



## International Potato Center (CIP)

Submitted on April 2021

### 1. Total funds provided under Window-III from ICAR

Year	Total funds provided under Window-III
Payment of 2012	INR 5,000,000
Payment of 2013	INR 20,000,000
Payment of 2014	INR 12,230,000
Payment of 2015	INR 22,770,000
Payment of 2016	INR 15,000,000
Payment of 2017	INR 20,000,000
Payment of 2018	INR 20,000,000
Payment of 2019	INR 20,000,000
Payment of 2020	INR 20,000,000

### 2. How the research priorities are set in National and Global Context

The research work plan developed between ICAR and CIP covers the national, regional global context. CIP is providing diversified germplasm such abiotic: heat and drought tolerant, day neutral, short duration and biotic stress tolerant to viruses and late blight. CPRI uses these germplasm accessions to develop varieties to meet National demand. The scientists working in National Program are given opportunities for advanced training to learn latest technologies such as diploid breeding, biofortified technique and cryopreservation at CIP-HQ or countries of

regional office. Scientists are sponsored to attend the International Symposium, Seminar and Scientific Meeting outside India.

### **3. Research output (only 5 most significant) (Explain the mechanism)**

- A. International Potato Center (CIP) has supplied 1194 potato germplasm to Central Potato Research Institute (CPRI) since CIP office was established in India in 1975. Total 11 potato varieties have been developed by using CIP germplasm. In last ten years five potato varieties: Kufri Chipsona -4 (processing) Kufri Mohan (table purpose), Kufri Lima (heat tolerant), Kufri Thar -2 (drought tolerant), Yusi Maap (red skin medium maturing and resistant to late blight) released by CIP germplasm. In last three years three potato varieties (Kufri Lima, Kufri Thar-2 and Yusi Maap) have been notified directly from CIP advanced clones.

Recently released varieties from CIP germplasm:

#### **a) Kufri Lima (397065.28)**

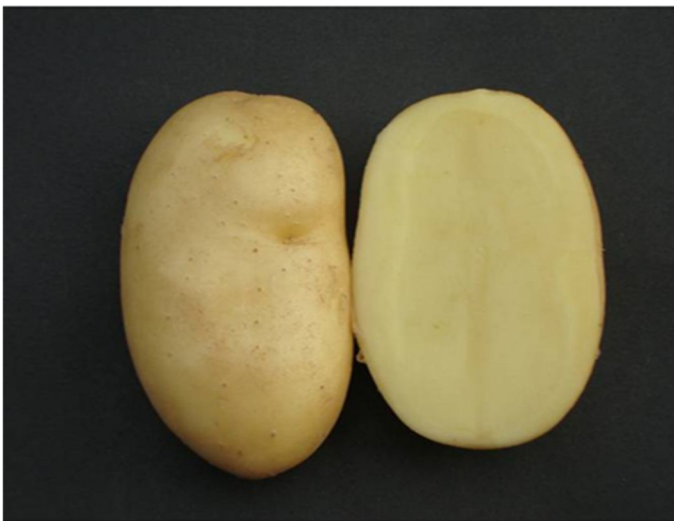
An early bulking heat tolerant and virus resistant potato variety notified in 2018 is preferred trait by local farmers. High temperatures pose a serious problem to potato farmers in India. Farmers usually have to wait until temperatures drop to plant potatoes, but because of its high tolerance to heat Kufri Lima can be planted a full 20-30 days earlier than other local varieties. Earlier planting means earlier harvests, giving Kufri Lima farmers the ability to sell their potatoes at a premium price before other varieties hit the market. Farmers can expect to be paid 40 to 50 percent higher prices than farmers harvesting potatoes during the normal season. An added benefit to these farmers is that the early harvests give them a productive window to plant an additional winter crop, such as wheat or rice, that other varieties don't allow. Kufri Lima farmers can invest their earnings into a second winter harvest helping them to improve the overall productivity of the cropping system



**Figure 1: KUFRI LIMA**

**i) Kufri Thar-2**

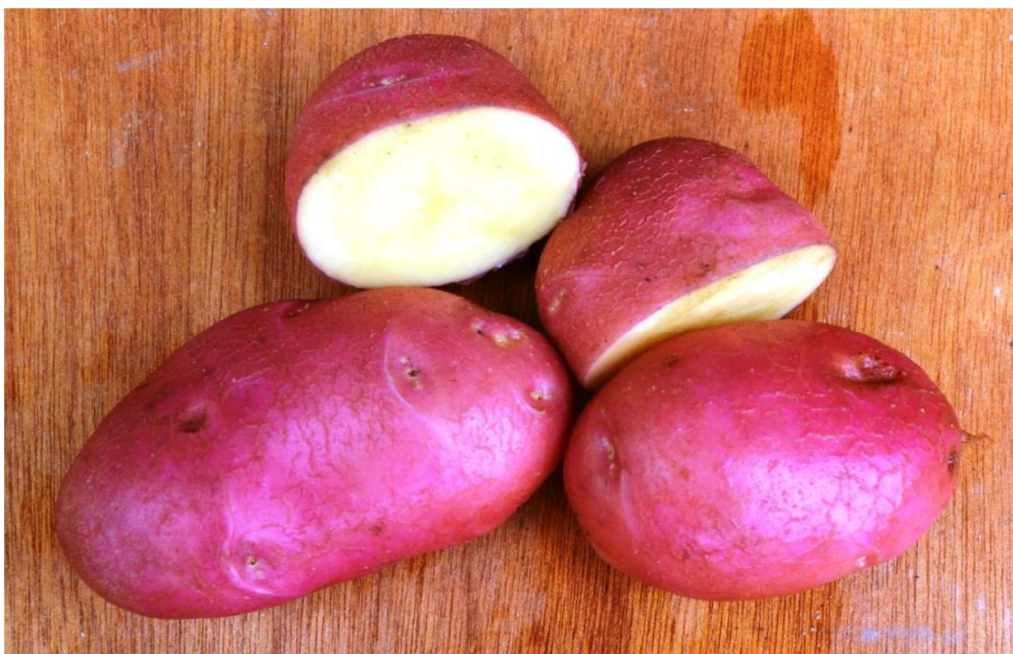
A new drought tolerant variety Kufri Thar-2 (397006.18) released from CIP Clone in 2020 for arid and semiarid agro-ecologies of India. It is a water use efficient variety with high drought tolerance index and lower water requirement. The variety produces attractive, light yellow tubers, possess 20-21% tuber dry matter and excellent keeping quality. It can produce 30 t/ha tuber yield under less water (<20%) and 35 t/ha under normal irrigation regime.



**Fig 2: KUFRI THAR-2**

## ii) **Yusi Maap**

A day neutral Potato Variety Yusi Maap notified by Ministry of Agriculture in 2020. This is red skin with oblong tubers and highly resistant to late blight as was selected over 2000 masl in Bhutan under long day conditions. Minitubers are being produced at CPRI-Shimla and DoH, Karnal by CIP for conducting multilocation adaptability trials of new variety in different zones in 2021-22 rabi season. This can be grown both in plains and hills. The suitable region for this variety will be Eastern plains, N-E hills and Z&K where consumers like red skin potato and also late blight is major limiting factor to get the potential yields of exiting varieties. This variety will increase productivity and profitability of potato cultivation in hills.



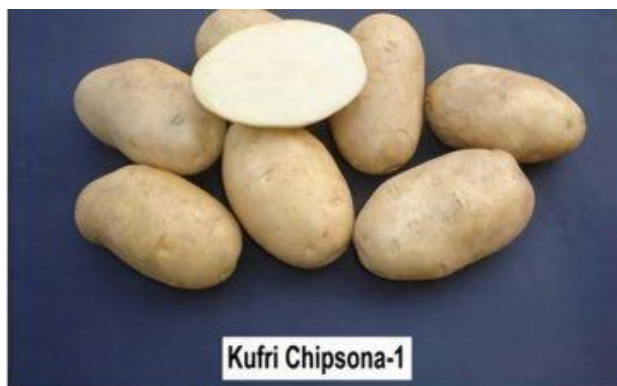
**Fig 3: YUSI MAAP**

- B. Decentralization of potato seed system by low cost temporary net houses and apical rooted cuttings (ARC). Non-seed producing states such as West Bengal, Karnataka and Assam have accepted. CIP also introduced a low cost apical rooted cutting technology to produce mini tubers as an alternative to highly capital intensive aeroponics.



CIP is working closely with CPRI to conduct economic viability of this technology in CPRI Shillong center. We have set up two facilities that include tissue culture, poly house and net house to produce mini tubers from tissue culture plantlets. The cost of one mini tuber would be about one rupee in apical rooted cuttings as compared to 6-8 rupees in aeroponics.

- C. Farmers growing CIP germplasm released potato varieties mainly processing such as Kufri Chipsona-1,2,3, 4 and Kufri Frysona. More than 250,000 ha area is occupied by these varieties. Farmers also growing Kufri Mohan, Kufri Surya and Kufri Himalani varieties released by using CIP germplasm.



#### D. Organizing and Strengthening the Role of Small holder Framers in Potato production

CIP is working in the states of Assam and Odisha to strengthen the role of small holder farmers in Potato Production through a participatory and innovative bottoms up informal model of production called "Small Farmer Large Field" (SFLF) model. This model thus enables small and marginal farmers to achieve economies of scale and bargaining power by strengthening backward and forward integration along the supply chain, lowering costs, and improving efficiency by synchronizing and harmonizing selected key operations (such as: land preparation, planting, and harvest). The SFLF initiative has received overwhelmed response from farmers in both the states. Farmers participating in this farming model, have claimed that their productivity has doubled, and profit has increased three to four times.

#### 4. Research Outcome

The potato growers have largely benefitted by growing the varieties developed from CIP germplasm. These varieties were bred by using one of the CIP parents at CPRS- Kufri. Today, Indian processing varieties used for Chipping and French fries by private sectors are only CPRI/CIP bred material. More than 200,000 ha area is grown under CPRI/CIP potato varieties for processing purpose. These varieties have high dry matter and low reducing sugar and therefore preferred by private companies like PepiCo, Haldi Ram, Balaji, McCain and small-scale potato processing entrepreneurs. Only 7-8 % of total potato produced in India is used for processing. Out of this processing potato, more than 50% is the CPRI/CIP bred Chipsona varieties and rest by imported varieties. Farmers who are growing processing varieties and supplying to processing industries by contract farming get almost 50-60 percent higher price compared to table potato in India.

Kufri Himalani and Kufri Lalit are other table purpose varieties in large demand in India. Germplasm imported from CIP was used to breed these varieties. Kufri Himalani is late blight resistant and medium maturing and out yielding Kufri Jyoti and therefore taking place for Kufri Jyoti and in Eastern and South India. Kufri Lalit is used as table purpose because this has higher yield than most of exiting white skin table varieties.

Recently two red skin potato varieties selected directly from CIP clones will be cultivated by farmers in North-Eastern, Eastern and hills in summer season for table potato. At present there is no farmers preferred red skin late blight resistant variety for these regions. More than 25% area of potato will be covered by these varieties in Bihar, Eastern UP, North Bengal, North Eastern hills and Z&K

## **7. Visible Impacts**

More than 200,000 ha area is cultivated by CIP bread varieties in India. Farmers are benefitted by growing processing varieties through contract farming or directly. Decentralizing of seed system is picking up by adopting apical rooted cuttings as low cost planting material for basic seed production for further multiplying to G1, G2 . Zero till (ZT) technology has been introduced and picked up by farmers in Assam and Odisha. The cost of cultivation is reduced significantly by ZT and farmers can grow potato in fallow fields after kharif rice where they were not able to do it earlier.

## **8.Economic Evaluation**

**(Name of Agency, year of evaluation, 3 key recommendations)**

NA

## **9. Technical Evaluation**

**(Name of Agency, year of evaluation, 3 key recommendations)**

NA

## **10. Benefits to ICAR/India (Germplasm sharing, Capacity Development, Infrastructure Development)**

In last ten years, CIP supplied 185 germplasm of potato. These accessions were heat tolerant, LTVR (low tropical virus resistant), tetraploid biofortified rich in iron and zin and diploid accession used for breeding to develop varieties. Three of the five varieties developed during this period. One CIP advanced clone early maturing, early bulking

and day neural red skin with 20% dry matter has been proposed for variety releases for North-Eastern States, Bihar, West Bengal, Odisha and Eastern UP. This will enhance farmers income by planting and harvesting one month earlier than normal potato season and to sell at premium price when there will be no fresh potato in market. In addition, this variety will give a window to plant timely boro rice, wheat or winter vegetables for increasing farm productivity and profitability. We expect to get 5 candidate biofortified varieties to be registered from 57 accessions in next five years. These varieties will meet the iron and zinc deficiency of the poor people do not have purchasing capacity for green vegetables, pulses, or meat. The exiting varieties developed from CIP accessions in India have benefitted the farmers. Private industries have been doing contract farming for CIP bred varieties such as Kufri Chipsona-1, Kufri Chipsona-4 and Frysona. This has increased farmers income by 50-60 % than table varieties.

More than 5000 stakeholders trained on different subject such as participatory variety selection to select potato varieties of stakeholders' choice by mother and baby trial approach. Farmers and extension staff of Universities and State Departments of West Bengal, Haryana, Assam, Karnataka and Odisha were trained on best integrated potato seed production practices including post-harvest management to reduce losses and improve quality. Seven scientists from CPRI have been trained at CIP- HQ in Lima on advanced breeding tools, diploid potato seed production technology and biofortified potato production techniques. Six scientists attended International Symposiums/Workshops during last 10-year. CIP sponsored fellowship for three students to do MSc courses. More than 25 research articles published by CIP/CPRI jointly.

Supported National Programs in West Bengal and Karnataka to build up temporary net houses to demonstrate quality seed production /multiplication in aphid free net houses for decentralizing the potato seed production from North to the non-seed



producing states. This has been adopted successfully in West Bengal and Government of West Bengal has now started multiplying the minitubers produced by in-vitro in net houses at farmer's fields.