भाकृअनुप
ICAR

भाकृअनुप-सीफेट
ICAR-CIPHET

2021 ANNUAL REPORT

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ICAR-CIPHET

भाकृअनुप–केन्द्रीय कटाई–उपरांत अभियांत्रिकी एवं प्रौद्योगिकी संस्थान,
लुधियाना–141004 (पंजाब)

ICAR-CENTRAL INSTITUTE OF POST-HARVEST ENGINEERING & TECHNOLOGY
LUDHIANA-141004 (PUNJAB)
(ISO 9001:2015)

वार्षिक प्रतिवेदन

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Preface

The post-harvest management including processing of the agricultural commodities plays a crucial role in coping up with the challenges of food security and agriculture value chains. It helps to minimize losses and spoilage and adding value to various commodities. Over the past years, post-harvest interventions with renewed emphasis on enhancing the efficiency of process, nutritional security and food safety has spurred a major paradigm shift.

It's my privilege to present before you institute's Annual Report - 2021 to give insights about our R&D activities, outreach programmes and significant achievements made during last year. Institute is providing its services to the country for increasing farmers' income, generating employment though entrepreneurship, value addition, developing post-harvest technologies, process protocols, novel machineries and products, and utilization of agro by-products. Institute along with two All India Coordinated Research Projects (AICRPs) and one consortium Research Platforms (CRPs), is contributing significantly in various national programmes.

Venturing into automation and sensor technology domain

Online business meets for more effective and rapid transfer or technology

Major contributions to national policies on post - harvest management

Effective tools and protocols for food quality and safety

Novel products to ensure nutritional security

Tailor-made training programmes under SCSP scheme at beneficiary's door step

Addressing both food and food machinery testing

Celebration of Azadi ka Amrit Mahotsav - webinars, workshops, sectoral campaigns etc.

During the past year, our institute made concerted efforts to develop various machines, agriculture structures, process protocols and different value-added products in line with nation's sustainable development goals. Automatic sorting/grading system, machine vision-based insect detection device, oxygen concentrator for rapid ozone generation, air cooling unit for onion storage structure, modified push cart for small scale vegetable vendors, litchi de-stoner tools and modified live fish carrier system are few of the developments which were culminated during this reported period. Besides, process protocols and technologies have also been standardized for extraction of protein and bio-active compounds from by-products. NIR-spectroscopy methods for adulteration detection in chickpea flour have been developed. Products like fruit bar, roasted *Sangri* seeds and cereal gluten free ribbon pasta needs special mention. The institute projects were carried out with in-house funds as well as with financial, physical and intellectual support from different government organizations, private institutions and some stakeholders. The institute submitted two major reports to Food Corporation of India and Department of Consumer Affairs, GoI; both these reports are leading to major policy interventions at national level.

Under AICRP on PHET, 31 cooperating centers contributed in development of 103 post-harvest tools/equipment/process protocols and products during 2021. A total of 87 technologies were transferred to the stakeholders under this scheme. Moreover, AICRP on PHET established 37 new agro-processing centres during the period. Under AICRP on PEASEM, 16 technologies were developed by the efforts of 14 centers whereas 2 technologies were transferred to the stakeholders.

For increasing institutes visibility at both national and international level, ICAR-CIPHET has taken a major

leap by organizing Industry Interface Fair on Agro processing - 2021 (CIPHET-IIFA 2021), where institute technologies were showcased and demonstrated to various stakeholders. Besides this, various human resource development programmes such as entrepreneurship development programmes (EDP), farmer's training, student's trainings were organized under different schemes for capacity building. Total of 1097 participants were trained for post-harvest management of agricultural and livestock produce through entrepreneurship development programs (EDP), farmer's trainings, and sensitization programmes. Besides online programmes were conducted for around 200 students & 1500 budding entrepreneurs from different places. Under Azaadi Ka Amrit Mahotsav, ICAR-CIPHET has organised various programmes, webinar series, orientation programmes, EDPs etc. Training programmes were organized for skilling and upliftment of socially deprived classes in various parts of the country.

Institute's efforts are reflected through the developments made by technology transfer, patents granted, research publications and revenue generation etc. ICAR-CIPHET has got 08 technologies licensed whereas 03 patents were filed and 02 were granted. The scientists of institute published 39 research papers in national and international peer reviewed journals and various prestigious awards were received during 2021. ICAR-CIPHET has generated a net revenue of Rs. 23.83 lakh during the year. Our Post-Harvest Machinery and Equipment Testing Centre (PHMETC) tested 33 machines from different parts of the country. The Krishi Vigyan Kendra acts as pivotal link between institute and farmers, especially of western Punjab.

Significant effort has been made towards enhancing the usage of Hindi in routine official work and to implement important schemes like SCSP, Swachh Bharat Mission and Mera Gaon Mera Gaurav. Despite impediments and threats posed by Covid-19 pandemic, the institute employees kept high morale and very effectively utilized alternate avenues for contactless meeting and information dissemination. I believe that, our team will keep its untiring efforts to showcase its excellence in Post-Harvest Research and Development. I feel honoured in presenting this ICAR-CIPHET Annual Report 2021 to the readers.

(Nachiket Kotwaliwale)
Director

कार्यकारी सारांश

भाकृअनुप-सीफेट फसल कटाई उपरांत अभियांत्रिकी एवं प्रौद्योगिकी के क्षेत्र में देश का एक प्रमुख अनुसंधान संस्थान है। वर्ष 2021 के दौरान संस्थान ने नवोन्मेषी प्रौद्योगिकियों को विकसित करने, फसलोत्तर गुणवत्ता प्रबंधन से संबंधित कार्य प्रणालियों को विकसित करने और प्रौद्योगिकी लाइसेंसिंग, प्रशिक्षण, क्षमता निर्माण और विस्तार गतिविधियों के माध्यम से इन प्रौद्योगिकियों को संबंधित हितधारकों जैसे किसान, उद्यमी और उद्योग को स्थानांतरित करने में महत्वपूर्ण भूमिका निभानी जारी रखा। संस्थान ने अपने विभिन्न बहु-विषयक आंतरिक और बाह्य वित्त पोषित अनुसंधान परियोजनाओं के माध्यम से योगदान दिया है। वर्ष 2021 के दौरान भाकृअनुप-सीफेट की प्रमुख उपलब्धियों का सारांश निम्नानुसार है:

विकसित मशीनें/उपकरण

स्वचालित प्रणाली द्वारा टमाटर/अनार की छँटाई/ग्रेडिंग

एक स्वचालित दृष्टि-आधारित छँटाई/ग्रेडिंग प्रणाली विकसित की गई है, जो सतह के रंग और बनावट में भिन्नता के आधार पर टमाटर और अनार को छाँटने में सक्षम है। छँटाई के बाद, विकसित प्रणाली वस्तुओं को उनके आकार के आधार पर ग्रेड करती है। वर्तमान में, मशीन की प्रति मिनट 45-50 फलों/वस्तुओं को छांटने की क्षमता है, जो डायवर्सन/इजेक्शन सिस्टम के प्रतिक्रिया समय पर निर्भर है।

मशीन दृष्टि आधारित कीट पहचान उपकरण

भंडारित अनाज में कीड़ों का पता लगाने और उनकी पहचान करने के लिए एक स्वचालित उपकरण विकसित किया गया है। सिस्टम कैमरे द्वारा कैप्चर की गई चित्रों का विश्लेषण करके कुछ ही समय में नमूने में कीड़ों की संख्या का पता लगाने, पहचानने और गणना के लिए इस सिस्टम को प्रोग्राम किया गया है। गेहूं के दाने में कीट (लेसर ग्रेन बोरर) का पता लगाने और गिनती के लिए आवश्यक समय 210 सेकंड के मैनुअल ऑपरेशन की तुलना में 85-88% सटीकता के साथ 3-4 सेकंड है।

मखाना पापिंग यंत्र के लिए घूर्णन छिद्र भरण प्रणाली

विभिन्न आकारों (7.48-12.40 मिमी व्यास) के भुने हुए मखाने के बीजों के निरंतर और समान प्रवाह के लिए 10-30 किग्रा/घंटा की निरंतर प्रवाह दर के साथ एक सरल फीडिंग सिस्टम विकसित किया गया है। फीडिंग सिस्टम में एक घूमने वाली छिद्र प्लेट होती है जो एक ट्रैपेज्वाईडल हॉपर के नीचे से जुड़े पाइप के अंदर एक ऑफ-सेंटर दूरी पर रखी जाती है। घूर्णन गति, छिद्र व्यास और ऑफ-सेंटर दूरी में वृद्धि और स्थिर स्थिति में कोई प्रवाह नहीं होने के साथ बीज प्रवाह दर बढ़ जाती है। सभी आकारों के लिए परिमित द्रव्यमान प्रवाह दर 2.25-29.81 किग्रा/घंटा की सीमा में है। विकसित आहार प्रणाली विभिन्न आकारों के मखाना बीजों को परिमित द्रव्यमान प्रवाह दर पर भरने के लिए अच्छा प्रदर्शन करती है। विकसित प्रणाली की अनुमानित लागत लगभग 30,000/- रुपये है।

ओजोन के तीव्र उत्पादन के लिए ऑक्सीजन सांद्रक

विकसित सांद्रक तीव्र प्रेशर स्विंग डीजोर्प्सन के सिद्धांत पर काम करता है। यह उच्च दबाव पर सोडियम आधारित जिओलाइट खनिजों पर गैसों को सोखने के लिए एक आणविक चलनी का उपयोग करता है। इस प्रकार की सोखन प्रणाली कार्यात्मक रूप से एक नाइट्रोजन स्क्रबर (8ml/g/min) है जो अन्य वायुमंडलीय गैसों को गुजरने देती है और इस तरह ऑक्सीजन को प्राथमिक गैस (90% तक) के रूप में साद्रित करती है। यह सांद्रित ऑक्सीजन को जब ओजोन जनरेटर से जोड़ा जाता है तो यह तीव्र गति से ओजोन उत्पादन में मदद करता है और इसकी क्षमता भी बढ़ाता है ।

छोटे पैमाने के सब्जी विक्रेताओं के लिए संशोधित पुश कार्ट

प्रतिकूल वातावरण में सब्जी की ताजगी को बनाए रखने के लिए 200 किग्रा क्षमता की पुश कार्ट विकसित कर मूल्यांकन किया गया है। यह पुश कार्ट बाहरी औसत तापमान 34°C के समय आतंरिक तापमान 24°C (बिना लोड के) बनाए रखता है। लोड के साथ वास्तविक स्थिति में, विकसित गाड़ी बाहरी परिस्थितियों की तुलना में तापमान और आर्द्रता में क्रमशः लगभग 28°C और 48% का अंतर पैदा करती है, जिसके परिणाम स्वरूप नियंत्रण (कंट्रोल) की तुलना में वस्तुओं के वजन के भौतिक नुकसान (PLW) में लगभग 50% कम कमी होती है।

लीची की गुठली को निकालने का औजार

एक हाथ से संचालित और पेडल संचालित लीची की गुठली को निकालने का औजार (लीची डिस्टोनिंग उपकरण) को विकसित कर मूल्यांकन किया गया। हाथ से संचालित उपकरण (11.85 किग्रा/घंटा की क्षमता वाला) डिस्टोनिंग के बाद 48.63% की एक अक्षत गूदा प्रति-फल देता है। इस प्रक्रिया में रस की हानि 8.08% पाई गई है जबकि कुल गूदे की हानि लगभग 32.53% होती है। पेडल संचालित लीची डिस्टोनर की क्षमता 8.86 किलोग्राम/घंटा है, जिसमें डिस्टोनिंग प्रक्रिया के दौरान 34.02% की अक्षत गूदा प्रति-फल प्राप्ति होती है, और रस एवं गूदा की हानि क्रमशः 5.08% और 38.42% होती है।

संशोधित जीवित मछली वाहक प्रणाली

मौजूदा जीवित मछली वाहक प्रणाली (लाइव फिश कैरियर सिस्टम) को लंबी दूरी की यात्राओं के लिए अधिक क्षमता (200-300 किग्रा) के साथ निर्मित किया गया है। कंटेनर में एक बहुउद्देश्यीय कक्ष और जलीय जीव को जीवित करने के लिए उपकरण है। यह पानी की बौछार के लिए दो पंपों, निस्पंदन उपकरण, एयर-पंप एरेटर्स, एग्जॉस्ट फैन और वाटर चिलर से लैस है। संशोधित प्रणाली के उपयोग से जीवित मछली को 3 से 5 दिनों तक परिवहन किया जा सकता है।

कम लागत वाली प्याज भंडारण संरचना के लिए एयर कूलिंग यूनिट

प्याज भंडारण प्रणाली के लिए ड्राई-टाइप एयर कूलिंग यूनिट विकसित की गई है। एक एयर कूलिंग सिस्टम जहां हवा के तापमान में उसकी सापेक्ष आर्द्रता को प्रभावित किए बिना कम कर दिया जाता है। एक सिरे पर लगा ब्लोअर (इनलेट चेंबर) एल्युमिनियम पाइप के अंदर हवा को घुमाता है, जहां पाइप पर पानी छिड़कने से हवा का तापमान और नमी कम हो जाती है। पानी को ठंडा करने के बाद सिस्टम में दोबारा इस्तेमाल किया जाता है। विकसित एयर कूलिंग यूनिट परिवेशी वायु के तापमान और वातावरणीय आर्द्रता को क्रमशः 2-4°C और 6% तक कम करने में सक्षम है।

स्मार्ट सोलर ड्रायर

सौर ऊर्जा का उपयोग करने वाले 10-15 किग्रा क्षमता का सौर आधारित ड्रायर विकसित किया गया है जो थर्मल के साथ-साथ विद्युत ऊर्जा के रूप में सौर ऊर्जा का उपयोग के लिए सक्षम है। थर्मल भंडारण में पैराफिन मोम (फेज चेंज मटेरियल, चरण परिवर्तन सामग्री, पीसीएम के रूप में) और फोटो वोल्टाइक सेल का उपयोग कर विद्युत ऊर्जा के माध्यम से प्रदान किया जाता है। सौर विकिरण प्रणाली मे किसी कमी होने की स्थिति में संचालित गर्म हवा के धौंकनी के साथ सौर बैटरी का उपयोग किया जाता है। ड्रायर सेंसर और माइक्रोकंट्रोलर व्यवस्था, एयर हीटिंग यूनिट, एयर हैंडलिंग और वितरण इकाई, सुखाने वाले कक्ष के तापमान नियंत्रण, अति ताप, थर्मल भंडारण और बिजली की आपूणत को रोकने के लिए शुष्क वजन माप से लैस है।

प्रक्रिया/विधि विकसित

मिलावट का पता लगाने के लिए नियर इंफ्रा-रेड स्पेक्ट्रोस्कोपी आधारित विधि

बेसन में मक्के के आटे और मटर के आटे में मिलावट की मात्रा का निर्धारण करने के लिए नियर इंफ्रा-रेड (एनआईआर) आधारित पद्धतियां विकसित की गई हैं। मक्के के आटे की मिलावट का पता लगाने के लिए संशोधित आंशिक न्यूनतम वर्ग प्रतिगमन (एमपीएलएसआर) मॉडल आरएसक्यू और 1-वीआर क्रमशः 0.9989 और 0.9963 के साथ एसईसी और एसईसीवी क्रमशः 1.0918 और 2.0468 के साथ विकसित और मान्य किया गया है। इसी प्रकार बेसन में मटर के आटे की मात्रा का निर्धारण करने के लिए मॉडल में 0.99 के निर्धारण गुणांक (आरएसक्यू), 0.827 के अंशांकन की मानक त्रुटि (एसईसी) और 1.491 के

क्रॉस सत्यापन (एसईसीवी) की मानक त्रुटि दिखाई गई। विकसित विधि से बेसन में मक्के के आटे की मिलावट का तेजी से और गैर-विनाशकारी तरीके से मात्रा का पता लगाया जा सकता है।

तेल रहित चावल की भूसी से प्रोटीन निष्कर्षण

तेल रहित चावल की भूसी से प्रोटीन निकालने के लिए एक प्रक्रिया को अनुकूलित किया गया है। निष्कर्षण तापमान (40-60°C), निष्कर्षण अवधि (30-60 मिनट), और निष्कर्षण पीएच (9-11) को निष्कर्षण दक्षता (%), पुनर्लाभ (%), शुद्धता (% प्रोटीन) और उपज (ग्राम/100 ग्राम) जैसी प्रतिक्रियाओं के लिए अनुकूलित किया गया है। कार्यप्रणाली में आइसोइलेक्ट्रिक बिंदु पर क्षारीय निष्कर्षण के बाद अम्लिक अवक्षेपण शामिल है। अनुकूलित परिस्थितियों में प्रोटीन के निष्कर्षण के परिणाम स्वरूप 59% की निष्कर्षण क्षमता और 7.5 ग्राम/100 ग्राम की उपज 78% की शुद्धता के साथ प्राप्त हुई।

गिरे हुए कच्चे किन्नू फल से बायोएक्टिव यौगिक

निष्कर्षण प्रक्रिया को विभिन्न सॉल्वैंट्स (मेथनॉल, इथेनॉल और एसीटोन) और निष्कर्षण तकनीक (कक्षीय झटकों और अल्ट्रासोनिक सहायता) का उपयोग करके अनुकूलित किया गया है। अल्ट्रासाउंड असिस्टेड एक्सट्रैक्शन का उपयोग करने वाले अर्क ने कुल फेनोलिक मात्रा (टीपीसी), कुल फ्लेवोनोइड और एंटीऑक्सीडेंट गतिविधि के लिए 2.63 से 4.59 ग्राम गैलिक एसिड समकक्ष (जीएई) / 100 ग्राम, 5.35 से 7.60 ग्राम क्वेरसेटिन समकक्ष (क्यूई)/100 ग्राम और 178.89 से 251.41 मिली ग्राम AAE/100 ग्राम FRAP से बेहतर परिणाम दिए। मिथेनॉल और एसीटोन के बाद इथेनॉल सबसे प्रभावी विलायक पाया गया है।

भुने हुए मखाना बीजों का भंडारण

मखाना (यूरेल फेरोक्स) बीज भंडारण के दौरान यह देखा गया है कि कम अनाज छेदक कीट (राइजोपरथा डोमिनिका), ग्रब और वयस्क अवस्था में नुकसान पहुंचाते हैं और भुने हुए बीजों की पॉपिंग को प्रभावित करते हैं। विभिन्न आकारों के कीड़े लगे हुए मखाने के बीजों पर किए गए अध्ययन से पता चला है कि कीड़े 11 मिमी आकार के बीज पसंद करते हैं, इसके बाद क्रमशः 9 मिमी. और 7 मिमी.। यह भी पाया गया कि भंडारण के 15 दिनों के भीतर 40±1.24% क्षति होती है। राइजोपरथा डोमिनिका मादा 200-500 अंडे देती है और 35-50 दिनों में अपना जीवन चक्र पूरा किया।

काले चने की भूसी से कैरोटीनॉयड निष्कर्षण

बॉक्स-बेनकेन डिजाइन का उपयोग करके रेस्पोंस सरफेस मैथोडोलोजी (आरएसएम) द्वारा काले चने की भूसी से कैरोटेनॉइड निष्कर्षण के लिए प्रक्रिया को अनुकूलित किया गया है। भूसी के अर्क में कुल कैरोटीनॉयड की मात्रा 2.94-3.94 मिलीग्राम/100 ग्राम में पाई गयी। काले चने की भूसी के कुल कैरोटेनॉइड निष्कर्षण को अधिकतम करने के लिए इष्टतम स्थितियां 27.28 मिली/ग्राम विलायक, 30 डिग्री सेल्सियस निष्कर्षण तापमान और 6 घंटे का समय है।

पीएचबी परत निर्माण के लिए माइक्रोबियल विधि

आम के उप-उत्पाद से किण्वन योग्य शर्करा की अधिकतम निष्कर्षण के लिए पूर्व-उपचार प्रक्रिया को अनुकूलित किया गया है। आर्थिक लागत को ध्यान में रखते हुए आम के उप-उत्पादों से किण्वन योग्य शर्करा की प्राप्ति के लिए दोनों (सलफ्युरिक एवं हाइड्रोक्लोरिक) अम्लों का 1% उपयोग करने की सलाह की गयी है।

आम की गुठली से बने स्टार्च का अभिलक्षण

आम की गुठली (मैंगो सीड कर्नेल, एमएसके) स्टार्च को इसकी शुद्धता, एमाइलोज की मात्रा, सूजन शक्ति और पानी में घुलनशीलता सूचकांक के लिए अभिलक्षित किया गया। स्कैनिंग इलेक्ट्रॉन माइक्रोग्राफ से पता चला है कि एमएसके स्टार्च कण गोलाकार से दीर्घवत् आकार में 8-18.5 माइक्रोन लंबाई और 5.4-10.6 माइक्रोन चौड़ाई के आकार के होते हैं। एक्स-रे विवर्तन ने 15°, 23° के विवर्तन शिखर (2θ) पर और 17 और 18° पर एक अनसुलझे दोहरे शिखर पर A-प्रकार का स्टार्च दिखाया।

सूखी मछली भंडारण के लिए पैकेजिंग

सूखी मछली के भंडारण के लिए एल्युमीनियम लैमिनेटेड एचडीपीई पिलो पाउच और एचडीपीई ट्रे पैकेजिंग स्वीकार्य पाये गए। संवेदी मूल्यांकन

(9-प्वाईंट हेडोनिक स्केल) के आधार पर सूखी मछली 8 महीने तक भंडारण के बाद भी गुणवत्ता बनाए रखता है।

प्रसंस्करण में रुचि रखने वाले प्रसंस्करणकर्ताओं और किसानों के सामने आने वाले उद्यमी व्यवहार और बाधाओं के आधार पर कटाई के बाद की प्रौद्योगिकियों को बढ़ावा देने के लिए रणनीतियां

अध्ययन ने प्रसंस्करण में रुचि रखने वाले प्रसंस्करणकर्ताओं और किसानों की प्रमुख बाधाओं के बारे में अंतर्दष्टि प्रदान की। परिणामों से पता चला कि वित्तीय बाधाओं (मीन रैंक 204.850) और प्रसंस्करण प्रौद्योगिकियों (मीन रैंक 12.85) से संबंधित जानकारी की कमी क्रमशः प्रसंस्करणकर्ताओं और किसानों के लिए बाधक है। उनके व्यवहार संबंधी पहलू और बाधाओं का सामना करने के लिए कटाई के बाद की प्रौद्योगिकियों को लोकप्रिय बनाने के लिए कुछ रणनीतियां तैयार की गई हैं।

हवाईजार (सोयाबीन से बना एक पदार्थ) से सूक्ष्मजीव समूह का पृथक्करण, पहचान और अभिलक्षणन

स्टील कंटेनर, ग्लास जार और केले के पत्ते में तैयार हवाईजार से पृथक सूक्ष्मजीवीय कॉलोनियों की मैक्रो-मॉर्फोलॉजी का अध्ययन किया गया है। पृथक कॉलोनियां छड़ के आकार की और बैंगनी रंग की पाई गई जो ग्राम-पॉजिटिव बैक्टीरिया के परिवार से संबंधित होती हैं और बैसिलस सबटिलिस मानक कल्चर (एमटीसीसी 2756) की कॉलोनियों के समान होती हैं।

विकसित उत्पाद

भुने हुए सांगरी बीज

सांगरी बीजों का उपयोग करके एक स्वास्थ्यवर्धक वैकल्पिक नमकीन विकसित किया गया है। सूखे सांगरी के बीजों को 10, 20, 30, 40 और 50 (%wb) की वांछित नमी प्राप्त करने के लिए 80°C पर भिगोया जाता है और इन्हें तीन अलग-अलग तरीकों से भुना जाता है, जैसे माइक्रोवेव रोस्टिंग, सॉल्ट रोस्टिंग और ड्राई रोस्टिंग। सांगरी बीज (10% नमी) को नमक में भूनने से सबसे अच्छी संवेदी गुणवत्ता प्राप्त हुई।

सेमी-पॉप्ड मखाने के साथ अनाज -ग्लूटेन मुक्त इंस्टेंट रिबन पास्ता

सेमी-पॉप्ड मखाना (एसपीएम) आटा, वाटर चेस्टनट (डब्ल्यूसीएन) आटा और आलू पाउडर (पीपी) और गाजर के रस पर आधारित अनाज-ग्लूटेन मुक्त इंस्टेंट रिबन पास्ता (सीजीएफआई पास्ता) विकसित किया गया है। एसपीएम आटा, डब्ल्यूसीएन आटा और पीपी के लिए इष्टतम सांद्रता क्रमशः 47.81, 23.50 और 28. 69% पाई गई। अनुकूलित और मान्य फॉर्मूलेशन के साथ सीजीएफआई पास्ता ने 7.39 की समग्र संवेदी स्वीकार्यता के साथ कुल प्रोटीन, कुल वसा, लोहा और कैल्शियम सामग्री क्रमशः 10.23%, 0.51%, 10.62 मिलीग्राम/100 ग्राम और 39.21 मिलीग्राम/100 ग्राम दिखाया है। अनुकूलित सीजीएफआई पास्ता कुल फेनोलिक, फ्लेवोनोइड सामग्री में समृद्ध है और डीपीपीएच अवरोध और एफआरएपी परख के संदर्भ में एंटीऑक्सीडेंट गतिविधि रखता है।

विकिरण द्वारा सुखाने की विधि का उपयोग कर फल पट्टी निर्माण

तीन अलग-अलग फलों के गूदे (अमरूद, जामुन और आम) से फल की पट्टीयों को आईसीएआर-सीफेट, अबोहर द्वारा विकसित एक सतत प्रकार के अपवर्तक विंडो ड्रायर का उपयोग करके विकसित किया गया है। फलों के गूदे को माइलर शीट पर फैलाया जाता है और फ्लोट ड्रायर के एक सिरे से दूसरे सिरे तक चला जाता है। लगभग 3 घंटे में मध्यवर्ती नमी (20-25% wb) प्राप्त करने के लिए ड्रायर का उपयोग करके फलों के गूदे को 80 (% wb) से सुखाया जाता है। सूखे अमरूद के गूदे (पट्टी) की मोटाई 1.78 मिमी है और 140 मिनट में पूरी तरह से सूख जाती है। इसी तरह जामुन और आम के गूदे के लिए सुखाने का समय 120 से 220 मिनट तक और सुखाने के बाद पट्टी की मोटाई 1.44 से 1.98 मिमी तक होती है। अपवर्तक खिड़की आधारित सुखाने की प्रक्रिया में सुखाने में कम समय लगता है और रंग, स्वाद और पोषण संबंधी प्रोफाइल के मामले में उत्पाद की समग्र गुणवत्ता बनी रहती है।

सहयोगात्मक/बाह्य रूप से वित्त पोषित परियोजनाएं

प्रमुख दालों की खरीद, भंडारण और एक समान मिलिंग उत्पादन के लिए संचालन प्रक्रियाओं का मानकीकरण

भाकृअनुप-सीफेट ने अन्य सहकारी केंद्रों के साथ उपभोक्ता मामले विभाग द्वारा वित्त पोषित परियोजना के तहत प्रमुख दालों की खरीद, भंडारण, और एक

समान मिलिंग के लिए मानक संचालन प्रक्रियाओं पर एक अध्ययन किया। प्रमुख दालों (चने की दाल, अरहर, काला चना, हरा चना और मसूर) की खरीद के लिए मानक संचालन प्रक्रियाओं की सिफारिश भी की।

सीएपी प्रणाली में भंडारित गेहूं व धान की भंडारण क्षति

कवर और प्लिंथ (सीएपी) भंडारण संबंधी एक राष्ट्र स्तरीय संदर्भ अध्ययन किया गया है और सीएपी प्रणाली में संग्रहीत गेहूं और धान के भंडारण के नुकसान के लिए एफसीआई को सिफारिशें की गई हैं। संग्रहीत धान और गेहूं में भंडारण हानियों सम्बन्धी अध्ययन के परिणाम राष्ट्रीय महत्व के हैं।

चावल और गेहूं का माइक्रोवेव की सहायता से कीटाणुशोधन

प्रमुख भंडारित चावल की कीटों (चपटे अनाज भृंग, चावल की घुन), और गेहूं के कीड़े (अनाज छेदक और आटा भृंग) के लिए माइक्रोवेव की सहायता से कीटाणुशोधन विधियों को मानकीकृत किया गया है। आईएमआरसी, नवी मुंबई में 130-150 किग्रा/घंटा क्षमता का एक सतत माइक्रोवेव अनाज कीटाणुशोधन प्रणाली भी स्थापित की गई है।

प्रकाशीय पिंजरे का विकास

भंडारण के दौरान अनाज कीट (सिटोट्रोगैसेरियलेला प्रजाती) के प्रबंधन के लिए प्रकाशीय पिंजरे का विकास किया गया जो कीटों के प्रकाश संबंधित व्यवहार के आधार पर काम करता है। इसके लिए ऐक्रेलिक और पीवीसी से युक्त दो अलग-अलग परीक्षण कक्ष विकसित किए गए। मानक जांच के रूप में परावैगनी प्रकाश के साथ-साथ पांच अलग-अलग रंगों, नीला, पीला, हरा, लाल एवं सफेद का उपयोग किया गया। परिणामों से पता चला कि मानक परावैगनी (76.20%; 254±10 नैनोमीटर) के मुकाबले 73.34% सिटोट्रोगा नीली रोशनी (470±10 नैनोमीटर) की ओर सबसे अधिक आकर्षित हुए, उसके बाद हरे (520±5 नैनोमीटर, 43.34%) और लाल (625±10 नैनोमीटर, 23.34%) की ओर।

चुनिंदे कृषि उत्पादों के भंडारण के लिए हर्मेटिक बैग

धान, चावल, गेहूँ, अरहर, हल्दी और काली मिर्च का मूल्यांकन हर्मेटिक भंडारण स्थितियों में किया गया। वस्तुओं को दो अलग-अलग परिस्थितियों में संग्रहित किया गया-संक्रमित (कृत्रिम रूप से) और गैर-संक्रमित (हर्मेटिक भंडारण बैग में)। धान और चावल में पूर्ण भंडारण अध्ययन के आधार पर, अनाज की गुणवत्ता में कोई महत्वपूर्ण परिवर्तन नहीं होने के साथ अनाज के भंडारण के लिए हर्मेटिक भंडारण प्रभावी पाए गये।

फल-मक्खी स्कैनिंग मशीन

खीरा (Gherkins) के लिए एक्स-रे आधारित फ्रूट फ्लाई स्कैनिंग मशीन का मूल्यांकन किया गया और इसे संतोषजनक पाया गया। खराब फलों को पहचानने की सटीकता का परीक्षण किया गया और 95% (3 मिमी. दोष वाले फलों के लिए 100% और >3 मिमी. वाले फलों के लिए 94%) पाया गया। मशीन की पृथक्करण दक्षता 85% है।

एआईसीआरपी-पीसेम द्वारा विकसित मशीनरी / प्रक्रियाएं / उत्पाद

एआईसीआरपी-कृषि संरचनाओं और पर्यावरण प्रबंधन (PEASEM) द्वारा संरक्षित खेती के तहत मिट्टी रहित मीडिया में लेट्यूस उगाने के लिए पूरक प्रकाश व्यवस्था का मानकीकरण, पहाड़ी क्षेत्र में नदी के किनारे की खेती के लिए जल उठाने वाला उपकरण, उपयोगकर्ता के अनुकूल मछली पालन के लिए बॉयोफ्लॉक सुविधा का विकास, मछली और पौधों के बायोमास उत्पादन के लिए ऊर्ध्वाधर एक्वापोनिक्स, कृषि सुविधाओं के स्वचालन की सुविधा के लिए कम लागत वाली सौर विकिरण ढाल प्रणाली, उच्च ऊंचाई वाले चारागाह पर पशुधन बढ़ाने के लिए पोर्टेबल और पृथक्करणीय पशु आश्रय, मछली बीज के लिए परिवहन प्रणाली, उपयुक्त लागत का डिजाइन-समशीतोष्ण हिमालयी क्षेत्र के लिए प्लास्टिक का उपयोग करके प्रभावी पशु आश्रय, धान के भूसे आधारित सब्सट्रेट का उपयोग करके जल-पोषक तत्व उत्पादकता बढ़ाने के लिए उच्च मूल्य वाली सब्जियों की मिट्टी रहित खेती, गीली घास और ड्रिप सिंचित उच्च मूल्य वाली फसलों के तहत पानी और पोषक तत्वों की गतिशीलता की मॉडलिंग, मेघालय की मध्य-पहाड़ियों के लिए गुरुत्वाकर्षण-फेड ड्रिप सिंचाई प्रणाली का आकलन, संरक्षित खेती के तहत खीरा

उत्पादन के लिए चुंबकीय पानी का अनुप्रयोग और गुलदाउदी (गुलदाउदी इंडिकम एल) आदि की वृद्धि और उपज पर विभिन्न रंगों की कम सुरंग छाया जाल का प्रभाव शामिल है।

एआईसीआरपी-पीएचईटी द्वारा विकसित मशीनरी / प्रक्रियाएं / उत्पाद

एआईसीआरपी-पोस्ट-हार्वेस्ट इंजीनियरिंग एंड टेक्नोलॉजी (पीएचईटी) ने विभिन्न मशीनों, उत्पादों और प्रक्रिया प्रोटोकॉल विकसित किए हैं जिनमें कच्चा नारियल काटने की मशीन, कोको बीन शेलर कम विनोवर, और संतरा तोड़ने के बाद होने वाली सड़न को कम करने के लिए परावैगनी उपचार, खाद्य मैट्रिक्स में चुनिंदे भारी धातुओं का पता लगाने और मात्रा का पता लगाने के लिए संवेदन प्रणाली, सूखे नारियल पाउडर में मिलावट का तेजी से पता लगाना: वीआईएस-एनआईआर स्पेक्ट्रोस्कोपी और केमोमेट्रिक दृष्टिकोण, एंटीमाइक्रोबियल आवश्यक तेलों के साथ खाद्य फल कोटिंग और नागपुर के संतरे में फसल के बाद के क्षय नियंत्रण के लिए माइको-नैनोपार्टिकल्स, करंज के बीज के तेल से जूता पॉलिश बनाने की प्रक्रिया प्रौद्योगिकी और तिलहन प्रसंस्करण से प्राप्त वानस्पतिक सूत्रीकरण शामिल हैं।

अन्य पेशेवर उपलब्धियां

वर्ष 2021 में हमारे वैज्ञानिकों को कटाई-उपरांत अनुसंधान में उनके योगदान के लिए कई पुरस्कार और सम्मान (मौखिक / पोस्टर प्रस्तुति पुरस्कार) से सम्मानित किया गया है। हमारे वैज्ञानिक विभिन्न समितियों और वैज्ञानिक पैनलों के सदस्य हैं। हमसे सहायता प्राप्त एक किसान ने सर्वश्रेष्ठ किसान का पुरस्कार भी प्राप्त किया है। वर्ष 2021 के दौरान आठ प्रौद्योगिकियों को लाइसेंस किया गया जिसमें पोर्टेबल स्मार्ट पराबैंगनी-सी कीटाणुशोधन प्रणाली (यूवीआईसी), ओजोन आधारित फल और सब्जी वॉशर-कम-प्यूरिफायर (ओजो-सी), वसा रहित स्वाद वाले मखाना तैयार करने की प्रक्रिया, और तैयार मखाना खीर मिश्रण, तिलहन केक/ मील से प्रोटीन आइसोलेट / कंसन्ट्रेट के उत्पादन के लिए सूक्ष्मजीव विधि, जीवित मछली वाहक प्रणाली और उसमें जीवित मछली के परिवहन की विधि, पौष्टिक मल्टीग्रेन चपाती आटा और मूंगफली आधारित स्वाद पेय, दही और पनीर तैयार करने की प्रक्रिया शामिल हैं। प्रौद्योगिकी लाइसेंसिंग के जरिये वर्ष के दौरान 7 लाख रुपये का राजस्व उत्पन्न किया। रिपोर्ट की गई अवधि के दौरान पांच पेटेंट प्रदान किए गए। पोस्ट-हार्वेस्ट मशीनरी एंड इक्विपमेंट टेस्टिंग सेंटर (PHMETC) ने देश के विभिन्न हिस्सों से 33 मशीनों का परीक्षण किया, जिससे कुल राजस्व रु.31.44 लाख प्राप्त हुआ।

रिपोर्ट की अवधि के दौरान, विभिन्न योजनाओं के तहत विभिन्न उद्यमिता विकास कार्यक्रम, मानव संसाधन विकास कार्यक्रम, किसान प्रशिक्षण, छात्र प्रशिक्षण आदि आयोजित किए गए। विभिन्न स्थानों से 200 से अधिक छात्रों और 1500 नवोदित उद्यमियों को प्रशिक्षित किया गया और कार्यक्रम को सफलतापूर्वक पूरा किया गया। कुल 1097 प्रतिभागियों को उद्यमिता विकास कार्यक्रमों (ईडीपी), किसानों के प्रशिक्षण और संवेदीकरण कार्यक्रमों के माध्यम से कृषि और पशुधन उपज के फसल कटाई के बाद प्रबंधन के लिए प्रशिक्षित किया गया था। इस अवधि के दौरान फसल कटाई उपरांत इंजीनियरिंग और प्रबंधन के क्षेत्र में कुल 178 छात्रों को प्रशिक्षित किया गया। आजादी का अमृत महोत्सव के तहत, भाकृअनुप-सीफेट ने विभिन्न कार्यक्रमों का आयोजन किया है; जैसे वेबिनार श्रृंखला, अभिविन्यास कार्यक्रम, ईडीपी आदि। भाकृअनुप-सीफेट, लुधियाना ने अपना स्थापना दिवस मनाने के लिए कृषि प्रसंस्करण-2021 (सीफेट-आईफा 2021) पर उद्योग इंटरफेस मेला का आयोजन किया है। राष्ट्रीय और अंतर्राष्ट्रीय समकक्ष समीक्षा पत्रिकाओं में उच्च गुणवत्ता वाली 39 से अधिक शोध पत्र प्रकाशित हुए। संस्थान के अन्य प्रमुख प्रकाशनों में संग्रह, पुस्तक, पुस्तक अध्याय, लोकप्रिय / तकनीकी लेख, तकनीकी बुलेटिन, वाणषक रिपोर्ट, समाचार पत्र और पत्रक शामिल हैं।

Executive Summary

ICAR-CIPHET, a premier institute in the country with a mandate to undertake research activities in the area of post-harvest engineering and technology. During this reported period, institute continued to play a significant role in developing innovative technologies, methodologies related to post-harvest quality management and in further transfer of these technologies to respective stakeholders, farmers, entrepreneurs and industry through technology licensing, trainings, capacity building and extension activities. Institute has contributed through its various multidisciplinary in-house and externally funded research projects, the institute has developed many innovative solutions for the problems posed by stakeholders. The salient achievements of ICAR-CIPHET during the year 2021 are summarized here.

Machines / Equipment Developed

Automatic sorting / grading system for Tomatoes / Pomegranate

An automatic vision-based sorting/grading system has been developed, capable of sorting tomatoes and pomegranate on the basis of surface defects which are directly correlated to the variation in the surface color and texture. After sorting, developed system grades the commodities based on their sizes. At present, machine has the capacity to sort the 45-50 fruits/objects per minute depending on the response time of the diversion/ejection system.

Machine vision based insect detection device

An automatic device has been developed to detect and identify insects in stored grains. System has been programmed to detect, identify and count the number of insects in the sample instantaneously by analysing images. The time required for detection and counting of insects (Lesser grain borer) in wheat grain is 3-4 seconds with 85-88% accuracy as compared to 210 seconds of manual operation.

Rotating orifice feeding system

A simple feeding system has been developed for continuous and uniform discharge of roasted makhana seeds of different sizes (7.48-12.40 mm diameter) with a consistent flow rate of 10-30 kg h^{-1}. The developed feeding system performs well for feeding makhana seeds of different sizes at finite mass flow rates of 2.25-29.81 kg h^{-1}. The estimated cost of the developed system is about Rs 30,000/-.

Oxygen concentrator for rapid ozone generation

The developed concentrator works on the principle of rapid pressure swing adsorption (PSA). It utilizes a molecular sieve to adsorb gases onto sodium-based zeolite minerals at high pressure. This type of adsorption system is functionally a nitrogen scrubber (8ml/g/min) allowing the other atmospheric gases to pass through, therefore concentrating oxygen as the primary gas (up to 85%). The concentrated O_2 when fed to ozone generator helps in rapid O_3 generation and also enhanced its capacity.

Modified push cart for small scale vegetable vendors

Push cart of 200 kg capacity has been developed and evaluated for maintaining the freshness of the fresh produce as compared to the outside conditions (control). System maintains an average inside temperature of 24°C (at no load) with outside average temperature recorded as 34°C. With load the

developed cart creates a temperature and humidity difference of about 28% and 48% respectively, as compared to control. It resulted in about 50% less reduction in PLW of the commodities as compared to the control.

Litchi de-stoner tools

A hand operated and pedal operated Litchi de-stoning tools have been developed and evaluated. Hand operated tool gives an intact pulp recovery of 48.63% after destoning. Loss of juice in the process is found to be 8.08% whereas total pulp loss is about 32.53%. Pedal operated litchi destoner gives intact pulp recovery of 34.02% during destoning process, with a juice and total pulp loss of 5.08% and 38.42%, respectively. Both these tools have capacity of about 12 to 9 kg/h, respectively.

Modified live fish carrier system

Existing live fish carrier system has been redesigned and fabricated for increasing its capacity (200-300 kg) and to cover long distance trips. The container has now a multipurpose chamber and the equipment for supporting aquatic lives. System is equipped with two pumps for water showering, filtration device, air-pump aerators, exhaust fan and water chiller. The modified system can carry live fish up to a journey time of 3-5 days as compared to earlier.

Air cooling unit for low-cost onion storage structure

Dry-type air cooling unit has been developed for an onion storage system, where in the temperature of air is reduced without affecting its relative humidity. Blower attached at one end (inlet chamber) moves the air inside the aluminium pipes (25 no.), where the temperature and moisture of the air is reduced by sprinkling water over the pipes. Water is re-circulated in the system after cooling. The developed air cooling unit is capable of reducing the temperature and RH of ambient air by 2-4°C and 6%, respectively.

Smart solar dryer

Solar based dryer of 10-15 kg capacity that utilizes solar energy in the form of thermal as well as electrical energy has been developed. Thermal storage is provided through paraffin wax (as phase change materials, PCM) and electrical energy using photo voltaic cell. In case of no solar radiation, system is supplemented with hot air blower, powered by solar battery. Dryer is equipped with sensors and microcontroller arrangement, air heating unit, air handling and distribution unit, temperature control of the drying chamber, dry weight measurement for preventing overheating, thermal storage and power supply.

Processes / Methods Developed

Near Infra-Red Spectroscopy based Methods for maize and pea flour in chickpea flour

NIR based methods have been developed for quantification of maize flour and pea flour adulteration in chickpea flour. For maize flour as adulterant modified partial least square regression (MPLSR) model with RSQ and 1-VR value of 0.9989 and 0.9963 having SEC and SECV value of 1.0918 and 2.0468, respectively has been developed. Similarly model for quantification of pea flour in chickpea flour showed coefficient of determination (RSQ) of 0.99, standard error of calibration (SEC) of 0.827 and standard error of cross validation (SECV) of 1.491. The developed methods allow rapid and non-destructive detection and quantification of maize and pea flour adulteration in chickpea flour.

Protein Extraction from De-oiled Rice Bran

A process has been optimized for extraction of protein from defatted rice bran. Process variables like extraction temperature (40-60°C), extraction duration (30-60 min), and extraction pH (9-11) and the responses *viz*. extraction efficiency (%), recovery (%), purity (% protein) and yield (g/100 g) have been optimised. The methodology includes

alkaline extraction followed by acid precipitation at isoelectric point. The predicted values of extraction of protein under optimized conditions resulted in extraction efficiency of 54.2%, and yield of 7.35g/100g with purity of 79%.

Bioactive compounds from immature dropped Kinnow fruit

Process for extraction of bioactive compounds has been optimized using different solvents (methanol, ethanol and acetone) and extraction technology (orbital shaking and ultrasonic assisted extraction). The extract using ultrasound assisted extraction gave better results for the total phenolic content (TPC), total flavonoid and antioxidant activity in the range of 2.63 to 4.59g gallic acid equivalent (GAE)/100g, 5.35 to 7.60g quercetin equivalent (QE) /100g and 178.89 to 251.41mg ascorbic acid equivalent (AAE)/100g, respectively. Ethanol has been found to be most effective solvent followed by methanol and acetone.

Storage of roasted makhana (*Euryale ferox*) seeds

During makhana seed storage, it has been observed that the insects *viz.* lesser grain borer *(Rhyzopertha dominica)* in the grub and adult stages causes damage and affects popping of roasted seeds. Studies on naturally infested roasted makhana seeds of different sizes revealed that insect infestation was more on 11 mm size seeds, followed by 9 mm and 7 mm, respectively. It has been found that 40±1.24% damage is caused during 15 days of storage. *R. dominica* female lays 200-500 eggs and completes its life cycle in 35-50 days.

Carotenoids from black gram husk

Process has been optimized for carotenoids extraction from black gram husk using the Box–Behnken design of RSM. The total carotenoid content of the husk extracts has been observed in the range of 2939 – 3941 µg/100g. The optimum conditions for maximum extraction of total carotenoids from black gram husk are 27.28 ml/g at 30°C extraction temperature and 6 h time.

Microbial method for PHB film production

Pre-treatment process has been optimized for maximum recovery of fermentable sugars from mango by products. Considering the cost economics, 1% of both acids (H_2SO_4, and HCl) is recommended to be used for the recovery of fermentable sugar from mango by-products. Further PHB producing bacteria have been isolated and screened from the soil samples.

Characterization of mango seed kernel (MSK) starch

Mango seed kernel (MSK) starch has been characterised for its purity, amylose content, swelling power, and water solubility index. Scanning electron micrographs have revealed that the MSK starch granules are round to oblong in shape with particle size of 8-18.5 μm in length and of 5.4 - 10.6 μm in width. X-ray diffraction revealed the diffraction peaks at (2θ) of 15°, 23° and an unresolved doublet peak at 17 and 18° showing A-type starch.

Packaging materials for dried fish under storage

Aluminium laminated HDPE pillow pouches and HDPE trays have been found acceptable for storing dry fish, which maintains cooking quality up to 8 months of storage based on sensory evaluation (9-point Hedonic scale).

Strategies for promoting post-harvest technologies based on entrepreneurial behaviour and constraints faced by processors and farmers interested in processing

The study provided insight into the major constraints faced by processors and farmers interested in processing. The results have shown that financial constraints (Mean Rank 204.850) and lack of information related to processing technologies (Mean rank 12.85) are reported for processors and farmers, respectively. Strategies for promotion post-harvest technology include custom

processing centres, development of small multifunction / multipurpose processing machineries, capacity building of extension functionaries in processing sector etc.

Isolation, identification and characterization of microflora from *Hawaijar*

The macro-morphology of isolated colonies from *Hawaijar* prepared in steel container & glass jar and banana leaf have been studied. Isolated colonies are of rod-shaped and purple-colored, belong to the family of gram-positive bacteria and are similar to the colonies of *Bacillus subtilis* standard culture (MTCC 2756).

Products Developed

Roasted *Sangri* Seeds

A healthy alternative snack item has been developed using *sangri* seeds. Dried sangri seeds, are soaked at 80°C to get the desired moisture content of 10, 20, 30, 40 and 50 (% wb). Soaked seeds having different moisture contents (10-50%) have been roasted by three different ways *viz.*, microwave roasting, salt roasting and dry roasting. Salt roasting method with initial seed moisture content of 10% resulted in the roasted seeds with good sensory quality.

Cereal-gluten free instant ribbon pasta with semi-popped makhana

Cereal-gluten free instant ribbon pasta (CGFI pasta) based on semi-popped makhana flour (SPM), water chestnut flour (WCN) and potato powder (PP) and carrot juice has been developed. Optimum concentrations for SPM flour, WCN flour and PP are found to be 47.81, 23.50 and 28.69%, respectively. CGFI pasta with the optimized and validated formulation has shown total protein, total fat, iron, and calcium content of 10.23%, 0.51%, 10.62 mg/100g and 39.21 mg/100g respectively, with overall sensory acceptability of 7.39. Optimized CGFI pasta is rich in total phenolic, flavonoids content and possess antioxidant activity in terms of DPPH inhibition and FRAP assay.

Fruit bar manufacturing using refractance window drying

Fruit bars from three different fruit pulps (guava, jamun and mango), have been developed using a continuous type Refractance window dryer developed by ICAR-CIPHET, Abohar. The fruit pulp is spread on the Mylar sheet and the float moves from one end of the dryer to the other end. Fruit pulp is dried from 80% (wb) using the dryer to achieve intermediate moisture content (20-25% wb) in about 3h. Final thickness of dried guava pulp (bar) is 1.78 mm and complete drying is achieved in 140 min. Similarly, for jamun and mango pulps, the drying time varied from 120 to 220 min and pulp thickness after drying varied from 1.44 to 1.98 mm. Refractive window based drying process takes less drying time and the overall product quality in terms of color, flavor, and nutritional profile is maintained.

Collaborative / Externally Funded Projects

Standardization of operating procedures (SOP) for procurement of major pulses, storage and uniform milling outturn

ICAR-CIPHET along with other centres conducted a study on SOP's for the procurement, storage, milling and uniform milling outturn of major pulses under DoCA funded Project. SOP's for procurement of major pulses (chick pea, pigeon pea, black gram, green gram and lentil) have also been recommended.

Storage losses of wheat and paddy stored in CAP system

A national level reference study has been performed and recommendations have been made to FCI for storage losses for wheat and paddy, stored in CAP system. The outputs of the study are of national level importance for the record on extent of storage losses in paddy and wheat stored under CAP.

Microwave assisted disinfestation of rice and wheat

Microwave assisted

disinfestation methods for rice and wheat against major stored rice insects (flat grain beetles, rice weevils, flour beetles and khapra beetle) and wheat insects (lesser grain borer and flour beetles) have been standardized. A continuous microwave grain disinfestation system of 130-150 kg/h capacity has also been established at IMRC, Navi Mumbai.

Light trap development

Light traps for managing grain moth (*Sitotroga cerealella*, spp.) during storage exploits photo tactic behaviour of the insects. For this purpose, two different test chambers comprising of acrylic and PVC have been developed. Five different colours have been used i.e., blue, yellow, green, red, white along with the UV light as standard check. The results showed that 73.34% Sitotroga were attracted towards blue light (470±10 nm) followed by green (520±5 nm, 43.34%) and red (625±10 nm, 23.34%) as against 76.20 % towards UV (254±10 nm) i.e. standard check.

Hermetic bags for storage of selected agriculture commodities

Commodities like paddy, rice, wheat, tur, turmeric and black pepper have been evaluated under hermetic storage conditions. Commodities were stored under two different conditions *viz.*, infested (artificially infested) and un-infested in Save Grain bags. Based on the completed storage study in paddy and rice, Save Grain Bags are found to be effective for storage of grains with no significant changes in the grain quality.

Soy and groundnut protein Isolates

A novel process based on microbial precipitation process to produce protein isolates/concentrates from oilseed cakes/meals (example soy meal, groundnut cake) without addition of strong or diluted acid has been developed. The developed process is unique as it is added acid free and also provides about 5% higher yield of protein as compared to the existing chemical process. The protein isolates samples have been tested for biochemical and toxicity parameters using rat models.

Fruit fly scanning machine

Performance of X-ray based fruit fly scanning machine has been evaluated for gherkins (CONRAD-G) and found satisfactory. The detection accuracy has been tested for bad fruits is 95% (100% for fruits with defect $\geqslant$ 3mm and ~94% for fruits with defect <3mm). Fruits with defect size larger than 3 mm can be successfully removed. The machine's segregation efficiency is 85%.

Machineries/ Processes/ Products Developed by AICRP-PEASEM

Developments made by AICRP on Plastic Engineering in Agriculture Structures & Environment Management (PEASEM) includes various standardization of the supplemental lighting system for growing lettuce in soilless media under protected cultivation, water lifting device for river bed cultivation in hilly region, development of user-friendly biofloc fish rearing facility, vertical aquaponics for fish and plant biomass production, low- cost solar radiation shield system to facilitate the automation of agricultural facilities, portable and detachable animal shelters for raising livestock at high altitude pasture, transportation system for fish seed, design of suitable cost-effective animal shelter using plastics for temperate Himalayan region, soil-less cultivation of high value vegetables for enhancing water-nutrient productivity using different paddy straw based substrates, modelling of water and nutrient dynamics under mulch and drip irrigated high value crops, assessment of gravity-fed drip irrigation system for mid-hills of Meghalaya, application of magnetized water to gherkins (*Cucumis angora L.*) under protected cultivation and impact of different colour low tunnel shade nets on growth

and yield of chrysanthemum (*Chrysanthemum indicum L.*) etc.

Machineries/ Processes/Products Developed by AICRP-PHET

The AICRP on Post-Harvest Engineering and Technology (PHET) has developed various machines, products and process protocols which includes tender coconut cutting machine, cocoa bean sheller cum winnower, UV-assisted treatment device for post-harvest decay control in Nagpur mandarins, development of sensing system for detection and quantification of selected heavy metals in food matrix, rapid detection of adulteration in desiccated coconut powder using VIS-NIR spectroscopy and chemometric approach, edible fruit coating impregnated with antimicrobial essential oils and myco-nanoparticles for post-harvest decay control in Nagpur mandarins, process technology for making shoe polish from karanj seed oil, botanical formulation derived from oilseed processing.

Other Professional Achievements

Our scientists are conferred with many awards and honours (including oral/poster presentation award) in recognition of their contributions in research and development in post-harvest sector. Our scientists are members of various committees and scientific panels. One of the farmer has received innovative farmer's award from ICAR-NAARM, Hyderabad.

Eight technologies were licensed during 2021 which include Portable smart ultraviolet-C disinfection system (UViC), Ozone based fruits and vegetable washer-cum-purifier (Ozo-C), process for preparation of fat free flavoured makhana, ready to constitute makhana kheer mix, microbial method for production of protein isolate/concentrate from oilseed cakes/meals, live fish carrier system and method of transporting live fish therein, process for preparation of nutritious multigrain chapatti flour and groundnut based flavoured beverage, curd and paneer. The technology licensing generated a revenue of Rs. 7 lakh during the year. Five patents were granted during the reported period.

The Post-Harvest Machinery and Equipment Testing Centre (PHMETC) tested 33 machines from different parts of the country, earning a total revenue of Rs. 31.44 lakh.

During the reported period, Various Entrepreneurship Development Programmes, Human Resource Development programmes, Farmer's Training, Students's Trainings etc. were organized under different schemes. More than 200 students & 1500 budding entrepreneurs from different places were trained and successfully completed the programme. Total of 1097 participants were trained for post-harvest management of agricultural and livestock produce through entrepreneurship development programs (EDP), farmers' trainings, sensitization programmes and special programmes for training under SCSP. A total of 178 students were trained during this period in the area of post-harvest engineering and management. Under Azaadi Ka Amrit Mahotsav, ICAR-CIPHET has organised a number of programmes; e.g. webinar series, orientation programme, EDPs etc. ICAR-CIPHET, Ludhiana has organised Industry Interface Fair on Agro processing – 2021 (CIPHET-IIFA 2021) to commemorate its foundation day.

More than 39 research papers were published in high quality national and international peer reviewed journals. The other major publications of the institute include Compendiums, Book, Book chapters, Popular/Technical Articles, Technical Bulletins, Annual Reports, Newsletters, and Leaflets.

Vision

Achieving near zero post-harvest losses and high level of processing of agricultural commodities through excellence in research.

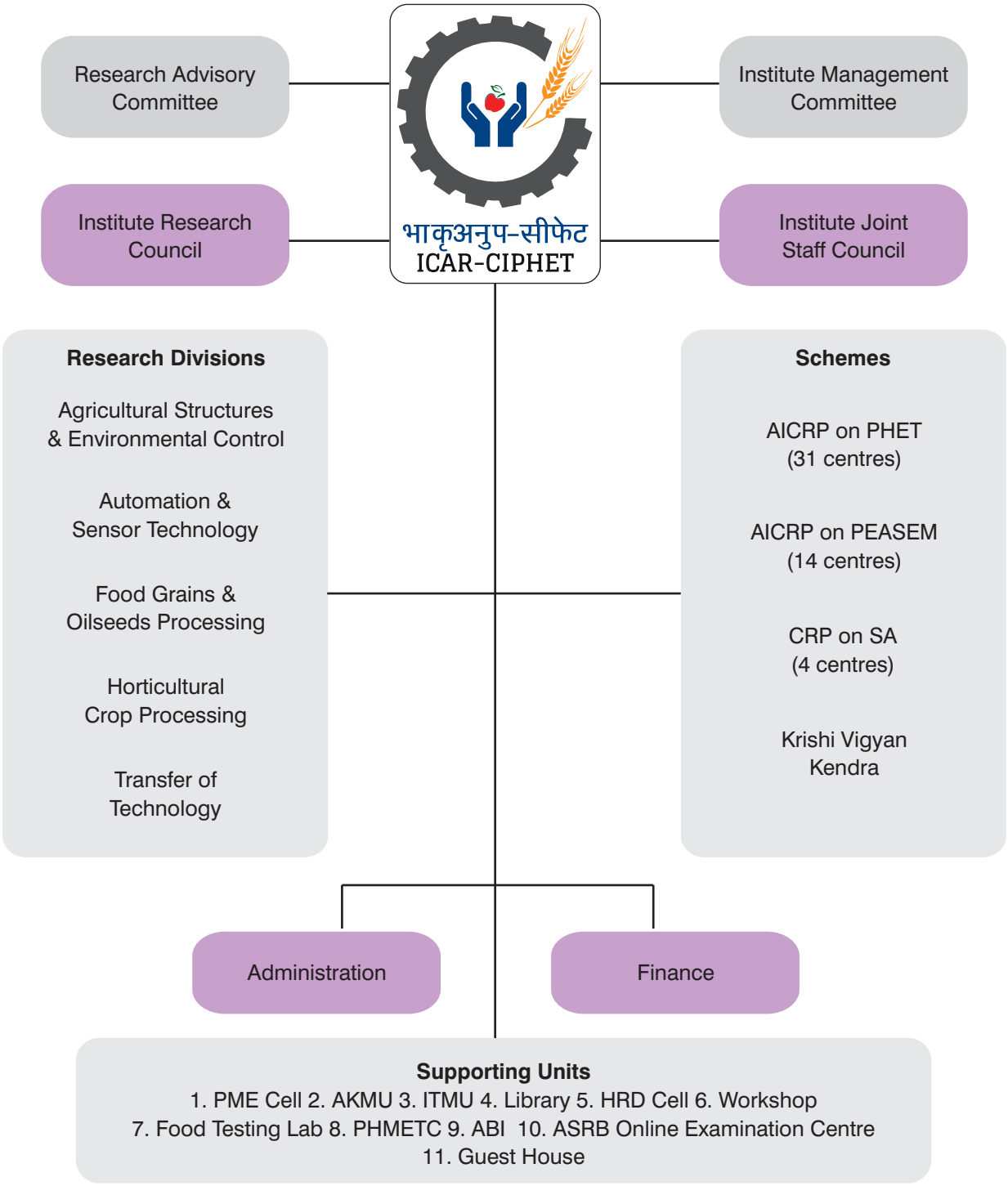
Mission

- Evolving efficient post-harvest engineering and technological interventions to enhance farmers income by transforming farmers and rural youth into entrepreneurs, providing products with quality and safety assurance to consumers, addressing environmental protection issues as well as acting as referral point for policy inputs, defining standards and networking with sister organizations to harness synergies for solving problems in post-harvest sector
- 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

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

Organogram


Research Advisory Committee
Institute Management Committee
Institute Research Council
Institute Joint Staff Council
भाकृअनुप-सीफेट
ICAR-CIPHET
Research Divisions
Agricultural Structures & Environmental Control
Automation & Sensor Technology
Food Grains & Oilseeds Processing
Horticultural Crop Processing
Transfer of Technology
Schemes
AICRP on PHET (31 centres)
AICRP on PEASEM (14 centres)
CRP on SA (4 centres)
Krishi Vigyan Kendra
Administration
Finance
Supporting Units
1. PME Cell 2. AKMU 3. ITMU 4. Library 5. HRD Cell 6. Workshop
7. Food Testing Lab 8. PHMETC 9. ABI 10. ASRB Online Examination Centre
11. Guest House

Overview

ICAR-Central Institute of Post-Harvest Engineering and Technology (ICAR-CIPHET) was established on 03 October 1989, at Ludhiana, Punjab. It is a nodal institute that undertakes lead research in the area of the post-harvest engineering and technologies, value-addition appropriate to agricultural production catchments and agro-processing industries. Another campus of the Institute was established on 19 March 1993 at Abohar, Punjab, to primarily undertake the research and development activities for processing and value addition of fruits, vegetables and horticultural crops. ICAR-CIPHET is also headquarter of two All India Coordinated Research Projects (AICRPs) *viz.* AICRP on Post-Harvest Engineering and Technology (PHET) with 31 Centres and AICRP on Plastic Engineering in Agriculture Structures & Environment Management (PEASEM) with 14 Centres across the country.

ICAR-CIPHET is the only institute in India which works entirely for applied post-harvest technology and value addition of all commodities for farmers, orchardists, rural youth and entrepreneurs. It also generates basic knowledge by taking various basic and strategic research projects in the mandated areas.

The Institute has five divisions:

1. Agricultural Structures and Environmental Control
2. Automation and Sensor Technology
3. Food Grains and Oilseeds Processing
4. Horticultural Crop Processing
5. Transfer of Technology

The Institute has developed nearly 120 technologies including 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, 73 have been licensed/ commercialized to about 155 entrepreneurs / end users. The technologies developed by ICAR-CIPHET helped the farming community in reducing post-harvest losses, value addition to the farm produce, development of functional foods and safety related to food through interventions in the arena of protected cultivation, threshing, milling, processing, with improved storage, preservation, quality evaluation using non-destructive, 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 generating employment in rural areas. ICAR-CIPHET has so far filed 69 patents out of which 17 have been granted. The institute also has food testing laboratory, agri-business incubation centre, and post-harvest machinery and equipment testing centre.

All India Co-ordinated Research Projects (AICRP) on Post-Harvest Engineering and Technology (PHET)

AICRP on PHET 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 post-harvest 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) Multilocation trials and demonstrations of the post-harvest technologies

All India Co-ordinated Research Projects (AICRP) on Plastic Engineering in Agriculture Structures & Environment Management (PEASEM)

AICRP on PEASEM became operational in the year 1988 by the name of AICRP on Application of Plastics in Agriculture (APA). The project is operative at 14 centers including six ICAR Institutes, seven SAUs and one CAU. 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, mulching with plastic, use of plastics in farm tools, machinery, post-harvest handling, packaging processes, animal shelters and aquaculture technology. The project has very good impact on farmers field particularly due to enhanced income per unit area of land and substantial saving of inputs like water, fertilizer and manpower.

Krishi Vigyan Kendra (KVK)

Krishi Vigyan Kendra, an innovative science–based Institution, was established to accelerate the agricultural production and post-harvest management and also to improve the socioeconomic conditions of the farming community of Fazilka district. This KVK was reestablished at ICAR-Central Institute of Post-Harvest Engineering and Technology, Abohar (Fazilka) on 20 October 2016. Aim of KVK is to accelerate the post-harvest management of agricultural produce and allied activities for improving the economic status of the rural community. The concept of vocational training programme in agriculture through KVK grew substantially due to greater demand for improved/ agriculture technology by the farmers. The farmers not only require the knowledge and better understanding of technologies, but also need skills development works in various agricultural adoptions on their on/off farms. The effectiveness of the KVK has been further enhanced by adding the activities related to on-farm testing and front line demonstration on major agricultural technologies in order to make the training of farmers' location specific, need based and resource orientated. It runs the need based skill development oriented training programme to create job opportunities related to rural community. It also acts as a facilitator to coordinate the extension activities of different departments for the benefit of the farmers. The KVK also helps in disseminating post-harvest based production technologies in neighboring KVKs.

Units

Food Testing Laboratory (FTL)

The well-equipped Food Testing Laboratory funded by Ministry of Food Processing Industries (MoFPI), New Delhi 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. Testing protocols for certain parameters like water quality testing, fat, protein and fibre analysis, mineral content etc. have been validated. This facility has enabled the institute to answer the need based test requirement of processers, entrepreneurs, small and medium enterprises and industry at reasonable testing charges.

This laboratory is catering to the food testing and quality analysis requirements of different stake holders, entrepreneurs in getting their samples tested.

Post-Harvest Machine and Equipment Testing Centre (PHMETC)

Post-Harvest Machine and Equipment Testing Centre (PHMETC), ICAR-CIPHET, Ludhiana is approved by Mechanization & Technology Division, Department of Agriculture & Cooperation, Ministry of Agriculture and Farmers' Welfare, Govt. of India, New Delhi. 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. Purpose of establishment of PHMETC is to provide a platform for manufacturers and entrepreneurs involved in PHT machine and equipments.

PHMETC is a unique facility in the country, which is available at ICAR-CIPHET for testing of various post-harvest technology related equipments & machinery.

Agri Business Incubation (ABI) Centre

Agri-Business incubation centres of ICAR provide support to the farmers and entrepreneurs & young unemployed youth by generating new technologies & machineries; creating path to access latest agricultural technologies, by providing suitable need based services. Through this Centre, the Institute has conducted number of trainings, awareness /sensitization programs to more than 300 participants and also acts as incubation centre for the startups.

ABI Centre offers its services to all farmers, entrepreneurs and youth along with small and medium scale industries to get benefit from our technologies.

Prioritization, Monitoring and Evaluation (PME) Cell

PME Cell 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. It also acts as link between the council and the institute scientists. 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 for digital management of research projects.

Agricultural Knowledge Management Unit (AKMU)

AKMU of the institute helps in providing a necessary assistance in analysis of data, electronic communication and IT related management & solutions. The AKMU owns a number of analysis and design software such as corel draw graphic suite software, adobe photoshop CS6 software, adobe premier pro software (Creative Cloud Full Suite), MATLAB software, Design Expert, Google Hindi Input, Google Input Tools. Institute's website www.ciphet.in is being maintained by AKMU and the website is enabled for internet payment gateway.

Institute Technology Management Unit (ITMU)

ITMU is responsible for IP protection, management and transfer/ commercialization of the ICAR-CIPHET technologies. The role of ITMU is to guide, encourage and accelerate the efforts towards development of technologies in the field of post-harvest management and to help in facilitation of novel ideas, inventions and technologies developed by the Institute into commercial ventures to serve the society. A total of 69 patent applications have been filed through ITMU so far, out of which 17 patents have been granted. Regular & sturdy efforts of ITMU lead to commercialization of 73 technologies developed by ICAR-CIPHET.

Workshop

ICAR-CIPHET, Ludhiana and Abohar campuses have separate workshop facility which is used to manage fabrication and modification of post-harvest machineries, designed under different research projects. The 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 machines, gas welding set, arc welding set, sheet bending machine etc. to deliver their services.

Guest House

Both Ludhiana and Abohar campus have guest house facilities for providing the accommodation to ICAR/ SAUs/ Government employees and farmers. An international training centre with 08 AC-rooms and dining hall with kitchen is also available at Ludhiana campus.

Agro Processing Centre

Agro-processing centre (APC) 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. Besides, the APC facilities are also used to impart training to potential small rural entrepreneurs.

Library

The 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 are 5265. 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 have been received on gratis and are available to the readers.

Staff Position

Category	Sanctioned	Filled		Total Filled	Vacant
		Ludhiana	Abohar		
Director (R.M.P)	01	01		01	00
Scientific	77	33	02	35	42
Administrative	42	17	02	19	23
Technical	29	19	07	26	03
Supporting	03	01	01	02	01
Total	152	71	12	83	69

Unified Budget of ICAR-CIPHET

ICAR-CIPHET

(As on December 31, 2021)

Approved allocation Plan RE (2021-22)	Total remittance plan (2021-22)	Total expenditure	% Utilization with respect to allocation under Plan RE 2021-22	% Utilization with respect to remittance
2148.00	1692.38	1302.33	60.63	76.95

AICRP-PHET

Approved allocation Plan RE (2021-22)	Total remittance Plan (2021-22)	Total expenditure	% Utilization with respect to allocation under Plan RE 2021-22	% Utilization with respect to remittance
2378.91	1912.41	1889.24	79.42	98.79

AICRP-PEASEM

Approved allocation Plan RE (2021-22)	Total remittance Plan (2021-22)	Total expenditure	% Utilization with respect to allocation under Plan RE 2021-22	% Utilization with respect to remittance
422.70	330.28	327.39	77.45	99.12

CRP-SA

Approved allocation Plan RE (2021-22)	Total remittance Plan (2021-22)	Total expenditure	% Utilization with respect to allocation under Plan RE 2021-22	% Utilization with respect to remittance
130.00	92.42	64.53	49.64	69.82

Revenue Generation

Financial year	Target for the financial year 2021 -2022	Revenue generated
2021-2022	46.00	23.83

Note: The Financial Year is from April to March (2021-2022)

(Amounts in Lakh)

Research Highlights

1.1. Machines / Equipment Developed

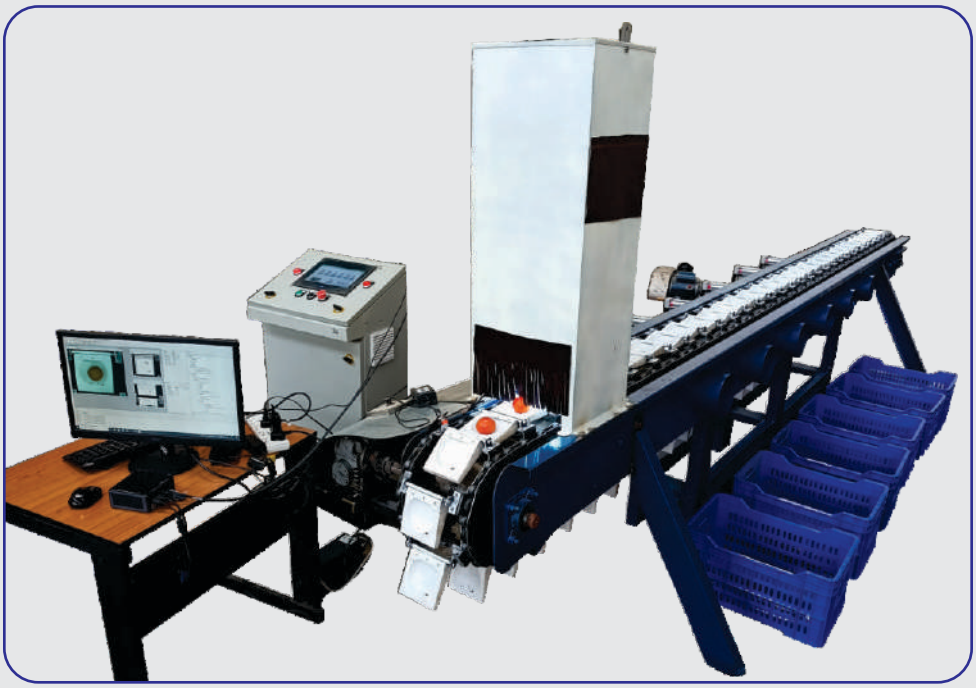


Fig. 1. Automatic sorting/grading machine

1.1.1. The automatic sorting / grading system for tomato / pomegranate

In our country, great losses incur during handling and processing of fruits and vegetables. Due to the increasing demand of fruits and vegetables of high quality with good appearance, there is a need for the development of accurate, fast and focused quality grading/sorting system for the pomegranate and tomato. These operations are very laborious and there is no objectivity while sorting / grading by manual methods. The automatic vision-based sorting/grading system has been developed comprising of conveyor, diversion system, vision and sorting system with a capacity to sort 45-50 fruits/objects per minute. Cup type chain conveyor has been developed to carry fruits (tomato and pomegranate) in singulation beneath the imaging chamber (Fig. 1A). The dimensions of conveyor, cup and pitch of chain have been kept in such a way that single fruit will be carried forward and should not drop down in between. Cups are hinged on the conveyor at one end and free at the other end for the ease of dropping the fruits/object. The machine has a provision for six grades with pneumatic based diversion system which are controlled through a developed program.

1.1.2. Machine vision technology based device for automatic detection and identification of insects in stored grains

In India manual sieving and counting are predominantly used in storage godowns. But manual insect detection and identification needs skilled & trained manpower, since these commodities and their target insects are heterogeneous in nature. Moreover, manual handling employment may give inconsistent and variable results also. Further, huge quantity of grain makes the quality inspection and evaluation process more complicated due to scarcity of trained personnel. Improper detection methods and practices lead to improper prediction of the need of fumigation, thus causing more damage to food grains. Development of an effective method to detect and identify the stored grain insects can overcome the problems of existing method of detections. New method may lead to on time fumigation and reduction of the food grain wastage. Considering this, a program has been developed for the machine vision-based system which could rapidly detect and identify the insect infestation of stored grains. The program can access the android camera and capture images to detect and count insects by image analysis (Fig. 2.).

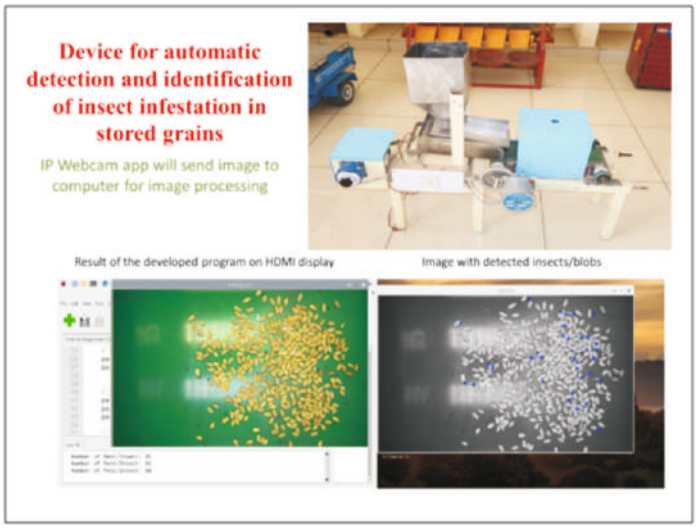


Fig.2. Output of the developed system

1.1.3. Continuous feeding system for makhana popping machine

Consistent and slow mass flow rates of granular materials through a small diameter orifice at the centre of the bottom of a hopper is difficult to obtain when orifice diameter is less than 5 times of the characteristic seed diameter. Rotation of the bottom in the horizontal plane with the orifice placed at an off-centre distance from the centre of the hopper can sustain controlled flow rates even at small orifice diameters. A simple feeding system was developed in this study for discharging roasted makhana seeds of different sizes (7.48-12.40 mm diameter) at 10-30 kg/h consistent mass flow rates. The feeding system consists of a rotating orifice plate at an off-centre distance, which is placed inside a pipe connected with the bottom of a trapezoidal hopper (Fig.3.). The effects of rotational rate, orifice diameter, and off-centre distance on the mass flow rates of makhana seeds and plastic beads of different sizes were studied. The materials did not discharge when the orifice was stationary. The mass flow rate increased with the increase in rotational rate, orifice diameter, and off-centre distance. Finite mass flow rates in the range of 2.25-29.81 kg/h were obtained for different seed sizes of roasted makhana seeds with varying orifice diameter (15-20 mm), off-centre distance (20-30 mm), and rotation rate (0.52-7.86 rad/s).

The mass flow rates >30 kg/h were obtained at orifice diameter 25 mm, however, finite mass flow rate ranges were not be obtained for all seed sizes at off-centre distances 20 mm. The Beverloo equation did not describe the mass flow rate adequately for the developed system. Therefore, Beverloo equation was modified using a function similar to the Froude number to describe the mass flow rate. This feeding system is a cost effective solution, which is simple in construction and eliminates the need of manual feeding in makhana popping machine. Thus, the efficiency and output of the popping machine improved. This feeder can be used for other similar processing machines also for uniform feeding of various grains.

Fig.3. Feeding system for Continuous and uniform discharge of makhana seeds

1.1.4. Oxygen concentrator for rapid ozone generation

Oxygen concentrator has been developed for ozone generation which can be further be used in post-harvest application of agricultural produce. The developed system is based on the principle of rapid pressure swing adsorption (PSA). It utilizes a molecular sieve to adsorb gases onto zeolite minerals at high pressure. This type of adsorption system is therefore functionally a nitrogen scrubber allowing the other atmospheric gases to pass through, leaving oxygen as the primary gas remaining. The developed oxygen concentrator has a molecular sieve with sodium based zeolite, which has lower rate of nitrogen scrubbing (8ml/g/min), due to this it is unable produce oxygen with higher concentration (>85%). The concentrated O_2 when fed to ozone generator helps in rapid O_3 generation and also enhanced its capacity. However, nitrogen scrubbing efficiency of the developed system can be increased by using lithium based molecular sieve or zeolite, which has higher rate of nitrogen absorption (>22 ml/g/min) to produce high purity oxygen, due to its small bead size. Lithium based sieves has rapid adsorption/ desorption rates, which is ideal for removing nitrogen from atmospheric air and creating streams of high purity oxygen (Fig.4.).

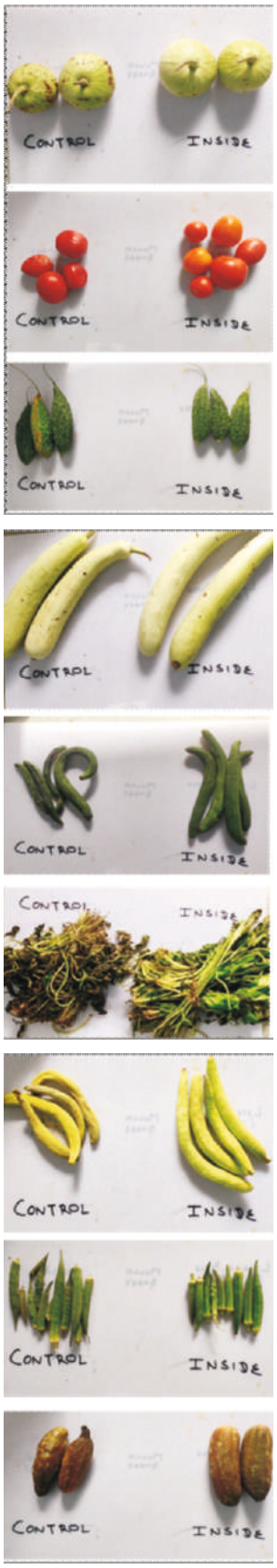
Fig.4. Oxygen concentrator for ozone generation

1.1.5. Modified push cart for small scale vegetable vendors

Push cart with capacity of 200 kg has been developed for small vendors to prevent the spoilage of fruits and vegetables during storage period of 2-5 days. Push cart has been evaluated under no-load conditions and temperature is recorded at a 30 min interval of time. Daily average temperature in the outside environment and centre of the cool chamber has been recorded as 34°C and 24°C, respectively. Under full load condition freshly harvested tomatoes, cucumbers, ridge gourds, bottle gourds, tar, palak, okra and bitter gourds were kept in the cart for 3 consecutive days. Cart was kept under the sun from 10am to 5pm during the storage period. Temperatures, RH and physiological loss in weight (% PLW) in the produce are recorded at specific interval of time. Daily average temperature recorded as outside (46°C) and temperature at the centre of the cool chamber of the cart (33°C). Relative humidity outside the cart is 32% and inside the cart 62% is recorded. Different vegetables *viz* tomato, cucumber, bottle gourd, ridge gourd, spinach and okra have been evaluated under control and inside cart (Table 1 & Fig. 5).

Vegetables	% PLW after 3 days	
	Outside	Inside cart
Tomato	19.40	3.62
Cucumber	33.33	14.52
Bottle gourd (spherical)	12.66	6.61
Ridge gourd	35.45	17.94
Bottle gourd	12.08	5.51
Tar	40.41	17.23
Palak	69.69	21.36
Okra	44.72	19.76
	32.50	16.10

Table 1. Comparison of percentage physiological loss in weight (% PLW)



*control: kept outside, inside: kept inside

Fig.5. Visual comparison of the produce

1.1.6. Performance evaluation of litchi de-stoner hand operated tool & pedal operated tool

Performance evaluation of the hand operated litchi de-stoner is conducted by taking 500g litchi in triplicate. Peeled litchi fruits with stone were taken for the performance evaluation of hand tools. In the case of hand operated tool, intact pulp recovery is 48.63% and pulp remains adhered with stone is 22.69% after de-stoning. Juice loss is found to be 8.08% where as total pulp loss is obtained as 32.53%. Capacity of litchi de-stoning hand tool is found as 11.85 kg/h.

Performance evaluation of the pedal operated litchi de-stoner is conducted by taking 500g litchi in triplicate. In case of Pedal operated litchi destoner, intact pulp recovery is 34.02 % and pulp remains adhered with stone is 22.88% after the destoning process. During the testing, juice loss was 5.08% and total pulp loss obtained was 38.42%. Capacity of the pedal operated litchi destoning machine is 8.86 kg/h.

1.1.7. Modified live fish carrier system

In order to enhance the carrying capacity and journey time of existing E-rickshaw based Live Fish Carrier System (100kg capacity & 4-6h journey time), minitruck based live fish carrier system has been developed. It has the capacity to carry 200-300kg live fish for a journey time of 3-5days. The container is provided with a multipurpose chamber and the equipment for supporting aquatic lives. Two pumps for water showering, one filtration device, high capacity air-pump aerators, exhaust fan and water chiller are also added.

1.1.8. Solar operated air-cooling unit for onion storage structure

Low temperature is required for onion storage, achieving this is difficult in situation where electrical power availability cannot be assured. Hence, solar operated air cooling system in which the temperature of the air can be reduced without increasing its relative humidity has been developed. It consists of 25 aluminium pipes. Air blower is attached at the one end of the pipes (inlet chamber) whereas the outlet chamber is attached at the other end of the pipes. Water is misted/sprinkled over the pipes through a fogging system which reduces the temperature of pipes. Air passes through the pipes and loses the temperature as well as moisture during its movement through pipes. As water is re-circulated, its temperature reduces due to increase in specific area.

Performance of the dry-type air cooling unit has been evaluated under three different conditions with no-load of onions. The air cooling system when operated using a storage chamber (Fig.6.) open to atmospheric air, a storage chamber covered with an LDPE transparent sheet and a 25 micron LDPE sheet showed average temperature drop of 4°C, 2°C and 3°C ,respectively. Average RH of ambient air is observed as 78%, whereas average RH of modified air is 72%. Results showed that the air cooling unit reduced the temperature and RH of ambient air by 2-4°C and 6% respectively.

Fig.6. Onion storage structure

1.1.9. Smart solar dryer

A dryer has been developed that works entirely by solar energy using both thermal and electrical modules. The thermal energy is collected through evacuated tube solar thermal collector whereas electrical energy is obtained through solar photovoltaic panels. Thermal storage is provided through paraffin wax (as phase change materials, PCM) and electrical

energy is stored at solar battery. A hot air blower, powered by solar battery, is provided to supply heat when there is less or no radiation. The speed control of the exhaust fan is made in order to control the temperature of the drying chamber. Load cells are provided below each tray to indicate the weight of dry matter and thus prevent overheating. The dryer consists of drying chamber with sensors and microcontroller arrangement, air heating unit, air handling and distribution unit, thermal storage and power supply (Fig.7). The factors considered for the design of the dryer are moisture content to be removed, total solar energy received in the region and permissible temperature for drying agricultural produce.

The designed capacity of the dryer is 10-15 kg of raw material. The targeted temperature to be attained inside the drying chamber is kept as 55-65°C.

The drying chamber accommodates six perforated trays in such a way that it provides thin layer drying in a uniform manner. The design factors of the drying chamber include its size, number of trays, space between two trays and materials for insulation. The drying chamber is made of mild steel with glass wool insulation to prevent heat loss from the chamber. A hole is provided at the bottom side for the hot air entrance through the evacuated tube collector.

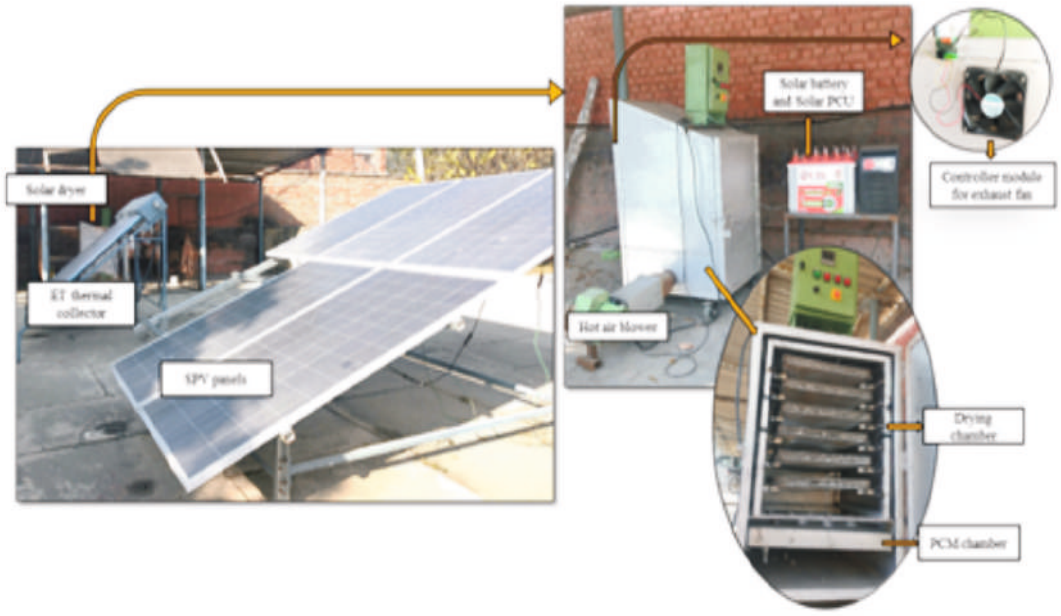


Fig.7 Different components of smart solar dryer

1.2. Processes

1.2.1. Near infra-red spectroscopy based methods for detection of maize flour and pea flour adulteration in chick pea flour *(besan)*

Chick pea flour or *besan* is important constituent of many Indian dishes. Due to the demand and high price, *besan* is often adulterated by the unscrupulous traders with less expensive materials *viz.* maize pea flour to achieve higher economic gains. Adulteration of *besan* with maize flour reduces protein content and deprives the consumers of the expected protein level and the quality of the product. The presence of maize flour cannot be identified by visual examination, and moreover, the existing methods are on the basis of identification of starch of maize and *besan* or adulteration can be detected by measuring protein content of the flour. Both these methods are cumbersome, require expert personnel and are destructive in nature. In order to provide rapid and non-destructive method for detection of maize flour adulteration in *besan*, near infra red spectroscopy (NIRS) model has been developed.

Adulterated samples of *besan* (180) have been prepared in the laboratory using maize flour in the range of 1-90% (w/w). Spectra of pure *besan*, pure maize flour and adulterated samples of *besan* with maize flour have been acquired as the logarithm of reciprocal of reflectance (log 1/R) in the Vis-NIR wavelength range of 400 to 2,498 nm (Fig.8A). Standard normal variate (SNV) and detrending (DT) pre-treatment is applied to the raw data using WinISI III software for correcting the scattering effect. Among the various statistical methods, modified partial least squares regression (MPLSR) has been applied for development of the NIRS prediction model. MPLSR model with RSQ and 1-VR value of 0.9989 and 0.9963 having SEC and SECV value of 1.0918 and 2.0468, respectively has been developed and validated (Fig.8 B&C). The developed method allows rapid and non-destructive detection and quantification of maize flour adulteration in *besan*.

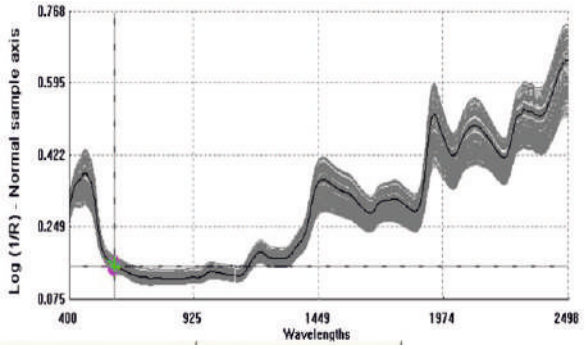


Fig.8A. Spectra plot of the pure besan, maize and adulterated *besan* with maize samples in 400-2498 nm wavelength range

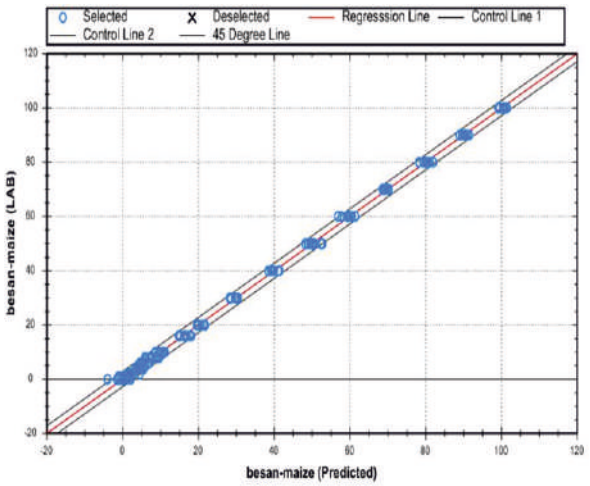


Fig.8B. Internal validation plot of MPLS-NIRS developed model for quantification of maize flour in *besan*

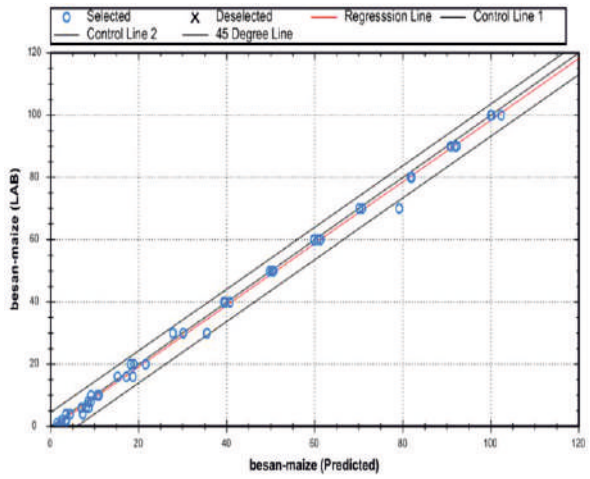


Fig.8C. External validation plot of MPLS-NIRS developed model for quantification of maize flour in *besan*

Similarly pure Pea flour and *besan* and spiked samples of *besan* with pea flour (1-90%, w/w) have been prepared in the laboratory. Spectra of pure *besan*, pure pea flour and spiked samples of *besan* with pea flour have been acquired as the logarithm of reciprocal of reflectance (log 1/R) in the wavelength range of 400 to 2,500 nm. Principal component regression (PCR), partial least square regression (PLSR) and modified partial least square regression (MPLSR) method have been employed and based on various statistical parameters MPLSR model has been optimized for quantification of pea flour in *besan*. The developed model for quantification of pea flour in *besan* showed coefficient of determination (RSQ) of 0.99, standard error of calibration (SEC) of 0.827 and standard error of cross validation (SECV) of 1.491. The developed method has been cross as well as test validated. The statistical results showed that developed model can be used to predict adulteration of *besan* with pea flour.

1.2.2. Protein extraction from de-oiled rice bran

De-oiled rice bran (DRB) is generated as a leftover in the process of oil extraction from rice bran. Currently, it is commonly used for animal feeding owing to its handling and processing difficulties. The DRB contains approximately 15 to 17% proteins, which possess excellent nutritional, nutraceutical, and functional properties. Considering the qualities of this protein, a process has been optimized for extraction of protein present in deoiled rice bran. For this purpose, the leftover de-oiled rice bran (DRB) has been collected from a rice bran oil refinery. It has been characterized in terms of its physical and flow properties (bulk density, tapped density, compressibility index, hausner ratio, particle size analysis), hydration properties (moisture content, water activity (aw) and water holding capacity) and its chemical properties (crude protein, crude fat, crude fiber). Physical and flow properties showed a good flowability of DRB during its handling for protein extraction. The analysis of chemical properties of DRB includes crude protein content (15.5%), crude fat content (0.6%), and fiber content (15%). Effects of independent variables like extraction temperature (40-60˚C), extraction duration (30-60 min), and extraction pH (9-11) on the responses *viz.* extraction efficiency (%), purity (% protein) and yield (g/100 g) were studied. The methodology includes alkaline extraction followed by acid precipitation at isoelectric point.The predicted values obtained for responses are extraction efficiency (54.2%), and yield of (7.35 g/100g) with purity of (79%)and the results have been validated.The process flow chart for protein extraction from De-oiled Rice Bran is given in fig.9.

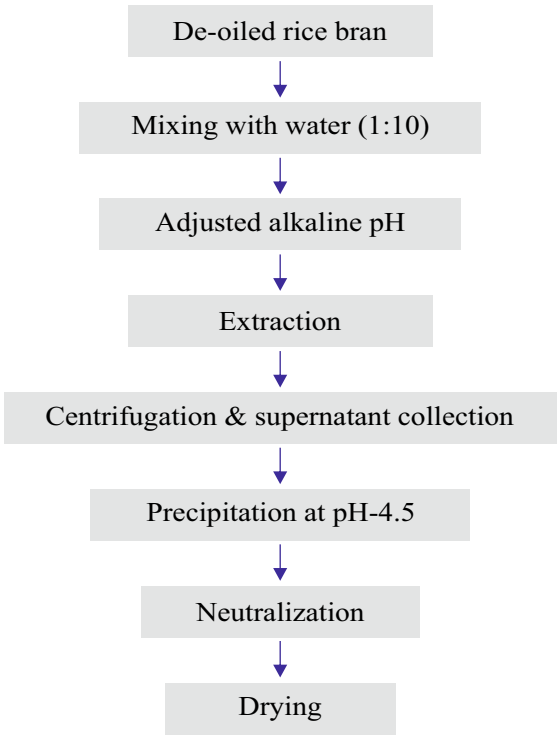
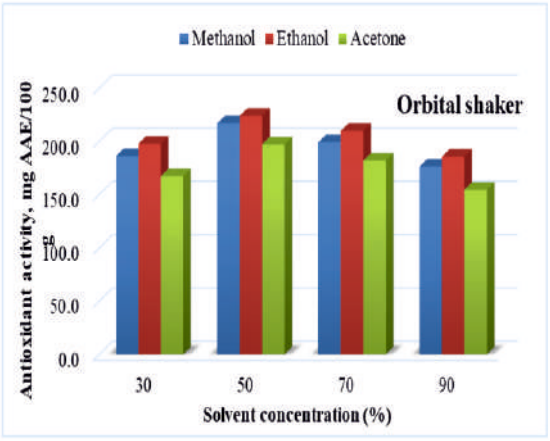


Fig.9. Process flow chart for protein extraction from de-oiled rice Bran

1.2.3. Bioactive compounds from immature dropped kinnow fruit

Citrus fruit is one of the most popular fruit, contain plethora of bioactive compounds that can protect human beings from various diseases. The agro-ecological conditions of Punjab are best suited for the production of kinnow, particularly in Fazilka and Hoshiarpur district. Generally, very small fraction of flowers turns to the marketable kinnow fruit (Fig.10). Shedding of flowers and fruits comes more or less in three distinct waves known as post-bloom drop, immature drop and pre-harvest drop. It is envisaged that these immature dropped kinnow fruit could be rich source of bioactive compounds. Therefore, this study has been carried out to standardize the process parameters for maximizing the extraction of the bioactive compounds viz., total phenolic, total flavonoid, total saponin, and alkaloid content and their antioxidant potential using different solvents and extraction techniques. Three different organic solvents namely, methanol, ethanol and acetone have been used at different concentration (up to 90%) in aqueous mixtures. The efficiency of orbital shaker is compared with ultrasonication technique for extraction of bioactive compounds from immature dropped kinnow fruit. The total phenolic content (TPC), in the immature dropped kinnow fruit extract ranged from 2.63 to 4.59g Gallic acid equivalent(GAE)/100g and 2.89 to 5.17g GAE/100g, while total flavonoid content has been found between 5.35 to 7.60g Quercetin equivalent(QE) /100g and 5.93 to 8.40g QE/100g, respectively using orbital shaking and ultrasonic assisted extraction, respectively. The antioxidant activity in the extracts ranged from 154.76 to 224.20mg Ascorbic acid equivalent (AAE)/100g and 178.89 to 251.41mg AAE /100g while FRAP activity has been found between 3.40 to 5.72g Trolox equivalent (TE)/100g and 4.13 to 6.38g TE/100g, using orbital shaking and ultrasonic assisted extraction, respectively. Ethanol has been found to be most effective solvent followed by methanol and acetone along with ultrasonic assisted extraction, resulting in maximum extraction of total phenolic compounds, total flavonoids and antioxidant activity in the extract of immature dropped kinnow fruit. Based on results, ultrasonic assisted extraction with use of ethanol as a solvent can be considered for the extraction of bioactive compounds from immature kinnow fruit (Fig.11 A&B).

Fig.10. Immature dropped kinnow fruit



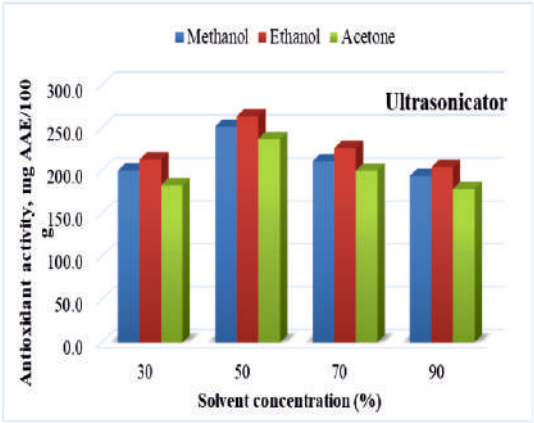


Fig.11 A&B Effect of extraction method on antioxidant activity of immature dropped kinnow fruits extract

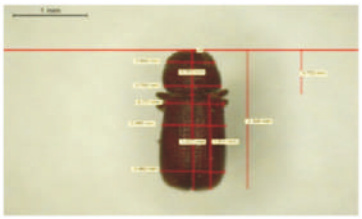
1.2.4. Storage of roasted makhana (*Euryale ferox*) seeds

Euryale ferox is an important aquatic crop belonging to the family Nympheaceae. It is commonly known as makhana, gorgon nut or fox nut, and grown in stagnant perennial water bodies like ponds, land depressions, oxbow lakes, swamps and ditches. Makhana seeds are also known as black diamond. It is a cash crop (dry fruits) and marketed in the form of popped makhana. The seeds generally stored either in roasted or popped form. However, during makhana seed storage it has been observed that the insects are causing losses and affectes popping of roasted seeds. Thus, the present study has been undertaken using the natural infested roasted makhana seeds with lesser grain borer, *Rhyzopertha dominica* (Coleoptera: Bostrichidae) to know its type of damage, preference and biology of the insect for makhana. The results showed that, both grub and adult stages are able to cause damage by boring the seeds. For preference study three standard size grades of makhana seeds were selected i.e., 7 mm, 9 mm and 11 mm and observed the number of insects per seed to know its preference. It is found that insects preferred 11 mm size seeds, followed by 9 mm and 7 mm, respectively. For damage studies 10 adults were released in 100g of seeds, 40±1.24% damage has been observed during 15 days of storage. The study of the insect biology revealed that *R. dominica* female laid 200-500 eggs and completed its life cycle in 35-50 days (Fig.12).

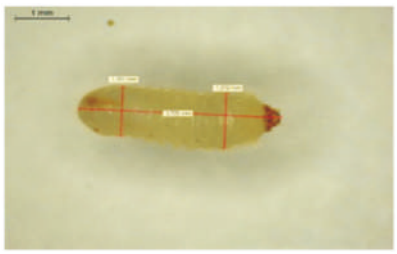
Entry holes

Internal makhana feeding

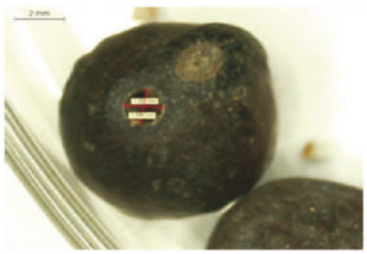
Lesser grain borer (adult)



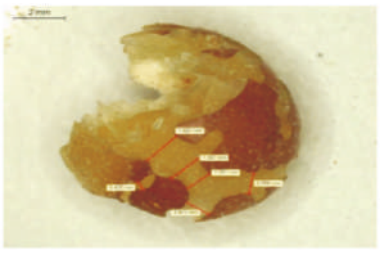
Morphometry of adult Rhyzopertha



Morphometry of Grub



Entry bore hole size



Feeding path

Fig.12. Various stages of *Rhyzopertha dominica* on makhana

1.2.5. Carotenoids from black gram husk

Black gram (*Vigna mungo*) is one of the important pulse crops in India which is used for preparation of variety of food products after dehulling. During milling of black gram into dhal about 25% is left as a by-product comprising of husk(9%) and chuni(16%) and is presently used as cattle feed. However, the utilization of black gram husk (Fig.13.) can be diversified as a potential source of bioactive compounds, such as carotenoids. The carotenoids extraction from black gram husk has been optimized by using the Box–Behnken design using response

surface methodology (RSM). The solvent to solid ratio (upto 30 mL/g), extraction temperature (upto 50°C) and extraction time (upto 8 h) have been used as independent variables (Fig.14). The total carotenoid content of the husk extracts was observed in the range of 2939.58–3941.68 μg/100g. The optimum conditions for maximizing the total carotenoids extraction of the black gram husk are obtained as 27.28 mL/g solvent, at 30°C extraction temperature for 6 h. The predicted total carotenoids content is 3964 μg/100g and the results have been validated.

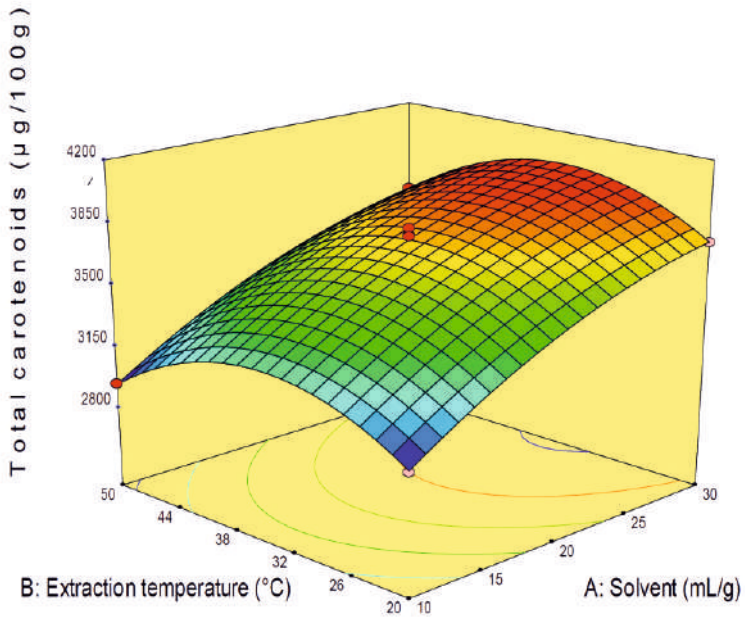
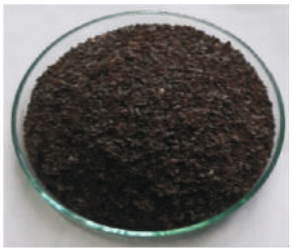


Fig.14. Interaction effect of solvent to solid ratio and extraction temperature on total carotenoids content

Black gram
(cv. Mash 114)



Black gram husk

Ground black gram husk

Fig.13. Raw material preparation

1.2.6. Evaluation of mango peel and seed kernel powder for minerals profile, microbial safety and screening of PHB producing bacteria

Considering seasonal availability of mango peel/seed by-products there is a need to store them for their wider applications throughout the year. Being a perishable commodity due to its high moisture content, these are susceptible to attack, degradation and spoilage by different kinds of general and pathogenic microflora. Mango peels and seed kernels are rich sources of bioactive compounds and minerals. For keeping them for longer periods these have to be dried. It is known that the drying process affects the bio-active compounds, minerals, fermentable sugar and microbial safety of the end product. In the present study effect of drying on minerals profile and microbial safety of mango peel and seed kernel powder has been studied. The mineral analysis has been conducted using the inductively coupled plasma optical emission spectrometry (ICP-OES) at citrus estate laboratory, State Horticulture Department, Abohar (Punjab) has been studied. The result indicated that all the by-products contain significant amounts of macro and micro nutrients concentrations respectively (Table 2&3). Further, drying of peel and seed kernels at different drying temperatures did not affect their composition significantly.

Table 2. Major Nutrients of mango peel and seed kernel powder prepared by drying at different temperature

Sample	Drying temp. (°C)	Major nutrients (mg/kg of sample)				
		P	K	Ca	Mg	S
MSK	50	1752±31.00^{a}	3438.5±65.50^{a}	726.50±11.30^{a}	1350.00±27.00^{ab}	825.35±8.95^{b}
	60	1662.50±77.50^{b}	3256±162.00^{b}	726.15±31.45^{a}	1296.00±56.00^{b}	826.65±32.65^{b}
	70	1810.50±34.50^{a}	3372.5±36.50^{ab}	708.35±48.15^{a}	1395.00±15.00^{a}	888.75±14.15^{a}
	80	1747.50±03.50^{ab}	3423±3.00^{ab}	681.65±7.65^{a}	1367.00±5.00^{a}	870.65±4.45^{a}
MP	50	766.6±4.20^{a}	5214±66.00^{a}	1714.5±30.50^{a}	1145.50±30.50^{a}	495.25±7.75^{c}
	60	1016.5±7.50^{d}	5539.5±122.50^{b}	3042.5±79.50^{d}	1798.50±9.50^{d}	797.20±1.10^{a}
	70	891.7±5.70^{c}	5947±7.00^{c}	2087±101.00^{b}	1356.00±17.00^{b}	518.85±1.15^{b}
	80	858.2±1.80^{b}	6221±90.00^{d}	2280.5±33.50^{c}	1396.50±9.5^{c}	516.45±3.25^{b}

The data revealed that microbial load in dried material measured in terms of total plate count(CFU*10^4/g), the fungal count (CFU*10^3/g), salmonella count (CFU*10^2/g) and E.coli count(CFU*10^2/g) was within the limit. This indicates that mango peel and seed kernel powder are safe and can be stored for six months (Table 4).

Table 3 .Minor Nutrients of mango peel and seed kernel powder prepared by drying at different temperature

Sample	Drying temp. (°C)	Minor nutrients(mg/kg of sample)		
		Fe	Mn	Zn
MSK	50	68.44±0.54^{b}	10.84±0.28^{a}	6.43±0.11^{a}
	60	69.72±9.39^{b}	10.79±0.43^{a}	7.58±1.88^{a}
	70	62.26±2.05^{b}	11.15±0.20^{a}	6.60±0.19^{a}
	80	80.62±2.58^{a}	11.23±0.04^{a}	8.01±0.18^{a}
MP	50	110.04±20.06^{ab}	25.27±0.79^{a}	6.65±0.88^{a}
	60	79.10±5.59^{c}	26.29±0.05^{b}	4.94±0.09^{a}
	70	89.52±6.07^{bc}	38.23±0.10^{c}	7.52±2.88^{a}
	80	123.85±2.7^{a}	41.35±0.26^{d}	6.35±0.25^{a}

Table 4. Microbial load of mango peel and seed kernel powder prepared by drying at different temperature

Mango by-products	Microbial load in the mango peel and seed kernel dry powder				
	Drying temp. (°C)	Total plate count (CFU*10^4/g)	Fungal count (CFU*10^3/g)	*Salmonella* count (CFU*10^2/g)	*E.coli* count (CFU*10^2/g)
Mango peel powder	50	1.33±0.33	nd	nd	nd
	60	0.67±0.34	nd	nd	nd
	70	nd	nd	nd	nd
	80	nd	nd	nd	nd
Mango seed kernel powder	50	0.33±0.34	nd	nd	nd
	60	0.33±0.33	nd	nd	nd
	70	nd	nd	nd	nd
	80	nd	nd	nd	nd

*nd- not detected

Further pre-treatment process for maximum recovery of fermentable sugars from mango by products has been standardized as fermentable/reducing sugar serves as a direct utilizable carbon source for the microbial fermentation process. In order to recover fermentable sugars from mango by-products, the pre-treatment process has been optimized. Different concentrations (1, 2, 3 4 and 5%) of H_2SO_4, and HCl have been tried. From the results it can be observed that increase in

concentration of acid did not affect the sugar yield. Therefore, considering the cost economics, 1 % of both acids may be used for the recovery of fermentable sugar from mango by-products.

Collected soil samples from local fields and processed for isolation of bacteria by dilution plate method. Based on morphological characters 9 different bacterial isolates were selected and purified. Three bacterial cultures were also procured from MTCC Chandigarh. These culture were screened for production of polyhydroxy butyrate by staining with dye sudan black B. The isolates (colonies) showing production of polyhydroxy butyrate stained blue/black after staining. Further confirmation was done based on preparing the slides of isolates and staining with sudan black B and safranin (Fig.15 A&B). All the bacterial isolates were also screened for starch hydrolysis. Among all these isolates one showed starch hydrolysis (Fig.16).

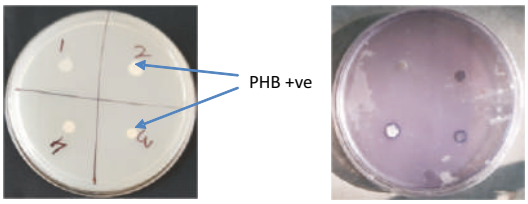


Fig.15 Isolates on agar medium (A) after staining with sudan black B (B)

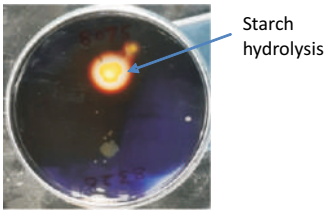


Fig.16 Isolate showing starch hydrolysis due to amylase production

1.2.7. Characterization of mango seed kernel (MSK) starch

Mango processing industries generate large amounts of by-products in the form of peel and kernels. The mango seed kernels are a rich source of starch (50-65%). A process has been optimized for the extraction of starch. In present study, MSK starch has been characterized for purity, amylose content, swelling power, and water solubility index using standard methods.The starch is characterized using FTIR, scanning electron microscopy, X-ray diffraction and particle size analysis. Scanning electron micrographs (Fig.17) have revealed that the MSK starch granules are round to oblong in shape with particle size of 8-18.5 μm in length and of 5.4 -10.6 μm in width. X-ray diffraction (Fig.18) have revealed the crystal structure of starch can be of four types, A, B, C and V type. The MSK starch has shown diffraction peaks at (2θ) of 15°, 23° and an unresolved doublet peak at 17° and 18° and which are characteristic features of A-type starch. It has shown a crystallinity index of 40.08% which could be due to the high proportion of amylopectin in structure.

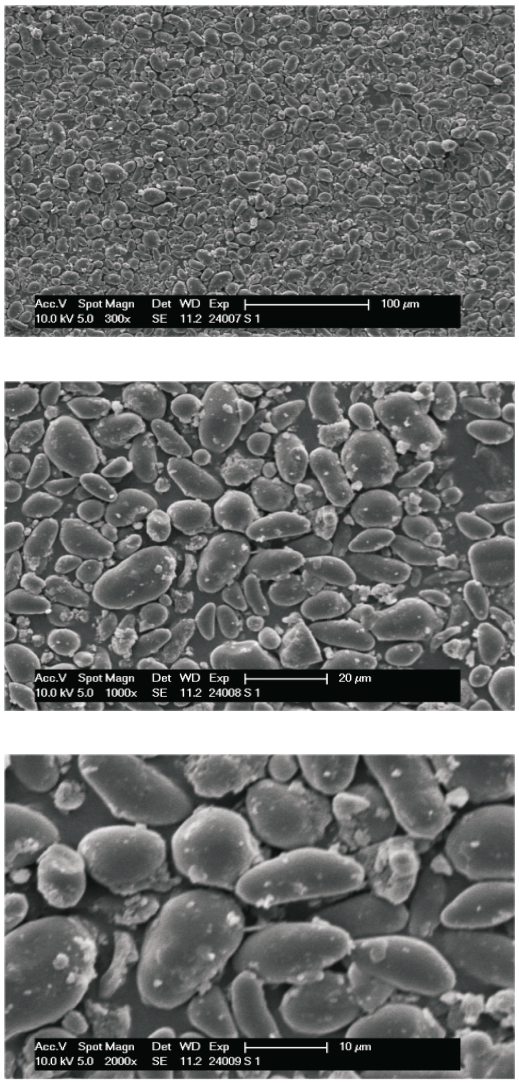


Fig.17 Surface morphology of mango seed kernel starch

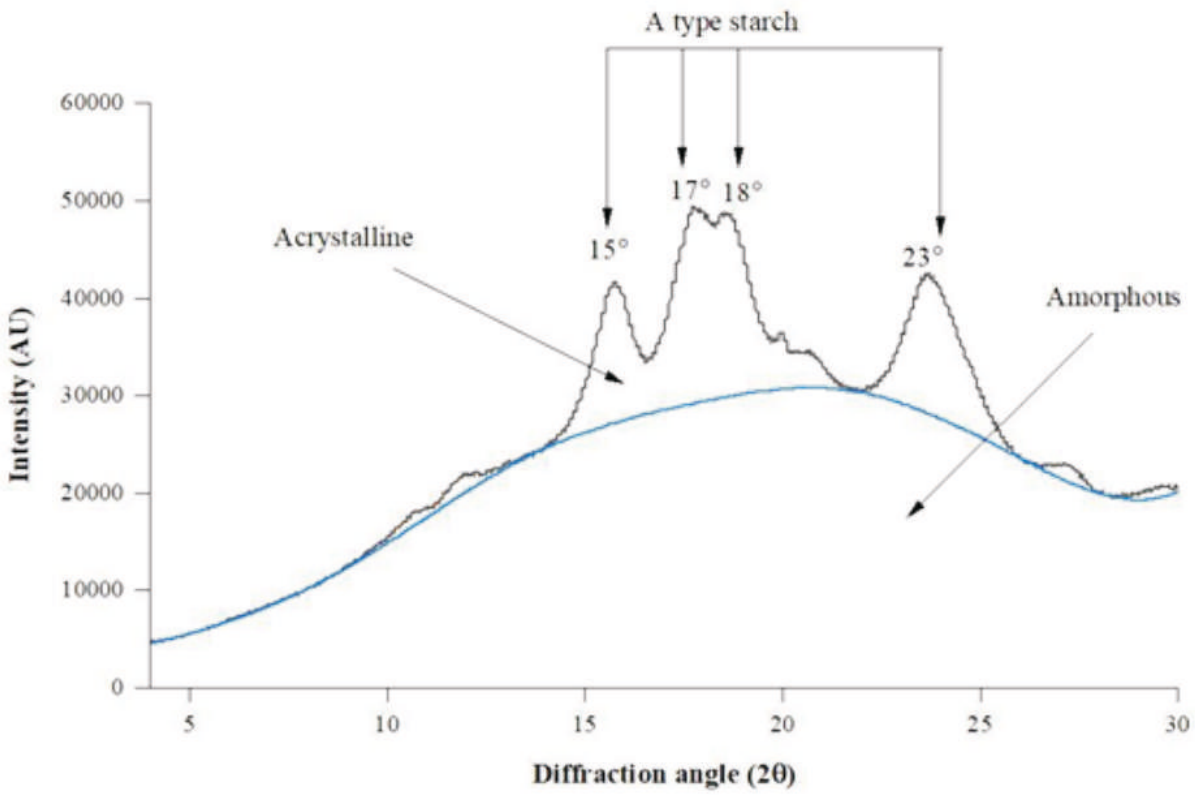


Fig.18 X-Ray Diffraction (XRD) pattern of mango seed kernel starch

1.2.8. Strategies for promoting post-harvest technologies based on entrepreneurial behaviour and constraints faced by processors and farmers interested in processing

Technology adoption is a crucial component for agricultural intensification and development. This study has been designed to identify post-harvest technologies related to the needs of the farmers/ entrepreneurs and how it can be delivered best at the field level. The entrepreneurial behaviour and the constraints faced by processors and farmers (60 each) interested in primary processing of cereals, pulses and oilseeds from 3 districts of Punjab (Ludhiana, Sangrur and Roopnagar) is studied for the purpose. 'Modified Entrepreneurial Assessment Scale', which consists of 11 different aspects/dimensions, has been used for estimating the entrepreneurial behaviour of the respondents. The constraints faced by processors were measured using a Likert type (Summated rating) scale and were compared using Kruskal-Wallis one-way ANOVA. The major constraint faced by processors (K (critical) = 9.488 < K (observed) = 100.943, df= 4, $p < 0.001$) is related to financial related constraints (Mean Rank 204.850). The constraints faced by farmers interested in processing were analyzed using the Friedman's test (Chi-Square = 124.980, df = 17, $p < 0.001$). The major constraint is lack of information related to processing technologies with mean rank 12.858. Based on the findings some strategies like Custom Processing Centres, development of small multifunction/ multipurpose processing machineries, capacity building of extension functionaries in processing sector etc. have been proposed for popularizing post-harvest technologies.

1.2.9. Isolation, identification and characterization of microflora from *hawaijar*

Hawaijar has been prepared by traditional method in which medium-sized soybean seeds are soaked, boiled, and then packed tightly in a bamboo basket layered with banana leaves to allow natural fermentation. Another two batches are made in the same way, but are packed in steel container and glass jar to see how the packing material affects the biodiversity of the microorganisms that will grow during fermentation. All samples are kept in an incubator maintained at 37°C. The palatable stage of fermented soybean has been examined within 4 to 6 days. The microflora present in naturally fermented soybean and inoculated samples has been examined using a serial dilution and plating method. On TPC agar plates, different colonies isolated from *hawaijar* grown under different conditions (Fig.19).

From these plates, colonies showing different morphologies are selected and isolated using the dilution streak method. All colonies are circular in shape, with creamy white texture, irregular margins and smooth texture. For identification, *Bacillus Subtilis* (MTCC) has been used as a standard culture. The macro-morphology of isolated colonies from steel container & glass jar and banana leaf are found to be similar to colonies of *Bacillus Subtilis* Further Gram staining has been done to examine the cell morphology of these isolated colonies under microscope at 40x and 100x magnification as shown in fig. Results of gram staining showed that the isolated colonies are of rod-shaped and purple-coloredthusbelong to family of gram-positive bacteria and possibly *Bacillus* sps (Fig.20).

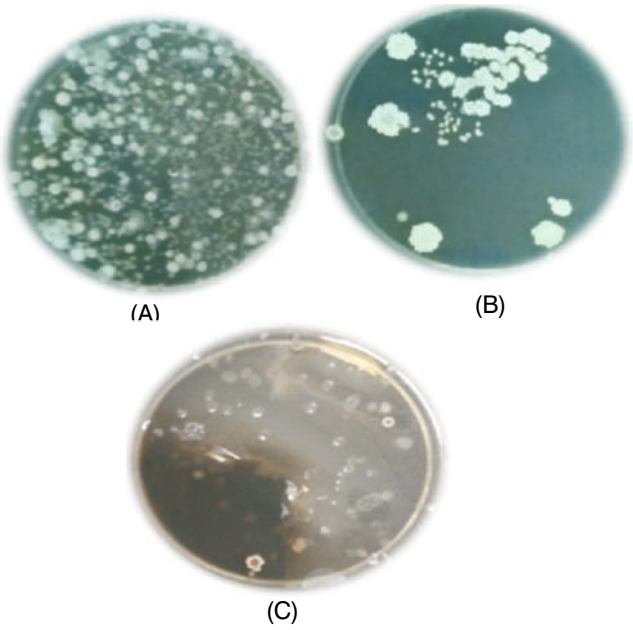


Fig.19 Different colonies isolated from *hawaijar* prepared in (A) steel container, (B) banana leaf (C) glass container

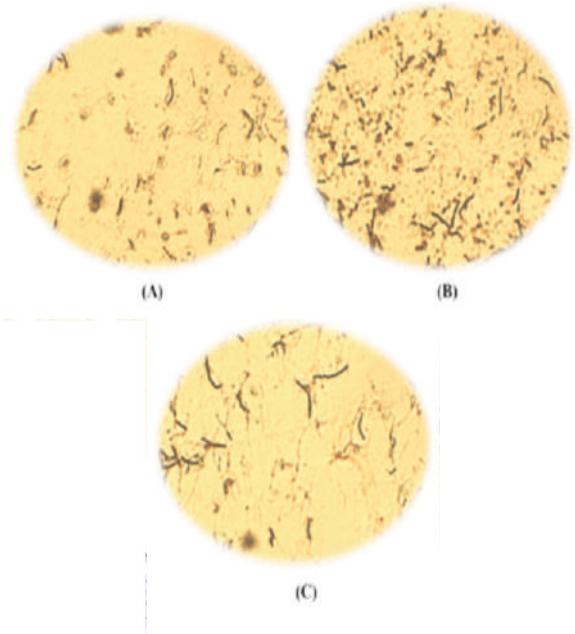


Fig 20. 100X magnification picture of Bacterial colonies isolated from (A) steel container (B) banana leaf (C) glass container

1.3. Products developed

1.3.1. Roasted *Sangri seeds*

The seeds of mature sangri pods are used for fodder purpose and are not used for human consumption. They are rich in different macro and micronutrients. Hence, a process is developed where these seeds are converted into a healthy alternative snack. Dried sangri seeds are soaked in water at seven different temperature of 70, 75, 80, 85, 90, 95 and 100°C to observe gain in the weight of seeds at specific intervals. Results indicated that the water absorption rate is temperature dependent and increase in temperature caused rise in water absorption rate (Fig.21). Results further indicated that there is a slow rise in the moisture content till 18-20% at all the soaking temperatures followed by a steep rise till 60% moisture content. Further, dried sangri seeds were soaked at 80°C till moisture increased up to approximately 10, 20, 30, 40 and 50 (% wb). Soaked seeds having different moisture contents (10-50%) are roasted by three different ways *viz.*, microwave roasting, salt roasting and dry roasting (Fig.22). It is observed that a moisture content of 10% and salt roasting method the roasted seeds with good sensory quality.

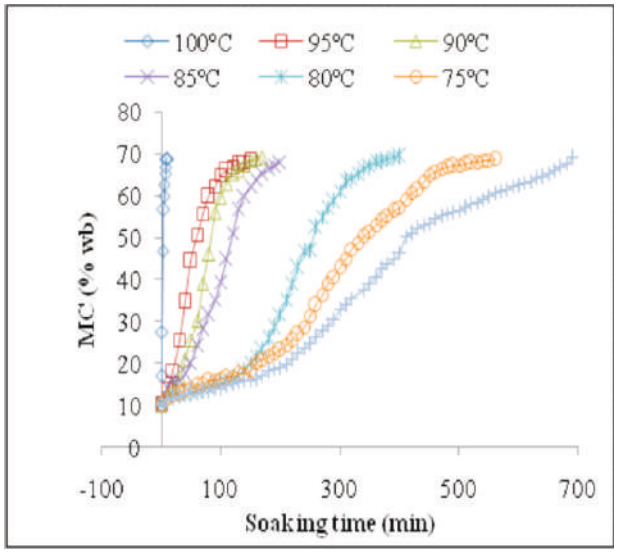


Fig.21. Soaking behaviour of sangri seeds prior to their roasting

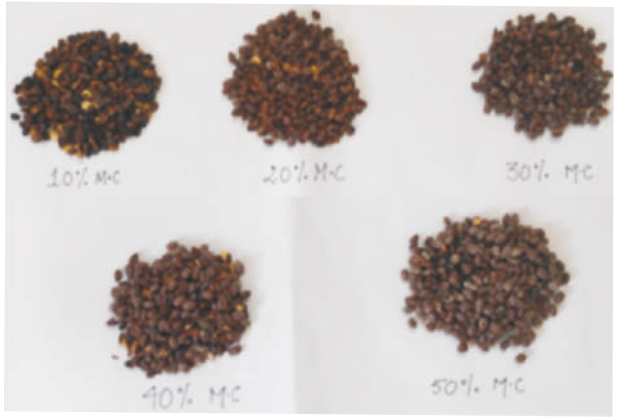


Fig.22. Sand roasted sangri seed samples

1.3.2. Cereal-gluten free instant ribbon pasta with semi-popped makhana

Semi-popped makhana is obtained as a by-product during popping of makhana seeds. Nutritional quality of semi-popped makhana has been found similar to that of popped makhana. Being nutritious and gluten free, it can be utilized for making of gluten free pasta and other products. The present study has optimized the formulation of cereal-gluten free instant ribbon pasta (CGFI pasta) (Fig.23) based on semi-popped makhana flour (SPM), water chestnut flour (WCN) and potato powder (PP) with equal quantity of carrot juice by using a response surface

Fig.23. Cereal-gluten free instant ribbon pasta with makhana

methodology (RSM) following methodology (RSM) following Box-Behnken design. The physico-chemical, phytochemical, cooking quality and sensory properties of CGFI pasta have been evaluated. Optimum concentrations for SPM flour, WCN flour and PP are found to be 47.81, 23.50 and 28.69%, respectively. CGFI pasta with the optimized and validated formulation has shown total protein, total fat, iron, and calcium content of 10.23%, 0.51%, 10.62 mg/100g and 39.21 mg/100g respectively, with overall sensory acceptability of 7.39. Optimized CGFI pasta is rich in total phenolic (713.43 mg Gallic acid equivalent/100 g) and flavonoid content (344.80 mg quercetin equivalent/100 g) with antioxidant activity in terms DPPH inhibition (28.49 %) and FRAP assay value of 321.88 mg Trolox equivalent/100 g. This CGFI pasta showed 1.62 min cooking time, 2.46 rehydration ratio, 7.25% solid loss, 27.49 g tensile strength with overall desirability of 0.90.

1.3.3. Fruit bar manufacturing using Refractive window drying

Fruit bars are conventionally prepared by tray drying/sun drying and bars prepared using these techniques takes longer time to dry which adversely affects the color and flavor of the product followed by nutritional losses. Refractance Window drying takes less drying time and therefore helps to maintain the overall product quality in terms of color, flavor, and nutritional profile. A continuous type dryer based on Refractance window (RW) drying technique Refractance window dryer (RWD) has been developed. The dryer consists of Mylar sheet which are kept over water bath. Fruit pulp is dried using the dryer to achieve intermediate moisture content (20-25% wb) from initial moisture content of approx. 80% (wb) in about 3 h. Using this RWD three different fruit pulps (guava, jamun and mango) at three different pulp thicknesses (4, 5 and 6 mm) have been developed (Fig.24.) . For guava pulp, the drying time is about 90 to 180 min. Results indicated that when initial thickness of the guava pulp was 5 mm, thickness of the dried pulp (bar) was 1.78 mm and complete drying was achieved in 140 min. Similarly, for jamun and mango pulps, the drying time varied from 120 to 220 min and pulp thickness after drying varied from 1.44 to 1.98 mm (Table 5). Average temperature of the water is about 90±2°C whereas the average temperature of the pulp under drying is about 70±2°C.

Table 5. Optimum drying time of the fruit pulps of different thickness

Initial pulp thickness (mm)	Drying time (min)		
	Guava pulp	Jamun pulp	Mango pulp
4	90	160	120
5	140	180	140
6	180	220	180

Fig.24. Fruit bars of different thickness prepared on RWD system

1.4. Collaborative/Externally funded projects

1.4.1. Development of protocols for shelf life, safe storage, milling outturn and indicative norms for procurement of major pulses

Government of India decided to create buffer stock of 2 mT pulses in 2016-17 with substantial support to the farmers in the form of increase in minimum support prices of pulses. This initiative resulted into stable prices of pulses with insured market for the farmers for their produce. Dynamic storage of pulses involves huge investment in procurement, handling, transport, storage, milling, and further distribution. Storage of pulses is entirely different from food grains storage due to the requirement of different environmental conditions and management practices. Further, the government decided to add dal in the PDS system and hence norms for the dal recovery from stored pulses are required. Thus, the Department of Consumer Affairs awarded a study to recommend norms for procurement, storage and milling outturn ratio for the best possible management of pulses in India.

ICAR-CIPHET, Ludhiana and 07 cooperating centers (ICAR-IIPR Kanpur, MPUA&T Udaipur, JAU, Junagarh, PDKV Akola, JNKVV Jabalpur, ANGARU Baptla, and UAS Raichur) were involved conducted this study for this purpose. Samples of 20 kg were drawn for different pulses (Pigeon pea, chick pea, black gram, green gram, and lentil) stored in warehouses of CWC/SWC quarterly for one year. Altogether 529 samples were taken from different stacks of pulses stored in 101 warehouses and analyzed for quality and outturn ratio (OTR) (Fig.25 A,B & C). A laboratory storage study was also conducted for storage of pulses and dal under ambient conditions. The protocol for milling of the selected pulses was prepared and OTR was defined. The data were analyzed separately for the laboratory and warehouse studies and then optimally combined to arrive at norms, standards and protocols for the selected pulses.

Major recommendations of the study were as under

Procurement and storage norms

- Pulses should be stored in covered godowns, which are free any leakage to rainwater and have good drainage. All electrical installations, light points, roof structure, and ventilators in the godowns should be in proper condition.
- Whole pulses may be stacked up to a maximum of 16 bags height (3 m) by following available stacking standards of rice or wheat.
- Proper aeration should be there during storage of pulses. Whole pulses may be stored in 50 kg capacity bags. Prophylactic treatment shall be given on the same day or within 24 hours of receipt at the latest.
- Aluminium phosphide (9 g per ton of pulse, 7 days exposure in airtight condition) was found effective against pulse beetles and other insects. The pulse beetles damage the grains more in a short span. Attack of pulse beetles was observed when hot and humid condition prevailed for 4-5 days or more. Further, it was found that the beetles flied

away from the godown when fumigation was initiated. The beetles were observed again on the stack after 3-4 days of completion of fumigation. Therefore regular sampling (weekly) and monitoring is essential.

- Procurement of pulses should be done within one month of harvesting. Date of start of procurement and end date should be defined for each state and each pulse depending upon the harvesting time in a particular state.
- Dal must be taken from millers at 12% moisture content (wet basis) in all regions of India after packaging in polypropylene or plastic laminates of suitable thickness. Delivery of Grade-I and Grade-II dals must be taken separately for storage.
- Forced aeration is essential for storage of dal. In place of opening the doors in day hours, exhaust fans should be used for aeration and roof turbo ventilators are mandatory in the warehouses where dal is stored.
- Dal should not be stored with other food grains, whole pulses, oilseeds, and any other item.
- Every depot storing pulses should mandatorily have cleaning and drying facility, if possible. This will ensure better storage management of pulses.

Standards for milling and OTR of dal

- The uniform milling outturn (OTR) should be used as standard throughout the year for milling of pulses. OTR for different pulses were recommended.
- Modern machineries and equipment must be used for milling of pulses. The industries using burr mill for dehulling are not suitable for pulse milling. Dust and noise pollution is very common problem in pulse milling industries and proper licensing should be there.
- Common admixture of pigeon pea and chick pea dal is pea dal (*mattar dal*). Sometimes *khesari dal* is also mixed with Grade-II dal. Any such admixture should not be permitted.

Fig.25. A,B&C Sampling at storage site

1.4.2. Study on determining storage losses of food grains in FCI and CWC warehouses and to recommend norms for storage losses in efficient warehouse management

Food Corporation of India (FCI) agencies procure about 69 million tonnes wheat and rice every year for creating buffer stock to maintain the supply chain for the whole year and ensure food security of the whole nation. FCI and other organisations, such as Central Warehousing Corporation (CWC), State Warehousing Corporations (SWC) and private warehousing agencies store the food grains filled in sacks in the Warehouses, CAP, and sometimes in the concrete/metal bins. Proper loss assessment through the systematic data collection and its analysis help in better understanding and standardization of the norms. FCI awarded the study to identify the extent of losses, factors responsible for losses in storage, recommend storage loss norms and to suggest ways and means to reduce the extent of storage losses in different unit operations.

ICAR-CIPHET, Ludhiana along with 20 cooperating centres conducted the study. The observations on physical parameters of the commodities were recorded fortnightly. Liquidations of the stacks were done after every 3 months and continued for 3 years. 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. Data at the time of stacking and liquidation were collected from 1569 stacks placed in 159 chambers of 41 depots of FCI/CWC/SWC in different regions of India. The collected samples were analysed in the laboratories. Samples were taken from the complete stack at the time of stacking and liquidation. Samples were analysed using the instruments provided by the FCI/CWC in their laboratories. The data were digitized, verified, and erratic data and outliers were removed. Finally the data were analysed zone-wise, thereafter merged to develop the statistical models were developed to predict storage losses/gain of wheat and rice stored in warehouses.

The following major recommendations were made to reduce the storage losses and improve the storage management practices.

- The FCI guidelines for storage management practices in the warehouses are exhaustive, practically applicable and sufficient to avoid losses during storage, when followed in holistic manner.
- Accurate moisture meter with less than 0.1% least count and 0.02% accuracy, particularly Near Infrared Moisture Meters (NIR moisture meter) having printing facility is recommended for the moisture measurements. In the present scenario, the moisture meters used in the warehouses should be calibrated frequently, preferable in every quarter from accredited laboratories.
- The proper laboratory facilities for analysis of samples drawn fortnightly was lacking in majority of the depots. So a proper laboratory should be established in each depot. The laboratory should be equipped with

NIR moisture meter, hot air oven, sample divider, electronic balance (least count 0.001 g), digital balance (5 kg capacity, least count 0.1 g), BOD incubator, standard sieve set, etc. The analysis of samples should be done by trained technical person only.

- Stacking/storage of rice should be done at 13-14% moisture content and stacking/storage of wheat should be done at about 11% moisture content in all the zones. Therefore, the farmers should be encouraged to sell wheat at less than 11% moisture contents.
- Every depot should mandatorily have cleaning and drying facility, if possible. This will ensure better storage management of food grains.
- The infestation level must be "Clear" in subsequent fortnightly observation after fumigation of the stacks. It may be better to fumigate all the stacks in a godown immediately even when "few" infestation is observed.
- The issues of spillage, moisture content fluctuations, handling, aeration, fumigation, dunnage, dry matter loss, etc. can be addressed by silo storage. Storage of food grains into silos will be helpful in efficient management and quality retention for long durations. Therefore the replacement of warehouse storage with silo storage is recommended in planned manner.
- The study on losses/gain in storage of Paddy and Wheat under CAP storage shall be taken up separately with sufficient and statistically valid data points.
- This study may be a bench mark study for estimation of losses in food grains during storage in warehouses. In future some more studies should be conducted with controlled conditions for estimating the losses and evaluating the effect of several other parameters, such as forced aeration of stacks, quality of grains, quantification of loss due to individual biotic factors.
- The recommendations of this study was implemented by the Ministry of Consumer affairs, Food and Public Distribution, Govt. of India w.e.f. 01.01.2022.

1.4.3. Microwave assisted disinfestation of selected food grains (rice and wheat)

Post-harvest losses in India are due to unscientific storage, insects, rodents, micro-organisms etc. During storage major damage is mainly caused by insects. The prevention of the pests before grain infestation can be done in order to avoid the later efforts of management. Among the disinfestation measures, use of dielectric heat is one of the novel ideas in stored grain protection. ICAR-CIPHET has completed a consultancy project on 'Microwave Assisted Disinfestation of Selected Food Grains (Rice and Wheat)' with M/s. Pradeep Metals Ltd., Navi Mumbai. The study was based on the idea to disinfest the grains with minimum exposure of microwave radiations to grains while killing the insect's infestation while retaining the food properties and to establish a continuous system for the same. The major stored grains insects i.e. flat grain beetles, rice weevils, flour beetles for rice and khapra beetle, lesser grain borer and flour beetles for wheat, respectively were the targeted insects. The studied microwave exposure durations for rice ranges between 10 – 40 s and 20-80 s for wheat at different moisture levels i.e for non-basmati rice: 11, 12, 13, 14%; for basmati rice: 11.5, 12.5,

13.0, 13.5, 14.0% and for wheat: 9.5, 11.0, 12.0, 13.0, 14.0%. The grains were stored at ambient conditions in air tight packaging materials after treatment. The protocol standardised by ICAR-CIPHET, Ludhiana along with the technical inputs of the IMRC team, a continuous microwave grain disinfestation system was established at IMRC, Navi Mumbai (Fig.26). The system was effective in disinfesting the rice and wheat without altering the quality significantly. The treated grains can be stored for a duration of 8 months, if cross infestation is avoided.

Specification for continuous microwave disinfestation system:

- Total length: 3 meter
- Microwave zone: 80 cm (w) x 45cm (h) x 117(l)
- Microwave input power: 4.5 kw
- Automation: PLC based programmer with HMI
- IR Pyrometers for temperature sensing along with PID controller
- Capacity - 130-150 kg/h
- Coupled with grain mixer, Vibratory feeder & cyclone separator

Fig.26. Continuous microwave disinfestation system for rice & wheat

1.4.4. Response of stored grain moths towards coloured lights

Post-harvest losses of agricultural commodities caused by the insects need to be managed at every stage especially during storage and handling. The commonly followed methods to control insect infestation during storage include chemical treatments like surface sprays and fumigation. However, looking into the ecological and environmental effects by these chemicals, there is need to search for non-chemical management alternatives. One such management option is the use of light traps which exploits photo tactic behaviour of insects. For this purpose to carry out *in-vitro* studies, two different test chambers have been developed (Fig. 27 A&B-acrylic; C-PVC). Experiments have been conducted using grain moth, *Sitotroga cerealella* adults. Five different colours have been used i.e., blue, yellow, green, red, white along with the UV light as standard check. The insects were released freely in the test chambers and the percent of attraction was recorded. The results showed that 73.34% *Sitotroga* were attracted towards blue light (470±10 nm) followed by green (520±5 nm, 43.34%) and red (625±10 nm, 23.34%) as against 76.20 % towards UV (254±10 nm) i.e. standard check.

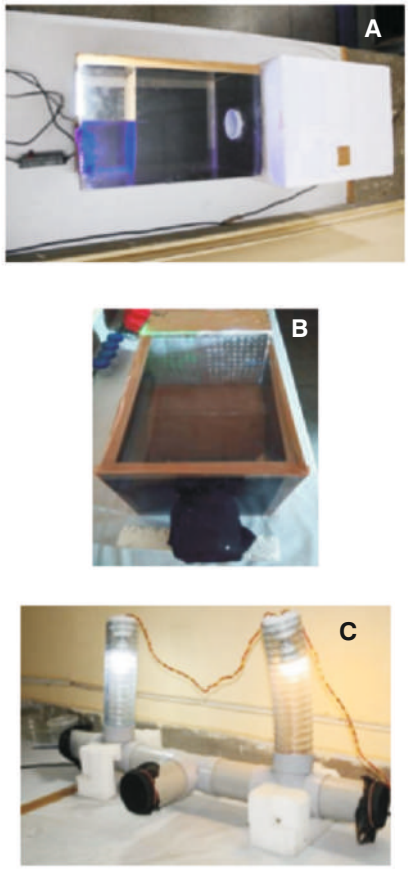


Fig.27. A & B. Acrylic chambers & C. PVC chamber

1.4.5. Performance evaluation of hermetic bags on selected commodities

Hermetic technology is one of the cutting-edge technologies for the preventive insect management in grain storage. In this line, Save Grain Advanced Solutions Pvt. Ltd., Pune has developed a hermetic bag 'Save Grain Bag' for the storage of different food grains. In order to study the durability of the bag, storage shelf life of the grains and their quality parameters, ICAR-CIPHET, Ludhiana is conducting a consultancy project. The commodities under study are paddy, rice, wheat, tur, turmeric ad black pepper, under two different conditions *viz.,* infested (i.e., artificially infested with the insects infesting the respective commodities) and un-infested condition (i.e., market procured samples, cleaned and dried). Based on the completed storage study in paddy and rice, Save Grain Bags are found to be effective for storage of grains with no significant changes in the grain quality (Fig.28 A&B).

Fig.28. A&B Glimpses of the storage study

1.4.6. Studies on dried fish

A. Biology of *Deremstes* on dried fish under storage and the loss assessment

The harvested fish are generally preserved by curing, i.e., salting, drying or smoking, or a combination of these treatments. Among these, drying is regarded as a low-cost and simple method of preservation of fish. However, using the traditional method of sun drying, the dried fishery products suffer severe losses due to insect infestation. In this study, the biology and behaviour of *Deremstes* infestation in driedhas been studied under laboratory conditions. The natural infestation was collected from Jagiroad dry fish market, Morigaon (Assam) (Fig.29). It has been observed that females prefer to lay eggs in dark spaces and also where there is sufficient food available for newly hatched larvae. Preferred egg laying site is near the eyes of fish and tissue/ organ hides. The biology of the insect is presented in Table 6 & Fig.30.

Fig.29. Dry fish market (conventional drying and storage)

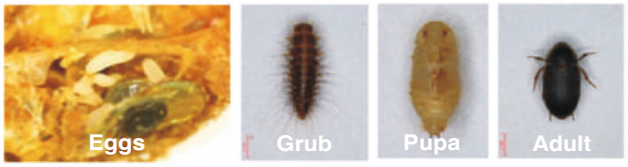


Fig.30. Biology of *Deremstes*

Table 6. Data presenting biology of Deremstes

Total fecundity (eggs/ female)	Hatching (%)	Incubation period (h)	Larval period (days)	Pupal period (days)	Average no. of moults	Sex ratio (M:F)
50±6.2	50±3.25	36±1.25	25±5.4	8±1.5	7	3:5

B. Studies on dry fish packaging

Packaging of dry fish has been a problem due to several reasons including puncturing by sharp spines, hygroscopic nature of dry fish and evaporation of its volatile components. To find an appropriate packaging 300 gsm HPDE, aluminium laminated HDPE (3-ply) and LDPE have been used in different forms of packages including pillow pouch, tray and stand pouch. Dry fish were stored in these packages and quality was assessed through sensory evaluation (9-point Hedonic scale) at monthly intervals. Dry fish stored in aluminium laminated HDPE pillow pouches and HDPE trays have been found acceptable for cooking even after 8 months of storage (Fig.31).

Fig.31. Dry Fish stored in different packaging materials

1.4.7 Production and characterisation of soy and groundnut protein isolates

India produces about 17 million tonnes de-oiled cakes/meals including 7.4 and 1.6 million tonnes soy-meal and groundnut cake, respectively. At present, cakes/meals are utilized as animal feed locally or exported. Soy meal contains about 50% protein and groundnut cake about 35% protein. In order to meet the protein deficiency in Indian population there is need to produce protein isolates from underutilised de-oiled meal/cake. A novel process based on microbial precipitation for protein isolates/concentrates from oilseed cakes/meals (example soy meal, groundnut cake) without addition of strong or diluted acid has been developed. The developed process is unique as it is added acid free and also provides about 5% higher yield of protein as compared to the existing chemical process. The protein produced is superior in terms of solubility, wettability, water absorption capacity and degree of hydrolysis. The yield so obtained is about 35-36% of the total weight of soymeal and 25% of total weight of groundnut cake used, whereas, in the traditional chemical process, maximum 30% protein yield from soymeal can be obtained. The developed method comprises novel bacterial strains isolated from a food sample for producing protein from de-oiled meal/flour. The protein isolates samples have been tested for biochemical and toxicity parameters using rat model at ICAR-NDRI Karnal. Biochemical analysis measured in terms of liver profile like ALP, SGPT and SGOT was found lower in case of microbial precipitated soy protein isolates. Lipid profiling measured in terms of Total cholesterol, LDL, HDL and triglyceride value were also found significantly lower in case of microbial precipitated soy protein isolates. Kidney function tests were also carried and was measured in terms of creatinine and uric acid. Both the parameters were found higher in case of acid hydrolyzed soy protein isolates in comparison with microbial precipitated protein isolates. The indigenous produced protein isolates will be valuable for nutritional security of Indian population as well as for Indian economy.

Fig.32. Soy and groundnut protein supplements

1.4.8 Performance evaluation of 'Fruit fly scanning machine

The X-ray-based 'Fruit fly scanning machine'developed by Wide Mobility Mechatronics Pvt. Ltd., Hubli, Karnataka has been evaluated at ICAR-CIPHET, Ludhiana under the consultancy project funded by Indian Gherkins Export Association (IGEA) of India.The tested X-ray based fruit fly scanning machine (CONRAD-G) for gherkins was found satisfactory, and all the specification claims of the manufacturer could be verified. The machine is fabricated with all necessary safety measures and signs. The radiation leakage was also less than measurable limits. It worked well for both the grades (20+ and 30+) which were tested, where the detection accuracy for bad fruits was 95% (100% for fruits with defect $\geqslant$ 3mm and ~94% for fruits with defect <3mm). It can be inferred that all the fruits with defect size larger than 3 mm can be successfully removed. The machine's segregation efficiency was 85%. The machine can be considered as a best alternative for manual culling of gherkins.

2.1. Machineries / processes / products developed by AICRP-PEASEM

The following are the specific achievements made by cooperating centres during the year under report:

2.1.1. Standardization of supplemental lighting system for lettuce grown in soilless media under protected cultivation

A smart sensor system for automation of red and blue light emitting diode (LED) lights based on solar intensity measurement through the light sensor has been developed for the playhouse (Fig.1). Red and Blue supplemental LED lights are installed at the height of 184 cm from the floor of the polyhouse in the ratio of 70:30, respectively. The three compartments out of four, one compartment with no supplemental lighting/control compartment, to increase the photoperiod of the lettuce crop. The LED lights in each compartment are connected in series along with a smart sensor system. In these compartments, three lighting treatments consisting of 14, 16 and 18 h of photoperiod were provided to the lettuce plants. The results showed that lettuce crop recorded significantly higher yield in winter season of both the years with supplemented lighting as compared to spring season. The average highest yield recorded 12.8 and 12.95 kg/m^2 during winter season in Red-Blue LEDs in the proportion of 70:30 in 18h supplemental lighting. The same treatment recorded the lowest yield 10.06 and 9.72 kg/m^2 in spring season. The quality parameters like antioxidant capacity, total phenol content, ascorbic acid content, fruit firmness and TSS recorded improvement with supplemental lighting.

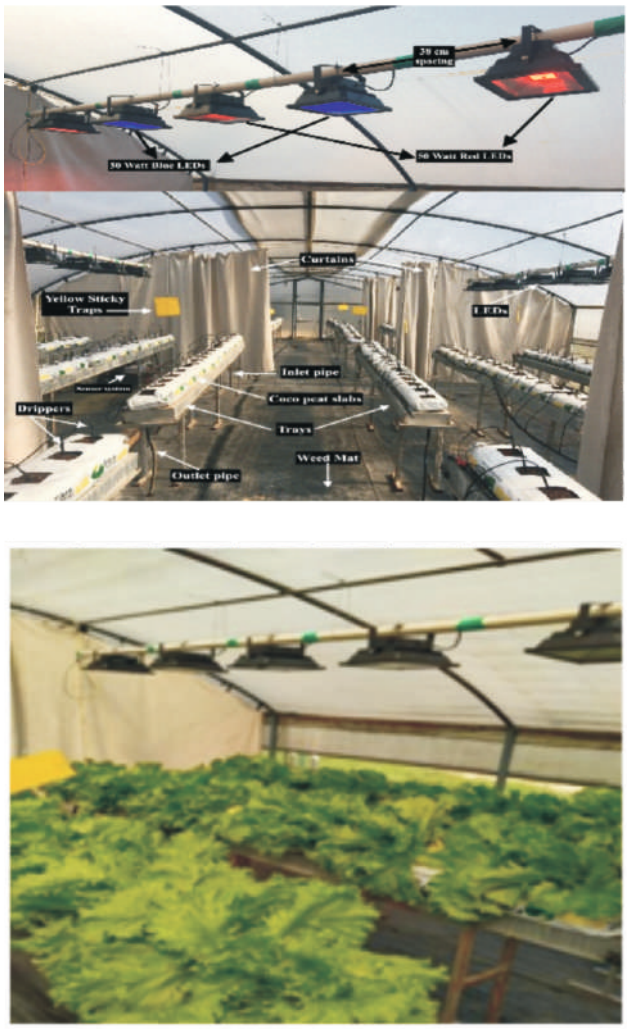


Fig. 1. LED

Table 1. Yield of Lettuce in soilless media at different lighting conditions

Treatment	Yield (kg/m^2)			
	Winter Season		Spring Season	
	(2020)	(2021)	(2020)	(2021)
T_1 = No Supplemental Lighting/Control	11.01	10.03	10.60	10.81
T_2 = 14 Hours Supplemental Lighting	11.07	10.53	10.60	10.82
T_3 = 16 Hours Supplemental Lighting	11.99	10.84	10.50	10.21
T_4 = 18 Hours Supplemental Lighting	12.84	12.95	10.06	9.72
CD (p = 0.05 %)	0.805	1.01	NS	NS

2.1.2. Water lifting device for river bed cultivation in hilly region

The ICAR-VPKAS centre has developed water lifting machine (Fig.2) from river bed. The machine utilizes the hydraulic energy of flowing water to lift water from water source. Two plunger pump assembly was used to pump water from river. River current with the help turbine was used as motive power to drive the pumps. Initially 14 numbers of blades were used in the turbine. The gear on the turbine drive shaft was of 14 teeth and that of pump driven shaft was of 36 teeth. The discharge capacity of water lifting device was 15200 litre/day at 6 metre head and 10,080 litre/day at 9 m head and 75 m away from river source.A water lifting device will utilize the flow of water as source of energy for irrigating cropped area. Therefore, crop cultivation could take place under un-irrigated area of river bed in hilly region..This device will be most useful in areas where spring or/on gravitational flow of energy is available.

Fig. 2. Water lifting device

2.1.3. Development and evaluation of plastic based different sizes of multi-tier portable rooftop/terrace vegetable nutrition garden models using soil-less media

The plastic based structure of vegetable nutrition garden model is designed by PAU, Ludhiana center. It is made of high quality PVC pipes. Presently, plastic based three rows of two tier vegetable nutrition garden model has been developed. For ease of installation, user manual has been made providing step by step guide showing how you can assemble nutrition garden. Instructions are given as foot note for easy assembly of the structure of garden. Assemble every part of vegetable nutrition garden model as indicated in the pictures and, after that fix all pipe joints with PVC pipe solution. Place the beds on the bench as given. After completing all the steps cover the roof of the model with UV poly sheet and tighten the crop wires (2 per bed) with U clamps on each bed (Fig. 2).

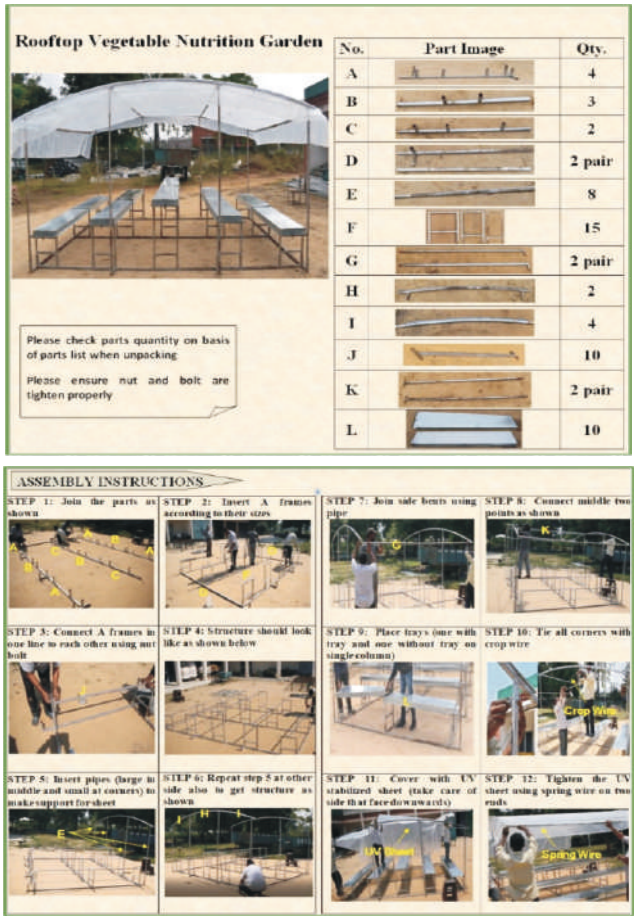


Fig. 3. Plastic based vegetable nutrition garden model

2.1.4. Development of user-friendly biofloc fish rearing facility

ICAR-CIFA, Bhubaneshwar center has designed a biofloc fish rearing facility incorporating a fish rearing tank, a mechanical settler and one bioreactor. It is Ø 3 x 1.2 m cylindrical PVC coated polyester lining surrounded by rigid plastic mesh (25 mm). A bottom curvature of R 2.5 m is provided for adequate sludge removal while maintaining the structural integrity. The flexible polyliner moulds to the shape of 8 rigid FRP sectors which are interlocked with butt joints. The settling unit is a 200 L HDPE radial flow type tank. The inside of the settler is equipped with L-shaped upward flowing 63 mm piping capped with a turbulence baffle. The settler is designed to handle water loading of 150-200 litres per minute (LPH). The sedimentations settle at the bottom and water from the top level is passed to the Bioreactor. Bioreactor is a 200 L HDPE tank, filled with lava rocks (120 L) and provided with 13.8 kPa of internal aeration. The water from the bioreactor is pumped back to the fish rearing biofloc tank *via* an inline 3000 LPH 63 x 63 mm pump (Fig. 4).

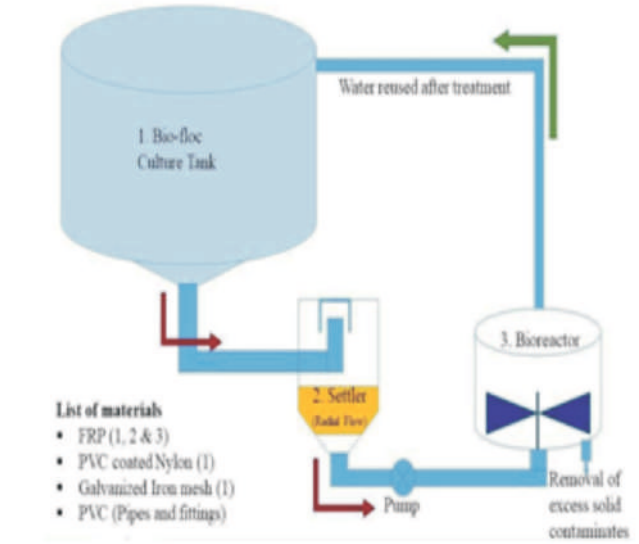


Fig. 4. Biofloc Fish Rearing Facility

2.1.5.Vertical aquaponics for fish and plant biomass production

A vertical aquaponics setup has been designed and developed using ø 0.16 ×1.5 m PVC tube with 50 L fish rearing tank. A 300 LPH submersible pump moves the water from the bottom of the fish rearing tank to the top of the vertical tube *via* one 12 mm silicon pipe. The plantation is done in 50.8 mm cups in 20˚ slanted holes fabricated into the PVC pipe. The system was initially stocked with 30 numbers of *Puntius gonionotus* fry and 15 numbers of marigold, *Tagetes erecta* plants. This unit is in operation with 15 numbers of Guppy fish; and 12 nos of ornamental plants (white & orange Gemini (6) and violet Petunia (6). The system is designed for indoor decor as well as a sustainable technology to promote healthy lifestyle. The system being a basic aquaponics, can be used to grow organic herbs and spices at home (Fig. 5).

Fig. 5. Vertical Aquaponics

2.1.6. Development and assessment of microcontroller based solar tunnel drier suitable for heavy rainfall region of Northeast India

ICAR-RC, NEH Region, Barapani center has developed the microcontroller based solar tunnel dryer with capacity of 100 kg (Fig. 6). It costs of Rs. 80,000/-. 100 kg turmeric at 71.60 % (w.b.) moisture content was reduced to 10% (wb) in 29 bright sunshine hours (BSH). It took 5 to 6 days to dry turmeric in tunnel dryer, whereas it took 11 to 12 days in conventional sun drying and 8 days in natural ventilated tunnel dryer. 50 kg ginger at 88.09% moisture content was reduced to less than 1% in 16 BSH using solar tunnel dryer. The developed tunnel dryer has average efficiency of 19% with energy saving of 98.33% as compared to Hot air oven dryer.

Fig. 6. Solar tunnel dryer

2.1.7. Low- cost solar radiation shield system

DBSKKV, Dapoli centre has designed and developed a low-cost solar radiation shield system (Fig.7) for temperature and relative humidity sensors to facilitate the automation of agricultural facilities such as greenhouses, animal buildings, storage facilities, open field operations, etc. The solar radiation shield system will be used for temperature and relative humidity loggers installed in open field agriculture and in automation of agricultural facilities, where temperature and RH sensors are used. The total production cost of a solar radiation shield system is Rs. 576/- and approximate selling price will be Rs 1000 per unit.

Fig. 7. Solar radiation shield

2.1.8. Portable & detachable animal shelters for livestock raising at high altitude pasture

ICAR-NRCY, Dirang centre has designed portable and detachable animal shelter for yak. A make-shift portable animal shelter was fabricated with plastic materials CPVC pipes, nylon ropes, 50% shade net, HDPE Tarpaulin and GI pipes, rods, nuts, bolts etc. This type of prefabricated tent will be very useful for the nomadic livestock farmers for protecting their young and milking animals from predators and environmental stress. Approximate weight of the shelter material is around 20 kg which can be easily transported on yaks and the cost is around Rs.15000/- per shelter. This shelter can accommodate 8-10 yak calves or 4 adult females (Fig. 8).

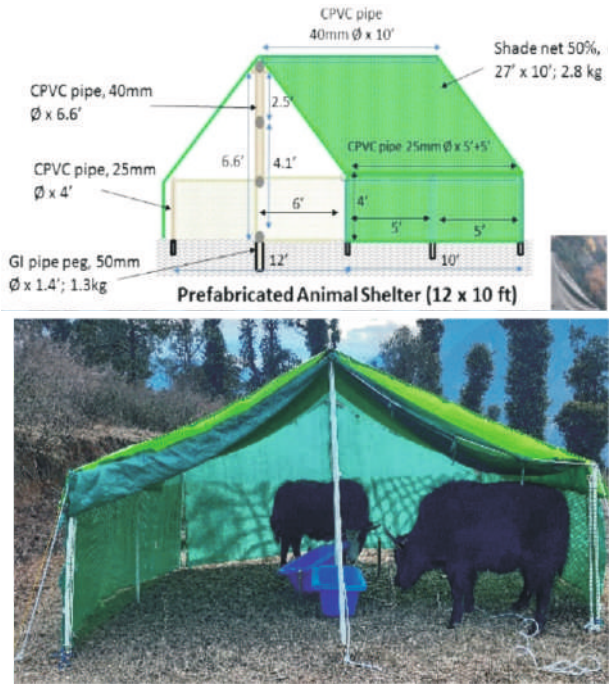


Fig. 8. Animal shelter

2.1.9. Fish seed transportation system

ICAR–CIFA, Bhubaneswar centre has developed fish seed transportation system of 250 litre water holding capacity. It has dimensions (L×B×H) of 1050×550×650 mm made of Fibre Reinforced Plastic. The system is suitable for 2000 fry with mortality< 0.01% and provided with splash breaker. Thermocol insulation of 50 mm thickness has been provided from all sides. The cost of the system is Rs. 40,000/- with life of 15 years (Fig. 9).

Fig. 9. Fish seed transportation system

2.1.10. Design of suitable cost-effective animal shelter using plastics for temperate Himalayan region

SKUAST-K, Srinagar centre has designed a cost-effective animal shelter using plastics for temperate Himalayan region. The existing animal shelter has an effective ventilation area with an increase from 12.72% to 79% with side opening/closing provision for its optimum utilization. Temperature range varied from 25-36°C. The animal shelter found the total dead load, purlins load, live load, wind load and spacing of truss of 248 N/m^2, 731 N/m^2, 350 N/m^2, 5599.58N and 2.3m, respectively. The

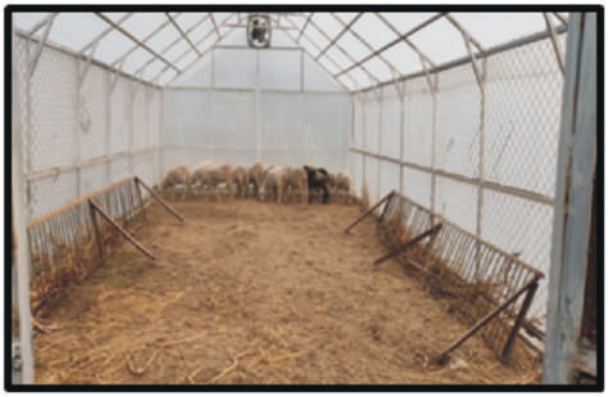


Fig. 10. Plastic made animal shelter

space requirement for one animal is found to be 10-12 sq. ft. In this shelter, 50 Nos. of animals can be accommodated in the base area of 480 sq. ft. The approximate cost of animal shelter is Rs. 1500/m^2 (Fig. 10).

2.2. Processes

2.2.1. Soil-less cultivation of high value vegetables for enhancing water-nutrient productivity using different paddy straw based substrates

PAU, Ludhiana center has developed soil less water-nutrient product using different paddy straw based substrates. Bio Char is a carbon rich porous product obtained after the partial combustion of rice straw at low temperatures in the presence of little or no oxygen. To prepare 8 quintals of Biochar from 12 quintals of paddy straw, normally, it takes about two days to cool, however it can also be cooled by sprinkling water for removing the biochar on the same day. On an average, it contains 30-36 % carbon, 0.5-0.6% nitrogen, 0.16-0.22% phosphorus and 1.6-2.2% potassium. Its' application to rice and wheat @ 2.0 tonnes/acre saves 16 kg N (35 kg urea), increases crop productivity and improves soil health.

Table 2. Yield of Tomato as influenced by substrate media composition

Treatments	Single fruit weight (g)	Fruit girth (mm)	Fruit length (mm)	Yield (kg/plant)
T_1: Paddy straw (100%)	78.1	44.5	35.6	2.18
T_2:Paddystraw+Coco peat (3:1)	82.8	48.7	38.5	2.45
T_3: Paddy straw+Coco peat (1:1)	90.0	51.4	40.5	2.63
T_4:Paddystraw+Coco peat (1:3)	97.9	52.4	45.2	3.03
T_5: Biochar (Paddy) (100%)	77.5	43.6	34.3	1.04
T_6:Biochar + Coco peat (3:1)	88.6	50.2	40.4	2.30
T_7:Biochar + Coco peat (1:1)	92.3	55.3	42.2	2.37
T_8:Biochar + Coco peat (1:3)	101.6	56.3	44.4	2.42
T_9: Briquette(Paddy based)-100%	91.2	50.6	39.1	2.33
T_{10}: Briquette+ Coco peat (1:1)	99.8	52.1	43.9	2.82
T_{11}: Cocopeat (100%)	113.3	57.6	52.2	5.74
CD=0.05 %	9.60	3.60	2.76	0.51

Briquettes (from chopped paddy straw): To get chopped paddy straw, the dried paddy straw is chopped to size of 2-3" length by chaff cutter (toka) then dried in the sun. The paddy straw briquetting process involves crushing of the straw, drying, briquetting and cooling. While preparing the media/ substrate the material was mixed on a volume basis in different proportions. The Results showed that mixing of 25% paddy straw with 75% coco peat (T_4) and briquettes 50% + coco peat 50% (T_{10}) resulted in yield penalty of 47 and 50 % respectively as compared to 100 % of coco peat used for growing tomato. However, the quality parameters of tomato *viz.* total phenolic content, ascorbic acid content, total flavonoid content, TSS, firmness and lycopene content was significantly higher, where paddy straw and coco peat were used in the ratio of 1:3 followed by mixing ratio of 1:1 (Fig. 11).

Fig. 11. Tomato grown by using different substrate media composition

2.2.3. Modelling of water and nutrient dynamics under mulch and drip irrigated high value crops

ICAR-VPKAS, Almora centre studied the modelling of water and nutrient dynamics under mulch and drip irrigated high value crops. Water contents in various layers of crop root zone after 48h of irrigation varied from 16.50-22.70%. Soil matric potential in the range of -27 to -34 kPa at 30 cm depth and irrigation frequency at once in two days can be used as an index for drip irrigation scheduling during cabbage and capsicum growth period in sandy loam soils for attaining higher yields. The maximum yield (38.9 tha^{-1}) of cabbage crop has been obtained by applying water @ 100% of ET_c + 100% RDF + Mulch with once in 2 days irrigation frequency followed by 80% of ET_c + 100% RDF + Mulch with crop yield (36.5 tha^{-1}) at once in 2 days irrigation frequency. The maximum yield (37.3 tha^{-1}) of capsicum crop is obtained by applying water @ 100% of ET_c + 100% RDF + Mulch with once in 2 days irrigation frequency followed by 100% of ET_c + 80% RDF + Mulch with crop yield (36.7 t ha^{-1}) at once in 2 days irrigation frequency (Fig. 12).

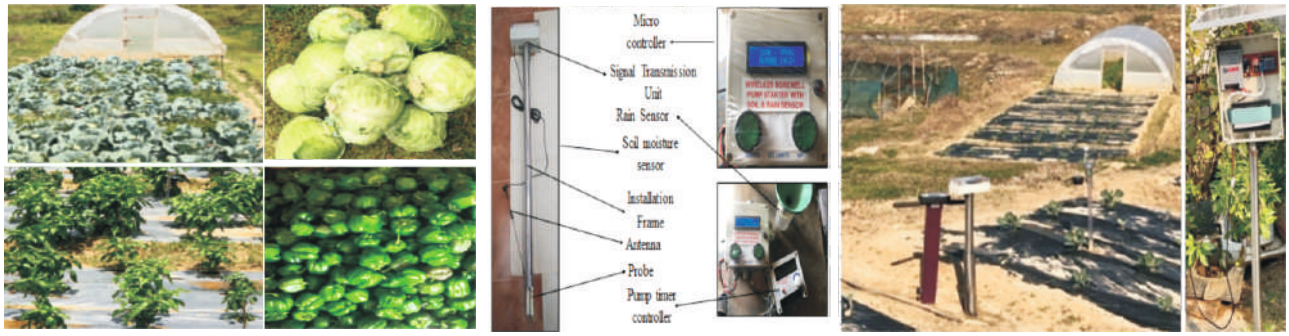


Fig. 12. Mulch and drip irrigated high value crops

2.2.4. Assessment of gravity-fed drip irrigation system for mid-hills of Meghalaya

ICAR RC NEH Region, Barapanic centre assessed the solar powered water lifting pump (0.5 hp, capacity = 45 l/min, 40 m head with 2 nos. of 250 W solar pannel) and gravity fed drip irrigation system for strawberry cultivation. The overall average efficiency of the system is 7.02%. Average water use efficiency of the crop under the system is found to be 31.8 Kg/ha-mm. The farmer used to get annual income of Rs. 50,000/ from strawberry cultivation, whereas with solar powered water lifting pump and gravity-fed drip irrigation system, the annual income incremented to a total of Rs. 90,000/- with cost saving of Rs. 5,500/- from 0.2 acre of land (Rs. 27,500/- per acre) in the production of strawberry (Fig. 13).

Fig. 13. Gravity-fed drip irrigation system

2.2.6. Application of magnetized water to gherkins (*Cucumi sangura* L.) under protected cultivation and its impact on soil-water-plant dynamics

An experiment has been conducted to study the application of magnetized water through drip irrigation for gherkins (*Cucumi sangura* L.) under protected structure. The experiment consisted of three replications using factorial Randomized Block Design. The treatment consisted of magnetized water and non-magnetized water, shade net conditions and open field conditions and irrigation levels of 40% ET, 60%ET, 80%ET and 100%ET. The use of magnetized water and 100% ET resulted in fruit yield of 9.77 t ha^{-1} and 9.86 t ha^{-1}, respectively. The highest nutrient uptake and fertilizer use efficiency of 189.98 N, 49.05 P, 217.56 K kg ha and 38.06 N, 59.22 P, 39.98 K kg ha respectively

Fig. 14. Flowering and fruiting of gherkins under shadenet

has been observed under shade net conditions. It is observed that the growth and yield of gherkins is superior in shade net with magnetized water and irrigation level of 100% ET (Fig. 14).

2.2.7. Impact of different colour low tunnel shade nets on growth and yield of chrysanthemum (*Chrysanthemum indicum* L.)

The present experiment was conducted to study the impact of different colour low tunnel shade nets and also different mulches on chrysanthemum. The experiment consisted of twenty treatments and two replications with split plot design consisting of different colored low tunnel shade nets and mulches. The main treatments are white, green, black shade nets and open field conditions. The sub treatments consisted of white, silver, black colour plastic mulch, jute mulch and no mulch. Based on results of number of branches per plant, plant spread, leaf area index and plant chlorophyll content, yield per ha and water use efficiency chrysanthemum cultivation using white shadenet and silver mulch is recommended as this resulted in the maximum benefit cost ratio of 2.8 (Fig. 15 & 16).

Fig. 15. Growth and flowering of *Chrysanthemum* under white shadenet

Fig. 16. Growth and flowering of *Chrysanthemum* under white plastic mulch

3.1. Machineries / Technologies by AICRP-PHET

The following are the specific achievements made by cooperating centres during the year under reports:

3.1.1. Tamarind deseeder

Tamarind deseeder is an electric motor (3 hp) operated machine suitable for the removal of seeds from dehulled tamarind pods especially for commercial pulp production. The prototype of deseeder consists of feed hopper, feeding belt conveyor, rotating deseeding drum, stationary concave, seed separation screen, pulp collection unit and drive mechanism (electric motor, pulley, belt and starter). The deseeding drum has sharp edged, fluted projections over its surface while the stationary concave has smooth edged fluted /ribbed surface projections. When dehulled tamarind pods pass by gravity between the rotating deseeding drum and stationary concave, the seeds are removed due to nipping action (impact and shear). The capacity of Tamarind deseeder is about 100 kg/h and the deseeding efficiency is over 90%. The perforated screen is provided for partial separation of seeds after deseeding (Fig. 1).

Fig.1. Tamarind deseeder

3.1.2. Pilot plant for mahua flower candy and nectar

The unit consists of stainless steel steeping vessel, cooking vessel, perforated container, Main frame, LPG stove, monoblock pump, pipe line and valve. The cooking vessel is heated by LPG stove for preparation of sugar syrup. The sugar syrup is transferred to the steeping vessel for dipping with mahua flower kept in the perforated container. The sugar syrup is then transferred to the cooking vessel for further concentration and recirculation. Finally the spent up sugar solution is again transferred to the cooking vessel for preparation of mahua nectar adding other ingredients. Cost of the pilot plant is Rs. 70,000/- (Fig.2.)

Fig.2. Mahua flower candy and nectar pilot plant

3.1.3. Detopping machine for carrot

A continuous power operated green detopping machine for carrot was developed with the help local manufacturer at CCS HAU, Hisar centre. The machine consists of a main frame made of mild steel in which the motor (1HP) was installed with chain sprocket drive for feed conveyor. The chain sprocket drive is connected with a conveyor that feed the carrot to the cutting blade assembly. The feed conveyor is also made of half circular shaped stainless steel pipes or slots fixed on chain and sprocket that holds and feeds the carrots to cutting blade assembly at 22 RPM. Before cutting the green, the both sides of carrots was required to be held firmly on feed conveyor. Therefore, a belt and roller mechanism was installed near to the cutting blade assembly to fix carrots firmly on feed conveyor for proper cutting of green part of carrot. The cutting blade assembly is also made of stainless steel and have two cutting edges. It cut the green top part from the carrot and these detopped carrots are collected in the container outside of the machine. The carrots contact surfaces are made of food grade stainless steel SS304. The cutting blade assembly is kept covered for the safety of machine operator. The capacity of the machine is 180kg/h and the cost is Rs. 40,000/- (Fig. 3).

Fig. 3. Detopping machine for carrot

3.1.4. Ozonation system for sanitization of horticultural produce

A high capacity-compact ozonation treatment system has been developed by the PAU, Ludhiana centre, Department of Processing and Food Engineering, Punjab Agricultural University, Ludhiana for effective sanitization of fresh produce. The system uses ozone gas produced by a L10G ozone generator (Corona discharge, Maximum output – 10g/h, 220 -240 V AC single phase power supply) and a separate water tank (20 L, food grade plastic) in which the water is ozonized prior to washing. The ozonized water is pumped into a treatment section above through fine spray nozzles to wash the produce for required amount of time. Since ozone gas is detrimental to human health, the treatment section has been designed air-tight to prevent possible leakage of gas into the surroundings. Around 10 kg of fresh produce can be sanitized in a batch with an exposure time to a maximum of 5 min. After the treatment, the produce is rinsed and washed with running water. Capacity of the machine is 10 kg/batch and the approximate cost is Rs. 20.000/-

3.1.5. Cucumber seed extraction machine

Multi commodity vegetable seed extractor was tested for the cucumber seed extraction with modifications made in machine like sieve and cleaning drum were made in machine. The capacity of machine was found to be 300 kg/h with 99.93% extraction efficiency. The machine is developed by PDKV, Akola centre. The cost of the machine is Rs. 65,000/- approx (Fig. 4)

3.1.6.Modern jaggery plant

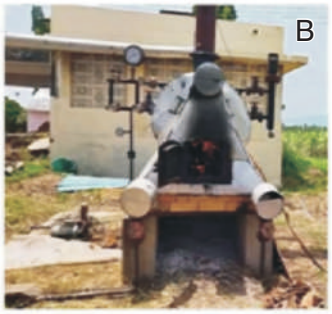
Anakapalle centre of AICRP on PHET has developed a modern jaggery plant for the production of about 1.5 tonne liquid jaggery/1 tonne soild jaggery/800 kg granular jaggery per day. The plant is fitted with a multi jet condenser for the removal of condensate to maintain

vacuum level. A scrapped surface heat exchanger, granulator and sieve are also installed in the plant for continuous production of granular jaggery. All the components of the plant are made of food grade stainless steel. The plant can be used for the complete processing from cane juice extraction to the production of solid or granular jaggery. This is complete automatic plant and no human touch is required after juice extraction till final production of jaggery (Fig. 5) A & B.

Fig. 4. Cucumber seed extraction machine

Stainless steel crusher

Vibro Seiver



Furnace & Steam boiler

Boiling pan

Filtration system

Preheater 1 &2

3.1.7. Tender coconut cutting machine

Tender coconut punching and cutting are important unit operations during the process of making many high value products including frozen coconut delicacy and tender coconut water beverages. Currently, the street vendors and tender coconut processing industries are using lengthy knife to cut open the tender coconut, which is not safe, laborious and time consuming process. The gender friendly automatic machine to perform cutting of tender coconut is the current need. In this context, ICAR-CPCRI has developed an automatic cutting machine that works on the concept of conversion of rotary motion to linear motion. The important components associated with the developed machine are cutting knife, collection tray, and electrical circuit to operate the cutting knife (Fig.6). Total power required to operate this machine is 12 V. The cost and capacity of the developed machine is Rs. 25000 and 180-210 nuts/h, respectively.

Fig. 6. Tender coconut cutting machine

3.1.8. Cocoa bean sheller cum winnower

Cocoa (*Theobroma cacao* L.) is a commercial plantation crop in India. It is the main raw material in the production of chocolates, cosmetics, health drinks, pharmaceuticals etc. The cocoa beans which are embedded in a mucilaginous pulp inside the pod consist of two parts- seed coat (shell) and seed cotyledon (nib). Shell is being removed from the cocoa bean before or after the seed is roasted. Shelling is one of the primary unit operation and critical step in the processing of chocolate or any product that is derived from cocoa beans. It determines the quality of the cocoa nibs in terms of flavour and purity. Shelling of cocoa bean is a difficult and time-consuming operation. Traditionally, cocoa shelling was done manually or with the help of animals. Now a days, though few shelling machines are available in the industry, an efficient machine suited to small and marginal farmers is still inaccessible. Homemade chocolate industry requires a single small scale cocoa sheller cum winnower that is both efficient and affordable for small scale chocolate producers. Considering the above facts, a Cocoa sheller cum winnower" having a capacity of 155kg/h has been developed at this centre. The main components of the batch-type cocoa sheller are feed hopper, metallic rollers (2), chute, and motor and frame assembly (Fig. 7).

Fig. 7. Cocoa bean sheller

3.1.9. UV-assisted treatment device for post-harvest decay control in Nagpur mandarins

10 min. at 10 cm distance from UV-C source effectively controlled both the devastating storage diseases blue mould (Penicillium rot) and sour rot (Geotrichum rot) of Nagpur mandarins. When only pre-wax UV treatment was given to AmbiaBahar fruits 10 min exposure to UV-C followed by application of 6% Decco / Citrashine wax and 15 min exposure to UV-C followed by application of 6% Nipro plain wax was found to restrict post-harvest rotting of Nagpur mandarin fruits upto 69.64% without using fungicide when fruits were stored under ambient condition. When both pre-wax and post-wax UV treatments were given to AmbiaBahar fruits 4 min pre wax exposure to UV-C followed by application of 6% Decco / Citrashinewax followed by post UV-C exposure for 6 min gave maximum reduction (49.46 % over absolute control) in the post-harvest rotting of Nagpur mandarin fruits without using fungicide when fruits were stored under ambient condition. On the basis of above results, a continuous type UV-assisted treatment device of 2 tons per day capacity was developed. The developed machine consists of fruit conveyor, wax applicator, drying and a mounted UV-light source (Fig. 8).

Fig. 8. UV-assisted treatment device

3.2 Processes

3.2.1. Hermetic storage technology of foxtail millet rice

UAS, Bangalore centre has developed a hermetic storage technology for prolonged storage of millet rice & management of insects and rancidity. Foxtail millet rice packaged in 80 micron ethylene-vinyl alcohol (EVOH) multi-layered film package (Pro-Harvest) and sealed hermetically could be stored at ambient conditions for 60 days maintaining shelf-life quality i.e., without appreciable rise in rancidity and insect infestation. Dehulled foxtail millet rice treated with gamma irradiation @0.5-1.0 kGy and packed in 80 micron EVOH multi-layerd film package could be stored under ambient conditions for at least 6 months without insect infestation or rise in rancidity of stored grains. The microbial load (bacterial & yeast) was also low in the treated grain improving the quality of millet rice (Fig. 9).

Fig. 9. Gamma irradiated foxtail millet rice in EVOH package

3.2.2. Avocado-milk-brwn top millet drink

A process protocol for the preparation of Avocado-Milk-Brown top Millet Health Drink. The brown top millet rice is soaked overnight, required quantity of water was added and the slurry is prepared by grinding in high speed mixer-grinder. The resultant slurry is boiled till

optimum viscosity is developed due to gelatinization. Freshly prepared slurry is blended with avocado pulp and skim milk powder (SMP) to prepare the beverage. Specially prepared 'masala' is added to improve taste. The pasteurized masala blend at the ratio of 3:5:5 Brown top millet: Avocado: SMP has been found most acceptable based on sensory acceptability studies. Pasteurized drink is found acceptable up to 7 days when stored under refrigerated conditions.

Fig. 10. Avocado-milk-brown top millet drink

3.2.3. Process protocol for the production of wine from cocoa mucilage

Cocoa sweating, the pale yellowish liquid that drains off during cocoa fermentation, is the breakdown product of the mucilage surrounding the fresh cocoa bean, and constitutes about 10% of the weight of the cocoa fruit. This liquid has a sweet-sour flavor and is rich in sugars and bioactive compounds. It has been found to be a suitable medium for the production of wine and alcohol. Its rapid collection in high yields and quality is the first step to its utilization on a commercial scale. The wine extracted from cocoa mucilage has several medicinal benefits such as regulation of cholesterol, improves blood clotting functions etc. The cocoa sweating is extracted by using a cocoa pulp extractor for wine production.

Prior to the development of wine, the physico-chemical properties of the cocoa mucilage have been estimated. The cocoa mucilage has been a pH of 4.9. The TSS, titrable acidity and ascorbic acid values are found to be 14.23°Brix, 0.182mg/100ml and 3.5mg/100ml, respectively. The colour values *viz.* L*, a* and b* of cocoa mucilage were 44.34, 6.11 and 62.25, respectively. It has shown a viscosity value of 5.34 cP. The cocoa sweating from the extracted cocoa pulp was collected and used for wine preparation. The quality parameters of wine were evaluated. The ethanol content in wine was recorded as 9.8% and 10.2% in wine prepared from pasteurized and un- pasteurized cocoa sweating, respectively. This level is under the acceptable limit of maximum permissible ethanol content accepted for fruit wines. The quality parameters such as pH, TSS, ascorbic acid content of wine recorded as 3.48, 18.6°Brix and 1.34 mg/100 ml for wine made from fresh cocoa sweating, whereas, for wine prepared from pasteurized cocoa sweating was 3.63, 20.5°Brix and 1.64 mg/100 ml. The process has been developed by Tavanur Centre. (Fig. 11 & 12)

Fig. 11. Cocoa mucilage

Fig. 12. Wine

3.2.4. Rapid detection of adulteration in desiccated coconut powder: vis-NIR spectroscopy and chemometric approach

Adulteration of desiccated coconut powder (DCP) with coconut milk residue (CMR) is an emerging problem in the coconut processing industry. Consumers and industries are looking for a simple non-destructive device to measure the purity of DCP. Vis.-NIR (350–2500 nm) spectroscopy along with the chemometric techniques have been used to assess the purity of DCP. In this study, DCP was adulterated with CMR at different levels such as 0 (pure DCP), 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100% (pure CMR). Partial least squares regression (PLSR) models were developed using whole spectral data and selected wavelengths. The spectral data were pre-processed using different techniques such as raw, MSC + SNV, SG-smoothing, and detrending. The R^2 of the models constructed with the pre-processed spectral data was higher than 0.950, irrespective of pre-processing technique. Pre-processing of spectral data does not have a significant effect on model performance when compared with the model developed using raw spectral data (R^2_P = 0.973; SE_P = 9.681; RPD_P = 9.381; RER_P = 10.389), but the prediction accuracy was decreased. The wavelengths 653, 933, 1189, 1383, 1444, 1670, and 1911 nm were selected as the featured wavelengths for quantification of adulteration level in DCP. No significant difference in statistical results was observed between the PLSR model developed with selected wavelengths (R^2_P = 0.869; SE_P = 11.701; RPD_P = 9.381; RER_P = 8.595) and the PLSR model for whole spectral data. The developed model can be used to predict the level of adulteration in DCP if the adulterant concentration was more than 10%. The overall results obtained in present study suggest that the vis-NIR spectroscopy along with suitable chemometric techniques have a great potential for rapid measurement of adulteration level in DCP.

3.2.5. Edible fruit coating impregnated with antimicrobial essential oils and myconanoparticles for post-harvest decay control in Nagpur mandarins

- Silver myco-nanoparticles have been prepared using two isolates of *Aspergillus niger* AN-1 and AN-2 by reducing $AgNO_3$ solution at 2mM concentration confirmed by UV-vis spectroscopy at 320 and 416 nm wavelength.
- Particle size distribution and zeta potential of prepared nanoparticles suggest uniform size and good stability in water suspension.
- FTIR study reveal flavonoids and proteins present in fungal extracts are responsible for reduction and stabilization of prepared silver myco-nanoparticles.
- Procedure for bulk production of silver myco-nano particles is standardized and antifungal property of silver is demonstrated against two fungal pathogens of Nagpur mandarins Aspergillus niger and Curvularia lunata by Agar Well Diffusion technique.

3.2.6. Process technology for making shoe polish from Karanj seed oil

Standardized composition of shoe polish was obtained as 3 part oil and one part bee wax containing other elements like colour pigment, shellac, gumarabic and turpentine oil. In initial trials, there was colour problem .To overcome the problem of colour, sixteen various combination of Shellac and Gum Arabic was planned for improvement of colour in each case of black and brown polish.. Developed shoe polish was tested for texture, applicability, spreadibility and ease in taking out the material. Colour was recorded with gloss meter. The highest gloss meter reading i.e. 10.62 GU was recorded in case of black shoe polish containing shellac and gum arabic each

weighing 0.75g whereas sample containing 1.25g shellac and gum arabic each showed the lowest gloss reading of 3.88GU. In case of brown polish the highest gloss meter reading i.e. 5.24GU was recorded in case of sample containing shellac and gum arabic weighing 1.25g each and lowest was observed in case of sample containing shellac weighing 0.5g and gum arabic weighing 0.75g. Developed sample is very near to standard brand shoe polish (Cherry) except that it gives oily appearance initially.

3.2.7. Botanical formulation derived from oilseed processing

A botanical formulation derived from oilseed processing has been developed in PPP mode by AICRP-PHET Coordination Unit and tested successfully during multi-location trials. The developed formulation has been tested by PAU Ludhiana and SKUAST-J on paddy and maize crops. PAU Ludhiana observed that rice grain yield increased by 12.35% from 51.33 q/ha to 57.67 q/ha when the developed formulation is applied along with recommended dose of fertilizer (RDF) in comparison to RDF only. Whereas in case of maize, grain yield increased by 15.76% from 42.33 q/ha to 49 q/ha when the developed formulation is applied along with recommended dose of fertilizer (RDF) in comparison to RDF only. SKAUST-J concluded that there was 16.50% and 15.50% increase in yield due to application of the developed formulation in paddy (Basmati-370) and maize (Double Dekalp) respectively in comparison to control. Further test trials are ongoing at SKUAST-K, Srinagar, IISR Lucknow and RARS, Anakapalle for efficacy of the developed formulation in other crops.

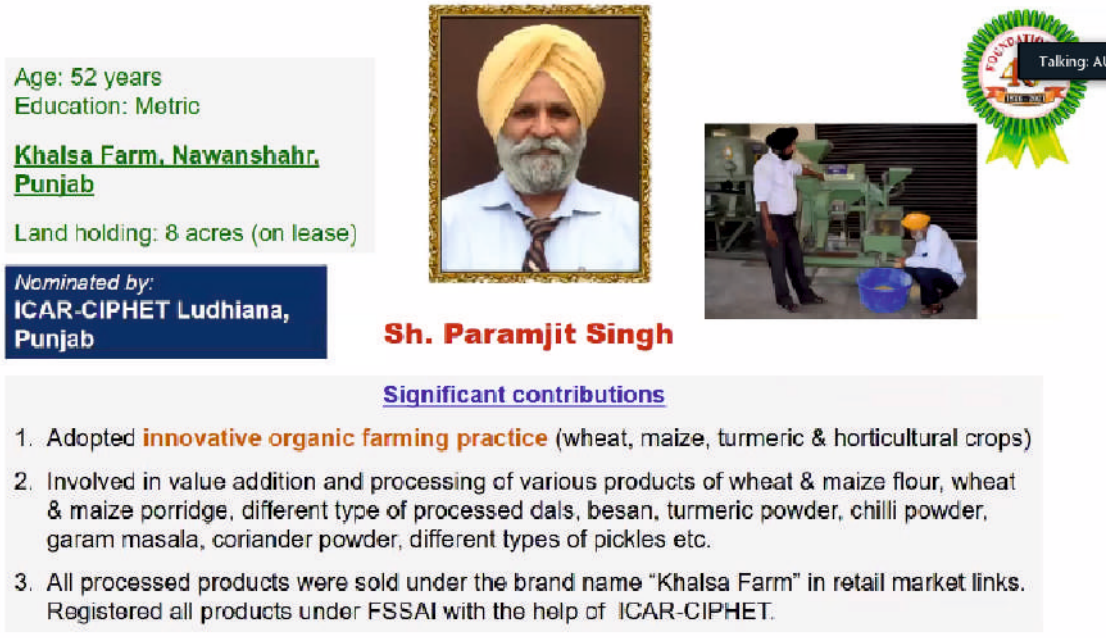
Awards & Recognition

S. No.	Name of Awardee	Name of Award
1.	Gaurav S. G. Guru P. N.	Second Prize for e-Poster entitled "Toxicological effects of spinosad against grubs and adults of red flour beetle; *Tribolium castaneum* (Herbst)" in the International virtual conference on 'Emerging Trends In Food Protectants and Infestation Control (ET-FPIC 2021)' organized by PSSG and CSIR-CFTRI, held during 24-25 February 2021 at Mysuru, Karnataka.
2.	Kalyani Sharma Sadanand Patel Shyam Narayan Jha Mridula D. Rajesh K. Vishwakarma	Best Poster Award for "Mechanized system for primary roasting of raw makhana seeds and roasting process" in XV Agricultural Science Congress & ASC Expo 2021 on 'Energy & Agriculture' organized by National Academy of Agricultural Sciences (NAAS) in collaboration with Banaras Hindu University, Varanasi held during 13-16 November 2021 at Varanasi, U.P.
3.	Mahesh Kumar Samota	Best Researcher Award in the "International Research Awards on New Science Inventions (NESIN-2021)" By 'Science Father (SF)' for the contribution and honorable achievement in innovative research on 3 July 2021.
4.	Manju Bala Swati Sethi Sanjula Sharma Mridula D. Gurpreet Kaur	Best Oral Presentation Award for paper entitled "Quantitative detection of maize flour adulteration in chickpea flour (Besan) using near infrared spectroscopy coupled with chemometrics" in the International Web Conference on 'Innovative and Current Advances in Agriculture and Allied Sciences (ICAAS-2021)' organized by Society for Scientific Development in Agriculture and Technology (SSDAT) held during 19-21 July 2021 at Meerut, U.P.

S.No.	Name of Awardee	Name of Award
5.	Poonam Choudhary	Best Oral Presentation Award for paper entitled "Optimization of starch isolation for mango seed kernel and its characterization" in the International Web Conference on 'Innovative and Current Advances in Agriculture and Allied Sciences (ICAAS-2021)' organized by Society for Scientific Development in Agriculture and Technology (SSDAT) held during 19-21 July 2021 at Meerut, U.P.
6.	Surya	Young Scientist Award (2021) in the International Web Conference on 'Innovative and Current Advances in Agriculture and Allied Sciences (ICAAS-2021)' organized by Society for Scientific Development in Agriculture and Technology (SSDAT) held during 19-21 July 2021 at Meerut, U.P.
7.	Swati Sethi Mridula D.	Best Oral Presentation Award for paper entitled "Integration of sprouting and flaking technologies for ready-to-eat green gram flakes" in '55th Annual Convention of Indian Society of Agricultural Engineers' organized by R.P.C.A.U, Pusa, Samastipur held during 23 -25 November 2021 at Patna, Bihar.

Innovative Farmer Award

Shri Paramjit Singh	Awarded with Innovative Farmer Award during ICAR-NAARM foundation day celebration in 1st September, 2021. He is the progressive farmer cum processor and working under the technical guidance of ICAR-CIPHET, Ludhiana since 2017 under Farmer FIRST Project led by Dr. Sandeep Mann, Dr. Rahul Kr. Anuraag, Dr. Renu Balakrishnan and Er. Yogesh Kalnar

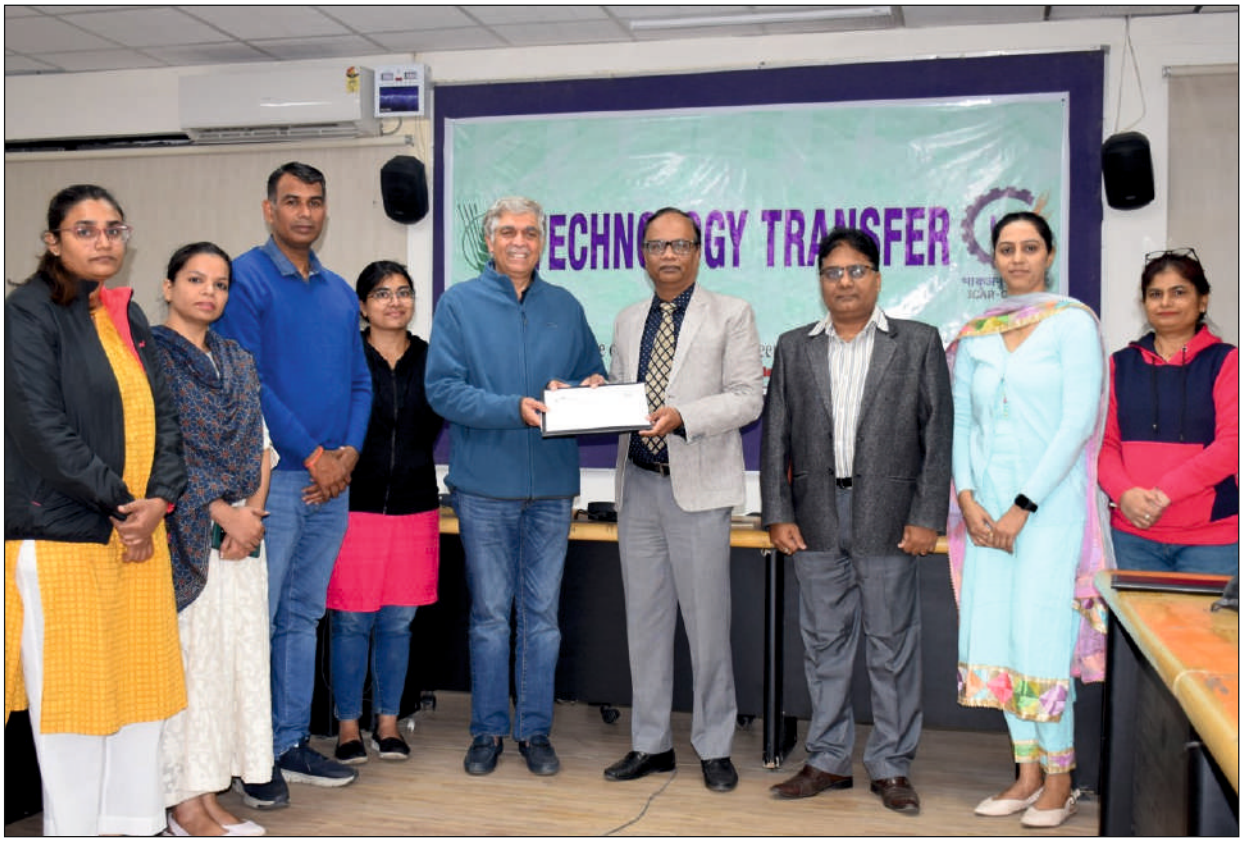


Technology Transfer

S.No.	Title	Firm	Licensing fee (Rs.)	Date of licensing
1.	Portable smart ultraviolet-C disinfection system" (UViC)	M/s GT Bio sciences Pvt Ltd., Plot No. 47/ 48, Prem Sai-IV, Shilpa Co-op. Housing Society, Nagpur	15000	30.03.2021
2.	Ozone based fruits and vegetable washer-cum-purifier (Ozo-C)	M/s GT Bio sciences Pvt Ltd., Plot No. 47/ 48, Prem Sai-IV, Shilpa Co-op. Housing Society, Nagpur	20000	30.03.2021
		M/s Ranjeetas Agrifoods Health and Hygiene Private Limited, LIG-5, Flat No-201, Debashram,SBI Colony At-Kesura, PO- Bankuala, PS-Sahid Nagar Bhubaneswar Khordha OR 751002	20000	12.5.2021
3.	Process for preparation of fat free flavoured makhana (Patent application no. - 201911036120)	Mr. Amit Kumar S/O Sanjay Kumar, Gram-Sidhauli, Post-Sidhauli, Singhauli, Darbhanga, Bihar-847101	25000	03.07.2021
		Mr. Ajit Singh Om Parkash Pvt. Ltd., 44/7, Ludhiana Road, Vill. Karyam, Nawanshahr – 144514, Punjab	25000	14.09.2021
		M/s Rikhi Ram Nand Lal, Main Haibowal Road, Ludhiana - 141001	25000	16.09.2021
4.	Ready to constitute makhana kheer mix (Patent no. - 287541)	Mr. Amit Kumar S/O Sanjay Kumar, Gram-Sidhauli, Post-Sidhauli, Singhauli, Darbhanga, Bihar-847101	50000	05.07.2021

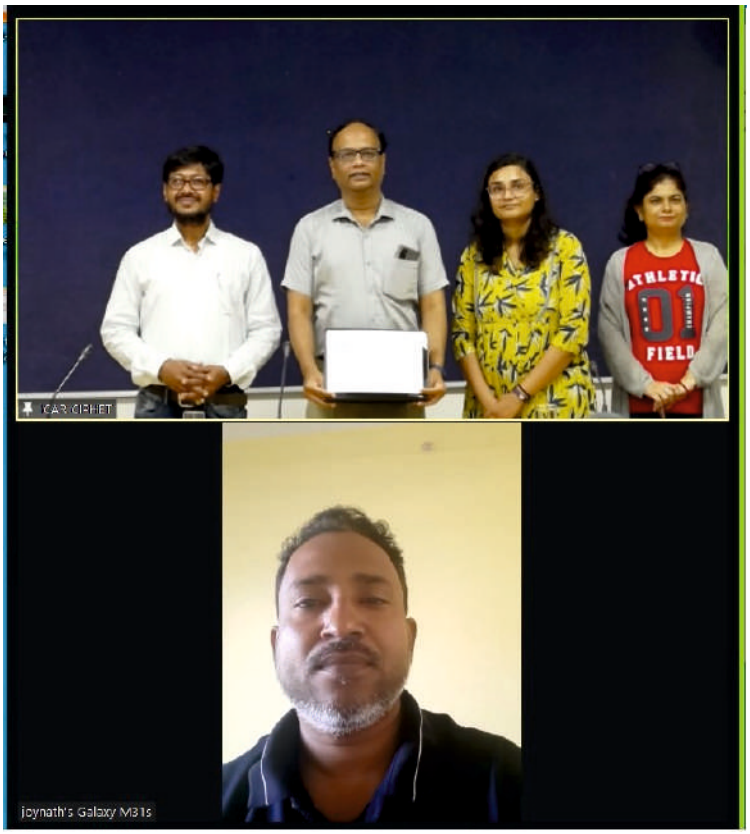
S.No.	Title	Firm	Licensing fee (Rs.)	Date of licensing
5.	Microbial method for production of protein isolate/concentrate from oilseed cakes/meals (Patent application no 201911012570)	Samyog Health Foods Pvt Ltd, B-604, Naman midtown Senapati Bapat marg Dadar West, Mumbai –400028, Maharashtra, India Tel.: +91 22 24372745 Mob.: +91 9820508003 Email: prakash@samyogfoods.com	300000	13.09.2021
6.	Live fish carrier system and method of transporting live fish therein	Mr. Indrajith MV, Mangalath Padath House, PO: Mayannur, Dist. Thrissur, Kerala – 679105	100000	04.10.2021
		M/s JJ FISH (Farakka), Vill-Khaira Kandi, PO- Beniagram. PS – Farakka, Dist. - Murshidabad (West Bengal) – 742212	100000	06.10.2021
7.	Process for preparation of nutritious multigrain chapatti flour	M/s Rikhi Ram Nand Lal, Main Haibowal Road, Ludhiana – 141001	11000	11.10.2021
8.	Groundnut based flavoured beverage, curd and paneer	Samyog Health Foods Pvt Ltd, B-604, Naman midtown Senapati Bapat marg Dadar West, Mumbai –400028, Maharashtra, India Tel.: +91 22 24372745 Mob.: +91 9820508003 Email: prakash@samyogfoods.com	15000	20.11.21

Licensing of "Process for preparation of nutritious multigrain chapatti flour"



Licensing of "Microbial method for production of protein isolate / concentrate from oilseed cakes/meals"

Licensing of "Microbial method for production of protein isolate / concentrate from oilseed cakes/meals"



Licensing of “Live fish carrier system and method of transporting live fish therein” to M/s JJ FISH (Farakka) on 06.10.2021 through virtual mode

Intellectual Properties

Patent filed

S. No.	Application No.	Title		Date of Filing	Inventors
National					
1	202111014289	Encapsulated curcumin in microcapsules for use as food ingredient		30.03.2021	Dr. K. Narsaiah
2	202111014302	Cool tower for production of microcapsules from high melting fats and waxes		30.03.2021	Dr. K. Narsaiah
International					
1	17/258088	Microbial method for production of protein isolate/concentrate from oilseed cakes/meals	USA	05.01.2021	Dr. D.N. Yadav Dr.Sangita Bansal Dr. R.K. Singh Dr. S.N. Jha

Patent granted

S. No.	Application/ Registration No.	Title	Date of grant	Patent No.	Inventors
1	201911032375	A method for detection of papaya seed powder adulteration in black pepper seed powder	13.12.2021	384183	Dr. Manju Bala Dr. Swati Sethi Dr. Surya Tushir Dr. Mridula Devi Dr. R.K. Gupta Dr. R.K. Singh
2	3172/DEL/2012	An ergonomically designed poultry processing table for the road side retailers	27.12.2021	385178	Dr. Tanbir Ahmed Dr. Nilesh Gaikwad Dr. Yogesh Kumar

Post-Harvest Machinery & Equipment Testing Centre

The Post-Harvest Machinery and Equipment Testing Centre (PHMETC), ICAR-CIPHET, Ludhiana has tested 33 machines during 1 January - 31 December 2021 earning a total testing fee of Rs. 31.44 lakh (Thirty One Lakh Forty Four Thousand).

S. No.	Name of Machine	Manufacturer
1	Pulverizer (Flour Mill- 5HP)	Lal Ji and Sons, Roorkee (Uttrakhand)
2	Pulverizer (Flour Mill- 3HP)	
3	Mini Rice Mill (Dehusker)	
4	Mini Rice Mill	S R Engineering and Services, Chandigarh (Punjab)
5	Flour Mill 1HP	Ramsons Impex, Saharanpur (Uttar Pradesh)
6	Flour Mill 5HP	
7	Flour Mill 3HP	
8	Ruber Roll Sheller cum Horizontal Polisher	Kisan Krishi Yantra Udyog, Kanpur (Uttar Pradesh)
9	Mini Rice Mill	Bansal Traders, Dehradun (Uttarakhand)
10	Oil Expeller/ Extractor	Idea Engineers, Channagiri (Karnataka)
11	Flour Mill / Pulverizer 10HP	
12	Flour Mill/ Pulverizer 3HP	
13	Mini Oil Expeller 2HP	
14	Mini Oil Expeller 1HP	
15	Pulverizer 2HP	
16	Pulverizer 1HP	
17	2-in-1 Pulverizer	E-Agro care Machineries and Equipments Pvt Ltd, Aurangabad (Maharashtra)
18	Domestic Flour Mill 1HP	
19	Chilli Pounding Machine	Bharat Heavy Machine, Kanpur (Uttar Pradesh)
20	Pulverizer (Flour Mill 2-in-1)	Dharti Industries, Rajkot (Gujrat)
21	Mini Dal Mill	Shri Balaji Foundry, Batala (Punjab)
22	Mini Rice Mill	
23	Flour Mill	
24	Mini Rice Mill	Kisan Machinery, Raipur (Chattisgarh)
25	Destoner	M.G. Industries, Batala (Punjab)
26	Gravity Separator	
27	Seed Cleaner cum Grader	
28	Indented Cylinder Grader	
29	Mini Dal Mill	
30	Gravity Separator	Agro Asian Industries, Ambala (Haryana)
31	Seed Grader	
32	Gravity Separator (4 t/h)	M/s Osaw Industrial Products Pvt. Ltd. Ambala (Haryana)
33	Air Screen Fine-Cleaner (4 t/h)	

HRD Programmes & Capacity Building

S.No.	Name	Title of HRD programme	Organizing Institute	No. of days
Scientific Staff				
1.	Dr. Nachiket Kotwaliwale	Right to Information Act for Appellate Authorities	ISTM, New Delhi	1
2.	Dr. R.K. Singh	MDP on Leadership Development	ICAR-NAARM, Hyderabad	12
3.	Dr. K. Narsaiah	Transforming Efficient Warehousing, Logistic Operation for uninterrupted Supply Chain	NPC, Jaipur	2
		MDP on Leadership Development	ICAR-NAARM, Hyderabad	12
4.	Dr. Mridula Devi	FSSAI (Labelling & Display Regulations) 2020	NPC under Ministry of Commerce & Industry, New Delhi	2
5.	Dr. Deep Narayan Yadav	NABL assessor's training programme (Level 1 and Level 2)	NABL House, Gurgaon (Haryana)	6
6.	Dr. Sandeep Mann	Transforming Efficient Warehousing, Logistic Operation for uninterrupted supply chain	NPC, Jaipur	2
		Creating Programming of Web & Mobile Applications using Low-code Platforms	ICAR-NAARM, Hyderabad	5
		Response Surface Methodology	-do-	3
7.	Dr. Armaan Ullah Muzaddadi	Response Surface Methodology	ICAR-NAARM, Hyderabad	3
8.	Dr. Ramesh Chand Kasana	Online MDP on Leadership Development	ICAR-NAARM, Hyderabad	12
		Training Workshop for Vigilance Officers of ICAR Institutes	ICAR-NAARM, Hyderabad	3
		Preventive Vigilance (PV 05)	ISTM, New Delhi	1

S.No.	Name	Title of HRD programme	Organizing Institute	No. of days
9.	Dr. Rahul Anurag	Importance of participation in PT/ILC for Quality Assurance in Testing	NIPHM, Hyderabad	1
		Documentation procedure for NABL accreditation for PTLs & PRLs	NIPHM, Hyderabad	2
		NABL assessor's training programme (Level- 1 & Level- 2)	NABL House, Gurgaon (Haryana)	6
10.	Dr. Deepika Goswami	Response Surface Methodology	ICAR-NAARM, Hyderabad	3
11.	Mrs. Leena Kumari	Internet of Things (IOT)	ESCI, Hyderabad	5
12.	Mrs. Surya	Response Surface Methodology	ICAR-NAARM, Hyderabad	3
13.	Er. Akhoon Asrar Bashir	IoT for Smart Agriculture	SKUAST-Kashmir & Innovanians Technologies Pvt. Ltd.	14
		A generic online training course in Cyber Security	Cyber Security Division	1
14.	Mr. Vikas Kumar	Microbiological Risk Assessment in Food Safety	Nitte University, India and Unversity of Maryland, USA	5
		Sustainable Fishing 14: a webinar on Entrepreneurship Development in Fisheries Sector, Showcasing Opportunities, Challenges and Best Practices for starts-ups	ICAR-NIVEDI, Bengaluru	1
		Protein Structure Modelling and Dynamics	ICAR-IASRI, New Delhi.	3
15.	Dr. Khwairakpam Bembem	Response Surface Methodology	ICAR-NAARM, Hyderabad	3

S.No.	Name	Title of HRD programme	Organizing Institute	No. of days
16.	Dr. Renu Balakrishnan	Market Research & Value Chain Management of Agricultural Commodities	ICAR-NAARM, Hyderabad	5
		Impact Assessment of Agricultural Research and Technologies		5
17.	Er. Kalnar Yogesh	Transforming Efficient Warehousing, Logistic Operation for uninterrupted Supply Chain	NPC, Jaipur	2
		Artificial Intelligence: Principle & Techniques	ASCI, Hyderabad, California, Los Angles & IGESIA	1
18.	Dr. Pankaj Kumar	Ergonomical Design Guidelines for Agricultural Tools & Equipments	ICAR-CIAE, Bhopal	5
19.	Dr. Poonam	Documentation procedure for NABL accreditation for PTLs & PRLs	NIPHM, Hyderabad	2
20.	Dr. Dawange Sandeep Popatrao	Time Series Data Analysis	ICAR-NAARM, Hyderabad	6
		Creating Programming of Web & Mobile Applications using Low-code Platforms		5
21.	Dr. Th. Bidyalakshmi Devi	Right to Information Act	ICAR-NAARM, Hyderabad	2
		Multidisciplinary Applications of MATLAB	Department f Electronics & Communication Engineering, Universal Engineering College, Vallivattom, Thrissur (Kerala)	3
		Rice Straw Management	IRRI South Asia Regional Centre (ISARC), Varanasi	3

S.No.	Name	Title of HRD programme	Organizing Institute	No. of days
22.	Dr. Bhupindra M. Ghodki	A generic online training course in Cyber Security	Cyber Security Division	1
		Transforming Efficient Warehousing, Logistic Operation for uninterrupted Supply Chain	NPC, Jaipur	2
23.	Er.Shaghaf Kaukab	Big Data Management & Comprehensive Analysis	C-DAC, Mohali	5
		Internet of Things (IoT)	ESCI, Hyderabad	5
		Big Data Analytics in Government (Basic)	ISTM, New Delhi	3
24.	Er. Thongam Sunita Devi	Big Data Management & Comprehensive Analysis	C-DAC, Mohali	5
		Internet of Things (IoT)	ESCI, Hyderabad	5
		Big Data Analytics in Government (Basic)	ISTM, New Delhi	3
Technical Staff				
1.	Dr. Vinod Saharan	E-Governance Application in ICAR for Technical Staff	ICAR-IASRI, New Delhi	5
2.	Dr. Mukund Narayan	Time Series Data Analysis	ICAR-NAARM, Hyderabad	6
3.	Sh. Vishal Kumar	E-Governance Application in ICAR for Technical Staff	ICAR-IASRI, New Delhi	5
4.	Dr. Rupinder Kumar	Motivation, Positive Thinking and Communication Skills	ICAR-NAARM, Hyderabad	6
5.	Sh. Prithvi Raj	Repair and Maintenance of office Residential Building including Guest Houses	ICAR-CIAE, Bhopal	3
6.	Sh. Rajesh Kumar	Pest Surveillance	NIPHM, Hyderabad	5
7.	Mrs. Pragya Singh	E-Governance Application in ICAR for Technical Staff	ICAR-IASRI, New Delhi	5

S.No.	Name	Title of HRD programme	Organizing Institute	No. of days
Administrative Staff				
1.	Sh. Manni Lal	Budget Utilization Procedure	ICAR-NAARM, Hyderabad	3
		Accrual Accounting (Third Batch)	ICAR-NRRI, Cuttack	5
2.	Sh. Kunwar Singh	Reservation in services	ISTM, New Delhi	4
		Emotional Intelligence		3
3.	Sh. Avtar Singh	Budget Utilization Procedure	ICAR-NAARM, Hyderabad	3
		Implications of new labour codes, 2020 for ICAR		
		Accrual Accounting for Administrative and Finance staff dealing with Accrual Accounting in ICAR Institutes and HQs	ICAR-NRRI, Cuttack	5
4.	Sh. Tarsem Singh Purba	Reservation in services	ISTM, New Delhi	4
5.	Smt. Jasvir Kaur	Public procurement for central govt. officers	AJNIFM, Faridabad	6
6.	Sh. Ashwani Kumar	Public procurement for central govt. officers	AJNIFM, Faridabad	6
7.	Sh. Rajinder Kumar Raheja	Accrual Accounting for Administrative and Finance staff dealing with Accrual Accounting in ICAR Institutes and HQs	ICAR-NRRI, Cuttack	5

Entrepreneurship Development Programme (EDP)

S. No.	Programme Title	Number of Participants	Duration
1.	Groundnut milk and its products	2	17-18 March 2021
2.	Baking technology for entrepreneurship development	19	18-19 March 2021
3.	Fish processing and value addition	7	14-16 June 2021
4.	Groundnut/soy based flavored beverage, curd and paneer	3	12-14 July 2021
5.	Processing and value addition of mango	4	19-22 July 2021
6.	Handling and storage of fruits and vegetables for distant marketing	3	03-05 August 2021
7.	Poly lined ponds for water harvesting and irrigation in semi -arid areas	21	28 August 2021
8.	Gluten free baked products from coarse cereals and millets	3	2-4 September 2021
9.	Post-harvest handling of mushroom and protected cultivation of high value winter vegetables for doubling farmer's income	3	7-9 September 2021
10.	Fish processing and value addition	1	14-16 September 2021
11.	Processing of groundnut/ soybean for milk, curd and paneer like products	2	04-08 October 2021
12.	Vegetable processing for rural women	36	16-18 November 2021
13.	Poultry and backyard fishery	18	23-24, November 2021
14.	Economic empowerment of farmers and entrepreneurs through value addition	1	25-27 November 2021
15.	Pest and disease management of fruit crops	32	08 December 2021
16.	Packaging of fresh, minimally processed fruits, vegetables and processed products	1	7-9 December 2021
EDP under CRP on SA			
1.	Value addition of millets	50	26 March 2021
2.	Makhana processing	1	3-5 July 2021
3.	Preparation of makhana kheer mix	1	5-7 July 2021
4.	Roasting of peanuts using makhana primary roasting machine	2	13-14 July 2021
5.	Roasting of dry fruits and seeds (almond, cashew, pumpkin seed, melon seed, etc.)	4	14-24 September 2021
6.	Pulse processing	34	28 September 2021
7.	Fruits, vegetables and millet processing	38	29 September 2021

Incubation of makhana pilot plant to Mr. Gurdeep Singh

EDP on gluten free baked products from coarse cereals and millets

Farmer's Training

S. No.	Programme Title	Number of Participants	Duration
1.	Balanced use of fertilizers	32	18 June 2021
2.	Management of foot and mouth disease (FMD) in cattle	32	30 June 2021
3.	Production and cultivation of mushroom	20	06 July 2021
4.	Integrated nutrient management of kharif Crops	46	23 July 2021
5.	Insect pest and disease management of kharif	60	30 July 2021
6.	Carrot grass *(Parthenium hysterophorus)*	15	22 August 2021
7.	Diseases of kharif crops	21	9 September 2021
8.	Post-harvest technology for agricultural produce	22	20-24 September 2021
9.	Cultivation techniques for rabi crops	20	22 October 2021
10.	Protected cultivation of vegetable crops & drip irrigation	36	29 October 2021
ATMA Sponsored			
1.	Nutri-cereals and maize based baked products	10	24-25 February 2021
2.	Packaging of coarse food grains especially millets and its processed products	36	7-9 March 2021
3.	Post-harvest technology for agricultural produ	30	20-24 September 2021

ATMA sponsored Farmer's training at ICAR-CIPHET, Ldh

SCSP Training

S. No.	Programme Title	Number of Participants	Duration
1.	Construction of low-cost polyhouse and shade net house structures for vegetables and nursery production	12	04-06 January 2021
2.	Post-harvest handling and processing of freshwater fish	50	02-04 February 2021
3.	Entrepreneurship development on fish drying and pickle making techniques	50	10-12 February 2021
4.	Processing and value addition of underutilized fruits of Manipur	50	15-17 March 2021
5.	Fish processing and value addition	50	16-18 March 2021
6.	Processing and value addition in millets and pulses	50	18-21 March 2021
7.	Post-harvest management of onions and grapes	50	11-13 October 2021
8.	Post-harvest handling of freshwater fish	50	26-28 November 2021
PMFME Scheme			
1.	Training of Master Trainers (ToMT) on Fat and Oilseed Products Processing	06	29 June - 03 July 2021
2.	Training of Master Trainers (ToMT) on Fat and Oilseed Products Processing	23	01-06 January 2021

SC Partcipants undergoing SCSP skill development training at CoF, Kishanganj (Bihar)

Student's Training

S. No.	University	Number of Participants	Duration
1.	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth-Dapoli, IGKV-Raipur, MPUAT- Udaipur	131	10 June -9 July, 2021
2.	SKAUST-Kashmir	25	17 November-16
3.	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth-Dapoli	02	December 2021
4.	Fish by-product utilization and low cost drying; GADVASU, Ludhiana	20	05-20 October 2021

Students visiting APC in ICAR-CIPHET, Ludhiana

Students from GADVASU, Ludhiana visitng ICAR-CIPHET

Agro Business Incubation Centre (ABI)

S.No.	Programme Title	Number of Participants	Duration
1.	Training on groundnut processing	02	17-18 March 2021
2.	Training on makhana processing	01	18 March 2021
3.	Sensitization program on agribusiness entrepreneurship development through agro processing	20	19 March 2021
4.	Sensitization program on agribusiness entrepreneurship development through agro processing	26	20 March 2021

Incubation provided: 03

S.No.	Title	Contracting party	Duration
1.	Processing of Jamun pulp	M/s Unitech Technocrats Kala Amb, H.P.	March 2021- till date
2.	Groundnut processing	Mr. Narinder Singh, Ludhiana	September 2021- till date
3.	Makhana processing	Mr. Gurdeep Singh, Rupnagar	October 2021- till date

Training on "Groundnut processing" to Mr. Jaswant Singh and Mr. Narinder Singh

Sensitization Program on Agribusiness Entrepreneurship Development through Agro Processing at Ayali Khurd Ludhiana on 20.03.2021

Krishi Vigyan Kendra (KVK), Activities

Trainings under KVK

S.No.	Program Title	Number of Participants	Duration
Vocational Training			
1.	Protected cultivation of vegetables	36	29 October 2021
2.	Integrated nutrient management	19	12 November 2021
3.	Vegetable processing	26	06-08 October 2021
4.	Beekeeping	52	13-15 January 2021
5.	Fruit processing	36	16-18 November 2021
On-Campus Training			
6.	Organic farming	14	30 January 2021
7.	Fruit orchards	40	12 February 2021
8.	Rabi crops	20	22 October 2021
9.	Drip irrigation	36	29 October 2021
10.	Protected cultivation of vegetable		
Off-Campus Training			
11.	Fruit processing	26	27 March 2021
12.	Backyard poultry and fishery	50	23-24 November 2021
Online Webinars			
13.	Beekeeping	40	20 May 2021
14.	Drip irrigation and fertigation	43	07 June 2021
15.	Cultural practices for production of kharif crops	24	11 June 2021
16.	Awareness campaign on balanced use of fertilizers	32	18 June 2021
17.	Management of foot and mouth disease (FMD) in cattle	32	30 June 2021
18.	Production and cultivation of mushroom	20	06 July 2021
19.	Integrated nutrient management of kharif crops	46	23 July 2021
20.	Training of insect pest and disease management of kharif crops	60	30 July 2021
21.	Poly lined ponds for water harvesting and irrigation in semi-arid areas	26	28 August 2021
22.	Diseases of kharif crops	21	9 September 2021
23.	Marketing and packaging of processing products for entrepreneurs	29	15 September 2021

S.No.	Program Title	Number of Participants	Duration
1.	Locust control for state agriculture extension functionary	22	16 September 2021
2.	Integrated pest management in kharif crops for state agriculture extension functionary	21	20 September, 2021
3.	Integrated nutrition management technology in rabi crops	19	12 November 2021
Crop Residue Managemet (CRM) Activities			
Awareness Programmes			
4.	*In situ* crop residue management at Raipura village of Abohar	45	31 August 2021
5.	*In situ* crop residue management at Malookpura	53	1 September 2021
6.	*In situ* crop residue management at Krishi Vigyan Kendra, ICAR-CIPHET, Abohar	47	23 September 2021
7.	An awareness program was organized by Krishi Vigyan Kendra Abohar on Paddy stubble management techniques at Government High Smart School, Malookpura	200	September 2021
8.	Field Days under CRM at Dhani Chirag, Dhani Kamamian and Awa Village	50	22-24 March 2021
Farmer's Visit			
9.	Farmers visit ICAR-CIPHET, Abohar	10	18 March 2021
Student's Visit			
10.	B.Sc Agriculture students from Adesh Institute of Higher Education, Faridkot, ICAR-CIPHET, Abohar	14	19 March 2021
11.	B. Sc Agriculture students from Ferozeshah College Ferozepur, visited ICAR-CIPHET, Abohar	20	25 February 2021

A participant receiving certificate at KVK, Abohar


कृषि विज्ञान केन्द्र [सीफेट] अबोहर


कृषि प्रसंस्करण केन्द्र
AGRO PROCESSING CENTRE
ICAR-Central Institute of Post-Harvest Engineering & Technology, Ludhiana-141004
Krishi Vigyan Kendra
Handiaya (Barnala)
Vocational Training
On
Processing of Agricultural Produce
Venue: KVK Handiaya
Date: 6-10-2021 to 13-10-2021
Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana (Pb.)

Events Organized

S. No.	Event	Date
1.	Republic Day Celebration	26 January 2021
2.	Science Day	28 February 2021
3.	International Women's Day Celebration	08 March 2021
4.	International Yoga Day Celebration	21 June 2021
5.	ICAR Foundation Day - Har Med Par Ped	16 July 2021
6.	Independence Day Celebration	15 August 2021
7.	हिंदी पखवाड़ा	14-28 September 2021
8.	Poshan Maah	17 September 2021
9.	Mahila Kisan Diwas	15 October 2021
10.	World Food Day	16 October 2021
11.	Vigilance Awareness Week	27 October - 02 November 2021
12.	Rashtriya Ekta Diwas	31 October 2021
13.	Indian Constitution Day	26 November 2021
14.	World Soil Health Day	05 December 2021
15.	PM address on Natural Farming	23 December 2021
16.	Kisan Diwas	23 December 2021
17.	Swachhta Pakhwada	16-31 December 2021

Republic Day Celebration

ICAR-CIPHET celebrated 72nd Republic Day to honour the date on which the Constitution of India came into effect. On this occasion Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET, hoisted the tricolour and addressed the staff of the institute. Different cultural and sports activities were organized for staff and their family members after the flag hoisting ceremony.

International Women's Day Celebration

ICAR-CIPHET celebrated International Women's Day (IWD) on 8th March 2021. This year theme of ICAR was "Women Leadership in Agricultural: Entrepreneurship, Equity & Empowerment (3 E's)". To commemorate the occasion and celebrate the theme, five successful women entrepreneurs, who were trained by the Institute, were honoured. Three women entrepreneurs' *viz.* Mrs. Anita Goyal, M/s Zaika, Jagraon; Mrs. Sarabjeet Kaur, M/s Gill Farms, Jalandhar and Ms. Shruti Goyal, M/s. Swadam Labh, Jagraon joined the programme at ICAR-CIPHET, Ludhiana while Mrs. Renu Mishra M/s Siya Ram Food Industries, Noida joined through online mode. Mrs. Snehal Dudue of Yavatmal, Maharashtra could not join due to technical issues. They shared their success stories and underlined active role of ICAR-CIPHET in technical as well as confidence building. Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET, Ludhiana congratulated all the women workforce engaged in technology development, dissemination and commercial exploitation.

International Yoga Day Celebration

ICAR-CIPHET, Ludhiana along with ICAR-CIAE, Bhopal successfully celebrated 7th annual International Day of Yoga on 21st June, 2021 through video conferencing. There were 122 participants participated during the programme from both the institutes (CIPHET, Ludhiana & Abohar, CIAE, Bhopal & Coimbatore). Dr. Debabandya Mohapatra, Principal Scientist, ICAR-CIAE coordinated the programme. This year's programme was themed at "Yoga for well-being". The programme started at 7.00 AM with introduction of Yog Guru, Shri. Sanjay Gurvekar followed by Pranayam as guided by Yog Guru. After pranayama, a lecture was delivered by Dr. Anju Soni, Physician. Earlier Dr. C.R. Mehta, Director, ICAR-CIAE, Bhopal, briefed about the importance of Yoga and urged to Yog Guru to suggest Yoga Asanaas for daily routine. Sh. Anil Handa delivered the vote of thanks, which was followed by the concluding remarks by Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET, Ludhiana, who urged the participants to practice basic yoga kriyas such as Pranayam, Sukshma Vyayam, and Asanas. He advised to form groups to ensure regularity and discipline.

ICAR's Foundation Day Celebration with theme 'Har Med Par Ped'

ICAR-CIPHET, Ludhiana celebrated ICAR's Foundation Day with theme 'Har Med Par Ped' and organized an 'on-farm boundary plantation in Punjab' for contributing to ICAR's mission to plant 1 crore saplings and thereby making India Green. Nine teams of Mera Gaon Mera Gaurav including 35 scientists and technical officers visited different villages to plant sapling of 3-varieties of Phycus, Ponocarpus and Neem on ICAR Foundation Day (16.07.2021) and to sensitize the people in and around to help the nation turn green by

joining the national campaign on plantation and awareness program. The plantation campaign was started from the institute followed by relaying green flag to MGMG teams visiting different villages. In this regard an online session on 'On-farm boundary plantation for Agro Ecological conditions of Punjab' was also conducted which was delivered by Dr. Rishi Indra Singh Gill, Pr. Scientist, PAU. It received 150 participants.

Plantation done by ICAR-CIPHET, Ludhiana

Independence Day Celebration

The Institute celebrated 75th Independence Day at both campuses on 15th August 2021. Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET unfurled the Tricolour in Ludhiana campus and addressed the staff on the occasion. He highlighted the achievements of the Institute during this year and stressed upon the importance of post-harvest management along with maintaining health and hygiene.

Poshan Maah

KVK, ICAR-CIPHET, Abohar organized One day Nation Campaign on "Poshan Abhiyan" and "Tree Plantation" on 17th September, 2021 in collaboration with IFFCO and Agriculture Department, Abohar. 75 Farmers from different villages participated in this program .

Mahila Kisan Diwas

KVK, ICAR-CIPHET, Abohar organised Mahila Kisan Diwas on 15th October 2021 in the Balluana village. The programme was attended by 45 women who were provided information about the advanced agricultural machinery/ instruments used in honey bee production, mushroom production, animal husbandry and dairy production. The procedure for obtaining loan from bank for starting own business was also discussed. The women were also acquainted with process of compost making and developing poshan vatika.

Vigilance Awareness Week

ICAR-CIPHET, Ludhiana and Abohar Campus observed the vigilance awareness week and organized different activities during 26th October- 2nd November 2021. The week started with the pledge taking ceremony by Dr. Nachiket Kotwaliwale, Director, Sr. Administrative Officer, Finance & Accounts Officer, all the Scientific, Technical and Administrative staff of the Institute. A virtual workshop on 'Independent India@75:Self-reliance with Integrity' was organized. The chief guest and invited speaker for the workshop, Mr. G.P. Sharma, Director (Finance), ICAR delivered his speech and shared his views on Vigilance structure in India. Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET expressed his views on

'Independent India@75:Self-reliance with Integrity' and emphasized to work with highest level of honesty, integrity and dedication for the growth of the Institute and benefit of the stakeholders. About 41 participants attended this virtual programme.

Swachh Bharat Abhiyan (SBA) Activities

While engaging in physical activities, the standard norms of guidelines concerning COVID-19 (wearing a mask/ maintaining Physical distance/ avoiding physical contact etc.) circulated by the Government of India /ICAR have been strictly followed. The “Swachchhta Pakhwada” was celebrated with highest spirit from 16-31 December 2021. All staff of ICAR-CIPHET, Ludhiana and Abohar actively participated in the events. The “Swachhata Pakhwada" was started by taking the swachchhata pledge through video conferencing on 16 December 2021. Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET, Ludhiana delivered a speech regarding the importance of swachhta in daily life and the participation of each individual in the Pakhwada. The activities such as cleanliness drive, awareness program, digitization of office records, disposal of old files and items, beautification of the institute campus and displaying banners showing the importance of swachhta have been conducted during the year. Various types of activities and cleanliness awareness programmes were conducted in campus and nearby areas during this

Pakhwada. Among these activities, one activity was organized as Kisan Diwas on 23 December 2021 through online mode. Different farmers participated and a few of them shared their experiences in village cleanliness maintenance and they also appreciated the role of ICAR-CIPHET for post-harvest management. This programme was attended by nearly 100 farmers from across the country.

KVK, ICAR-CIPHET, Abohar also organized “Waste to Wealth” Swachata Campaign on 12th October, 2021 at Malukpura Village. 50 school children's, 25 farmers and 2 dignitaries (Principal of Gov. High Smart School and Sarpanch) were participated in this programme.

CIPHET-IIFA 2021

ICAR-Central Institute of Post-Harvest Engineering and Technology, Ludhiana has celebrated its 33rd foundation day on 3rd October, 2021. To commemorate the occasion and also to celebrate 75 years of Indian Independence, the Institute organized ICAR-CIPHET and Industry Interface Fair on Agro processing – 2021 (CIPHET-IIFA 2021) during 3-4, October, 2021. The event was inaugurated virtually by Dr. Suresh Kumar Chaudhari, DDG (NRM & Engg.), ICAR on 3rd October, 2021 at 10.00 am. He highlighted that ICAR-CIPHET has a very vital role to play in increasing farmers' income. The technologies developed by the institute which includes machineries, equipment, process protocols and value added products can boost the income through processing and reducing post-harvest losses. All the former Directors of ICAR-CIPHET along with Dr. K K Singh ADG (Engg.) and Dr. S N Jha ADG (PE) were present during the inauguration and expressed their views about the institute and ways forward. A technology compendium and six technical bulletins were also released during the occasion. In the virtual fair different technologies (machines, process protocols etc.) were showcased in interesting way and panel discussions on different themes. The virtual exhibition and interaction sessions were throughout the days on 3rd and 4th October, 2021. Various sessions and virtual exhibition were attended by 3695 participants during the CIPHET-IIFA 2021.

Other webinars/meetings

Demonstration-cum-interaction meet

ICAR-CIPHET organized a demonstration-cum-interaction meet with the scientists of KVKs under GADVASU, Ludhiana on Post-Harvest Technologies on 13 Janauary, 2021. Eighteen scientists of KVKs participated in interaction meet. Dr. Inderjeet Singh, Vice Chancellor, GADVASU, Dr. Rajbir Singh, Director ATARI, Zone-I and Dr. Parkash Singh Brar, Director of Extension Education, GADVASU were also present during the demonstration and interaction meeting.

Prime minister's address & farmer scientist interface meeting

ICAR-Central Institute of Post-Harvest Engineering and Technology, Ludhiana organised web-casting of PM's address on Natural Farming to Farmers and Farmer Scientist Interface Meeting on 16 December, 2021. The event was attended by 182 participants including farmers, students and staffs of the institute.

Brainstorming session

A brainstorming session was organized on 23 June, 2021 through virtual mode for deliberating the course of action of the project "Capacity building of agricultural extension professionals to promote agro-processing". Dr. K. Alagusundaram, DDG (Agril. Engg.), ICAR, New Delhi and Dr. A.K. Singh, DDG (Agril. Extension), ICAR, New Delhi chaired the session. Dr. S.N. Jha, ADG (PE); Dr. Randhir Singh ADG (Agril. Extn); Dr. Rajbir Singh, Director ICAR-ATARI Zone- I, Ludhiana; Dr. S.K. Singh, Director ICAR- ATARI Zone- II, Jhodpur; Dr. Atar Singh, Director ICAR- ATARI Zone- III, Kanpur; Dr J.V. Prasad, Director ICAR-ATARI Zone- X, Hyderabad were the invited members of the session. Dr Nachiket Kotwaliwale Director, ICAR-CIPHET, Dr Sandeep Mann, OIC, PME and Dr Renu Balakrishnan, Dr. D.N. Yadav, Dr. K. Bembem and Mr. Vikas Kumar also attended the session.

Site implementation group meet on "Kisan Diwas" on 23.12.2021.

ICAR-CIPHET organized site plan implementation group meeting to commemorate 'Kisan Diwas' on 23.12.2021 under Farmer FIRST Program (FFP). At its established chemical free jaggery processing unit in Uppal Farm, Rahon and Agro Processing Centre (Khalsa Farm) at Balachaur, SBS Nagar, Punjab farmers were given live demonstrations of the established processing units (chemical free jaggery unit and agro-processing centre). Dr. Rajbir Singh, Director, ICAR-ATARI, Ludhiana; Dr. Amandeep Singh Brar, Deputy Director, KVK, SBS Nagar; Dr. Rajesh, HDO; Dr. Kamaldeep Singh Sanga, Director, ATMA; Dr. Jaswinder, ADO; Dr. Rajkumar, AEO; Dr. Pritpal Singh, Dr. Rahul Kumar Anurag, Dr. Renu Balakrishnan, Er. Yogesh Kalnar and team members were the facilitators. Dr. Nachiket Kotwaliwale highlighted the post-harvest loss of agricultural produce and sensitized farmers for agro-processing, value addition, custom hiring of APC facilities available at CIPHET at nominal rate and appealed farmers to participate in reducing huge post-harvest loss and increase their income by utilizing government resources. Dr. Rajbir Singh briefed about the benefits of agro-processing and justified the need to adopt such practices at field level.

Meeting at agro-processing centre (M/s Khalsa Farm, Balachour, SBS Nagar)

हिंदी पखवाड़ा /कार्यशाला

राजभाषा हिंदी पखवाड़ा

प्रत्येक वर्ष की भांति, संस्थान में इस वर्ष दिनांक 14 से 28 सितम्बर 2021 तक राजभाषा हिंदी पखवाड़ा मनाया गया। समारोह का उद्घाटन दिनांक 14 सितम्बर 2021 को डॉ. नचिकेत कोतवालीवाले, माननीय निदेशक, भा.कृ.अनु.प. -सीफेट, लुधियाना के कर कमलों द्वारा किया गया। इस अवसर पर वैज्ञानिक एवं स्टाफ सदस्यों को सम्बोधित करते हुए उन्होंने हिंदी के प्रचार-प्रसार के लिए दिनचर्या में सरल शब्दों के प्रयोग पर जोर दिया। मुख्य अतिथि ने भा.कृ.अनु.प.-सीफेट, लुधियाना में वैज्ञानिक एवं प्रशासनिक कार्यों में हो रहे हिंदी के उपयोग की सराहना की एवं प्रतियोगिताओं में बढ़-चढ़ कर भाग लेने का आहवान किया। राजभाषा हिंदी पखवाड़ा के अध्यक्ष डॉ. आर.के. सिंह ने अपने संबोधन में बताया कि हिंदी पखवाड़ा को त्यौहार के रूप में मनाने से हिंदी सशक्त एवं सामर्थ्यवान होगी और उन्होने संस्थान के समस्त वैज्ञानिकों से अनुरोध किया कि वे अपने शोध-पत्रों को हिंदी भाषा में प्रकाशित करने पर जोर दें। इस अवसर पर संस्थान की हिंदी पखवाड़ा समिति के सदस्य सचिव श्री कुंवर सिंह ने पखवाड़ा के दौरान 15 दिनों तक चलने वाली विभिन्न प्रतियोगिताओं एवं कार्यक्रमों की रूपरेखा बताई। राजभाषा हिन्दी पखवाड़ा समिति-2021 के सदस्य श्री विकास कुमार, श्री मन्नी लाल, डॉ पूनम, सुश्री थोंगम सुनीता देवी, डॉ प्रेरणानाथ और डॉ विनोद कुमार सहारण का कार्यक्रम के आयोजन में महत्वपूर्ण योगदान रहा। राजभाषा हिंदी पखवाड़ा के दौरान विभिन्न संयोजकों एवं सह-संयोजकों के सहयोग से दोनों परिसरों को मिलाकर कुल 16 प्रतियोगिताएं करवाई गई, जिनमें 4 प्रतियोगिताएं भाकृअनुप-सीफेट, लुधियाना एवं अबोहर में संयुक्त रूप से करवाई गई, जैसे हिंदी टिप्पण एवं प्रारूप लेखन, प्रार्थना पत्र, कंप्यूटर पर हिंदी में टाइपिंग, हिंदी निबंध, हिंदी काव्य पाठ, विज्ञान संबंधी शोध पत्र, पोस्टर, हिंदी अनुवाद प्रतियोगिता आयोजित की गई। राजभाषा हिंदी पखवाड़ा के अन्तर्गत आयोजित सभी प्रतियोगिताओं में संस्थान के सभी अधिकारियों एवं कर्मचारियों ने बढ़-चढ़कर हिस्सा लिया। दिनांक 28 सितम्बर 2021 को डॉ. नचिकेत कोतवालीवाले, सीफेट, लुधियाना द्वारा प्रतियोगिताओं के विजेताओं को पुरस्कार प्रदान किये गये। इसके अतिरिक्त संस्थान में हिंदी में किये गये कार्यों का मूल्यांकन कर संस्थान के कर्मचारियों को भी पुरस्कृत किया गया एवं अधिक से अधिक हिंदी में कार्य करने के लिए सभी को प्रोत्साहित किया गया। श्री विकास कुमार, प्रभारी राजभाषा प्रकोष्ठ एवं सदस्य सचिव राजभाषा कार्यान्वयन समिति ने भी सभी से हिंदी में अधिकाधिक कार्य करने की अपील की।

हिंदी पखवाड़ा के दौरान संस्थान के अधिकारी पुरस्कार प्राप्त करते हुए

Azadi Ka Amrit Mahotsav

Azadi Ka Amrit Mahotsav is an initiative of the Government of India to celebrate and commemorate 75 years of progressive India and the glorious history of its people, culture and achievements. The official journey of "Azadi ka Amrit Mahotsav" commenced on 12th March, 2021 which started a 75 week count down to our 75th anniversary of Independence and will end post a year on 15th August, 2023. In commemoration of this theme, ICAR-Central Institute of Post-Harvest Engineering & Technology, Ludhiana commenced various programmes, webinars, webinar series, orientation programme, EDPs etc. Some of the highlights are:

'National Webinar Series on ICAR-CIPHET Post-Harvest Technologies'

S No.	Webinar Topic	Speaker	Date	No. of participants
1.	Utilization and value addition to mustard processing by-products	Dr. S. K. Tyagi Project Coordinator, AICRP-PHET	27 August, 2021	200
2.	A sustainable option for agricultural crop residues management through mushroom production	Dr. RC Kasana, Principal Scientist Dr. Rahul Kumar Anurag Scientist, AS&EC Division	31 August, 2021	120
3.	Makhana production and its mechanized processing	Dr. R. K. Vishwakarma Principal Scientist, FGOP Division	28 September, 2021	170
4.	Protected agriculture - the next generation agriculture	Dr. R. K. Singh Project Coordinator, AICRP-PEASEM	26 October, 2021	80
5.	Plant based dairy analogues: a healthy choice	Dr. D. N. Yadav Head, TOT Division	29 November, 2021	85
6.	Entrepreneurship through mechanized wadi making	Dr. Sandeep Mann Principal Scientist, TOT Division	23 December, 2021	60

'Expertopedia' on ICAR-CIPHET Post-Harvest Technologies'

S. No.	Webinar Topic	Speaker	Date	No. of participants
1.	Entrepreneurship in livestock and poultry sector: opportunities and approach	Dr. Prithwi Singh, CEO, SuperZop	18 October, 2021	200
	Innovation & livestock products: the way ahead	Dr Rahul Srivastava, Consultant, International Development Organization		
2.	Development of sensors for quality analysis of livestock products	Dr. Sunil Bhand, Professor, Dept of Chemistry & Dean, Sponsored Research & Consultancy, BITS Pilani, Goa Campus	17 November, 2021	180
	Recent development in rapid point of care devices for quality evaluation of meat products	Dr. Yogesh Kumar, Senior Scientist, ICAR-CIPHET		
3.	Status & scope of non-thermal technology in India	Dr. C. Anandharamakrishnan, Director, NIFTEM-T, Thanjavur, Tamil Nadu	10 December, 2021	200
	Non-thermal technologies for quality improvement of livestock & fish products	Dr. P. Srinivasa Rao, Professor, Agricultural & Food Engineering, IIT Kharagpur		

An orientation programme cum exposure visit for the students of Partap Public School, Ludhiana was coordinated on theme "Opportunities in agriculture sector for entrepreneurship and employment" at ICAR-CIPHET, on 26th November, 2021, under Azadi ka Amrit Mahotsav programme series. About 65 participants attended this program.

Linkages & Collaboration

ICAR-CIPHET signs MoU with SBI, PAU, Ludhiana

Digital monitoring transactions offer ease & transparency, and this has been a priority of ICAR to enable all Institutes to accept payment through their websites. To implement this policy, MoU has been signed between ICAR-CIPHET Ludhiana, and State Bank of India for Payment Gateway on 04.09.2021. This facility has enabled the ICAR-CIPHET to do the digital transactions. The SBI Payment Gateway is live on the CIPHET website for the users. This initiative is under the Digital India Programme of Govt. of India.

ICAR-CIPHET, Ludhiana and SBI signed MoU for payment gateway

ICAR-CIPHET, Ludhiana and IGEA, Bengaluru signed MoU through online mode

ICAR-CIPHET, Ludhiana inks MoU with Indian Gherkin Exporters Association (IGEA), Bengaluru

MoU between ICAR-CIPHET, Ludhiana and Indian Gherkin Exporters Association (IGEA), Bengaluru is signed along with a Consultancy proposal for the project entitled 'Performance evaluation of Fruit fly scanning machine' for Rs.4.95 Lakh. Project team consists of Dr. Nachiket Kotwaliwale (PI), Er. Yogesh Kalnar (Co-PI), Dr. Guru P. N. (Co-PI).

ICAR-CIPHET signs MoU with ASCI, Haryana

ICAR-CIPHET, Ludhiana signs MoU with Agricultural Skill Council of India, (ASCI), Haryana, to act as Subject Matter Expert (consultancy Project Mode) to facilitate ASCI for competency based content development for the “Packhouse Worker” Job Role (Participant Handbook and Trainer/ Facilitator Guide) as per approved Qualification Pack (QP) and Model curriculum (MC)

ICAR-CIPHET in News

खरीफ फसलों की बीमारियों पर वैबिनार

अबोहर (कथूरिया) : कृषि विज्ञान केंद्र सीफैट अबोहर द्वारा खरीफ फसलों की बीमारियों पर एक दिवसीय वैबिनार आयोजित करवाया गया जिसमें 21 किसानों ने ऑनलाइन भाग लिया। इस अवसर पर डा. रमेश कुमार प्रभारी सीफेट ने किसानों का स्वागत करते हुए फसलों का लगातार निरीक्षण करने का आह्वान किया जिससे समय पर बीमारी नियंत्रण करने और कम करने के बारे जानकारी दी। एसीटीओ राजेश कुमार ने फसलों की बीमारियों, इनके फैलने के कारणों एवं उनके नियंत्रण पर विस्तृत जानकारी। पीएयू के वैज्ञानिक डॉ अजय चौधरी ने चावल की बीमारियों के कारण एवं नियंत्रण के उपाय बताए। डाक्टर संदीप रहेजा वैज्ञानिक पीएयू अबोहर में किन्नू की बीमारियां एवं इनके प्रबंध पर विस्तृत जानकारी दी।

डा. रमेश कुमार।

10 September 2021

उर्वरकों के संतुलित उपयोग पर जागरूकता अभियान पर वैबिनार

अबोहर (धर्मवीर) : उर्वरकों के संतुलित उपयोग पर जागरूकता अभियान पर वैबिनार शुक्रवार को केवीके, आईसीएआर-सीफेट, अबोहर द्वारा आयोजित किया गया। इस प्रशिक्षण में आसपास के विभिन्न गावों के लगभग 32 किसानों और अधिकारियों ने ऑनलाइन माध्यम से भाग लिया। केवीके, आईसीएआर-सीफेट के प्रभारी डॉ. रमेश कुमार ने किसानो का स्वागत किया और कम उर्वरक के महत्व के बारे में बताया। गुरबीर सिंह, फील्ड ऑफिस इफको ने उर्वरक के कम उपयोग पर विस्तार से चर्चा की। सीफेट के वैज्ञानिक डॉ. सखाराम काले ने ड्रिप सिंचाई के माध्यम से फर्टिगेशन पर व्याख्यान दिया। डॉ. महेश कुमार वैज्ञानिक सिफेट, अबोहर ने जैविक खाद के महत्व पर विस्तार से चर्चा की। डॉ. विनोद सहारन सीटीओ केवीके सीफेट, अबोहर ने उर्वरक और [illegible] विवेकपूर्ण उपयोग के लिए 43 [illegible]

सीफेट के प्रभारी डॉ. रमेश कुमार

आईसीएआर-सेंट्रल इंस्टिट्यूट आफ पोस्ट-हार्वेस्ट इंजीनियरिंग एंड टेक्नोलाजी, लुधियाना ने अपना 33वां स्थापना दिवस और भारत के 75वें स्थापना दिवस का जश्न मनाया

हल्दी, लाल मिर्च, धनिया और काली मिर्च की हो सकती है जांच

घर बैठे जांच करें मसालों में मिलावट है या नहीं, सीफेट ने बनाई टेस्टिंग किट

भास्कर न्यूज | लुधियाना

सेंट्रल इंस्टीट्यूट ऑफ पोस्ट हार्वेस्ट इंजीनियरिंग व टेक्नोलॉजी (सीफेट) के माहिरों ने मसालों में मिलावट की जांच के लिए टेस्टिंग किट तैयार की है। किट को बायोटेक्नोलॉजी इनक्यूबेटर लेबोरेट्री मोहाली से मान्यता मिली है। किट से हल्दी, लाल मिर्च व धनिया पाउडर और काली मिर्च में मिलावट की जांच की जा सकती है। इस मिलावट से मसालों में मौजूद प्रतिरोधक क्षमता पर भी असर पड़ता है। इस किट के जरिए आसान तरीके से मिलावट की जांच हो जाएगी।

बायोटेक्नोलॉजी इनक्यूबेटर ने भी दी मान्यता

ऐसे करें मिलावट की जांच

हल्दी में मेटानिल येलो की जांच के लिए 100 मिलीग्राम हल्दी में जांच किट में मौजूद डिटेक्शन की 1 मिलीलीटर की मात्रा मिलानी होगी। घोल का रंग गुलाबी या लाल होने का मतलब ये है कि हल्दी मिलावटी है। इसमें मेटानिल येलो मौजूद है। लेड की मौजूदगी पर घोल का रंग बैंगनी और चमकीला गुलाबी होता है। मिर्च में सूडान डाई होने पर जांच में गुलाबी और लाल रंग, रोडामीन डाई की मौजूदगी होने पर गहरा लाल रंग हो जाता है।

स्टार्च से धनिया नीली होगी

धनिया में स्टार्च जांचने को घोल की 5 बूंदें मिलाएं। अगर नीला रंग हुआ तो मिलावट है। वहीं, काली मिर्च में पपीते के बीज का पाउडर होने पर घोल में ऊपर पदार्थ दिख जाते हैं।

सीफेट से खरीदें किट

सेंट्रल इंस्टीट्यूट ऑफ पोस्ट हार्वेस्ट इंजीनियरिंग व टेक्नोलॉजी (सीफेट) से आप भी इस किट को खरीद सकते हैं। अभी ये किट मार्केट में उपलब्ध नहीं है।

सीफेट अते ऑस. बी. आई. विच होइआ करार

शुरुआत शिमलापुरी के 33 वर्षीय उद्यमी नरिंदर सिंह ने आइसीएआर सिफेट से ली है टेक्नोलाजी, अब मार्केट में उतारेंगे कई तरह के उत्पाद

अब मार्केट में मिलेगा मूंगफली से बना पौष्टिक दूध, पनीर और दही

जागरण संवाददाता, लुधियाना : पनीर, दूध व दही के शौकीनों और वीगन डाइट वालों को सस्ता और नया विकल्प मिलेगा। बाजार में जल्द ही मूंगफली से बना पनीर, फ्लेवर्ड मिल्क और दही आएगा।

लुधियाना के शिमलापुरी के रहने वाले 33 वर्षीय उद्यमी नरिंदर सिंह ने आइसीएआर सेंट्रल इंस्टीटयूट आफ पोस्ट हार्वेस्ट इंजीनियरिंग टेक्नोलाजी (सिफेट) से मूंगफली से दूध, दही और पनीर बनाने की पहले टेक्नोलाजी ली और अब सिफेट की मदद से मूंगफली से अलग-अलग तरह के प्रोडक्ट बनाकर मार्केट में उतारने जा रहे हैं। खासबात यह है कि वे उत्पाद सिफेट की गाइडेंस में बनेंगे। इसे लेकर शुक्रवार को एग्रो बिजनेस इंक्यूबेशन (एबीआइ) की स्कीम के तहत सिफेट और नरिंदर सिंह के बीच एमओयू साइन हुआ है।

मूंगफली से बना पनीर।। (दा) शिमलापुरी के रहने वाले एंटरप्रन्योर व उद्यमी नरिंदर सिंह के साथ एमओयू के दस्तावेज साझा करते हुए सिफेट डायरेक्टर डा.नवीन्द्र, डा. डीएन यादव, डा.रणजीत सिंह व अन्य • जागरण

सिफेट के ट्रांसफर आफ टेक्नोलाजी डिवीजन के हेड डा. डीएन यादव ने बताया कि साल 2010-11 में हमने मूंगफली से अलग-अलग तरह के प्रोडक्ट बनाने की टेक्नोलाजी तैयार की थी। उसी तकनीक को नरिंदर सिंह ने मार्च में हमसे ले लिया।

नार्मल पनीर की तरह कर सकते हैं इस्तेमाल

डा. यादव ने बताया कि मूंगफली से तैयार पनीर को नार्मल पनीर की तरह इस्तेमाल कर सकते हैं। यह पनीर पौष्टिक तत्वों से तो भरपूर होने के साथ-साथ स्वाद में भी लाजवाब है। वीगन डाइट वाली के लिए यह एक अच्छा विकल्प है। वीगन डाइट एक ऐसी डाइट है, जिसमें पशु या उनके जरिए तैयार होने वाली किसी भी उत्पाद का सेवन नहीं किया जाता, जिसमें अंडा, मांस, शहद, दूध, डेयरी प्रोडक्ट्स, मक्खन शामिल है।

नरिंदर सिंह को उम्मीद, मार्केट में अच्छी होगी डिमांड

नरिंदर सिंह ने कहा कि बाजार में मिलने वाले दूध व पनीर की क्वालिटी को लेकर हमेशा संदेह बना रहता है। इसी को मद्देनजर रखते हुए मूंगफली से दूध, पनीर व दही बनाने के बारे में सोचा। टेक्नोलाजी लेने से पहले मार्केट को सर्वे किया और इसकी डिमांड देखी। मार्केट में डिमांड अच्छी होगी। एक तो यह सस्ता है, दूसरा मूंगफली से बने उत्पाद पौष्टिकता से भरपूर होते है और सेहत के लिए बेहद फायदेमंद होते है।

Adopt Fisheries as an enterprise for income enhancement: VC SKUAST

Prof. J.P. Sharma, VC, SKUAST inaugurating 'Post-Harvest Handling and Processing of Freshwater Fish' at Krishi Vigyan Kendra in Jammu on Tuesday.

GJ REPORT

JAMMU, FEB 2: Prof. J.P. Sharma, Vice-Chancellor, SKUAST Jammu today inaugu- 3 days training on 'Post-Harvest ling and Processing of Freshwater Fish' heduled Caste community of Jammu at Vigyan Kendra Jammu. The training mme was organized by ICAR-CIPHET na with the aim to provide hand-on- for increasing their income and there- proving them socio-economically g on the occasion

the adoption of fisheries as an enterpris achieving manifold increase income and suggested the or demonstrate the practical aspect vest handling and processing di gramme.

Prof. Sharma, VC SKUA ICAR-CIPHET for its collabo institute for the benefit of SC Jammu and acknowledged t institute. Dr S.K. Gupta Extension and Dr. M.S. Badr & AH, SKUAST-J were G during inaugural function o the outset Dr. Punit Choudl and Head, KVK Jammu we taries in the program.

The programme was or guidance of Dr. Nachi Director, ICAR-CIPHET, dinated by Dr. A.U. Muz and Nodal Officer, SC (Fisheries) delivered exp harvest handling and opening

कृषि विज्ञान केंद्र सीफेट ने किया प्रशिक्षण कार्यक्रम का आयोजन

कृथूरिया) : कृषि विज्ञान केन्द्र सीफेट द्वारा रबी फसलों क नीक पर डा. रमेश कुमार प्रभारी कृषि विज्ञान केन्द्र के निर्देशन सीटीईओं द्वारा प्रशिक्षण कार्यक्रम का आयोजन किया गया को रबी में बोई जाने वाली फसलों जैसे गेहूं, सरसों उत्पादन को उन्नत तकनीकों की जानकारी देते हुए खेत की तैयारी, सल बोने का उचित समय, बीज की दर, बीज उपचार व जों के बारे में जानकारी देते हुए रोग व कीट प्रबधन गई। सिंचाई का उचित समय तथा खाद के छिड़काव में भी बताया गया। केन्द्र प्रभारी डॉ रमेश द करते हुए कम खर्चे में फसल विशेषज्ञ डॉक्टर

हिंदी का उपयोग बढ़ाने के लिए किया प्रोत्साहित

जागरण संवाददाता, लुधियाना: आइसीएआर सेंट्रल इंस्टीट्यूट आफ पोस्ट हार्वेस्ट इंजीनियरिंग एंड टेक्नोलाजी (सिफेट) की ओर से राजभाषा हिंदी की तिमाही कार्यशाला का आयोजन आनलाइन किया गया। इसमें मुख्य अतिथि एवं वक्ता नवदीप सिंह थे। उन्होंने रेडियो प्रसारण के दौरान राजभाषा हिंदी के वक्ताओं की ओर से उच्चारण एवं अन्य सावधानियों पर चर्चा संबंधी वैज्ञानिक आलेख पर चर्चा की।

सिंह ने बताया की रेडियो हेतु वैज्ञानिक प्रस्तुतीकरण के समय कम से कम तकनीकी शब्द का उपयोग, कम आंकड़ें का प्रयोग, बोले हुए बात को दोबारा ना बोलना व तथ्य को किसी घटनाक्रम से जोड़ कर कहानी के माध्यम से रोचकता

सिफेट की ओर से आयोजित आनलाइन हिंदी कार्यशाला में शामिल वक्ता • ट्विटर

विभिन्न कार्मिकों ने राजभाषा हिंदी में ई-ऑफिस का उपयोग, हिंदी से जुड़े साफ्टवेयर एवं फोंट्स का चयन, इंस्टालेशन एवं उपयोग, बोलकर राजभाषा हिंदी की टाइपिंग जैसी कई जानकारी श्रोताओं से साझा की। गैर-हिंदी भाषी क्षेत्र के कार्मिकों के कार्य अनुभव को साझा कर अन्य कार्मिकों को हिंदी के उपयोग की बढ़ाने के लिए

निदेशक डा. नचिकेत कोतवालीवाले के निर्देशन में वैज्ञानिक, प्रभारी, राजभाषा हिंदी प्रकोष्ठ एवं सदस्य सचिव शिवकास कुमार ने राजभाषा कार्यान्वयन समिति के द्वारा संस्थान के वक्ताओं वक्तव्य स संयोजन कि प्रभागाध्यक्ष कार्यशाला

मलूकपुरा में एक दिवसीय पराली प्रबंधन जागरूकता कार्यक्रम

सीफेट प्रभारी डा. रमेश कुमार किसान को संबोधित करते हुए।

अबोहर (कथूरिया) : केवीके सीफेट द्वारा गांव मलूकपुरा में एक पराली प्रबंधन पर किसान जागरूकता कार्यक्रम आयोजित करव इस मौके पर डॉ रमेश कुमार प्रभारी सीफेट अबोहर ने पराली मिलने वाली सहायता का लाभ उठाते हुए किसानों से पराली नही आह्वान किया। डा.. विनोद सहारन सीटीओ ने पराली को जमी की विधियां एवं परियोजनाओं की विस्तृत जानकारी दी। पृथ्वीरा ने पराली जलाने से होने वाले नक्सान के बारे में बताया। इस अमनदीप सिंह एएसआई, नीतू एएसआई कृषि विभाग भी अमनदीप सिंह ने भी किसानों को सीआरएम की जानका मनजीत सिंह व मलूकपुरा के कई किसान उपस्थित थे।

Thu, 02 September 2021

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उद्यमिता विकास कार्यक्रम का आयोजन

जागरण संवाददाता, लुधियाना : आइसीएआर सेंट्रल इंस्टीट्यूट आफ पोस्ट हार्वेस्ट इंजीनियरिंग एंड टेक्नोलाजी में 'मोटे अनाज और बाजरा से ग्लूटेन मुक्त बेकरी उत्पादों' पर तीन दिवसीय उद्यमिता विकास कार्यक्रम (ईडीपी) का आयोजन किया गया।

पंजाब और उत्तर प्रदेश के कुल तीन प्रतिभागियों ने इस ईडीपी प्रशिक्षण में भाग लिया। प्रधान वैज्ञानिक डा. मंजू बाला और वैज्ञानिक डा. दीपिका गोस्वामी ने ग्लूटेन मुक्त बेकरी उत्पादों के महत्व पर प्रकाश डाला। उभरते उद्यमियों को व्यावहारिक प्रशिक्षण प्रदान किया।

संस्थान के निदेशक डा. नचिकेत

आइसीएआर सेंट्रल इंस्टीट्यूट आफ पोस्ट हार्वेस्ट इंजीनियरिंग एंड टेक्नोलाजी में आयोजित तीन दिवसीय उद्यमिता विकास कार्यक्रम (ईडीपी) में वैज्ञानिकों के साथ प्रतिभागी • जागरण

स्वीकार किया। रिखिलाल नंदराम स्टोर चेन लुधियाना के मालिक और प्रतिभागियों में से एक नवीन अग्रवाल ने कहा कि संस्थान द्वारा आयोजित ईडीपी प्रशिक्षणों की श्रृंखला कई

और मूल्यवर्धन के विभिन्न पहलुओं पर उद्यमिता विकास कार्यक्रमों की श्रृंखला की योजना बनाई है। इच्छुक उम्मीदवार अधिक जानकारी के लिए संस्थान की वेबसाइट पर जा सकते हैं। वैज्ञानिक डा. संदीप दवंगे ने

गुड न्यूज • मार्केट से मिली डिमांड के बाद सीफेट ने तैयार की नई तकनीक

अब फैट फ्री फ्लेवर्ड मखाने का ले सकेंगे लुत्फ

सिटी रिपोर्टर | लुधियाना

डाइट-सेहत का ख्याल रखने वाले लोगों के लिए अच्छी खबर है। सेंट्रल इंस्टीट्यूट ऑफ पोस्ट हार्वेस्ट इंजीनियरिंग एंड टेक्नोलॉजी (सीफेट) के माहिरों ने नई तकनीक तैयार की है। इसकी मदद से बिना किसी फैट के इजाफा किए फ्लेवर्ड मखानों के स्नैक्स का लुत्फ लिया जा सकता है। इस टेक्नोलॉजी के तहत सीफेट की तरफ से अब तक 5 फूड प्रोसेसिंग कंपनी और एंटरप्रेन्योर्स को टेक्नोलॉजी दी जा चुकी है। इससे जल्द ही लोग फैट फ्री फ्लेवर्ड मखानों के स्नैक्स का मजा ले सकेंगे। सीफेट की साइंटिफिक टीम डॉ. मृदुला देवी, डॉ. आरके विश्वकर्मा, डॉ. रंजीत सिंह, डॉ. आरके सिंह और डॉ. एसएन झा ने प्रोसेस फॉर प्रेपरेशन ऑफ फैट फ्री फ्लेवर्ड मखाना की टेक्नोलॉजी विकसित की है, जोकि फैट देने वाले स्नैक्स का विकल्प हो सकते हैं। सीफेट डायरेक्टर डॉ. नचिकेत कोतवालीवाले ने इस तरफ से टेक्नोलॉजी के आ... स्थापित करने के...

मार्केट में मिलने वाले फ्लेवर्ड मखाना 10-30 फीसदी ज्यादा फैट वाले

फैट फ्री ... डायरेक्टर और माहिर।

भारतीय मसालों से लैस हैं फ्लेवर: सीफेट के माहिरों को मार्केट से फैट फ्री फ्लेवर्ड मखाने तैयार करने की डिमांड आई। इसके बाद माहिरों की ओर से 7 महीने के समय में ये टेक्नोलॉजी तैयार की है। इस टेक्नोलॉजी का इस्तेमाल करने के बाद भी फ्लेवर्ड मखाना 0.5 फीसदी फैट से नीचे है। ऐसे में इसे माहिरों की ओर से फैट फ्री फ्लेवर्ड मखाना कहा जा रहा है। यही नहीं भारतीय मसालों का...

ढਰਮ ਨੂੰ ਦਿੱਤਾ ਮਾਈਕ੍ਰੋਬਾਇਲ ਵਿਧੀ ਦਾ ਲਾਇਸੈਂਸ

2 दिवसीय मछली एवं मुर्गी पालन कौशल प्रशिक्षण कार्यक्रम संपन्न

सीफेट अधिकारी जानकारी देते हुए।

बोहर (धर्मवीर) : कृषि विज्ञान केंद्र-सीफेट द्वारा गांव एलकोसी में दो ...सीय मुर्गी एवं मछली पालन पर कौशल प्रशिक्षण कार्यक्रम सपन्न हुआ। 24 ...यर को मछली पालन हेतु परीक्षण कार्यक्रम किया गया। इसमें प्रभजोत कौर ...ी पालन प्रसार अधिकारी, कोकम कौर मछली पालन प्रसार अधिकारी ने ...ागों को मछली पालन हेतु विस्तृत जानकारी दी। प्रभजोत कौर ने तालाब ...। प्रशिक्षण देने व टयूबवैल परिएटर इत्यादि पर विस्तृत बताया। 1 हेक्टेयर ...ताब पर कुल खर्च 8.50 लाख इसमें से 40 प्रतिशत सबसिडी जरनल के ...व 60 प्रतिशत सबसिडी महिलाए, अनुसूचित जाति के लिए उपलब्ध होगी। ...कौर ने झीगा पालन, बायोफ्लक्स तकनीक, रिसकुलेटरी एक्वा कल्चर, ...ल संरंत्र लगाने इत्यादि पर सबसिडी के बारे में बताया। तालाब में बीज ...मछली के भोजन, निकालने तथा बेचने की विस्तृत जानकारी दी। डॉ ...मार, प्रभारी सीफेट अबोहर ने परम्परागत खेती को छोड़कर मछली ...तु प्रशिक्षण लेकर ग्रुप बनाकर मछली पालन करने हेतु किसानों को ...। किया। इस अवसर पर 50 किसानों ने भाग लिया।

दैनिक सवेरा टाइम्स

न्यूज गैलरी

वैज्ञानिक सलाहकार समिति की चौथी बैठक संपन्न

सीफेट के कांफ्रेंस हाल में मौजूद अधिकारी।

अबोहर (कथूरिया): कृषि विज्ञान केंद्र अबोहर की वैज्ञानिक सलाहकार समिति की चौथी बैठक सीफेट के कांफ्रेंस हाल में डायरेक्टर डा. नचिकेता कोतवाली वाले की अध्यक्षता में की गई। डा. नचिकेता कोतवाली वाले ने केंद की गतिविधियों को समयबद्ध पूरा करने के निर्देश दिए। बैठक में सीफेट प्रभारी डाक्टर रमेश कुमार ने कृषकों के पक्षेत्र पर किए जाने वाले विभिन्न कार्यों के तकनीकी परिणाम को अत्यंत महत्वपूर्ण बताया। वही डाक्टर रूपेंद्र कौर ने उन्हें गृह विज्ञान से संबंधित इस साल के दौरान किए गए आयोजनों की जानकारी दी। इस मौके पर गडवासू लुधियाना से आए डा. पीएस खालीदाल, पैटर्नरी डाक्टर बलदीप सिंह आदि ने अपने विचार व्यक्त किए। बैठक के दौरान मछली पालन, खाद्य प्रसंस्करण, मधु मक्खी पालन, मशरूम उत्पादन, लाइव स्टाक पर विभिन्न वक्ताओं ने विचार व्यक्त किए और आए हुए किसानों ने भी विभिन्न विषयों पर अपनी जिज्ञासाओं का निवारण किया। कृषि विज्ञान केंद्र के सीटीओ डा. विनोद सहारण ने केंद्र की अद्यतन प्रगति प्रतिवेदन एवं आगामी वर्ष की कार्य योजना प्रोजेक्टर के माध्यम से प्रस्तुत की। आयोजन को सफल बनाने के लिए डा. विनोद सहारण, पृथ्वीराज, राजेश कुमार आदि ने सहयोग किया।

Fri, 24 December 2021

मूंगफली के दूध से तैयार पनीर का किया वितरण

संस, अबोहर : सीफेट कार्यालय में अंतराष्ट्रीय पोषक अनाज वर्ष 2023 के परिपेक्ष्य में पौधारोपण एवं पोषण वाटिका का आयोजन कृषि विज्ञान केंद्र और इफको द्वारा संयुक्त रूप से किया गया। कार्यक्रम में लगभग 75 किसानों व विभिन्न सोसायटी सदस्यों ने भाग लिया। कार्यक्रम के संयोजक डा. पंकज कनौजिया वैज्ञानिक ने पोषक खाद्यान्नों का मानवीय स्वास्थ्य पर होने वाले लाभप्रद प्रभावों की जानकारी दी। कार्यक्रम में कुरकुरे व मूंगफली के दूध से तैयार पनीर का वितरण किया गया।

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Research Projects (2021)

S.No.	Project Name	Project Leader & Associates	Period of Association From	Period of Association To	Project period
List of In-house Projects along with their Investigators					
1.	Design and Development of Mechanized System for Fruit Bar Manufacturing	Er. Kirti Jalgaonkar (PI)	01.04.2016	30.11.2019	01.04.2016 31.03.2021
		Dr. Ramesh Kumar (Co-PI)	01.04.2016	31.05.2017	
		Mrs. Prerna Nath (Co-PI)	01.04.2016 01.12.2019	30.11.2019 31.03.2021	
		Dr. Manoj K. M. (Co-PI)	01.04.2016	30.11.2019	
		Dr. Sakharam Kale (Co-PI)	01.07.2020.	31.03.2021	
2.	Development of smart device for automatic detection and identification of insects in stored grains using machine vision technology	Dr. V.E. Nambi (PI)	01.04.2016	17.07.2018	01.04.2016 31.12.2021
		Dr. Ranjeet Singh (Co-PI)	01.04.2016 18.07.2018	17.07.2018 Till date	
		Dr. B.B. Ratnakar (Co-PI)	01.04.2016	13.11.2020	
		Er. Yogesh Kalnar	01.04.2019.	Till date	
3.	Development of mechanized litchi de-stoner.	Dr. Bibwe Bhusan Ratnakar (PI)	01.04.2017	13.11.2020	01.04.2017 31.08.2021
		Dr. Kirti Jalgaonkar (Co-PI)	01.04.2017	30.11.2019	
		Dr. Pankaj Kumar. Kannaujia (Co-PI) & PI	01.04.2017 14.112020	29.09.2018 31.08.2021	
4.	Designing Extension Strategies for Wider Adoption of Post-Harvest Technologies based on Adoption Behaviour of End Users	Dr. Renu Balakrishnan (PI)	01.04.2017	31.03.2021	01.04.2017 31.03.2020
		Dr. Anil Kumar Dixit (Co-PI)	01.04.2017	19.06.2017	
		Dr. Sandeep Mann (Co-PI)	01.04.2017	31.03.2021	
		Associated Dr Arvind Kumar (PS), ICAR-ATARI (Co-PI)	01.10.2018	31.03.2021	
5.	Development of automatic Sorter/Grader for Pomegranate and Tomato	Er. Yogesh Kalnar (PI)	01.04.2017	Till date	01.04.2017 31.09.2021
		Dr. V. E . Nambi (Co-PI)	01.04.2017	17.07.2018	
		Er. Sandeep Dawange Popatrao (Co-PI)	01.10.2018	Till date	
6.	Development of collagen hydrolysate from buffalo (Bubalus bubalis) skin and its effect on osteoarthritis.	Dr. Tanbir Ahmad (PI)	01.10.2018	30.11.2019	01.10.2018 30.09.2021
		Dr A.U. Muzzadadi (Co-PI)	01.10.2018	Till Date	
		Dr. Yogesh Kumar (Co - PI) &	01.10.2018 01.12.2019	30.11.2019 Till Date	
		Association of Dr. Tanbir Ahmad, Scientist (SS), ICAR-IVRI, Izatnagar	17.03.2021	Till Date	
7.	Development of process protocol for cryogenic grinding of selected medicinal herbs (Ashwagandha and Safed Musli)	Dr. Pankaj Kumar (PI)	01.10.2018	Till Date	01.10.2018 30.09.2021

* till date refers to June 2021 (31st IRC)

S.No.	Project Name	Project Leader & Associates	Period of Association		Project period
			From	To	
8.	Production of bio-active ingredients from mango seed kernels	Dr. Poonam (PI)	01.10.2018	Till Date	01.10.2018 31.03.2022
		Dr. Th. Bidyalakshmi (Co-PI)	01.10.2018	Till Date	
		Er. Sandeep Dawange Popatrao (Co-PI)	01.10.2018	Till Date	
	Development of a prototype for separation of peel and stone from mango processing waste	Dr. Manoj Kumar Mahawar (PI)	01.06.2019	30.11.2019	01.06.2019 31.05.2022
		Dr. Kirti Jalgaonkar (Co-PI)	01.06.2019	30.11.2019	
		The project is resumed for 01 year w.e.f. 01.07.2021 with only PI.			
		Dr. Sandeep Dawange Popatrao (PI)	01.07.2021	Till date	
9.	Development of ACE-Inhibitory Peptides from Fish and Livestock Processing Waste	Sh. Vikas Kumar (PI)	01.10.2018	31.03.2021	01.10.2018 31.03.2021
		Dr. Yogesh Kumar (Co -PI)	01.10.2018	31.03.2021	
		Dr. Tanbir Ahmad (Co-PI)	01.10.2018	30.11.2019	
		Dr. A.U. Muzadaddi (Co-PI)	15.01.2020	31.03.2021	
10.	Development of Lab-on-a-Chip method for detection of animal species in meat products	Dr. Yogesh Kumar (PI)	01.04.2019	Till Date	01.04.2019 31.03.2022
		Dr. K Narsaiah (Co-PI)	01.04.2019	Till Date	
		Dr. Tanbir Ahmad (Co -PI)	01.04.2019	30.11.2019	
		Dr Poonam (Co-PI)	01.04.2019	Till Date	
11.	Development of Infra-Red Spectroscopy Based Rapid Detection Methods for Adulterants in Chick pea flour (Besan)	Dr. Manju Bala (PI)	01.04.2019	Till Date	01.04.2019 31.03.2022
		Dr. Swati Sethi (Co-PI)	01.04.2019	Till Date	
		Mrs. P. Hemasankari (Co -PI)	01.04.2019	30.11.2019	
12.	Enhancing value of pigeon pea, black gram and their by-products through secondary agriculture	Dr. Deepika Goswami (PI)	01.01.2019	Till Date	01.01.2019 31.12.2021
		Dr. D. Mridula, (Co-PI)	01.01.2019	Till Date	
		Dr. Manju Bala, (Co-PI)	01.01.2019	Till Date	
13.	Development of ripening delaying kit for enhancing the shelf-life of fresh fruits	Dr. Sunil Kumar (PI)	01.04.2019	18.08.2020	01.04.2019 31.03.2021
		Dr. Ramesh Kumar (Co-PI)	01.04.2019	31.03.2021	
14.	Postharvest Management and Value Addition of Ker and Sangri for their Commercial Exploration	Prerna Nath (PI)	01.04.2019	31.03.2021	01.04.2019 31.03.2021
		Sakharam Kale (Co-PI)	01.04.2019	31.03.2021	
		Sunil Kumar (Co-PI)	01.04.2019	18.08.2020	
		Ramesh Kumar (Co-PI)	01.04.2019	31.03.2021	
15.	Development of mechanized system for deodorization and safe handling of dried fish	Dr A.U. Muzaddadi (PI)	01.04.2019	Till Date	01.04.2019 31.03.2022
		Dr. Sandeep Mann (Co-PI)	01.04.2019	Till Date	
		Dr. Kh. Bembem (Co-PI)	01.04.2019	Till Date	
		Dr. Bipul Kakati (Co-PI) (College of Fishery, AAU, Raha)	01.04.2019	Till Date	
		Dr. Guru P.N (Co -PI)	27.02.2020	Till date	
16.	Design and development of mechanized and continuous peeling system for citrus fruits	Dr. Manoj Kumar Mahawar (PI)	01.04.2019	30.11.2019	01.04.2019 31.03.2021

S.No.	Project Name	Project Leader & Associates	Period of Association From	To	Project period
17.	Upgradation and commercialization of woman-friendly semi-automatic fish cleaning-cum dressing system	Dr. A.U. Muzaddadi (PI)	01.04.2019	Till Date	01.04.2019 31.03.2020
		Mr. Vikas Kumar (Co-PI)	01.04.2019	Till Date	
18.	Development of enzyme assisted technology for enhancing protein extraction from de-oiled rice bran.	Ms. Surya (PI)	01.10.2020	Till Date	01.10.2020 30.09.2022
		Dr. D.N. Yadav (Co -PI)	01.10.2020	Till Date	
		Dr. Rajeev K. Kapoor (Co-PI), MDU, Rohtak, Haryana	01.10.2020	Till Date	
19.	Development of Photoreactor for Ethylene Degradation During Storage of Banana and Guava	Dr. Bhupendra M Ghodki (PI)	01.10.2020	Till Date	01.10.2020 30.09.2023
		Er. Yogesh Kalnar (Co -PI)	01.10.2020	Till Date	
		Dr. Poonam **(Co-PI)**	01.10.2020	Till Date	
20.	Development of Table Top Vaccum Frying System	Dr. Swati Sethi (PI)	01.10.2020	Till Date	01.10.2020 30.09.2022
		Dr. Pankaj Kumar (Co-PI)	01.10.2020	Till Date	
21.	Microbial production of PolyHydroxy Butyrate (bioplastic) using mango by products	Dr. Ajinath Dukare (PI)	01.10.2020	02.03.2021	01.10.2020 30.09.2022
		Sh. Mahesh Kumar Samota (Co-PI)	01.10.2020	Till Date	
		Dr. Bibwe Bhushan Ratnagar (Co-PI)	01.10.2020	13.11.2020	
		Dr. R.C. Kasana (PI)	01.07.2021	Till Date	
		Dr, Ramesh Kumar (Co-PI)	01.07.2021	Till Date	
22.	Development of Solar Operated Low Cost Onion Storage Structure	Dr. Sakharam Kale (PI)	01.10.2020	29.10.2021	01.10.2020 30.09.2022
		Dr. Dr. Ajinath Dukare (Co -PI)	01.10.2020	02.03.2021	
		Sh. Mahesh Kumar Samota (Co-PI)	01.10.2020	Till Date	
23.	Development and Updating of Post-Harvest Machineries & Technologies Database	Dr Sandeep Mann (PI)	01.10.2020	Till Date	01.10.2020 30.09.2023
		Dr Sandeep P. Dawange (Co-PI)	01.10.2020	Till Date	
		PC PHET/Scientist (Co-PI)	01.10.2020	Till Date	
		PC PEASEM/ Scientist (Co-PI)	01.10.2020	Till Date	
24.	Development of android based mobile application (Mobile app) on post-harvest technology for skill development and employment security.	Dr. Ranjeet Singh (PI)	01.10.2020	Till Date	01.10.2020 30.09.2023
		Er. Thongam. Sunita Devi (CoPI)	01.10.2020	Till Date	
25.	Mechanized system for making Hawaijar- a traditional fermented food of North-East India	Dr. Th. Bidyalakshmi Devi (PI)	01.04.2021	Till Date	01.04.2021 31.03.2023
		Mrs Surya (Co-PI)	01.04.2021	Till Date	
		Dr. K. Bembem (Co-PI)	01.04.2021	Till Date	
26.	IoT-Based Real-Time Intelligent Monitoring and Controlling System for Cold Storage	Er. Thongam Sunita Devi (PI)	01.07.2021	Till Date	01.07.2021 30.06.2023
		Er. Shaghaf Kaukab (Co-PI)	01.07.2021	Till Date	
		Er. Yogesh B. Kalnar (Co -PI)	01.07.2021	Till Date	
		Dr. Nachiket Kotwaliwale (Co-PI)	01.07.2021	Till Date	

S.No.	Project Name	Project Leader & Associates	Period of Association From	To	Project period
27.	Development of process for improved head rice recovery from long grain paddy	Dr. Swati Sethi (PI)	01.07.2021	Till Date	01.07.2021 30.06.2023
		Dr. Mridula D. (Co-PI)	01.07.2021	Till Date	
		Dr. R. K. Vishwakarma (Co-PI)	01.07.2021	Till Date	
28.	Development of on farm maize cob drying system for effective value chain	Dr. Pankaj Kumar (PI)	01.07.2021	Till Date	01.07.2021 30.06.2023
		Er. Shaghaf Kaukab (Co-PI)	01.07.2021	Till Date	
		Dr. Sumit Kumar Aggarwal (Co-PI), ICAR-IIMR Ludhiana	01.07.2021	Till Date	
29.	Safe storage of pulses using microwave assisted disinfestation	Dr. Guru P. N. (PI)	01.07.2021	Till Date	01.07.2021 30.06.2022
30.	Development of Low-Calorie beverages and Utilization of syrup waste during osmotic dehydration of aonla & mango	Dr. Prerna Nath (PI)	01.07.2021	29.10.2021	01.07.2021 30.06.2022
		Dr. Ramesh Kumar (Co-PI)	01.07.2021	Till Date	
		Dr. R. C. Kasana (Co-PI)	01.07.2021	Till Date	
31.	Capacity building of agricultural extension professionals to promote agro processing	Dr. Renu Balakrishnan (PI)	01.07.2021	Till Date	01.07.2021 30.06.2024
		Dr. Khwairakpam Bembem (Co-PI)	01.07.2021	Till Date	
		Dr. Deep Narayan Yadav (Co-PI)	01.07.2021	Till Date	
		Mr. Vikas Kumar (Co-PI)	01.07.2021	Till Date	
32.	Techno-economic feasibility assessment and socio-economic impact analysis of selected post-harvest technologies	Dr. Renu Balakrishnan, Scientist (PI)	01.07.2021	Till Date	01.07.2021 30.06.2024
		Dr Sandeep Mann, Pr. Scientist (Co-PI)	01.07.2021	Till Date	
		Dr Ankita Kandpal, Scientist (Co-PI) - ICAR-NIAP, New Delhi	01.07.2021	Till Date	
		Dr Reshma Gill, Scientist (Co-PI) - ICAR-CMFRI, Cochi	01.07.2021	Till Date	

List of ICAR Funded Projects 2021 along with their Investigators

Under AICRP on PEASEM at HCP Division, ICAR-CIPHET, Abohar					
1.	Strategies for maximum vertical space utilization in growing of selected vegetables inside polyhouse in hot and arid region	Dr. Pankaj Kumar Kannaujia (PI)	0.1.04.2018	31.03.2021	01.04.2018 31.03.2021
		Dr. Sakharam Kale (Co-PI)	01.04.2018	31.03.2021	
		Er. Indore Navnath Sakaram (Co-PI)	01.04.2018	07.01.2021	
2.	Development of phase change material based assembled type fruit ripening chamber	Dr. Sakharam Kale (PI)	01.04.2020	29.10.2021	01.04.2020 31.03.2022
Under NAIF					
3.	Establishment of Agri-Business Incubation (ABI) Centre under XII Plan Scheme for National Agriculture Innovation Fund (NAIF) at ICAR-CIPHET, Ludhiana	Dr.Ranjit Singh (PI)	31.10.2016	Till date	01.01.2016 Till Date
		Mr. Vikas Kumar(Co-PI)	21.09.2016	Till date	
		Dr. Renu Balakrishnan (Co-PI)	21.09.2016	Till date	

S.No	Project Name	Project Leader & Associates	Period of Association From	To	Project period
Under CRP on SA					
4.	Establishment of modern fruits and vegetables Agro Processing Centre (APC)	Dr. P C Sharma (PI) Dr. D.M. Kadam (PI in Place of Dr. P.C. Sharma, Ex - Head, HCP Division, Abohar) Dr. R.K. Vishwakarma (PI in Place of Dr. D.M. Kadam, I/c Head, HCP Division, Abohar) Dr. Manoj Kumar Mahawar (Co-PI) PI w.e.f. Er. Bibwe Bhushan Ratnakar (Co-PI) Dr. Mridula D. (PI in place of Dr. R.K. Vishwakarma, PI & LCPC CRP on SA, ICAR-CIPHET, Ludhiana Er. Akhoon Asrar Bashir (Co-PI) Dr. Indore Navnath Sakharam (Co-PI) Dr. Deepika Goswami (Co-PI)	01.04.2015 20-02-2016 19.11.2016 12.10.2018 01.04.2015 12.10.2018 24.08.2018 19.11.2016 1.04.2019 22.12.2018 22.12.2018 22.12.2018	31.12.2015 19.11.2016 23.08.2018 31.03.2019 23.08.2018 21.12.2018 11.10.2018 21.12.2018 Till date Till Date 07.01.2021 Till Date	01.04.2015 Till Date
5.	Value addition of Makhana and its by-products	Dr. R.K. Vishwakarma (PI) Er. Arun Kumar TV (Co-PI) Dr. Ranjit Singh (Co-PI) Dr. Khwairakpam Bembem (Co-PI) Dr. Mridula D. (Co-PI)	01.04.2016 01.04.2016 01.04.2016 16.08.2016 01.04.2018	Till date 30.06.2017 Till date Till date Till date	01.04/2016 Till Date
Under Farmer FIRST Programme					
6.	Processing and Value Addition of Agricultural Produce for Enhancing Farmers income and Employment in Production Catchment under Farmer First Programme.	Dr. Sandeep Mann (PI) Dr. A.K. Dixit (Co-PI) Dr. Rahul Kumar Anurag (Co-PI) Dr. Renu Balakrishnan (Co-PI) Er. Yogesh Kalnar (Co-PI) Dr. B.V.C Mahajan (Co-PI) Director & Prof., (PHPTC)	30.01.2017 30.01.2017 30.01.2017 30.01.2017 30.01.2017 30.01.2017	31.03.2021 19.06.2017 31.03.2021 31.03.2021 31.03.2021 31.03.2021	30.01.2017 31.03.2021

List of Externally Funded Projects 2021-22 along with their Investigators

1.	Refinement of process protocol for preparation of traditional fermented fish products of Northeast India by using biotechnological tools and its process mechanization	Dr. A.U. Muzaddadi (PI) Er. Dhritiman Saha (Co-PI) Dr. Sandeep P. Dawange (Co-PI w.e.f.) Dr. Tanbir Ahmed (Co-PI)	23.03.2018 23.03.2018 14.08.2019 14.08.2019	22.03.2021 24.05.2019 22.03.2021 30.11.2019	23.03.2018 22.03.2021
2.	Valorization of industrially produced soybean and groundnut de-oiled meals/cakes by extraction, purification and production of protein isolates	Dr. D.N. Yadav (PI) Dr. R.K. Vishwakarma (Co-PI) Ms. Surya (Co-PI) Dr. Swati Sethi (Co-PI)	01.08.2018 01.08.2018 01.08.2018 01.08.2018	Till date 31.07.2019 Till date Till date	01.08.2018 to 31.07.2021
3.	Design and Development of protective structures for high valued crops to reduce damage from hail and frost	Er. Indore Navnath S. (PI) Dr. R.K. Singh (Co-PI)	23.08.2018 23.08.2018	07.01.2021 31.03.2021	23.08.2018 31.03.2021

S.No.	Project Name	Project Leader & Associates	Period of Association From	To	Project period
4.	Development of protocols for shelf life, safe storage, milling outturn and indicative norms for procurement of major pulses	Dr. R.K. Vishwakarma (PI)	27.03.2019	26.03.2021	27.03.2019 26.03.2021
		Dr. Mridula D. (Co-PI)	27.03.2019	26.03.2021	
		Dr. D.N. Yadav (Co -PI)	27.03.2019	26.03.2021	
		Dr. Deepika Goswami (Co-PI)	27.03.2019	26.03.2021	
		Er. Navnath Indore Sakharam (Co-PI)	27.03.2019	07.01.2021	
5.	Development of rapid quality monitoring system for wheat flour and its primary milled products	Dr. D.N. Yadav (PI)	02.05.2018	Till date	02.05.2018 01.11.2021
		Dr. V.Chandrasekar (Co -PI)	02.05.2018	02.09.2019	
		Mrs. Surya(Co-PI)	02.05.2018	Till date	
		Dr. Bhupendra M. Ghodki (Co-PI)	01.08.2019	Till date	
		Dr. Rahul Kumar Anurag (Co-PI)	01.10.2019	Till date	
6.	Development of Hand-Held Instrument for Non-Destructive Quality Testing of Mango.	Dr. K.Narsaiah (PI)	01.10.2019	Till date	01.10.2019 30.09.2021
7.	Study on Determining Storage Losses of Wheat and Paddy Stored in CAP System and to Recommend Norms for Storage Losses. (FCI)	Dr. R.K. Vishwakarma (LCPI)	20.11.2019	Till date	20.11.2019 31.12.2021
		Dr. Mridula D. (LCCo-PI)	17.01.2020	Till date	
		Dr. Bhupendra M. Ghodki (LCCo-PI)	17.01.2020	Till date	
		Dr. Guru P.N. (LCCo -PI)	17.01.2020	Till date	
8.	Non-chemical management of stored-grain moths using flexible light-trap	Dr. Guru P.N. (PI)	01.10.2020	Till date	01.10.2020 30.09.2023
		Er. Yogesh Kalnar (Co -PI)	01.10.2020	Till date	
9.	Storage study on "Performance Evaluation of Hermetic Bags on selected commodities"	Dr. Sandeep Mann (Pr. Scientist & PI)	01.10.2020	Till date	01.10.2020 30.09.2022
		Mrs. Surya (Scientist & Co-PI)	01.10.2020	Till date	
		Dr. Guru P.N. , Scientist (Co -PI)	01.10.2020	Till date	
		Dr. R.K. Singh, (Co-PI)	01.10.2020	Till date	
10.	Assessing post-harvest quality and grading of agri-produces for efficient management of storage and post-harvest operations. Co-operating Center under Network Project on Precision Agriculture (NePPA)	Dr. K. Narsaiah (CC-PI)	01.09.2021	31.08.2026	01.09.2021 31.08.2026
		Er. Yogesh Kalnar (Co -PI)			
		Dr. Bhupendra M. Ghodki (Co-PI)			
		Dr. Thingujam Bidyalakshmi Devi (Co-PI)			
		Er. Thongam Sunita Devi (Co-PI)			
11.	Mechanized system for making Hawaijar - a traditional fermented food of North-East India	Dr. Thingujam Bidyalakshmi Devi (PI)	01.10.2021	Till date	01.10.2021 30.09.2023
		Ms. Surya (Co-PI)	01.10.2021	Till date	
		Dr. Khwairakpam Bembem	01.10.2021	Till date	
		Dr. Ng. Joy Kumar (C0-PI from CoFT, CAU, Imphal)	01.10.2021	Till date	
12.	Performance evaluation of fruit fly scanning machine	Dr. Nachiket Kotwaliwale (PI)	01.09.2021	27.12.2021	01.09.2021 to 27.12.2021
		Er. Yogesh Kalnar (Co -PI)	01.09.2021	27.12.2021	
		Dr. Guru P. N. (Co -PI)	01.09.2021	27.12.2021	

Research & Administrative Meetings

22nd Research Advisory Committee Meeting (RAC)

The ICAR vide File No. Ag. Engg./2/10/2020-IA-II Efile No. 104118 dated 14.01.2021 constituted Research Advisory Committee for ICAR-CIPHET, Ludhiana for a period of three years w.e.f. 31st January 2021- 30th January 2024. The First meeting of the Research Advisory Committee (RAC) was held during 05-06 March, 2021 at ICAR-CIPHET, Ludhiana, through online as well as physical presence of the members. The Chairman & RAC members attended the meeting along with the all Heads, Project Coordinators & Scientists of ICAR-CIPHET.

Research Advisory Committee

1.	Dr. D. C. Joshi Vice Chancellor, Agriculture University, Kota	Chairman
2.	Dr. R. Viswanathan Former Prof. & Head, TNAU, Coimbatore	Member
3.	Dr. H. N. Mishra Professor I/c & Nodal Officer, Agri Business Incubation Centre , Indian Institute of Technology , Kharagpur	Member
4.	Dr. Meenakshi Singh Chief Scientist (Formerly at CFTRI and FSSAI) , Technology Management Directorate – SeMI, New Delhi	Member
5.	Dr. Kriti Bardhan Gupta Faculty, Center for Food and Agri -business Management, IIM, Lucknow	Member
6.	Dr. Sunil Bhand Dean, Sponsored Research and Consultancy & Professor Department of Chemistry, BITS Pilani, Goa Campus	Member
7.	Dr. S. N. Jha ADG (PE), Division of Agricultural Engineering, ICAR, KAB II, New Delhi	Member (Ex-Officio)
8.	Dr. Nachiket Kotwaliwale Director, ICAR-CIPHET, Ludhiana	Member
9.	Dr. Sandeep Mann Pr. Scientist, ToT Division & I/c PME, ICAR-CIPHET, Ludhiana	Member Secretary

Research Advisory Committee Meeting

On this occasion, ICAR-CIPHET's newly approved logo and New Division of "Automation and Sensor Technology" was formally inaugurated. ICAR-CIPHET's coffee table book on Institute Technologies, two technical bulletins under Farmers First project and one technical bulletin on "Mustard based bio pesticides: Efficacy against diseases and pests of Pomegranate" were also released.

31st Institute Research Council (IRC) Meeting

The 31st Institute Research Council Meeting was held through online mode during June 01-05 & 24, 2021 at ICAR-CIPHET, Ludhiana under the Chairmanship of Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET & Chairman IRC. During the 31st IRC meeting, 15 new project proposals (RPP I), 25 on-going projects (RPP II), 16 completed projects (RPP III) and 01 project proposal for further refinement and commercialization of technology (RPP IV) were presented.

Institute Research Council (IRC) meeting

Scientific Advisory Committee (SAC) of KVK

4th Scientific Advisory Committee of KVK, Abohar was organized under the Chairmanship of Director, CIPHET, Ludhiana on 20 December, 2021 at CIPHET, Abohar campus and more than 25 member, representative and progressive farmers participated in this meeting. Dr. Ramesh Kumar, OIC, KVK and Member Secretary, SAC presented the detailed progress report of KVK for year 2021 and future action plan of 2022 in this meeting.

Scientific Advisory Committee Meeting at KVK-Fazilka

Staff Recreation Club (SRC)

The General Body Meeting for the election of various positions of the Staff Recreation Club, ICAR-CIPHET, Ludhiana was held on 24th August, 2021 through online mode. The newly constituted SRC is as follows:

S. No.	Name	Post
1.	Dr. R.K. Vishwakarma	President
2.	Sh. Kunwar Singh	Vice-President
3.	Dr. Rahul Kumar Anurag	General Secretary
4.	Ms. Pragya Singh	Cultural Secretary
5.	Dr. Guru P. N.	Sports Secretary
6.	Dr. Poonam	Ladies Secretary
7.	Sh. Ram Khelawan Yadav	Cashier
8.	Sh. Rajinder Kumar Raheja	Auditor

Personalia

Appointment/ Recruitment/ New Joining

Name of the officials	Date of Joining	Designation
Dr. Rupinder Kaur	20.09.2021	SMS(T-6)
Sh. Ramesh Chand Meena	25.10.2021	Chief Administrative Officer
Sh. B.C. Katoch	24.12.2021	Administrative Officer

Superannuation

Name of the official	Date of Joining	Designation
Dr. R.K. Gupta	31.01.2021	Principal Scientist

Promotion

Name of the officials	Effective Date of Promotion	New Designation
Administrative		
Sh. Avtar Singh	29.06.2021	Assistant Administrative Officer
Sh. Iqbal Singh	12.08.2021	Assistant
Sh. Ram Khelawan Yadav	12.08.2021	Upper Division Clerk
Technical		
Sh. Mahipal Singh	01.07.2010	Assistant Chief Technical Officer
Dr. Mukund Narayan	09.08.2019	Assistant Chief Technical Officer
Sh. Ganpat Ram	29.08.2020	Technical Officer
Sh. Rajiv Sharma	25.01.2021	Technical Officer
Sh. Devinder Kumar	09.07.2021	Technical Officer
Sh. Yashpal Singh	01.08.2021	Senior Technical Assista nt
Sh. Manoj Kumar	04.12.2021	Technician

Clearance of Probation and Confirmation

Name of the official	Confirmation from the due date
Smt. Jasvir Kaur	06.02.2015
Ms. Pragya Singh	01.10.2020
Sh. Ajay Kumar	03.11.2020

Transfer

Name of the officials	Date of Transfer	Name of Place
Dr. Dukare Ajinath Shridhar	02.03.2021	ICAR-CIRCOT, Mumbai
Dr. Sakharam Jagan Kale	29.10.2021	ICAR-IINRG, Ranchi
Dr. Prerna Nath	29.10.2021	ICAR-RCER Research Station, Ranchi
Dr. Pankaj Kumar Kannaujia	20.11.2021	ICAR-NBPGR, New Delhi

Institutional Staff

At Ludhiana Campus

Scientific Staff

Name	Designation	Discipline
Dr. Nachiket Kotwaliwale	Director	Agricultural Structure Process Engineering
Dr. S. K. Tyagi	Principal Scientist & Project Coordinator (Acting) , AICRP (PHET)	Chemical Engineering
Dr. R. K. Singh	Principal Scientist & Project Coordinator (Acting) , AICRP (PEASEM)	Soil Water Conservation Engineering
Dr. K. Narsaiah	Principal Scientist	Agricultural Structures & Process Engineering
Dr. Mridula D.	Principal Scientist	Food & Nutrition
Dr. D. N. Yadav	Principal Scientist	Food Technology
Dr. Sandeep Mann	Principal Scientist	Agricultural Process Engineering
Dr. R. K. Vishwakarma	Principal Scientist	Agricultural Structures & Process Engineering
Dr. Manju Bala	Principal Scientist	Plant Biochemistry
Dr. A. U. Muzaddadi	Principal Scientist	Fish Processing Technology
Dr. Ramesh Chand Kasana	Principal Scientist	Microbiology
Dr. Ranjeet Singh	Principal Scientist	Agricultural Process Engineering
Dr. Yogesh Kumar	Senior Scientist	Livestock Product Technology
Dr. Rahul K. Anurag	Scientist (SS)	Food Technology
Dr. Deepika Goswami	Scientist (SS)	Food Technology
Smt. Leena Kumari	Scientist (SS)	Electronics & Instrumentation
Smt. Surya	Scientist (SS)	Agricultural Microbiology
Dr. Swati Sethi	Scientist (SS)	Food Technology
Er. Chandan Solanki**	Scientist (SS)	Agricultural Process Engineering
Er. Dhritiman Saha**	Scientist (SS)	Agricultural Process Engineering
Er. A. A. Bashir	Scientist	Agricultural Structures & Process Engineering
Er. Navnath Indore**	Scientist	Agricultural Structures & Process Engineering
Sh. Vikas Kumar	Scientist	Fish Processing Technology
Dr. Khwairakpam Bembem	Scientist	Home Science
Dr. Renu Balakrishnan	Scientist	Agricultural Extension
Er. Kalnar Yogesh	Scientist	Agricultural Process Engineering
Dr. Pankaj Kumar	Scientist	Agricultural Process Engineering
Dr. Poonam	Scientist	Plant Biochemistry
Er. Sandeep Dawange	Scientist	Agricultural Structures & Process Engineering
Dr. Thingujam Bidyalakshmi	Scientist	Agricultural Structures & Process Engineering
Dr. Guru P. N.	Scientist	Agricultural Entomology
Dr. B. M. Ghodki	Scientist	Agricultural Structures & Process Engineering
Ms. Shaghaf Kaukab	Scientist	Agricultural Structures & Process Engineering
Ms. Thongam Sunita Devi	Scientist	Agricultural Structures & Process Engineering
Dr. Mahesh Kumar Samota	Scientist	Plant Biochemistry

** On study leave

Administrative Staff

Name	Designation
Sh. Ramesh Chand Meena	Chief Administrative Officer
Sh. H.L. Meena	Senior Administrative Officer
Sh. Balwant Chand Katoch	Administrative Officer
Sh. Manni Lal	Finance and Accounts Officer
Sh. S. S. Verma	Personal Secretary
Sh. Kunwar Singh	Assistant Administrative Officer
Sh. Avtar Singh	Assistant Administrative Officer
Sh. Tarsem Singh Purba	Assistant
Smt. Jasvir Kaur	Assistant
Sh. Gurdial Singh	Assistant
Sh. Iqbal Singh	Assistant
Sh. Ashwani Kumar	Assistant
Sh. R. K. Raheja	Upper Division Clerk
Smt. Sunita Rana	Upper Division Clerk
Sh. R. K. Yadav	Upper Division Clerk
Sh. S. K. Gaur	Upper Division Clerk
Sh. Ajay Kumar	Lower Division Clerk

Technical Staff

Dr. Mukund Narayan	Assistant Chief Technical Officer
Sh. Gurdeep Singh	Technical Officer
Sh. H. S. Sekhon	Technical Officer
Sh. Vishal Kumar	Technical Officer
Sh. Beant Singh	Technical Officer
Sh. Rajiv Sharma	Technical Officer
Sh. Lakhwinder Singh	Senior Technical Assistant
Sh. Bhajan Singh	Senior Technical Assistant
Sh. Jaswant Singh	Senior Technical Assistant
Sh. Jaswinder Singh	Senior Technical Assistant
Sh. Hardeep Singh	Senior Technical Assistant
Smt. Sonia Rani	Senior Technical Assistant
Sh. Pradip Kumar	Senior Technical Assistant
Sh. Jagtar Singh	Senior Technical Assistant
Sh. Yashpal Singh	Senior Technical Assistant
Smt. Pragya Singh	Technical Assistant
Sh. Sarup Singh	Senior Technician
Sh. Satwinder Singh	Senior Technician
Sh. Manoj Kumar	Technician

Supporting Staff

Sh. Sukhbir	Skilled Supporting Staff

At Abohar Campus
Scientific staff

Name	Designation	Discipline
Dr. Ramesh Kumar	Principal Scientist	Horticulture
Dr. Mahesh Kumar Samota	Scientist	Plant Biochemistry

Administrative Staff

Sh. Pawan Kumar	Assistant Administrative Officer
Sh. Mohan Lal	Assistant

Technical Staff

Sh. V. K. Saharan	Chief Technical Officer
Sh. Prithvi Raj	Assistant Chief Technical Officer
Sh. Rajesh Kumar	Assistant Chief Technical Officer
Sh. Ganpat Ram (Driver)	Technical Officer
Sh. Devinder Kumar	Technical Officer
Sh. Pawan Kumar	Senior Technical Assistant
Sh. Dalu Ram	Senior Technical Assistant

Supporting Staff

Sh. Surinder Kumar	Skilled Supporting Staff


भाकृअनुप – सीफेट
ICAR-CIPHET
ICAR-CIPHET STAFF - 2021

Release of ICAR-CIPHET New Logo

Automation and Sensor Technology (AST Division)

Venturing into Automation and Sensor Technology Domain

Virtual Celebration of ICAR-CIPHET Industry Fair on Agro-Processing, 2021

Celebration of Azadi ka Amrit Mahotsav – Webinars, Workshops, Sectoral Campaigns, etc.