



A Pictorial Guide for Field Identification of Wheat Diseases



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Foreword

This pictorial guide on wheat diseases is a crucial resource for agricultural professionals and enthusiasts alike, and it is my privilege to write the foreword for it. Wheat, as one of the most significant cereal crops globally, plays a vital role in food security, particularly in regions like Bhutan, where it is second only to paddy and maize.

The introduction of durum wheat by the National Wheat Program marks a significant advancement in Bhutan's agricultural practices, especially for pasta production. However, with the anticipated increase in wheat demand by 50% by 2050 (CIMMYT), the challenges posed by emerging pests and diseases cannot be overlooked. This guide aims to address these challenges by enhancing the diagnostic capabilities of our field colleagues, enabling them to effectively monitor and manage wheat diseases.

Through comprehensive visual aids and detailed descriptions, this guide serves as a vital reference for identifying various wheat diseases. It is designed to support proactive measures in disease surveillance and management, ultimately safeguarding our wheat production against potential outbreaks.

As we face an evolving landscape of agricultural challenges, this guide is not just a tool but a call to action for preparedness and vigilance. I commend the authors for their dedication to improving our understanding of wheat diseases and their impact on our agricultural systems. May this guide empower all who engage with it to contribute to the resilience and sustainability of wheat farming in Bhutan and beyond.



Yeshey Dema
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1. Stripe rust/ Yellow rust

Causal agent: *Puccinia striiformis* f. sp. *tritici*

Conditions: Previously thought to be prevalent in cool climate & moist regions; now found in warm places aswell. The disease may develop rapidly when free moisture (rain or dew) occurs and temperatures range between 10-20°C.

Symptoms: Yellow masses of spores from pustules (uredia) arranged in long stripes on leaves (Figure 1) but at early growth stages, often no stripes (Figure 2). It can also infect spikes under severe condition (Figure 3). Late in the season, black telia forms on the leaves (Figure 4).

Plant parts infected: Leaf blades & sheaths; stems; glumes and awns under severe condition

Host range: Wheat (bread & durum); barley; rye, emmer wheat; triticale; some grass species

Alternate host: *Mahonia* sp. (Figure 5) & *Barberry* sp. (Figure 6)

Importance: Severe infections can cause yield losses, mainly by reducing the number of kernels per spike, test weights, and kernel quality.



Figure 1: Yellow rust symptoms on older wheat leaves



Figure 2: Yellow rust symptoms on younger wheat leaves



Figure 3: Yellow rust symptoms on spikes



Figure 4: Teliospores on leaves

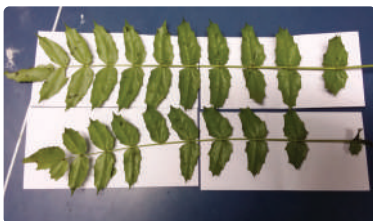


Figure 5: Mahonia sp.



Figure 6: Barberry sp.

Stripe Rust Management:

- ☐ Use resistant cultivars
- ☐ Use foliar fungicides

2. Leaf rust/Brown rust

Causal agent: *Puccinia triticina*

Conditions: The disease can develop rapidly when free moisture is available and temperatures are near 20°C.

Symptoms: Round to oval pustules with orange to light brown spores, found mainly on upper surface of leaves and sheaths (Figure 7). **Late in the season**, it develops black teliospores, usually on the under surface of the leaf or on the leaf sheath.

Plant parts infected: Leaves, sheaths, glumes and awn

Host range: Wheat; Tricale; emmer wheat; some wild grass species

Alternate hosts: *Thalictrum* sp.; *Anchusa* sp.; *Isopyrum*; *Clematis*

Importance: Severe early infections can cause significant yield losses, mainly by reducing the number of kernels per spike, test weights, and kernel quality.



Figure 7: Various symptoms of leaf rust on the wheat leaves

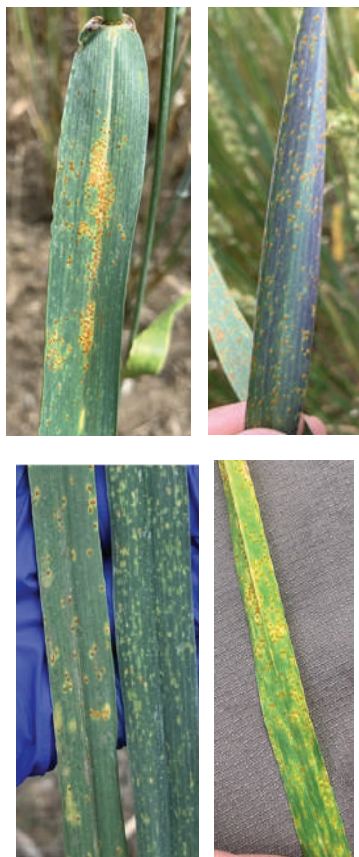


Figure 7 :Various symptoms of leaf rust on the wheat leaves

Leaf Rust Management:

- ☐ Use resistant cultivars
- ☐ Use foliar fungicides

3. Stem rust/Black rust

Causal agent: *Puccinia graminis* f. sp. *tritici*

Conditions: Hot days 25-30°C, mild nights 15-20°C with adequate moisture for night time dews.

Symptoms: Oval pustules with brick red spores and the pustules rupture the epidermis (Figure 8), on leaves pustules break through leaf – visible on upper and lower surface of leaf (Figure 10). In late season those pustules will turn into black teliospores (Figure 11).

Plant parts infected: All above ground plant parts (Leaves, sheaths, stems and spikes (Figure 9).

Host range: Wheat (bread & durum), barley and triticale

Alternate host: *Barberry vulgaris*

Importance: If infection occurs during the early crop stages, the effects can be severe: reductions in tillering and losses in grain weight and quality. Under favorable conditions, complete crop loss can occur.



Figure 8: Stem rust symptoms on wheat stems

Figure 9: Symptoms on spike



Figure 10: Symptoms on leaves

Figure 11: Stem rust teliospores on stem

Stem Rust Management:

- ☐ Use resistant cultivars
- ☐ Use foliar fungicides

4. Fusarium Head Blight

Causal agent: *Fusarium graminearum*

Conditions: Infection is favored by warm and humid weather during and after heading. Temperatures between 10-28°C are required for infection.

Symptoms: Bleached heads /spikelet (Figure 12), pink to salmon colour (Figure 14) (but maybe bleached white), Awns extended outwards (Figure 13).

Shape of the spores under microscopic observation: “banana” shaped (Figure 15)

Plant Parts infected: Spikes and leaves

Importance: Severe levels of infection can cause yield losses of more than 50 percent and significant reductions in grain quality. Kernels from diseased spikes are often shriveled. Harvested grain containing more than five percent infected kernels can contain enough mycotoxin to be harmful to humans and animals.



Figure 12: FHB symptoms on spikes/heads



Figure 13: Awns extended outward



Figure 14: Pinkish Colour Systems Figure 15: FHB spores

Fusarium Head Blight Management:

- ☐ Use resistant cultivars
- ☐ Residue management-managing the crop residue of corn, wheat and barleys to reduce the disease inoculum,
- ☐ Crop rotation- Avoid growing corn, wheat and barleys in same field every year, instead rotate those crops with some other crops like soya bean to reduce the disease pressure.
- ☐ Use of fungicides

5. Wheat blast

Causal agent: *Magnaporthe Oryzae Pathotype triticum* (MoT)

Conditions: The epidemiology of wheat blast is still largely unknown. Moderate to warm temperatures and heavy continuous rainfall seem to be important factors favoring epidemics.

Symptoms: Highly bleached heads (Figure 16), dark gray / charcoal sporulation on rachis (Figure 17), Eye shaped lesions on leaves with gray or whitish centers surrounded by dark brown margins (Figure 18), Shape of the spores under microscopic observation: “pear” shaped (Figure 19).

Plant part infected: Spikes and leaves

Importance: Wheat blast is prevalent in our neighboring country (Bangladesh) and there is a high chances of disease getting spread to its neighboring countries any time sooner.



Figure 16: Completely bleached spikes Figure 17: Charcoal sporulation on rachis



Figure 18: Blast symptoms on leaves



Figure 19: Wheat blast spores

Wheat Blast Management:

- ☐ Use resistant cultivars
- ☐ Seed treatment with fungicides
- ☐ Fungicide application

6. Septoria blotch

Causal agent: *Zymoseptora tritici*

Conditions: Initial infections tend to be on the lower leaves, progressing to the upper leaves and spikes if environmental conditions remain favorable. Cool temperatures (10-15°C) and prolonged wet, cloudy weather favors the development of these diseases.

Symptoms: Initially small yellowish spots on seedlings, black fruiting bodies visible to the naked eye on brownish tan spots, on mature leaves, lesions are long elliptical or shapeless; parallel to veins; **prominent fruiting bodies –pycnidia**, lesions may have yellow border (Figure 20).

Plant parts infected: Leaves

Importance: If these diseases reach severe levels prior to harvest, major losses can occur due to seed shriveling.



Figure 20: Septoria blotch symptoms on wheat leaves

Septoria Tritici Blotch Management:

- ☐ Use resistant cultivars
- ☐ Crop rotation
- ☐ Use of fungicides

7. *Septoria nodorum* blotch/*Septoria glume* blotch

Causal agent: *Parastagnopora nodorum*, previously know as *Septoria nodorum*

Symptoms: Oval/lens shaped dark brown lesion with yellow border (halo), older lesions have grey centers, lesion coalesce and can cover whole leaf, pin-head size black structures (pycnidia) visible on mature lesions-not so prominent as in *Septoria blotch*

Plant parts infected: Leaves, glumes, stems & nodes

Importance: If infection occurs early in the crop cycle and conditions remain favorable for development, complete defoliation is possible. Major reductions in yield and severely shriveled kernels will occur.



Figure 21: Glume blotch symptoms on leaves



Figure 22: Symptoms on spikes/heads

Septoria Nodorum Blotch Management:

- ☐ Use resistant cultivars
- ☐ Crop rotation
- ☐ Fungicide seed treatment
- ☐ Use of fungicides

8. Spot Blotch (Bipolaris)

Causal agent: *Bipolaris Sorokiniana*

Symptoms: Elongated to oval lesions, generally dark brown color, as lesions mature, the centers often turn a light brown to tan color, surrounded by an irregular dark brown ring (Figure 23). Primary infections tend to be on the lower leaves, beginning as chlorotic flecks or spots. These infection sites enlarge, turn dark brown, and often coalesce. When the disease is severe, affected leaves or leaf sheaths may die prematurely.

Plant parts infected: Leaves, stems and spikes

Importance: If infection occurs early in the crop cycle and conditions remain favorable for development, complete defoliation is possible. Which results in major reductions in yield and severely shriveled kernels.



Figure 23: Spot blotch symptoms on wheat leaves

Spot Blotch/Bipolaris Management:

- ☐ Use clean seed
- ☐ Crop rotation
- ☐ Seed treatment with fungicides
- ☐ Use of fungicides

9. Loose smuts

Causal agent: *Ustilago tritici*

Conditions: Infection and disease development are favored by cool, humid conditions, which prolong the flowering period of the host plant.

Symptoms: Black, powdery fungal spores replace normal head tissues and infected heads produce no grain (Figure 24).

Plant part infected: Spikes

Importance: Yield losses depend on the number of spikes affected by the disease.



Figure 24: Loose smut symptoms on wheat

Loose Smut Management:

- ☐ Use disease-free seeds
- ☐ Fungicide seed treatment

References

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