

Potato production technologies for north eastern region

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Potato cultivation in the North Eastern (NE) region of India faces various challenges due to factors such as adverse weather conditions and traditional farming methods. Despite these obstacles, potato plays a significant role in the cropping systems and dietary habits of the region's inhabitants. This article highlights the production technologies essential for improving potato cultivation in the NE region. It discusses key aspects such as varietal selection, climate requirements, soil conditions, planting seasons, nutrient management, irrigation practices, harvesting methods, and post-harvest management. Additionally, it addresses major pests and their control measures, as well as advancements in seed potato production systems, including micropropagation techniques and apical rooted cuttings (ARCs). The adoption of these improved technologies and best practices has the potential to enhance potato productivity, contributing to food security and economic prosperity in the NE region. However, concerted efforts from researchers, extension workers, policymakers, and farmers are crucial to fully realize this potential.

Keywords: Apical rooted cuttings, Micropropagation, Pests, Potato, Production technologies

NORTH Eastern (NE) India is the easternmost part of the country which comprises basically the seven sister and one brother states viz., Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland, Tripura and Sikkim with a distinct agro-climatic area as well as natural bioresources. These states have a total geographical area of approximately 2,62,180 km² which represents 8% of the country's total area with a population of about 46 million (Census 2011). However, the region is characterized by fragility, marginality, inaccessibility, cultural heterogeneity, ethnicity and rich in biodiversity with around 56% of the area coming under low altitude, 33% mid altitude and 11% under high altitude.

Potato forms an important part of prevailing cropping systems as well as the dietary food habits of the people of the region. The crop is grown throughout the year in one or the other parts of the NE

region. Potato is grown in summer and autumn at higher elevation, whereas in valley and plains, it is grown as a *rabi* crop in the winter. The NE region contributes about 6.1% of the total area under potato in the country, while the area under potato as a percentage of the net-cropped area is about four times of the national level.

Potato production in the NE region of India faces several challenges. The crop is mainly grown as a rainfed crop except in few areas in plains and valley where irrigation facilities are available. Most of the farmers are practicing traditional way of cultivation in marginal land with minimum inputs. The high rainfall and humidity along with moderate temperature conditions are congenial for the development of several potato diseases and luxuriant weed growth, both of which affect potato cultivation. In addition, most of the breeder/quality seed comes from outside the region

which leads to inconvenient factors such as higher seed prices, heavy transportation costs, physiological age of the potato seeds compelling the farmers to use old degenerated seeds. Despite the NE region being suitable for potato production, per unit production is very low (8.56 tonnes/ha on an average) as compared with National average yield of 25.79 tonnes/ha (DAC&FW). To increase the potato productivity and to achieve seed self-sufficiency, there is an urgent need to transfer the new technology from the research institute to the farmer's field.

Production technologies

Adoption of poor management practices by the farmers, which include traditional cultivation methods, imbalanced doses of fertilizers, non-adoption of suitable varieties and inappropriate plant production measures leads to poor productivity. ICAR-CPRI has standardized various agro-

Table 1. State wise area and production of Potato 2022-2023 (DAC&FW)

State	Area ('000 ha)	Production ('000 tonnes)
Arunchal pradesh	0.02	0.44
Assam	103.64	773.37
Manipur	1.59	11.25
Meghalaya	19.54	196.23
Mizoram	0.10	0.95
Nagaland	4.44	55.91
Sikkim	6.16	44.62
Tripura	7.58	141.30

techniques for improved cultivation of potato.

Varietal wealth

The institute has developed and released 70 potato varieties in the country for cultivation in various agroecological situations. Besides, nine varieties are suitable for processing purposes with high dry matter and low sugars. Varieties recommended for NE region are given in Table 2 and are classified as early (100-110 days), medium (110-120 days) and late (>120days).

Table 2. Potato varieties recommended for cultivation in NEH region of India

Agro-ecological zones	Duration	Recommended varieties
Plains and Valley	Medium	Kufri Jyoti, Kufri Pukhraj, Kufri Megha, Kufri Surya, Kufri Sinduri, Kufri Khyati, Kufri Chandramukhi, Kufri Chipsona-3
Hills	Medium and Late	Kufri Girdhari, Kufri Giriraj, Kufri Himalini, Kufri Jyoti, Kufri Megha, K. Karan

Climate requirements

Optimum temperature for tuber growth is between 10-30°C.

Soil conditions

Well-drained, levelled and fertile loamy soil with neutral to slightly acidic reaction is best suited for its growth.

Planting season

Potato is grown mostly as a rainfed crop and planting time differ according to the altitude of the area.

In hilly area, main crop is planted in the months of February-March (Summer crop) and autumn crop is planted in August- September. In plains and low-lying areas, it is grown as a winter crop (October to February).

Field preparation

- **In plains:** Ridge and furrow method, where, one operation with soil turning plough followed by two cross harrowing and levelling are adequate.
- **In Hills slope:** Make ridge and furrow against the slope to avoid soil erosion at a distance of 50-60 cm between the rows.

Seed rate and spacing

Seed tubers weighing 30-50 g are planted at a distance of 20 cm between plants and 60 cm between rows. In case of processing varieties, the row spacing at 67.5 cm and plant-to-plant distance of 20 cm (for chips) and 25 cm (for French fries) are recommended. The planting depth of 8-10 cm should be maintained for uniform emergence. Normally, the tubers with thick sprouts of 0.5-1.0 cm size are best for planting. Approximately 2.5-3.0 t seed potato tubers are required for planting of one hectare area.

Nutrient management

Well-rotted farmyard manure (FYM) at a rate of 10-15 t/ha along with 140:120:60 kg/ha of nitrogen, phosphorous and potash is recommended for ware potato. Apply half of nitrogen and full dose of phosphorous and potash at planting while remaining half dose of nitrogen should be applied at the time of earthing up.

Method of planting

- **Planting potatoes on the hill slopes:** Make furrow against the slope keeping 50 cm distance between the rows. Place the seed at 20-25 cm apart depending on the size of the seed tubers. Cover the seed with soil and make ridges to a height of 8-10 cm.
- **Planting potatoes on ridges:** Ridge and furrow method is

most commonly used for potato planting in plains and terraces. Mixed the fertilizer and FYM with soil at the time of land preparation. After preparation of field, ridges are made at a distance of 50-60 cm and placed the seed at 20-30 cm apart depending on the size of the seed tuber. Planting of potato is done on the ridges with tractor or spade.

Weeding

Potato weeds can be effectively and economically managed by applying Metribuzin @ 0.5 kg a.i./ha as a pre-emergence within 3-7 days of planting in moist soil, followed by manual weeding at 45 days after planting.

Earthing up

Weeding and earthing up of crop is done at 20-25 days after planting when potato plants are of about 8-10 cm height. Remaining dose of nitrogen is also applied before earthing.

Water management

Potato is grown as a rainfed crop in hilly areas and in plains and low-lying areas following the conventional furrow irrigation method. The first irrigation should be given 8-10 days after planting for quick and uniform emergence in the field. The second irrigation is given 21-25 days after planting just after earthing up. The subsequent irrigations should be applied at 10-12 days interval in the light soils whereas in medium soils at 12-14 days interval. Potato crop should not face moisture stress at stolon formation and tuberization stage. The irrigation should be stopped 10-12 days before harvesting in early crop. However, in main crop, stop the irrigation 10-12 days before haulm cutting when 40-50% plants have shown senescence.

Harvesting

Harvest the potato after 100-140 days after planting depending on the variety and when the prices are remunerative. De-hauling should be done 15-20 days before harvesting to get tuber skin cured/firmed.

Post-harvest management

Remove the damaged tubers (cut/crack/bruised) as well as late blight, pink rot and soft rot infected tubers. Produce should be graded into large (>75 g), medium (25-75 g) and small (<25 g) according to the marketing purposes.

Seed treatment

Dip seed tubers in 3% commercial grade boric acid for 25-30 minutes. The boric acid solution once prepared can be used 20 times. Treated seed tubers should be dried in shade, labelled and stored.

Storage of potato

Ware and processing purpose potatoes are generally stored at 10-12°C after CIPC treatment (sprout suppressant). Seed potatoes are stored in cold storage at 2-4°C.

Diffused light storage

A well-ventilated storage is made in such a way that there is partial entry of light and the store is neither too lighted nor dark. Spread the potato tubers on the floor or stored in a rack made of bamboo, wooden or plastic. The potatoes should be stored in 2-3 potato layers.

Major pest and control measures

- **Late blight, early blight and phoma leaf spot:** Use of disease free seeds and resistant varieties. Prophylactic spray (just at the time of canopy closure) with mancozeb @ 0.25% followed by cymoxanil + mancozeb @ 0.3%. Copper based fungicides @ 0.2% for management under organic farming.
- **Brown rot and Bacterial wilt:** Use of disease free seeds. Apply bleaching powder @12 kg/ha mixed with fertilizer at the time of planting. Uproot the wilted plants and scoop out the soil.

- **Dry rot:** Dip seed tubers in 3 % commercial grade boric acid for 25-30 minutes.
- **Potato tuber moth:** Use uninfested tuber seed, deep planting, covering the exposed tuber with soil. Use of sex pheromones trap in the field and storage. Use dried lantana leaves to cover the tubers. Use of *Bacillus thuringiensis* at storage. Spray of cypermethrin 25EC @ 450 ml/ha.
- **White grub:** Light trap, application of Phorate 10G or Carbofuran 3G @ 2.5-3 kg a.i./ha

Potato seed production system

The advancement in seed potato production, particularly through micropropagation techniques, has revolutionized the potato seed industry. By employing meristem culture for virus elimination, combined with thermotherapy and/or chemotherapy, the production of virus-free plants has become more feasible. Each mericlone undergoes rigorous testing for viruses before being utilized for large-scale micropropagation. Micropropagation involves growing single-node cuttings of virus-free potato mericlones in culture media under controlled conditions. Within a short period, these cuttings develop into full plants, which are further sub-cultured to generate abundant quantities of pathogen-free cultures. Microtuber production from microplants offers convenience in handling, storage and transportation. While microtubers are not commonly used for commercial crops, they serve as excellent sources for minituber production in controlled environments. Minitubers, produced either in soil or through soil-less aeroponic systems, offer significant advantages in disease control and multiplication rates.

The aeroponic system, in particular, has shown promising results in producing high yields of minitubers with fewer field exposures. Another noteworthy technology is the apical rooted cuttings (ARCs) method, which has proven successful in recent years and is being integrated into seed production systems in India. ARCs offer simplicity, effectiveness and high multiplication rates, making them a viable option for seed production. These innovations signify a paradigm shift in seed potato production, offering improved disease control, higher yields and enhanced efficiency.

CONCLUSION

Potato production in the NE region of India faces several challenges stemming from factors such as inadequate seed availability, adverse weather conditions, and traditional farming practices. Despite these hurdles, there is an immense potential for enhancing productivity through the adoption of improved technologies such as high-yielding varieties with late blight resistance, low-cost seed production systems and appropriate agro-techniques which could boost the region's productivity and remuneration of farmers. To fully realize the potential of potato cultivation in the NE region, concerted efforts are needed from all stakeholders, including researchers, extension workers, policymakers and farmers. By leveraging innovative technologies and adopting best practices, the region can overcome existing challenges and significantly enhance potato production, thereby contributing to food security and economic prosperity.

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