



Major Diseases of Wheat and their Management

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Introduction:

Wheat is one of the most important staple crops in the world and is often known as the 'king of cereals'. It ranks second after rice and serves as the primary source of plant-based protein in the human diet. It is cultivated worldwide in areas with varying soils, latitudes and climatic conditions. In India, wheat is a Rabi or winter crop, grown predominantly in Uttar Pradesh, Punjab, Madhya Pradesh, Haryana, Rajasthan, Bihar etc. Over the past few decades, wheat production has seen substantial yield gains, leading to a stable food supply. However, in order to meet the escalating demands of the global population, there will be a need to achieve significant crop production over the coming decades. There are several difficulties in sustaining the ongoing attempt to keep up with advances in yield and quality.

A number of biotic and abiotic factors mainly affect wheat production both regionally and across the globe. Amongst them, pathological diseases are the major constraint

that hinders wheat production leading to severe losses in grain quality and yield. Wheat plants are susceptible to attacks by bacteria, viruses, nematodes and fungal species. Of these, different fungal diseases like rusts, loose smut, powdery mildew, Karnal bunt, FHB and flag smut are the most prevalent and pose a challenge to wheat supplies.

Common diseases of wheat:

1. Wheat Rusts:

The rust pathogens have historically been the major hindrance in global wheat production. Wheat suffers from three types of rust diseases, namely stripe rust, leaf rust and stem rust, all caused by fungi that belong to the class Basidiomycotina in the order Uredinales and genus *Puccinia*.

1.1 Stripe or yellow rust (*Puccinia striiformis f. sp. tritici*):

Today, this disease is the most significant economically as it causes enormous yield losses. It is mostly found in cooler and wet weather conditions. Initially, the symptoms are small yellow-orange elongated

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pustules forming narrow stripes on the leaves. Moreover, leaf sheaths, necks, and glumes can also have these pustules. When these mature, they release a yellow-orange mass of urediospores. On maturity, dull black teliospores, covered with epidermis are also produced in long stripes. The affected plant remains dwarfed and gives a scorchy appearance.

1.2 Brown or leaf rust (*Puccinia triticina* or *P. recondita*):

Small, circular to oval orange pustules are formed on the upper leaf surface and rarely appear on the back of leaf. Symptoms mostly appears on leaf blades however, sheaths, glumes and awns may occasionally become infected and exhibit symptoms. The spores are initially bright orange but at maturity, they turn brown. As the crop mature, the orange urediospores are replaced by black teliospores.

The pustules that contain these spores have a black and lustrous appearance because the outer layer of skin does not break open. Severe rusting causes significant yield losses.

1.3 Black or stem rust (*Puccinia graminis f. sp. tritici*):

It is usually found in areas with warm and moist conditions. Symptoms appear nearly on all aerial parts, but commonly on stems, leaf sheaths and leaf surfaces. The first symptom is the appearance of flecks, which soon develop into oval to spindle, reddish brown uredial pustules. They are generally separate and scattered but coalesce under heavy infections. Infected areas appear rough when touched. Later in the season, these turn black forming teliospores. Reduction in grain size and plant lodging results in yield losses.

Management of wheat rust diseases:

The most effective way to prevent



(A) Yellow rust



(B) Leaf rust



(C) Black rust

different rusts is the use of resistant/tolerant varieties. Field inspection should be done at regular intervals to check it in the early stages. Eradication of volunteer wheat plants and other crop debris to maintain field sanitation. Fertilizers should be optimally used as per local recommendations and avoid excess use of nitrogenous fertilizers. Sowing time should be adjusted to check favourable conditions for fungal growth. Application of recommended fungicides like Propiconazole @ 0.1%, Zineb @ 2.5 kg/ha, Tebuconazole 25% EC @ 200 ml in 200l of water per acre etc.

2. Loose Smut (*Ustilago tritici*):

It is internally seed borne disease, so neither the infected seed nor the growing plants exhibit any major symptom until the emergence of ears. The spike maybe infected partially or completely and individual grains are replaced by a mass of loose brown or black spores covered by a thin membrane. When it ruptures, the powdery spores are easily released by wind, leaving only the bare rachis.

Management:

The best approach is always to use healthy and certified seeds free from pathogens. Hot water or solar heat treatment has been traditionally used. Seeds can also be treated using chemicals like carboxin (Vitavax @ 2g/kg seed) before sowing.

3. Powdery Mildew (*Blumeria graminis f. sp. tritici*):

Symptoms appear as small patches of white or greyish cottony fungal growth on the leaf surface and even on heads and stem under severe conditions. Yellow flecks appear on leaves prior to mycelium growth. The fungal pathogen infects the lower leaves at first before moving up the plant. The lower surface of the infected leaf turns yellow to brown. Upon reaching maturity, the fungus turns grey and forms black fruiting bodies called chasmothecia. Affected leaves die off and infected ears are malformed or poorly developed leading to reductions in yield.

Management:



Apart from using resistant wheat varieties, cultural practices can be adopted. Irradiation of stubble, optimum plant density, balanced crop nutrition, timely sown crop and proper irrigation scheduling are some practices to manage mildew. Fungicide seed dressings and foliar application particularly in the early stages also prove to be effective control measures.

into bunt balls encased by the pericarp. Upon rupturing, the black powdery mass is exposed which emits a fishy odour due to the presence of trimethylamine.

Management:

Use of resistant varieties like PBW 502 and disease-free seeds for sowing, crop rotation, intercropping, adequate sowing time etc. are measures to be taken.



4. Karnal Bunt (*Neovossia indica* or *Tilletia indica*):

It was first reported by Mitra in 1931 from Karnal (Haryana). Only a few spikelets are infected within an infected earhead. Mostly a small portion of the grains is affected or in extreme situations, the entire grain is reduced



In addition, seed treatment (carboxin 75% WP) and foliar application (e.g. Propiconazole (Tilt @ 0.1%)) have been found effective.

5. Fusarium Head Blight (FHB) or Scab (*Fusarium graminearum*):

Initial symptoms appear soon after



flowering and appear as premature bleaching of few or all of the spikelets in an earhead while healthy ones still remain green. During warm and moist weather, pink to orange spore masses are observed on the infected spikelets. Infected kernels, also called tombstones are lightweight, shriveled, rough and pink to greyish in colour.

It is characterised by the appearance of elongated and raised grey to black lesions running parallel to the vein on leaves and stems. When these mature and rupture, a black powdery mass of spores is released. Infected plants are stunted with twisted leaves and distorted tillers which leads to poorly developed heads with no grains.



Management:

Integrated management practices should be followed. These include crop rotation, managing crop residues, irrigation management, and suitable variety selection with healthy seeds, staggered planting, chemical seed treatment and foliar application.

6. Flag smut (*Urocystis tritici* or *U. agropyri*):

Management:

Crop rotation with non-host crops like corn or soybeans can reduce the pathogen population in fields. Seed treatment with Carboxin 75% WP @ 2-2.5 g/kg seed or Tebuconazole 2% DS @ 0.2 kg/10 kg seed is very effective in controlling flag smut of wheat.

