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The disease equation

How shifts in temperature, moisture and oxygen create a perfect storm for wilt-causing pathogens

BY VIKRANT
DHAWAN,
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MOHYUDDIN MIRZA

A wilted plant is often the first visible warning that something has gone wrong inside a greenhouse. Leaves lose their firmness, growth begins to slow, and plants may gradually, or sometimes rapidly, decline. Yet wilt itself is not a disease; it is a symptom that can develop when water movement through the plant is disrupted by root damage, vascular infection, environmental stress, or a combination of these factors.

What makes wilt particularly challenging in greenhouse production is that the environment can influence how strongly a disease develops. Temperature, humidity, moisture, irrigation practices, air movement, and plant stress interact with the host and pathogen to create the conditions under which disease can establish and spread.

Understanding this interaction is especially important when producing high-value crops such as cannabis, tomato, and cucumber.

DISEASE TRIANGLE

Plant disease is commonly explained through the disease triangle: **host, pathogen, and environment**. A susceptible crop and a pathogen may be present without causing significant disease until environmental conditions become favourable. The more favourable those conditions become, the greater the potential for disease development and severity.

Greenhouse production provides an advantage because many environmental variables can be monitored and influenced. However, rapid changes in temperature, prolonged high humidity,

ABOVE

An example of mature cannabis plants early wilting symptoms which was diagnosed to be due to very high relative humidity, over 90 per cent and a Vapour Pressure Deficit of less than a gram/m³ of air. Transpiration from leaves was reduced and all metabolic activities were negatively affected.

RIGHT

Recently planted cucumber seedlings showing wilt due to the fungus *Pythium* and also missing couple of fertigation.

condensation, excessive moisture, poor air movement, or stressed plants can shift the balance in favour of disease.

This is why environmental records can be just as valuable as visual symptoms when investigating a wilt problem.

WILT BELOW THE CANOPY

Cannabis can be affected by several soil- and substrate-associated pathogens, including species of *Fusarium* and *Pythium*. *Fusarium* species have been documented as causes of root rot, crown rot, damping-off, and wilt in cannabis. Symptoms may include chlorosis, stunting, root or crown discoloration, and, in more advanced cases, wilting.

Environmental conditions can influence how quickly these problems progress. High humidity can encourage fungal growth, while excessive moisture around roots can create favourable conditions for certain root pathogens. In a commercial greenhouse, disease management therefore begins with



preventing favourable conditions from developing and maintaining consistent sanitation and crop monitoring.

When wilt appears, growers should examine the roots, crown, and lower stem rather than assuming the plant simply requires more water. The distribution of affected plants can also provide valuable

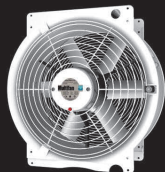
information: isolated plants may suggest a localized problem, while a pattern following irrigation or water movement may point toward a different source.

TOMATO WILT

Tomato provides a clear example of how environmental conditions can influence

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LEFT

A view of the cross-section of a wilting tomato plant stem, about 12 inches from the base.

works alongside sanitation, resistant varieties where available, and appropriate disease monitoring.

CUCUMBER: SPEED MATTERS

Cucumber can experience wilt associated with both soil- or substrate-borne pathogens and bacterial diseases. They are very sensitive to oxygen dynamics in the root zone and when dissolve oxygen drops below 4 mg/L then damping off molds like *Pythium* spp. attack roots and wilting occur.

Then *Fusarium* and *verticillium* and Gummy Stem Blight can all attack plant. Wilt causing fungi generally attack when plant is fully loaded with fruit and can cause a significant economic loss.

This illustrates why greenhouse disease management cannot focus only on humidity and irrigation. Pest management, sanitation, environmental monitoring, and early scouting all form part of the same disease-prevention strategy.

wilt disease. *Fusarium* wilt, caused by *Fusarium oxysporum* f. sp. *lycopersici*, is favoured by warm conditions.

Symptoms can include yellowing, wilting, and discoloration of the plant's water-conducting tissues.

Verticillium wilt can produce similar symptoms but is generally associated with cooler conditions. Because the symptoms overlap, temperature history can provide

an important clue, but it should not replace proper diagnosis.

Greenhouse tomatoes also demonstrate the importance of humidity management.

Dense canopies, limited airflow, condensation, and prolonged periods of high relative humidity can increase pressure from several diseases. Good environmental management therefore

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RIGHT

Tomato stems producing adventitious roots is an indication of high relative humidity and poor air movement.

READ THE ROOM

When wilt appears, the plant itself is only part of the story. Growers should ask what changed before symptoms appeared.

Was there an unusual temperature event? Did humidity remain elevated overnight? Was condensation present? Did irrigation patterns change? Were affected plants concentrated in one section of the greenhouse? Has airflow changed as the canopy became denser?

The answers can help distinguish environmental stress from an infectious disease and can also provide clues about how a pathogen may be developing.

Examining roots, crowns, and vascular tissues can provide additional information. Where symptoms are unclear or multiple causes are possible, laboratory diagnosis is valuable because treating the wrong problem can delay corrective action while disease continues to develop.

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MANAGING RISK

Greenhouse growers cannot eliminate every pathogen from a production system, but they can influence many of the conditions that determine disease development.

Maintaining appropriate temperature and humidity, promoting air movement, reducing unnecessary condensation and leaf wetness, managing irrigation carefully, maintaining sanitation, monitoring insect vectors where relevant, and scouting consistently can all reduce disease risk.

The most effective disease-management strategy is therefore not simply reacting when plants wilt. It is recognizing the environmental conditions that make disease more likely and correcting them before symptoms become widespread.

Wilt may be visible on the plant, but the conditions that allow it to develop often begin much earlier. Learning to read the greenhouse environment can give growers the advantage they need to identify problems sooner, respond more accurately, and protect crop performance.

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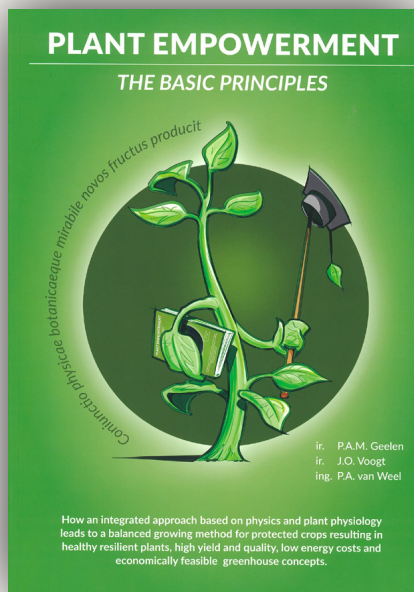


RIGHT

Tomato plants showing wilting of the top.

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