



ICAR-CENTRAL POTATO RESEARCH INSTITUTE NEWSLETTER

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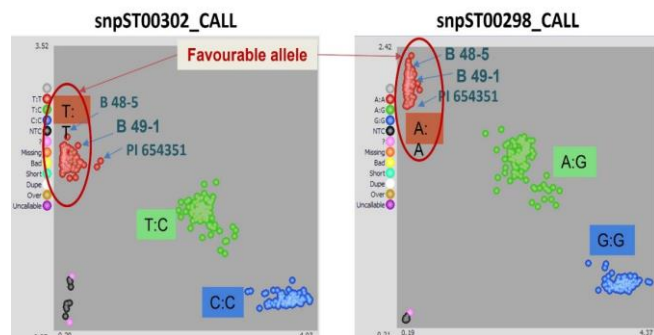
April-June, 2021

Development of improved self-compatible *Sli* gene donor line for inbreeding in diploid potatoes

Globally, significant efforts have been put forward by various potato research and development organizations in the direction of reinventing potato at the diploid level to make it a true seed-based crop rather than a clonal tuber-based crop. However, most diploid species and di-haploids of cultivated potato varieties are self-incompatible. This was the major hindrance until the first identification of the dominant *Sli* gene responsible for self-compatibility in a clone of diploid species *Solanum chacoense* in 1998. This is the key gene for developing inbred lines in diploid potatoes. The original self-compatible *Sli* gene donor line (PI 654351) is however shy flowering and produces small tubers. Therefore, crosses donors attempted between *Sli*

donor lines, BS48-6 and BS49-1 were homozygous for 90% of the total loci while PI 654351 was homozygous for 75% of the loci. The glycoalkaloid content in these two lines was also on the safer side (<20mg/100g). These newly identified elite self-compatibility gene donor lines will be useful in the introgression of the *Sli* gene for self-compatibility in self-incompatible diploid lines along with favourable alleles for fertility and tuber traits during inbreeding.

Salej Sood, Vinay Bhardwaj, Vikas Mangal, Sanjeev Sharma, Babita Chaudhary, Brajesh Singh, R.K. Singh and Manoj Kumar



Tubers of *Sli* gene donor lines a) PI 654351 b) BS49-1 c) BS48-6

Gene and elite self-incompatible diploid potato clones. In the inbreeding generation S₃, we identified two elite self-compatible *Sli* gene homozygous diploid lines (BS48-6 and BS49-1) in *Solanum tuberosum* background. The plants of these two lines are vigorous, flower profusely, show good fertility and berry setting upon selfing and produce 8 -10 medium-size tubers per plant. The flowering, berry setting and tuber shape, size and number were better in both the improved self-compatible lines in comparison to PI 654351. The homozygosity for self-compatibility *Sli* gene was also confirmed in all three lines through 10 SNP KASP markers of the candidate *Sli* gene. We also analyzed the genome homozygosity using 50 SNP KASP markers distributed across all the 12 potato chromosomes. The improved *Sli* gene

Development of Drone Based Potato Crop Management Technologies

Work on cutting edge technologies must be initiated in potato crop for developing production and protection technologies to break the sustainable quality yield barrier. ICAR-CPRI, Shimla has initiated a collaborative programme for use of drone in developing precised crop management technologies in collaborative research with M/s Bayer Crop Science Ltd., India, Thane (West) and M/s General Aeronautics Pvt. Ltd., Bengaluru under a tripartite memorandum of understanding. Necessary approvals have been taken from Director General of Civil Aviation, Ministry of Civil Aviation and local administration. As this crop is vulnerable to large number of insect-pests and diseases which adversely affect the quality and quantity of final produce. So, frequent applications of pesticides are required to achieve targeted productivity in a short span of crop season. Therefore, work on this aspect was given first priority and main objectives were to standardize the dose of pesticides and volume of water for effective management of pests and diseases, and to develop protocols for pest & disease monitoring using drone-based image analysis. First activity of the collaborative project i.e. comparative analysis of conventional vs drone-based application of pesticides, started at ICAR-CPRI RS, Modipuram during January, 2021. Drone application of eight pesticides was done in an area of 1.2 ha and observations on penetration efficiency, pesticide drift, plant coverage and phytotoxicity were recorded using standard protocols.

Higher penetration with fine droplet coverage at all three levels (top, middle & bottom) of the plants was observed in drone-based application of pesticides; whereas, lesser penetration at lower level of plants and bigger droplet size were observed in tractor mounted and battery-operated knapsack sprayers. None of the pesticides exhibited any phytotoxicity up to 10 days of application. However, more drift was observed with drone-based spraying that could be due to fine droplet size and high wind pressure. There was lot of savings on pesticides and spraying volume per unit area as only 23 l of water is sufficient to cover one-hectare area as against of 500-750 l water in conventional spraying. Moreover, time taken to cover one hectare was very less (15 minutes). Initial findings of the current studies indicate that drone-based application of pesticides is safe and can be used on large scale for effective management of potato pests and diseases. In second phase, the application of drone will be utilized for mapping/monitoring weeds, pests and diseases of potato for precision in application of chemicals.



Drone based spray of chemicals

Mehi Lal, Subhash S, Pooja Mankar, Sanjeev Sharma, Sanjay Rawal, Vinay Singh, Manoj Kumar, Bayer Crop Science and General Aeronautics Team

Novel Apical Rooted Cutting (ARC) technology of rapid seed potato production

In India, availability of quality planting material has always been a matter of concern in potato. During the last five decades, seed production has shown a spectacular progress in technology development and production strategies. Seed potato production involving micro-propagation techniques have potential to overcome many of problems associated with the conventional seed multiplication system. The consistent shortage of seed potatoes in most of the potato growing counties can be overcome through the ARC technology due to its robustness, faster rate of multiplication, disease free plants, low input cost and farmers-friendly nature. Recently, this technology has been standardized at ICAR-Central Potato Research Institute Shimla, India for the very first time after 2-3 years of experiments at various locations. The results were remarkable at all locations which suggests that the technology can be used for production of quality planting material at low cost in seed deficit areas. In addition, the use

of healthy in vitro mother stocks, disease diagnostics at seedling stage under net house conditions and reduced number of field exposures are added advantages of ARC system to ensure healthy seed potatoes. Apical rooted cutting technique is an alternative to the current minitubers production system in potato. Cuttings from apical or top portion of the healthy mother plants are excised, transplanted onto soil-based media and allowed for rooting under a hardening chamber. Before that, nursery of mother stock (in vitro plantlets) is raised to prepare cuttings. Rather than allowing direct in vitro plantlets to mature and produce tubers, hundreds/thousands of cuttings are produced from the healthy mother plant in a phased manner. Once apical cuttings are rooted, they are transplanted into the field or net-house to produce seeds (tubers). ARC works on the principle by removing the apical portion from potato plant, auxin particularly IAA (Indole-3-Acetic Acid) concentration gets lowered which allows the lateral buds to grow and produce new shoots. Once the apical dominance is removed from the plant, elongation and lateral growth is promoted and the lateral buds grow into new branches which are further used to increase the multiplication rate of potato plants. Apical rooted cuttings have the potential.



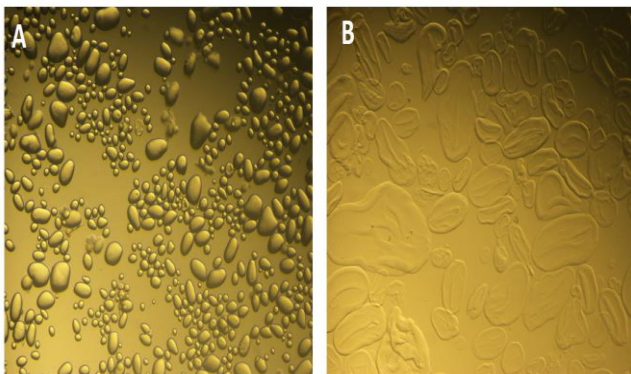
Different stages of ARC at CPRS Jalandhar

to transform potato seed systems. The rapid and high rate of ARC multiplication technique will significantly contribute to meet the demand of seed potato in the country. This will reduce the number of field exposures as well as shorten the time gap between variety release and further seed supply to the farmers. Additionally, it offers the potential to improve production and reduce production costs as compared to the conventional as well as cost-intensive aeroponics methods.

Tanuja Buckseth, Rajesh K Singh, Clarissa Challam, Jagesh K Tiwari, SK Chakrabarti, AK Singh, Vinay Singh, RP Kaur, Ashwani K Sharma and Manoj Kumar

Modified technique for production of granular cold-water soluble potato starch (CWSPS)

The starch, inexpensive, renewable and biodegradable polymer, is biosynthesized as semi-crystalline granules comprising of two glucosidic macromolecular components: amylose and amylopectin. Although there are various applications for native starch, its industrial usage is limited due to the some unfavorable characteristics such as poor solubility in cold water, tendency to retrograde and high viscosity once it is gelatinized. Alcoholic-alkaline treatment of native potato starch results in granular cold water-soluble starch. The nature of structural alterations occurred in starch due to the treatment is however relatively vague.



Light microscope images of native potato starch (A) and cold water soluble potato starch (B)

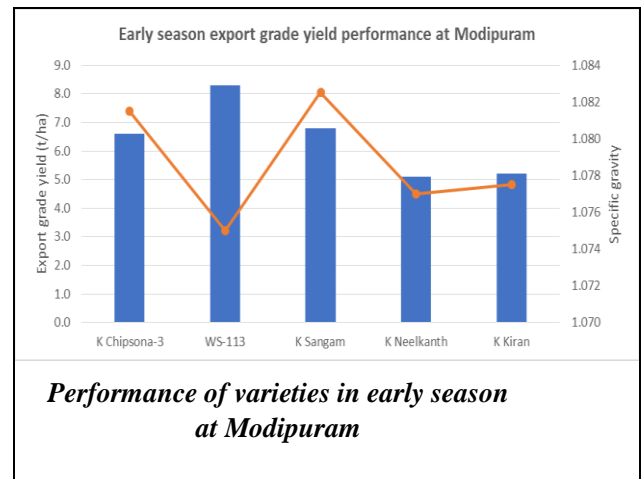
Potato starch was treated at various alcoholic-alkali conditions and subjected to light microscopy. Results showed about 100% solubility of potato starch in cold water.

Sushil S. Changan, Brajesh Singh, Som Dutt, Pinky Raigond, Arvind Jaiswal, Dharmendra Kumar, Milan Kumar Lal, Asha Thakur, Vandana Thakur

The export perspective of early and main-season potatoes from Uttar Pradesh

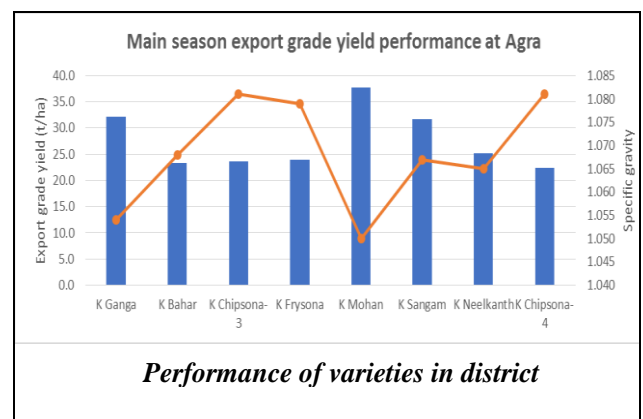
Uttar Pradesh, particularly its western region, has better export potential for the premium early potato segment as leading Indian exporters are demanding export-grade tubers (>55mm) during January to tap the deficit period in the international market. For this, a field experiment was conducted in the early crop season with five promising varieties/ advanced hybrid viz., Kufri (K) Sangam, K Kiran, K Neelkanth, K Chipsona-3, and WS/07-113. The crop was raised for 75 days during September- December 2020 and harvested in the second week of January 2021. Grading was done by the exporters strictly as per standard export parameters. Advanced hybrid WS/07-113 (8.27 t/ha) recorded the highest export-grade tuber yield, followed by K Sangam (6.80) and K Chipsona-3 (6.57 t/ha). Maximum specific gravity was attained by cv. K Sangam (1.083), closely followed by K Chipsona-3 (1.082) and hybrid WS/07-113 had a specific gravity value of 1.075. Exporters showed keen interest in cv. K Neelkanth with 5.02 t/ha export- grade tuber yield and specific gravity of 1.077. Newly released cv. K Kiran had 5.20 t/ha export-grade yield,

very shiny tubers and specific gravity (1.078) was also in an acceptable range. As exporters required potatoes in January, crop durations may easily be increased to 85-90 days to achieve higher yields. Performance of varieties and feedback of exporters indicate that the western part of UP has good export potential for early-season potatoes.



Performance of varieties in early season at Modipuram

For the export promotion of Indian potatoes during the main season, field evaluations were carried out at two locations in district Agra with eight varieties viz., K Ganga, K Bahar, K Frysona, K Mohan, K Sangam, K Neelkanth, K Chipsona-3, and K Chipsona-4. More than 30 t/ha of export-grade tuber yield was observed in cv. K Mohan, K Ganga and K Sangam. These cultivars had specific gravity values of 1.050, 1.054, and 1.067, respectively. Variety K Neelkanth also attained a good quality export-grade yield (25.1) and satisfactory specific gravity (1.065). Efforts are ongoing to identify potential varieties suitable for specific destinations in the international market and developing production and protection technologies complying with the GlobalGAP standards.



Performance of varieties in district

Pooja Mankar, Sanjay Rawal, VK Gupta, SK Luthra, Devendra Kumar, Mehi Lal, Subhash S, Sanjeev Sharma, Pinky Raigond, VK Dua and Manoj Kumar

A novel protocol for infecting potato with mycorrhiza

Mycorrhizae denote as “Fungus-root” is a term used to describe the symbiotic association between plant roots and fungi. Widespread in nature, mycorrhizae have been grouped into various types, of which most common is the Arbuscular mycorrhizal fungi (AMF) which belongs to the order Glomales. AMF colonize most of the vascular plants (more than 80% of plant species). This association play a pivotal role in nutrient acquisition as it creates an intimate link between plant roots and soil. Also known as nature’s bio-fertilizers, they are one of the most important plant symbionts. The following modified protocol developed for mycorrhizal infectivity in potatoes because potato has the different root system which needs different concentration of reagents at different time interval. The mycorrhizal infection could be effectively introduced in different saples with the range of 40% to 71% infestations.



Dharmendra Kumar, AK Choudhary, Jagdev Sharma, VK Dua, Name Singh, Som Dutt, Pinky Raigond, Sushil S Changan, M K Lal, RK Tiwari and Brajesh Singh

Refinement in tuber indexing methodology for potato

Tuber indexing is an important step in nucleus seed production through conventional method. It is a process of testing a single scooped eye out of a 4-clone set belonging to Stage I tubers for virus freedom using PCR and ELISA techniques by growing their eye plugs under net house/glass house. In existing method plantlets are raised from scooped eyes from the freshly harvested tubers after giving dormancy breaking treatment in pots filled with soil and testing the leaves for different viruses in the hot months of April-June in plains. It requires a lot of poly house space, time, labour and off-course there is risk of failure of plantlets due to soft rot and other soil borne diseases to high temperatures. As such, not only the reliability of results gets

reduced but only 60—70% of the clones are effectively tested for the disease.

Keeping all these problems in view, a modified method of growing plantlets from scooped eyes was developed at CPRS, Jalandhar. The sprouts were simply excised out of sprouted tubers using a sterilized scalpel and planted in plastic cup filled with sterilized medium under artificial growth conditions under white fluorescent lights, $22 \pm 2^\circ\text{C}$ temperature and 16 hour photoperiod. Two soilless media was tried, first one is cocopeat, perlite and vermiculite in 3:1:1 ratio (M1) and second one was sterilized foam of particular density (M2) and compared with soil media (M3). Nutritional requirements of plants were fulfilled with CPRI aeroponic nutrient solution with 1.0 EC and 5.8-6.0 pH in all treatments. Response of the five varieties Kufri Mohan, Kufri Khyati, Kufri Chandramukhi, Kufri Surya and Kufri Gaurav were evaluated under this system. Shoot length after 10 days was 7.28 cm, 7.24 cm and 2.86 cm in M1, M2 and M3, respectively. Number of leaves after 10 days were observed to be the maximum in M2 followed by M1 and



*A) Plants of K. Khyati from scooped eyes after 20 days
B) K. Surya after 15 days (in soil media v/s Foam) C) K. Gaurav plants in cocopeat based media v/s foam as media (15 days)*

minimum in M3. In comparison with soil media, shoot length at 20 days was recorded 2.9 times and 3.06 times in cocopeat based media and foam media, respectively. In traditional pot method, the stage suitable for virus testing (6-8 leaf stage) can be achieved only after 6-7 weeks after planting. But in this modified method plants are ready in 20 days (8-9 leaves) only with almost 100% emergence and with minimal care. The most significant advantage of the technique is that the testing conditions are controlled excluding the unpredictability arising due to appearance of diseases under hot weather conditions. Using the technique testing time can be easily be delayed until natural sprouting is attained, excluding the role of chemicals for dormancy breaking along with better phytosanitary conditions as it is soilless cultivation. Based on these observations, both the media are found useful for indexing of tubers for disease free seed production.

Sugani Devi, R P Kaur, Sukhwinder Singh, A K Singh and Raj Kumar

Live Phone-in Programme at Doordarshan

Scientists from ICAR-CPRI, Shimla participated in the live phone programme during April-June, 2021. The detail of the topic alongwith experts are given below:

Month	Topic	Name of the Expert
April	Potato Varieties and potato Sowing in high hills of Himachal Pradesh	Dr. RK Singh Dr. Ashwani Kumar Sharma
May	Inter culture operations in potato in higher hills of Himachal Pradesh	Dr. VK Dua Dr. Jagdev Sharma
June	Potato Storage and marketing in Mid hills of Himachal Pradesh	Dr. Brajesh Singh Dr. NK Pandey

Human Resource

Scientific

Retirement

- Er. Sunil Gulati, Scientist (SG), ICAR-Central Potato Research Institute, Regional Station, Jalandhar retired from Council's service w.e.f. 30.06.2021 (AN).

Technical

Promotion

- Sh. Rajdeep Bux, Sr. TO, ICAR-CPRI Shimla, promoted to ACTO from 14.10.2019.

- Sh. Kana Singh Chauhan, Sr. TO, ICAR-CPRI Shimla promoted to ACTO from 27.03.2020.
- Dr. Sanjay Kumar Sharma, Sr. TO, ICAR-CPRI RS, Gwalior promoted to ACTO from 14.05.2019.
- Dr. Sanat Kumar, Sr. TO, ICAR-CPRI RS, Modipuram, promoted to ACTO from 16.05.2016.
- Dr. Sushil Kumar, ACTO, ICAR-CPRI, Shimla promoted to CTO form 01.01.2020.

Transfer

- Dr. Kapil Kumar Sharma ACTO transferred from ICAR-CPRI Kufri-Fagu, Unit to Crop Production Division, ICAR-CPRI, Shimla, joined on 16.04.2021.

Retirement

- Sh. Ram Dass Rai, Tractor Driver, ICAR-CPRI RS, Shillong, retired on 30.04.2021(AN).
- Sh. Omvir, Sr. TO, CPRI RS, Modipuram, retired on 30.06.2021(AN).
- Sh. V Rajendran, TO, ICAR-CPRI RS, Ooty, voluntary retired on 31.07.2021(AN).

Death

- Sh. PR Khongbuh, Ex-TA, CPRI RS Shillong, expired on 15.06.2021.

Administrative

Promotion

- Sh. Sandeep Singh Dudi, Admn. Officer, CPRI, Shimla relieved from ICAR-CPRI, Shimla w.e.f. 30.06.2021(A/N) to join the post of Under Secretary, ICAR, New Delhi on promotion.

Death

- Sh Jaspal Singh, Admn. Officer, ICAR-CPRI RS, Modipuram has expired on 08.05.2021.

Skilled Supporting Staff

Promotions

- Sh. Akhilesh Singh, SSS, ICAR-CPRI RS, Patna promoted to the post of T-1 w.e.f. 15.6.2021.

Retirements

- Sh. Charan Dass, SSS, ICAR-CPRI, Shimla retired on 30.4.2021 (AN).
- Sh. Mansa Ram, SSS, ICAR-CPRI, Shimla retired on 30.4.2021(AN).

Death

- Smt. Tellinora Kurkalang, SSS, ICAR-CPRI RS, Shillong has expired on 23.5.2021.

From the Director's Desk



Azadi Ka Amrit Mahotsav' festival celebrates the rapid strides that India has taken in the past 75 years. This festival encourages all to rediscover our hidden strengths and prompts us to take sincere, synergistic action to regain our rightful place in the comity of nations. As per the instructions of Government of India for celebration of 75th year of India's Independence as *Azadi Ka Amrut Mahotsav*, ICAR-CPRI Shimla has planned various celebrations and campaigns around identified activities and events on the policy initiatives and major technological achievements of the Council and the Institute that have impacted nation's growth story-domestically & internationally. An intensive countrywide campaign is being organized focusing on citizen participation to make it a 'Jan andolan', where small changes or awareness camp, at the local level, will add up to significant national gains. Events like World Food Day, World Soil Day etc. are being organized in the institute during this mahotsav. It is planned to involve community participation, social and cultural events, in order to create awareness amongst masses about the scientific achievements and technological advancements of the Council and our Institute. Institute & its Regional Stations has organised major activities for the commemoration of 75th year of India's Independence including *kisan goshtis*, online webinar, farmers' trainings for women agriculturists, *swachhta campaign* in adopted villages under MGMG programme and exhibitions showcasing latest technologies developed by the Institute. Apart from these, Institute has also planned to organise many mass awareness campaigns on specific themes including lectures from eminent scholars under the theme '75th Years of India's Independence and Agriculture' during 2021-22.

Compiled and edited by: Brajesh Singh, Jagesh K. Tiwari, Aarti Bairwa, Dalamu, Tanuja Buckseth

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