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# Management of Major Diseases of Pearl Millet for Quality Seed Production

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## Introduction

Pearl millet is extremely vulnerable to several bacterial, viral, and fungal diseases. These diseases have the potential to cause catastrophic impacts on the crop, resulting in major output losses and financial distress for farmers. Sustainable production depends on identifying the main disease that impact pearl millet and comprehending their biology and treatment options. Through this article, we seek to give an overview of the major pearl millet disease and insights into practical disease management strategies. Even in areas with limited resources, millions of people rely on this crucial staple crop worldwide for their food and livelihood. Because of its ability to withstand tougher environmental conditions. However, these diseases and infections reduce the yield of the millet plant, making it difficult to grow. That's why there's a shift towards sustainable pearl millet production which depends majorly on identifying the main disease and comprehending their biology and treatment options so as to know a technique to treat them. Millions of people in India depend on pearl millet for their livelihood and food security. However, the crop might become affected and the disease caused not only lowers the yield but also has a grave impact on the grain's quality and nutritional content. For the country's food security and to maintain the production of pearl millet, it is essential to further comprehend the principal disease and its treatment.

### (i). Downy Mildew

**Etiology: -** One of the most harmful diseases of pearl millet is downy mildew, which is caused by the fungus *Sclerospora graminicola*. The disease attacks the plant's aerial portions, which stunts growth and lowers the grain output.

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**Symptoms: -** White to grayish downy growth on leaves, black lines on panicles, and white sporulation on diseased plant parts are all signs of downy mildew.

**Epidemiology: -** Mild temperatures and considerable humidity are favorable for the disease to prosper. The infection may spread by wind, rain, and irrigation water and can be found in debris from infected plants.

**Management: -** Use of resistant cultivars, crop rotation, seed treatment with fungicides, and appropriate field hygiene practices are some of the management techniques for downy mildew. A possible strategy for resistance is genetic improvement.

**Fig.1: Downy Mildew of Pearl Millet (Google Source: https://justagriculture.in/)**

**(ii). Rust Diseases**

**Etiology: -**Fungal pathogens like *Puccinia penniseti* and *Puccinia substrata* cause rust infections in pearl millet. They mostly impact the plant's leaves and panicles.

**Symptoms: -**Reddish-brown pustules on the leaves, glumes, and panicles are symptoms of rust infections. Serious infections might result in considerable production losses and early drying of panicles.

**Epidemiology: -** Infected plant detritus contains teliospores of the rust pathogens, which are dispersed by wind and rain. Environmental factors that favor disease development include excessive humidity and temperate temperatures.

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**Management:** -Using resistant cultivars, timely planting, removing infected plant debris, and applying foliar fungicides are all part of managing rust infections. Long-term control may be achieved by host resistance gene pyramiding and resistance breeding.

**(iii). Grain Mold**

**Etiology:** - Several fungi, such as *Curvularia lunata* and *Fusarium moniliforme*, are responsible for grain mold. This disease damages growing grains, causing discoloration and. deteriorating grain quality.

**Symptoms:** - Infected grains show discoloration, frequently becoming black or dark brown. The surface of the grain may develop a fluffy fungal growth, and the afflicted grains are thin.

**Epidemiology:** - Pathogens that cause grain mold can live on both plant detritus and in the soil. Although they may also spread by wind and rain, they are mostly seed-borne.

**Management:** - The use of disease-free seed, seed treatment with fungicides, appropriate drying and storage procedures, and crop rotation are all very necessary for the management of grain mold. For efficient control, integrated strategies that include cultural and chemical measures can be used**.**

**(iv). Blast**

**Etiology:** - The fungus *Magnaporthe grisea* causes blast, which affects the leaves, panicles, and stems of the pearl millet plant. The cultivation of pearl millet is seriously threatened.

**Symptoms:** - Oval to elliptical lesions on the leaves and panicles that have brown borders and grey centers are all signs of the blast. Panicle development may be stunted or generated with poor filling in severely infected panicles.

**Epidemiology:** - The blast pathogen lives on crop debris that has been infected and spreads by wind and rain splashes. Disease development is favored by high humidity and moderate temperatures.

**Management:** -The adoption of resistant cultivars, good field hygiene, timely planting, and the application of fungicides during disease outbreaks are all

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management techniques for blasts. Long-term control measures come in the form of integrated strategies that combine host resistance and cultural norms.

**(v). Smut**

**Etiology: -** *Ustilago bullata* is a fungus which causes smut. It affects the leaves, stems, and inflorescence of the pearl millet plant, among other parts.

**Symptoms: -**Swollen, deformed panicles covered in a black, powdery mass of spores can be seen on infected plants. Infections of the leaves and stems can also happen, which reduces plant vigor.

**Epidemiology: -** The smut fungus thrives in the soil and on plant waste that has been infected. The wind, the rain, and polluted agricultural equipment all disseminate spores.

**Management: -**The smut fungus thrives on decaying plant matter and diseased soil. Spores are disseminated by wind, rain, and polluted agricultural equipment.

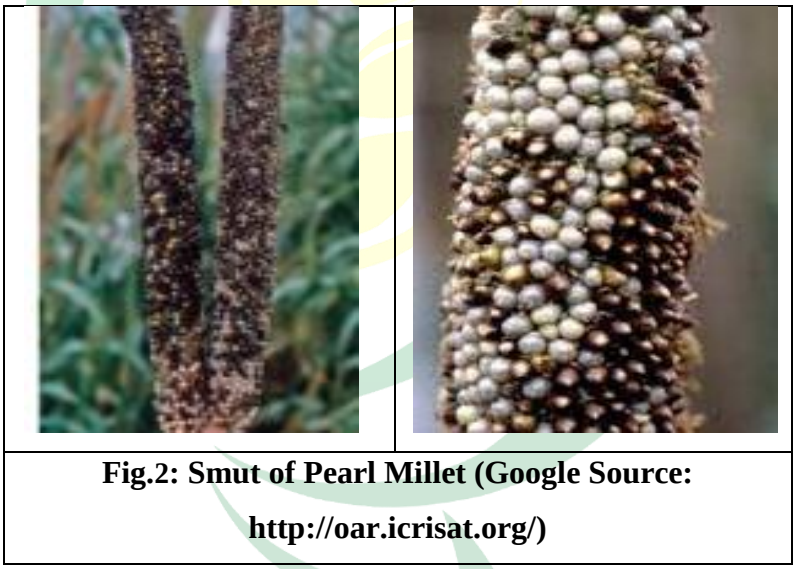

**Fig.2: Smut of Pearl Millet (Google Source: http://oar.icrisat.org/)**

**(vi). Leaf Blight**

**Etiology: -** The fungus *Pyricularia grisea* causes leaf blight of pearl millet. It damages the leaves, causing the development of recognizable brown to grayish lesions.

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**Symptoms:** -Brownish to greyish lesions that may have a yellow halo appear on the infected leaves which can result in Extensive defoliation. Conidia, which are crucial to the pathogen's survival and dissemination, are produced as part of the disease cycle.

**Epidemiology:** - In pearl millet, leaf blight can result in yield losses of up to 10% to 30% or more, depending on the disease's severity and the plant's stage of growth. Grain fullness and quality can also be impacted by severe defoliation.

**Management:** -The use of resistant cultivars, cultural techniques such as crop rotation, and the removal of affected plant detritus, with an optimized administration of fungicides are used to manage leaf blight in pearl millet. A good air circulation system with lesser plant densities can lessen the severity of the disease.

**(vii). Ergot**

**Etiology:** - *Claviceps fusiformis* is a kind of fungus that causes ergot of pearl millet. The resultant effects are the production of dark-colored sclerotia which severely affects the inflorescence.

**Symptoms:** - Unlike usual grains, infected panicles produce elongated, dark-colored sclerotia. Sclerotia that germinate as part of the disease cycle release ascospores and start fresh infections.

**Epidemiology:** - Depending on the disease's intensity, ergot can result in significant yield losses in pearl millet, ranging from 10% to 50% or more. Poor-quality infected grains can result in a decreased market value of the crop.

**Fig.3**: Ergot of Pearl Millet (Google Source: http://agropedia.iitk.ac.in/)

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**Management: -** The use of resistant cultivars and adoption of cultural techniques like crop rotation with the removal of diseased plant detritus are the common methods applied to manage ergot disease in pearl millet. Ergot contamination is less likely when high-quality, disease-free certified seeds are planted.

**Table1: Major Diseases of Pearl Millet**

| S.No. | Diseases | Causal organism | Order | Family | Symptoms |
|---|---|---|---|---|---|
| 1. | Smut | *Ustilago bullata* | Ustilaginales | Ustilaginaceae | Flowers are replaced by black, powdery masses. |
| 2. | Downy Mildew | *Sclerospora graminicola* | Peronosporales | Peronosporaceae | Yellowish-white downy growth on leaves and panicles |
| 3. | Leaf Blight | *Pyricularia grisea* | Magnaporthales | Magnaporthaceae | Small, water-soaked lesions on leaves |
| 4. | Blast | *Magnaporthe grisea* | Magnaporthales | Magnaporthaceae | Small, water-soaked lesions on leaves with a diamond- or elliptical-shaped appearance |
| 5. | Rust Diseases | *Puccinia penniseti and Puccinia substrata* | Pucciniales | Pucciniaceae | Orange pustules on leaves and stems |
| 6. | Ergot | *Claviceps* | Hypocreales | Clavicipitaceae | Black fungal |

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| | | | | | |
|---|---|---|---|---|---|
| | | *fusiformis* | | | structures (sclerotia) replace grains |

**Recent Advances in Disease Management**

**(1) Host resistance breeding:** -The discovery and introduction of disease-resistance genes into pearl millet cultivars has been made easier by developments in molecular biology and genomics. The creation of resistant variants with improved resistance to various serious diseases could be hastened through the implication of marker-assisted selection and genomic selection techniques.

**(2) Chemical control:** -For managing disease in pearl millet, fungicides have been employed extensively. However, their efficiency is reliant on appropriate timing, application techniques, and taking the environment into account. To reduce reliance on chemical control, integrated techniques that mix fungicides with other disease management strategies are advised.

**(3) Cultural practices:** -Implementing cultural practices like crop rotation, good hygiene, and efficient irrigation management can help lower the prevalence and severity of the concerned disease. These procedures reduce inoculums accumulation, break the cycle of disease and make it difficult for the pathogens to grow.

**(4) Integrated pest management approaches:** -IPM initiatives, which include a variety of disease management techniques, including host resistance, cultural norms, biological control, and prudent pesticide usage, have produced encouraging results. IPM strategies work better to control disease while having a smaller negative impact on the total environment and human health.

**Conclusion**

As we know by now, this commonly grown cereal crop called pearl millet might be vulnerable to a number of diseases that can severely lower its seed output and affect its quality. To cope up with the resultant financial losses and to provide a consistent supply of high-quality seeds, effective disease management techniques are crucial and are being adopted. For pearl millet production to be sustainable, it is essential to comprehend the etiology, symptoms, epidemiology, and management techniques of these diseases.

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Fighting these diseases may be accomplished by the use of resistant cultivars, integrated disease management strategies, and breeding for resistance. The resilience and production of pearl millet can be definitely improved by reducing the effects of these diseases, which would help the farmers and communities who depend on this important grain crop. So, in order to achieve the before said, efficient plans must be generated and food security must be ensured in areas where pearl millet is extensively grown and also research must be carried out indefinitely and interdisciplinary cooperation between scientists, agronomists, and politicians is all very crucial for holistic results.

**References:-**


- https://justagriculture.in
- http://oar.icrisat.org/
- http://agropedia.iitk.ac.in