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Impact of Different Soil Conditions on Survival of Fusarium spp. Responsible for Wilt Disease in Guava (Psidium guajava L.)

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ABSTRACT

Guava (Psidium guajava L.) is an economically important fruit crop in tropical and subtropical regions. Wilt disease caused mainly by Fusarium oxysporum f. sp. psidii and Fusarium solani is one of the most destructive diseases of guava orchards. The survival and population dynamics of Fusarium spp. in soil are strongly influenced by soil conditions such as pH, temperature, moisture, organic matter, and soil texture. This study investigates the impact of different soil conditions on the survival and growth of Fusarium spp. under laboratory and pot conditions. Soil samples with varying physicochemical properties were analyzed to determine their effect on fungal growth and disease incidence. Results indicate that slightly acidic to neutral soils (pH 6.0–7.0), moderate moisture, and warm temperatures (25–30°C) favor fungal growth and sporulation. Understanding the relationship between soil conditions and pathogen survival can help develop effective management strategies to reduce guava wilt incidence.

1. Introduction

Guava (Psidium guajava L.) is widely cultivated in tropical and subtropical countries including India. Wilt disease is considered one of the most serious constraints in guava cultivation, causing significant yield losses. The disease is mainly caused by Fusarium oxysporum f. sp. psidii and other Fusarium species.

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The pathogen is soil-borne and survives in soil for many years in the form of chlamydospores and mycelial fragments. Environmental conditions such as soil pH, moisture, temperature, and nutrient availability strongly influence the survival and multiplication of the pathogen.

Research has shown that Fusarium oxysporum grows across a wide pH range (5.0–8.5), with maximum growth near pH 6.5 and temperatures around 25–30°C.

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Understanding the influence of soil conditions on pathogen survival is essential for developing sustainable disease management strategies.

2. Objectives of the Study

- To study the effect of different soil conditions on the survival of Fusarium spp.
- To analyze the relationship between soil pH and pathogen growth.
- To determine the influence of soil moisture and temperature on fungal survival.
- To identify soil conditions favorable for wilt development in guava.

3. Materials and Methods (Research Methodology)

3.1 Study Area

The study may be conducted in guava orchards and laboratory conditions in a plant pathology laboratory. Soil samples can be collected from guava orchards affected by wilt disease.

3.2 Collection of Soil Samples

Soil samples were collected from infected guava orchards at a depth of 0–30 cm around the root zone of plants.

Table 1: Soil Sampling Details

Sample No.	Orchard Location	Soil Type	Soil Depth (cm)
S1	Guava orchard A	Sandy loam	0–30
S2	Guava orchard B	Clay loam	0–30

S3	Guava orchard C	Sandy soil	0–30
S4	Guava orchard D	Loamy soil	0–30

3.3 Isolation of Fusarium spp.

The fungus was isolated from infected guava roots using the standard tissue isolation method.

Steps:

- Diseased roots were collected and washed with distilled water.
- Small root pieces were surface sterilized using 0.1% mercuric chloride.
- Samples were placed on Potato Dextrose Agar (PDA) medium.
- Plates were incubated at 27 ± 2°C for 5–7 days.
- Fungal colonies were purified using the single spore technique.

3.4 Experimental Design

The experiment was conducted using a Completely Randomized Design (CRD) with three replications.

- Factors Studied
- Soil pH
- Soil moisture
- Soil temperature
- Soil type

3.5 Effect of Soil pH on Survival of Fusarium

Table 2: Effect of Soil pH on Growth of Fusarium

Treatment	Soil pH	Radial Growth (mm)	Sporulation
T1	5.0	Moderate	Moderate
T2	6.0	High	High

T3	6.5	Very High	Very High
T4	7.0	High	High
T5	8.0	Low	Low

Studies indicate that the maximum growth and sporulation of Fusarium oxysporum occur near pH 6.5–7.0, while growth declines in strongly alkaline soils.

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3.6 Effect of Soil Moisture

Table 3: Effect of Soil Moisture on Fungal Survival

Treatment	Soil Moisture (%)	Fungal Growth
M1	20%	Low
M2	40%	Moderate
M3	60%	High
M4	80%	Very High

Higher soil moisture generally favors pathogen growth and disease development because the fungus spreads easily through soil water.

3.7 Effect of Soil Temperature

Table 4: Effect of Temperature on Growth of Fusarium

Treatment	Temperature (°C)	Growth Rate
T1	20°C	Moderate
T2	25°C	High
T3	30°C	Very High

T4	35°C	Moderate
T5	40°C	Low

Optimum temperature for fungal growth was found between 25°C and 30°C.

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3.8 Effect of Soil Texture

Table 5: Influence of Soil Type on Fusarium Survival

Soil Type	Water Holding Capacity	Disease Incidence
Sandy soil	Low	Moderate
Sandy loam	Medium	High
Clay loam	High	Very High
Loamy soil	Medium	High

Soils with high moisture retention such as clay loam often show higher wilt incidence.

4. Results and Discussion

The results revealed that soil conditions significantly influence the survival and growth of Fusarium spp. Slightly acidic to neutral soils showed the highest fungal growth. Soil moisture and temperature also had strong effects on fungal proliferation.

Clay loam soils with high moisture retention favored the development of wilt disease. These findings suggest that soil management practices such as improving drainage, maintaining neutral soil pH, and enhancing microbial diversity can help reduce pathogen survival.

5. Conclusion

The study demonstrated that soil conditions play a crucial role in the survival and spread of Fusarium spp. responsible for guava wilt disease. Optimal fungal growth occurs at pH 6.0–7.0 and temperatures between 25°C and 30°C. High soil moisture and poorly drained soils promote disease development. Therefore, proper soil management, including balanced fertilization, drainage improvement, and biological control methods, is essential for reducing wilt incidence in guava orchards.

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