



## Potato: Crop Stage-wise IPM

### Table of contents

1. [Pre sowing\\*](#)
2. [Sowing\\*](#)
3. [Vegetative/ seed/tuber stage](#)
4. [Tuber initiation](#)
5. [Vegetative and tuber development stage](#)
6. [Harvesting](#)

#### Management

#### Activity

#### Pre sowing\*

##### Common cultural practices:

- Summer deep ploughing
- Soil solarization during summer.
- Field sanitation, rogueing.
- Avoid water logged conditions in the field.
- Follow crop rotation.
- Apply manures and fertilizers as per soil test recommendations
- Start to grow ecological engineering plants.
- Sow/plant 4 rows of maize, sorghum, bajra (pearl millet) around the potato crop field as a guard/barrier crop.

#### Nutrient

- Apply FYM @ 8 t/acre or vermicompost @ 4-6 t/acre
- Apply 2 Kg each of Azospirillum and Phosphobacterium with 10 Kg FYM /acre as soil application before planting

#### Weed

- Stale seed bed technique before sowing.
- Destroy all the germinated weeds by shallow ploughing before sowing.

##### Cultural control:

- Give light irrigation and cover the beds with polythene

Soil borne pathogens, nematodes and resting stages of insect pests

- Give light irrigation and cover the beds with polythene sheet of 45 gauge (0.45 mm) thickness for three weeks before sowing.
- Raise African marigold in the nursery 15 days prior to sowing against cyst nematode.
- Use raised seed beds of more than 35cm height (for better water drainage).

**Biological control:**

- Apply neem cake @ 80 Kg/acre.

**Sowing\***

**Common cultural practices:**

- Use resistant/tolerant varieties.
- Use healthy, certified and weed seed free tubers.

Nutrients

- Apply 48 Kg nitrogen (N), 16 Kg phosphorus ( $P_2O_5$ ) and 48 Kg potassium ( $K_2O$ )/acre.
- Apply N and K in two splits; half as basal and half as top dressing at 30 days after sowing.

Plant growth regulator (PGR)

- Dip cut pieces of tuber (seed) for 10 minutes in chlormequat chloride 50% SL @ 100 ppm solution.

Weeds

- Adopt recommended agronomic practices like field preparation, time of sowing, row and plant spacing, gap filling etc. to obtain the healthy plant stand to reduce the weed menace.
- If weed flora of the field is known based on previous season experience the preemergence recommended herbicide oxyflourfen 23.5% EC @ 170-340 ml in 200-300 l water/ acre be applied within 3-4 days after sowing.
- When 5-10 % tubers are germinated, application of paraquat dichloride 24 % SL @ 200 gram a.i./acre can be used to control broadleaf, sedges and grassy weeds.

**Cultural control:**

- Tubers stored in oxygen deficient structures should not be used.

**Chemical control:**

Resting stage of the diseases, black heart/ scurf

- Treat tuber with M.E.M.C. 6% FS @ 0.415 g/ Kg tubers in 100 ml water for 3-5 minute or soaking potato seed tubers in streptomycin 40 to 100 ppm solution for half an hour prior to planting or with carbendazim 25%+ mancozeb 50% WS @ (1.5 + 3.0) to (1.75 + 3.5) for 10 Kg seed (tuber) or with carboxin 37.5% + thiram 37.5% DS@ (1.5 + 3.0) to (1.75 + 3.5) for 10 Kg seed (tuber).

## **Vegetative/ seed/tuber stage**

### **Common cultural practices:**

- Collect and destroy crop debris
- Judicious use of fertilizers
- Provide irrigation at critical stages of the crop
- Avoid water logging
- Avoid any stress to the crop as much as possible
- Enhance biocontrol activity by avoiding chemical spray, when 1-2 natural enemies are observed.

### **Common mechanical practices:**

- Collect and destroy disease infected and insect infested plant parts
- Collect and destroy eggs and early stage larvae
- Handpick the older larvae during early stages of crop
- Use yellow and blue sticky traps @ 4-5 trap/acre
- Use light trap @ 1/acre and operate between 6 pm and 10 pm
- Install pheromone traps @ 4-5/acre for monitoring adult moths activity (replace the lures with fresh lures after every 2-3 weeks)
- Erect bird perches @ 20/acre for encouraging predatory birds such as King crow, common mynah etc.
- Set up bonfire during evening hours at 7-8 pm

### **Common biological practices:**

- Conserve natural enemies through ecological engineering
- Augmentative release of natural enemies

### **Cultural control:**

- Use pathogen free tubers

#### Bacterial wilt

- Use pathogen free tubers.
- Disinfect the cutting knife using 1% sodium hypochlorite solution.
- Apply lime (dolomite) in the soil as acidic or alkaline soil is not conducive to the bacterial wilt pathogen.

#### **Biological control:**

- Apply neem cake @ 80 Kg/acre

#### **Chemical control:**

- Two to three sprays of (streptomycin sulphate 9% + tetracylin hydrochloride 1%) SP @ 40 to 50 ppm solution at an interval of 20 days. First spray 30 days after planting.

#### **Cultural control:**

- Plant crop during the 2nd week of October in autumn and in early January to limit rootknot nematode infestation on tubers.
- Grow one row of repellent plants like Tagetes patula and T. erecta (African marigold) in between 2 or 3 rows of potatoes.

#### **Biological control:**

- Apply NSKE 4% and neem cake @ 80 Kg/acre.

#### Root-knot nematode

Follow common cultural, mechanical and biological practices

#### **Biological control:**

- Entomopathogenic nematodes (EPNs) can be sprayed at the rate of 1 billion nematodes per acre, in white grub / root grub infested fields OR
- EPN infected cadavers of Galleria/Corcyra larvae containing live infective juveniles (IJs) are implanted in soil at plant bases at the rate of four cadavers per plant during May/June and/or September for white grub / root grub control.

#### White grub / root grub

### Tuber initiation

#### Leaf spot complex

- Follow common cultural, mechanical and biological practices

Early blight

- Follow common cultural, mechanical and biological practices

**Chemical control:**

- Spray aureofungin 46.15% w/v. SP @ 0.005% in 300 l of water/acre or captan 50% WG @ 600 g in 200 l of water/acre (second spray after 5 days interval) or captan 50% WP @ 1 Kg in 300- 400 l of water/acre or captan 75% WP @ 666 g in 400 l of water/acre. (second spray after 8 days interval) or chlorothalonil 75% WP @ 350-500 g 240-320 l of water/acre (second spray after 14 days interval) or copper oxychloride 50% WP @ 1 Kg in 300-400 l of water/acre or mancozeb 35% SC @ 0.5% or 500 g/100 l water 500 l water or as required depending upon crop stage and equipment used or mancozeb 75% WP@ 600-800 g in 300 l of water/acre or hexaconazole 2% SC @ 1.2 l in 200 l of water/acre (second spray after 21 days interval) or kitazin 48% EC @ 0.20% or 200 ml in 200 l of water or propineb 70% WP @ 300 g in 100 l of water or 0.30% as required depending upon crop stage and plant protection equipment used (second spray after 15 days interval) or zineb 75% WP @ 600- 800 g in 300-400 l of water/acre or captan 70% + hexaconazole 5% WP @ 200- 400 g in 200 l of water/acre (second spray after 21 days interval).

- Follow common cultural, mechanical and biological practices

**Cultural control:**

- Use short-duration varieties.
- The model specifies that 7 days moving sum of RH > 85% for at least 90 hr coupled with a 7 day moving sum of temperature between 7.2 and 26.6°C for at least 115 hr would predict appearance of late blight within 10 days of satisfying the conditions.

**Chemical control:**

- Spray captan 50% WG @ 600 g in 200 l water (second spray after 5 days interval) or captan 50% WP @ 1 Kg in 300- 400 l water/acre or captan 75% WP @ 666 g in 400 l water/acre (second spray after 8 days interval) or

#### Late blight

water/acre (second spray after 8 days interval) or chlorothalonil 75% WP @ 350-500 g in 240-320 l of water/acre (second spray after 14 days interval) or copper oxychloride 50% WP @ 1 Kg in 300-400 l of water/acre or copper sulphate 2.62 % SC @ 400 ml in 200 l of water/acre (second spray after 3 days interval) or cyazafamid 34.5% SC @ 80 ml in 200 l water/acre (second spray after 27 days interval) or dimethomorph 50% WP@ 400 g in 300 l water/acre (second spray after 16 days interval) or mancozeb 75% WG @ 400 in 200 l water/acre (second spray after 3-5 days interval) or mancozeb 75% WP@ 600-800 g in 300 l water/acre or hexaconazole 2% SC @ 1.2 l in 200 l water/acre (second spray after 21 days interval) or mandipropamid 23.4% SC @ 0.2 ml/ l in 200- 300 l of water/acre (second spray after 40 days interval) or propineb 70% WP @ 300 g in 100 l of water or 0.30% as required depending upon crop stage and plant protection equipment used (second spray after 15 days interval) or zineb 75% WP@ 600- 800 g in 300-400 l of water/acre or captan 70% + hexaconazole 5% WP @ 200- 400 g in 200 l of water/acre (second spray after 21 days interval) or cymoxanil 8% + mancozeb 64% WP @ 600- 800 g in 200-300 l of water/acre (second spray after 10 days interval) or famoxadone 16.6% + cymoxanil 22.1% SC @ 200 ml in 200-300 l of water/acre (second spray after 27 days interval) or fenamidone 10% + mancozeb 50% WDG @ 500- 600 g in 200 l of water/acre (second spray after 30 days interval) or metalaxyl M 4% + mancozeb 64% WP @ 025% 1 Kg/ acre in 200-400 l water (second spray after 24 days interval) or metalaxyl 8% + mancozeb 64% WP @ 025% 1 Kg/ acre in 400 l water (second spray not less than 7 weeks) or metiram 55% + pyraclostrobin 5% WG @ 600-700 g in 200 l water/ acre (second spray after 15 days interval) or azoxystrobin 23% SC@200 ml in 200 l of water/acre or treat tuber with carbendazim 25% + mancozeb 50% WS @ (1.5 + 3.0) to (1.75 + 3.5) for 10 Kg seed (tuber).

- Follow common cultural, mechanical and biological practices

Leaf curl diseases

**Cultural control:**

- Use peppermint repellent plant for whitefly (vector).
- Show attractant plant like French bean to attract predatory thrips.

Spider mites\*\*

- Follow common cultural, mechanical and biological practices

**Cultural control:**

- Grow flowering plants for natural enemies attraction: carrot family, bishop's weed (spider mite destroyer), sunflower family, French bean (predatory mites) etc.

Leaf miner\*\*

- Follow common cultural, mechanical and biological practices

Tobacco caterpillar\*\*

- Follow common cultural, mechanical and biological practices

**Cultural control:**

- Grow castor as ovipositional trap crop.

**Biological control:**

- Release egg parasitoid, *Trichogramma pretiosum* @ 20,000/acre/week four times.
- Spray NSKE 5% against eggs and first instar larva.
- Apply entomopathogenic nematodes (EPNs) @ 2,50,000 infective juveniles of *Steinernema feltiae*/sq mt area.

Aphid, thrips\*\* and leaf hopper (aphid's transmit potato virus Y (PVY) and potato

- Follow common cultural, mechanical and biological practices

**Cultural control:**

- Use healthy seed, hot and cold weather cultivation, green manuring, irrigation, fertilizer application.
- Plant early bulking and/or maturing cultivars to help seed production programme in areas having short aphid-free periods so that the seed crop may escape the population pressure of aphid vectors.

**Biological control:**

- Spray NSKE 5%.

r (PVY) and potato  
leaf roll virus (PLRV),  
whitefly

**Chemical control:**

- Apply carbofuran 3% CG @ 6.64 Kg/ acre or oxydemeton-methyl 25% EC @ 0.4 l in 200-400 l of water/acre or thiamethoxam 25% WG @ 40 g in 200 l of water/acre or phorate 10% CG @ 4 Kg/ acre or soil drenching of thiamethoxam 25% WG @ 80 g in 200 l water/acre for aphid control.
- Spray carbofuran 3% CG @ 1.328 Kg/ acre for controlling leaf hopper
- Spray dimethoate 30% EC @ 264 ml in 200- 400 l water/acre for controlling thrips.

- Follow common cultural, mechanical and biological practices

**Cultural control:**

- Attracting cutworm larvae using rice bran – heaps of rice bran should be placed in several places in the late afternoon. They can be removed from the rice bran on the next day and destroyed.
- Flood field prior to planting - where/whenever possible farmers can consider temporarily flooding fields, particularly on severely infested fields.

Cutworms\*\*

- Follow common cultural, mechanical and biological practices

**Cultural control:**

- Adopt intercropping potato with maize or rotational crops such as bean and radish (reduce population of viable resting spores in soil)

Potato wart

- Follow common cultural, mechanical and biological practices

**Cultural control:**

- Use healthy tubers and treat the seed tubers with boric acid (3% for 30 minutes) before or after cold storage.

Potato scab

- Maintain optimum soil moisture from tuber initiation.

- Practice crop rotation with wheat, peas, oats, barley, lupin, soybean, sorghum, bajra and green manures crops.

**Chemical control:**

- Spray thiram 75% WS @ 25 g/ l water (second spray after 7-10 days interval)

## Vegetative and tuber development stage

### Nutrients

- Apply 2nd half of N & K at 30 days after planting after hoeing / weeding.
- Apply mepiquat chloride 5% AS @ 1.25-1.5 l (mix 200 -300 ml of products in 10 l of water) at 45 days after sowing to restrict the excessive vegetative growth of potato and increases yield
- Apply gibberellic acid 0.001% L @ 180 ml in 450-500 l of water twice at 45 days after sowing and 65 days after sowing or Apply triacontanol 0.05% EC @ 0.50 l in 500-600 l of water twice at 30 and 45 days after sowing to enhance the yield

### Plant growth regulators

### Weeds

- Hand tool weeding/hoeing along with earthing twice at 30 and 60 days after planting.
- Pre-emergence application of oxyflourfen 23.5% EC @170-340 ml in 200-300 l of water/acre
- Post-emergence overall/ inter-row application (at 5-10% emergence) of paraquat dichloride 24% SL @ 800 ml in 200 l of water/acre or 2,4-D dimethyl amine salt 58% SL @1.376 l in 160 l of water/acre.
- Use mulch on ridges to suppress weed growth such as paddy straw, maize or sorghum stalks or farm refuses.
- In hilly regions, used local available materials such as pine needles or leaf litter as

mulch for controlling weeds and reduce run off loss and conserving moisture.

- Follow common cultural, mechanical and biological practices

**Cultural control:**

- Grow intercrops such as cowpea, onion, maize, coriander, urdbean in 1:2 ratio
- Rotate the potato crop with a non host cereal, cucurbit, or cruciferous vegetable crop
- Grow repellent plants such as ocimum/basil
- Use healthy seed, hot and cold weather cultivation, green manuring, irrigation, fertilizer application, storage and adoption of seed plot technique

Potato tuber moth

- Plant seed tubers at a depth of 10 cm
- The fields should be ridged after 6 to 7 weeks of planting so that the tubers are buried at least 25cm below the soil surface
- Timely and adequate irrigations minimize soil cracking and thereby reduce the risk of tuber exposure to potato tuber moth attack or their egg laying
- Always keep the tubers underneath the soil surface

**Biological control:**

- Inundative release of *T. pretiosum* @ 0.4 lakh/acre 4-5 times from flower initiation stage at weekly intervals

Bacterial diseases, black surf / canker

- Follow common cultural, mechanical and biological practices

**Cultural control:**

- Soak seed tubers in a solution of trisodium phosphate (90 g/l of water) one day before sowing. The tubers should be thoroughly rinsed and dried in shade.

Potato virus Y, S, X

- Same as in aphid/thrips control

- Follow common cultural, mechanical and biological practices

Bacterial soft rot

**Cultural control:**

- Physical damage must be avoided as it encourages post harvest rots.

## Harvesting

Weeds

- Prior to harvesting/ after harvesting left over weeds should be removed before shedding of their seeds to reduce the spread of weeds.

**Cultural control:**

Potato tuber moth

- After harvesting, potatoes should be kept in heaps in cool places for another 10-15 days for drying and further curing of skin. Heaps 3-4 meter long, wide at the base and about 1 meter wide at the top are the best. In hills the harvested potatoes are spread in well-ventilated rooms for drying.
- Fresh market potatoes should be stored between 5 to 6 °C. Potatoes that are used for making chips should be stored between 7 and 10 °C.
- Collection of left over tubers in the field after harvesting
- Storage of healthy tubers in moth proof structures

Bacterial soft rot

**Cultural control:**

- Physical damage must be avoided as it encourages post-harvest rots.
- Before storage curing is effective and non-chemical control method can be done by exposing tubers for 5 days at 15 – 20 °C and 90 - 95% RH.

Black heart

**Cultural control:**

- Maintain cold storage at 4 °C or slightly higher.
- Maintain proper aeration in the storage.

**Note:** Pesticides dosages and spray fluid volume are based on high volume sprayer.

\*Apply *Trichoderma viride/harzianum* and *Pseudomonas fluorescens* for treatment of seed tubers and soil application (if commercial products are used, check)

check

for label claim. However, biopesticides produced by farmers for own consumption in their fields, registration is not required).

**\*\* Pests of regional significance**

**Source:** [NIPHM](#), and [Directorate of Plant Protection, Quarantine & Storage](#)

**Source:** <https://data.vikaspedia.in/short/lc?k=kilVZY6B1JbVDIZK-ji2uA>

