

e-Lecture on Potato

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Scientific Cultivation of Potato

Botanical name: *Solanum tuberosum*

Chromosome no.: 12

Family: Solanaceae

Origin

The probable centre of origin of potato is in south America in the central Andean region. But some scientists believe that the origin of potato is South American state **Peru/Chilly**. In India potato was brought by the Portuguese in 17th century.

Climatic requirement

Potato is cool season crop. It grows very well where suitable moisture and fertile soil is available with proper drainage facility. Bright sunshine, low relative humidity (60-80%) and temperature is suited for better growth and development of the crop. This is grown in winter in plains while in summer season in northern hills. Potato is long day plant but some varieties can easily be grown in short days. For better **germination** it requires **20-22 °C** and for **tuber formation** and growth **18-20 °C** temperature is too good. When the temperature exceeds 30 °C it hampers the tuberization because due to high respiration rate, the carbohydrates produced by the photosynthesis are consumed rather than stored in tuber. More humidity, cloudy sky and rains help in spreading of various diseases.

Important Varieties Recommended for Uttar Pradesh

- A. **Early Varieties (Duration: 60-75 days):** K. Chandrmukhi, K. Pukhraj, K. Surya, K. Khyati, K. Bahar, K. Ashoka
- B. **Main Crop (Duration: 90-110 days):** K. Bahar, K. Anand, K. Badshah, K. Sinduri, K. Satlaj, K. Lalima, K. Arun, K. Sadabahar, K. Pukhraj
- C. **Late Varieties (Duration: 110-120 days):** K. Satlaj, K. Badshah, K. Anand
- D. **Varieties Suitable for Processing (For Chips /wafers):** K. Surya, K. Chipsona-1, K. Chipsona-2, K. Chipsona-3, K. Frysona, K. Jyoti, K. Lavkar

Some Special Varieties of India

- i. **Better Storage Quality:** K. Deva, K. Kundan, K. Lal, K. Dewa, K. Safed
- ii. **Early Blight Resistant:** K. Lalima, K. Jeewan, K. Kundan, K. Jyoti, K. Badshah, K. Satlaj, K. Pukhraj, K. Sinduri
- iii. **Late Blight Resistant:** K. Jyoti, K. Badshah, K. Sherpa, K. Swarna, K. Megha, K. Jawahar, K. Salaj, K. Pukhraj, Chipsona-1 and 2, K. Giriraj, K. Kumar, K. Neela, K. Chamatkar, K. Neelmani.
- iv. **Wart Disease Resistant:** K. Naveen, K. Jeewan, K. Jyoti, K. Sherpa, K. Khasi Garo
- v. **Frost Resistant :** K. Sheetman, K. Dewa, Chipsona-2, K. Anand, K. Chamatkar
- vi. **Suitable for Intercropping :** K. Jawahar (JH 222)
- vii. **Suitable for Multiple Cropping :** K. Alankar
- viii. **Photo insensitive Variety :** K. Alankar
- ix. **Nematode Resistant :** K. Swarna
- x. **Mosaic Tolerant :** K. Jyoti, K. Sinduri, K. Kuber

Hybrid Varieties of Potato : B-420(2), Ex/A-680-16, HT/92-621, HT/93-707, J/92-13, J/92-164, J/92-167, J/93-4, J/93-77, J/93-81, J/93-86, J/93-87, J/93-139 etc. (All these Hybrids are late blight resistant varieties).

Soil conditions

Potato can be cultivated in wide range of the soils having the textures of sandy loam to clay loam. But the well drained sandy loam and **medium loam is most suited** for its growth and development. Soil texture and structure also affect the quality of potato tuber. Alkaline or saline soils are not suited to this crop but the acidic soils having a **pH range of 5 to 6.5** is well suited because acidic conditions tend to limit scab disease. Soil should be friable, well aerated and rich in organic matter for higher yields.

Planting time

In Plains

Early crop- III week of September to I week of October

Main crop- I week to III week of October

Late crop- III week of October to I week of November

In Hills

North-west Hills- March to April

North –East hills- a. Summer season: Early to mid March

b. Autumn season: Last week of August to I week of September

Southern Hills(Nilgiri hills): a. Winter crop: I fortnight of August

b. Spring season: I fortnight of February

c. Summer season: I fortnight of April

In the plateau of Madhya Pradesh, Bihar and Maharashtra potato is raised in rainy and winter seasons, respectively.

Seed Rate

Seed rate of potato depends upon the variety, size and weight of cut tuber, spacing and purpose of growing the crop. Per hectare seed rate on the basis of seed size and spacing are as under-

Type of the crop	Seed size (Diameter in cm)	Spacing in cm	Required seed in q/ha
Early crop	2.5-3.0	45 x 15	10 – 15
Main crop	3.0-4.0	60 x 25	25 – 30
Late crop/Seed purpose	4.0-5.0	50 x 20	20 – 22

Selection of Seed

Seed is one of the most important input in potato cultivation because seed shares alone about **30-40%** of whole cost of cultivation. Therefore select healthy and pure seed of high yielding varieties free from pests and diseases. The tubers showing any surface borne diseases like Wart, Scab, Nematode infection or effect of rot should be sort out.

Seed Treatment

Before planting, the seed potatoes after removing from the cold storage be kept in cool and shady place for one to two weeks to allow the emergence of sprouts. The sprouted tubers should be used as seed.

A. Treatment Against Diseases

Both the whole and cut tubers should be treated with **0.25% Aretan or Tafasan (6% mercury) solution for at least 5 minutes** against black surf disease and rotting of seed potatoes. Dipping of cut seed tubers in **0.5% Dithane M – 45 solution for 10 minutes** is also effective in avoiding rotting in early planting.

B. Breaking Dormancy

If seed is required for planting before completion of tuber's dormancy period, there is need to artificial breaking of tuber dormancy for better germination. The dormancy can be broken by treating the tubers with **1% Thiourea (1 kg Thiourea in 100 litres water) + 1ppm Gibberellic Acid (1 mg in 1 litre water)** for one hour followed by treatment with 3% Ethylin Chlorohydrin solution and keeping the tubers in an airtight place for 72 hours.

Planting Methods

There are three methods of planting potatoes in India-

1. Flat Sowing

In flat sowing whole plot is divided into beds of convenient sizes. The shallow furrows are opened and tubers are planted at recommended distance. The tubers are covered with the furrow soils. After completion of germination when plants become 10 – 12 cm in height, earthing is done.

2. Planting Potatoes on Flat Surface Followed by Ridge Making

In this method field is prepared and the shallow furrows are opened on the flat surface. Potatoes are planted in such furrows and immediately after planting tubers, small ridges are made and thick by earthing up of the side soil.

3. Ridge and Furrow Sowing

In this method, the ridges are prepared with the help of plough or ridge maker at recommended distance. The length of ridges depends on the slope of the field. Potato tubers are planted on these prepared ridges.

Nutrients Management

Soil testing is key tool for nutrient management in any crop. Since, potato crop is comparatively heavy feeder, therefore, soil should be well fertile. The soils poor in organic matter must be supplied with **300 – 500q well rotten FYM** or compost/ha 15 – 20 days before planting the crop. Green Manuring or organic sources of nutrients also helps in improving the physical properties like structure,

aeration, temperature, water holding capacity etc. If the soil sampling is not possible, **100-150 kg Nitrogen, 60-80 kg Phosphorous and 80-100 kg Potassium/ha** should be applied in medium type of soils.

Two third quantity of nitrogen and whole quantity of phosphorous and potassium should be applied as basal dressing. Remaining one third of nitrogen should be given at 30-35 days after planting i. e. at the time of first earthing as top dressing. **Calcium Ammonium Nitrate, Single Super Phosphate and Muriate of Potash fertilizers are considered as better** sources for production of quality tuber crop. For fetching better yield of potato crop micronutrients such as Zn, Fe, Mn, Cu, Mo and Na may also be required in deficient soils.

Intercultural Operations

Narrow and broad leaves both type of weeds are found in potato fields. For their effective control, hand pulling or a manual weeding should be done at 20-25 days after planting when plants attained a height of 8-10 cm along with top dressing of remaining dose of nitrogen followed by earthing. Weeding and earthing help in soil aeration and weed control.

Chemical Control

Pre-emergence application of **Alachlor 2.0 kg a.i./ha** or **Metribuzin 1.0kg a.i./ha** or post emergence of **Paraquat and Diquat (Gramaxon) @ 0.36 to 1.0kg a.i./ha** (Applied when 5-10% of germination has taken place) is done with 800-1000 litres of water. If necessary, second earthing may be done after two weeks of the first weeding.

Water Management

Potato is very sensitive to soil moisture. In both excess and scarcity conditions, the quality and yield is badly affected. Before coming to planting operation, it should be assure that there should be optimum soil moisture for better sprouting and germination of tubers. Pre-sowing irrigation is must if there is insufficient moisture in the field. In potato, furrow irrigation is most commonly used. The light irrigation is done to maintain optimum soil moisture in the potato field. A maximum height of two third of ridges is flooded through irrigation water. Further irrigations are done as and when is required. In general, irrigation is done

at an interval of 6-10 days in sandy loam soils and 10-12 days in heavy soils. In seed production, the last irrigation is done before 15 days earlier to dehauling.

Excess water should immediately be drain out from the field otherwise, it causes various diseases and rotting of tubers.

Dehauling

Dehauling is removal of aerial parts of the potato plants from ground level. This practice is done for thickening of skin and suberization of potato tubers and to prepare quality tubers as seed. Sometimes it is done to reduce loss from viral diseases which are spread by aphids.

Dehauling can manually be done **by sickle** or by spraying weedicide like **Gramaxon (Paraquat Dichloride) @ 2.5 litre/ ha** in 1000 litres of water. This practice should be done about 15 days before harvesting the crop when haulms start yellowing and falling on the ground.

Harvesting

The crop should be harvested about 15 days after cutting the haulms. Digging is done with spade in small fields. However, tractor operated potato diggers are more popular in potato growing areas for harvesting the crop in big plots. There should be optimum moisture in the soil at the time of harvest. After digging, the tubers may be allowed to dry on the ground for sometime in shade.

Yield

With recommended package of practices, and yield of 300 to 350 quintals per hectare can be obtained.

Grading of tubers

Grading is an important process for better marketing and to get higher prices with uniform size tubers having high quality. Cut, deformed and diseased are sorted out during grading. Grading is done on the basis of diameter of tubers as under :

1. A Grade – 5 to 8 cm
2. B Grade – 3.75 to 5 cm
3. C Grade – 2.5 to 3.74 cm

True Potato seed

True potato seeds are produced from the fruits of potato plant botanically known as berry. A single potato plant bears about 40-50 berries and each fruit or berry contains 200-250 seeds. So one plant can produce about 10,000-12,500 seeds.

Advantages/Merits of TPS Technology

1. Traditionally, a large quantity of potato tubers are kept as seed for next year but sowing of true potato seed a huge quantity of tubers will be available for our consumption.
2. Sowing true potato seed cost of cultivation of potato may be minimized because farmers incurred about 40% on seed potato.
3. Transportation of tubers are tedious and costly practices because tubers are bulky, heavy and perishable and easily damaged and rotten. However, transportation and handling of TPS without damage is so easy at very cheaper cost.
4. TPS requires only 100-150 g for one hectare sowing while 25-30 q tubers are used for planting. These tubers may be used as food.
5. Quality tuber seeds are produced only in north hilly areas but TPS can be grown anywhere in India as quality seed where potato cultivation is done.
6. Storage of tubers needed special type of arrangement; however, TPS is stored without any extra cost.
7. Many seed borne diseases are spread through potato tubers while there is negligible or no chance of spreading these diseases by the TPS technology. Various types of bacteria, viruses, fungi and nematodes are spread through tubers. Crop produced by TPS is almost free from these problems. Adopting TPS technology spreading of disease to new areas can be checked.
8. TPS crop is generally more resistant against various diseases in comparison to tuber seeded crop.
9. TPS has potential to extend the cultivation in non-traditional potato growing areas.
10. The farmers who do not grow potato crop because they do not have access to good planting material or have not found a way to store seed tubers under

high temperatures; under such conditions direct transplanting of seedlings from TPS into the field appears to be a very suitable system.

Disadvantages/Demerits of TPS Technology

1. TPS technology requires more knowledge and skill.
2. TPS is very costly.
3. It is more labour intensive to grow and it requires a longer growing season.
4. The crop is not genetically uniform due to sexually produced seed.
5. There is considerable variability among plants in terms of type, size, skin colour, shape of tubers and size of plant, days needed until maturity and cooking quality.
6. Market value of tubers is lower due to above demerits.
