SSR allelic variations were analysed in Indian potato varieties and a database was developed for varietal identification. A total of 155 SSR alleles of 12 markers were scored in 48 varieties with alleles per locus varied from 4 (STM1053) to 35 (STIKA) and polymorphic information content (PIC) ranged between 0.53 (STM1053) to 0.92 (STIKA). Total of 1492 absolute alleles frequencies were detected in the varieties ranging from 19 (Kufri Arun or Kufri Sadabahar) to 45 (Kufri Kundan) with marker-wise allele frequencies were maximum in STIKA (273) and minimum in STMS127 (73) or STM1053 (73). During the analysis two markers STM0037 and STI0030 did not show any amplification (null alleles).

Allelic profiling of potato varieties showed distinctness and polymorphism of the SSR markers system. A set of minimum two SSR markers (STIKA and STU6SNRN) was developed for varietal identification up to similarity coefficient (0.89). Besides, another set of 6 markers (STI0012, STPoAC58, STM0019, STM0031, STM1104 and STM1052) was also identified from the Potato Genome Identity (PGI) kit for the same. In addition, we identified allelic variations in wild potato species using these SSR markers and developed another markers-set for their molecular characterization. SSR allelic profiles showed high polymorphism and distinctness in the wild species. A total of 663 alleles of 14 polymorphic SSR loci were scored in 82 accessions of 22 wild species. Alleles per locus ranged from 15 (STM5127) to 101 (STM0019) while polymorphic information content (PIC) varied between 0.887 (STM5114) to 0.983 (STM0019). Cluster analysis of wild species based on the 14 SSR profiles distinguished all the accessions. To save the resources, a three-markers-set (STM0031, STM1106 and STM0037) was developed to distinguish all the accessions.

To conclude, our study suggests the use of SSR markers (STIKA and STU6SNRN) for identification of true-to-type clones of Indian potato varieties and other molecular characterization like genetic fidelity testing, DUS testing. Besides, it also suggests to use the SSR markers (STM0031, STM1106 and STM0037) for identification and genotyping of wild potato species.

JK Tiwari, Shashi Rawat, Rasna Zinta, Vinod Kapoor, CM Bist, Shefali Sood & SK Chakrabarti
Understanding the soil health Status through metagenomics

Soil is probably the most complex and heterogenous microbial habitat on earth. Soil microbial communities determine the health of the soil along with the other abiotic factors. Soil is the habitat for the heterogeneous microbial communities which may prove beneficial or harmful to the crop. Hence, it is crucial to decipher and understand the heterogeneous microbial communities present in the soil. It is more important for crops like potato, groundnut and tuber crops where economic part of the crop lies in the soil. With this objective, we studied the microbial communities present in the potato rhizospheric soils using whole metagenome sequencing (indirect molecular approach).

<table>
<thead>
<tr>
<th>Abundance count</th>
<th>% Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaea</td>
<td>6637</td>
</tr>
<tr>
<td>Bacteria</td>
<td>210152</td>
</tr>
<tr>
<td>Eukaryota</td>
<td>758</td>
</tr>
<tr>
<td>Viruses</td>
<td>49</td>
</tr>
</tbody>
</table>

Preliminary analysis reveals the Krona graph showing the microbial diversity (Kingdom to species level) present in the potato rhizospheric soil. The mode of interaction of these microorganisms with potato plant can be understood using the transcriptomics approach and the same is underway to get more insight about the effect of soil microbiota on potato crop.

Hemant Kardile, NK Sharma, Sanjay Rawal, JK Tiwari, Vinay Bhardwaj & VK Dua

Potato halwa premix: Conversion of potato in various value-added processed products may be the best way to tackle the reoccurring glut situations. But in India, potato processing sector is still in the infancy stage. Potato processing sector has the potential to reduce post-harvest losses. Moreover, due to urbanization and modern lifestyle, the demand for ready-to-cook and ready to eat type processed food products is continuously increasing. ICAR-CPRI has developed ready-to-cook type potato halwa premix. Potato halwa premix is fat free, fasting friendly and free from gluten and cooks in less than 5 minutes. Premix have shelf-life of 6 months. This technology is applicable for fresh as well as cold-stored potatoes of all varieties, age and size. From economic point of view potato varieties with high dry matter are more suitable for product preparation.

Potato Daliya and Semolina: Among the different preservation methods drying is commercially accepted and economic for preserving the vegetables and reducing the bulk weight. In this direction ICAR-CPRI has standardized the process for dehydration of fresh potato and particle size of dehydrated potato for their utilization in the form of Porridge/Daliya and Semolina. Potato porridge can be cooked in milk or water and eaten with salt or sugar added. It can be consumed as breakfast or whenever a light meal is required with added fruits or vegetables by the population of all ages. Moreover, potato porridge is a gluten-free alternative of wheat porridge for a population suffering from celiac disease or wheat allergy.
Due fasting friendly properties, its demand will be higher during festive seasons/Navratri, and other occasions where cereals and millets cannot be consumed. The technology involves the use of the whole potato of medium to high dry matter varieties. Potatoes of all size, shape, and duration of storage can be used for making the porridge and semolina. These products have a shelf life of 9 months if stored in a cool, dark and dry place.

Arvind Jaiswal, YK Gupta, Brajesh Singh, Pinky Raigond, Som Dutt & SK Chakrabarti

Development of a sampling plan for cotton whitefly, *Bemisia tabaci* (Genn.) in potato crops

Whitefly, *Bemisia tabaci* (Genn.) is a major threat for seed potato production in India. For its efficient management, the within-plant distribution of *B. tabaci* were explored and a sequential sampling plan was developed for potato crops. Highest proportion of *B. tabaci* adults, nymphs and eggs was found on leaf number 3-7, 6-9, and 2-6, respectively (top to bottom) with minimum corresponding coefficients of variation. The sampling efforts for studies on biology and ecology of *B. tabaci* life stages should therefore, be concentrated on such node positions for maximum efficiency. The average nodal position of the most infested leaf with respect to adults was 4.33 ± 0.52 when crop was 19 days old and increased to 5.83 ± 0.41 when the crop was 55 days old, however the slope of the regression of nodal position of the most infested leaf on crop age was not significant. Further, the adult *B. tabaci* population is randomly distributed among the sample units in contrast to expected aggregated distribution. Therefore, the count of adults from three leaves from three strata in a plant is proposed as a sampling unit for whitefly in potato for taking management decisions.

Md A Shah & Sanjeev Sharma

Application of high-throughput plant phenomics technique for potato

Since share of water for agriculture is likely to reduce substantially, the improvement in productive use of water by crop plants is critical for future food production. Traditional phenotyping methods for identification of such genotypes are not robust to meet the requirement of molecular breeding approaches. Hence high throughput plant phenotyping approaches are emerging to address these limitations. These approaches encompass image based, non-destructive procedures that employ a series of electro-magnetic-radiation (EMR) wavelength bands, sensed by high resolution cameras for capturing plant responses to environmental stimuli.

![Distribution of adults and immature stages of Bemisia tabaci along the main stem of potato in field](image)

The three leaves are selected by dividing a plant into three vertical strata (upper, middle and lower), and one leaf is selected randomly from each stratum. The proposed sample unit yielded adult *B. tabaci* densities that do not differ from the means of absolute density per plant. The sequential sampling plans obtained with Green’s and Kuno’s methods yielded similar average required sample size for adult *B. tabaci*. For example, at a precision level of 0.1, Green’s method required 35 samples at a density of 2 adult whiteflies per plant which is close to Kuno’s method which required 37 samples. The required sample size decreases with increasing whitefly density. The validation analysis using the RVSP software showed a good precision of the sampling plans developed. The current study will enable efficient monitoring for pest management decisions and will aid the study of bioecology of *B. tabaci*.
The event was organized by Indian Science Congress Association during 03-07 January 2019 at Lovely Professional University, Jalandhar, Punjab. Various technologies developed by Institute like Live working model of Aeroponics system along with micro tubers, live samples of popular potato varieties, processed potato products like cookies, potato Dalia, Potato Semolina, dehydrated shreds and cubes etc. were displayed during the exhibition. A large number of distinguished visitors like scientists, foreign delegates, farmers, students, women entrepreneurs and companies visited the stall and showed keen interest in the technologies developed by Institute. ICAR-CPRI stall received overwhelming response from electronic as well as print media. Lead stories were published in Dainik Jagran, Tribune, Dainik Bhaskar, and Punjabi Jagbani newspaper. short documentary of 2-3 minutes was broadcasted by PTC Punjabi, Jagbani channel and All India Radio.

ICAR-CPRI participation in Kisan Mela

ICAR-CPRI participated and put up an exhibition stall during Kisan Mela with the theme “Crop Residue Management”.

Mela was organized by Punjab Agricultural University at Krishi Vigyan Kendra, Nurmahal, Jalandhar on 22nd February, 2019.

Awareness programme on new value-added potato products held at ICAR-CPRI, RS, Jalandhar

For precisely extracting the desired information about the plant phenotype from these cameras, protocols needs to be optimized for monitoring plant growth. Such protocols should maximize reproducibility and reliability of phenotyping experiments for enhancing precision in quantifying variation of plant trait expression. So, it is important to quantify features of both the plant as well as its growth environment that allows expression of desired trait. Hence to standardize methods for phenotyping drought responses of potato we employed automated high throughput phenotyping system. The present work on potato (Kufri Jyoti and Kufri Chipsona 3) has been undertaken at ICAR-NIASM, Baramati (MH) using LemnaTech Plant Phenomics facility. Images acquired using high-throughput visible, infra-red and NIR imaging system with different angles for each potato plant and were analyzed to extract pertinent parameters associated with plant features. These images were further processed using grid developed by LemnaTech software system. The image based parameters of plants like digital biomass, plant water content, plant surface area, canopy temperature etc. explained variation between genotypes for desired trait. High throughput phenotyping method can be used to screen large set of genotypes and genetic improvement for desired trait.

S S Changan, Brajesh Singh, Jagadish Rane, Som Dutt, Pinky Raigond, Mahesh Kumar, Anant Mali, Vidyadhar Konde & Mahesh Shitole.

Transfer of Technology

ICAR-CPRI participated in exhibition during 106th Indian Science Congress

ICAR-CPRI participated and put up an exhibition stall during 106th Indian Science Congress on frontier Science & Technologies Mega Expo “Pride of India.”
Agri-business Incubator of Central Potato Research Institute organized a half day awareness programme on new value-added products from potato developed by the institute at its one of the regional stations situated at Jalandhar on 12th March, 2019. The programme addressed the problem of frequently occurring glut and continuously increasing post-harvest losses in potato. The main emphasis of this program was to create an awareness about the significance and possible business opportunities in new value-added products from potato developed by CPRI, which includes gluten-free potato cookies, fasting friendly cookies, low sodium cookies, fasting friendly potato Daliya, semolina, and low-fat halwa premix. These products may reduce the post-harvest loses and situation of glut in potatoes. Farmers, food processing entrepreneurs, bakery owners from different states of India and students participated in this programme.

Farmers training program on scientific potato cultivation

A three days training programme on “Scientific potato cultivation” was organized by the institute for 20 potato growers of Uttarkashi district, Uttarakhand during 07 to 09 January, 2019. The training programme was sponsored by Reliance Foundation, Uttarkashi (Uttarakhand).

The objective of the training programme was to enhance the knowledge and skills of the trainees about different improved potato technologies developed by the institute. A number of training methodologies like lecture cum discussion, practical sessions, skill demonstration, field visits and video film show, etc were implemented during this training.

Three days training program on scientific potato cultivation

The institute organised a 3 days training programme on “Scientific potato cultivation” for 20 progressive potato growers and two horticulture officers of Aravalli district of Gujarat during 12-14th February, 2019.

The training programme was sponsored by the Directorate of Horticulture, Government of Gujarat. Lecture-cum-discussion, video shows, demonstrations, practical exercises, field and lab visit, etc. were the modes for imparting training to the participants.

Three training programmes organized under Mera Gaon Mera Gaurav

ICAR-CPRI, RS, Modipuram organized one farmers’ training programme in three villages i.e Paswada (Meerut), Mehmoodpur (Hapur) and (Mirzapur) Muzaffarnagar on 21.2.2019, 23.2.2019 and 08.3.2019 respectively under “Mera Gaon Mera Gaurav” in which about 50 farmers each from Paswada and Mahmoodpur and 40 farmers from Mirazpur.

In this programme, information related to varieties, crop improvement, use of soil and chemical fertilizers in crop, processing, Integrated pest management etc. were imparted. Also, scientists provided solutions to the problems of farmers and asked them to come in direct contact with them so as to get solutions instantly. They also stressed upon using organic farming techniques. Beside
that, scientists inspected the front line demonstrations of Kufri Mohan variety and provided feedbacks to all the farmers of three villages for better management.

**Training programme on “Office Procedure & Etiquettes” organized at Gwalior**

A three day training programme was arranged for 30 skilled supporting staff of ICAR CPRS, Gwalior on topic “Office Procedure & Etiquettes” The programme was inaugurated by Head of the station, Gwalior on 25th March, 2019. Lectures were given by faculty members from CPRI and its regional stations on different aspects of office procedure viz., how to apply for leave, RTI rules, Personal Asset management, File management, importance of cleanliness etc. As part of exposure, on 27-03-2019, a tour programme was arranged for these trainees at IISWC, Regional Station at Agra where SSS were made aware about different aspects of soil and water conservation.

Certificates were distributed to the every Staff for their active participation in this programme.

**Training programme on “Potato Production Technology” organized at Gwalior**

A three day training program was organized at ICAR-CPRI, RS, Gwalior during 17-19 Feb, 2019. Training programme was sponsored by Programme Organizer, ATMA, Bhind. A total of 45 farmers participated from Mehgaon Block of Bhind District. All the scientist and technical officers gave the lectures on different aspects of potato production technology which included ware potato production technology, seed production and processing potato production technologies. Varietal suitability for Madhya Pradesh, weed, diseases & pest management in potato crop, their control, management options for irrigation systems followed in potato and repair and maintenance of farm machinery used in potato production were covered during three days training schedule. Farmers were given practical knowledge through field and lab visits. Ongoing farm operations were also shown to farmers. A special programme of “quiz” was organized for farmers and prizes were distributed to winner.

**Field level demonstration and seed village concept programme.**

FLD’s were organized and monitored at Mathura and Gunna for varieties Kufri Lauvkar and Kufri Sindhuri. Seed multiplication at Gwalior and Dabra blocks were organized through seed village concept and monitored by KVK, Gwalior and ICAR-CPRI, RS, Gwalior.

**Hon’ble Union Minister of Agriculture and Farmers’ Welfare visited exhibition stall of ICAR-CPRI**
ICAR-CPRI, Regional Station, Patna participated and put up an exhibition stall during Purvanchal Kisan Mela at Mahayogi Gorakhnath KVK, Gorakhpur during 02 to 03 March, 2019. The function was inaugurated by Shri Radha Mohan Singh, Hon’ble Union Minister of Agriculture and Farmers’ Welfare. He and other VIPs visited the stall of institute and interacted with staffs of the institute about various technologies developed by the institute like potato varieties, processed products, True Potato Seeds (TPS), etc. A large number of farmers also visited the stall and they were made aware about various technologies for scientific potato cultivation. About 500 folders and technical bulletins were distributed among potato growers.

ICAR-CPRI participated in Pusa Krishi Vigyan Mela 2019

ICAR-CPRI, Shimla participated and put up an exhibition stall in Pusa Krishi Vigyan Mela- 2019 at ICAR-IARI, Pusa, New Delhi from 05-07th March, 2019. Various technologies of the institute like live sample of potato varieties, processed products, True Potato Seeds (TPS), minitubers from net house, microtubers from aeroponic system, virus testing kits, etc. were displayed during the exhibition. About 700-800 potato farmers, scientists, agricultural students and extension workers from all over India visited the stall.

Farmers’ Day organized at aspirational district Balrampur of Uttar Pradesh

Under the Kisan Kalyan campaign, the ‘Farmers’ Day’ on improved technologies of potato production was organised in Bhaggaor village of the aspirational district Balrampur of Uttar Pradesh on 15th January, 2019. The latest varieties of potato developed by the institute were demonstrated on 6 farming fields in this village. Fifty farmers took part in this event.

Scientists visited the potato and vegetables field of the farmers and discussed about various problems of the farmers and gave solutions on the spot.

Live Phone-in Programme at Doordarshan

Scientists from ICAR-CPRI, Shimla participated in the live phone-in programmes during January to March 2019. The details of the topics along with experts are given below.

<table>
<thead>
<tr>
<th>Month</th>
<th>Topics</th>
<th>Name of the Expert</th>
</tr>
</thead>
</table>
| January | Potato varieties, planting and fertilizer management in the higher hills of Himachal Pradesh | Dr. Tanuja Buckseth  
Dr. Vinod Kumar |
| February | Potato cultivation, harvesting and storage in lower hills of Himachal Pradesh | Dr. Brajesh Singh  
Dr. AK Sharma |
| March | Management of potato diseases and pests for medium hills of Himachal Pradesh | Dr. Baswaraj Raigond  
Dr. Kailash Naga |

Important Meetings, Events & Visitors

Celebration of National Potato Day and Krishidham Expo 2019

In the direction of increasing farmers’ income by the use of advanced farming techniques, ICAR-CPRI and Indian Potato Association celebrated National Potato Day and Krishidham Expo-2019 from 15-17 Feb. 2019 at ICAR-CPRI, RS Modipuram. Various events like Agriculture exhibition, Potato recipes competition, Kufri Jyoti-Golden Jubilee celebration, session on “World without potato”, Potato pride prize distribution and sugarcane convention organized during this programme. Dr. AK Singh, Deputy Director General (Hort. Sci.) was the Chief
Guest of the opening ceremony. Dr. SM Paul Khurana, Dr. SK Pandey and Dr. BP Singh, Former Directors of ICAR-CPRI, Shimla and Dr. S Mohanty, Regional Director, CIP, New Delhi were the Guest of Honour.

Dr. SK Chakrabarti, Director, ICAR-CPRI, Shimla welcomed all the dignitaries and briefed them about the recent developments in the field of Potato.

Dr. AK Singh, in his address, stressed upon crossing China and making India no.1 world potato producing country and also improving the quality of potatoes and making it profitable crop for the farmers. Winners of various events were also felicitated during this event.

Town Official Language Implementation Committee (TOLIC), Shimla held its sixth monthly meeting

Town Official Language Implementation Committee (TOLIC), Shimla held its sixth monthly meeting in the institute auditorium on 13.2.2019. Thereafter three years Annual Official Language function for the year 2015-16, 2016-17 and 2017-18 was celebrated and prize distribution thereof took place. In the different official language TOLIC, Shimla organized competitions during these three years.

ICAR-CPRI, Shimla won 3rd prize among the Central Govt. big offices of North Zone for the year 2017-18 for best implementing and disposal of Official Language Policy and Rajbhasha works. Institute also won the 3rd prize for the year 2015-16; 2nd prize for the year 2016-17 and 1st prize for the year 2017-18 for the best implementation of Official language policy and disposal of Rajbhasha works from the Central Govt. offices of TOLIC, Shimla. TOLIC, Shimla honoured the institute with Rajbhasha Samman Puraskar for winning 3rd prize among the Central Govt’s big offices of North Zone for the year 2017-18.

Institute’s participation in Bihar Kisan Mela 2019

ICAR-CPRI, Regional Station, Patna participated and put up an exhibition stall during Bihar Kisan Mela 2019 organised by Bihar Agriculture University on 23 to 25 February, 2019. Various technologies of the institute like live sample of potato varieties, processed products, True Potato Seeds (TPS), minitubers from net house, microtubers from aeroponic system, virus testing kits etc. were displayed during the exhibition. A large number of farmers, scientists, professors, NGO members, women entrepreneurs and other stakeholders in agriculture and allied activities visited the stall and they were made aware about various technologies of the institute. The institute bagged third best stall award during the exhibition.

Live Webcast/Telecast of Inauguration of PM-KISAN at ICAR-CPRI, Shimla

On 24th February, 2019, ICAR-CPRI, Shimla organised a live telecast programme for farmers on the inauguration of “Pradhan Mantri Kisan Samman Nidhi Yojana” by the Prime minister of India. The programme was telecasted live in the conference hall of the institute. The Deputy Mayor of Shimla MC, Sh. Rakesh Sharma was the chief guest of the function.
On the occasion Smt. Brij Bala Sood, Councillor, Kanlog ward and Smt. Asha Kashyap, President, Mahila Mandal were also present in the programme. The programme was attended by 90 farmers of district Shimla.

ICAR-CPRI, Shimla participated in Agriculture Science Congress Expo-2019

ICAR-CPRI, Shimla participated and put up an exhibition stall during the 4 days Agriculture Science Congress Expo-2019 at Pusa, New Delhi during 20th–23rd February, 2019.

The event was organised by NASC, New Delhi and IARI, Pusa New Delhi. About 500 delegates from country and abroad visited the stall and they were made aware about various technologies developed by the institute.

International Women’s Day Celebration at ICAR-CPRI, Shimla

The ICAR-Central Potato Research Institute, Shimla organised “International Women’s Day” on 8th March, 2019. The whole staff of the Institute attended the live telecast speech of Hon’ble Prime Minister on the “International Women’s Day” from Varanasi (UP).

In his inaugural address, Dr. SK Chakrabarti, Director, ICAR-CPRI, Shimla briefed the staff about the history of International Women’s Day and emphasised on women empowerment and necessity for development of the country. He asserted on the current year theme of International Women’s Day: Think Equal, Build Smart and Innovate for Change. Chief Administrative Officer and Sr. Finance Officer emphasised on importance of women in day-to-day life and their need in future development of a family. Some women staff of the institute shared their views and experiences during the occasion.

Human Resource

Scientific Promotion

1. Dr. Som Dutt, Sr. Scientist promoted to Pr. Scientist w.e.f. 31.05.2017 in Level-14 (Pre-revised PB 37400-67000 + RGP 10,000/- pre-revised).

Technical Joining


Promotions


3. Sh. Jagdish Chand, Sr. Technician, ICAR-CPRI, Shimla promoted to T-1-3 (Tech. Asstt) w.e.f. 29.06.2006.


9. Dr. Ashok Kumar, Asstt. Chief Tech. Officer, ICAR-CPRI, RS, Modipuram promoted to Chief Tech. Officer w.e.f. 08.05.2018.


Transfers

1. Sh. Pratish Kumar Patel, Technical Trainee relieved from ICAR-CPRI, RS, Kufri on 02.03.2019 to join at ICAR-CPRI, RS, Patna.

Retirements


Death


Administrative Joining

1. Sh. Mohit Oberoi, Steno Grade-III, Division of Social Sciences, ICAR-CPRI, Shimla on 22.03.2019 (FN).

2. Sh. Pawan Kumar, Steno Grade-III, ICAR-CPRI, RS, Patna on 23.03.2019 (FN).

Transfers


Retirements


Skilled Supporting Staff Retirements


ICAR – CPRI NEWSLETTER | JANUARY – MARCH, 2019

From the Director’s Desk

Though potato is a household name today in India, it came to this ancient land only about 400 years ago during Mughal dynasty. After its introduction from Europe in the beginning of 17th century, it remained an insignificant crop till independence, largely because of poor productivity of introduced European varieties that were adapted to temperate agro-climate and were suitable for cultivation in hills of India as summer crop. The Government of India established the ICAR-Central Potato Research Institute in the year 1949 to harness the potential of this promising crop for food security. The institute developed suitable varieties and technologies that virtually transformed the temperate potato crop to sub-tropical one enabling its spread from cooler hill regions to the vast Indo-Gangetic plains as a rabi crop. It triggered a revolution in potato production causing very fast growth in area, production and productivity during next five decades. However, the impact of global warming started manifesting during 1990s and it became imperative that further adaptation of potato from sub-tropical to a tropical crop would be necessary in near future to sustain its cultivation in the plains. Moreover, the food basket of the country will undergo a drastic change due to economic growth, life style change and dietary preference. India would require potato production of about 56.15 and 124.88 million tonnes during 2025 and 2050, respectively. On the other hand, all the natural resources including soil, water, and energy are under severe constraint. Inputs for agricultural production will also become scarcer and dearer with time. It is also imperative that future food production technologies should be carbon neutral and sustainable. Under this background, we have to strike a balance between cutting edge technologies and their environmental cost for sustainable production enhancement of potato. Since its establishment in the year 1949, ICAR-Central Potato Research Institute played a pioneering role in developing varieties and technologies for growing potato under sub-tropical agro-climate. The scientists, students and other staff of the institute are the best in the country for their original thinking, innovativeness, hard work and national commitment. They have the proven capacity to face any tough challenge and I am sure the imminent threat of global warming on sustaining potato cultivation in the vast Indo-Gangetic Plains (IGP) will be met squarely by our hard-working farmer friends with the technology support from ICAR in which ICAR-CPRI would take a lead role. The following work plan is prepared to reorient the course of the institute to develop suitable varieties, production, protection and post-harvest technologies particularly for the vast IGP which is at the threshold of losing potato cultivation due to climate change.

Adapting potato to warmer growing condition: It is predicted that suitable growing period for potato in eastern UP, Bihar, and West Bengal will be not more than 75-80 days as a consequence of global warming. Potato production may decline by 15.32% in the year 2050. To overcome this situation and to satisfy the projected demand, it is necessary to strengthen research work on developing varieties and production technologies for cultivating potato under warmer condition. Research emphasis should be on developing short duration, early-maturing varieties with heat tolerance for both fresh consumption and processing. Concomitantly, safe and sustainable technologies should be developed for heat and water stress management, nutrient management, management of invasive and range-expanding pests and diseases, and cold chain management.

Productivity enhancement: The estimated jump in potato production has to come from productivity enhancement, since availability of additional cultivable land for potato cultivation by the year 2050 would be virtually nil due to unfavorable changes in land utilization pattern. On the contrary, plateauing of yield gain in potato has emerged as a roadblock for achieving productivity enhancement in a sustainable manner. Innovative technologies are immediately required for breaking this yield barrier. Research emphasis should be targeted for harnessing maximum yield potential of potato by broadening genetic base of varieties, improving photosynthetic energy conversion efficiency, conferring
atmospheric nitrogen fixation ability, root biology & architecture for input use efficiency and improving sink strength. Besides, emphasis should be given on diploid breeding to exploit hybrid vigour in potato, which is yet to be exploited. Precision breeding tools such as genomic selection, genome editing, and marker assisted selection should be fully integrated with conventional breeding to break yield barrier in potato.

Sustainable production system: The green revolution during 1960s took the country out of the “ship-to-mouth” existence to a status of food surplus nation. On the other hand, all the natural resources including soil, water, and energy are under severe constraint now. Inputs for agricultural production will also become scarcer and dearer with time. It is also imperative that future food production technologies should be carbon neutral and sustainable. Moreover, income of farmers in real term has not appreciated adequately during recent years causing widespread agrarian distress. Therefore, a paradigm shift is necessary now from the policy of mere food production to income security of farmers. Agriculture is the largest private enterprise in India, consisting of more than 138 million holdings, ~ 85% of which are < 2 ha in size. Most of these family farms are engaged in multiple agricultural activities like agri/horticulture, poultry and livestock rearing, fishery, beekeeping, sericulture, and agroforestry. All our future technologies should aim at addressing the farming system in its entirety instead of particular mandate crop of any institute. Under this background, we have to strike a balance between cutting edge technologies and their environmental cost for sustainable production enhancement of potato. Research emphasis should be given on integrated farming system (IFS) approach for technology development, water use efficiency, nutrient responsive technologies, conservation agriculture, and bio-intensive crop management. Use of ICT-enabled advisories and artificial intelligence (AI) would be encouraged for technology dissemination.

Postharvest management: It is estimated that ~ 2.8-10% in non-perishable, 6.8-12.5% in semi-perishables and 5.8-18% in perishable agricultural products are lost after harvesting in India. It may be much higher (~ 20%) for a perishable commodity like potato that is harvested at the onset of summer season. About 50% of these losses can be prevented using appropriate post-harvest measures. Establishing on-farm primary processing facilities would capacitate small farmers in a big way. The family farmers can be trained to undertake post-harvest processing and packaging of farm produce, preferably on-farm or near to the production site. Such technologies would promote entrepreneurship in rural areas by strengthening forward linkage in agriculture. This would generate additional working days to farm family members, add value to harvest and generate additional income. The following areas will be given thrust for lowering postharvest losses: development of processing varieties and technologies, on-farm storage and primary processing units, energy-efficient storage structure, technologies for cold chipping, managing bruising injuries, and technologies for export facilitation

Integrated pest management and bio-security: Potato is affected by late blight, viruses, bacterial wilt, aphids, and other common soil and tuber borne pests and diseases. Movement of plant pests, pathogens and invasive weeds does not recognize physical and political boundaries. Globalization of commodity and food trade has increased the bio-security risk, which threatens food security of the nation. Pests and pathogens have their strength in number and are capable of adapting to changing climate much faster than our effort to breed new varieties. Keeping in view the future challenges, emphasis on the following areas will be given for effective plant health management: robust diagnostic tools for effective interception of alien invasive pests and pathogens, application of pathogenomics for understanding epidemiology and management, breeding for multiple stress tolerance, use of info-chemicals for integrated pest management (IPM), emphasis on biological control of pests and diseases, and DSS & forecasting for environmental safety.