

When Maize Leaves Turn Brown: Understanding and Managing Maydis Leaf Blight in Maize

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Southern corn leaf blight (SCLB) epidemic of 1970 in the United States is a classic example of the risks associated with genetic uniformity in maize. Widespread use of Texas male-sterile cytoplasm (CMS-T), which facilitated hybrid seed production without detasseling, made ~85–90% of commercial maize hybrids susceptible to *Bipolaris maydis* (formerly *Helminthosporium maydis*) race T. The pathogen produced T-toxin, damaging mitochondria and causing severe leaf blight, with an estimated 15–16% loss in yield of the national maize crop in the USA. Though the outbreak of disease was not reported in India, this epidemic highlights the importance of managing maydis leaf blight (MLB) through resistant varieties, genetic diversity, and integrated disease management to minimise yield losses and ensure sustainable maize production.

Introduction

Maize (*Zea mays* L.) is a strategically important crop worldwide and plays a vital role in global food security. Beyond its use as a staple food, maize supports food and feed systems, poultry and livestock production, and several agro-industries (Katral et al. 2026). However, its yield potential is often threatened by diseases that damage the green leaves, which serve as the plant's primary food-producing factories through photosynthesis. Among these, southern corn leaf blight (SCLB) caused one of the most devastating disease epidemics in maize history in the United States in 1970. The epidemic was exacerbated by the widespread use of Texas male-sterile cytoplasm (CMS-T), which made maize plants highly susceptible to the T-toxin produced by *Helminthosporium maydis* (now *Bipolaris maydis*) and the disease is commonly known as maydis leaf blight (MLB). Thus, maize MLB disease is a serious foliar disease distributed across India, particularly in the Northern part of the country, including Delhi, Punjab, Uttar Pradesh, Haryana, Madhya Pradesh, Karnataka, and Andhra Pradesh (Kumar et al. 2022). Fungicide/chemical-based management of disease adds to production costs, thereby reducing the BC ratio and causing an economic yield loss up to ~40%. Early disease identification, the cultivation of resistant varieties/hybrids, and the adoption of integrated disease management practices are essential to minimise yield losses and ensure sustainable maize production (Khokhar et al. 2014).

How to recognise the disease

Maydis leaf blight is caused by the fungus *Cochliobolus heterostrophus*, commonly referred to by its asexual name *Bipolaris maydis*. The first warning signs are small, elongated or diamond-shaped spots on the leaves. They typically have a straw-coloured to light-brown centre surrounded by a darker brown margin. As lesions enlarge and multiply, leaves may look scorched; in severe cases, blighting can spread across much of the foliage. Symptoms may also be seen on leaf sheaths, husks and other plant parts (**Figure 1**). The damage is not merely cosmetic. Green leaves capture sunlight and convert it into energy needed for grain

development. When large areas of leaf tissue are destroyed, the plant has less capacity to fill kernels. Infection early in crop development can be particularly damaging, affecting plant growth and yield components. Under favourable conditions and with susceptible maize for MLB disease, it can cause severe yield losses; actual yield losses vary with disease pressure, crop stage, weather, and the hybrid under cultivation (Kumar et al. 2022).

When does the disease become serious?

Warm, humid weather favours disease development. Kumar et al. (2022) reported that temperatures around 20-30 °C and relative humidity above 80% are conducive to MLB. Moisture from rain, dew, or prolonged leaf wetness helps fungal spores germinate and infect plant tissue. The fungus can survive on infected crop residues, which may serve as a source of inoculum for the next crop. Once lesions produce spores, these can spread to nearby leaves and plants, allowing the disease to build up quickly when conditions remain favourable. Farmers should therefore pay attention to the lower leaves as well as the overall appearance of the crop, especially during warm, humid periods. Regular field scouting helps to identify suspicious lesions before extensive blighting develops. Because other maize leaf diseases can look similar, uncertain cases should be checked with the plant pathology specialist or local agricultural extension officer rather than diagnosed from appearance alone.

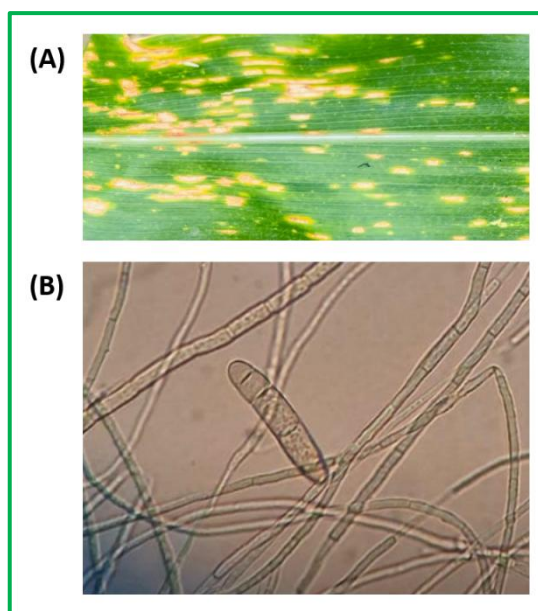


Figure 1: MLB disease incidence in maize. (A) Disease incidence on leaves; (B) Conidia of MLB

A combination of measures works best

No single practice is equally effective in every field. Integrated disease management, which combines several compatible measures, is more sustainable than relying entirely on fungicides (Rai et al. 2012).

- ✓ Choose resistant varieties or hybrids: Host-plant resistance is a cost-effective, environmentally sound foundation for management. The source review reports resistant maize lines identified in India and other countries, but performance can vary by location and pathogen population. Farmers should select varieties recommended for their region and current disease situation.
- ✓ Reduce carry-over effect from crop residues: Practically manage heavily infected maize debris and follow locally adapted cultural practices. Crop rotation and residue management can help to reduce the amount of disease-causing material available to initiate infection.
- ✓ Scout fields and seek timely advice. Monitor the crop during humid weather, note where symptoms begin and whether they are spreading, and consult local experts when disease severity increases. Good crop management supports healthy plants, but no cultural practice should be considered a guaranteed cure.
- ✓ Use crop-protection products responsibly: Fungicides like carbendazim would be greatly useful in controlling disease in some situations, depending on disease severity, crop value, product registration, and timing. Use only products approved for maize in the relevant jurisdiction, and follow the label and advice of qualified local specialists. Avoid unnecessary or repeated applications, which add cost and can increase environmental risks.

Breeding stronger maize for the future

Long-term protection depends on developing maize that can withstand the disease. Resistance may be controlled by a major gene, by several genes with small individual effects, or by a combination of both. The studies on MLB disease highlight quantitative resistance as especially

valuable because it can be more durable and less dependent on the pathogen race than resistance controlled by a single gene. Modern breeding tools can help researchers to identify and combine useful resistance regions more efficiently. Marker-assisted selection uses DNA markers linked to desirable genes or genomic regions, while genomic selection can help predict the breeding value of plants using information from across the genome. These approaches do not replace field testing: promising lines still need to be evaluated under relevant disease conditions and across locations (multi-locations). The studies also emphasise the need to validate known resistance regions and discover new ones in Indian maize germplasm, particularly material adapted to tropical and subtropical environments.

Conclusion

Maydis leaf blight is a reminder that protecting yield begins with protecting the plant. Early recognition, locally adapted resistant hybrids, sensible crop-residue management, regular monitoring and responsible use of crop-protection procedures can work together to limit disease pressure. At the same time, sustained research into the pathogen and the genetic basis of resistance will help to deliver more resilient maize varieties. A combination of informed farm management and science-led breeding offers the strongest path towards healthier crops and more reliable harvests.

References

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