



**ABC**

*Agrobiotechnology (P) Ltd.*

# Pomegranate (*Punica granatum*)



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# Agronomy Practices

## Agro-climatic Conditions :

Best quality Pomegranate is produced in regions with cool winters and hot dry summers. Pomegranate grows well under semi-arid conditions and can be grown up to an altitude of 500 meter above mean sea level. The tree requires hot and dry climate during fruit development and ripening. Pomegranate tree is deciduous in areas of low winter temperature and an evergreen or partially deciduous in tropical and sub-tropical conditions. It can tolerate frost to a considerable extent in dormant stage, but is injured at temperature below - 11°C.

### Varieties

Important pomegranate varieties cultivated in India are Bhagwa/Sinduri and Super Bhagwa

### Land and Pit Preparation :

Pomegranate prefers well drained, sandy loam to deep loamy or alluvial soils. Soil pH between 6.5 to 7.5 is ideal and soil salinity up to 6 dS/m. Quality and color development is good in light soils. Land is prepared by ploughing, harrowing, leveling and removing weeds. Apply lime if soil is below pH 7, at a rate of 4.5 kg lime per 9 square metres.

Pit should be dug at least a month prior to planting and kept open to disinfect the pits by intense solar radiation during the day. Just before filling the pits drench the bottom and sides of the pit with 4 -5 liters of 0.4% ( 4 ml/liter) Chloropyriphos 20EC solution.

Dust the pit with bleaching powder @ 100g/pit before filling. Fill the pit with soil having sand, silt and clay in equal proportions along with the components mentioned bellow and fill the pit up to 30 – 50 cms.

### Planting pit filling components

<b>Farm Yard Manure ( FYM)</b>	10 kgs
<b>Vermicompost</b>	1 kg
<b>Neem cake</b>	0.5 kg
<b><i>Trichoderma</i> Formulations</b>	25 gms
<b>Phosphate Solubilizing</b>	25 gms
<b>Bacteria ( PSB)</b>	
<b><i>Pseudomonas fluorescense</i></b>	25 gms
<b><i>Azotobactor</i> Formulations</b>	25 gms
<b><i>Azospirillum</i> Formulations</b>	25 gms

## Planting

### Planting Material :

Tissue Cultured Plants , before taking the plants to the main field spray the plants with COC ( 2.5 g/lit.) + Streptocycline( 0.25 g/lit.). Plant two rows of wind break like Casurina (Saru) Grevillea robusta ( Silver Oak) Sesbania grandiflora etc. around the orchard.

### Planting season :

Planting is usually done in spring (February-March) and July-August in sub-tropical and tropical regions respectively.

### Spacing :

Row to row spacing of 4.5 m and plant to plant spacing of 3.0 m. is ideal. Keep proper spacing and follow proper pruning and training to develop optimum canopy and avoid contact of branches with neighboring plants. This is to ensure proper aeration and interception of solar radiation, which helps in better fruits development and also to reduce the incidence of diseases. High density planting is adopted in temperate regions. A spacing of 5-6 m. in northern India and also in the plains of Deccan plateau is also followed. High density planting gives 2-2.5 times more yield than that obtained when the normal planting distance. Farmers adopted high density planting, experience higher incidence of pest and diseases.



### Fertilizer requirements :

Pomegranate trees are not high demanding when it comes to mineral nutrition. In different soil characteristics and tree productivity level the N application varies between 80-200 Kg/Ha. Adequate potassium fertilization rate is important to achieve high yield and increase fruit size and quality. Adopting scientific management practices to improve fertilizer efficiency like evaluation of leaf analysis data, selection of fertilizer formulations, adjusting quantities based on expected fruit yield, careful placement of fertilizer under the tree canopy within the root zone and split application and good irrigation management to minimize fertilizer leaching etc. can improve the overall performance.

### Nitrogen (N) :

Numerous N rates and timing were recommended for pomegranate trees. They vary with location, tree age, tree size, soil conditions, fruit yield, and other cultural practices. Pomegranate plants benefit from 225 – 625gms N/tree/year split into three doses.

Young trees should receive about 125 – 150 gms N twice a year in early spring and early summer. Mature trees can use 400 – 625gms N/tree/year. Excessive or late applications of N may cause excessive vegetative growth which will reduce fruit production and quality, and delay fruit maturity and color.

Nitrogen needs to be applied preferably through urea in black soil and Calcium Ammonium Nitrate (CAN) in red soil.

### Phosphorus( P<sub>2</sub>O<sub>5</sub>) :

Optimum soil P levels for Pomegranate is >27 kgs / acre. Over the years, P applied to established plantations had not leached but had accumulated in the soil at high levels and is available slowly. P does not leach readily where the soil pH is 6 or higher and the fruit crop removes very little. Therefore, regular P applications are not necessary.

### Potassium (K<sub>2</sub>O) :

N and K are the most important nutrients for fruit trees including pomegranate. An adequate level of N is required for vegetative growth, flowering, and fruit yield. K also plays an important role in determining yield, fruit size, and quality. Optimal N to K<sub>2</sub>O ratio is 1:1 for Pomegranate. However, a ratio of 1:1.25 is recommended for high pH or calcareous soils and heavy producing trees. Post bloom foliar applications of potassium nitrate (1.8 -2.7 kgs K<sub>2</sub>O/acre) during the spring may increase fruit size and yield and reduce fruit splitting.

About a week after defoliation when all or 85-90% leaves fall down, apply FYM and NPK as detailed below depending on the age of the plant. Remember to adjust the total NPK dose based on the soil and leaf tissue analysis value.

## Fertilizer Application Timing and Methods :

Apply N and K<sub>2</sub>O in three split doses starting at the time of first irrigation after flowering (bahar) treatment and next at 3 - 4 weeks interval. Full dose of P<sub>2</sub>O<sub>5</sub> should be applied as single dose with first irrigation. Apply fertilizers in shallow circular trenches, 30 – 45 cm away from the main stem below tree canopy, up to 8-10 cm depth and cover with soil and irrigate immediately.



During first three years, chemical fertilizers are applied in three equal doses in July, September and January. Split fertilizer application combined with sound irrigation management will increase fertilizer efficiency.

### Pomegranate Fertilizer requirement

( For Normal Soil)

### Nitrogen, Phosphorous and Potassium ( Gms/Tree/Year)

Age of the Tree (Years)	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
1-2	150-225	150-225	150-225
3	225-300	225	225-300
4	290-450	225	290-450
5+	450	225	450

### The Recommended dose of fertilizers :

Age of Plant (Years)	Recommended Dose of Fertilizers/Plants/Year.			
	FYM (kg)	N (g)	P (g)	K (g)
1	10	250	125	125
2	20	250	125	125
3	30	500	125	125
4	40	500	125	250
5 & Above	50	625	250	250

(Source: NRCP ,Solapur)

### Fertigation Schedule :

Time of Application	Fertilizer	Dose	No. of Application	Interval
Flowering Starts	12:61:00	3.2 kg/Acre	15	Alternate days
Fruits setting initiated	19:19:199	3.2 kg/Acre	15	Alternate days
After Complete Fruit setting	0:52:34	1 kg/Acre	15	Alternate days
One month before Harvesting	Calcium Nitrate	5 kg/Acre	2	15 days

### Micronutrients (Mn, Zn, B) :

The use of most micronutrients (Mn, Zn, B) is recommended at least twice a year through foliar spray. Molybdenum (Mo) deficiency occurs on soils that have been allowed to become very acid. Liming those soils should fix the problem. Copper should not be included in dry fertilizers if Cu sprays are used and if the soil test show adequate Cu (2.2 – 4.5kgs/acre). The best indication of successful fertilizer management practices for fruit trees is having leaf nutritional concentrations within the optimum ranges.



Beside N, Zn is the most common limiting nutrient for pomegranate trees. Foliar sprays of Zn, Mn, B, and Cu are a more effective, more economical, and a quicker way to supply these nutrients (when applied during the dormant season, post bloom or summer) than soil application. Sulfate forms are less expensive and nitrate forms appear to facilitate more uptakes of micronutrients.

### Iron deficiency :

Foliar application of Fe is not recommended for fruit trees due to lack of effectiveness and risk of leaf and fruit burn. Soil application of Fe chelates is the most reliable strategy of supplying Fe to fruit trees.

### Causes and Correction of Fe deficiency :

Fe chelates are not equally effective in various soils pH ranges. The Fe availability to the plants can be affected by the following factors like white sandy soils, high levels of P or Cu in the soil, high soil pH or calcareous soils and also poor irrigation management like flooding, poor drainage and over irrigation. Low soil temperature can also affect Fe availability to the plants.

#### Iron Chelates Effective pH Range

Iron Chelates	Effective pH Range
Fe-EDTA	4 to 6.5
Fe-HEDTA	4 to 6.5
Fe-DTPA	4 to 7.5
Fe-EDDHA	4 to 9.0

### Foliar fertilization

Foliar feeding will improve nutrient use efficiency to a great extent hence increase yield, enhance fruit quality, drought tolerance etc.

### When does foliar nutrition make sense ?

- Soil conditions prevent nutrient uptake
- Small amounts of nutrients are needed which makes ground application inefficient
- Nutrients are not mobile in the tree
- Visual deficiency symptoms
- Need nutrients fast-- Application is profitable

### Organic Manure

Application of organic manures like FYM, Vermicompost, Bonemeal and various oil cakes will improve the C : N ratio.

### Leaf Tissue Analysis ( Optimum Concentration %)

N	1.5 – 2.0
P	0.1 – 0.2
K	0.6 – 0.8
Ca	0.7 – 1.5
Mg	0.3- 0.4

3- 4 Months old spring cycle leaves from non-fruiting terminals collected in June – July

## Leaf Sample collection for Analysis

100 spring cycle leaves, from 20 – 25 trees, at least one leaf from each trees, 3 - 4 months old from non-fruiting shoot at the middle third branch at the height of 3- 5 feet should be collected in June - July from uniform trees of similar age under the same fertilizer program.

## Use of Growth Regulators:

Judicious use of growth regulators at various stages could produce high quality pomegranates.

Purpose/effects	Stage of Application	Growth Regulator
To suppress the growth of new shoots and increase the girth of the main stem.	2 sprays at 8-10 days intervals during new shoot emergence period up to first 18 months after plantation.	Lihosin (500ppm)
To increase the photosynthesis activity of the young leaves.	2 sprays at 7-8 days interval five weeks after planting.	6 BA (20ppm)
Thinning of excess flowers by the use of chemicals.	Flowering stage	GA <sub>3</sub> (20ppm)
To control unwanted flower drop and to increase the fruit set.	2-3 sprays at weekly intervals as soon as the flower drop is observed.	NAA (10ppm)
To impart natural attractive color to the fruits during unfavorable climatic conditions.	2 sprays at 15 days interval at the time of fruit maturity.	Etherel (500ppm)

### Note :

- After bloom, applications of 4.4-6.4 Kg/Acre Potassium nitrate may lead to a bigger size fruit and help avoid fruit splitting.
- Zinc (Zn) is the most common deficiency. At least 2 foliar applications of Zn should be considered.

## Irrigation Requirement :

First irrigation is provided in case of mrigbahar crop in the middle of May followed by regular irrigation till the monsoon sets in. Weekly irrigation in summers and that during winters at fortnightly intervals is recommended. The check basin system of irrigation is usually followed. Avoid excess irrigation. Drip irrigation with four drippers place in from directions need to be employed. Irrigate the crop immediately after fertigation application in the case of soil application with light irrigation initially and then irrigate at regular intervals. The average annual water requirement through drip irrigation is 20 cm. Drip irrigation helps to save 44% on irrigation and 64% when sugarcane trash mulch is used. It also helps to increase the yield by 30-35%.

## Water Requirement of Pomegranate Plants

Months	Water Requirement (liters/Day/Tree)
January	17
February	18
March	31
April	40
May	44
June	30
July	22
August	20
September	20
October	19
November	17
December	16

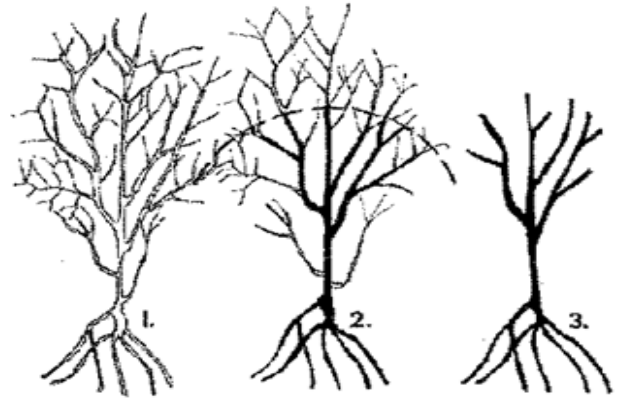


### **Training :**

Plants are trained on a single stem or in multi-stem system. Since the crops trained on single stem training system are more susceptible to pests viz. stem borer and shoot hole borer, the other system is more prevalent in the country.

### **Pruning :**

Pruning required for the removal of ground suckers , water shoots, cross branches , dead and diseased twigs and also to give shape to the tree. A little thinning and pruning of old spurs is done to encourage growth of new ones.



### **Inter-cropping :**

Inter-cropping with low growing vegetables, pulses or green manure crops is beneficial. In arid regions, inter-cropping is possible only during the rainy season, whereas winter vegetables are feasible in irrigated areas.

### **Regulation of bearing :**

Pomegranate plants flower and provide fruits throughout the year in central and southern India. Depending on patterns of precipitation, flowering can be induced during June-July (mrigbahar), September-October (hasta bahar) and January-February (ambe bahar). In areas having assured rainfall where precipitation is normally received in June and continues upto September, flowering in June is advantageous; where monsoon normally starts in August, flowering during August is beneficial. Areas having assured irrigation potential during April-May, flowering during January can be taken and where monsoon starts early and withdraws by September induction of flowering in October is possible. Considering comparable yields, prices and irrigation needs it is recommended that October cropping could be substituted for January flowering.

### **Plant Protection Measures :**

A number of bacterial, fungal, insects, mites and nematodes and some disorders are known to cause quantitative as well as qualitative losses in Pomegranate. Some of the most common pest observed in the Orchard with most characteristic symptoms that can help in correct identification of the disease are given below.

## Bacterial Blight :

On leaves water soaked spots on under surface of leaf which later turns to blackish brown. Irregular spots of different size on leaves, with a clear regular chlorotic halo against light. On fruits spots of water soaked appearance or brownish black spots with cracks or split fruits. The bacterial ooze if it comes out after rain/spray feels sticky to hands and after drying gives white shiny encrustation on the surface of blight lesions. On stems water soaked grey/black lesions on nodes or brown cankers with/without stem cracking.



Water soaked spots on under surface of leaf



Necrotic spots with yellow halo



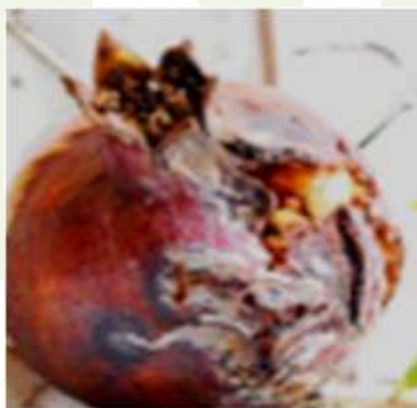
Water soaked spots on fruits



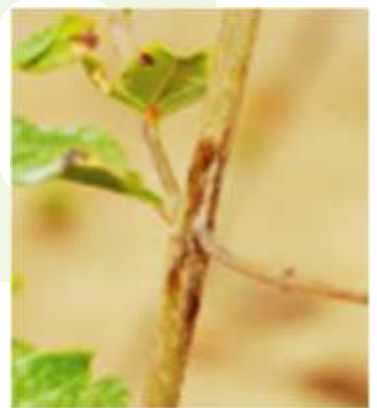
Necrotic spots with small cracks on fruits



Splitting of fruits at necrotic spot



White shiny encrustation of bacteria ooze on infected fruits.



Water soaked lesions on stem nodes turning brown



## Control Measures :

### Cultural Controls :

- Select disease free Tissue culture planting material.
- Fallen twigs, leaves and fruits should be destroyed outside the orchard premises.

### Chemical Controls :

- Spray Bordeaux mixture ( 1.0%) during dormancy.
- Spray with Streptocycline( 0.025%) in combination with Copper Oxy Chloride ( 0.25%) at 15 days interval for 5 - 6 times starting from leaf initiation stage.
- After pruning cut end should be pasted with Bordeaux paste (10%).
- Spray Copper formulation + Streptocycline or Carbendazim + Streptocycline( 0.05%) and other bactericides if disease pressure is high and weather conditions are favorable.

## Wilt Complex :

Plants with yellow/drooping /drying of leaves in some of the branches or entire plant or drying of some branches or entire plant.

Observe the roots and also split open the roots and lower portion of the stem, if you observe the following:

Brown/grey/ black discoloration of wood – Fungus *Ceratocystis fimbriata*

Only Xylem is brown - *Fusarium* sp.

Pin Hole – Shot hole borer

Knots on fine roots – Nematode infestation



Yellowing/drooping/drying of leaves in 1-2 branches of a plant



Plants with yellowing/drooping/drying of leaves and dried fruits attached



Drying and death of several neighboring plants in a row due to *Ceratocystis* wilt



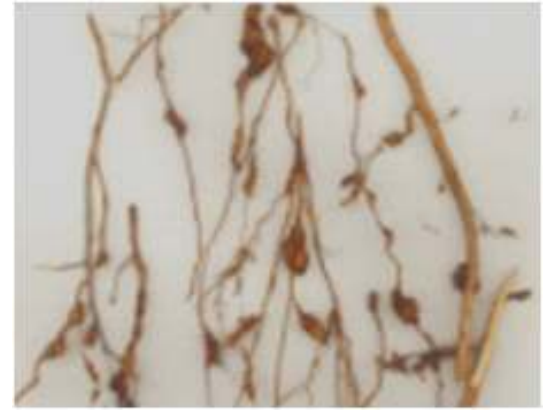
Brown/gray/ black discoloration of xylem and surrounding woods due to *Ceratocystis* wilt



Browning of xylem due to Fusarium wilt



Pin holes in the lower parts of stem due to shot hole borer and with *C. fimbriata*



Knots on fine roots of wilted plant due to Nematode infestation

## Control Measures :

### Cultural Controls :

- Adopt spacing of 4.5 x 3.0 m.
- Ensure Proper drainage in the orchards and avoid over irrigation.
- Nematodes , plant Targets erecta ( African Marigold) between plant to plant space in a row or in a ring on the border of plant basin. It needs to be grown for more than 4- 5 months.

### Chemical Controls :

- **Fusarium and Ceratocystis fimbriata** : Drench the soil with Carbendazim (0.2%) or Propiconazole (0.15%) or Tridemorph ( 0.15%) + Chlopyriphos ( 0.25%).
- **Shot hole Borer** : Drench soil around main trunk with a mixture of Chlopyriphos 2.5 ml/lit + Tridemorph 1 ml/lit. Use 2 -3 liters of mixture per tree. After three weeks repeat with Monocrotophos 1.5 ml + Carbendazim 1 g/lit. If pest infestation is severe repeat the above drenching after a month. If infestation is low drench with Azadirachtin.
- **Nematode** : Apply Phorate 10G , 10-20 g/plant or Carbofuran 3G 20 -40 g/plant, in the plant basin in a ring near root zone and cover it with soil

### Fruit Spot :

Cercospora Fruit spot, dark black discrete spots of various sizes without cracks and no stickiness



Dark black discrete spots of various sizes without cracks and no stickiness

## Control Measures

### Chemical Control :

- Spray the crop with Carbendazim (0.15%) or Mancozeb (0.25%) or Copper Oxy Chloride ( 0.25%) before plucking fruits.

### Fruit Scab :

Rough raised brown spots of various shapes and size giving russet appearance to fruit skin



Rough raised brown spots of various shapes and size giving russet appearance to fruit skin

## Control Measures

### Chemical Control :

- Spray the crop with Carbendazim (0.15%) or Mancozeb (0.25%) or Copper Oxy Chloride ( 0.25%) after fruit setting.

## Anthracnose (on Fruits)

Hard dark, black to brownish black spot of no proper shape or sometimes spot with light center and dark brown black edge.

Hard dark black to brownish black spots of no proper shape or size covering small or large surfaces



## Control Measures

### Chemical Control :

- Spray the crop with Carbendazim (0.15%) or Mancozeb( 0.25%) or Copper Oxychlorie ( 0.25%) before plucking fruits.

## Fruit Rot

### Colletotrichum Fruit Rot

Dark brown fast spreading dry rot generally starting from calyx end and spreading towards stem end of the fruit with rusty appearance bellow skin



Dark brown dry rot from calyx end and spreading towards stem end of fruit

## Control Measures

### Chemical Control :

- Spray the crop with Carbendazim (0.15%) or Mancozeb ( 0.25%) or Copper Oxychlorie ( 0.25%) before plucking fruits.

## Phytophthora Fruit Rot :

Light brown tan color rot neither hard nor soft, generally first in fruits near ground level spread rapidly with white sporulation in humid conditions.



## Control Measures

### Chemical Control :

- Spray the crop with Carbendazim (0.15%) or Mancozeb ( 0.25%) or Copper Oxychlorie ( 0.25%) before plucking fruits.

### **Aspergillus Fruit Rot :**

Brownish soft spot with blackish sporulation of the fungus is also seen in later stages.

### **Control Measures**

#### **Chemical Control :**

- Spray the crop with Carbendazim (0.15%) or Mancozeb (0.25%) or Copper Oxchlorie (0.25%) before plucking fruits.



### **Disorders**

#### **Sun Scald :**

Surface of fruits facing afternoon sun turns brownish black due to scorching, underneath skin is normal.

### **Control Measures**

- Maintain suitable crop canopy through proper pruning to ensure that fruits facing the noon sun are not directly exposed to sun rays.
- Spray anti transpirant like KAOLIN (50%) 2-3 times during the fruit development stage.
- Covering the fruits, particularly those receiving direct sun light, with paper ( preferably butter paper) bags also reduce sunburn.



### **Internal Breakdown ( Aril Browning)**

Randomly open some of the fruits and observe soft arils of brown color in fruits looking healthy from outside, more common in dry conditions with intense heat.

### **Control Measures**

- Harvest fruits at the right time and avoid excess irrigation



### **Abiotic Fruit Cracking**

Healthy fruits split open all though they do not have any scar/spot on the fruit surface. Water stress caused by drought or flooding can aggravate fruit splitting. Fungal diseases affecting both the leaves and the fruit cause premature leaf loss and fruit splitting. Do not allow the fruit to become overly ripe as they may split open.

### **Control Measures**

- Do not allow the fruit to become overly ripen.



### **Insects and Pests**

#### **Fruits Borer :**

Look for fruits showing holes with blackish brown excreta of larva coming out continuously. Cut open the damaged fruits to see the larva of fruit borer hiding inside.

### **Control Measures**

Chemical Control :

- Spray Chlopyri phos (0.02%) or Dichlorovos (0.05%)



### Thrips :

Thrips if present can be seen by tapping the tender shoots on white paper. Affected leaves curl upwards or downwards and inwards. The tip of the tender growth gets dried. Scrapping marks on buds and fruits can be noticed easily.



### Control Measures

#### Chemical Control :

- Spray Dimethorate 0.06% , If the infestation is serious a spray of Methyl oxy-demeton 0.05% should be repeated after fruits set.
- Spray Acephate 0.075% number spray should depends on the severity. A follow up spray of multineem (0.05%) is also useful.

### White Flies :

White appearance on the lower surface of the leaves and insects seen flying around, affected parts distort and dry.

stages of infection



White appearance on the lower surface of the leaves Initial



Whitewash like appearance on lower surface of leaf in severe attack



Distorting and drying of affected parts

### Control Measures

#### Chemical Control :

- Spray Dimethorate 0.06%

### Aphids :

Whitish green aphids can be noticed on under foliage, buds, flowers and fruits, which may be accompanied with black exudate. Sticky honey like semisolid also found on upper surface of leaves on which sooty molds grows.

### Control Measures

#### Chemical Control :

- Spray Dimethorate 0.06%

### Mealy Bugs :

White waxy cottony appearance on tender foliage, buds and fruits are observed. If infestation severe it looks as if white lime is sprinkled on plant parts.

### Control Measures

#### Cultural Controls :

- Remove affected twigs and branches

#### Chemical Control :

- Spray Monocrotophos (0.1%) or Chlopyriphos (0.02%) or Dichlorovos (0.05%)



## Hairy Caterpillar

Bored sepals of buds, eaten sepals of flowers and nibbled rind of fruits and bark of soft stems can be noticed. Black and brown hairy caterpillar can be seen at affected sites.

### Control Measures

#### Chemical Control :

- Spray Monocrotophos (0.1%) or Chloropyriphos (0.02%) or Dichlorovos (0.05%)



Nibbled rind of fruit

## Semilooper :

Leaf lamina eaten by caterpillar hence only mid ribs seen on the entire leaves of the branches, milky brown caterpillars are seen around affected area.

### Control Measures

#### Chemical Control :

- Inject the hole with DDVP 2- 3 ml and plug the hole with mud.



## Bark Eating Caterpillar :

Wood dust and faecal matter having in the form of a web around the joints of branches with main stem or on the main stem directly.

### Control Measures

#### Chemical Control :

- Spray Dichlorovos (0.05%)



## Fruit Sucking Moths:

Needle size punctured holes can be noticed on fruits, from which blackish brown rotten juice oozes out.

### Control Measures

#### Chemical Control :

- Spray Chloropyriphos (0.02%)



## Mites :

Shiny White /Brown patches can be seen on the under surface of affected leaves, which may further curl and fall. Leaf may get reddish look due to heavy buildup of mites population. If you press thumb against the surface of infested leaves hands turns red.

### Control Measures

#### Chemical Control :

- During dry spell spray Fenazaquin 10 EC 2 ml/lit or Dicofol 50 WSP 1 g/lit. or Dicofol 18.5 EC 2.5 ml /lit or wetable sulfur 80WP 3 g/lit in rotation when required.



## Plant protection Spray Schedule from Pruning till Harvesting.

Spray Schedule	Time of Spray	Plant Protection Chemicals to be Sprayed
1 <sup>st</sup>	Immediately after Pruning	Bordeaux Mixture 1%
2 <sup>nd</sup>	7 Days after 1 <sup>st</sup> Spray	<i>Pseudomonas fluorescence</i> talc based formulation 2.g/l with continuous agitation
3 <sup>rd</sup>	8 Days after 2 <sup>nd</sup> Spray ( New flesh stage)	Copper oxychloride 50 WP 2.5 g/l + Bronopol 0.5 g/l along with spreader sticker. Also spray Thiamethoxan 25 WG 0.3 g/l for sucking pest
4 <sup>th</sup>	15 days after 3 <sup>rd</sup> Spray ( at flower initiation)	Streptocycline 0.5 g/l + Carbendazim 50 WP 1 g/l + Acetamiprid 20SP 0.3 g/l for sucking pest soluble form of Zinc, Magnesium, Boron and Calcium each 1 g/l for disease control and better flowering and fruit growth.
5 <sup>th</sup>	15 Days after 4 <sup>th</sup> Spray	Captan 50WP 2.5 g/l + Bronopol 0.5 g/l + Imidachloprid 17.8 SL 0.3 ml/l for sucking pest
6 <sup>th</sup>	15 Days after 5 <sup>th</sup> Spray ( Fruit setting Stage)	Streptocycline 0.5 g/l + Thiophanate Methyl 70 WP 1 g/l + Cypermethrin 25% EC 1 ml/l for fruit borer. Soluble B or ob 1 g/l + commercial micronutrients mixture containing Zinc, Magnesium, Calcium and Iron 1 g/l + Neem kernel extract 50 g/l ( 75 g if entire seed is used). Black soil which is rich in Magnesium and Calcium need not includes these elements in micronutrient spray.
7 <sup>th</sup>	7 Days after 6 <sup>th</sup> Spray	<i>Pseudomonas fluorescence</i> talc based formulation 2.0g/l with continuous agitation
8 <sup>th</sup>	7 Days after 7 <sup>th</sup> Spray	Bordeaux Mixture 0.5%
9 <sup>th</sup>	15 Days after 8 <sup>th</sup> Spray (50% fruit set)	Streptocycline 0.5 g/l + Carbendazim 50 WP 1.0 g/l Chloropyriphos 20% EC 2.0 ml/l + Neem kernel extract 50 g/l ( 75 g if entire seed is used).
10 <sup>th</sup>	15 Days after 9 <sup>th</sup> Spray (100% Fruit set)	Bordeaux Mixture 0.5%
11 <sup>th</sup>	15 Days after 10 <sup>th</sup> Spray	Captan 50 WP 2.5 g/l + Bronopol 0.5 g/l + Methomyl 40% SP 1.0 g/l
12 <sup>th</sup>	15 Days after 11 <sup>th</sup> Spray	Streptocycline 0.5 g/l + Thiophanate Methyl 70 WP 1.0 g/l + Acetamiprid 20 SP 0.3 g/l
13 <sup>th</sup>	15 Days after 12 <sup>th</sup> Spray	Bordeaux Mixture 0.5%
14 <sup>th</sup>	15 Days after 13 <sup>th</sup> Spray	Streptocycline 0.5 g/l + Copper Hydroxide 77 WP 2.0 g/l + Neem kernel extract 50 g/l ( 75 g if entire seed is used) or Azadirachtin 1500 ppm 3.0 ml/l
15 <sup>th</sup>	15 Days after 14 <sup>th</sup> Spray ( 1 Month before Harvesting)	<i>Pseudomonas fluorescence</i> talc based formulation 2.0 g/l with continuous agitation or Bordeaux Mixture 0.5%
16 <sup>th</sup>	15 – 20 Days after 15 <sup>th</sup>	Potassium Hydrogen Phosphate 5.0 g/l or

## Pomegranate Plant Protection – A ready Reckoner

Disease	What is to be done	When is to be done	Why is to be done	How is to be done	What Not to be done	Why not to do
<b>Fruit rot</b> <i>(Collectotrichum sp. Aspergillus spp.)</i>	Spray the crop with Carbendazim (0.15%) or Mancozeb (0.25%) or Copper oxychloride (0.025%) before plucking fruits.	After flower initiation	Fruit rot would spoil packed consignment	Spraying	Avoid fruit injury during harvest	To avoid entry of these pathogens
<b>Wilt complex</b> <b>(Complex of fungal infection, Ceratocystisfimbriata,, FusariumOxyspoum)</b>	Follow spacing of 4.5 x3.0 m in the orchard in sandy loam soil with proper drainage. Soil drenching with Carbendazim (0.2%)or Propiconazole (0.15%)orTridemorph (0.15%)+Chloropyriphos(0.25%)	While planting the orchard  On observing the infected plants	Plant parts and roots of the adjacent trees do not touch each other  To prevent further spread of disease	Consult experts for site selection while planting pomegranate orchards  Prepare a trench around the basin of trees and drench the solution	Avoid high density planting  Treat apparently healthy trees around the infected trees  Treat all the wilt symptom showing trees	Plant parts and roots of adjacent trees could touch each other and spread the inoculum in the orchards
<b>Anthraxnose &amp; Leaf spot and fruit spot</b> <i>Colletotrichum sp. Alternaria sp. Cercosporasp</i>	Spray the crop with Carbendazim (0.15%) or Mancozeb (0.25%) or copper oxychloride (0.25%) before plucking fruits	At flower initiation during May to December	Otherwise all leaves will fall down, die-back will start, fruit will get infected	spraying	Do not leave diseased plants unsprayed	Such unsprayed plants will become reservoir of inoculum in the orchard
<b>Bacterial leaf and Nodal Blight</b> <i>(X anthomonasaxonopodispvunicae)</i>	Select disease free planting material  Spray Bordeaux mixture (1%)  Spray with Streptocycline (0.025%) in combination with Copper oxychloride ( 0.25%) or Carbendazim at 15 days interval for 5-6 times starting from leaf initiation stage.  If possible cut ends should be pasted with Bordeaux (10%) paste  Follow orchard sanitation measures strictly. Fallen twigs leaves and fruits should be destroyed outside the orchard premises.  Copper formulation + Streptocycline or Carbendazim + Streptocycline 0.05% and other bactericides if disease pressure is high and weather conditions are favorable.	During dormancy  During rainy season and post rainy season  After every pruning	To avoid the disease appearance , otherwise the fruits will crack and plants will die	Spraying  Pasting	Old spray solutions should be avoided	Old solutions are not effective  Disease get suppressed
<b>Disorders</b>						
<b>Internal breakdown of arils</b>	Harvest fruits at right time and avoid excess irrigation	Harvest as soon as the crop matures	To manage the disorder	Monitoring of fruit maturity	Avoid fruit injury at harvest	Improper irrigation may lead to cracking
<b>Sun Scald</b>	Work on the canopy so as to make a good canopy	Appropriate pruning	To avoid strong light intensity	Proper pruning and applying recommended dose of nutrients	Avoid heavy pruning	Exposing fruits to direct sunlight



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### Pests

<p><b>Rhipiphorothripscruentatus Hood and Scirtothripsdorsalis Hood</b></p> <p><i>( ThripidaeThysanoptera)</i></p>	<p>Removed pruned material from main field and burn. Rake the soil periodically. Keeping the basin clean also reduces damage due to thrips, Spraying Dimethoate 0.06% prior to flowering is important. If serious, a spray of methyl oxy - demeton 0.05% should be repeated after fruit set. The subsequent spray for borer will limit thrips build up. In case of species other than R.cruentatus, Acephate 0.075% should be sprayed. The number of sprays depend on the severity. A follow up spray of multineem(0.05%)</p>	<p>Thrips would emerge after pruning when tender leaves are ready as ovipositional sites. So, it is crucial to flowering. Pruned material should be removed immediately from the main field. Spraying of specified chemicals should be carried out at pre flowering and post berry formation</p>	<p>Thrips rasp tender fruits, causing scab on them and thereby, reducing market and export value. Thrips infestation is often seen on leaves and also on young fruits causing characteristic scab on fruits. When severe on leaves, it causes leaf tip curl and drying and shedding of lowers. The yield is drastically reduced</p>	<p>Spraying should be carried out perfectly during evening hours. The specified insecticides should be mixed always with adjuvant/sticker(eg.Teepol @ 1 ml/lit) to have enhanced efficacy.</p>	<p>Never mix insecticides and fungicides during spraying</p>	<p>It will reduce the efficacy of both insecticides and fungicides.</p>
<p><b>Pomegranate butterfly, Deudrix Isocrates ( Fab)</b></p>	<p>Remove and destroy all the affected fruits (fruits with exit holes). Spray Decamethrin @ 0.0028% at the time when more than 50% of fruits have set. Repeat after two weeks with Carbaryl @ 0.2% or Fenvalerate @ 0.005%. In non rainy seasons Quinalphos @ 0.06% is also effective. The number of sprays depends on severity of infestation. Remove flowering weeds especially of compositae family</p>	<p>Removal and destruction of all affected fruits as and when spotted. Spraying should be carried out when &gt;50% of fruits have set. Spraying of specified chemicals for rainy non-rainy seasons should be followed. Removal of flowering weeds should be carried out on regular basis</p>	<p>It has been found boring into fruits of pomegranate besides guava, anona, apple,ber,citrus, litchi,loquat, sapotaetc.,Pomegranate is the most preferred host in which it may destroy upto 50% fruits. The female lays eggs singly on calyx of flowers or small fruits. On hatching , the caterpillars bore inside the developing fruits and are usually found feeding on pulp and seeds just below the rind. Subsequently bacteria and fungi causing the fruit to rot also attack the infested fruits. The conspicuous symptoms of damage are offensive smell and excreta of caterpillars coming out of the entry holes, with excreta found stuck around the holes. The affected fruits ultimately fall down.</p>	<p>Spraying should be carried out preferably during evening hours. The specified insecticides should be mixed always with an adjuvant/sticker (egTeepol @ 1 ml/lit) to have enhanced efficacy</p>	<p>Never mix insecticides and fungicides during spraying</p>	<p>It will reduce the efficacy of both insecticides and fungicides</p>

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<p><b>Shot hole borer</b> (<i>Xyleborus sp.</i> <i>Coleoptera</i>)</p>	<p>Early diagnosis with symptoms is a must. Hence regular visit to orchards by growers is suggested. Signs of lateral branch yellowing to quick drying of full tree, should be immediately brought to notice of specialists and treatments be undertaken as recommended</p>	<p>Immediately, when the wing symptoms were observed in orchard the management practices should begin. The early stages of infestation in an orchard begins as a mild yellowing of a branch on one or more trees, generally in a contiguous patch. Within a month to the whole tree yellows followed by dying of branches. Some infested trees have shown heavy bearing but reduced size and immature ripening .On careful examination, the main trunk just a foot above the soil shows pinholes, which may or may not be seen with odor coming out of it. However if the infestation is due to shot hole borer , subterranean (below soil) holes in the root region are a symptom. If the pest is epidemic in that area, care should be taken during new infestations and as well as during replanting as per guidelines</p>	<p>This is becoming a major pest now a days on pomegranate in many parts of Karnataka. The adult beetles bore holes on the roots and later on lower parts of the main trunk. These holes cut through xylem and phloem , resulting in the death of the tree. From an infested tree adults migrate, within a month to the nearest healthy tree and further infest. Thus infestation spreads. The infested patch of trees if kept untreated , becomes a major source of inoculum. The rate of spread of infestation at this time will be rapid, and a whole orchard can show symptoms in a matter of 3 – 6 months. From one orchard, the infestation can spread to neighbouring orchards</p>	<p>Drench soil around main trunk with a mixture of Chloropyriphos 2.5 ml+ Tridemorph 1 ml/lit. Use 2- 3 liters of mixture/ tree. After three weeks repeat with Monocrotophos 1.5 ml + Carbendazim 1 g/liter. If pest is severe , repeat the above drenching after a month. If infestation is low, drench with Azadirachtin (0.15%) 3ml/liter around main trunk 2 -3 liters of mixtures/tree with either of the above fungicide. Avoid water logging and keep soil rakes and aerated. Infested trees should be uprooted and burned, especially the root zone . Pits of uprooted trees should be treated with Chlro pyriphos 0.05% around all un treated trees prophylactically once in six months, followed by a spray on trees with Quinaliphos 0.06%, Followed by Azadirachtin 1500 ppm 3 ml/liter. Avoid leaving infested trees in field after uprooting</p>	<p>Infested cut trees should not left in the field</p>	<p>It will serve as source of inoculum</p>

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Pomegranate aphid , <i>Aphis punicae</i> Passerini	Spray Dimethoate 0.06%	As new shoot emerge	These are small green plant bugs on young leaves and flowers. Their sap sucking leads to shriveling of shoots. If serious, honey dew accumulates on leaves and sooty mold develops affecting photosynthesis	Spraying should be carried out preferably during evening hours. The specified insecticides should be mixed always with and adjuvant/sticker ( eg. Teepol @ 1 ml/liter) to have enhanced efficacy	Never mix insecticides and fungicides during spraying. If predators like syrphids and coccinelids are found delay spraying and in some cases, natural enemies can sufficiently suppresses the aphids and coccinel	It will reduce the efficacy of both insecticides and fungicides. The insecticidal sprays kills natural enemies present
Mealy bugs <i>(Ferrisaivirgate, Planococcus citri)</i>	Remove affected twigs and small branches. Spray monocrotophos (0.1%) or Chlorpyriphos (0.02%) or Dichlorovos (0.05%)	Whenever infestation is noticed	To destroy the colonies	Spraying	Provide light irrigation	Heavy irrigation enhances their build up
Leaf eating Caterpillar <i>(Acheajanata)</i>	Spray monocrotophos (0.1%). or Chlorpyriphos ( 0.02%) or Dichlorovos ( 0.05%)	Whenever infestation is noticed	To suppress leaf feeding	Spraying	Avoid leaving live caterpillar that may pupate and develop a generation	To prevent build up

## Harvesting and Yield

Pomegranate being a non-climacteric fruit should be picked when fully ripe. it take 4-5 years to come into bearing. Harvesting of immature or over mature fruits affects the quality of the fruits. The fruits become ready for picking 120-130 days after fruit set. The calyx at the distal end of the fruit gets closed on maturity. At maturity, the fruits turn yellowish-red and get suppressed on sides.

## POST HARVEST MANAGEMENT

### Grading

Fruits are graded on the basis of their weight, size and color. The various grades are super, king, queen and prince-sized. Besides that, pomegranates are also graded into two grades- 12 A and 12 B. Fruits of 12-A grade are generally preferred in southern and northern region.



## Storage

Fruits can be stored in cold storage upto 2 months or 10 weeks at a temperature of 5°C. Longer storage should be at 10°C and 95% RH to avoid chilling injury and weight loss.

## Packing

The size of packages varies according to the grade of the fruits. Corrugated fibre board boxes are mostly used. In a single box, 4-5 queen sized fruits, 12 prince sized and some of 12-A and 12-B grades may be packed. The white colored boxes having 5 plies are generally used for export purpose, whereas red-colored ones having 3 plies are used for domestic markets. The red colored boxes are cheaper than white colored ones. The cut pieces of waste paper are generally used as cushioning material.



## Transportation

Road transport by trucks/lorries is the most convenient mode of transport due to easy approach from orchards to the market.