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Pomegranate wilt: Identification and management

Wilt disease in pomegranate is one of the major bottlenecks in increasing the production and productivity of pomegranate and can cause major economic losses if timely control measures are not taken. However, mere drying plant does not always mean it is a wilt disease. Nutritional deficiencies/toxicities or irrigation errors can also lead to yellowing or drying of plants, hence, before taking any control measures for wilt disease, first you should pinpoint the cause through symptoms and then take appropriate management practices described below.

Symptoms:

Carefully observe the plants in the orchards showing yellowing/drooping/drying of leaves/nutrient deficiency type symptoms in some of the branches or entire plant. Make sure that plants have not dried because of unavailability of irrigation water due to blocked drippers. If this is ruled out, then observe the roots of wilted plant for external and internal symptoms to ascertain the cause of wilt, as several other factors are also known to cause wilt in pomegranate. Observe the roots for presence of fungus; split open the roots and lower portion of the stems to check internal symptoms. You can confirm the cause based on diagnostic symptoms enlisted below. This is utmost necessary to initiate the correct management practice for the management of pomegranate wilt.

- If the brown/grey/black discolouration of wood is observed on the roots of wilted plant, this type of symptoms results from infection of *Ceratocytis fimbriata* fungi (Plate-1). It is the most prevalent fungus associated with pomegranate wilt in India. In early stages of infection, inner root shows yellow wood with alcoholic smell. Plants die one after the other over a period in a row or vicinity generally is due to spread of *C. fimbriata* through water, intercultural operations like weeding, fertilizer application, farm implements or by farm animals like poultry birds.
- In case the xylem/center pith is brown/red in colour, these symptoms can be attributed to another fungi i.e. *Fusarium* sp. Though, it is not a major cause of wilt in many pomegranate areas.
- Fungi species like *Sclerotium* or *Macrophomina* cause grey/black root rot and generally observed where moisture is high around root zone.

- Collar rot/canker on stem at soil level (can also spread below and above soil level); caused due to infestation of *Phytophthora nicotianae* var. *nicotianae* or *Rhizoctonia* sp. Symptoms can also extend up to the root causing root rot.
- White wash /**mesh** like fungal growth on the root surface is due to *Rhizoctonia* sp. This is generally observed when beds are raised after plants grow and soil is heaped around the stem.
- Presence of pin holes on inner wood/outer surface, are due to shot hole borer (*Euwallacea/Xyleborus fornicatus*). These shot hole borers generally attack weak plants and are also attracted to metabolites produced by *Ceratocystis fimbriata*.
- Knots/galls on the pomegranate roots confirm the infestation of root-knot nematode. Above ground plant shows symptoms of nutrient deficiency and stunted growth. It is also observed that sometimes luxuriantly growing plants show reduced or no flowering for long periods (more than 1 year) due to heavy root infestation with root-knot nematode - *Meloidogyne incognita* (major parasitic species). It is the second major cause of wilt in pomegranate. Other plant parasitic species like *Rotylenchulus*, *Aphelenchus* and *Helicotylenchus* were also reported from pomegranate orchards.

The above symptoms may be present individually or 2 or more organisms may be present in association. If you do not find any of the above symptoms or are not sure of the cause, then samples should be sent/brought to the nearest laboratories of SAUs or ICAR institutes for identification/confirmation.

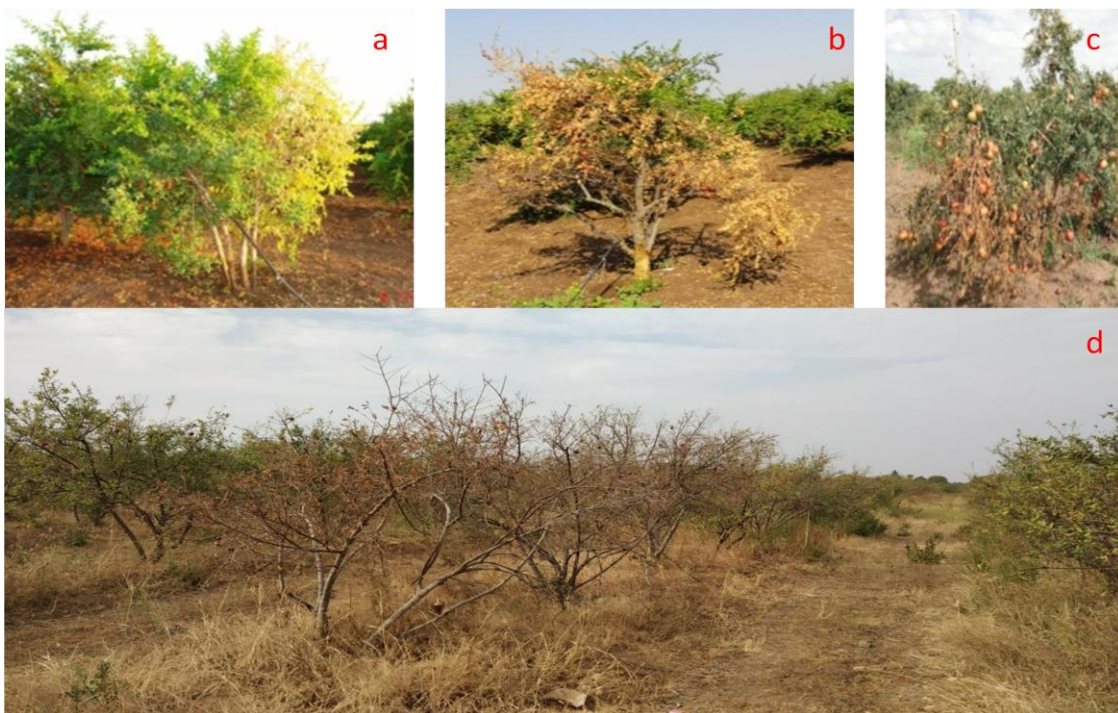


Plate-1: Wilted plants due to *Ceratocystis fimbriata* fungus. a) Initial yellowing of leaves. b & C) drying of one branch as disease progress d) wilting of plants in line.

Survival and Spread:

- Wilt fungus *C. fimbriata* can survive in the soil and in infested plant debris for several years (5-7 yrs). Wilt caused by root-knot nematode is reported from all type of soils but more severe in sandy loam soil with more aeration.
- Majority of wilt pathogen including fungus and nematodes spreads through infected planting material to new areas while intercultural operations like weeding, manure application, farm machinery and pruning tools, root grafts, flooding/runoff irrigation water and insects like shot hole borer can spread the pathogens within and nearby orchards.



Plate-2: Symptoms of Root-knot nematode on Pomegranate a) Pomegranate plant showing the symptoms of nutrient deficiency. b) Small galls visible in early nematode infestation. c) Fully grown plants without flowers d) Large sized galls on the roots of heavily infested pomegranate plants.



Plate-3: Root rot and collar rot by a) *Sclerotium* b) *Rhizoctonia* c) *Macrophomina* d) *Phytophthora* fungi



Plate-4: Symptoms due to minor wilt pathogens e) *Fusarium* wilt f) & g) Pin/Shot hole borer

Management:

1. The planting material i.e. sapling and the potting mixture in which sapling is planted should be free from wilt pathogens like fungi, nematodes and insects. Use of solarized/ sterilized soil (potting mixture) for saplings eliminates almost all soil borne pathogens. Planting samplings on raised beds increases aeration and reduce wilt incidence in the pomegranate orchards.
2. Soil solarization for 6 weeks in the hottest month (April-May) using 50-75 LLDPE (Linear Low Density Polyethylene) sheet kills the soil borne pathogen. Prepare the plot selected for planting, irrigate it and cover with the LLDPE sheet for better results.



Plate-5: Soil solarization before planting using LLDPE sheet during hottest summer months

3. Apply promising bioformulations such as *Aspergillus niger* AN27 (IRG 07) and Mycorrhiza [*Rhizophagus irregularis* Syn. *Glomus irregularis*], @ 1kg/acre and *Trichoderma harzianum*, *T. viride*, *Pseudomonas* spp. *Paecilomyces* spp. etc., right from planting, every 6 months. These serve as best preventive measure for all types of wilt pathogens.
4. Grow green manure crops like dhaincha (*Sesbania aculeata*) and sunhemp (*Crotalaria juncea*) during rainy season and incorporate in soil before flowering.
5. Apply boron depending on soil test value.
6. On observing first symptoms of wilt first ascertain the cause/s. If it is due to **fungal pathogens *Ceratocystis*, *Fusarium***, etc. in the orchard treat soil with only one of the following most promising protocols:
 - a. 1st drenching with Propiconazole 25 EC @ 2ml/ L + Chlorpyriphos 20 EC @ 2ml/L. After 30 days of first application; 2nd drenching with *Aspergillus niger* AN 27 (IRG 07) @ 5g/plant with 2Kg FYM/plant followed by 3rd

drenching of Mycorrhiza [*Rhizophagus irregularis* Syn. *Glomus irregularis*] @ 25g/plant with 2Kg FYM/plant 30 days after 2nd drenching.

OR

- b. Three drenchings at 20 days interval with propiconazole 25 EC @ 2 ml/L + Chlorpyrifos 20 EC @ 2 ml/L. Use 5-10 L solution/plant.

OR

- c. 1st and 3rd drenching with fosetyl Al 80% WP @ 6g/plant, 2nd and 4th drenching with Tebuconazole 25.9% w/w EC @ 3ml/plant. Make solution volume 10 L with water for each drenching.
- d. Drenching with Metalaxyl 8% + Mancozeb 64% @ 2-2.5g/L will be beneficial if *Phytophthora* is causing any loss.

7. To avoid residues in fruits drenching should be done immediately after harvest in rest period. Irrigate well the plants one day before treatment. After chemical drenching irrigation should be stopped for 2 days.
8. For controlling **shot hole borer** (*Xyleborus* spp.) which is associated with wilt disease, 10 litres preparation (paste) containing red soil (4kg) + Chlorpyrifos 20 EC (20ml) + Copper oxychloride 50 WP (25 g) needs to be applied on stem surface from plant base up to 2 ft. from second year onwards. Pasting should be done twice a year; once soon after the harvest and once at defoliation, before crop regulation. Shot hole borer attacks weak plants, hence keep plant vigour through recommended nutrition and proper irrigation during as well as after crop period. Prune out affected branches and do not dump in or near orchard.
9. Wilt due to **root knot nematodes** can be managed with soil application of promising bioformulations along with FYM like *Paecilomyces lilacinus*, @ 1-2 Kg/acre, *Aspergillus niger* (IRG07), Mycorrhiza [*Rhizophagus irregularis* Syn. *Glomus irregularis*] @ 1 Kg/acre. Application should be done from planting of saplings and repeated every 6 months. Drenching with azadirachtin 1% @ 3ml/L can be done twice a year. If the incidence of root-knot nematode is high, first go for chemical nematicides for reducing the nematode population below the damage threshold. Drenching of nematicide like fluopyrum 34.48% SC should be done @ 2 ml/plant. Plants should be sufficiently watered day before drenching. Mix 2 ml of the nematicide in one liter of water and pour 250 ml per dripper (4 drippers/plant) or 500 ml per dripper (2 drippers/plant). Farmer can also use the granular nematicide Fluensulfone 2% GR. In order to use the granular nematicide, make a small pit under the dripper and apply the granular chemical @ 10 gm per dripper (Maximum dose should not exceed 40 gm/plant); cover it with the soil and start watering. The planting of African marigold (*Tagetes erecta*) varieties like 'Pusa Narangi Gaiinda' and 'Pusa Basanti Gaiinda' in the space between pomegranate plants for 3-5 months for the effective results. Application of well decomposed organic manure, vermicompost, neem cake along with green manuring crops like sesbania or

sunhemp and above mentioned bioformulations can manage the menace of root-knot nematode in pomegranate.



Pusa Narangi Genda

Pusa Basanti Genda

Plate-6: African marigold varieties recommended for intercropping in pomegranate for the management of root-knot nematode

10. Once the wilt disease is detected in the orchard, dig the 3-4 feet long trench between healthy and diseased/wilted plant. The partial wilt affected plants showing initial symptoms should be immediately treated with suitable agrochemicals. The plants showing more than 25% dry branches or completely dead plant should be removed and burnt and should not be kept dumped as woodpile. While removing wilted plant from the orchard, due care should be taken not to spread the infected root samples and soil to nearby plants.
11. Soil solarization or formalin should be used to disinfect such pits after removing the diseased (wilt affected) plants. For this 1 foot deep and 2X2 feet pit should be made at the place where trunk has been removed. Formaldehyde solution (37-41% formalin) Half a liter of the solution is required for 10 liter of water per pit. The solution should be made at the site of pit and poured immediately. Before starting, one should cover whole body, use mask, gloves and eye protection as formalin is poisonous to humans. After adding the formalin into the water, quickly pour it in the pit and cover it with plastic and soil so that vapor generated from the solution should not escape in the atmosphere. Keep the pit covered for 1 week. After 1 week, remove the plastic cover and rake the soil for next 10-15 days, till the smell for formalin is completely gone. The pit can be used for planting new sapling.
12. As soon as the initial symptoms of the wilt visible in the orchard, drenching should be taken in the root areas around the main trunk and 2-3 plants in all four sides using recommended agrochemicals.



Plate -7: Soil treatment of wilt affected plot.

- Pruning tools should be disinfected after each use; plants cut ends painted with 10% Bordeaux paste. *Azadirachta indica* (neem) oil may be added @ 50ml/L in the paint during rainy season. Pruning should be avoided during monsoons/rainy days. Affected plants within the buffer zone should be treated with a systemic fungicide; neighboring asymptomatic apparently healthy plants should also be treated with appropriate systemic fungicides. Plants with more than 25% canopy loss should preferably be uprooted and burnt for better wilt management.