

Tuber Crop

POTATO

Potato occupies an important place in the economy of Himachal Pradesh because of the natural advantages the State enjoys in respect of potato seed production. The cool temperate climate with high wind velocity and moderate humidity found in higher hills coupled with negligible or low aphid population are the right conditions under which the disease free potatoes are produced in the State. The total area occupied by the crop in H.P. is 16.2 thousand hectares and registered about 140.0 thousand tones production (1997-98) with an average yield of 86 q/ha.

Varieties

Kufri Chandramukhi : This is an early variety and a good substitute for old up-to-date variety. This has a very wide adaptability and can be grown in plains as well as in the hills. It matures in 110-130 days. The plants are medium tall, vigorous with light purple flowers. Tubers are large, oval, uniform with flat eyes. The flesh colour of tubers is dull white. The variety shows low rate of degeneration and thus meet all the quality requisites for export purpose as seed. It yields about 90-100 q/ha in high hills and about 150 q/ha in dry temperate zone.

Kufri Jyoti : A medium maturing variety and takes about 130-150 days to mature. It is moderately resistant to late blight both on foliage and tubers. It is high yielding variety, also suitable for plains and highly suitable for H.P. Its yield ranges between 150-175 q/ha. This variety should not be allowed to grow beyond its maturity time as tubers will grow larger in size and bounds to show some cracking which is not a desirable quality. The plants are tall, erect, vigorous and medium compact and flowers are white in colour.

Soil

Well drained sandy loam and fertile loam soils are most suitable for potato cultivation though it can be grown on variety of soils.

Preparatory tillage

One deep ploughing with soil turning plough followed by 2-3 ploughings with a country plough or harrow provides favourable seed bed for potato. The seed bed should have sufficient moisture. The field should be levelled and provision made for good drainage.

Manuring

| Nutrients* (kg/ha) | | | Fertilizers (kg/ha) | | | Muriate of Potash |
|--------------------|-------------------------------|------------------|------------------------|-----|------------------------|-------------------|
| N | P ₂ O ₅ | K ₂ O | Urea or | CAN | Single Super phosphate | |
| 120 | 80 | 60 | 260 | 400 | 500 | 100 |
| | | | Fertilizer (kg/ bigha) | | | |
| | | | Urea or | CAN | Super phosphate | Muriate of Potash |
| | | | 21 | 32 | 40 | 8 |

Note : In case FYM or compost is available, it should be applied @ 25 tonnes per hectare at the time of field preparation so that it can be incorporated properly in the soil. The dose of SSP can be reduced to half if FYM is applied @ 25 tonnes/ha.

Method of Application

For basal application, apply full amount of phosphorus, potash and half of nitrogen at sowing time in furrows, then cover them partially with soil and then plant the tubers so that the tubers do not come in direct contact with the fertilizers. The remaining half nitrogen should be top dressed at the time of first earthing up. However, if FYM has been applied @ 25 tonnes/ha, the doses of phosphorus and potash can be reduced by half.

The quantity of P_2O_5 can be reduced to 40 kg/ha by soaking the seed tubers in 1.5% SSP solution for 4 hours before planting.

Seed preparation

Good seed having following characteristics should be used for sowing :

- (a) Should be true to type.
- (b) Should be healthy i.e. free from virus infection.
- (c) Should be free from fungal and bacterial disease.
- (d) Should be free from damage and nematode infections.
- (e) Should be in. right stage of sprouting.

Seed potatoes can be planted both as whole and cut pieces depending on size of tuber. If tuber size is large, it can be cut into pieces having at least 2 eyes in each piece and weighing not less than 30 g. Treatment of cut seed pieces with Dithane M-45/Indofil M-45 (0.5%) improves the crop stand and yield.

Planting time

| | |
|------------------------------------|--|
| Low hills (upto 800 masl) | Mid September –mid October (Autumn crop) January-February (Spring crop) |
| Mid hills (800-1600 m) | Mid January-March |
| High hills (1600-2400 m) | March-April |
| Very high hills (2400 m and above) | April-early May |

Seed rate and method of sowing

Potato should be sown/planted in furrows followed by ridge making immediately after planting at 50-60 cm apart running across the slope. Tuber to tuber distance should be 15-20 cm. A seed rate of 20-25 q/ha will be sufficient, if seed pieces are not less than 30 g in weight.

Weed control

Potatoes suffer heavily in yield from competition with weeds. Hence, it is necessary to keep the crop free from weeds particularly during the initial stages. Intercultural operations can be done efficiently and cheaply only when the crop is sown in lines. Give the first weeding immediately after 75% emergence. This stage normally reaches within 30 days after timely planting. Second weeding followed by earthing up should be given when the plants are 15 to 20 cm high.

Weeds can also be controlled chemically. Anyone of the following herbicides may be used:

| Herbicide | Rate | Time of application |
|--|-----------|-------------------------------|
| 1. Fluchloralin (Basalin 45 EC) | 1.5 L/ha | Pre-Planting or Pre-emergence |
| 2. Atrazine (Atrataf 50 WP) | 1.0 kg/ha | Pre-emergence |
| 3. Isoproturon (Arelon/Graminon 75 WP) | 1.5 kg/ha | Pre-emergence |
| 4. Oxyflourfen (Goal 23.5 EC) | 0.5 L/ha | Pre-emergence |

These may be dissolved in 700-800 L water per hectare.

Precautions

1. To avoid photo-decomposition, Basalin should be applied in the evening.
2. Use flat fan nozzle and avoid over-lapping of spray.
3. In Potato sunflower rotation, Atrataf spray on potato crop is not advisable as it affects germination of sunflower.

Water Management

Time and number of irrigations in potato are dependent on type of soil, climatic demand, stage of crop growth and variety grown. The critical growth stages of potato for irrigation are stolon formation, elongation of tubers and their development. Hence, these stages must not suffer due to want of moisture. Light and frequent irrigations are more advisable for this crop than heavy irrigations. Flooding the field over the ridges is harmful, rather half full application of the potato furrows and moistening the ridges by seeping water is good for the health of growing crop. Normally, 5-6 irrigations each of 5-7 cm depth to spring potato are enough to meet the irrigation needs.

Mulching

Spring sown potato should be mulched with pine needles @ 10 t/ha for soil moisture conservation, increasing irrigation water efficiency and for moderation of thermal regime. The practice significantly increase the tuber size and yield and saves irrigation water.

Harvesting and grading

Harvest the crop when it is fully mature. Do not allow it to over mature. At the time of harvesting, the field should neither be too wet nor too dry. Partial drying of the haulms and non-pulling of the tuber skin on rubbing are the indications of crop maturity.

The potatoes can be graded as follows:

| | |
|------------------|-------------------------|
| Grade A (Large) | Weighing more than 75 g |
| Grade B (Medium) | Weighing 50-75 g |
| Grade C (Small) | Weighing less than 50 g |

Plant Protection

| Sign of Attack/ Symptom | Control |
|---|--|
| (i) Insect-pests : White grubs, cutworms and wire worms : cutworms cut the young plants at the soil surface whereas white grubs and wire worms feed on tubers. | Adopt integrated control against beetles and grubs. Management through control of adult beetle : Adopt the chemical and mechanical control measures to kill the adult beetles which congregate on preferred hosts during the evening. |
| | The preferred hosts on which the beetles congregate should be sprayed with 0.05% Monocrotophos during the day time just after the onset of monsoon. No time gap should be given between onset of monsoon and spraying and efforts should be made to spray all the preferred hosts within 3-4 days of the first emergence of beetles. If there is emergence of beetles in response to pre-monsoon, then 2 sprayings will be required first in response to pre-monsoon, and second in response to regular monsoon. |

| | |
|--|--|
| | <p>For mechanical control, the host plants should be jerked by hand or with the help of a hooked bomboo pole, and the beetles which fall on the ground should be picked up and killed in kerosene water mixture. The time of mechanical collection should be between 8.30 P.M. and 11.30 P.M. Mechanical collection should be done for 4-7 consecutive days depending upon beetle population. If there are no host trees in the vicinity of an infested field, the twigs of easily available preferred hosts should be sprayed with insecticides and planted in such fields to attract and kill the beetles.</p> <p>Management through control of grubs : Treat the soil before sowing with Phorate 10 G at the rate of 25 kg/ha. The other insecticides which are slightly less effective than Phorate but can be used as alternatives are Sevidal 4G at 25 kg/ha, Carbofuron 3G at 25 kg/ha and Quinalphos 5G at 25 kg/ha. The grubs exposed during ploughing may be collected manually and killed.</p> |
| <p>Hadda beetle : Adults and grubs skeletonize the leaves.</p> | <p>Spray 1.5 kg Carbaryl 40 LV (sevimol) in 625 L water/ha.</p> |
| <p>Jassid and aphid : Cause damage by sucking sap from foliage and flowers and also transmit virus diseases.</p> | <p>Spray 750 ml Methyl demeton 25 EC (metasystox) or 200-250 ml Phosphamidon 100 (dimecron) or 750 ml Dimethoate 30 EC (rogor) in 750 L water/ha.</p> |
| <p>Potato tuber moth : The larvae damage the plants as well as the exposed tubers in the field and also tubers in the store. They mine leaves and later on enter into the stem. In the store, the larvae enter the tubers through the eyes and make tunnels in them. Such infestation is easily seen as huge faecal matter accumulates near the entry holes in the tubers. The tubers rot is due to secondary infection by micro-organisms.</p> | <ol style="list-style-type: none"> 1. Use healthy seed potato for planting. 2. Do proper earthing up so that the tubers do not remain exposed. 3. Harvested tubers in the field should be covered with tarpaulin/bed sheets so that moths are unable to lay eggs on the tubers. 4. Under storage conditions, cover healthy tubers with 2.0 cm thick layer of dry <i>neela phulnu</i> (<i>Ageratum haustonianum</i>) leaves/dry lantana (<i>Lantana camara</i>) leaves/dry sand. But after use of plant product, debris should be burnt. 5. Before storage of tubers, disinfect the store by spraying Malathion 50 EC (10 ml / litre of water). 6. Spray the crop with 1350 ml decamethrin 2.8 EC (Decis) or 450 ml cypermethrin 25 EC (Cyperkill) or 1200 ml monocrotophos 36 SL (Monocil) or mixture of 225 ml decamethrin 2.8 EC (Decis) + 1125 ml B.T. (Dipol 8 L) in 750 litres of water/ha during the third week of March. 7. Dust tubers meant for seed only with 5% Malathion dust @ 125 g/100 kg seed potato. <p>Precautions</p> <ol style="list-style-type: none"> 1. Do not spray malathion solution in stores which is used for living/sleeping purposes. <p>Do not use any insecticide on tubers meant for consumption.</p> |

| | |
|---|--|
| <p>Diseases Early blight : Brown spots with concentric rings appear on leaves causing premature defoliation in severe infection.</p> | <p>Spray the crop with Dithane Z-78/Dithane M-45 (0.2%) or Blitox 50 (0.3%) at fortnightly interval with the first appearance of the disease.</p> |
| <p>Late blight : Lesions appear on leaves as small black areas which may extend and kill the whole plant in a few days if moist weather prevails resulting in severe losses in yield.</p> | <ol style="list-style-type: none"> 1. Spray twice with Ridomil MZ 70 WP (0.15%) at 15 day interval on first appearance of disease followed by 4 sprays of Dithane M-45/ Indofil M-45 (0.2%) at 7 day interval. 2. Use healthy seed for sowing. 3. Follow high ridge culture to avoid tuber infection. |
| <p>Phoma blight : The initial symptoms consist of small, circular, pinhead sized spots on leaves. The necrotic area is surrounded with yellow halo and later turns into zonatic spots alternating with brown to dark brown concentric rings.</p> | <p>As above for late blight and early blight diseases.</p> |
| <p>Common scab : The skin of affected tubers becomes rough with deep pits. Raised brown to black corky pustules also appear on tubers.</p> | <ol style="list-style-type: none"> 1. Use healthy and disease free seed. 2. Treat the seed potato in Agallol solution (0.25%) at sowing time (25 g Agallol in 25 L water) . 3. Use ammonium sulphate instead of CAN fertilizer. |
| <p>Black Scurf : Sprouts of germinating tubers are killed. Cankers are formed in the underground parts and scurf (brown) appear on tubers.</p> | <p>Deep the seed tubers in 3% Boric acid (Pharmaceutical grade) solution for 30 minutes or Agallol (0.5%) for 30 minutes or acetic acid (1%) + ZnSO₄ (0.05%) for 15 minutes. The same fungicide suspension may be used for 20 dips.</p> |
| <p>Powdery scab : Initially raised pimple like pustules appear on tubers. Later cavities are formed filled with spore mass and surrounded by loose skin ring.</p> | <ol style="list-style-type: none"> 1. Use healthy seed tubers for sowing. 2. Avoid contaminated fields. 3. Treat seed tuber with Agallol (0.5%) for 30 minutes. |
| <p>Bacterial wilt : The characteristic symptoms are drooping of leaves leading to complete wilting and vascular browning of tubers with white slimy bacterial ooze.</p> | <ol style="list-style-type: none"> 1. Crop rotation with maize and cereals should be followed. 2. Full earthing up at planting should be done. 3. Use disease-free seed tubers. |
| <p>Mild and severe mosaic viruses (PVY): The normal green colour of leaves is interspersed with light green patches Occasionally, necrotic spots appear on leaves. The plants become stunted in growth.</p> | <ol style="list-style-type: none"> 1. Use certified seed. 2. Spray the crop with methyl demeton 25 EC (Metasystox) @ 750 ml in 750 L water/ha. 3. Wherever possible, dehauling of crop should be completed before mid August. |