ICAR–Central Potato Research Institute Newsletter

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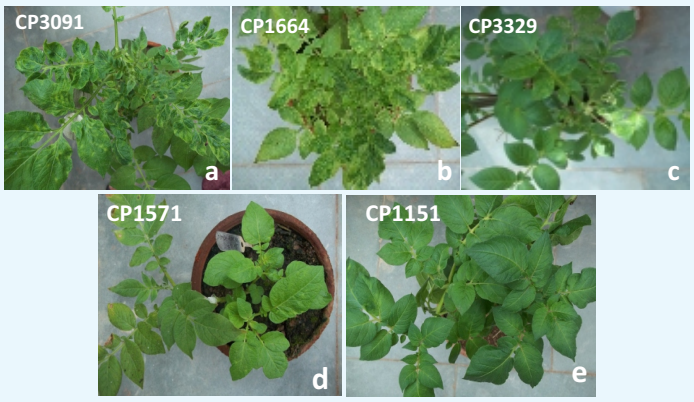
Research Highlights

Screening of potato germplasms for apical leaf curl disease resistance

Apical leaf curl disease (APLCD) caused by a begomovirus, Tomato leaf curl New Delhi virus-potato was initially observed in western UP and later in Haryana. Within the last 15 years, the virus spread to other parts and the occurrence of the disease has increased to significant level particularly in Indo Gangetic plains. Severe incidence in susceptible varieties causes as high as 50 % marketable yield loss. Identification of resistant source is crucial for imparting resistance in cultivated potato varieties through breeding and other molecular approaches. Only one potato variety Kufri Bahar is known to show resistance to APLCD. Hence, in this study potato germplasm accessions were screened for APLCD resistance. Twenty germplasms were planted in triplicates in glass-house and inoculated through grafting along with appropriate controls. During the experiment, the day ambient temperature was maintained above 24 °C and symptom development was observed periodically. The level of resistance varied between germplasms and the symptom expression was categorized as follows: (a) Very severe-mosaic, crinkling, cupping and very small apical leaves (b) Severe-Mosaic, crinkling and small leaves (c) Moderate-mosaic (d) Mild- mild yellow spots and (e) No symptoms. In this study the APLCD symptoms were categorized for the first time. Out of twenty germplasms, four were grouped under mild (CP1992, CP1571 & CP3247) and no symptoms (CP1151) categories and others showed medium, severe or very severe symtpoms. This study indicates the possibility of using grafting technique for screening potato germplasms and existence of resistance in the above germplasms which needs to be confirmed in next season. This work represents the initiation of identification of a resistant source for ToLCNDV-potato. The identified resistant germplasms and resistant grouping can be used for further studies in developing resistant potato varieties.

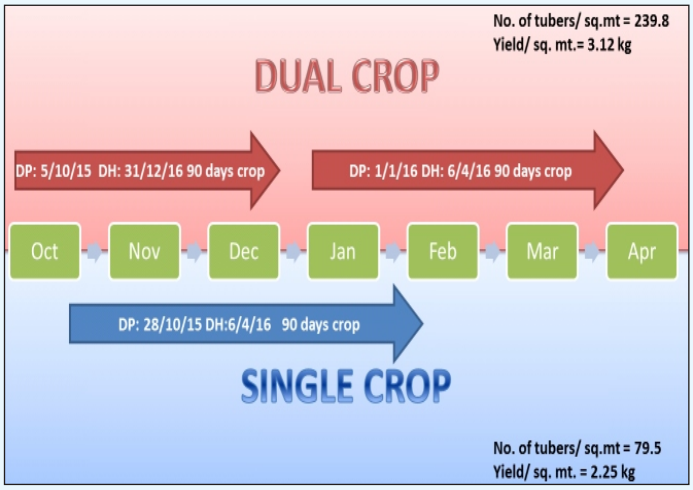


Potato germplasms with different level of APLCD symptoms. (a) Very severe, (b) Severe, (c) Moderate, (d) Mild and (e) No symptoms

A Jeevalatha, G Vanishree, Vinay Bhardwaj, Rajinder Singh, M Nagesh, BP Singh

Dual potato crop under net-house for rapid seed multiplication

Disease-free potato seed is an expensive input in potato production, and also not readily available in required quantity, leading to its very high demand in the country. The north-western plains of India, are identified as quality seed production area in India where tissue culture/aeroponic seed tubers are multiplied, for at least one generation, in the vector-free conditions of net house, from November to January only. However, temperature profile in the north western plains allows about 200 days suitable for growing potatoes from November till April. This period can be better utilized by taking more than one potato seed crop in a single season under vector-free net house conditions, without sacrificing the quality of the seed. Thus allowing better



Dual crop in net house with two plantings from October first week to April first week as against single crop from October last week to February fist week, where DP is date of planting and DH is date of harvesting.

utilization of expensive net house space, costing approximately Rs 80,000 for 500 m^2 area.

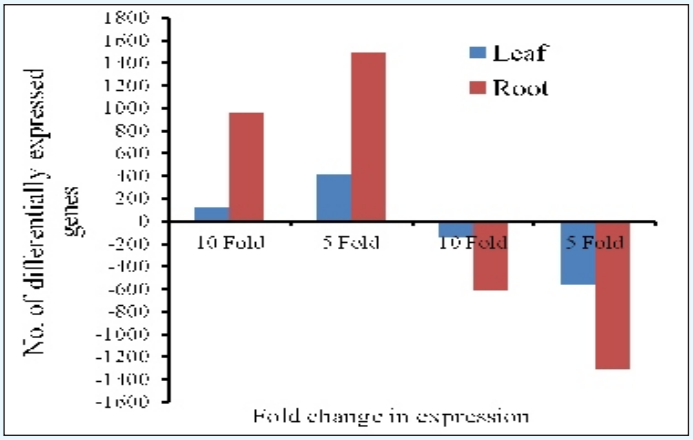
Two crops of six potato varieties namely Kufri Khyati, Kufri Surya, Kufri Chandramukhi, Kufri Jyoti, Kufri Badshah and Kufri Himalini were successfully grown in an experiment conducted at ICAR-CPRS Jalandhar in Rabi, 2015. The comparison made between planting of single crop vs planting of double crop in a season. Observations were taken on per square metre basis and were summed up for the same net house area planted twice in case of double crop. Significant yield and tuber number advantage were observed in double crop as against the single crop, with simultaneous decrease in average tuber weight as expected, due to shorter bulking period in case of dual crop.

A comparative production and economics for seed potato production under the two planting systems was worked out revealing an increase of 1.71 times in production cost, and 3.01 times in tuber production with overall decrease in cost of production from Rs. 3.29 to Rs. 1.88 per tuber under the dual crop over single crop planting. Dual crop holds potential for not only rapid multiplication of seed tubers but also for double cropping of microplants in microplant-based hi-tech seed production system. Intervention in the technology by way of ensuring plentiful and proficient chitting of seed tubers before planting and increase in crop duration of second crop planted in January will further enhance the tuber bulking, increasing weight, vigour and size of seed tubers thus obtained. The technology promises increased overall seed potato production by favourably boosting the rapid multiplication of early generation seed from the available net area.

Ratna Preeti Kaur, Sukhwinder Singh, J S Minhas and Akhilesh Kumar

Potato root transcriptome is more responsive to drought as compared to that of leaf

Drought is one of the major abiotic stresses which affects potato crop adversely and leads to losses in crop yield. Perception of drought signals and subsequent response of plants to the drought has been found to be very complex, not understood completely, and hence need more comprehensive studies. In order to have broader picture of the effect of drought stress on transcriptome dynamics of potato, an experiment was conducted (in controlled environment plant growth chambers). Both, leaf and roots were used for comparative transcriptome sequencing and profiling.



Number of genes up - or - down-regulated in response to drought stress.

Comparative analysis of the leaf transcriptome revealed that in response to drought stress expression of ~120 and 410 genes were found to increase by Ã 10 and 5 fold, respectively. Similarly, ~140 and 560 genes exhibited Ã 10 and 5 fold decrease in their expression in response to drought stress. In case of roots, drought stress resulted in Ã10 and 5 fold increase in expression of ~950 and 1490 genes, respectively. Also, Ã10 and 5 fold decrease in expression was exhibited by ~610 and 1310 genes, respectively.

In case of roots, 29 genes showed Ã100 fold increase in their expression under drought (e.g. Abscisic acid and environmental stress-inducible protein TAS14, Dehydrin DH2a, Glycine-rich protein A3, Protein phosphatase 2C, Heat shock factor protein HSF30, etc.). Forty one genes exhibited Ã 100 fold decrease in their expression under drought (e.g. 1-aminocyclopropane-1-carboxylic acid oxidase, ATP binding protein, Sugar transporter, Early light inducible protein, Abscisic acid receptor PYL4, Peroxidase etc.).

In leaves, only six genes showed Ã100 fold increase in their expression under drought. These are: SNF4, YA3, Abscisic acid and environmental stress-inducible protein TAS14, Embryonic protein DC-8, ATP binding protein and HB1). Only

one gene i.e. “kinesin heavy chain” exhibited 100 fold decrease in its expression under drought. On comparative analysis of the leaf transcriptome at Ã 25 fold change level, 25 genes were found to have Ã 25 fold increase in their expression level under drought. Similarly 23 genes exhibited Ã 25 fold decrease in their expression under drought. These results clearly showed that root transcriptome is more responsive to drought stress as compared to that of leaf. Although many genes showing differential expression in response to drought are already known to play role in plants response to drought, however, several other genes were found to be differentially expressing the role of which are not known in case of drought and hence these genes are the candidates for further experimentations in order to have better understanding of plants responses to drought.

Som Dutt, Brajesh Singh, Pinky Raigond, Maharishi Tomar, Virupasksh U Patil, Joginder S Minhas

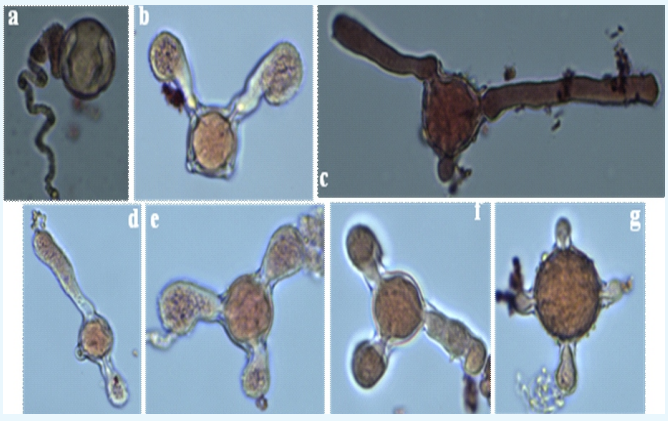
Pollen studies in Kufri Girdhari: A non-fruiting potato cultivar

The cultivated potato Solanum tuberosum L. is an autotetraploid species with a narrow genetic base due to the isolation of the wild species after the introduction and domestication in Europe. Wild Solanum species generally produce abundant and highly viable pollen, whereas, the cultivated species produce little pollen of low viability. This may be because of deleterious nucleus genes common in cultivated potato. As the marketable product is not seed, there is no selection pressure for high fertility in potato breeding programs. In addition, deleterious recessive alleles can accumulate in tetraploid potato cultivars because, they are more easily masked than in diploids. Therefore, variations in pollen production and viability rate between the clones of wild and cultivated species can impair the choice of male parents in breeding studies. One such major problem that resides in the male parent is pollen viability and vigour. Therefore, it is essential to evaluate the viability and vigour of pollen before using it in hybridization studies. The present study was undertaken to unearth the reasons behind non fruiting character of selfed K. Girdhari.

Commonly observed pollen growth abnormalities were stunted, and/or having curly pollen tubes, damaged membranes that allowed the leakage of the cytoplasmic content, including nucleic acids, into the germination medium (50-60%). Pollen with pollen tubes originating from two points on the pollen grain located at 90°, 120° and 180° angles from each other were commonly found (30-40%). Pollens with three pollen tubes and 1f) (5-10%) and four pollen tubes (<5%) were observed in Kufri Girdhari pollens.

The pollen giving rise to four pollen located at 90° angles from each other is the first observation made in potato. Pollen with two pollen tubes or one split tube were frequent in the derived tetraploid Indian potato cultivar Kufri Girdhari. Though, there is extremely higher abnormality observed in pollens of Kufri Girdhari, it may not be concluded as the reason for non-fruit forming as pollens of K. Girdhari forms fruits when crossed with other tetraploid potato varieties. The detail studies to understand the role of self incompatibility or any other similar mechanisms responsible for non-fruit formation is under way through SLF (pollen determinant) and SRNase (stylar determinant) genes.

Vanishree G, U Patil, Rajendra Singh, Hemant B Kardile and SK Chakrabarti



Pollen abnormalities found in K. Girdhari

Transfer of Technology

Extension Functionaries Training on Seed Potato Production and Marketing at CPRIC, Modipuram

A farmers training programme was organized at CPRIC, Modipuram, UP during 18-22 October, 2016. The training was sponsored by SAMETI, Rehmankheda, Lucknow in which a total of 35 extension officers from different districts of UP

participated and benefitted. Director, CPRI Shimla and other scientists from Campus delivered lectures on different aspects of seed potato production and marketing. During the valedictory session, Dr AS Panwar, Director, IIFSR was invited as chief guest. He motivated the trainees to reach farmers with new technologies in order to increase their income

Farmer's Training organized on seed potato cultivation at ICAR-CPRI, Shimla

A farmer's training on "Technology for quality seed potato production" was organized at ICAR-CPRI, Shimla on 17th October, 2016. A total of 33 farmers from Ludhiana district of Punjab participated and benefitted from this training programme. Lecture on different aspects of potato cultivation like planting, irrigation, disease pest management etc were

delivered to farmers by the expert scientists. They were also shown video film on seed potato production and scientific museum of the institute. The training was sponsored by NABARD, Punjab.

Training on scientific potato cultivation organized at Shimla

A one day farmer's training was organized on "Scientific methods of potato cultivation and value addition" at ICAR-CPRI, Shimla on 15th November, 2016. A total of 32 farmers

including women farmers from different villages of Sunni tehsil of Shimla district participated in this training programme. They were delivered lectures on improved methods of potato cultivation, plant protection and value addition in potato.

Model Training Course for Extension functionaries organized at Shimla

ICAR-CPRI, Shimla successfully organized an 8 days Model Training Course on "Disease and Pest Management in Potato" during 5-12 December, 2016. The major objectives of this training was to enhance the knowledge and skills of trainees regarding latest plant protection technologies adopted to manage pest and diseases in potato. A total of 22 Agriculture/Horticulture officers from different State Development Deptt. working in the field of potato R&D participated in this programme. Different training methods viz. lecture-cum-discussion, practical sessions, skill

demonstration and field visits were used during this MTC. Emphasis was given on proper diagnosis of potato disease and pest by various lab methods and their proper management. Field visits to CPRS farm at Kufri-Fagu, and DMR, Solan were also organized during the course.

Kisan Prashn Manch programme at Shimla

A field based extension prohramme "Aloo ki kheti par Kisan Prashn Manch" was organized on 27th October, 2016 by ICAR-CPRI, Shimla at its Kufri centre in collaboration with DD Kisan Channel of Prasar Bharti. All heads of division participated in this programme as experts of potato crop. A total of 35 farmers from Shimla district took part in this programme and got their potato related queries answered by the expert scientists. This programme was later on broadcasted by the DD Kisan Channel for the benefit of farmers.

Live Phone-in Prgramme at Doordarshan

Scientists from CPRI, Shimla participated in the Live-phone programmes on different subjects on Doordarshan from October to December, 2016. The details of the topics along with experts are given below.

Month	Topics (Live phone in on Doordarshan)	Name of the Expert
October	Potato varieties and planting operations in plain areas of HP	Dr. Vinod Kumar Dr. Jagesh Tiwari
Nov.	Intercultural operations and weed management in potato	Dr. Jagdev Sharma Dr. Pooja Chaukhande

Important Meetings, Events & Visitors

National Productivity week 2017 celebrated at ICAR-CPRI, Shimla

Under the National Productivity Council, Ministry of Commerce and Industries, Govt. of India; National Productivity week – 2017 was celebrated across the country

during 12-18 February, 2017 through organization of various training programmes, awareness camp, workshops, seminars etc. On the theme of National Productivity week celebration i.e. "From Waste to profit through Reduce, Recycle and Reuse",

ICAR-CPRI, Shimla organized a training cum awareness programme on 17th February, 2017. All categories of staff from ICAR-CPRI, Shimla participated in this event. At the outset, Director, ICAR-CPRI, Shimla welcome two guest speakers Dr. DP Singh, Project Manager, Municipal Corporation, Shimla and Dr. Ravi Sharma Sr. Scientific Assistant, State Council for Science Technology & Environment, Govt. of HP. In his welcome address Dr. Chakrabarti talked about three R's i.e. Reduce, Recycle & Reuse for waste management & motivated employees of the institute to keep the premises clean by proper adoption of waste management practices. Guest speakers Dr. DP Singh & Dr. Ravi Sharma talked about Plastic & Solid waste management in Himachal Pradesh. They highlighted the achievements of State Govt. through programmes like "Polythene Hatao, Paryawaran Bachao". Concepts of disposal, Recycle & Reuse of municipal waste was also talked about by the speakers. A lot of discussion between participants & trainees took place during the event. About 150 staff of ICAR-CPRI, Shimla participated and were benefitted from this event.

Hindi Pakhwada at ICAR-CPRI, Shimla and its Regional Centres

The Hindi Pakhwara at the institute was organized 14-28 September, 2016 wherein various competitions like, Hindi typing on computer, Noting and Drafting, Hindi essay writing, Vocabulary/translation knowledge on Potato Research, Smaran Shakti, Chitra Kahani and Prashna Manch were held pertaining to Rajbhasha Hindi. Officers and employees of the institute took part in these competitions. Shri Pritam Singh, Principal Income Tax Commissioner and Chairman TOLIC (Town Official Language Implementation Committee) Shimla graced as chief guest on the occasion of closing ceremony held on 17-10-2016. On this occasion prizes were awarded to the winners of different competitions held during Hindi Pakhwara. Besides officers/employees who worked exceedingly well in Hindi during 2015-16 were also awarded with cash prizes.

Besides these activities a day long Hindi workshop on "Tankini Seva mein Rajbhasha ka prayog: Samasyaiyen evam Samadhan" was also organized on 24th December, 2016 where 17 officers/employees were participated and got benefitted. Similar programs related to Hindi language were organized at the regional centers located at Modipuram, Patna, Jalandhar, Gwalior, Shillong, Ooty and Kufri of the institute.

Dr AK Singh, DDG (Horticultural Sciences) visited CPRIC, Modipuram campus

Dr AK Singh, DDG (Horticultural Sciences), ICAR visited CPRIC, Modipuram campus on 5th October, 2016. Joint Director Dr Manoj Kumar welcomed him and briefed him about the Research and development activities being carried at the campus through a power point presentation. Dr Singh visted tissue culture laboratory, Farmers training Hall, plant protection lab and potato processing plant of the campus. He also planted a tree in the campus and interacted with all the staff.

Sh Chhabilendra Roul, Additional Secretary (DARE) & Secretary (ICAR) and Dr. A.K. Singh, DDG (Agri. Ext. & Hort. Sc.) visited CPRI Campus, Modipuram

Additional Secretary (DARE) & Secretary (ICAR) Sh Chhabilendra Roul and Dr AK Singh, DDG (Agricultural Extension and Horticultural Sciences) visited CPRI Campus,

Modipuram on 20 December, 2016. Dr. SK Chakrabarti, Director, CPRI, Shimla welcomed the hounarable guests and gave details of research activities being conducted at the Campus. During their visit guests inspected Potato Breeder Seed Production Unit at Machhari. Director and Joint Director briefed to the guests about various stages of potato breeder seed production, the guests showed their keen interest in the process and they appreciated the contribution of the campus in the meeting demand of potato seed to the country. Thereafter, Secretary, ICAR and DDG visited Tissue Culture Lab, Farmers training Hall and potato processing unit. Secretary, ICAR and DDG took a meeting with Director, CPRI and Staff members of the Campus, Directors and Scientists of IIFSR, Meerut and CIRC, Meerut. Secretary, ICAR discussed in detail about the policies of ICAR for bringing efficiency, compatibility and transparency in the official activities by

implementing electronic methods. He stressed for all the transactions through E-payments methods using online transactions and swipe machines. He also stressed for installing solar panels and maximizing of Non-conventional methods of energy and emphasized on "Swachh Bharat Abhiyan". Dr AK Singh, DDG motivated the Scientists presented in meeting to link the research with progress of farmers by doubling the income of farmers. The meeting ended with the vote of thanks. Secretary and DDG also visited the Indian Institute of Farming Systems Research and Central Institute of Research on Cattle in Meerut and reviewed their research activities.

Human Resource

Scientific

Transfers

1. Dr. Vallepu Venkateswarlu, Scientist (Entomology), CPRI, Shimla to Central Tobacco Research Institute, Rajamundry-26.12.2016.

Technical

Promotions

1. Sh. Madan Pal, Technician, CPRIC, Modipuram promoted as Sr. Technician.
2. Smt. Asha Thakur, Tech. Assistant, CPRI, Shimla promoted as Sr. Tech. Assistant.
3. Smt. Manjit Syal, Tech. Assistant, CPRI, Shimla promoted as Sr. Tech. Assistant.
4. Sh. Ram Singh, Tech. Assistant, CPRI, Shimla promoted as Sr. Tech. Assistant.
5. Sh. Hari Kishore, Tech. Assistant, CPRI, Shimla promoted as Sr. Tech. Assistant.
6. Sh. Yash Pal Sharma, Sr. Tech. Asstt., CPRI, Shimla promoted as Technical Officer.
7. Smt. Madu Bala, Tech. Assistant, CPRI, Shimla promoted as Sr. Tech. Assistant.
8. Sh. Dharminder Kumar Gupta Tech. Assistant, CPRI, Shimla promoted as Sr. Tech. Assistant.
9. Sh. Onkar Singh, Tech. Asstt.(Driver) CPRI, Shimla promoted as Sr. Tech. Assistant(Driver)
10. Sh. Shyam Kumar Gupta, Tech. Officer, CPRS, Gwalior promoted as Sr. Tech. Officer.
11. Sh. Harvinder Singh, Tech. Officer, CPRI, Shimla promoted as Sr. Tech. Officer.

Transfers

1. Sh. Vijay Kumar, Technical Assistant, CPRI, Shimla transferred to CPRS, Jalandhar.

Retirements

1. Sh. Onkar Singh, Sr. Tech. Asstt.(Driver), CPRI, Shimla retired on 31.12.2016.

Administrative

Promotion

1. Sh. HN Sharma promoted to the post of Administrative Officer on 11.10.2017 and he joined at DMR, Solan on 24.10.2017.

Retirements

1. Sh. Dhani Ram, AAO, CPRI, Shimla retired on 31.10.2016.

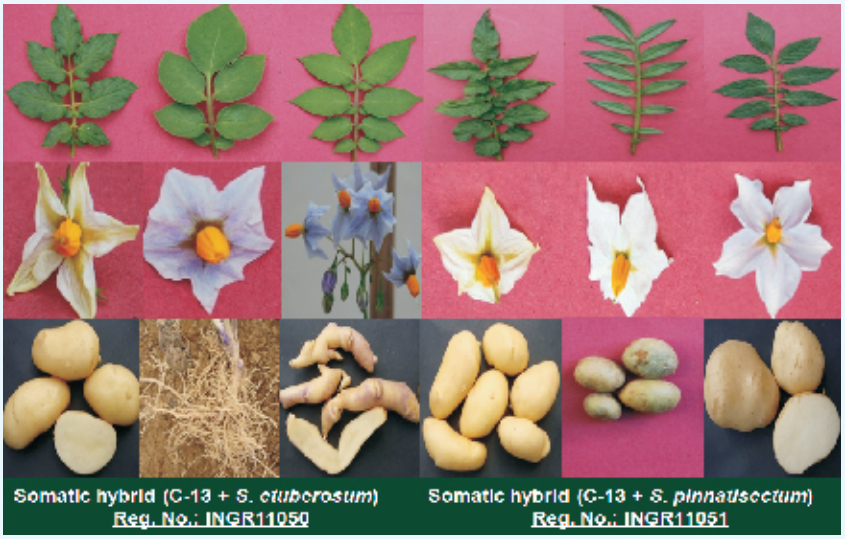
Skilled Supporting Staff

Retirements

1. Smt. N. Rajamma, Skilled Support Staff, ICAR-CPRS, Muthorai (30.11.2016)
2. Sh. Bat Bok Kharir, Skilled Support Staff, ICAR-CPRS, Shillong (31.12.2016)

From the Director's Desk

Potato, being an essential global food commodity, recorded quantum jump in global annual production (270.55 to 381.68 MT during 1961 to 2014), but reached almost to yield plateau (12.4 to 19.9 t/ha) level. In India, it is estimated that domestic demand of potato would be 55 MT in 2025 and 122 MT in 2050. To achieve the projected demand, it would be a herculean task and cannot be achieved through traditional technologies. The complex nature of emerging problems such as especially devastating disease late blight followed by potato virus Y (PVY) and the narrow genetic base of the cultivated potato varieties necessitate applications of cutting-edge technologies to address the issues. To develop tailor-made varieties applying state-of-the-art technologies via harnessing rich genetic diversity present in Solanum species is inevitable approach. Albeit, wild Solanum species are not crossable with common potato due to differences in ploidy number and endosperm balance number (EBN). Biotechnological approaches like somatic hybridization is a tool to subdue the problems of sexual incompatibility via protoplast fusion for any trait of interest to be Introgressed from wild species like resistance to late blight and viruses. Development of interspecific potato somatic hybrids via symmetric protoplast fusion such as Solanum tuberosum dihaploid 'C-13' + S. cardiophyllum for late blight resistance, and C-13 + *S. pinnatisectum* for late blight resistance; and C-13 + *S. etuberosum* for potato virus Y resistance at the institute will certainly be useful in developing potato varieties for resistance to late blight and PVY. This would be helpful to the resource poor farmers to save cost of cultivation by growing resistant varieties which would be developed using these lines as parents in breeding programmes. Moreover, it would reduce the fungicide load on the crop and the environment in general by eliminating indiscriminate fungicidal spray. Further, the infected seed tubers transmit viruses from one to the next growing season and cause a progressive decline in potato yield and quality. In addition, identification of novel genes in somatic hybrids and wild Solanum species deploying biotechnological interventions like allele mining and microarray would help in management of these problems via transgenic manipulation and molecular breeding approaches.



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Assistance: Sachin Kanwar & Suresh Kumar
Phone: 0177-2625073**, Fax:** 0177-2624460**, E-mail:** directorcpri@gmail.com**, Website:** cpri.ernet.in
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