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## Research Highlights

### Kufri Thar-3: A water use efficient variety for Indian plains

Kufri Thar-3 is a high yielding medium maturing white tuber variety for table purpose. Most striking feature of this hybrid is that it is water-use efficient. It was tested along with other water use efficient medium maturing hybrids in multi-location trials under the All India Coordinated Research Project (AICRP). This variety was recommended for release for Transgangetic plains, Upper Gangetic plains and Eastern plateau and hills region because of its better yield performance under water stress and better water use efficiency than controls. The variety possesses moderate tuber dry matter 17.9% which is better than control variety Kufri Pukhraj. The variety has good keeping quality under ambient storage conditions. The variety produces a greater number of tubers per plant as compared to control varieties used in the trials with an overall mean increase of 22.07% in the number of tubers.

| Location/year | Water requirement (in liters) per kg of tuber produced for | | Water saving (in liters) by Kufri Thar-3 per kg tuber |
|---|---|---|---|
| | Kufri Thar-3 | Best control | |
| Modipuram (2017-2018) | 68.4 | 67.7 | -0.7 |
| Raipur (2017-2018) at 75 days | 138.8 | 202.1 | 63.3 |
| Raipur (2017-2018) at 90 days | 148.4 | 223.9 | 75.5 |
| Hisar (2018-2019) at 75 days | 74.0 | 107.3 | 33.3 |
| Hisar (2018-2019) at 90 days | 63.6 | 124.1 | 60.5 |
| Modipuram (2018-2019) at 90 days | 57.5 | 54.2 | -3.3 |
| Raipur (2018-2019) at 75 days | 119.0 | 156.0 | 37.0 |
| Raipur (2018-2019) at 90 days | 166.7 | 206.9 | 40.2 |
| Average | 104.55 | 142.8 | 38.2 |

*Water requirement and water saving by Kufri Thar-3 per kg*

The overall water use efficiency (quintals tubers produced/mm) of this variety (1.406) was 26.4% higher as compared to control (1.112). Based on the mean of all trials Kufri Thar-3 saved 38.2 liters per kilogram of tuber produced which is 26.8% less water requirement than control.

*Raj Kumar, GS Kang, Name Singh & Manoj Kumar*

### Breeding data digitization for improving genetic gains in potato breeding

Digitization of potato breeding data and trials is being undertaken for ease of handling, access, analysis, interpretation, future reference and enhancing the selection efficiency for high genetic gain in potato breeding under the ICAR-BMGF project. To digitize the breeding data initially a list of potato parental lines comprising 2680 accessions was uploaded in the breeding management system (BMS) with the help of ICRISAT. All the potato breeders can access the database, design crosses, advance clonal generations, and prepare trials using BMS. A multi-location trial on processing potato genotypes under AICRP was prepared using BMS in winter 2019-20 and implemented in 12 AICRP locations. The handheld devices for the recording of data were provided to all the scientists in-charge of 12 AICRP locations. The Institute as well as AICRP scientists were trained on the use of handheld devices and Field Book application for digital data recording of trials. Every year the new parental lines can be added in the BMS software and used for breeding nurseries and trial generation. This year 24 parental lines list was added in the BMS for multi-location AICRP trials generation in BMS. All AICRP potato

trials were generated using BMS in the year 2020-21. The barcode labels were also generated for two AICRP trials and sent to all the locations. The data collected from different trials will be filled in BMS excel trial formats by respective breeders and will be imported back into the BMS for further analysis.

*Salej Sood, Vinay Bhardwaj, Vinod Kumar, Vijai Kishor Gupta, Dharminder Verma & Manoj Kumar*

## Production of industrially used glucose syrup from potato starch

Starch is a major polysaccharide found in potatoes. It is generally made up of two molecules i.e. the linear amylose and the branched amylopectin. There are two types of linkage present in starch structures viz. $\alpha$-1,4 and $\alpha$-1,6 glycosidic linkages. The breakdown of the $\alpha$-1,4 and $\alpha$-1,6 linkages to small units of glucose is made possible by the actions of $\alpha$-amylase and glucoamylase enzymes. Starch is generally used as a raw material for the production of various industrially used sweeteners like glucose, maltose, fructose syrups which have wide applications in sugar, brewing, juice, textile pharmaceutical industries etc.


*Glucose syrup made from potato starch*

The breakdown of starch to glucose units can be achieved through either chemical or enzymatic hydrolysis. The conversion of starch to glucose involves gelatinization, liquefaction and saccharification steps. We have achieved about 81.13% of starch to glucose conversion by using the enzymatic hydrolysis method.

*Sushil S Changan, Dharmendra Kumar, P Raigond, Som Dutt, Milan Kumar Lal, Asha Thakur & B Singh*

## SM/11-120: Promising potato clone highly resistant to PCN and late blight

Hybrid, SM/11-120 is a promising clone highly resistant to both the species of potato cyst nematode (*Globodera rostochiensis* and *Globodera pallida*), resistant to late blight disease (*Phytophthora infestans*) and showed resistance/non-preference to white fly. The hybrid has been developed through biparental crossing between CP 2379 and Kufri Himalini. Kufri Himalini is a medium maturity adapted variety with good tuber attributes and is moderately resistant to late blight. CP 2379 is an advanced exotic line resistant to late blight and PVY. The clone was selected from the segregating population for late blight resistance under controlled conditions through artificial inoculation in year 2012. The clone was subsequently multiplied for tuber increase and evaluated for field resistance to late blight, potato cyst nematode, whitefly and agronomic superiority.

| Hybrids/ controls | Globodera rostochiensis | | | G. pallida | | |
|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2020 | 2018 | 2019 | 2020 |
| SM/11-120 | HR | HR | HR | HR | HR | HR |
| K. Girdhari | S | HS | HS | S | HS | HS |
| K. Himalini | S | HS | S | S | HS | S |
| K. Jyoti | S | HS | HS | S | HS | HS |

*PCN resistance of advanced hybrid, SM/11-120 under controlled conditions*

The clone is highly resistant to PCN, resistant to late blight, whitefly and exhibited high yield with medium to late maturity. It produces round yellow

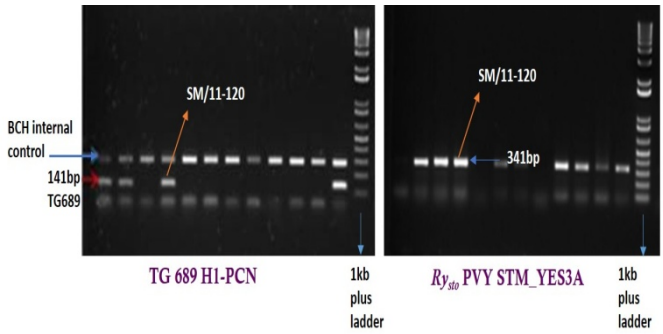
pink tubers with medium deep eyes and light yellow flesh. The hybrid SM/11-120 did not observe even a single cyst of both the PCN species in the root balls during three years of evaluation under controlled conditions. The hybrid also showed the least preference to whitefly under choice assay. Besides, the hybrid is resistant to late blight and has shown agronomic superiority over best controls at Kufri. With these parameters, SM/11-120 is an exceptional hybrid/parental line suitable for PCN, late blight and whitefly resistance breeding in developing new potato varieties.

In advanced generation yield trials, SM/11-120 consistently out yielded all the controls for total and marketable tuber yields at 100-120 days crop duration at Kufri. The hybrid out yielded the control variety, Kufri Girdhari by a margin of 71.6%, Kufri Himalini by 68.75% and Kufri Jyoti by 238.5% for total tuber yield over the last 4 years. During three years of evaluation under controlled conditions the hybrid observed highly resistant reaction to both *G. rostochiensis* and *G. pallida* and not even a single cyst of both the species of PCN was observed in root balls of the hybrid.

*Screening for PCN resistance. No cysts on the roots of genotype, SM/11-120 (Left), Cysts of both species present in the roots of Kufri Jyoti (right)*

The hybrid possesses a consistently high level of resistance against late blight over the years which was at par to best control Kufri Girdhari. The mean AUDPC for four years in SM/11-120 was 19.8 whereas the best control variety, Kufri Girdhari recorded a mean AUPDC of 18.4, which much lower than other control varieties viz., K. Jyoti (1654.2) and K. Himalini (789.7).

Molecular markers data also supported its resistance to PCN as the hybrid showed a resistant band for *H1* gene markers TG689 and 57R specific to *G. rostochiensis* and *Gpa2QTL* markers *Gpa2-1* and *Gpa2-2* specific to *G. pallida*. The hybrid also showed a resistant band for late blight (*cLET5E4_R3, R1-CosA*) and PVY (*YES3A* and $Ry_{adg}$) resistant genes.




*Screening of hybrids and controls for PCN and PVY resistance genes using linked markers*

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## A Success Story of Kufri Himalini in West Bengal

West Bengal is the second-largest producer of potato in India next to U.P. During the last five years the annual average production of potato in West Bengal varied between 11-13 million tonnes. The total area under potato cultivation has increased from 3 lakh to 4.22 lakh hectares. In West Bengal, three main varieties cultivated are Kufri Jyoti, Kufri Chandramukhi (KCM) and Kufri Pukhraj. Kufri Jyoti is cultivated in more than 80% of the total area under potato followed by KCM (10%) and K. Pukhraj (10%). But continuous cultivation of this single variety K. Jyoti since the 1970s has made the variety late blight susceptible and gradually started degenerating. Therefore, the production of K. Jyoti can't be increased furthermore to reach the national target. Therefore, the scientists attached with AICRP on Potato, BCKV, ICAR- CPRI, Shimla took up a program to replace Kufri Jyoti with a variety that has higher productivity than K. Joyti, late blight resistant, having good storability and above all good to taste. All these criteria were found in Kufri Himalini.

Kufri Himalini was first introduced in the AICRP trial at BCKV, Kalyani center during the 2012-13 crop season and recorded 38.50 t/ha yield which was

37.11% higher over Kufri Jyoti (28.08t/ha). Thereafter, in subsequent years i.e. 2013-14, 2014-15, 2015-16, 2016-17 and 2017-18 Kufri Himalini recorded 34.1, 31.8, 29.7, 29.9 and 34.7% increase in yield over Kufri Jyoti, respectively. As far as late blight is concerned no late blight was observed in Kufri Himalini.

After observing the merit of K. Himalini in AICRP trial the variety was brought under on-farm trial at Khanyan and Dhaniakhali during 2013–14 crop season in Hooghly District of West Bengal. At Khanyan the trial was conducted by a progressive farmer Ranjan Das. He conducted this trial for 3 consecutive years, like 2013-14, 2014-15 and 2015-16 crop season. It was observed that in all three years he got 25.00%, 29.43% and 25.98% more yield than Kufri Jyoti respectively. During these years no late blight was observed in this variety.

Likewise, Pranab Pal of Dhaniakhali, Hooghly conducted the trial from 2015-16, 2016-17 and 2017-18 crop season and in all the three years he got the yield of 40.00, 39.50 and 40.50t/ha respectively and the yield was 33.33, 36.20 and 26.56 % more than


Kufri Jyoti. Here also no late blight was observed in this variety. By observing the success of Shri Ranjan Das and Pranab Pal, other farmers in their area became interested and they also started cultivating Kufri Himalini. Gradually the message started spreading to district Burdwan also. Starting from only 10 bigha in 2015-16 the area under Himalini cultivation has increased to 200-250 bigha during 2018-19 crop season in Hooghly district. Likewise in Burdwan also more than 200 bigha of land has been brought under the cultivation of Himalini. The variety was also been tried in other districts like Bankura, West Midnapur and Jalpaiguri. In all the cases the seed martial was supplied by AICRP on Potato, BCKV, Kalyani center.

At last, the variety Kufri Himalini was marketed in March, 2018 by its name at Saptaparni market, Kalyani, Nadia with the help of members attached with AICRP on Potato, Kalyani. It was observed that the persons who purchased the variety again enquired about the variety the next day and this was due to its good taste. The variety fetched a higher price than Kufri Chandramukhi which is the most popular and costly variety in west Bengal. Therefore, it was observed that the variety had a good market also and this news was covered by the daily leading newspaper of West Bengal.

Now Himalini is growing in a large area of Hooghly like Tarakeswar, Haripal, Dhaniakhali, Pundua Singur, Pursura, and Jamalpur, Memari-1, Memari-2 in Burdwan, Garbeta and Chandrakona in West Midnapur. The Govt of West Bengal started procuring breeder seed material of this variety from ICAR- CPRI, Shimla. In 2017-18 and 2018-19 Govt. of West Bengal procured 18.50 and 46.10 quintals of breeder's seed for its large-scale multiplication..

***A. Chakraborty, S.K. Das, A. Sarkar & V.K. Dua***

## Transfer of Technology

### Mobile Based Advisory under Mera Gaon Mera Gaurav

During the period as many as 18 mobile base advisory to the farmers was sent through SMS regarding time to time various operations required in the subject matter area in crops grown. A total no. of 3253 farmers were covered through this service.

### Awareness program on systems for rooftop/ kitchen gardening

CPRI-Agribusiness incubator (ABI) cell organized a 2

days awareness program on systems for rooftop as well as backyard kitchen gardening during 17-18 July 2020 at ICAR-CPRS, Jalandhar. The main objective of this program was to create awareness on necessity, available technologies, and possible business opportunities related to rooftop/ backyard

kitchen gardening.

As we know that many vegetable producers apply overdoses of various harmful pesticides and sell their produce in the market without recommended waiting period. Several scientific reports indicate that prolonged consumption of such type of vegetables/fruits may impose serious health concerns in humans as well as animals. In this awareness programme about 40 participants took interest and unanimously appreciated the importance and necessity of home grown vegetables. Participants were given a chance to see variety of vegetables and various type of systems for rooftop gardening. After a fruitful brainstorming discussion with the participants a society and a social media WhatsApp group "Rooftop Vegetabling" was created for future discussions, sharing innovative ideas, advancements and other information among the rooftop vegetable growers. Additionally in future ABI cell will attempt to incubate some youngsters who may establish small businesses for supplying inputs like media, troughs, seeds, hand tools, trellising system and other inputs related to roof top vegetable gardening.

## Live Phone-in Programme at Doordarshan

Scientists from ICAR-CPRI, Shimla participated in the live phone programme during July-September, 2020. The detail of the topic alongwith experts are given below:

| Month | Topics | Name of the Expert |
|---|---|---|
| July, 2020 | Potato storage and Marketing in the mid-hills of HP | Dr. NK Pandey<br>Dr. Brajesh Singh |
| August, 2020 | Disease and pest control of potato in high hills of HP | Dr. Ravinder Kumar<br>Dr. KC Naga |
| September, 2020 | Inter culture operations in potato in high hills of HP | Dr. AK Sharma<br>Dr. Vinod Kumar |

## Important Meetings, Events & Visitors

### CPRI celebrated its 72nd Foundation Day

ICAR-CPRI Shimla celebrated its 72nd Foundation Day on 9th September, 2020. Due to COVID-19 the foundation day was celebrated virtually. Dr. AK Singh, DDG (Hort. Sci.) ICAR, New Delhi was the chief guest of the event. On the occasion former directors of CPRI Dr. SK Chakrabatri, Dr. BP Singh, Dr. SK Pandey, Dr. SM Paul Khurana also joined in

and shared their reminiscence at ICAR-CPRI. Dr. V Pandey, ADG (Hort.I) was also present as guests of

honour. During the event Best Worker Awards were given to the staff of all categories of the institute. Some institute publications were also released on the occasion. The programme was attended virtually by a number of farmers from nearby areas, students, ex-staff of the institute, scientists from other institutes, policy makers, entrepreneurs and other stake holders in agriculture and allied activities. They all were made aware about technologies of the institute.

## Week-long celebrations before 150th Birth Anniversary of Mahatma Gandhi

To celebrate the two-year long commemoration of 150th Birth Anniversary celebration of Mahatma Gandhi, one-week program during Sept 26 – Oct 02, 2020 on Gandhian Philosophy was organised following social distancing and also through virtual mode. On September 26, Tribute to Mahatma Gandhi was paid by all the staff. On September 27, an Essay Writing Competition on the topic "Teachings of Mahatma Gandhi" and on September 28, painting competition with the theme: Mahatma Gandhi, was organised for the children of staff. On September 29, a Quiz competition on 'Life of Mahatma Gandhi' was organised in the Institute for the Staff. On

October 01, Institute invited a special invitee: Dr. Girjesh Shukla, Dean (Academics), HP National Law University Shimla for delivering a lecture on 'Philosophy of Mahatma Gandhi and Indian Constitution' to the staff of the Institute. Staff members from Institute's Regional Stations also joined the event through video conferencing. On October 02, concluding ceremony of week-long celebration of 150th Birth anniversary of Mahatma Gandhi was organised at the Institute. During this occasion, a Yoga session and Swachta Abhiyaan/Cleaning campaign was organised at the

Institute. Also, prize distribution ceremony was held in which the winners of the competitions were awarded mementos and certificates. The ceremony ended with remarks by the Director, CPRI Shimla.

## Research Advisory Committee Meeting

The 26th meeting of the Research Advisory Committee (RAC) was held at the ICAR-Central Potato Research Institute, Shimla on 23rd July 2020 (through virtual mode) under the Chairmanship of Prof. KV Peter, Ex-Vice Chancellor, Kerala Agricultural University, Thrissur. Special Invitee Dr. AK Singh, DDG (HS), ICAR, New Delhi, Members: Dr. PS Naik, Former Director, ICAR-IIVR, Varanasi; Dr. U.S Singh, CIP, New Delhi; Dr. Madan Pal, Principal Scientist, IARI, New Delhi; Dr, P.S Birthal, Principal Scientist, NIAEPR, New Delhi; Dr. VS Pandey, ADG (HS-I) (Acting); Dr. Manoj Kumar, Director (Acting), ICAR-CPRI, Shimla; Dr. VK Dua, Member-Secretary, RAC, ICAR-CPRI, Shimla and IMC Non-official member Sh. Rajesh Kumar Garg, participated in the meeting. All the scientists from the headquarters and regional stations also joined

the meeting through video conferencing. After the deliberations & discussions on all the ongoing

programmes, recommendations were made for each onging research programme which have also been approved by the Council.

### Institute Research Committee Meeting

The Institute Research Committee Meeting (IRC), 2020 was held at through virtual mode due to pandemic situation during 25th to 28th August, 2020 under the Chairmanship of Dr. Dr. Manoj Kumar, Director (Acting), ICAR-CPRI, Shimla. Dr. Vikramaditya Pandey ADG (Hort Sci.-I) and Dr. BK Pandey, ADG (Hort Sci.-II) also attended the meeting as special invitees. This meeting was attended by most of the scientists from the headquarters and regional stations. The basic objective of this meeting was to review the research achievements under different ongoing programmes. Overall achievements of the Division were presented by respective Divisional Heads. Scientists also made individual presentations regarding the research achievements and proposed work plan for the next year. Ten new programmes were initiated from April 2020. On the basis of detailed deliberations, many decisions were made which are being implemented.

## Human Resource

### Scientific

#### Transfer (Inter-Institute)

1. Sh. Raj Kumar Scientist, ICAR-CPRI, Shimla relieved on 07.08.2020 (AN) to join at ICAR-IARI, New Delhi.
2. Sh. Rahul Rameshrao Bakade, Scientist, ICAR-CPRI, Regional Station, Patna relieved on 14.09.2020 (AN) to join at ICAR-IINRG, Ranchi (Jharkhand).
3. Dr. (Mrs.) Girimlalla Vanishree, Scientist, ICAR-CPRI, Shimla relieved on 30.09.2020 (AN) to join at ICAR-IIMR, Hyderabad.

### Technical

#### Promotions

1. Sh. Anil Kumar Chandel, Tech. Asstt, ICAR-CPRI, Regional Station, Jalandhar promoted to Sr. Tech. Asstt. (T-4) w.e.f. 27.9.2019
2. Sh. Ram Jivan, Tech. Asstt., ICAR-CPRI, Regional Station, Kufri promoted to Sr. Tech. Asstt (T-4) i.e. 8.9.2019.
3. Sh. Narinder Mayar, Sr. Tech. Asstt., ICAR-CPRI, Regional Station, Jalandhar promoted to Tech. Officer (T-5).

#### Retirements/Resignations

1. Sh. Bijendra Singh, Sr. Technician, ICAR-CPRI, Regional Station, Gwalior retired on 31.8.2020
2. Sh. Rajat, Tech. Trainee, ICAR-CPRI, Regional Station, Kufri resigned on 23.6.2020.

### Administrative

#### Promotions

1. Sh. Rakesh Negi, LDC, ICAR-CPRI, Shimla promoted to the post of UDC w.e.f. 08.09.2020 through LDCE.
2. Sh. Naresh Kumar, LDC, ICAR-CPRI, Regional Station, Jalandhar promoted to the post of UDC w.e.f. 08.09.2020 through LDCE.Sh. Pawan Kumar, UDC, ICAR-CPRI, Shimla promoted to the post of Assistant w.e.f. 08.09.2020 through LDCE.

#### Transfers

1. Sh. Sunil Kumar, LDC relieved from ICAR-CPRI, Regional Station, Modipuram w.e.f. 18.09.2020 and joined at ICAR-CPRI, Regional Station, Gwalior on 29.09.2020.

### Skilled Supporting Staff

#### Promotions

1. Sh. Tejbir Singh, SSS, ICAR-CPRI, Regional Station, Modipuram promoted as LDC and joined on 08.6.2020 at Modipuram.

#### Retirements

1. Sh. Ram Nath, SSS, ICAR-CPRI, Regional Station, Jalandhar retired from Council's service on 31.8.2020.
2. Sh. Ramesh Kumar, SSS, ICAR-CPRI, Shimla retired from Council service on 30.9.2020.

## From the Director's

Nation-wide lockdown announced by Honourable Prime Minister to contain the spread of COVID-19 pandemic in India and imposition of indefinite state-wide curfew by various state governments to tackle the corona virus spread, had brought to a halt all the works and services (except those pertaining to essential services) throughout the country. That in turn had left poor, daily wage, low-paid workers without work and thus without daily earning to buy foods for day to day survival of their families. For example, in Shimla, there were several migrant workers engaged in various construction or other associated activities. Their daily-wage works had come to complete halt and thus they were not in a position to buy food and other essential items for them and their families in the present scenario of complete lockdown. Keeping this unwarranted grim situation being faced by these poor needy families in view, staff members (including research scholars and contractual staff) of ICAR-Central Potato Research Institute, (CPRI), Shimla (Himachal Pradesh) immediately discussed the ways and means to provide assistance to the needy ones and all CPRIans took pledge to stand together with nation in these tough times. They made monetary contribution (collectively) to arrange ration and other food items for these needy families. In association with local representatives, district administration and NGOs, the vital food items / ration (rice, wheat flour, vegetable oil, pulses, salts, soap etc) were procured, packed and distributed to these needy families residing in Shimla. Also, keeping in mind the fact that there are several kids in those families who might not get proper nutrition required for their proper development, decent amount of milk, fruits/ rusk packets to these needy families having children less than 5 years of age and/or families having expecting mothers, were provided on daily basis. Similar assistance to the needy ones was provided in areas around Research Stations of CPRI, located in different states. Further, at individual level as well as member of "Indian Potato Association" CPRI employees made a significant contribution to PM-CARES Fund. During this period, CPRI also distributed sanitizers, gloves and masks to our corona worriers i.e. policemen/ Women and other security personnel in Shimla. CPRI was continuously engaged in different welfare activities for needy families and Corona worriers during the whole lockdown period. All CPRIans pray for early escape from this pandemic.

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