K-Solubilizers (cfu $g^{-1} \times 10^{-5}$)	Iron bacteria (cfu $g^{-1} \times 10^{-4}$)	Sulfur bacteria (cfu $g^{-1} \times 10^{-4}$)
No	31 ± 4.04	110 ±5.20	189.5 ± 10.14	235 ± 8.62
Organic	39.5 ± 3.75	153± 10.39	306.5 ±4.95	55.5 ±12.41
Black	68.5 ± 8.95	179.5 ±4.91	407.5 ±4.48	434 ±5.20
Silver	46.5 ± 6.06	220 ±4.62	234 ±8.49	299 ±43.30
Red	34 ± 1.15	23 ±3.46	247.5 ±10.61	237.5 ±33.77
White	48.5 ± 0.87	93.5 ±8.95	129.5 ±27.58	203.5 ±6.64
Yellow	72 ± 19.63	26.5 ±2.60	109.5 ±8.72	286.5 ±3.18



Effect of various mulches on Nematode infection

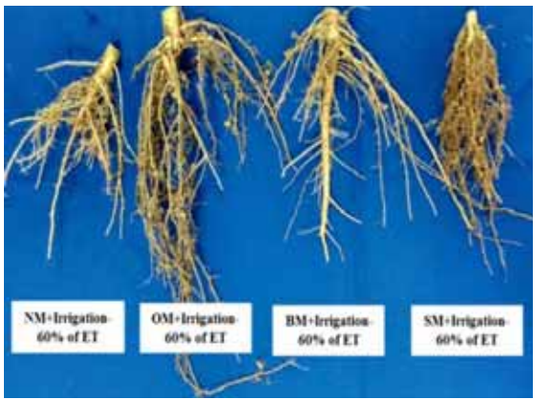
assess the impact of different mulching on the soil nematode. Visual symptoms of wilting was observed and recorded. Simultaneously, roots of such wilted plants and soil near roots was analyzed for the nematode infection (%), root knots, and nematode population in the soil. Maximum number of plants infested with nematode infection was found in organic treatment (38.33%) while lowest infection was found in black mulch treatment (16.67%), followed by white mulch treatment (21.67%). In terms of nematode population, lowest population of nematode was found in white mulch treatment, *i.e.* 60/100 g of soil, followed by black mulch treatment (84.5/100 g of soil). This result was also confirmed by its observation of root knot infected with nematode under light microscope.

Effect of Different Mulching on Root Nodules, Nodulation and Microbial Population in Cowpea Rhizosphere

Root nodule development and soil microbial population in cowpea rhizosphere was measured under different mulching conditions. Highest number of nodules (93.20 ± 21.48) per plant root was found in cowpea grown under silver mulch treatment while lowest root nodules of 17.80 ± 9.53 were found in no mulch treatment. Soil microbial load (cfu/g of soil) was assayed during vegetative and fruiting stage of crop. During vegetative stage, maximum bacterial ($44.33 \pm 3.93 \times 10^{-5}$ cfu/g) and rhizobium population count ($184.33 \pm 13.99 \times 10^{-2}$ cfu/g) was found in organic mulch and silver mulch treatment, respectively while bacterial and rhizobium population was found lowest in no mulch and black mulch. Similarly, during fruiting stage, maximum bacterial and rhizobium population was found in organic mulch and silver mulch treatment respectively. However, fruiting stage crop rhizosphere has more population of bacteria and rhizobium as compared to vegetative stage.

Effect of Mulching Technology on Plant Growth Parameters and Soil Microbial Activity

This study was conducted to explore the possibility of cowpea (cv. Kashi kanchan) cultivation in between wheat-rice cropping system using different mulching treatments viz.



Effect of mulching on fresh pod quality and root nodulation in cowpea

organic mulch (thin layer of wheat straw), black mulch (25 µ), silver mulch (25 µ) and no-mulch. Among the different mulching treatments, silver mulched cowpea had better plant growth and yield parameters *viz.*, number of leaves, secondary branches and pod length and width followed by organic mulched cowpea. Plant height (33.95 cm) and total number of leaves (30.8) was highest in organic mulch followed by silver mulch (32.81 cm and 27.42 respectively).

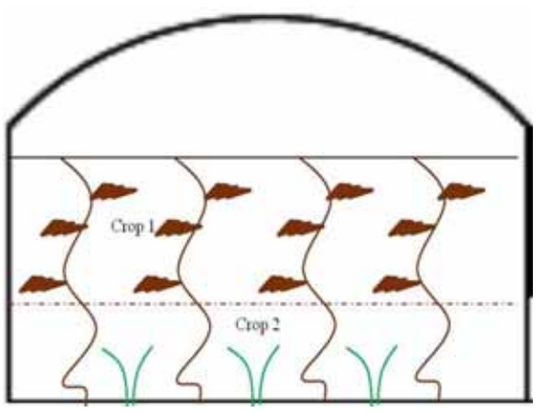
Root length was highest in organic mulch (25.7 cm) followed by silver mulch (22.7 cm). Total number of nodules/plant was highest in silver mulch (93.20) followed by black mulch (46.60); however, least was in no-mulch (17.80). Soil microbial analysis indicated that actinomycetes population was highest in organic mulch (228.33 cfu/g) followed by silver mulch (223.00 cfu/g), while least was in black mulched plants (120.33 cfu/g). Population of rhizobium, key bacteria for nitrogen fixation from atmosphere in legume plant, was highest in silver mulch (184.33 cfu/g) followed by organic mulch (174.0 cfu/g), while least count was in black mulch (115.67 cfu/g). Micro and major nutrient contents were found more in silver mulched cowpea pods (Ca-10283.67 ppm, Fe-84.04 ppm) than other mulching treatments. Highest yield (kg/100 plants) was found in silver mulched cow pea (17.30 kg) followed by black mulched cow pea (15.87) compared to no mulched plants (12.41 kg). Overall, silver mulch was found better in terms of higher yield, more nutrients in pods and good soil microbial activity.

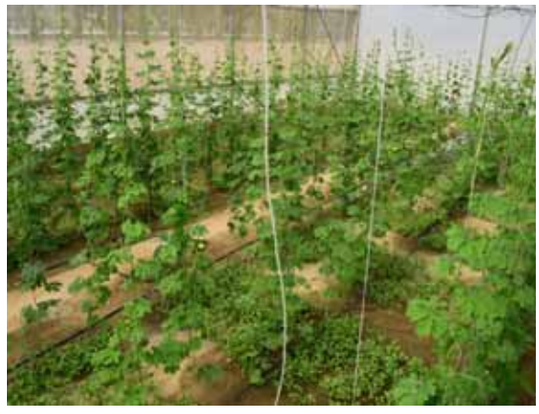
Hydroponics System for Vertical Space Utilization

This system was developed for utilization of vertical space inside polyhouse, as some vertical space inside polyhouse remains unutilized which can be used for growing of vegetables. Structure had length of 6 m, height 1.86 m and total number of pipes was 9. This hydroponics system was found useful for growing of small height crops and leafy vegetables *viz.* lettuce, spinach, coriander.

Strategies for Maximum Vertical Space Utilization Standardized

The aim of this study was to utilize the vertical space inside polyhouse for vegetables growing. As polyhouse is a costly structure and if we go for 100% cropping intensity then we get only single crop at a time. So space between the plants and row remains unutilized. Therefore, small height crop (secondary crop) was grown in between the gaps of main crop (tall height). Due to this main crop was not affected and additional crop yield was obtained. During study, bitter gourd (cv. Sungro F1 hybrid bitter gourd No. 165) were grown during February as a main crop with spacing of 0.6 m (P × P) x 1.0 m (R × R) in 120 m^2 of polyhouse whereas coriander (local cv.) was grown as secondary crop on bed of 1.0 × 1.0 m between the bitter gourd inside the polyhouse for maximum use of vertical space by





Depiction of space utilization in green houses

growing of two crops of different height. Coriander green leaves gave 12.5 kg yield in single cutting and bitter gourd yield was 253 kg in 80 m^2 floor area.

Soil-less Media Rooftop/Terrace Vegetable Nutrition Garden for Urban and Peri-urban Population

Overall dimensions of the unit is 5.5 m×3.6 m and made of MS frame with 200 µm polythene on the top. The vegetable produced will be sufficient for a family of 2-4 persons. Ten vegetables like Tomato, Bell Pepper, Cucumber, Coriander, Broccoli, Spinach, Pea, Lettuce, Fenugreek and Chinni sarson can be grown with staggered sowing/transplanting, the vegetables would be available round the year. The approximate cost of this model is around Rs. 40000/-

Rooftop terrace vegetable nutrition garden model for urban and peri- urban population using soil-less media

Off-season Capsicum Cultivation under Poly-house in Organic Manures and Different Moisture Depletion Levels in Sikkim

In this work, the effect of maximum number of fruits per plant (6 No.), yield 21 t/ha and water use efficiency (58.02 Kg/m^3) in combination with organic manure used (FYM (1kg/m^2) + Vermicompost (500g/m^2) + Biofertilizer (Bio NPK culture) was evaluated. 35- 40% increase in the yield was found under organic conditions in poly-house over open conditions. The micro-climate of the polyhouse was monitored during reporting period. The weekly average daily maximum temperature (32.88 °C) and RH (91.48%) increased by 4.9 °C and 1.8%, respectively inside the polyhouse compared to the outside. Similarly, the weekly average daily minimum temperature (16.04 °C) increased by 0.07 °C inside the poly-house in comparison to the outside values and the daily minimum RH (42.25%) decreased by 8.4% inside the poly-house compared to the outside.

Off season capsicum cultivation under poly house in organic manures and different moisture depletion levels in Sikkim

Portable Low-cost Multiple Use Portable Poly-tunnel Cum Polyhouse for Higher Hills

The main feature of this structure is that it can be easily dismantled, assembled and relocate to a

Portable low-cost multiple use portable polytunnel-cum-polyhouse for higher hills

new location as per the need in the hills. The first version of low-cost multiple use portable polyhouse of 50 m^2 floor area was modified by replacing MS round rods (12 mm) with the GI pipes (1/2 inch). The size (floor area) was also increased to 62.4 m^2. The height of this version increased to 2.6 m while width increased to 5.2 m. Hence, two structures of size 50 m^2 and 62.5 m were developed and cost of the structures were Rs. 50000/- and 62000/- respectively. For shifting of this structure only four persons are required who can shift this in 3h.

Conjunctive Use of Runoff Harvested Water from Plastic Lined Farm Pond and Groundwater for Crop Production in Semi-arid Region

Raichur centre has constructed plastic lined pond. Collected runoff water and bore well water was used to irrigate the selected crop of chilli (*Capsicum annum* L.) var Guntur. The crop growth parameters were taken at 30, 60, 90 and 120 DAT and yield parameters were taken at harvest. All the growth parameters like plant height (77.07 cm), no of primary branches (13.13), no of secondary branches (47.40), 50% flowering (39.91 days), fruit length (8.97) and diameter (1.73) and yield (19.99 t/ha) were observed to be maximum in 100% RDF and 80% irrigation levels. Minimum values were observed for these parameters under 75% RDF and 60% irrigation levels. The interactions between 100% RDF and 80% irrigation levels is best suitable for growing of chilli crop.

Use of runoff harvested water from plastic lined farm pond and groundwater for chilli crop production

Pabda Hatchery Unit

ICAR-CIFA has designed and developed a Pabda hatchery unit under its AICRP on PET. It

Pabda Hatchery Unit

comprises of 3 breeding pools (rectangular tanks, the bigger one with 3 m length, I.I m width and 0.65 m height) and 3 incubation pools (circular tanks, of I.2 m, I.I m and I.0 m diameters having a water height of 0.35 m). Three circular incubation pools of gradually increasing diameters are designed and fabricated to be stacked one above the other in a pyramidal structure. These tanks are provided with individual valves to control flow from inlet and outlet pipes. In each of the incubation pool, 4 numbers of duck mouths (0.75 inch diameter) are provided to maintain a circular flow of water.

Plastic feeder

Rectangular Plastic Feeder

Rectangular Plastic Feeder (CIRG-RP) for adult goats to reduce feed wastage under stall-fed conditions was developed. It is suitable for feeding I0 adult goats, five on each side. It reduces feed wastage in goat farm i.e. almost nil wastage in concentrate feed, 5-I0 percent wastage in case of dry and green fodder. The height of feeding trough is fixed at shoulder point height of animals, therefore, height of feeder varies with the breed and age categories. It reduces agonistic feeding behavior among goats like butting at the time of feeding, competition for feed etc.

Awards and Recognitions

S.No.	Scientist	Award/Recognition
1.	Dr. R. K. Singh Director, ICAR-CIPHET	National Societal Innovation Award-2018 by National Research Development Corporation (An Enterprise of DSIR, Ministry of Science and Technology, Government of India) (Jointly with Dr. Sandip Mandal and Dr. Arvind Kumar of ICAR Research Complex for NEH Region, Umiam, Meghalaya)
2.	Dr. R. K. Singh Director, ICAR-CIPHET	Eminent Scientist Award, 2017 by Society for Upliftment of Rural Economy (SURE) (Varanasi) in 'International Conference 'Rural livelihood improvement by enhancing farmers' income through sustainable Innovative Agri and allied enterprises (RLISAAe)' organized during 30th October to 1st November, 2018 at BITs, Patna, India.
4.	Dr. K. Narsaish National Fellow and Principal Scientist	Fellow of National Academy of Dairy Sciences
3.	Dr. Sakharam Kale (Scientist)	Jawaharlal Nehru Award for P. G. Outstanding Doctoral Thesis Research in Agricultural and Allied Science for Agricultural Engineering for the year 2017 by Indian Council of Agricultural Research.
4.	Dr. Yogesh Kumar (Scientist, Senior Scale)	All India Best Publication Award-2018 for the paper 'Loop Mediated Isothermal Amplification (LAMP): A Rapid and Sensitive Tool for Quality Assessment of Meat Products' by Society of Advancement of Human and Nature (Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, India.

S.No.	Scientist	Award/Recognition
5.	Dr. Tanbir Ahmad (Scientist, Senior Scale)	Best Ph.D Student Award by the Faculty of Agriculture, Universiti Putra Malaysia (UPM), Serdang, Selangor, Malaysia.
6.	Dr. Bhupendra M. Godki (Scientist)	Young researcher partial funding from SERB, DST India and conference organizers to attend the International Conference on 'Technological innovation for integration of food and health: A focus on North-Eastern India (TiiFH-2019)' organized during 14th to 16th February at Tezpur University, Tezpur, Assam, India.
7.	Dr. Kirti Jalgaonkar (Scientist)	Young Scientist Award by Venus International Foundation, Chennai, India.
8.	Dr. Yogesh Kumar (Scientist, Senior Scale)	Best Oral Presentation Award (First) for the paper 'Effect of $W_1/O/W_2$ emulsion, aloe gel, and pea pod fibres as an edible fat replacer on quality attributes of low-fat meat batter' in 'International Conference 'Rural livelihood improvement by enhancing farmers' income through sustainable Innovative Agri and allied enterprises (RLISAAe)' organized during 30th October to 1st November, 2018 at BITs, Patna, India.
9.	Dr. Yogesh Kumar (Scientist, Senior Scale)	Best Poster Presentation Award (First) for the paper 'Pediocin and *Murraya koenigii* berry extract: Antilisterial, antimicrobial and antioxidant effects in refrigerated (4±1 ÚC) goat meat emulsion' in 'International Conference 'Rural livelihood improvement by enhancing farmers' income through sustainable Innovative Agri and allied enterprises (RLISAAe)' organized during 30th October to 1st November, 2018 at BITs, Patna, India.
10.	Dr. Kirti Jalgaonkar (Scientist)	Best Oral Presentation Award for the paper 'Development and performance evaluation of mechanized system for destalking of dried red chillies (*Capsicum annum* L.)' in International Conference on 'Food security, nutrition and sustainable agriculture-emerging technology' organized during 14th to 16th February, 2019 at Bhatinda, Punjab, India.
11.	Er. Navnath Indore (Scientist)	Best Poster Presentation Award (First) for the paper 'Low cost poly-tunnel dryer technology for farm households' in 'International Conference 'Rural livelihood improvement by enhancing farmers' income through sustainable Innovative Agri and allied enterprises (RLISAAe)' organized during 30th October to 1st November, 2018 at BITs, Patna, India.
12.	Er. Akhoon A. Bashir (Scientist)	Best Oral Presentation Award (Third) for the paper 'Effect of carbon dioxide enriched modified atmospheric storage on insect mortality and quality of green gram' in 'International Conference 'Rural livelihood improvement by enhancing farmers' income through sustainable Innovative Agri and allied enterprises (RLISAAe)' organized during 30th October to 1st November, 2018 at BITs, Patna, India.
13.	Er. Dhritiman Saha (Scientist)	Best Poster presentation Award for the paper 'Shelf life study of spray dried groundnut milk powder" in International Conference 'Recent advances in food processing technology' organized during 17th to 19th August, 2018 at Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu, India.

S.No.	Scientist	Award/Recognition
14.	Dr. D. N. Yadav (Principal Scientist)	Member of scientific panel on 'Cereals, Pulses & Legumes and their products (including bakery)', FSSAI, New Delhi, India.
15.	भा.कृ.अनु.प.–सीफेट	संस्थान द्वारा राजभाषा में किये गए उत्कृष्ट कार्य के लिए नगर राजभाषा कार्यान्वयन समिति, लुधियाना, पंजाब के द्वारा 'तृतीय पुरस्कार' प्रदान किया गया।
16.	भा.कृ.अनु.प.–सीफेट	संस्थान द्वारा प्रकाशित राजभाषा पत्रिका 'प्रसंस्करण प्रगति' को नगर राजभाषा कार्यान्वयन समिति, लुधियाना, पंजाब के द्वारा **'राजभाषा पत्रिका पुरस्कार'** प्रदान किया गया।
17.	भा.कृ.अनु.प.–सीफेट	श्री राजकुमार **(राजभाषा अधिकारी)** को नगर राजभाषा कार्यान्वयन समिति, लुधियाना, पंजाब के द्वारा 'प्रमाण पत्र' प्रदान किया गया।

Intellectual Properties (Licensing and Patents)

Technology Licensed

S.No.	Title	Firm	Licensing Fee (Rs.)	Date
1.	Mechanized System for Popping and Decortication of Makhana Seeds	M/s Unitech Technocrats Village Meerpur Gurudwara, Kala Amb (Sirmour)-173030 Himachal Pradesh	150000/-	28 March, 2019

Licensing of Mechanized System for Popping and Decortication of Makhana Seeds to M/S Unitech Technocrats

Patents Granted (2018-19)

S.No.	Title	Patent Number	Date of Grant	Inventors
1.	A New Process for Milling of Millets to Get Refined Powder	299250	26.07.18	Dr. R. K. Vishwakarma Dr. S. K. Nanda Dr. R.T. Patil
2.	Process for Dehulling Guar Seed for Refined Guar Gum Split Production	302861	02.11.18	Dr. R. K. Vishwakarma Dr. S. K. Nanda Dr. U. S. Shivhare
3.	Method of Predicting Maturity Stage and Eating Quality of Mango	309470	19.03.19	Dr. S. N. Jha Dr. K. Narsaiah Dr. Pranita Jaiswal Dr. Ramesh Kumar

Patents Filed (2018-19)

S.No.	Application Number	Title	Date of Filing	Inventors
1.	201811044800	Mechanized System for Removing Stalks of Dry Red Chillies (*Capsicum annum* L.)	28.11.2018	Er. Kirti Jalgaonkar Er. Manoj Mahawar Dr. R. K. Vishwakarma
2.	201911012570	Microbial Method for Production of Protein Isolate/Concentrate from Oilseed Cakes/Meals	29.03.2019	Dr. D. N. Yadav Dr. Sangita Bansal Dr. R. K. Singh Dr. S. N. Jha

Success Stories

Pulse processing

Today, when agrarian crisis is ailing the region and state, a graduate-turned-agriculturist's business model has brought prosperity for Sh. Gurpreet Singh, and savings for number of farmers from Nurpur and adjoining villages of Shaheed Bhagat Singh Nagar district of Punjab.

ICAR-CIPHET made a survey with the help of KVK Langroya, Nawanshahr to identify progressive farmers who grow pulses and have potential to come ahead for pulse processing in the area. Sh. Gurpreet Singh is a farmer with a potential interest in the field of food processing. He was selling his pulses at price of 30-35 Rs/kg to middlemen at local mandi. Technical training and assistance was provided to him and mini dal mill was installed at his Nurpur Village.

After formal training of marketing from ICAR-CIPHET, he registered his brand and got a FSSAI certificate. To promote his sales, he started online selling of his processed pulses and also setup an outlet of his brand. According to Sh. Gurpreet Singh, the value addition has changed the perception of various farmers and attached them under his brand because the farmer which was selling his produce at just 30-35 Rs/kg is now selling the processed dal at around 90-95/kg. Currently, other farmers from neighbouring villages bring quintals of dal to his mill for processing. As per the business model, farmers take some polished dal in lieu of the processing charges and sell through brand 'Kisaan Sauda'. By intervention of ICAR-CIPHET, a young farmer has become a role model for many other farmers who can increase their income by value addition of produce.

Honey processing

Sh. Mohinder Singh of Nawanshahr, Punjab is in honey production for last 10 years. He got the honey processing unit with technical assistance of ICAR-CIPHET Ludhiana. Earlier he was using the conventional method of honey processing in which heating was done by burning fire wood. This led to uncontrolled temperature due to which heating was not uniform and smoke of the fire also affected the quality of the honey, as processed honey had smell of smoke in it. Overheating of honey also caused post-bottle crystallization. The other problem faced by the farmer was marketing of honey due to lack of knowledge and the farmer had only option of selling bulk honey to the processing company at low price of 80-85 Rs/kg.

To tackle the problem, the honey heating cum filtration unit, which was developed under AICRP-PHET scheme was given to the farmer. This is fully mechanized honey processing unit with complete temperature control system. The quality of the honey is improved by using this unit due to uniform and controlled heating at optimum temperature range of 55-65 °C. Honey is completely processed into pure form with high quality standards. Sh. Mohinder Singh has now also started the bottling of the honey for commercial purpose and selling the processed honey at 180-200 Rs/kg. By intervention of ICAR-CIPHET, a local farmer has turned into an entrepreneur.

Infrastructure Development (2018-19)

Work	Campus
Renovation of Workshop Building	Ludhiana
Renovation of Biotechnology and Biochemical Engineering Laboratory	Ludhiana
Renovation of Bioprocess Engineering Laboratory	Ludhiana
Repair of Guest House	Ludhiana
Minor Works in Administrative Corridor (Ground Floor)	Ludhiana
Installation of Solar Lights	Ludhiana
Repair of Type-V Quarters	Ludhiana
Plasticulture Park	Ludhiana
Naturally Ventilated Polyhouse	Ludhiana
Shade-net Structure for Seasonal Vegetable Production	Ludhiana
Plastic-lined Pond for Multiple Use of Water from Water Harvesting	Ludhiana
Replacement of Electric Supply Line of Divisional Building	Ludhiana
Renovation of Workshop Building	Abohar
Repair of Type-IV Quarters	Abohar
Repair and Distempering of Guest House	Abohar
Repair of One Block of Type-IV Quarters	Abohar

Renovated Biotechnology and Biochemical Engineering Laboratory at ICAR-CIPHET, Ludhiana

Post-Harvest Machinery and Equipment Testing Centre (PHMETC)

Post-Harvest Machinery and Equipment Testing Centre (PHMETC), ICAR-CIPHET, Ludhiana has tested 25 machines during 2018-19 and has received a total of Rupees Twenty Nine Lakh Seventy Five Thousand Nine Hundred Ninety (Rs. 29,75,990) towards testing fee.

Sr.No.	Machine Name	Manufacturer	Test Report No.	Testing Fee (Rs.)
1.	Mini Rice Mill	MG Industries, GT Road, Batala	PHMETC/CIPHET-11/21/2018	114070.00
2.	Seed Grader (Fine Cleaner)	Radiant Equipment Company, Ambala	PHMETC/CIPHET-12/22/2018	107470.00
3.	Arecanut Dehusker I-2	Idea Engineers, Channagiri, Davangere	PHMETC/CIPHET-13/23/2018	100870.00
4.	Arecanut Dehusker I-4	Idea Engineers, Channagiri, Davangere	PHMETC/CIPHET-14/24/2018	100870.00
5.	Arecanut Dehusker I-6	Idea Engineers, Channagiri, Davangere	PHMETC/CIPHET -15/25/2018	100870.00
6.	Oil Mill-Eco	Andavar Lathe Works, Erode, TN	PHMETC/CIPHET-16/26/2018	144100.00
7.	Oil Mill-Woodking	Andavar Lathe Works, Erode, TN	PHMETC/CIPHET-17/27/2018	144100.00
8.	Oil Mill-K-Series	Andavar Lathe Works, Erode, TN	PHMETC/CIPHET-18/28/2018	144100.00
9.	Mini Rice Mill	Bhoomi Agro Industries, Rajkot, Gujrat	PHMETC/CIPHET-19/29/2018	114070.00
10.	Mini Oil Expeller	Chetan Agro Industries, Rajkot (Gujrat)	PHMETC/CIPHET-20/30/2018	144100.00
11.	Sugarcane Crusher	Bhagavati Engineering Works, Rajkot, Gujrat	PHMETC/CIPHET-21/31/2018	107470.00
12.	Mini Rice Mill	Maruti Engineering Works, Davangere, (Karnataka)	PHMETC/CIPHET-01/32/2019	114070.00
13.	Mini Flour Mill	Maruti Engineering Works, Davangere, (Karnataka)	PHMETC/CIPHET-02/33/2019	54670.00
14.	Mini Oil Mill (2 hp)	Maruti Engineering Works, Davangere, (Karnataka)	PHMETC/CIPHET-03/34/2019	317020.00
15.	Mini Oil Mill (1 hp)	Maruti Engineering Works, Davangere, (Karnataka)	PHMETC/CIPHET-04/35/2019	201740.00
16.	Mini Rice Mill (Dehusker)	Bharat Agro Engineering,	PHMETC/CIPHET-05/36/2019	103700.00
17.	Mini Rice Mill (Dehusker)	Kabadi Agro Industries,	PHMETC/CIPHET-06/37/2019	114070.00
18.	Mini Rice Mill (Dehusker)	Central Industries	PHMETC/CIPHET-07/38/2019	103700.00

Sr.No.	Machine Name	Manufacturer	Test Report No.	Testing Fee (Rs.)
19.	Flour Mill (18 inch-Horizontal Type)	Kabadi Agro Industries,	PHMETC/CIPHET-08/39/2019	107470.00
20.	Flour Mill (14 inch-Vertical Type)	Kabadi Agro Industries,	PHMETC/CIPHET-09/40/2019	54670.00
21.	Flour Mill (16 inch-Vertical Type)	Kabadi Agro Industries,	PHMETC/CIPHET-10/41/2019	107470.00
22.	Flour Mill (18 inch-Vertical Type)	Kabadi Agro Industries,	PHMETC/CIPHET-11/42/2019	107470.00
23.	Rawa Machine	Kabadi Agro Industries,	PHMETC/CIPHET-12/43/2019	107470.00
24.	Dalia/Rawa Machine (Steel Plate Type)	Kabadi Agro Industries,	PHMETC/CIPHET-13/44/2019	107470.00
25.	Vermicelli/Sevai Machine	Kabadi Agro Industries,	PHMETC/CIPHET-14/45/2019	52910.00

Annual Workshop of AICRPs

All India Coordinated Research Project (AICRP) on Plasticulture Engineering & Technology

The XIV Annual Workshop of All India Coordinated Research Project (AICRP) on Plasticulture Engineering & Technology (PET) was held at ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan during December 18-19, 2018. Dr. R. S. Rawal, Director, GBPNIHESD was the chief guest of function. Dr. Pitam Chandra, Ex Director, ICAR-CIAE, Bhopal, Dr. Ashwani Kumar, Ex Director, ICAR-IIWM, Bhubaneswar and Dr. Awani Kumar Singh, Principal Scientist, ICAR-IARI, New Delhi were the experts for the workshop.

In the workshop, total 19 new research projects were discussed out of which 14 were approved with major or minor modifications and 5 were not approved. The progress of 48 ongoing research programmes was also critically reviewed and inputs were given to improve quality of intended output. Valedictory and felicitation programme was chaired by Dr. Patnaik, Director VPKAS. Best Centre Award was given to PAU, Ludhiana centre while researchers from Junagadh and CAEPHET, Gangtok centre received Best Innovation-RE and Best Extension Worker awards, respectively.

All India Coordinated Research Project (AICRP) on Post-harvest Engineering and Technology

The XXXIV Annual workshop of AICRP-PHET was held during 12-15 March 2019 at TNAU, Coimbatore, TamilNadu to review the progress of the Projects. Dr. K. Alagusundaram, DDG (Agriculture Engineering) was the Chairman of this workshop. Dr. S. N. Jha ADG (PE) and Dr. S. K. Tyagi, I/c, PC-PHET, Dr. S. M. Ilyas, Dr. B. S. Bisht, Dr. B. Ranganna and Dr. K. P. Sudheer were the expert members.

During 2018-19, about 52 post-harvest tools/equipment/structures, 49 process protocols/products were developed. In addition 25 agro process centres were established. Further, 01 patent was granted and 07 patents were filed. In this workshop, around 242 research projects were discussed. Out of 80 new research proposals, 53 projects were approved. Dr. YSPUHF, Solan received Best Centre Award of the Year 2018-19. CAU, Imphal and UAS, Bangalore received first and second runner up of Best Centre Award of the Year 2018-19, respectively.

HRD Programmes Organized

S.No.	Programme Title	Type	Number of Participants
1.	Advancements in Post-Harvest Management of Legumes for Minimizing Losses and Sustainable Protein Availability (04-25 July, 2018)	Summer School	19
2.	Emerging Post-harvest Engineering and Technological Interventions for Enhancing Farmers Income (04-24 September, 2018)	Summer School	14
3.	Recent Engineering Interventions in Food and By-Product Processing for Sustainable Growth and Profitability (5-25 October, 2018)	Winter School	16
4.	Processing Value Addition and Entrepreneurship Development in Post-Harvest Sector (14-21 January, 2019)	Officer's Training/ Model Training Course	18
5.	Preparation of Biscuits and Muffins from Barnyard Millet (20-21 August, 2018)	Entrepreneurship Development Program	1
6.	Drying of Apple Slices (25-26 March, 2019)	Entrepreneurship Development Program	3
7.	Oat Processing and Value Addition (18-19 January, 2019)	Entrepreneurship Development Program	1
8.	Nutritive Flour and Health Foods (22-26 October, 2018)	Entrepreneurship Development Program	12
9.	Nutritive Flour and Health Foods (29 October-02 November, 2018)	Entrepreneurship Development Program	12
10.	Meat Processing and Value Addition (20-22 September, 2018)	Entrepreneurship Development Program	5
11.	Packaging of Fresh and Processed Food Products (26-28 November, 2018)	Entrepreneurship Development Program	9
12.	Milling of Grains, Pulses and Spices (13-14 September, 2018	Entrepreneurship Development Program	4
13.	Fruit and Vegetable Processing (08-12 May, 2018)	Entrepreneurship Development Program	2
14.	Processing of Mango and Apple for Value Addition (05-07 June, 2018)	Entrepreneurship Development Program	3
15.	Jamun Processing (09-11 July, 2018)	Entrepreneurship Development Program	3
16.	Tomato Processing and Value Addition (18-20 July, 2018)	Entrepreneurship Development Program	4
17.	Construction of Low-cost Polyhouse Structures for Production and Drying of Horticultural Crops (22-25 October, 2018)	Entrepreneurship Development Program	12
18.	Application of Mulching Technology in Production of Horticultural Crops (03-06 December, 2018)	Entrepreneurship Development Program	13

S.No.	Training Title	Type	Number of Participants
19.	Processing of Green Chilli (12-14 March, 2019)	Entrepreneurship Development Program	5
20.	Groundnut/Soybean Processing (24-25 April, 2018)	Entrepreneurship Development Program	05
21.	Farmers Awareness Programme on Dal Milling (01 September, 2018)	ABI Centre Programme	25
22.	Groundnut/Soybean Processing (15 January, 2019)	Entrepreneurship Development Program	01
23.	Awareness cum training program on Groundnut/ Soybean Processing (16-17 January, 2019)	ABI Centre Programme	30
24.	Post-Harvest Management of Agricultural Produce (07-11 January, 2019)	Farmer's Training	25
25.	Processing and Value Addition of Cereal, Pulses and Oilseed Crops (25 February-01 March, 2019)	Farmer's Training	25
26.	Post-Harvest Management of Agricultural Produce (26-28 September, 2018)	Farmer's Training	30
27.	Post-Harvest Management of Agricultural Produce (01-03 October, 2018)	Farmer's Training	30
28.	Food Processing and Value Addition (18-22 Feb, 2018)	Farmer's Training	25
29.	Post-Harvest Management of Fruits, Vegetables and Grains (29-31 October, 2018)	Farmer's Training	30
30.	Post-Harvest Management of Fruits, Vegetables and Grains (11-15 March, 2019)	Farmer's Training	25
31.	Post-Harvest Management of Agricultural Produce (12-14 March, 2019)	Farmer's Training	15
32.	Operation of Makhana Processing Machines (26-28 December, 2019)	Farmer's Training	05
33.	Workshop cum training on Agri-business Opportunities for budding women entrepreneurs at Pratap Singh Wala, Ludhiana (16 November, 2018)	ABI Centre Programme	31
34.	Workshop cum training on Agri-business Opportunities for budding women entrepreneurs at RSETI, Ayali Khurd Ludhiana (17 November, 2018)	ABI Centre Programme	28
35.	Students Training (throughout year)	1 months	100
36.	Students Training (throughout year)	1-3 months	30
37.	Students Training (throughout year)	4 months	32

- Total 648 Participants have been trained for Post-harvest Management of Agricultural and Livestock Produce

Farmers Training Programmes

Five days training on 'Post-Harvest Management of Agricultural Produce'. It was sponsored by Project Director, ATMA, Jalgaon, Maharashtra (07-11 January, 2019).

Five days training on 'Processing & Value Addition of Cereal, Pulses and Oilseed Crops'. It was sponsored by Project Director, ATMA, Nanded, Maharashtra (25 February to 01 March, 2019)

Five days training on 'Post-Harvest Management of Fruits, Vegetables and Grains'. It was sponsored by Project Director, ATMA, Dhule, Maharashtra (11-15 March, 2019)

Summer/Winter Schools & Model Training Courses

ICAR-CIPHET Ludhiana organized an ICAR sponsored 21 days Summer School on 'Advancements in postharvest management of legumes for minimizing losses and sustainable protein availability', during 5- 25 July, 2018. Inaugural session was chaired by Dr BS Dhillon, VC, PAU, Ludhiana. 19 participants across the country joined this summer school successfully.

The Valedictory function of this summer school was held on July 25th, 2018 under the able guidance of ADG (PE) Dr SN Jha as Chief Guest and Dr RK Singh, Director, ICAR-CIPHET. The Chief Guest Dr Jha, emphasized to extend every possible efforts by the scientific community to save the legumes and other food grains from quantitative and qualitative losses by following appropriate scientific post-harvest management practices for production, handling, storage, processing and value addition.

A 21 days Summer School on "Emerging Post-Harvest Engineering and Technological Interventions for Enhancing Farmer's Income during October 04-24 September, 2018 was organized.

India has now attained the phase where apart from improved production of good crops, emphasis is being laid on processing and their by-product utilization. In view of above, ICAR-CIPHET, Ludhiana organized an ICAR sponsored 21 days Winter School on "Recent engineering interventions in food and by-product processing for sustainable growth and profitability' during October 05-25 October, 2018. Inaugural session was chaired by Dr Ramesh Kanwar, Hon'ble VC, LPU, Phagwara. During this inaugural session, a compendium of this winter school was released by the Chief Guest, which highlighted the global scenario of the status of agricultural processing and by-product utilization in particular.

Model Training Course

Eighteen state government agriculture extension officers from seven different states (Haryana, Jammu and Kashmir, Maharashtra, Punjab, Chhattisgarh, Uttar Pradesh, and Arunachal Pradesh) were given 8 days training on 'Processing Value Addition and Entrepreneurship Development in Post-Harvest Sector'. It was sponsored by Directorate of Extension (DOE), Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi (14-21 January, 2019).

Entrepreneurship Development Programme (EDP)

A three day Entrepreneurship Development Programme (EDP) on 'Meat Processing and Value Addition' was conducted from 20-22 September, 2018. This programme was aimed to impart hands on training to the budding entrepreneurs in meat processing and related aspects of food safety, packaging and quality control. Special emphasis was given to train the candidates in development of novel meat products like low-fat and high-fibre meat snacks. Dr RK Singh, Director, ICAR-CIPHET, presented the certificates to the participants in valedictory session and laid emphasis on the need of nurturing such meat processing start-ups. A compendium on Meat Processing and Value Addition was released in the session.

A 3- day Entrepreneurial Development Programme on 'Packaging of fresh and processed food products' from November 26-28, 2018 to train aspiring entrepreneurs in packaging technologies for fresh and processed food commodities. Special emphasis was given to train the participants in packaging of perishable food commodities, dairy products and spices. Speaking in the valedictory session, Dr. R. K. Singh, Director ICAR-CIPHET, acquainted the participants about the entrepreneurial opportunities in food processing sector. Dr. R. K. Singh, Director, ICAR-CIPHET, presented the certificates to the participants in valedictory session. A compendium on 'Packaging of fresh and processed food products' was also released in the session.

Krishi Vigyan Kendra (KVK) ICAR-CIPHET, Abohar

Trainings, Farmers Scientists Interface, and Awareness Camp Organized

Sr. No.	Title	Duration	Number of Participants
1.	Training on Food Processing (09-29 April, 2018)	21 Days	18
2.	District Level Training of ADOs of Fazilka (04 July, 2018)	1 Day	35
3.	Training on Bee Keeping (09-13 July, 2018)	5 Days	34
4.	Training on Fruit and Food Processing (10-16 July, 2018)	7 Days	19
5.	Training on Fruit and Vegetable Processing (3-7 December, 2018)	5 Days	26
6.	Training on Bee Keeping (7-11 January, 2019)	5 Days	25
7.	Demonstration of PHT Equipment and Machinery (11 January, 2019)	1 Day	12
8.	Storage and Marketing of Agricultural Commodities in collaboration with National Institute of Agricultural Marketing, Jaipur and WDRA (24 January, 2019)	1 Day	17
9.	Scientific Advisory Committee Meeting (08 February, 2019)	1 Day	25
10.	In-situ Crop Residue Management (04 July, 2018)	1 Day	30
11.	In-situ Crop Residue Management (11-15 September, 2018)	5 Days	25
12.	In-situ Crop Residue Management Scientist and Farmers Interaction Meet in Village Kera Khera (29 August, 2018)	1 Day	200
13.	In-situ Crop Residue Management Scientist and Farmers Interaction Meet in Village Dharanghwala (01 September, 2018)	1 Day	300
14.	In-situ Crop Residue Management Scientist and Farmers Interaction Meet in Village Mammukhera (24 October, 2018)	1 Day	200
15.	In-situ Crop Residue Management Awareness Camp at Maya Devi Sr. Sec. School, Kera Khera (25 August, 2018)	1 Day	310
16.	In-situ Crop Residue Management Awareness Camp at Govt. Model School, Dharanghwala (30 August, 2018)	1 Day	200
17.	In-situ Crop Residue Management Awareness Camp at Guru Nanak Khalsa College, Abohar (05 September, 2018)	1 Day	200
18.	In-situ Crop Residue Management Awareness Meeting and demonstration on machine (Happy Seeder and Cutter cum Spreader) at Kera Khera (29 September, 2018)	1 Day	20

Training on food processing organized by Krishi Vigyan Kendra, ICAR-CIPHET, Abohar

Crop Residue Management Awareness by Krishi Vigyan Kendra, ICAR-CIPHET, Abohar

In-situ Crop Residue Management Scientist and Farmers Interaction Meet Organized by Krishi Vigyan Kendra, ICAR-CIPHET, Abohar

Mera Gaon Mera Gaurav (My Village My Pride)

ICAR-CIPHET, Ludhiana has actively participated in the Mera Gaon Mera Gaurav (My Village My Pride) Scheme of Government of India by forming ten teams from both of its campuses.

Summary

Teams	Scientists	Villages Adopted	Blocks Covered	Districts Covered	Bench Mark Survey Conducted (Number of Villages)
10	37	45	6	5	19

Activities

S. No.	Activity	Number	Number of Farmers Participated
1.	Visit to village by teams	10	250
2.	Interface meeting/ *Goshthies*	10	210
3.	Trainings conducted	-	-
4.	Mobile based advisories	1	25
5.	Literature support provided	17	250
6.	Awareness created	40	275
7.	Linkages developed with other agencies	2	100

Team of ICAR-CIPHET visited villages under Mera Gaon Mera Gaurav scheme

Team of ICAR-CIPHET visited villages under Mera Gaon Mera Gaurav scheme

AICRP on PET, ICAR-CIPHET Abohar constructed four low-cost polyhouse structures (floor area 60 m^2) at farmers' fields in the village of Amarpura and Kala Tibba

- Team of ICAR-CIPHET visited the farm of a vegetable grower Sh. Aman Ahuja, Khubban village, Fazilka. Sh. Aman Ahuja grows different vegetables which include cauliflower, cabbage, bitter gourd, onion, garlic, some leafy vegetables in more than 30 acres of land. He uses organic mulch, plastic mulch and drip irrigation for vegetable production. Problems associated with adoption of plastic mulching technology in hot and arid region were understood through the experience of this vegetable grower.

- Team of ICAR-CIPHET visited the farm of a watermelon grower Sh. Sukhjeet Singh, Santpura village, Hanumangarh. Sh. Sukhjeet Singh grows watermelons in 22 acres of land using plastic mulch and drip irrigation. He was advised about disposing of the plastic waste generated after crop mulching.

- One of the participants has received 'First prize' for the successful demonstration of the Aonla products in the Kisan Mela organized by Punjab Agricultural University (PAU), Ludhiana (23-24 March, 2018)

- A three days EDP on 'Aonla Processing and Value addition' was organized under CRP on Secondary Agriculture (08-10 February, 2018).

Swachh Bharat Abhiyan

Various activities such as digitization of office records, disposal of old files and items, auction of obsolete/unserviceable items/equipment, beautification of the institute campus, and displaying banner showing importance of swachhta has been successfully performed under the 'Swachh Bharat Abhiyan'. 'Swachhta pledge' was taken by all the employees followed by intensive cleanliness activity in and around the campus.

Swachhta Hi Sewa (15th September-2nd October, 2018)

All the staff of ICAR-CIPHET, Ludhiana and Abohar participated in "Swachhta Hi Sewa" mission. The cleanliness activities in the campus as well as outside the campus were organized during this mission. The cleanliness drive was undertaken at nearby goushalas like Govind Goudham, New Kitchlu Nagar.

Live telecast of Pradhan Mantri Kisan Samman Nidhi Scheme

Sr.No.	Name of the State	Total number of farmers viewed the programme	Total Number of public representatives/invited officers
1	ICAR-CIPHET, Ludhiana Punjab	110	10

HRD Programmes Attended

HRD Budget Utilization in 2018-19

Allocated Budget (Rs. in Lakhs)	Budget Utilized (Rs. in Lakhs)
2.0	1.99

ICAR-CIPHET employees attended following programmes during 2018-19

Scientific staff

S.No.	Scientist	Participation	Venue
1.	Dr. R. K. Singh Director	Right to Information for Appellate Authorities (16 November, 2018)	ISTM, New Delhi
2.	Dr. A. U. Muzaddadi	Hands on Training on Functioning of Real Time PCR (17-18 July, 2018)	BHU, Varanasi
3.	Dr. Ajinath Dukare	CAFT program on Advances in Biological Control of Plant Diseases (24 May-13 June, 2018)	ICAR-IARI, New Delhi
4.	Dr. Bibwe Bhushan	CAFT program on Synergistic Approaches for Bioprocessing of Foods and By-Products for Nutritional and Industrial Use (31 August - 20 September, 2018)	ICAR-CIAE, Bhopal
5.	Dr. K. Bembem	Winter School on Technological Advances to Minimize Wastage of Horticultural Produce (1-21 November, 2018)	Punjab Agricultural University, Ludhiana
6.	Dr. P. K. Kannaujia	Summer School on Recent Developments in Organic Vegetable Production System Under Changing Climate Scenario (24 July -13 August, 2018)	SKUAST, Srinagar, Jammu & Kashmir
7.	Dr. P. N. Guru	Professional Attachment Training (12 November, 2018 to 12 February, 2019)	ICAR-National Bureau of Agricultural Insect Resources, Bengaluru
8.	Dr. Pankaj Kumar	Tool and Techniques for Quality Environment and Safety Professionals (19-20 September, 2018)	National Productivity Council, Chennai
9.	Dr. Poonam Chaudhary	Laboratory Quality System Management and Internal Audit as Per ISO/IEC 17025:2017 (23-27 July, 2018)	NIPHM, Hyderabad
10.	Dr. Renu Balakrishnan	Winter School on Farmer Empowerment through Entrepreneurial Ventures (1-21 February, 2019)	Punjab Agricultural University, Ludhiana
11.	Dr. Sandeep Mann	Training on Role of Technology in Community Level Disaster Mitigation (20-24 August, 2018)	Lal Bahadur Sashtri National Academy of Administration, Mussoorie, Uttrakhand
12.	Er. Chandan Solanki	Soft Computing Tools for Applications in Food and Agricultural Processing (01-21 August, 2018)	ICAR-CIAE, Bhopal

Technical Staff

S.No.	Employee	Participation	Venue
1.	Sh. Jagtar Singh	Repair, Maintenance of Motor and Submersible Pumps for Agricultural Use (14 January -February 4, 2019)	CFMTTI, Budni
2.	Sh. Beant Singh	Automobile Maintenance, Road Safety and Behavioural Skill (16-22 January, 2019)	ICAR-CIAE, Bhopal

Administrative Staff

S.No.	Employee	Participation	Venue
1.	Sh. Raj Kumar	Orientation Training Programme for Retiring Officials (10-11 September, 2018)	ISTM, New Delhi
2.	Sh. Ashwani Kumar	Workshop on Goods and Services Tax (GST) (11-12 March, 2019)	ISTM, New Delhi.
3.	Sh. Pawan Kumar	Workshop on Goods and Services Tax (GST) (11-12 March, 2019)	ISTM, New Delhi.

Participation in Conferences/Symposia/ Workshops/Meetings

S.No.	Scientist	Participation	Venue
1.	Dr. A. U. Muzaddadi	31st All India Congress of Zoology and National Seminar on Climate Smart Aquaculture and Fisheries (15-16 January, 2019)	College of Fisheries, CAU (I), Tripura
2.	Dr. Ajinath Dukare	1st International Conference on Climate Change and Adoptive Crop Protection for Sustainable Agri-Horticulture Landscape (20-22 December, 2018)	ICAR-NRC Seed Spices, Ajmer, Rajasthan
3.	Dr. B. M. Ghodki	International Conference on Technological Innovation for Integration of Food and Health: A Focus on North-Eastern India (TiiFH-2019) (14-16 February, 2019)	Tezpur University, Tezpur, Assam
4.	Dr. Bhushan Bibwe	Board of Management Meeting as a member academician-Food Processing and Preservation (25 March, 2019)	Gopichand Arya Mahila community College, Abohar, Punjab
5.	Dr. Bibwe Bhushan	53rd Annual Convention of ISAE and International symposium on Engineering Technologies for Precision and Climate Smart Agriculture (28-30 January, 2019)	Banaras Hindu University, Varanasi, Uttar Pradesh
6.	Dr. Mridula D.	Meeting of FADC Committee (13 June, 2018)	NASC Complex, New Delhi
7.	Dr. Mridula D.	Meeting of FAD-28 Committee (30 January, 2019)	Manak Bhawan, BIS, New Delhi
8.	Dr. Mridula D.	Meeting of FADC Committee (8 March, 2019)	Krishi Bhawan, New Delhi
9.	Dr. Mridula D.	8th International Food Convention (IFCON) on Holistic approaches for Start-ups, Human Resource Training for Agriculture and Food Industry Gemmation (HASTAG) (12-15 December, 2018)	CSIR-CFTRI, Mysuru
10.	Dr. K. Bembem	A multi tract National Conference SLIETCON -2019 (1-2 March, 2019)	National Institute of Technical Teacher's Training and Research (NITTTR), Chandigarh
11.	Dr. Kirti Jalgaonkar	International Conference on Food security, Nutrition and Sustainable Agriculture-merging Technology (14-16 February, 2019)	Baba Farid College, Department of Agriculture, Bathinda, Punjab
12.	Dr. Manju Bala	International Conference on Food Security: Challenges and Opportunities (07-08 December, 2018)	Thapar Institute of Engineering and Technology, Patiala, Punjab

S.No.	Scientist	Participation	Venue
13.	Dr. Manju Bala	One day workshop on J-Gate @ CeRA regional Ambassador Training Programme (27 August, 2018)	Mohinder Singh Randhawa Library, PAU, Ludhiana
14.	Dr. Pankaj Kumar	53rd Annual Convention of ISAE and International symposium on Engineering Technologies for Precision and Climate Smart Agriculture (28-30 January, 2019)	Banaras Hindu University, Varanasi, Uttar Pradesh
15.	Dr. P. K. Kannaujia	Indian Horticulture Congress on Shaping future of Indian Horticulture (17-21 January, 2019)	Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh
16.	Dr. Poonam Choudhary	International Conference on Food Security: Challenges and Opportunities (07-08 December, 2018)	Thapar Institute of Engineering and Technology, Patiala, Punjab
17.	Dr. Prerna Nath	13th International Conference on Development of Drylands: Converting Dryland Areas from Grey into Green (11-14 February, 2019)	ICAR-CAZRI, Jodhpur, Rajasthan
18.	Dr. R. K. Singh	International Conference on Rural Livelihood Improvement for Enhancing Farmers' Income Through Sustainable Innovative Agri and Allied Enterprises (30 October to 1 November, 2018)	Birla Institute of Technology, Patna, Bihar
19.	Dr. Renu Balakrishnan	3rd National Workshop of Nodal Officers on ICAR Research Data Repository for Knowledge Management (KRISHI) (04-05 Deember, 2018)	ICAR-IASRI, New Delhi
20.	Dr. Renu Balakrishnan	National Workshop on Horti-Produce Transport in India-Present Status and Issues for Reduction in Post-harvest Losses (27 December, 2018)	NASC Complex, New Delhi
21.	Dr. Renu Balakrishnan	Zonal Review Workshop of Farmer First Programme (9-10 February, 2019)	ICAR-ATARI, Ludhiana
22.	Dr. Renu Balakrishnan	Review Workshop of Cluster Frontline Demonstration of Pulses and Oilseeds for KVK's of Punjab (9 February, 2019)	ICAR-ATARI, Ludhiana
23.	Dr. Renu Balakrishnan	Punjab Agri- and Food Conclave (16 May, 2018)	Punjab Agricultural University (PAU), Ludhiana
24.	Dr. Sakharam Kale	13th International Conference on Development of Drylands: Converting Dryland Areas from Grey into Green (11-14 February, 2019)	ICAR-CAZRI, Jodhpur, Rajasthan
25.	Dr. Sakharam Kale	National Workshop on Horti-produce Transport in India- Present Status and Issues for Reduction in Post-harvest Losses (8 January, 2019)	NASC Complex, New Delhi
26.	Dr. Sandeep Mann	IUFoST World Congress of Food Science and Technology (24-27 October, 2018)	Cidco Exhibition Centre, Vasi, Mumbai
27.	Dr. Sandeep Mann	3rd National Workshop of Nodal Officers on ICAR Research Data Repository for Knowledge Management (KRISHI) (04-05 December, 2018)	ICAR-IASRI, New Delhi
28.	Dr. Sandeep Mann	Punjab Agri- and Food Conclave (16 May, 2018)	Punjab Agricultural University (PAU), Ludhiana
29.	Dr. Sunil Kumar	International Conference on Technological Innovation for Integration of Food and Health: A Focus on North-Eastern India (TiiFH-2019) (14-16 February, 2019)	Tezpur University, Tezpur, Assam

S.No.	Scientist	Participation	Venue
30.	Dr. Sunil Kumar	International Conference on Climate Change Towards Health and Agricultural Sustainability (CCHAS-2019) (18-20 February, 2019)	Guru Jambheshwar University of Science and Technology, Hisar, Haryana
31.	Dr. Swati Sethi	8th International Food Convention (IFCON) on Holistic approaches for Start-ups, Human Resource Training for Agriculture and Food Industry Gemmation (HASTAG) (12-15 December, 2018)	CSIR-CFTRI, Mysuru
32.	Dr. Tanbir Ahmad	International Conference on Rural Livelihood Improvement for Enhancing Farmers' Income Through Sustainable Innovative Agri and Allied Enterprises (30 October to 1 November, 2018)	Birla Institute of Technology, Patna, Bihar
33.	Dr. Th. Bidyalakshmi Devi	National Workshop on Artificial Intelligence (AI) in Agriculture: Status and Challenges (30-31 July, 2018)	NASC Complex, New Delhi
34.	Dr. Th. Bidyalakshmi Devi	53rd Annual Convention of ISAE and International symposium on Engineering Technologies for Precision and Climate Smart Agriculture (28-30 January, 2019)	Banaras Hindu University, Varanasi, Uttar Pradesh
35.	Dr. Yogesh Kumar	International Conference on Rural Livelihood Improvement for Enhancing Farmers' Income Through Sustainable Innovative Agri and Allied Enterprises (30 October to 1 November, 2018)	Birla Institute of Technology, Patna, Bihar
36.	Er. A. A. Bashir	International Conference on Rural Livelihood Improvement for Enhancing Farmers' Income Through Sustainable Innovative Agri and Allied Enterprises (30 October to 1 November, 2018)	Birla Institute of Technology, Patna, Bihar
37.	Er. Dhritiman Saha	International Conference on Food Security: Challenges and Opportunities (07-08 December, 2018)	Thapar Institute of Engineering and Technology, Patiala, Punjab
38.	Er. Dhritiman Saha	International Conference on Recent Advances in Food Processing Technology (17-19 August, 2018)	Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu,
39.	Er. Yogesh Kalnar	Punjab Agri- and Food Conclave (16 May, 2018)	Punjab Agricultural University (PAU), Ludhiana
40.	Er. Yogesh Kalnar	Zonal Review Workshop of Farmer First Programme (9-10 February, 2019)	ICAR-ATARI, Ludhiana
41.	Er. Yogesh Kalnar	53rd Annual Convention of ISAE and International symposium on Engineering Technologies for Precision and Climate Smart Agriculture (28-30 January, 2019)	Banaras Hindu University, Varanasi, Uttar Pradesh
42.	Er. Yogesh Kalnar	National Workshop on Artificial Intelligence (AI) in Agriculture: Status and Challenges (30-31 July, 2018)	NASC Complex, New Delhi
43.	Er. Yogesh Kalnar	Workshop on Impact Assessment of Farmer First Programme (13-14 February, 2019)	CSSRI, Karnal
44.	Er. Yogesh Kalnar	Punjab Agri and Food Conclave (16 May, 2018)	Punjab Agricultural University, Ludhiana, Punjab
45.	Smt. Surya Tushir	International Conference on Food Security: Challenges and Opportunities (07-08 December, 2018)	Thapar Institute of Engineering and Technology, Patiala, Punjab

Participation in Exhibitions/Mela

Sr. No.	Exhibition/ Mela	Venue
1.	Rural Entrepreneurship and Innovation-Convention and Exhibition (10-11 April, 2018)	Government Mohindra College, Patiala, Punjab
2.	Kisan Mela (20-22 September, 2018)	PAU, Ludhiana
3.	Krishi Kumbh (26-28 October, 2018)	ICAR-IISR, Lucknow
4.	Food Industry and Craft Mela (30 October, 2018)	PAU, Ludhiana
5.	13th Edition of Agro Tech India, 2018 (01-04 December, 2018)	Parade Ground, Sector 17, Chandigarh
6.	National Eat Right Mela along with the National Street Food Festival (14-16 December, 2018)	IGNCA, New Delhi
7.	106th Session of the Indian Science Congress, 2019 (03-07 January, 2019)	LPU, Phagwara (Punjab)
8.	14th Science Congress (20-23 February, 2019)	IARI, New Delhi
9.	Coastal Agriculture Expo, 2019 (02-04 March, 2019)	ICAR-CCARI, Old Goa
10.	Kisan Mela (15-16 March, 2019)	PAU, Ludhiana

Agri-Expo and Mega Farmers Meet in Krishi Kumbh at ICAR-IISR, Lucknow during 26-28 October, 2018

Major Events Organized

Vigilance Awareness Week (October 29-November 3, 2018)

ICAR-CIPHET, Ludhiana and Abohar have organized various programs/activities under 'Vigilance Awareness Week-2018' during Oct 29- Nov 3, 2018. Activities such as e-pledge and pledge taking ceremony by the officers and officials of the Institute were held as per the guidelines of Government of India. A debate competition on "Corruption free India: An utopian dream or a possible vision" was organized by the Institute. In addition, a number of vigilance related posters were displayed at various places of ICAR-CIPHET, Ludhiana and Abohar Campus. A sensitization lecture on "Corruption free India" was delivered by Dr. Ramesh Kumar, I/c Head, ICAR-CIPHET, Abohar to the students of Government Senior Secondary School, Abohar. Dr. Ashok Kumar, Assistant Director of Research, PAU, Ludhiana gave the lecture on 'Possible ways of combating corruption in society'. The week concluded with the presentation of awards to the winners of various competitions held during the week. Dr. R. K. Singh, Director, ICAR-CIPHET, Ludhiana urged the employees of ICAR-CIPHET to be honest and vigilant for a corruption free working environment and society.

National Productivity Week (12-18th February, 2019)

National Productivity Week (NPW) was celebrated at the Institute with the theme 'Circular Economy for Productivity and Sustainability in Agriculture'. A number of events were organized during this programme including slogan competition, poster competition and a motivational lecture by the Guest Speaker Dr. Sagar Kashyap, Professional Consultant and Motivational Speaker, Join 4 Smile group, Ludhiana. All the scientific, technical and administrative employees of the institute have actively participated in the events and celebrated the week with enthusiasm. The week concluded with the presentation of awards to the winners of various competitions held during the week.

International Day of Yoga (21st June, 2018)

ICAR-CIPHET, Ludhiana celebrated fourth "International Day of Yoga" on 21st June, 2018 as per the directives of Ministry of AYUSH, Government of India. More than 70 participants attended the event in the playground of the institute campus. Dr. Shiv Kumar Sharma, MD (A.M.) from Bharat Vikas Parishad conducted the morning yoga session as an expert yoga teacher. Employees of ICAR-CIPHET, their family members, training students as well as people from nearby areas actively participated in the event and performed various yoga asana as demonstrated by the yoga expert. Dr. Sharma described the positive effects of each asana on human body or body parts. He also highlighted the role of yoga in overall development of humans. The participants were motivated towards adapting a healthy lifestyle by good food habits as well as physical fitness.

Mahila Kisan Diwas (15 October, 2018)

ICAR-CIPHET organized the 'Mahila Kisan Diwas' on 15.10.2018. A debate competition was organized on this occasion. ICAR-CIPHET honoured Smt. Gurdev Kaur Deol, a progressive Mahila Kisan, to promote the participation of women in the farming and entrepreneurship activities. The day concluded with the presentation of certificate and cash awards to the winners of debate competition.

हिन्दी पखवाड़ा (14–28 सितम्बर, 2018)

भाकृअनुप–केन्द्रीय कटाई–उपरान्त अभियांत्रिकी एवं प्रौद्योगिकी संस्थान (सीफेट), लुधियाना में हिंदी पखवाड़े (14–28 सितम्बर, 2018) का आयोजन किया गया। मुख्य अतिथि अपर उपायुक्त, जगरावं, डॉ नीरू कटयाल गुप्ता ने दीप प्रज्वलन कर विधिवत् रूप से कार्यक्रम का उद्घाटन किया। इस अवसर पर वैज्ञानिक एवं स्टाफ सदस्यों को सम्बोधित करते हुए उन्होनें हिन्दी के प्रचार–प्रसार के लिए दिनचर्या में सरल भाब्दों के प्रयोग पर बल दिया। भाकृअनुप–सीफेट, लुधियाना में वैज्ञानिक एवं प्रशासनिक कार्यों में हो रहे हिन्दी के उपयोग की मुख्य अतिथि ने सराहना की। संस्थान के निदेशक, डॉ आर के सिंह ने कहा कि हिन्दी पखवाडे को त्यौहार के रूप में मनाने से हिन्दी सशक्त एवं सामर्थ्यवान होगी। डॉ सिंह ने संस्थान के समस्त वैज्ञानिकों से अनुरोध किया कि वे अपने शोध–पत्रों को हिन्दी भाषा में प्रकाशित करने पर जोर दें । इस अवसर पर पखवाड़े के दौरान 15 दिनों विभिन्न प्रतियोगिताओं एवं कार्यक्रमों का आयोजन किया गया।

हिंदी कार्यशालाएं

- मुख्य अतिथि डॉ. अनिल कुमार गुप्ता, सहायक प्रबंधक राजभाषा (न्यू इंडिया इंश्योरेंस कंपनी लिमिटेड, मंडल कार्यालय–1, जालंधर, पंजाब ने 'भारत की राजभाषा नीति: नियम एवं अधिनियम' और 'हिंदी भाषा के माध्यम से रोजगाार की संभावनाएं' विषयों पर अपनी प्रस्तुति देकर सभी को लाभान्वित किया।
- मुख्य अतिथि डॉ. शिव कुमार शर्मा,एम.डी. (ए.एम.), ऋषि नगर लुधियाना ने 'हिंदी भाषा की वर्तमान' स्थिति एवं 'त्वरित ध्यान से स्वास्थ्य लाभ' विषयों पर अपनी प्रस्तुति देकर सभी को लाभान्वित किया।
- मुख्य अतिथि डॉ. बलवेन्द्र सिंह, सहायक प्राध्यापक, स्नातकोत्तर हिंदी विभाग, डी.ए.वी. कालेज, जालंधर, पंजाब ने 'मानक हिंदी वर्तनी' एवं 'वर्तमान में हिंदी भाषा के माध्यम से रोजगार की संभावनाएं' विषयों पर अपनी प्रस्तुति देकर सभी को लाभान्वित किया।

30th Foundation Day

The institute celebrated its 30th foundation day on December 29, 2018. Dr Balraj Singh, VC of Agriculture University, Jodhpur was the Chief Guest on this occasion. Dr Sujoy Rakshit, Director, ICAR-IIMR, Ludhiana and Dr Rajbir Singh, Director, ICAR-ATARI, Ludhiana graced the occasion as Guest of Honour. Dr R K Singh, Director, ICAR-CIPHET, briefed about the pioneering post-harvest engineering interventions developed by ICAR-CIPHET for management of agricultural and livestock produce. Since its inception, the institute has also developed linkage and collaboration with many national agencies for solving the problems associated with the processing and value addition of agricultural produce. The Chief Guest Dr Balraj Singh applauded the efforts of ICAR-CIPHET for reducing the post-harvest losses through processing interventions. On this occasion, the employees of the institute who performed well during the year were awarded in different categories.

First Monthly Death Anniversary of Bharat Ratna Late Sh. Atal Bihari Vajpayee Ji, former Prime Minister of India

Staff Recreation Club (SRC) of ICAR- CIPHET, Ludhiana organized event to observe First monthly death anniversary of Bharat Ratna late Sh Atal Bihari Vajpayee Ji, former Prime Minister of India on 16 September, 2018. A fitting tribute was paid to the deceased by the staff of the institute. A programme for recital of the poems composed by late Sh Vajpayee Ji was organized in the evening of 16 September, 2018 and many of his famous poems were recited by the scientific, administrative and technical staff of the institute.

बाधाएँ आती हैं आएँ, घिरें प्रलय की घोर घटाएँ,
पावों के नीचे अंगारे, सिर पर बरसें यदि ज्वालाएँ,
निज हाथों में हँसते–हँसते, आग लगाकर जलना होगा।
कदम मिलाकर चलना होगा।

ICAR-CIPHET participated in ICAR-Zonal Sports Tournament

A 42-member contingent from ICAR-CIPHET participated in ICAR-Zonal Sports Tournament for North Zone from 14.11.2018 to 16.11.2018. This was the biggest contingent ever sent by ICAR-CIPHET to any sports tournament. The tournament was organized by ICAR-Central Institute of Research on Buffaloes, Hisar at Haryana Agricultural University, Hisar. ICAR CIPHET contingent participated in Badminton (Men & Women), Football, Table tennis (Men & Women) Chess, Volleyball (Shooting), Volleyball (Smashing) and Atheletic events. The contingent performed well in many of the events and reached to quarter final, semi-final and final stages. Women members of the contingent performed exceedingly well and won many events like, Badminton Singles and Doubles (Women), 100-m, 200-m race (Women) and Long Jump. Dr T Bidyalakshmi was declared as the Best Women Athlete of the tournament.

Research & Administrative Meetings

Research Advisory Committee (RAC)

Research Advisory Committee (RAC) of CIPHET was constituted by ICAR (Council's order no. F.No.-A.Engg/4/2/2018-IA-II (AE) dated 07.02.2018) for a period of three years with effect from 31.01.2018 to 30.01.2021.

Chairman	**Prof. Anwar Alam, Former DDG (Engg.) ICAR**
Members	Dr. Nabarun Bhattacharya, Director, C-DAC, Kolkata Dr. Vasudeva Singh, Former Cheif Scientist, CSIR-CFTRI, Mysore Dr. S. Ganapathy, Prof. & Head, TNAU, Coimbatore Dr. S. K. Dash, Dean, COAE&T, OUAT Dr. R. K. Gupta, Former Director, ICAR-CIPHET Dr. S. D. Kulkarni, Former PD, SPU, ICAR-CIAE, Bhopal
Ex-Officio Member	Dr. S. N. Jha, ADG (PE), ICAR
Member Secretary	Dr. K. Narsaiah, National Fellow & Principal Scientist, ICAR-CIPHET

20th Research Advisory Committee (RAC) meeting

- The 20th Research Advisory Committee (RAC) meeting of CIPHET was held on 25-26 April, 2018 at ICAR-CIPHET, Ludhiana
- The 21st Research Advisory Committee (RAC) meeting of CIPHET was held on 05-06 February, 2019 at ICAR-CIPHET, Ludhiana.

Institute Research Council (IRC)

Chairman	**Dr. R. K. Singh, Director, ICAR-CIPHET**
Experts	Dr. D. C. Joshi, Former Dean, AAU, Gujarat Dr. S. N. Jha, ADG (PE), ICAR
Member Secretary	Dr. D. N. Yadav, Principal Scientist, ICAR-CIPHET

- The 28th Institute Research Council (IRC) meeting of CIPHET was held on 28-29 September, 2018 at ICAR-CIPHET, Ludhiana.

Institute Management Committee (IMC)

Chairman	**Dr. R. K. Singh, Director, ICAR-CIPHET**
Members	Dr. S. N. Jha, ADG (PE), ICAR Dr. M. K. Garg, Prof. CCSHAU, Hisar Dr. R. K. Jhorar, Dean, CCSHAU, Hisar Sh. R. S. Dhillon, Farmer Dr. H. S. Oberoi, Head, PHT Division, ICAR-IIHR, Bangaluru Dr. A. K. Thakur, Principal Scientist, ICAR-NIRJAFT, Kolkata Er. Amanpreet Singh, Respresentative of Director of Agriculture, Govt. of Punjab
Member Secretary	SAO, ICAR-CIPHET

- The 35th meeting of Institute Management Committee of ICAR-CIPHET was held on 28 March, 2019 at ICAR-CIPHET, Ludhiana

Women Complaint Committee

In compliance of the Council letter F. No. 24(14)/2008-CDN, the Director, ICAR-CIPHET has constituted Women Complaint Committee to deal with complaints regarding sexual harassment of women at the work place (F.No.8 (85)/2006-Cdn dated 05.12.2017.

Chairperson	**Dr. Mridula D., Principal Scientist, ICAR-CIPHET**
Members	Dr. Renu Balakrishnan, Scientist, ICAR-CIPHET Dr. Ranjeet Singh, Senior Scientist, ICAR-CIPHET
Member Outside	Dr. Sandhya Singh, Asstt. Research Engineer, PAU, Ludhiana

Women Cell

Chairperson	Dr. Manju Bala, Principal Scientist, ICAR-CIPHET
Members	Dr. Poonam Chaudhary, Scientist, ICAR-CIPHET Mrs. Sunita Rana, LDC, ICAR-CIPHET
Member Secretary	Mrs. Sonia Devi, Tech. Asstt., ICAR-CIPHET

- The Director, ICAR-CIPHET has constituted Women Cell to look after the concerns of women officers and staffs and their guidance (F.No.9 (16)/2014-Cdn 2611-2617 dated 18.12.2017.

Institute Joint Staff Council (IJSC)

Official Side

Chairman	Dr. R. K. Singh, Director, ICAR-CIPHET
Members	Dr. D. N. Yadav, Principal Scientist Dr. Sunil Kumar, Principal Scientist Dr. Deepika Goswami, Scientist Dr. V. Chandrasekar, Scientist Sh. Raj Kumar, SAO Sh. T.S. Bhatti / Sh. Mannilal, AF&AO

Staff Side

Members	Sh. Ashwani Kumar, UDC Sh. R. K. Raheja, UDC Sh. H. S. Sekhon, Tech. Officer Sh. Vishal Kumar, Senior Tech. Asstt. Sh. Sukhbir, SSS Sh. Manoj Kumar, SSS

- A new Institute Joint Staff Council (IJSC) has been constituted by the Director (F. No. 9(43)/2015-Cdn dated 11.02.2019) for a period of three years.

Personnel

Director
Dr. R. K. Singh (Acting)

Project Coordinator, AICRP (PHET)
Dr. S. K. Tyagi (Acting)

Project Coordinator, AICRP (PET)
Dr. R. K. Singh

Head of Divisions
Dr. K. Narsaiah (Agricultural Structure and Environmental Control Division) (In-Charge)
Dr. Mridula D. (Food Grains and Oilseeds Processing Division) (In-Charge)
Dr. Sandeep Mann (Transfer of Technology Division) (In-Charge)
Dr. Ramesh Kumar (Horticulture Crop Processing Division) (In-Charge)

ICAR-CIPHET, Ludhiana

Principal Scientist
Dr. S. K. Tyagi
Dr. K. Narsaiah
Dr. Mridula D.
Dr. D. N. Yadav
Dr. Sandeep Maan
Dr. R. K. Vishwakarma
Dr. Manju Bala
Dr. A. U. Muzaddadi

Senior Scientist
Dr. Ranjeet Singh

Scientist
Er. P. Hemasankari
Dr. Yogesh Kumar
Dr. Tanbir Ahmad
Dr. R. K. Anurag
Dr. Deepika Goswami
Smt. Leena Kumari
Smt. Surya
Dr. Swati Sethi,
Er. Chandan Solanki
Er. Dhritiman Saha
Er. A. A. Bashir
Er. Navnath Indore
Sh. Vikas Kumar
Dr. Khwairakpam Bembem
Dr. Renu Balakrishnan
Er. Kalnar Yogesh
Dr. Pankaj Kumar
Dr. V. Chandrasekar
Dr. Lovejot Kaur
Dr. Poonam
Er. Sandeep Dawange
Dr. Thingujam Bidyalakshmi
Dr. Guru P. N.
Dr. B. M. Ghodki

Administrative Staff

Senior Administrative Officer
Sh. Raj Kumar (retired on 30.4.2019)

Assistant Administrative Officer
Sh. B. C. Katoch

Finance and Accounts Officer
Sh. T. S. Bhatti (expired on 05.06.2019)

Assistant Finance and Accounts Officer
Sh. Manni Lal

Personal Secretary
Sh. S. S. Verma

Assistant
Sh. Kunwar Singh
Sh. Avtar Singh
Sh. Tarsem Singh Purba
Smt. Jasvir Kaur

Upper Division Clerk
Sh. Gurdial Singh
Sh. Ashwani Kumar
Sh. R. K. Raheja
Sh. Iqbal Singh

Lower Division Clerk
Smt. Sunita Rana
Sh. R. K. Yadav
Sh. S. K. Gaur

Technical Staff

Technical Officer
Sh. Gurdeep Singh
Sh. H. S. Sekhon (Driver)

Senior Technical Assistant
Sh. Beant Singh (Driver)
Sh. Vishal Kumar
Sh. Lakhwinder Singh
Sh. Bhajan Singh
Sh. Jaswant Singh
Sh. Rajiv Sharma

Senior Technician
Sh. Satwinder Singh
Sh. Sarup Singh

Technical Assistant
Sh. Hardeep Singh
Smt. Sonia Rani
Sh. Jaswinder Singh
Sh. Jagtar Singh
Sh. Pradip Kumar
Sh. Yashpal Singh
Smt. Pragya Singh

Supporting Staff

Skilled Support Staff
Sh. Sukhbir
Sh. Manoj Kumar

ICAR-CIPHET, Abohar

Principal Scientist
Dr. Ramesh Kumar
Dr. Sunil Kumar

Scientist
Dr. Prerna Nath
Dr. M. K. Mahawar
Dr. Kale Sakharam
Dr. Jalgaonkar Kirti
Dr. Bibwe Bhushan
Dr. Dukare Ajinath
Dr. P. K. Kannaujia

Administrative Staff

Assistant Administrative Officer
Sh. Pawan Kumar

Assistant
Sh. Mohan Lal

Lower Division Clerk
Sh. Ajay Kumar

Technical Staff

Chief Technical Officer
Sh. V. K. Saharan

Senior Technical Officer
Sh. Prithvi Raj
Sh. Rajesh Kumar

Senior Technical Assistant
Sh. Ganpat Ram (Driver)
Sh. Devinder Kumar
Sh. Pawan Kumar

Technical Assistant
Sh. Dalu Ram

Supporting Staff

Skilled Support Staff
Sh. Surinder Kumar

Personalia

Joining

Smt. P. Hemasankari, Scientist	5.5.2018 (on transfer)
Dr. Guru P. N., Scientist	9.10.2018
Smt. Pragya Singh, T-3 (Field Farm)	1.10.2018
Sh. Ajay Kumar, LDC	3.11.2018

Promotion

Dr. A. U. Muzaddadi	Senior Scientist to Principal Scientist under CAS
Dr. Ranjit Singh	Senior Scientist RGP 8000 to 9000 under CAS
Dr. V. S. Meena	Scientist RGP 6000 to 7000 under CAS
Dr. Deepika Goswami	Scientist RGP 6000 to 7000 under CAS
Dr. Monika Sharma	Scientist RGP 6000 to 7000 under CAS
Sh. Prithvi Raj	Next higher grade T-7/8/ Assistant Chief Technical Officer.
Sh. Rajesh Kumar	Next higher grade T-7/8/ Assistant Chief Technical Officer.
Sh. Hardeep Singh	Next higher grade Senior Technical Assistant
Sh. Dallu Ram	Next higher grade Senior Technical Assistant

MACP

Sh. Iqbal Singh, UDC	MACP granted *w.e.f.* 10.03.2019.
Smt. Sunita Rana, LDC	MACP granted *w.e.f.* 08.03.2019.
Sh. Surinder Kumar, SSS	MACP granted *w.e.f.* 01.09.2018.
Sh. Manoj Kumar, SSS	MACP granted *w.e.f.* 04.03.2019.
Sh. Sukhbir, SSS	MACP granted *w.e.f.* 01.09.2018.

Probation Confirmation

Er. A. A. Bashir, Scientist
Er. Navnath Indore, Scientist
Dr. Bibwe Bhushan, Scientist
Dr. Ajinath Dukare, Scientist
Er. Yogesh Kalnar, Scientist
Dr. Renu Balakrishnan, Scientist
Dr. P. K. Kannaujia, Scientist

Selection

Dr. V. E. Nambi, Scientist, selected for the post of Programme Coordinator, KVK, Gandhigram and relieved on 17.7.2018.

Publications

Publications in Peer Reviewed Journals, Book Chapters, Technical Bulletins, Compendiums, Newsletters

Institute Publications

Annual Report 2017-18

ICAR-CIPHET E Newsletter (July-August, 2018) (Issue 1)

ICAR-CIPHET E Newsletter (September-October, 2018) (Issue 2)

ICAR-CIPHET E Newsletter (November-December, 2018) (Issue 3)

Prasanskarna Pragati (Hindi) (July-December, 2017)

Quarterly Newsletter (July-September, 2018)

Compendiums

(Summer/Winter School, Entrepreneurship Development Programme, Model Training Course)

Anurag, R. K., Kumar, Yogesh and Bashir, A. A. (2018). Packaging of fresh and processed food products. 26-28 November, 2018, Pages 1-108. (EDP)

Kumar, Yogesh, Anurag, R. K., Bashir, A. A. and Ahmad, T. (2018). Meat processing and value addition. 20-22 September, 2018, Pages 1-62. (EDP)

Mann, Sandeep, Balakrishnan, R. and Kalnar, Y. (2018). Emerging post-harvest engineering and technological interventions for enhancing farmer's income. 4-24 September, 2018, Pages 1-264. (Summer School)

Mann, Sandeep, Bembem, K. and Dawange, S.P. (2019). Processing, value addition and entrepreneurship development in post-harvest sector. 14-21 January, 2019, Pages 1-184. (MTC)

Mridula, D., Goswami, D., and Saha, D. (2018). Recent engineering interventions in food and by-product processing for sustainable growth and profitability. 05-25, October, 2018, Pages 1-264. (Winter School)

Mridula, D., Vishwakarma, R. K. and Nath, P. (2018). Advancements in post-harvest management of legumes for minimizing losses and sustainable protein availability. 5-25 July, 2018, Pages 1-368. (Summer School)

Technical Bulletins

Kumar, S., Kumar, R. and Sharma, P. C. (2018). Debittering of kinnow juice. Pages 1-17.

Peer Reviewed Journals

Ahmad, T., Ismail, A., Ahmad, S. A., Khalil, K. A., Leo, T. K., Awad, E. A., Adeyemi, K. D. and Sazili, A.Q. (2018). Autolysis of bovine skin, its endogenous proteases, protease inhibitors, and their effects on quality characteristics of extracted gelatin. *Food Chemistry, 265:* 1-8.

Ahmad, T., Ismail, A., Ahmad, S. A., Khalil, K. A., Leo, T. K., Awad, E. A. and Sazili, A. Q. (2019). Physicochemical characteristics and molecular structures of gelatin extracted from bovine skin: Effects of actinidin and papain enzymes pretreatment. *International Journal of Food Properties, 22*(1): 138-153.

Panghal, A., Singh, B. K., Yadav, D. N. and Chhikara, N. (2018). Effect of finger millet on nutritional, rheological, and pasting profile of whole wheat flat bread (chapatti). *Cereal Chemistry, 96*: 84-94, doi: 10.1002/cche.10111.

Das, A. K. and Muzaddadi A. U. (2019). Assessment of hygiene status of retail fish market using seasonal changes in microbial load as a tool. *Fishery Technology, 56*: 60-67.

Murai, A. S., Vijayraghavan, K., Singh, P. and Balakrishnan, R. (2018). Farmers' preference of e-learning courses: implications for extension professionals. *Journal of Community Mobilization and Sustainable Development, 13*(3): 589-594.

Babu, R., Singh, K., Jindal, S. K, Jawandha, S. K., Narsaiah, K. and Alam, M.S. (2018) Storage behavior of modified atmosphere packed tomatoes (*Solanum lycopersicum* L.) treated with aqueous 1-methylcycloprpene. *Plant Archives, 18*(2): 1809-1813.

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