

New high-yielding potato varieties for cultivation in Indian plains, hills and plateau regions

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The newly released potato varieties, viz. Kufri Lohit, Kufri FryoM, Kufri Manik, Kufri Thar-3, Kufri Sangam, Kufri Chipsona-4 and Kufri Kiran have a great potential to improve the productivity and profitability of farmers, thus improving their socio-economic conditions. Most of these varieties are suitable for cultivation in Indian plains, while Kufri Karan is suitable for cultivation in hills and plateaus. The adoption of these varieties can lead to the rise of national average productivity and provide food and nutritional security.

Keywords: Breeding, Heat tolerant, Potato, Processing, Water-use efficiency

POTATO belongs to the family Solanaceae and the genus *Solanum* having nearly 200 tuber-bearing species. The cultivated species *Solanum tuberosum* L. is a tetraploid ($2n=4x=48$) and is clonally propagated through tubers. It is the world's number one food crop after the major cereal grains. India stands as one of the world's largest producers of potatoes, a crop integral to its agricultural landscape and food security. However, amidst changing climatic conditions and evolving disease pressures, the need for innovative solutions in potato cultivation has become increasingly apparent. This is particularly pronounced in the hilly regions as well as the fertile plains of the country. With a burgeoning population and rising food demand, the agricultural sector faces mounting pressure to enhance productivity sustainably. Potatoes, being a staple crop in the Indian diet, are central to addressing this challenge. However, traditional potato varieties often struggle to meet the demands of modern agriculture, especially in the face of evolving diseases and

pests. Potato cultivation in India is confronted with numerous challenges, chief among them being various diseases and pests and climatic conditions. Further, the diverse geography of India presents a unique set of challenges. While the plains experience varying climatic conditions, the hilly regions encounter distinct challenges such as colder temperatures, erratic rainfall, and soil erosion. To counter the challenges, plant breeders are continuing their efforts for the better adaptation of the potato to a wide range of environments while seeking cultivars that meet current consumer preferences and the stringent quality requirements of processors and supermarkets. Variety development is a continuous process as new biotic and abiotic stresses continue to arise and the variety previously resistant or tolerant to such stresses may become susceptible due to the evolving of new strains/races of the pathogens or insects and also due to emerging abiotic factors. The performance of a variety depends on the agro-climatic conditions under which it is grown and also the purpose for which it has to be used. Since

the establishment of the Central Potato Research Institute (CPRI) in 1949, concerted efforts of potato breeders led to the development and release of 70 improved indigenous potato varieties suitable for varied agroecologies of India. These have successfully taken care of the needs of potato cultivation in India in different geographies. Besides, table varieties, processing varieties have also been developed to cater the needs of the processing industry. These varieties have contributed substantially to the observed increase in production and productivity in the country.

Breeding focus and new varieties

- The major aim of potato breeding is to develop varieties with higher tuber yields, early bulking, short days (for plains)- and long days (for hills)-adapted, and resistance/tolerance to various biotic and abiotic stresses.
- Mostly white/yellow-skinned varieties with attractive, medium-sized and shallow/medium-eyed tubers and good keeping quality, as well as low glycoalkaloids content,

are preferred in the country, whereas red-skin potatoes are preferred in the eastern part of India (North Bengal, Bihar and Sikkim regions).

- In sub-tropical plains, short duration and early bulking agile potato varieties (< 80 days) are suitable for cereals-based intensive cropping systems to ensure supply of fresh potatoes

in the market to fetch high prices.

- At CPRI, breeding for table/fresh/processing potato varieties on early bulking (<80 days) and medium maturing (80-100 days) is continued with the aim at higher tuber yields, multiple disease-pest resistances (late blight, viruses & cyst nematodes), tolerance to abiotic

stresses (heat and drought/water), and nutritionally rich coloured potatoes.

CPRI has been continuously working to develop new varieties for different segments and agro-ecologies. The details of new varieties suitable for cultivation in various ecologies and segments are given in Table 1.

Table 1. Varieties suitable for cultivation in various ecologies

Variety	Characteristics and recommended areas of cultivation
<i>Varieties for main season (Winter season) planting in Indian plains</i>	
Kufri Neelkanth	Table purpose variety for North Indian plains, moderate resistance to late blight, dark purple-black tubers, ovoid in shape with medium deep eyes, cream flesh, good keeping quality. Tuber yield 35-38 t/ha. Nutritionally superior to white skin potato varieties.
Kufri Lima	Table purpose variety for North Indian plains possessing tolerance to hopper and mite burn. The variety produces attractive, white-cream, ovoid tubers with shallow eyes and cream flesh. Tuber yield 30-35 t/ha.
Kufri Mohan	High-yielding table potato for Northern and Eastern plains, white cream ovoid with shallow eyes and white flesh. Tuber yield 35-40 t/ha.
Kufri Lalit	Table potato variety for Eastern plains, light red round tubers with medium deep eyes and light-yellow flesh. Tuber yield 30-35 t/ha.
Kufri Manik	Field resistance to late blight, produces attractive, deep red, ovoid-shaped tubers with shallow eyes and white flesh. The variety has high levels of anthocyanin (0.68µg/g FW), carotenoids (33.0µ/100g FW), micronutrients (Zn, Fe, Cu, Mn), and waxy texture with good flavours and taste. Suitable for cultivation in the Eastern plains of India. Tuber yield 30-32 t/ha. This variety is nutritionally superior.
Kufri Lohit	Kufri Lohit is a red skin, medium maturing, main season, high-yielding table potato variety recommended for cultivation in North-Indian plains (Eastern & Central plains). It produces attractive red-coloured, ovoid tubers with shallow eyes, cream flesh and mealy texture. It is responsive to crop nutrition and capable of yielding 36-38 t/ha total tuber yield under optimum crop management.
<i>Processing (Chips and French fries) varieties for main season (Winter season) planting in Indian plains</i>	
Kufri Chipsona-4	Suitable chips owing to its round tuber shape and high dry matter (>20%), good keeping quality and good taste, recommended for release in Southern plateau and hills region, lower gangetic plains region, Central plateau and hills region and Gujarat plains and hills region. Medium maturity 90-100 days. Tuber yield 30-35 t/ha.
Kufri FryoM	Medium maturing potato genotype for French fries. Field resistance to late blight. Suitable for cultivation in North West and Central plains and similar agro-ecologies. Medium maturity 90-100 days. Tuber yield 30-35t/ha.
Kufri Sangam	Dual purpose hybrid (Processing to French fries & table potatoes) is recommended for release in central plains for both table & processing purposes, while for table purposes in northern plains. Medium maturity 90-100 days, excellent storability and high dry matter. Tuber yield 35-40 t/ha.
<i>Late blight-resistant varieties for the summer season (Kharif season) planting in Indian hills and plateaus</i>	
Kufri Karan	Table potato medium-maturing variety suited for cultivation in Indian hills (North-western, North-eastern & Southern) and plateau regions of the country. It possesses high resistance to late blight, viruses (PALCV, PVY, PLRV, PVA, PVM and PVS) and moderate resistance to PCN, high dry matter (18.8%) and good keeping quality. Maturity 100-120 days. Tuber yield 27-29 t/ha. Tubers (6-9), ovoid, skin whitish cream, smooth, eyes shallow, flesh cream, texture mealy. It has good keeping/culinary quality.
Kufri Sahyadri	Kufri Sahyadri is a table potato variety with combined resistance to PCN and late blight. Tubers are oval in shape with light yellow skin, yellow flesh, medium-deep eyes and are free from after-cooking discolouration. Suitable for cultivation in the Nilgiri Hills of India. Tuber yield 28-35 t/ha.
<i>Heat tolerant varieties for main season (Winter season) planting in Indian plains (North-Western, Central and Eastern plains)</i>	
Kufri Kiran	Heat-tolerant potato variety for Indian plains and plateau regions, early to medium maturity (85-90 days), excellent storability under ambient conditions. Tuber yield 30-35 t/ha. It is also suitable for cultivation in the southern region.
<i>Water-use efficient varieties for main season (Winter season) planting in Indian plains</i>	
Kufri Thar-1	Water use efficient table potato variety recommended for release in East coast plains & hills and Middle Gangetic plains. Good tuber traits, tuber dry matter (19%), medium maturity 90-100 days, Tuber yield: middle Gangetic plains 30-35 t/ha; East coast plains & hills 16-20 t/ha
Kufri Thar-3	Medium maturing, white tuber table purpose, water-use efficient variety recommended for release in Trans Gangetic plains, Upper Gangetic plains and Eastern plateau and hills region. Tuber yield 30-35 t/ha
Kufri Thar-2	Water use efficient table potato genotype recommended for release in Western dry region and Central plateau & hills. Field resistant to late blight. Very good keeper and dry matter 20-21%, medium maturity 90-100 days. Tuber yield 30-35 t/ha.
Kufri Daksh	The variety is recommended for release in the central and eastern plains of India. It also possesses cross-tolerance to heat and produces attractive, whitish cream, ovoid-shaped tubers with shallow to medium eyes and creamy flesh. Medium maturity (90-100 days). Tubers don't show deformities like cracking or hollow heart. Good keeping quality. Tuber yield 28-30 t/ha.



New potato varieties for table and processing use

Importance of high-yielding climate-resilient varieties

Introducing new potato varieties that are high-yielding and resilient to climate change as well as prevalent diseases is imperative for enhancing agricultural productivity and ensuring food and nutritional security. These varieties not only offer increased yields but also reduce reliance on chemical inputs, thereby promoting sustainable farming practices. The adoption of high-yielding, climate-resilient potato varieties has the potential to bolster the economic prosperity of farmers. The biofortified and processing varieties also cater the specific

needs of the industry and thereby requirement of quality potatoes for various uses. By increasing yields and reducing production costs, farmers can improve their livelihoods and contribute to the overall economic growth of the country.

CONCLUSION

The introduction of high-yielding, climate-resilient potato varieties is essential to meet the growing agricultural demands in both the hills and plains of India. By addressing the challenges posed by diseases, climatic variability, and increasing food demand, these

varieties hold the key to sustainable agricultural development and enhanced food security in the country. The new potato varieties have a great potential to improve the productivity and profitability of the farmers, thus improving their socio-economic conditions. These varieties have one or the other special attributes in them and by adopting these varieties, farming community can substantially increase their production and productivity and also enhance the potato production of the country.

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