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CERTIFICATION COURSES

# Organic Farming for Sustainable Agricultural Production

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**Lecture 23 : Organic Vegetable Crop Management**

# POTATO (*Solanum tuberosum*)

**Family:** Solanaceae

## **Origin:**

The probable centre of origin of potato is in South America

## **Climatic Requirements**

- A cool season crop
- Potato is a long day plant
- It grows well in temperature between  $15^{\circ}\text{C}$  to  $25^{\circ}\text{C}$ .
- High day temperature  $20\text{-}25^{\circ}\text{C}$  is good for vegetative growth while  $15\text{-}20^{\circ}\text{C}$  night temperature is good for tuber formation.

## **Soil**

- Well- drained sandy loam and medium loam soils are most suitable.
- Soil should be friable, well aerated, fairly deep and well supplied with organic matter.
- Alkaline or saline soil is not suitable for potato cultivation. Well suited to acidic soils (pH 5.0 to 6.5) as acidic conditions tend to limit scab diseases.

## Propagation

Use disease free, well sprouted seeds weighing 30 – 50 grams. Plant the tubers at 20-25 cm apart. Seed rate is 20-25 quintals/ha.

## Land Preparation

Prepare the land to fine tilth. The land is ploughed at a depth of 25 cm and exposed to the sun. The soil should have a higher pore space and offer least resistance to tuber development.

## Method of Planting

- Planting Potatoes on ridges: After preparation of field, ridges are made at a distance of 45-60 cm. Planting is done on the ridges.
- Flat Bed Method: Planting of potato is done on flat method in shallow furrows. This method is for light soils.
- Planting on flat surface followed by ridges: In this method shallow furrows are prepared and immediately after planting tubers, small ridges are made.



## NUTRIENTS MANAGEMENT

Chemical Properties	Conventional VC (%)	Microbial Enriched VC (%)	Rock enriched VC (%)	FYM
Total N	1.3-1.5	1.8-2.4	1.4-1.5	0.5
Total P	0.8-1.0	0.9-1.3	2.9-3.5	0.2
Total K	1.0-1.1	1.1-1.60	2.8-3.5	0.5

SOURCE	DOSE, Based on K content
Conventional VC	11 tonnes/ha.
Microbial Enriched VC	8 tonnes/ha
Rock enriched VC	4 tonnes/ha
FYM	25 tonnes/ha
Chemical fertilizer	120-100-150 kg of N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O

## Nutrient Management:

- Application of biodynamic compost @ 5 t/ha at the time of land preparation
- Application of neem cake @ 1250 kg/ha at the time of land preparation
- Application of biofertilizers like *Azospirillum* and *Phosphobacteria* @ 25 kg each/ha at the time of land preparation. Spraying cow pat pit @ 5 kg/ha in 100 liters of water on 45th, 60th and 75th day after planting



## Growth regulators

- Foliar spraying of panchagavya (Cow dung - 7 kg, Cow ghee - 1 kg, Cow Urine - 10 litres, Cow milk - 3 litres, Cow curd - 2 litres, Water - 10 litres, ) @ 3 % at 10 days interval from 1st month after sowing
- Spraying 10% vermiwash 5 times at 15 days interval from one month after sowing



Potato Scab

# Plant protection

## Pests

### Aphids

- Foliar spray of 10% garlic- chilli extract on 45th, 60th and 75th day after sowing
- Foliar spray of 3% neem oil

### Potato tuber moth

- Avoid shallow planting of tubers. Plant the tubers at 10 – 15 cm depth
- Install pheromone traps @ 20 numbers per hectare
- Earth up at 60 days after planting to avoid potato tuber moth egg laying in the exposed tubers
- To control foliar damage, spray 5% neem seed kernel extract



Aphids



Potato tuber moth



## Diseases

### Potato blight

- Plant healthy and blight free seed
- Select varieties with high blight resistance
- Spraying Agni Hotra ash (200 g Agni Hotra ash soaked in 1 liter cow urine for 15 days and diluted in 10 litres of water before spraying). Spray 3 times at one month interval from one month after planting



Blight affected Potato field





## Virus diseases

- Use virus free potato tubers
- Rogue the virus affected plants regularly
- Control the aphid vectors by spraying 10% nettle leaf extract on 45th, 60th and 75th day after planting

## Nematodes

- Avoid growing potato year after year in the same field
- Follow rotation of crop with vegetables and green manure
- Application of *Pseudomonas fluorescens* @ 10 kg/ha can be done
- Sow mustard as intercrop at the time of potato planting and harvest the mustard greens and incorporate on 45th day for the control of potato cyst nematode.

Symptoms of a heavy nematode infestation in a potato field



# TOMATO (*Lycopersicon esculentum*)

**Family:** Solanaceae

## Climatic Requirements

- Tomato is a warm season crop.
- Thrives well in temperature 10°C to 30°C with optimum range of temperature is 21-24°C.
- Lycopene is highest at 18 to 26°C
- Avoid water stress and long dry period as it causes cracking of fruits. Bright sunshine at the time of fruit set helps to develop dark red coloured fruits.

## Soil

- Sandy loam soil is best suited.
- Grows best at pH 6.0 to 7.0.
- The soil should be well prepared & leveled by ploughing the land 4 - 5 times.

## Land Preparation

- Soils should be prepared early by incorporating organic matter.
- Ridges and furrow type of layout is used. The spacing recommended for tomato crop is 60 cm to 75 cm x 60 cm.

## Nutrient Management:

- Commonly used organic fertilizers include: calcitic or dolomitic limestone (for Ca, Mg); mica (for K) ; rock phosphate or bone meal (for P); blood meal or Chilean nitrate
- Nutrient dose: N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O - 100:100:80 kg/ha



Cover crops in Tomato field



## Disease Management

Some of the control measures for early Blight, Damping Off and Fruit Rot are

- Supporting the plant properly, planting on ridges in irrigated soil.
- Planting on well drained soil,
- Spraying Bordeaux mixture.

Some control measures for viral diseases like Tomato Mosaic Virus are

Uprooting and burning the disease affected plants as soon as they are noticed is the best method to check the spread of this disease.



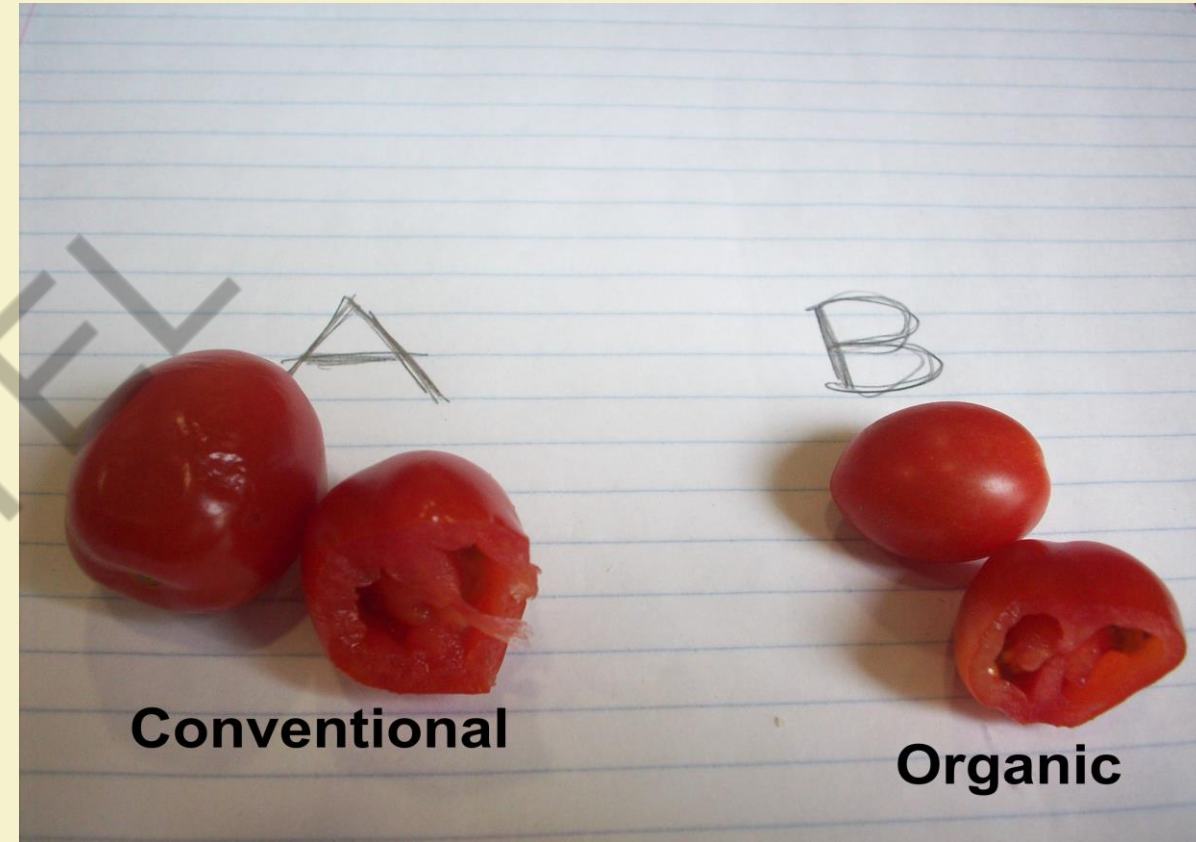
**Tomato Mosaic Virus affected plant**



**Damping Off**

## Organic Tomatoes vs. Conventional Tomatoes

- A study conducted by researchers at the University of Barcelona shows that organic tomatoes contain higher levels of phenolic compounds than conventional tomatoes .
- Phenolic compounds are organic molecules with proven human health benefits and are found in many vegetables.
- Organic tomato juice and ketchup contain higher polyphenol content than juice and ketchup made from conventionally grown tomatoes.
- Polyphenols are natural antioxidants of plant origin and are of extreme interest because they are associated with reduced risk of cardiovascular and degenerative diseases, and some forms of cancer.



## Quality

- Lower nitrate content and higher vitamin C and chlorogenic acid content to be the parameters most consistently differentiating organically from conventionally produced potatoes (HAJSLOVA, et al., 2005).
- Organic farming caused a 25% marketable yield reduction with a higher percentage of large tubers under conventional farming, whereas irrigation increased the marketable yield and the percentage of large tubers (Maggio et al., 2008)
- Ten-year mean levels of quercetin and kaempferol in organic tomatoes were 79 and 97% higher than those in conventional tomatoes, respectively (Mitchell et al., 2007).
- Growth was reduced in fruits from organic farming while titratable acidity, the soluble solids content and the concentrations in vitamin C were respectively +29%, +57% and +55% higher at the stage of commercial maturity (Oliveira et al., 2013).

HAJSLOVA J., V. SCHULZOVA , P. SLANINA , K. JANNE , K. E. HELLENA S, & CH. ANDERSSON. 2005. Quality of organically and conventionally grown potatoes: Four-year study of micronutrients, metals, secondary metabolites, enzymic browning and organoleptic properties. *Food Additives and Contaminants*, June 2005; 22(6): 514–534

Maggio Albino , Petronia Carillo , Giovanni Serafino Bulmetti , Amodio Fuggi, Giancarlo Barbieri, Stefania De Pascale. 2008. Potato yield and metabolic profiling under conventional and organic farming. *European Journal of Agronomy*, 28 (2008) 343–350

Mitchell Alyson E., Yun-Jeong Hong, Eunmi Koh, Diane M. Barrett, D. E. Bryant, R. Ford Denison, and Stephen Kaffka. 2007. **Ten-Year Comparison of the Influence of Organic and Conventional Crop Management Practices on the Content of Flavonoids in Tomatoes.** *Journal of Agricultural and Food Chemistry*, 55 (15): 6154–6159.

Oliveira Aurelice B., Carlos F. H. Moura, Enéas Gomes-Filho, Claudia A. Marco, Laurent Urban, Maria Raquel A. iranda. 2013. The Impact of Organic Farming on Quality of Tomatoes Is Associated to Increased Oxidative Stress during Fruit Development. *Plos One*, <https://doi.org/10.1371/journal.pone.0056354>