

Plant Diseases: A Threat to Global Food Security

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ABSTRACT

Plant diseases pose a direct threat to the food security of any nation. Numerous plant pathogens are responsible for substantial yield losses in major food crops. Pathogens belonging to diverse groups possess specialized mechanisms of infection and can affect multiple crops under favourable conditions. In severe cases, pathogen infection can result in crop losses of up to 100%. Fungal pathogens are particularly notorious for causing destructive diseases. Several bacterial pathogens are also well known for causing serious infections in plants. Historically, major plant disease outbreaks have contributed to famines, causing widespread crop failure and severe disruption to human populations. Thus, plant diseases remain a major challenge to crop production, food security, and agricultural sustainability.

INTRODUCTION:

Plant diseases are a major challenge for farmers due to their rapid spread and the notable yield losses they can cause (Strange and Scott, 2005). Several groups of pathogens occur naturally, including fungi and bacteria, which are responsible for causing various diseases in crops (Figure 1, Table 1).

Major microbial groups causing plant diseases

Fungal diseases: Fungal plant pathogens are among the most destructive and widely distributed plant pathogens worldwide and are known to cause several diseases in diverse crops. Diseases such as wilting (caused by

Fusarium spp. and *Verticillium* spp.), rust and smut (caused by *Puccinia* spp. and *Ustilago maydis*), leaf spot (caused by *Alternaria* spp.), and root, stem, and fruit rots (caused by *Rhizoctonia* spp. and *Botrytis* spp.) are common examples (Lavanya, 2025).

Bacterial diseases: Several bacterial species are also known to cause severe plant diseases, resulting in yield losses. Some important examples include bacterial blight (caused by *Erwinia* and *Pectobacterium*), leaf spots (caused by *Pseudomonas* and *Xanthomonas*), crown gall (caused by *Agrobacterium*), bacterial canker and vascular diseases (caused by *Clavibacter*), and bacterial wilt (caused by *Ralstonia*) (Borkar and Yumlembam, 2016).

Viral diseases: Several groups of viruses are also involved in causing diseases in plants. They are primarily transmitted through insect vectors, mechanical transmission, or vegetative propagation. Common examples of viral diseases include Tobacco mosaic virus (TMV), which causes leaf distortion and mottling, Cucumber mosaic virus (CMV), which causes leaf spotting and stunted growth and Tomato yellow leaf curl virus (TYLCV), which causes leaf curling and stunted plant growth (Petrov *et al.*, 2024).

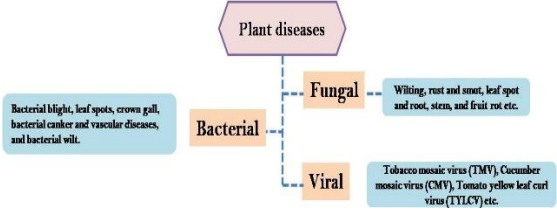


Figure 1: Different plant diseases and their sources

Table 1: Major Crop Diseases and Their Causal Pathogens

S.No.	Disease	Pathogen involved	Crop effected
1.	Fusarium wilt	<i>Fusarium oxysporum</i>	Banana, tomato, pulses etc.
2.	Bacterial blight	<i>Xanthomonas oryzae</i>	Rice
3.	Stem rust	<i>Puccinia graminis</i> f. sp. <i>tritici</i>	Wheat

4.	Rice blast	<i>Magnaporthe oryzae</i>	Rice
5.	Potato late blight	<i>Phytophthora infestans</i>	Potato
6.	Tobacco Mosaic disease	Tobacco Mosaic Virus (TMV)	Tobacco, tomatoes, peppers, and cucumbers,

Management of plant disease

Chemical Control: Several chemicals are available for controlling plant pathogens. Although this approach is effective and widely used, their excessive or improper use can adversely affect soil health and the environment. Persistent pesticide residues may remain in the soil for extended periods, contaminating soil and water bodies and adversely affecting beneficial organisms and other forms of life.

Biological Control: Microorganisms have the natural ability to suppress plant pathogens through several mechanisms. These microorganisms, including beneficial bacteria and fungi known as antagonists, can be utilized for disease suppression while also promoting plant growth. Several microbial biofertilizers and biocontrol formulations are available that can help reduce plant diseases and improve crop health.

Integrated Disease Management: Agricultural practices that employ disease-management strategies, such as the use of resistant varieties and healthy cultural practices can help minimize disease incidence and reduce crop losses. The integration of these practices provides an effective and sustainable approach to maintaining crop health and productivity.

CONCLUSION

Plant diseases are a serious threat to crop production, capable of reducing both yield and quality and causing substantial economic losses to farmers. With changing climatic

conditions, intensive cultivation, and the continuous emergence of new disease problems, managing plant diseases has become more challenging than ever.

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