

Wheat diseases

- Rust
- Loose smut
- Karnal bunt
- Leaf blight (spot blotch)

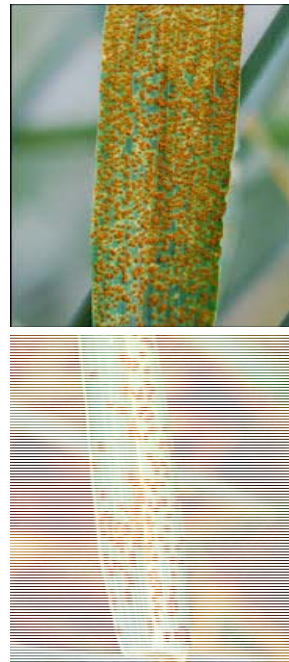
Rust diseases

- Stem rust (Black) (*Puccinia graminis* f. *sp. tritici*)
- Leaf rust (Brown) (*Puccinia triticina*)
- Stripe rust (Yellow) (*Puccinia striiformis*)

Stem rust



Leaf rust



Stripe rust



- **Survival:** Volunteer wheat and collateral grasses in cooler hilly areas (Himalayan range in North India and Nilgiri and Pulney Hills in South India)
- **IPM Practices:**
 - **Cultural practices:** Destroy volunteer wheat plants, Community efforts are required to eradicate volunteers
 - **Application of fungicides:** Propiconazole 250-500 ml/ha, Tebuconazole 145 or 290 ml/ha, Propiconazole + Cyproconazole 250-500 ml/ha
 - **Use of resistant cultivars:** According to suitability of local conditions
 - **Biological Control:** Foliar spray of spore suspension of *Verticillium lecanii*, *Paecilomyces fumosoroseus*, *Beauveria bassiana* are very effective.

Loose smut (*Ustilago tritici*)



- **Survival:** Internally seed-borne
- **IPM Practices:**
 - **Cultural practices:** Growing of disease free seeds. Visit the crop regularly and uproot plants with diseased ears (put in envelop) and destroy it by burying under the ground or by burning.
 - **Application of fungicides:** Seed treatment with Vitavax @2.5 g/kg seed.
 - **Solar heat treatment:** Soak the seeds in water for about 4 h in the morning and then dry it under hot sun in the afternoon. Store the well dried seeds for next season.
 - **Use of resistant cultivars:** Select suitable local cultivars
 - **Biological Control:** Seed treatment with *Trichoderma viride*, *Pseudomonas fluorescens* in combination with Vitavax (half dose) @ 1.25g/kg seed is very effective.

Karnal bunt (*Tilletia indica*)



- **Survival:** Seed and soil borne
- **IPM Practices:**
 - **Cultural practices:** Use of disease-free seed, rotate to crops other than wheat for up to 5 years. Mulching with polyethylene to raise soil temperature and reduce teliospore germination. Early sowing is better to avoid conducive conditions to infection.
 - **Application of fungicides:** Seed treatment with Carboxin + Thiram or Tebuconazole + Thiram provides some protection. Foliar spray with Mancozeb (0.2%) or Canbendazim (0.1%) at early heading stage. Propiconazole is also effective.
 - **Use of resistant cultivars:** No cultivars are immune
 - **Biological Control:** Seed treatment with *Trichoderma harzianum*, *T. viride* and foliar spray with neem (*Azadirachta indica*) and amaltas (*Cassia fistula*) extracts

Leaf blight (spot blotch) (*Bipolaris sorokiniana*)



- **Survival:** Soil or crop debris
- **IPM Practices:**
 - **Cultural practices:** Rotation with non-host crops can reduce inoculum but may not be practical due to the wide host range. Recommendations include planting healthy seed, shallow planting in cool soil and avoiding nutrient, moisture and other stress factors. Late sowing and high N fertilizer application.
 - **Application of fungicides:** Seed treatment with Carboxin 37.5% WP + Thiram 37.5% WP @ 1.5 g/kg seed followed by spraying with Propiconazole 25% EC @ 0.1% at boot leaf stage
 - **Use of resistant cultivars:** Partially resistant or tolerant varieties have been developed but can not be used as the sole management tool.