

BACTERIAL LEAF BLIGHT (BLB) IN RICE

Causes, Symptoms, Treatment, Control Methods, and Best Medicines (ICAR-NRRI-Based)

What Is Bacterial Leaf Blight (BLB) and Why It Matters

Bacterial Leaf Blight (BLB) is one of the most damaging diseases of rice across India and Southeast Asia.

It is caused by a bacterium called *Xanthomonas oryzae* pv. *oryzae*.

BLB mainly appears during warm, humid, or rainy weather, when the air is moist and temperatures are high — perfect conditions for the bacteria to multiply and spread.

How Bacterial Leaf Blight Spreads

The bacteria spread easily:

- Through rain splashes and irrigation water.
- By wind carrying water droplets.
- Via contaminated farm tools, workers' hands, or machinery moving between fields.

Why It's Dangerous

Once infection starts, BLB spreads fast and can reduce yield by 20–60% if not controlled early.

Early detection and timely spray are critical to saving your crop.

How to Identify Bacterial Leaf Blight (BLB) in the Field

Look for these early warning symptoms:

| Stage | Visible Signs |
|-------|---------------|
|-------|---------------|

| | |
|-----------------|--|
| Early infection | Leaf tips start yellowing and dry backward along edges |
|-----------------|--|

| | |
|--------------------|--|
| Moderate infection | Leaves become straw-colored, showing irregular patches |
|--------------------|--|

| Stage | Visible Signs |
|------------------|--|
| Severe infection | Entire leaves wither, curl, and die, plants look scorched |
| Field level | Patchy appearance — some green and some brown plants |
| Quick test | Cut an infected leaf and place it in clean water — a milky ooze appears from the cut end (this is the bacterial exudate) |

● Tip: When these symptoms appear, act immediately — early sprays can stop the disease from spreading across the field.

⚡ Causes of Bacterial Leaf Blight (BLB)

1. Bacterium: *Xanthomonas oryzae* pv. *oryzae*
 2. Favorable conditions:
 - Warm temperature (25–35°C)
 - High humidity (>70%)
 - Frequent rainfall or standing water
 3. Farming practices that worsen BLB:
 - Using infected seeds
 - Excess nitrogen fertilizer (lush, soft leaves)
 - Poor drainage or stagnant water
 - Use of same sprayer for multiple chemicals without cleaning
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💊 Treatment and Control of Bacterial Leaf Blight (BLB)

Field studies by ICAR-NRRI (Cuttack) and state agricultural universities show the following proven treatment procedures:

✓ Most Effective BLB Control Programs

| Rank | Control Method | Components | Purpose |
|------|--|--------------------------------|--------------------------------------|
| 1 | Streptocycline + Copper Oxychloride (Tank Mix) | Systemic + Contact bactericide | Fast action and best results |
| 2 | Copper Hydroxide (Kocide 3000) | Preventive copper spray | Alternate option / rotation |
| 3 | Kasugamycin 3% SL | Systemic antibiotic | Internal protection, rotation use |
| 4 | Pseudomonas fluorescens | Biological control agent | Preventive, eco-friendly IPM support |

Let's understand each solution in detail.

1. Streptocycline (Antibiotic Bactericide)

◆ What It Is

Streptocycline is a mixture of two antibiotics:

- Streptomycin sulfate (9%)
- Tetracycline hydrochloride (1%)

Common Brand: Plantomycin

◆ How It Works

Streptocycline is a systemic bactericide — it moves inside the plant and kills the BLB bacteria from within.

However, using it alone repeatedly can make bacteria resistant.

 Therefore, the ICAR-NRRI recommends mixing it with a copper bactericide such as Copper Oxychloride for complete protection.

◆ Recommended Dose (as per ICAR-NRRI for Rice BLB)

| Product | Quantity per Acre | Water Required | Remarks |
|-----------------------------|-------------------|-----------------|-----------------------------|
| Streptocycline | 30 g | 200 liters | Mix with Copper Oxychloride |
| Copper oxychloride (50% WP) | 200 g | Same 200 liters | Protects leaf surface |

 **Important:**

You do not use 200 liters of water for each medicine separately.

- ➡ Both 30 g Streptocycline + 200 g Copper Oxychloride are mixed together in 200 liters of water per acre.
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◆ **Step-by-Step Mixing and Application**

1. Fill sprayer tank halfway with clean water (about 100 L).
 2. Dissolve 30 g Streptocycline in a small container of water.
 3. Pour it into the tank.
 4. Add 200 g Copper Oxychloride (e.g., Blitox) slowly while stirring.
 5. Top up with water to reach 200 liters total.
 6. Stir occasionally while spraying for uniform mixing.
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◆ **When to Spray**

- First Spray: When BLB symptoms first appear (yellowing leaf tips).
 - Second Spray: Repeat after 7–8 days if weather is humid or disease spreads.
 - Spray in early morning or evening — avoid hot sun or rain.
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◆ **Why Mix with Copper Oxychloride**

- Streptocycline kills bacteria inside the plant (systemic action).
- Copper Oxychloride kills bacteria on the surface (contact protectant).

- Combination provides internal + external protection and slows resistance development.

Cost Estimate (per acre)

| Item | Market Rate (₹) | Total Cost per Acre |
|-------------------------------------|-----------------|---------------------|
| Streptocycline (₹600–700 /100g) | ~₹210 | |
| Copper oxychloride (₹400–500 /500g) | ~₹160 | |
| Total per acre | ₹350–400 | |

Subsidy / Govt Support

- No direct subsidy for antibiotics like Streptocycline under central schemes.
- Some State Agriculture Departments (e.g., Odisha, Tamil Nadu, Telangana) provide it at 50% subsidy during disease outbreaks under Pest/Disease Compensation Programmes or through Kisan Seva Kendras.
- Farmers should check with local KVK or District Agriculture Office for availability.

2. Copper Oxychloride (Copper Bactericide)

◆ What It Is

Copper Oxychloride (50% WP) — a contact bactericide that forms a protective coating on leaves.

Brand example: Blitox (Tata Rallis)

◆ How It Works

- Kills bacteria before they enter the plant.
- Acts on multiple sites, making it hard for bacteria to develop resistance.

◆ BLB Dose (ICAR Recommendation)

- 200 g per acre, mixed with 30 g Streptocycline in 200 L water.

◆ Key Tips

- Don't spray during or just before rain.
- Ensure both sides of leaves are covered.
- Clean sprayer after use to avoid nozzle blockage by copper.

Cost Estimate

- ₹80–100 per 100 g
- Total cost per acre ≈ ₹160–200

Subsidy / Govt Support

- Copper-based fungicides (like Blitox, Kocide, etc.) are included in Integrated Disease Management (IDM) subsidy components under Rashtriya Krishi Vikas Yojana (RKVY) and State Crop Protection Schemes.
- Farmers in states like Andhra Pradesh, Kerala, Tamil Nadu, and Assam can get up to 40–50% subsidy via input distribution camps or Krishi Vigyan Kendras (KVKs).

● 3. Copper Hydroxide (Alternative Copper Bactericide)

◆ What It Is

Copper Hydroxide 46.1% WG

Brand: Kocide 3000 (Bharat Certis)

◆ How It Works

Similar to copper oxychloride — creates a protective coating that kills BLB bacteria on contact.

Best used preventively or in rotation with other sprays.

◆ Dose

- 500 g per acre in 200 L water.

◆ How and When to Use

- Spray before BLB appears when weather is humid, or at early infection stage.
- Do not mix with Streptocycline unless recommended.

- Repeat every 10–12 days if disease pressure continues.

Cost Estimate

- ₹800–900 per kg
- Total cost per acre ≈ ₹400–450

Subsidy / Govt Support

- Covered under Plant Protection Inputs in several states' schemes.
 - Farmers registered under RKVY, NFSM (National Food Security Mission – Rice) or ATMA projects may get 30–40% subsidy on copper hydroxide formulations.
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4. Kasugamycin (Systemic Bactericide)

◆ What It Is

Kasugamycin 3% SL

Brands: Kasu-B (Dhanuka), K-Mycin (Aries)

◆ How It Works

- A systemic antibiotic that moves inside the rice plant.
- Kills BLB bacteria from within.
- Ideal for rotation to prevent resistance buildup.

◆ Recommended Dose

- 400–600 ml per acre in 200 liters of water (check product label for your state).

◆ How to Apply

1. Confirm registration for rice BLB in your state.
2. Mix the required amount in half-filled sprayer, stir well, fill to 200 L.
3. Avoid mixing with alkaline products (like lime or Bordeaux mixture).
4. If unsure, do a jar test.

◆ When to Use

- At early infection stage, or

- As a follow-up spray after Streptocycline + Copper Oxychloride (keep 7–10 days gap).

 **Cost Estimate**

| Brand | Market Price | Cost per Acre |
|---------|---------------------|---------------|
| Kasu-B | ₹900–1100 per liter | ₹360–660 |
| K-Mycin | ₹850–1000 per liter | ₹340–600 |
| Average | | ₹400–600 |

 **Subsidy / Govt Support**

- Kasugamycin is not universally subsidized, but some state governments (like Tamil Nadu, Chhattisgarh, and West Bengal) occasionally include it in seasonal BLB management kits distributed through Agri Departments during epidemics.
- Farmers can check with nearest Agri Office or Block Technology Manager (BTM) under ATMA scheme.

 **5. Pseudomonas fluorescens (Bio-Bactericide for IPM)**

◆ **What It Is**

A beneficial bacterium that suppresses BLB pathogens and enhances plant defenses. It doesn't kill directly but helps plants resist infection.

◆ **Why It's Important**

- Eco-friendly, safe, and residue-free
- Improves soil health
- Key component of Integrated Pest Management (IPM) or Integrated Disease Management (IDM)

◆ **Application Methods**

| Method | Quantity | How to Apply |
|----------------|--------------------------|---|
| Seed treatment | 10 g per kg seed | Mix seeds before sowing |
| Root dip | 1 kg in 100 L water | Dip seedlings 30 min before transplanting |
| Foliar spray | 500 g or 500 ml per acre | Spray in 200 L water every 15–20 days |

◆ When to Start

- From nursery stage or early crop stage.
- Continue through the season as a preventive measure.

₹ Cost Estimate

| Formulation | Market Price | Cost per Acre |
|-------------|--------------------|---------------|
| WP (powder) | ₹200–250 per kg | ₹200–250 |
| Liquid | ₹180–220 per liter | ₹180–220 |
| Average | | ₹200 per acre |

🏛️ Subsidy / Govt Support

- Yes, widely available at subsidy (50–75%) under:
 - National Food Security Mission (NFSM – Rice)
 - Paramparagat Krishi Vikas Yojana (PKVY) for organic farming
 - RKVV – Integrated Pest Management (IPM) programs
- Farmers can often get Pseudomonas formulations free or at half price from local KVKS, State Agriculture Departments, or Cooperative Societies.

🕒 Spray Timing Summary for Bacterial Leaf Blight (BLB)

| Crop Stage | Weather Condition | Recommended Action |
|------------------|-----------------------|--|
| Early tillering | Humid or rainy | Spray Streptocycline (30 g) + Copper Oxychloride (200 g) in 200 L water per acre |
| 7–8 days later | Disease spreading | Repeat the same mixture |
| 10–12 days later | Disease still visible | Switch to Kasugamycin 3% SL (400–600 ml/acre) |
| Entire season | Preventive IPM | Apply Pseudomonas fluorescens (seed, root, or foliar use) |

⚠ Important Do's and Don'ts for Bacterial Leaf Blight Treatment

✓ DO:

- Start control immediately at first BLB symptoms.
- Always mix Streptocycline with Copper Oxychloride for best results.
- Use clean water for spray solution.
- Maintain correct dose and water volume.
- Wear PPE (gloves, mask, protective clothing).
- Rotate chemical + biological products.
- Spray in calm, cool hours (morning/evening).

✗ DON'T:

- Overuse antibiotics — it causes bacterial resistance.
- Mix incompatible chemicals without jar test.
- Spray during midday heat or before rain.
- Reuse unclean sprayers for other chemicals (herbicides/fertilizers).

Possible Side Effects or Risks of Bacterial Leaf Blight (BLB) Sprays

All agricultural sprays — especially **antibiotic or copper-based bactericides** — are effective but must be handled **carefully**.

Here are the main **side effects, risks, and precautions** to know for each type of product used against BLB.

1. Streptocycline (Streptomycin + Tetracycline Antibiotic)

Possible side effects:

- **On plants:** Safe when used at the correct ICAR-NRRI dose (30 g/acre). Overdose can cause **leaf burn or yellowing**.
- **On humans:** Can irritate the skin, eyes, or nose if inhaled or touched in concentrated form.
- **On environment:** Overuse may build **antibiotic resistance** in soil bacteria, reducing long-term effectiveness.

Precautions:

- Always use **recommended 30 g per acre** only in **tank mix with copper oxychloride**.
 - **Do not spray more than twice** in one crop season.
 - Wear **gloves, mask, and long sleeves** while mixing and spraying.
 - Wash hands, face, and clothes after spraying.
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2. Copper Oxychloride (50% WP) and Copper Hydroxide (46.1% WG)

Possible side effects:

- **On plants:** If sprayed in excess (more than 200–500 g/acre) or under very hot sun, leaves may show **slight brown spots or burn**.
- **On soil/environment:** Continuous heavy use can **increase copper buildup** in soil over many years.
- **On humans:** Copper dust or spray mist may cause **eye or skin irritation**.

Precautions:

- Measure carefully — **200 g/acre (oxychloride)** or **500 g/acre (hydroxide)** is enough.
- Do not spray during mid-day or when temperature > 32°C.

- Clean the sprayer properly after use to prevent copper clogging.
 - Avoid repeated copper use season after season — rotate with biological or antibiotic sprays.
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3. Kasugamycin (3% SL)

Possible side effects:

- **On plants:** Generally safe; very low risk of phytotoxicity (leaf damage).
- **On humans:** Mild irritation if inhaled or spilled on skin; wear protection.
- **On environment:** Safer than streptomycin but still an **antibiotic**, so avoid unnecessary use.

Precautions:

- Use only **as per label** (400–600 ml/acre).
 - Maintain **7–10 days gap** between kasugamycin and streptocycline sprays.
 - Don't mix with **alkaline products** (lime, Bordeaux mixture).
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4. Pseudomonas fluorescens (Bio-bactericide)

Possible side effects:

None. It's a **beneficial bacteria** that is safe for humans, animals, soil, and the environment.

Precautions:

- Store away from direct sunlight and high temperature.
 - Use before the expiry date for best results.
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General Safety Rules for All Sprays

Do

- Use **gloves, mask, and protective clothes**.
- Spray in **morning (before 10 AM) or evening (after 4 PM)**.
- Avoid spraying when it's **windy or rainy**.
- Always follow the **product label and ICAR/SAU advisory**.
- Wash equipment and clothes properly after spraying.

Don't

- Spray near ponds, fish tanks, or water bodies.
 - Eat, drink, or smoke during spraying.
 - Use antibiotics more than 2–3 times per crop.
 - Mix unknown or **unlabeled products**.
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Where to Buy BLB Control Sprays (Genuine Sources in India)

All the BLB control products mentioned — **Streptocycline (Plantomycin)**, **Copper Oxychloride (Blitox)**, **Copper Hydroxide (Kocide 3000)**, **Kasugamycin (Kasu-B, K-Mycin)**, and **Pseudomonas fluorescens** — are available from **registered agricultural input suppliers**.

◆ 1. Local Agri-Input Shops

- Visit your **nearest Krishi Seva Kendra**, cooperative store, or **authorized pesticide dealer**.
- Ask specifically for products **registered for rice and BLB**.
- Request **bill and batch number** for traceability.

◆ 2. Government / University Outlets

- **State Agriculture Department** and **Krishi Vigyan Kendras (KVKs)** often stock or recommend brands.
- You can get **bio-bactericides (Pseudomonas fluorescens)** directly from **SAU farms or Bio-control Labs**.

◆ 3. Trusted Online Agri-Platforms

(Examples — for reference only, availability varies by region)

- **BigHaaat**
- **Agribegri**
- **KisanKraft Store**
- **Amazon India Agri Section**
- **IFFCO-Bazar**

Before buying, always **check that:**

1. The product is **FCO or CIBRC registered** for use on rice.

2. The **expiry date** and **batch number** are visible.
 3. The label clearly mentions “**For Bacterial Leaf Blight / BLB in Rice**”.
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In Summary

| Product | Type | Dose (per acre) | Possible Side Effect | Safety Tips | Where to Buy |
|-------------------------|-------------------------|---|------------------------------|---|------------------------|
| Streptocycline | Antibiotic bactericide | 30 g (with copper oxychloride 200 g in 200 L water) | Leaf burn if overdosed | Always mix with copper, use mask/gloves | Local dealers / online |
| Copper Oxychloride | Contact bactericide | 200 g/acre | Leaf burn if hot or overused | Don't spray before rain | Local agri shops |
| Copper Hydroxide | Preventive copper spray | 500 g/acre | Same as above | Rotate with other modes | Input dealers |
| Kasugamycin | Systemic antibiotic | 400–600 ml/acre | Mild irritation | Avoid alkaline mixes | Online & KVKs |
| Pseudomonas fluorescens | Bio-bactericide | 500 g or 500 ml/acre | None | Store in shade | SAU / KVK / Bio labs |

STRUCTURE TEMPLATE FOR CHATBOT RESPONSES

1. Disease Overview

Keywords: disease name, causal organism, visible symptoms, affected parts, impact, spreading method.

Simple Explanation:

- **What it is:** Describe the disease in short, e.g., *Brown spot is a fungal disease of rice caused by Bipolaris oryzae*.

- **What it looks like:** Explain what farmers can see — *small brown circular spots on leaves that grow bigger over time and make the leaves look burned.*
 - **Parts affected:** Mention leaves, panicles, or grains.
 - **Why it matters:** Explain its effect — *the disease reduces yield, weakens plants, and can spoil grain quality.*
 - **How it spreads:** Talk about seeds, air, residues, and weeds — *it spreads through infected seed and wind-borne spores.*
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2. Early Identification (Symptoms)

Keywords: leaf symptoms, grain symptoms, nursery signs, difference from healthy plants.

Simple Explanation:

- On leaves: *Small, round, brown or dark spots that can grow and join together.*
 - On panicles and grains: *Dark patches or discolored grains.*
 - In nurseries: *Infected seedlings may turn yellow and die early.*
 - Healthy vs diseased comparison helps the farmer visually confirm.
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3. Disease Causes and Favoring Conditions

Keywords: nutrient deficiency, stress, temperature, humidity, drought, soil fertility.

Simple Explanation:

- *Brown spot gets worse when the soil lacks silica or potash, and when the plant is weak or stressed.*
 - *It likes dry or drought conditions and appears more in low-fertility or rainfed fields.*
 - *Unlike rice blast, which loves high humidity, brown spot often appears when fields are dry.*
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4. Spread and Contagiousness

Keywords: seedborne, windborne, residues, weeds, field spread.

Simple Explanation:

- *The fungus lives on old straw, seeds, and weeds.*

- *Infected seed starts disease early in the nursery.*
 - *Spores from infected leaves can travel by wind to nearby plants.*
 - *Cleaning seed and removing infected plant material helps break this cycle.*
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5. Preventive Measures

Keywords: seed health, sanitation, nutrition, residue management, weed control.

Simple Explanation:

- *Use clean, certified seed.*
 - *If not sure, treat seed with **hot water (53–54 °C for 10–12 minutes)** to kill fungus.*
 - *Keep fields clean — remove straw, weeds, and old residues after harvest.*
 - *Apply balanced fertilizers, especially silica and potash, to make plants stronger.*
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6. Cultural Practices

Keywords: water management, rotation, residue disposal, nursery hygiene.

Simple Explanation:

- *Avoid water stress — brown spot loves dry fields.*
 - *Keep nurseries weed-free and remove any heavily infected seedling patches.*
 - *Don't reuse infected straw or plant debris.*
 - *Rotate rice with other crops to reduce fungus build-up.*
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7. Organic / Eco-friendly Options

Keywords: hot water seed treatment, biologicals, Trichoderma, Pseudomonas, chitosan.

Simple Explanation:

- *Hot water treatment is safe and effective.*
- *Bio-control options like **Trichoderma** or **Pseudomonas** can be used on seeds or seedlings.*
- *Chitosan sprays can strengthen plants naturally.*
- *Avoid homemade chemical mixes — they may harm crops or not work well.*

8. Fungicide Options (Chemical Control)

Keywords: active ingredient, product name, FRAC code, dose, spray schedule.

Simple Explanation:

| Fungicide | Group (FRAC) | Example Product | How it Works | Example Dose | When to Apply |
|------------------------|--------------|-----------------|---|---------------------------------|--|
| Propiconazole | FRAC 3 | Tilt | Systemic, prevents fungus growth inside plant | 1 ml/l water or 6–10 fl oz/acre | At first disease sign, repeat after 10–15 days |
| Tebuconazole | FRAC 3 | — | Systemic triazole | 1.5 ml/l | First symptoms, repeat after 15 days |
| Difenoconazole | FRAC 3 | Score | Systemic, curative | 0.5 ml/l | First symptoms, repeat if needed |
| Mancozeb | FRAC M03 | — | Multi-site protectant | per label | Alternate with triazoles |
| Carbendazim + Mancozeb | — | Saaf | Mix of systemic + protectant | 300 g/acre | Benchmark mixture used widely |

Simple Explanation of Action:

- *Triazoles (like propiconazole, tebuconazole, difenoconazole) stop fungus growth inside the plant.*
 - *Mancozeb is a protectant that blocks infection on the surface.*
 - *Alternating or mixing helps prevent resistance.*
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9. Spray Timing and Conditions

Keywords: first symptom, re-spray interval, morning/evening, before rain, calm weather.

Simple Explanation:

- *Spray at the first sign of brown spots.*

- *Repeat after 10–15 days if needed.*
 - *Best time: early morning or late afternoon when it's cool and calm.*
 - *Avoid spraying before rain — the chemical can wash off.*
 - *Follow the product label for exact timing and number of sprays.*
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10. Safety and Pre-Harvest Interval (PHI)

Keywords: PHI days, PPE, re-entry interval, water release.

Simple Explanation:

- *Always wear gloves, mask, and protective clothes while spraying.*
 - *Don't enter sprayed fields until the safe re-entry time mentioned on the label.*
 - *Follow PHI (days between last spray and harvest):*
 - Propiconazole (Tilt): ~35 days
 - Difenoconazole (Score): ~14 days (varies)
 - *Never release irrigation or flood water within 7 days after spraying Tilt.*
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11. Resistance Management

Keywords: FRAC rotation, triazoles, multi-site, QoI, season limits.

Simple Explanation:

- *Don't use the same fungicide group repeatedly.*
 - *Alternate between triazoles (FRAC 3) and protectants like mancozeb (FRAC M03).*
 - *Follow the maximum number of sprays allowed per season.*
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12. Weather and Environmental Advice

Keywords: dry conditions, rain forecast, wind, temperature, water stress.

Simple Explanation:

- *Spray when weather is calm and no rain is expected for 24 hours.*
- *Avoid hot sunny times — spray early or late.*
- *Maintain soil moisture to reduce stress — stressed plants get more disease.*

13. Buying and Legal Use

Keywords: licensed agrovets, registered products, leaflet, PQPMC, AKC.

Simple Explanation:

- *Buy only from licensed agrovets or cooperatives.*
 - *Ask for labeled products with a Nepali leaflet.*
 - *Follow the exact dose and use written on the product label.*
 - *Never buy or use unregistered or unlabeled products.*
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14. Yield and Recovery

Keywords: loss range, visible recovery, timeline.

Simple Explanation:

- *Yield loss can range from 5% (mild) to over 40% (severe).*
- *With proper sprays and nutrition, you'll see new leaves appearing clean in about 10–15 days after the first treatment.*
- *Healthy nutrition and good water management support quick recovery.*

1. Treatment Methods Overview

Rice Brown Spot can be managed using **four main treatment approaches**, often combined for best results:

| Method Type | What It Means | Example Practices | Key Benefit |
|---------------------------------|---|--|-------------------------------|
| 1. Cultural / Preventive | Farm hygiene and soil management | Use clean seed, balance nutrients, remove residues, control weeds | Reduces disease source |
| 2. Seed Treatment | Kill fungus in or on seed before planting | Hot water treatment (53–54 °C for 10–12 min), fungicidal seed dressing | Prevents early infection |
| 3. Chemical (Fungicide) Control | Use registered fungicides on leaves | Propiconazole, Tebuconazole, Difenoconazole, Mancozeb, or Carbendazim + Mancozeb | Fast control during outbreaks |

| Method Type | What It Means | Example Practices | Key Benefit |
|-------------------------------------|--|---|---|
| 4. Biological / Eco-friendly | Use natural microbes or organic boosters | <i>Trichoderma, Pseudomonas fluorescens</i> , chitosan sprays | Safe for environment, long-term benefit |

💧 2. Details of Each Method (in Simple English)

(A) Cultural and Preventive Methods

- Use **healthy or certified seed** to start disease-free.
- Remove infected straw and weeds after harvest.
- Maintain soil fertility, especially **silica and potash**.
- Keep fields weed-free and properly drained.
- Avoid drought stress in rainfed areas.

💰 Cost:

Mostly low — extra cost is for fertilizer balance or residue disposal.

(Approx. ₹500–₹1,000 per acre / NPR 800–1,500 per hectare for nutrients or field cleaning).

🏛️ Government Facility:

- Soil testing and nutrient recommendation are **free or subsidized** at local **Agriculture Knowledge Centres (AKCs)** or **Soil Testing Labs**.
- **Subsidized fertilizer programs** (Urea, DAP, Potash) are available seasonally through cooperatives.

(B) Seed Treatment

Option 1:

Hot water treatment – dip clean seed at **53–54 °C for 10–12 minutes**, then dry in shade.

Option 2:

Use **registered fungicidal seed dressers** such as:

- Carbendazim 50 % WP @ 2 g/kg seed
- Mancozeb 75 % WP @ 2.5 g/kg seed

💰 Cost:

- Hot water: negligible (fuel + setup cost ₹50–100 / NPR 80–150 per batch).

- Fungicidal dressing: ₹100–150 per acre / NPR 150–250 per hectare.

Government Facility:

- Some AKCs and agrovets under government programs offer **free seed treatment campaigns** before rice season.
 - Farmer cooperatives sometimes provide **hot-water seed treatment units** during planting season.
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(C) Chemical (Fungicide) Sprays

Use only registered products, follow **label dose and PHI**.

| Fungicide | Type | Dose (example) | When to Use | Indicative Cost |
|---------------------------------------|-----------------------------|-----------------|--|----------------------------------|
| Propiconazole (Tilt 25 % EC) | Systemic triazole | 1 ml/l water | First symptoms, repeat after 10–15 days | ₹400–₹500 per acre / NPR 650–800 |
| Tebuconazole (25.9 % EC) | Systemic triazole | 1.5 ml/l water | At first infection, repeat after 15 days | ₹450–₹600 per acre / NPR 700–900 |
| Difenoconazole (Score 25 % EC) | Systemic triazole | 0.5 ml/l water | First lesions | ₹400–₹550 per acre / NPR 650–850 |
| Mancozeb (75 % WP) | Protectant | 2–2.5 g/l water | Early stage, alternate with triazoles | ₹250–₹400 per acre / NPR 400–600 |
| Carbendazim + Mancozeb (Saaf) | Mix (systemic + protectant) | 300 g/acre | Benchmark mixture in trials | ₹350–₹500 per acre / NPR 550–800 |

Average spray cost (chemical + labor): ₹700–₹1,200 per acre (NPR 1,100–1,900 per hectare).

Number of sprays: 1–2 sprays per season based on pressure.

Government Facility:

- Some **provincial agriculture offices** (AKC/PMAMP programs) distribute **free or subsidized fungicides** for demonstration or outbreak control.

- Farmers can also get training and spray schedule guidance from Plant Protection Officers or Plantwise Plant Clinics.
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(D) Biological and Eco-friendly Methods

Use beneficial microbes that suppress the fungus naturally.

Examples:

- *Trichoderma viride* (Bio-fungicide) @ 5 g/kg seed or soil application.
- *Pseudomonas fluorescens* seed treatment @ 10 g/kg seed or foliar @ 0.5 %.
- **Chitosan**-based plant booster sprays help reduce infection.

Cost:

₹200–₹400 per acre / NPR 300–600 per hectare.

Government Facility:

- **Bio-fungicides** like *Trichoderma* and *Pseudomonas* are often **distributed free or at 50% subsidy** by AKCs, PMAMP, or IPM programs.
 - Local **Agriculture Offices** and **cooperatives** under the **Integrated Pest Management (IPM)** program conduct **training and free demos**.
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3. Summary of Approximate Costs

| Treatment Type | Estimated Cost (per acre) | Cost in NPR (per hectare) | Notes |
|----------------------------------|---------------------------|---------------------------|---------------------------------------|
| Cultural & sanitation | ₹500–₹1,000 | NPR 800–1,500 | Field cleaning, fertilizer correction |
| Seed treatment | ₹100–₹150 | NPR 150–250 | Hot water or fungicide dressing |
| Fungicide spray (each) | ₹700–₹1,200 | NPR 1,100–1,900 | Includes labor and chemical |
| Biological treatment | ₹200–₹400 | NPR 300–600 | Bio-fungicide or booster |
| Total seasonal cost (avg) | ₹1,500–₹2,500 | NPR 2,400–3,800 | If combined program used |

(Actual prices vary by brand, region, and dealer.)

4. Government and Institutional Support in Nepal

| Facility Type | Available Through | What Farmer Gets |
|---|---|---|
| AKC (Agriculture Knowledge Centre) | Under Ministry of Agriculture and Livestock Development | Free advisory, crop clinic, disease ID, sample testing |
| PQPMC (Plant Quarantine and Pesticide Management Centre) | National regulatory body | Official list of registered pesticides and safety guidelines |
| PMAMP (Prime Minister Agriculture Modernization Project) | District/provincial offices | Subsidized input packages (fertilizer, bio-fungicides, demo kits) |
| Cooperatives and Agrovets | Local supply centers | Purchase registered fungicides, sometimes get free awareness programs |
| IPM Program (FAO/DOA collaboration) | Selected districts | Free IPM training, bio-fungicide kits, PPE distribution |
| Soil Testing Labs (Govt or AKC) | Regional labs | Free or low-cost soil nutrient testing, fertility recommendations |

FARMER ASSISTANCE CHATBOT KNOWLEDGE STRUCTURE

MAIN CATEGORY: Rice Leaf Blast Disease

1 Disease Overview

Keywords:

Rice blast, Magnaporthe oryzae, fungal disease, leaf blast, neck blast, infection spread

Simplified Explanation:

Rice leaf blast is a **fungal disease** caused by *Magnaporthe oryzae*. It starts as small gray or white spots on the leaves. These spots grow into bigger, spindle-shaped patches with brown

edges. If not controlled early, the fungus spreads to the **collar**, **node**, and **neck** of the plant, which can cut down yield badly.

The disease spreads fast through **tiny airborne spores**, so even nearby fields can get infected. It spreads more when the weather is **humid**, **warm at night**, and leaves stay **wet for a long time**.

2 Symptoms and Early Identification

Keywords:

leaf lesions, gray-green spots, collar rot, neck blast, node infection, white panicle

Simplified Explanation:

- **Leaves:** Small white or gray-green spots appear first, which become spindle-shaped with gray centers and brown edges.
 - **Collar area:** The part where the leaf joins the stem turns brown — this is called **collar rot**.
 - **Nodes:** The stem nodes turn black.
 - **Neck area:** When the neck (below the panicle) is infected early, the entire head turns white and empty.
 - The disease attacks **young plants** first, especially where **too much nitrogen** is used.
-

3 Environmental Conditions Favoring Disease

Keywords:

humidity, dew, rain, warm nights, temperature 25–28°C, wet leaves

Simplified Explanation:

Blast fungus likes **high humidity (above 90%)**, **wet leaves**, and **warm nights** (20–28°C). It spreads faster after **rain**, during **cloudy weather**, or when **dew** stays long on leaves. Fields with **uneven water** or **dry patches** also get more infections.

4 Is the Disease Contagious?

Keywords:

airborne spores, spread between fields, spore cycle, infection time

Simplified Explanation:

Yes, very contagious. The fungus produces **spores** that fly in the air and infect nearby plants.

Under good weather, new infections can appear **within a week**.

That's why one infected field can quickly cause an outbreak in a whole area.

5 Preventive and Cultural Measures

Keywords:

resistant varieties, certified seed, continuous flooding, nitrogen management, residue destruction, silicon fertilizer

Simplified Explanation:

- **Use resistant varieties:** Choose rice types that don't easily get blast, as advised by the agriculture office.
 - **Certified seeds:** Use healthy, clean seed to avoid bringing the fungus from old fields.
 - **Water management:** Keep the field **continuously flooded** and avoid dry spots.
 - **Fertilizer:** Don't use too much nitrogen — split it into smaller doses.
 - **Residue management:** Bury or destroy old straw and stubble after harvest.
 - **Silicon addition:** In areas where soils lack silicon, apply silicon fertilizer or silicon-rich straw to make leaves stronger.
-

6 Organic and Eco-Friendly Practices

Keywords:

organic system, cultural control, water management, silicon, disease resistance

Simplified Explanation:

Organic farmers can control blast by:

- Choosing **blast-resistant varieties**
- Using **certified organic seed**
- Maintaining **continuous water**
- Managing **nitrogen carefully**
- Using **silicon soil amendments** to strengthen the plants

No need for harsh chemicals — good management practices are usually enough in organic systems.

7 Chemical (Fungicide) Control Options

Keywords:

fungicide, tricyclazole, isoprothiolane, azoxystrobin, tebuconazole, trifloxystrobin, metominostrobin, dose, PHI

◆ Common Fungicides in the Market (India Example):

| Active Ingredient | Formulation Type | Example Brand Names | Typical Dose / Acre | When to Apply | Waiting Period (PHI) | Remarks |
|-------------------------------------|------------------|--|---------------------|--|----------------------|--|
| Tricyclazole (melanin inhibitor) | 75% WP | Indofil Baan, Adama Blastogan, TagTeem | 120–160 g | Early leaf symptoms, again near boot stage if pressure is high | 30 days | Main preventive fungicide for blast |
| Isoprothiolane (systemic) | 40% EC | Fujione, Lavazza, I-Lane 40 | 300 ml | Around heading or early neck blast | 28–60 days | Moves inside plant, good neck blast control |
| Azoxystrobin (Qo1) | 23% SC | Amistar, Quadris, generics | 12.5–15.5 fl oz | Mid-boot to boot-split stage | 28 days | Prevents panicle infection; rotate to avoid resistance |
| Tebuconazole + Trifloxystrobin | 75 WG (50+25) | Nativo, Gezeko | 80 g | Early disease, or near heading | 21–35 days | Dual-action (curative + preventive) |
| Metominostrobin | 20% SC | Oribright | 500 ml/ha | Tillering to heading | 28 days | Used in many Asian countries |
| Tricyclazole + Hexaconazole | 22% + 3% SC | Various Indian brands | As per label | Early leaf blast | Label PHI | Mix for better coverage |

| Active Ingredient | Formulation Type | Example Brand Names | Typical Dose / Acre | When to Apply | Waiting Period (PHI) | Remarks |
|-------------------|------------------|---------------------|---------------------|--------------------------|----------------------|-----------------------|
| Fenoxanil | 20% SC | Limited brands | As per label | Preventive, near heading | Label PHI | Regional availability |

8 Spray Guidelines

Keywords:

mid-boot stage, re-spray, weather, tank mix, calm wind, early morning

Simplified Explanation:

- Spray **before rainy or humid conditions** when the disease may spread.
 - **Best time:** Morning or late afternoon (no strong wind, no rain expected).
 - If disease pressure is high, **repeat spray after 7–14 days**.
 - Always **read the product label**, mix only compatible products, and don't overdose.
-

9 Safety Precautions

Keywords:

PPE, REI, PHI, floodwater holding, food safety

Simplified Explanation:

- Wear gloves, mask, and long clothing while spraying (PPE).
 - Don't enter the sprayed field before the **Restricted Entry Interval (REI)** — usually a few hours.
 - Respect the **Pre-Harvest Interval (PHI)** — the number of days to wait before harvesting (often 28–30 days).
 - Don't drain floodwater for 14 days after spraying azoxystrobin (as per label).
-

10 Yield Loss and Recovery

Keywords:

yield reduction, loss percentage, recovery time, protected panicles

Simplified Explanation:

If untreated, rice blast can reduce yield by **10–50%**, depending on how early and how badly it attacks.

With **timely spraying** and **good water and fertilizer management**, plants recover within **1–2 weeks** as new panicles come out healthy and protected.

Practical Farmer Protocol (Checklist)

Keywords:

scouting, risk check, timely spray, water management

Simplified Explanation:

1. **Scout** your fields twice weekly from nursery to boot stage.
 2. If you see early leaf spots or weather is humid and warm, plan a **preventive spray** at mid-boot stage.
 3. **Maintain continuous flood** and avoid dry or over-fertilized patches.
 4. If pressure is high, **repeat the spray** 7–14 days later.
 5. Use **certified seed** next season and **destroy infected residue** after harvest.
-

Chatbot Integration Blueprint

When a farmer asks a question, your chatbot can:

| User Query Type | Detect Keywords | Pull From Section | Example Simple Reply |
|--------------------------------|----------------------------------|--------------------------|--|
| “What causes rice leaf blast?” | cause, pathogen, fungus | Disease Overview | “Rice blast is caused by a fungus called <i>Magnaporthe oryzae</i> . It spreads fast in humid, warm weather and causes gray-brown spots on leaves.” |
| “Which medicine should I use?” | medicine, fungicide, dose, spray | Chemical Control Options | “You can use tricyclazole 75% WP (120–160 g/acre) or isoprothiolane 40% EC (300 ml/acre). Spray at early infection or boot stage, and repeat after 7–14 days if needed.” |

| User Query Type | Detect Keywords | Pull From Section | Example Simple Reply |
|-----------------------------------|-------------------------|--------------------------------|---|
| “When should I spray for blast?” | spray, timing, schedule | Spray Guidelines | “Best time is at mid-boot stage, before rain or heavy humidity. Spray in the morning or evening when it’s calm.” |
| “Can organic farmers control it?” | organic, natural, eco | Organic/Eco-friendly Practices | “Yes. Use resistant varieties, good water management, moderate nitrogen, and silicon soil supplements.” |
| “How much loss can occur?” | yield, loss, damage | Yield Loss | “Mild attacks cause about 10–18% yield loss; severe neck blast can cut over 50%. Early management prevents this.” |

RICE LEAF BLAST — TREATMENT METHODS, COST, AND GOVERNMENT FACILITIES

1 TYPES OF TREATMENT METHODS

Rice leaf blast can be controlled using **three main approaches**:

| Method Type | Main Idea | Goal |
|---|--|--|
| A. Preventive & Cultural Control | Use resistant varieties, manage water, fertilizer, and residue | Stop the fungus before it infects |
| B. Chemical (Fungicide) Control | Use approved fungicides to kill or stop the fungus | Protect leaves and panicles during critical stages |
| C. Organic / Eco-Friendly Control | Use natural or biological ways to reduce disease | Safe for organic farms and low-cost production |

A. PREVENTIVE & CULTURAL METHODS

Keywords: resistant varieties, seed quality, water management, nitrogen control, residue destruction

◆ What to Do

1. Plant resistant or tolerant rice varieties

- Example: *Swarna Sub1, IR64 blast-tolerant lines, MTU 1010 Blast-Resistant*, etc.
- These are available through state seed corporations or Krishi Vigyan Kendras (KVKs).

2. Use certified, pathogen-free seed

- Certified seed ensures the fungus is not carried over from previous crops.

3. Maintain continuous flooding

- Keep a steady 2–5 cm water level during vegetative stage to prevent blast spread.
- Avoid dry or uneven patches.

4. Split nitrogen fertilizer

- Apply in 3–4 small doses instead of one large dose.
- Too much nitrogen at once makes plants soft and more prone to blast.

5. Destroy infected straw and stubble after harvest

- Burning or deep plowing old residue reduces next-season infection.

6. Add silicon fertilizer if soil is low in it

- Example: *Calcium silicate, rice husk ash, or silicon-rich compost*.
- Silicon strengthens leaves against fungal entry.

Estimated Cost

| Practice | Cost per Acre (approx.) | Notes |
|--------------------------------------|-------------------------|--------------------------------|
| Certified seed | ₹500–800 | Depending on variety |
| Laser leveling / water management | ₹400–600 | Shared or custom hiring center |
| Balanced fertilizer & split nitrogen | ₹300–500 | Managed by farmer |
| Residue destruction / plowing | ₹300–700 | Tractor hire or local labour |

 **Total preventive cost:** around ₹1500–2500 per acre (one-time seasonal cost).

 **Benefit:** Long-term reduction of disease and better yield every year.

B. CHEMICAL (FUNGICIDE) TREATMENT

Keywords: tricyclazole, isoprothiolane, azoxystrobin, nativo, cost, PHI, timing

◆ **Common Fungicides & Doses (India Examples)**

| Fungicide | Formulation | Example Brand | Typical Dose / Acre | Best Time to Spray | Approx. Market Cost (₹) | Remarks |
|---|---------------------------|-------------------------------|---------------------|--------------------------------|-------------------------|--|
| Tricyclazole 75% WP | Wettable Powder | Indofil Baan, Adama Blastogan | 120–160 g | Early leaf blast or boot stage | ₹350–450 | Main preventive fungicide; very effective |
| Isoprothiolane 40% EC | Emulsifiable Concentrate | Fujione, Lavazza | 300 ml | Heading or neck blast stage | ₹450–550 | Systemic, good for neck blast |
| Azoxystrobin 23% SC | Suspension Concentrate | Amistar, Quadris | 150–200 ml | Mid-boot to boot-split | ₹500–700 | Prevents panicle blast; rotate to prevent resistance |
| Tebuconazole + Trifloxystrobin (50% + 25%) 75 WG | Water Dispersible Granule | Bayer Nativo, Gezeko | 80 g | Early disease or boot stage | ₹500–600 | Dual-action; curative & preventive |
| Tricyclazole + Hexaconazole 22% + 3% SC | Suspension Concentrate | Generic brands | As per label | Leaf blast / early boot | ₹450–550 | Combines two modes of action |
| Metominostrobin 20% SC | Suspension Concentrate | Oribright | 500 ml/ha | Tillering–Heading | ₹600–750 | Used regionally; effective on resistant strains |

💰 **Typical Total Chemical Cost per Acre:**

Including spray labour and water:

- **1 spray:** ₹700–1000
- **2 sprays (under high pressure):** ₹1200–1800

Timing:

- **1st spray:** Mid-boot to boot-split stage (panicle inside the stem).
 - **2nd spray:** 7–14 days later if weather stays humid or disease persists.
-

C. ORGANIC / ECO-FRIENDLY MANAGEMENT

Keywords: organic seed, water control, silicon source, resistant variety

What to Do

- Use **blast-resistant varieties** suited to organic systems.
- Keep fields flooded and avoid drought stress.
- Use **certified organic seed** to avoid fungus carryover.
- Apply **rice husk ash or silicon** (natural source) to strengthen plant tissue.
- Spray **neem-based bio-pesticides** (where allowed) for leaf health — though not curative for blast.

Approximate Cost:

| Practice | Cost per Acre | Remarks |
|----------------------------|---------------|---------------------------------|
| Organic seed | ₹700–1000 | Available via seed cooperatives |
| Neem bio-spray (if used) | ₹150–250 | For general leaf protection |
| Water & residue management | ₹400–700 | Similar to cultural control |

 **Total:** ₹1200–2000 per acre (depends on materials available).

GOVERNMENT FACILITIES AND SUPPORT (India)

Keywords: subsidy, KVK, ATMA, PMKSY, State Agri Dept, input support, crop insurance

1. Subsidy on Seeds and Inputs

- **Source:** State Agriculture Departments, ATMA (Agricultural Technology Management Agency).
- **Support:** 25–50% subsidy on **certified seed, bio-fertilizers, and plant protection chemicals** under state schemes.
- **How to Apply:** Through your local **Agriculture Office, PACS, or KVK**.

◆ 2. Krishi Vigyan Kendra (KVK) Support

- KVKs provide **free guidance, disease diagnosis, and field demonstrations.**
- They distribute **demo packets** of resistant seeds or fungicides in outbreak areas.
- Farmers can visit or call their **district KVK** for advice.

◆ 3. Crop Insurance (PMFBY)

- **Pradhan Mantri Fasal Bima Yojana (PMFBY)** covers losses from disease epidemics like blast.
- Farmers pay **1.5–2% premium**, and claim support if the disease causes major yield loss verified by officials.

◆ 4. Custom Hiring & Equipment Centers

- Under schemes like **SMAM (Sub-Mission on Agricultural Mechanization)**, farmers can **rent sprayers, levellers, and power weeders** at low cost.
- Spraying cost is often **₹100–150 per acre** when done through custom hiring centers.

◆ 5. Training and Alerts

- **Agro-meteorological advisory services (Agromet)** send SMS alerts through **mKisan Portal** and **state agriculture departments** about weather and disease risk.
- Farmers get **advice on when to spray** and **what product to use** for their region.

COST SUMMARY (Per Acre Estimate)

| Treatment Category | Main Cost Items | Approx. Range (₹) | Remarks |
|------------------------|---------------------------------------|-------------------|-------------------------------|
| Preventive / Cultural | Seed, leveling, fertilizer management | 1500–2500 | One-time seasonal investment |
| Chemical (1–2 sprays) | Fungicide + labour + water | 700–1800 | Based on pressure and product |
| Organic / Eco-friendly | Certified seed, bio-inputs | 1200–2000 | For organic systems |
| Government Subsidy | Seed & input support | 25–50% subsidy | Varies by scheme/state |

| Treatment Category | Main Cost Items | Approx. Range (₹) | Remarks |
|---------------------------|--------------------|-------------------|-----------------------------|
| Total Integrated Approach | Combined practices | 2000–3500 | For full protection program |

1. STANDARD RESPONSE STRUCTURE

Each chatbot answer should follow a clear, repeatable structure:

(1) Disease Overview (What it is)

Keyword triggers: “What is”, “Tell me about”, “overview”, “cause”, “symptoms”

Structure Example:

- **Name of the disease**
- **What causes it (pathogen name)**
- **Main symptoms farmers can see**
- **Why it's harmful or dangerous**

Example for Rice Leaf Scald:

Rice leaf scald is a **fungal disease** caused by *Microdochium oryzae* (also known as *Monographella albescens*).

It starts as **small, water-soaked, grey-green spots** on the leaf tips or edges.

These spots turn **light brown and dark brown in bands**, then dry out and form **large, straw-colored scalped patches**.

It weakens the leaf, **reduces green area**, and can **lower yield by 20–25%** if not managed properly.

(2) How It Spreads (Contagiousness & Environment)

Keyword triggers: “how it spreads”, “how it comes”, “why it happens”, “from where it comes”, “weather conditions”, “favorable conditions”

Structure Example:

- How the disease spreads (seed, soil, air, rain, etc.)
- Weather or fertilizer conditions that make it worse

- When it usually appears (early stage, late season, etc.)

Example for Rice Leaf Scald:

The fungus spreads mainly through **infected seeds** and **old rice stubble** left in the field.

It can also move through **wind and rain splash** from infected plants.

It appears mostly **late in the season** when the weather is **warm (26–29°C)** and **humid (85–92%)**.

Overuse of **nitrogen fertilizer** and **very close planting** make the disease worse.

③ How to Identify (Symptoms & Field Test)

Keyword triggers: “how to identify”, “symptoms”, “how to check”, “difference from bacterial blight”, “how to test”

Structure Example:

- Visible signs on leaves
- How to confirm it's not another disease

Example for Rice Leaf Scald:

You will first see **small grey-green, water-soaked spots** at the **leaf tips or sides**.

These turn into **light brown and dark brown bands** like layers on the leaf.

Finally, large parts of the leaf look **burnt or scalded**—that's why it's called leaf scald.

Test to confirm: Cut a leaf and dip it in clean water for 5–10 minutes.

If **no sticky bacterial ooze** comes out, it's leaf scald (not bacterial blight).

④ Prevention (Before Disease Appears)

Keyword triggers: “how to prevent”, “precautions”, “avoid disease”, “prevention methods”

Structure Example:

- Resistant varieties
- Proper fertilizer use (especially nitrogen)
- Proper spacing and sanitation
- Field management (stubble, water, weeds)

Example for Rice Leaf Scald:

- Use **resistant or less sensitive rice varieties** if available.
- Avoid **too much nitrogen fertilizer**; use a balanced amount.

- Keep **enough spacing** between plants for better airflow.
 - **Remove stubble and weeds** after harvest to stop the fungus from staying in the field.
 - Maintain **good drainage** and avoid long wet periods on the leaves.
-

⑤ Cure / Treatment (After It Appears)

Keyword triggers: “medicine”, “chemical”, “fungicide”, “how to control”, “what to spray”, “treatment”, “organic control”

Structure Example:

- Chemical treatment options (name, concentration, timing)
- Bio or organic options
- Seed treatment
- How many times and when to spray
- Safety and timing notes

Example for Rice Leaf Scald:

Chemical Fungicides

| Fungicide (active ingredient) | Example Brand | Dose / Concentration | When to Apply |
|-----------------------------------|---------------|----------------------|--|
| Copper oxychloride 50% WP | Blitox 50 | 0.25% (2.5 g/L) | At first symptom and again after 15 days |
| Carbendazim 12% + Mancozeb 63% WP | Saaf | 0.1% (1 g/L) | 2 sprays, 15 days apart |
| Propiconazole 25% EC | Tilt | 0.1% (1 mL/L) | 2 sprays, 15 days apart |

Bio / Organic Options

| Product / Agent | Use Rate | Effect |
|--------------------------------|--------------|--------------------------|
| Neem leaf extract | 10% solution | Eco-friendly control |
| <i>Pseudomonas fluorescens</i> | 5 g/L | Reduces disease severity |
| <i>Trichoderma viride</i> | 5 g/L | Prevents early infection |

Seed Treatment (Before Sowing)

| Chemical | Example Brand | Purpose |
|---------------------------|----------------|------------------------|
| Thiophanate-methyl 70% WP | Topsin | Kills seedborne fungus |
| Carbendazim / Benomyl | Saaf / Benlate | Protects seedlings |

Key Points:

- Spray **in dry weather**, early morning or late afternoon.
 - Repeat after **15 days**.
 - Don't spray before **rain**.
 - Follow **label and safety instructions** (wear gloves, mask, etc.).
-

⑥ Aftercare & Next Season Tips

Keyword triggers: “next time”, “how to avoid next year”, “after harvest”, “seed treatment next crop”

Structure Example:

- Destroy stubble and infected ratoons
- Clean tools
- Treat next season's seeds
- Keep balanced fertilizer use

Example for Rice Leaf Scald:

After harvest, **remove or plow under all rice stubble** so the fungus doesn't survive.

Clean tools before using in other fields.

Next time, **treat seeds** with thiophanate-methyl or carbendazim before sowing.

Use **proper spacing** and **balanced fertilizers** to keep plants strong and resistant.

2. BACKEND LOGIC (for your chatbot)

To automate retrieval from PDF or database:

| User Intent | Keyword Detection Examples | Section to Fetch from PDF | Response Style |
|------------------|---------------------------------|---------------------------|----------------------------|
| Disease overview | what is, cause, overview | “Disease overview” | Short, clear explanation |
| Symptoms | identify, symptoms, signs | “Early identification” | Visual + descriptive |
| Spread | spread, infection, transmission | “Environment and spread” | Simple cause explanation |
| Prevention | avoid, stop, prevention | “Preventive measures” | Steps and practices |
| Treatment | medicine, cure, fungicide | “Fungicides and control” | Table + plain text summary |
| Aftercare | after harvest, next crop | “Seed health next season” | Checklist format |

3. OUTPUT STYLE (Farmer-Friendly English)

- Use **short, clear sentences**.
- Replace scientific words with **common terms**.
- Explain technical words in brackets.
- Use **bullet points, tables, or numbered steps** for readability.

Example conversion:

“Microdochium oryzae infects leaves through stomata under high humidity.”

 becomes:

“The fungus enters the leaf through small openings when the weather is very humid.”

1. STANDARD CHATBOT STRUCTURE — “Treatment, Cost, and Government Help”

Your bot’s answer should be divided into 3 clear sections:

(A) Treatment Methods

Explain all available control options, grouped into:

1. **Chemical (fungicide) control**
2. **Bio/organic control**
3. **Cultural/agronomic control**

4. Seed treatment (if seed-borne disease)

Include:

- What to use (name or active ingredient)
 - How much (rate or %)
 - When to apply (timing)
 - How many times (frequency)
 - Effectiveness (simple % or visual benefit)
-

(B) Approximate Cost (per acre or per spray)

Include **typical market prices** (in ₹ INR or local currency).

Mention that prices **may vary by location or brand** but give a **realistic average** range for farmers.

(C) Government Facilities / Subsidy / Farmer Support

Include:

- State Agriculture Department programs (if available)
 - KVK (Krishi Vigyan Kendra) / ATMA / NFSM programs
 - Input subsidies for fungicides or bio-products
 - Training / Demonstration / Helpline facilities
 - PM-KISAN or Crop Insurance related support
-

2. EXAMPLE: RICE LEAF SCALD

(A) TREATMENT METHODS

◆ 1. Chemical (Fungicide) Control

| Fungicide Name (Active Ingredient) | Example Brand | Use Rate | When to Apply | Expected Result |
|------------------------------------|---------------------|-----------------|--------------------------------------|--------------------------|
| Copper oxychloride 50% WP | <i>Blitox 50 WP</i> | 0.25% (2.5 g/L) | At first sign + repeat after 15 days | 70–85% disease reduction |

| Fungicide Name (Active Ingredient) | Example Brand | Use Rate | When to Apply | Expected Result |
|------------------------------------|------------------|---------------|--------------------------------|------------------|
| Carbendazim 12% + Mancozeb 63% WP | <i>Saaf</i> | 0.1% (1 g/L) | 2 sprays, 15 days apart | 60–80% control |
| Propiconazole 25% EC | <i>Tilt</i> | 0.1% (1 mL/L) | 2 sprays, 15 days apart | 65–80% control |
| Edifenphos 50% EC | <i>Hinosan</i> | 1.5 mL/L | As per label | 60–70% control |
| Validamycin 3% L | <i>Sheathmar</i> | 2.5 mL/L | For sheath/leaf blight & scald | Moderate control |

◆ 2. Bio / Organic Treatments

| Bio-Agent / Botanical | Dose | Purpose | Remarks |
|--------------------------------|--------------|--------------------------|-------------------------------|
| <i>Pseudomonas fluorescens</i> | 5 g/L | Preventive control | Used by TNAU in IPDM programs |
| <i>Trichoderma viride</i> | 5 g/L | Prevents early infection | Seed or soil application |
| Neem leaf extract | 10% solution | Reduces leaf infection | Low-cost eco-friendly option |

◆ 3. Cultural & Agronomic Control

- **Use resistant varieties** (check local agri office list)
- **Balanced nitrogen:** avoid high N; use recommended rate (~40 kg N/ha).
- **Add silicon fertilizer** (e.g., calcium silicate) if soil deficient.
- **Maintain wider spacing** (20×15 cm or as per variety).
- **Remove crop residues and plow in stubbles** after harvest.
- **Avoid continuous rice cropping** in the same field.

◆ 4. Seed Treatment (Prevent Seedborne Infection)

| Seed Treatment Chemical | Example Brand | Dose | Benefit |
|---|-----------------|-------------|------------------------------------|
| Thiophanate-methyl 70% WP <i>Topsin</i> | | 2 g/kg seed | Kills seedborne fungus |
| Carbendazim 50% WP | <i>Bavistin</i> | 2 g/kg seed | Early protection against infection |

 **(B) APPROXIMATE COSTS (per acre basis)**

| Treatment Type | Example Products | Average Cost/acre (₹) | Remarks |
|---|-------------------|-----------------------|------------------------------|
| Copper oxychloride spray | Blitox 50 WP | ₹250–₹400 per spray | 2 sprays recommended |
| Carbendazim + Mancozeb spray | Saaf | ₹300–₹450 per spray | 2 sprays recommended |
| Propiconazole spray | Tilt | ₹350–₹500 per spray | 2 sprays recommended |
| Bio agents (<i>P. fluorescens</i> / <i>T. viride</i>) | Local Agri Inputs | ₹150–₹250 per spray | Safe and organic |
| Neem extract (10%) | Homemade / Market | ₹50–₹100 per spray | Low-cost eco-friendly option |
| Seed treatment (Carbendazim / Topsin) | ₹50–₹80/kg seed | ₹100–₹150 per acre | Once before sowing |

 **Total estimated control program cost:**

≈ ₹700–₹1,200 per acre for chemical control

≈ ₹400–₹700 per acre for bio-organic programs

(Prices may vary by district, dealer, and brand.)

 **(C) GOVERNMENT FACILITIES & SUPPORT**

| Facility / Scheme | What It Provides | Where to Contact |
|---|--|---|
| State Agriculture Department (ATMA / NFSM / RKVY programs) | Subsidized fungicides, bio-fertilizers, or demonstration kits for paddy diseases | Local Agriculture Office or Block ATMA Centre |

| Facility / Scheme | What It Provides | Where to Contact |
|---------------------------------|---|--|
| Krishi Vigyan Kendra (KVK) | Free training on pest & disease management, live field demos, diagnostic services | District-level KVK |
| PM-KISAN Helpline / Agri Portal | Information and financial support (₹6,000/year assistance) | pmkisan.gov.in |
| Crop Insurance (PMFBY) | Compensation for yield loss due to major diseases or weather | Enroll via local bank or CSC centre |
| ICAR / SAU Disease Clinics | Disease diagnosis, treatment advice, free samples | Regional Agri University / ICAR Research Station |

How farmers can benefit:

- Visit **local agriculture office** for subsidized fungicide or bio-agent supply under *Plant Protection Subsidy*.
- **KVks** regularly organize **free awareness programs** on “Rice Disease Management.”
- Government-approved **mobile apps** like **Kisan Suvidha, AgriApp, and IFFCO Kisan** also list available fungicides and subsidy alerts.

Farmer Assistance Chatbot Structure for Narrow Brown Leaf Spot (NBLS) in Rice

1. Disease Overview

Keywords: narrow brown leaf spot, rice disease, brown streaks, Cercospora, foliar disease

Explanation:

Narrow brown leaf spot is a disease of rice caused by a fungus. It shows **long, thin brown lines on leaves**, usually later in the crop season. It spreads more quickly when it is **warm, humid, and the plant lacks nutrients like potassium or silicon**.

Most of the time, if you manage the field correctly and spray the right fungicides, the crop can **recover with little loss in yield**.

2. Early Signs & Symptoms

Keywords: early symptoms, leaf streaks, linear lesions, gray centers, net-blotch

Explanation:

- First signs appear as **thin, linear brown streaks** on the leaves, **2–10 mm long and ~1 mm wide**.
 - Older leaves are affected first, and it worsens from **panicle initiation to heading**.
 - On some varieties, lesions may have a **gray center**, and the leaf sheath may develop a **net-like pattern**.
 - **Grains can discolor** if the disease is severe.
 - **How to tell it apart from other diseases:**
 - NBLS: narrow, straight lines
 - Blast: spindle-shaped with wide gray center
 - Brown spot: oval with halo
-

3. Healthy vs. Affected Leaves

Keywords: leaf appearance, necrosis, yellowing, leaf death

Explanation:

- **Healthy leaves:** green, smooth, no streaks
 - **Infected leaves:** multiple long brown lines along veins; may **yellow and dry from the tips** in severe cases
-

4. Environmental Factors

Keywords: temperature, humidity, leaf wetness, nutrient stress, canopy density

Explanation:

The fungus grows best when:

- **Temperature:** 25–28°C
 - **High humidity and prolonged wet leaves**
 - **Dense crop canopy** and too much nitrogen without enough potassium or silicon
 - **Late planting** also increases risk
 - **How it spreads:** wind, rain splash, infected seeds, and leftover crop residues
-

5. Contagiousness

Keywords: spore spread, wind, rain, tools, crop debris

Explanation:

- The disease spreads within the field and to neighboring fields by:
 - **Wind and rain-splashed spores**
 - **Infected crop residues and seeds**
 - **Shared tools and movement through wet crops**
-

6. Preventive Measures

Keywords: resistant varieties, nutrition balance, canopy management, irrigation

Explanation:

- Use **resistant or less-susceptible rice varieties**
 - Ensure **potassium and silicon** are sufficient for healthy leaves
 - Reduce leaf wetness and dense canopy by:
 - Correct plant spacing
 - Timely weeding
 - Avoiding too much late nitrogen
 - Manage irrigation to **avoid prolonged wet leaves**
-

7. Cultural Practices

Keywords: spacing, irrigation, nutrition, leaf removal, sanitation

Explanation:

- **Spacing:** Keep rows wide enough for air and light
- **Irrigation:** Avoid wetting leaves often; water early in the day to allow leaves to dry
- **Fertilizer:** Split nitrogen doses; maintain potassium; add silicon if low in soil
- **Remove infected leaves carefully** in seedbeds or small plots and **destroy them**, not compost
- **Clean tools** after use and avoid moving through wet fields

8. Organic / Eco-Friendly Options

Keywords: biocontrol, neem, *Bacillus subtilis*, *Pseudomonas fluorescens*, copper, silicon

Explanation:

- **Biocontrols:** Use friendly bacteria like ***Bacillus subtilis* or *Pseudomonas fluorescens*** to protect plants
 - **Botanical products:** Neem sprays, copper-based fungicides (organic approved)
 - **Minerals:** Silicon and potassium supplements help reduce disease severity
 - Apply **multiple times starting before heading**
-

9. Fungicide & Chemical Treatments

Keywords: fungicides, systemic, protectants, propiconazole, triazole, copper, PHI

Explanation:

Recommended medicines:

A. Systemic Fungicides (effective against NBLS)

| Active Ingredient | Brand Examples | Use | Notes |
|------------------------------------|---|--------------------------------------|--|
| Propiconazole 25% EC | Tilt, Katayani Boost | Systemic, apply from boot to heading | Rate: ~1 mL/L knapsack or 200 mL/acre; PHI: ~14 days |
| Strobilurin + Triazole premixes | Trifloxystrobin + Tebuconazole, Azoxystrobin + Difenoconazole | Systemic, broad-spectrum | Follow label instructions for timing and rate |

B. Protectants (surface protection)

- Mancozeb 75% WP, Chlorothalonil
- Preventive, applied before infection periods

C. Organic / Biocontrol options

- *Bacillus subtilis*, *Pseudomonas fluorescens*
- Neem-based sprays
- Copper-based products approved for organic use

Application Tips:

- Spray in the **morning or late afternoon**
 - Ensure **full leaf coverage** (upper and lower sides)
 - **Reapply every 7–10 days** for protectants or 10–14 days for systemics under high disease pressure
 - Adjust after **heavy rain**
-

10. Safety & Handling

Keywords: PPE, re-entry, mixing, disposal, spray timing

Explanation:

- Wear gloves, long sleeves, boots, and eye protection
 - Follow **pre-harvest interval (PHI)** from the label
 - Clean and rinse containers properly
 - Avoid spraying when **windy, very hot, or leaves are wet**
-

11. Yield & Recovery

Keywords: yield loss, grain quality, symptom reduction

Explanation:

- Early management leads to **minimal yield loss**
 - Leaves may still show old lesions, but **new leaves emerge healthy in 7–14 days**
 - If untreated, disease can cause **premature yellowing and grain discoloration**
-

12. Step-by-Step Treatment Procedure

Keywords: scout, nutrition, fungicide timing, biocontrol, sanitation

Stepwise Guide:

1. **Scout:** Check for long, thin brown streaks
2. **Correct nutrition:** Apply potassium and silicon if needed
3. **Spray fungicides:** Apply propiconazole or strobilurin-triazole premix between **boot and heading**

4. **Integrate biocontrol:** Bacillus/Pseudomonas sprays between fungicide applications
 5. **Sanitation:** Clean tools, manage residue, avoid wet field movement
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13. Where to Buy Fungicides

Keywords: agro-input dealers, licensed retailers, online availability, local extension

Explanation:

- Purchase from **licensed agro-input retailers, farmer cooperatives, or reputable e-commerce platforms**
 - Check **local registration, batch details, and PHI**
 - Local extension services can **confirm suitable brands and dosages**
-

Summary Table for Quick Chatbot Reference

| Keyword | Info to Fetch |
|-----------------|--|
| Symptoms | Long, thin brown leaf streaks; gray centers; net-botch; grain discoloration |
| Differentiation | NBLS: linear; Blast: spindle; Brown spot: oval with halo |
| Environment | Warm, humid, leaf wetness, nutrient stress, dense canopy |
| Spread | Wind, rain splash, residues, infected seeds, tools |
| Prevention | Resistant varieties, potassium/silicon, spacing, irrigation, canopy management |
| Organic | Bacillus subtilis, Pseudomonas fluorescens, neem, copper, silicon |
| Fungicides | Propiconazole 25% EC (Tilt, Katyayani Boost), strobilurin-triazole mixes |
| Application | Boot to heading, morning/evening, proper coverage, reapply 7–14 days |
| Safety | PPE, PHI, avoid spraying wet leaves or windy conditions |
| Yield Recovery | Minimal loss if managed early; symptoms stabilize in 7–14 days |

1. Treatment Methods for NBLS

A. Cultural & Preventive Practices

Keywords: spacing, nutrition, irrigation, residue management, canopy management

Description:

- **Plant spacing:** Follow recommended distance to allow airflow.
- **Balanced nutrition:** Ensure adequate **potassium and silicon**; avoid excess nitrogen late in season.
- **Irrigation management:** Avoid wetting leaves repeatedly; water early in the day.
- **Residue management:** Remove or plow under infected plant residues after harvest.

Cost:

- Mostly **low to moderate**.
- Potassium fertilizers: ₹15–30/kg (depends on type and brand)
- Silicon sources (rice husk ash, calcium silicate): ₹10–20/kg
- Labor for spacing/weeding: ₹150–300/day

Government Support:

- Fertilizers often **subsidized** under schemes like **NFSM (National Food Security Mission)**.
 - State agriculture departments may provide **free or low-cost soil testing** to detect nutrient deficiencies.
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B. Chemical/Fungicide Treatments

Keywords: systemic fungicide, propiconazole, triazole, protectant, spraying

Description:

1. **Systemic fungicides (curative + preventive)**
 - **Propiconazole 25% EC** (Tilt, Katyayani Boost)
 - **Strobilurin-triazole premixes** (e.g., Azoxystrobin + Difenoconazole, Trifloxystrobin + Tebuconazole)
 - Spray **between boot and heading** stages
2. **Protectant fungicides (preventive only)**
 - Mancozeb 75% WP, Chlorothalonil
 - Spray **before infection or high humidity periods**

Cost:

- Propiconazole 25% EC: ₹400–600 per liter; 200 mL/acre (~₹80–120 per acre)
- Strobilurin-triazole premixes: ₹500–700 per liter; 200 mL/acre
- Protectants: ₹150–250 per kg; 200–250 g/acre

Government Support:

- **Subsidy programs** in some states for fungicides under NFSM or state crop protection schemes.
 - Farmers can **purchase from government cooperative outlets** or **Krishi Vigyan Kendra (KVK)** recommended dealers.
-

C. Organic / Biocontrol Treatments

Keywords: biocontrol, Bacillus subtilis, Pseudomonas fluorescens, neem, copper

Description:

- **Biocontrol bacteria:** Bacillus subtilis, Pseudomonas fluorescens – sprayed preventively before heading
- **Botanical sprays:** Neem-based formulations
- **Copper-based products:** Approved for organic rice systems

Cost:

- Bacillus/Pseudomonas: ₹150–250 per 500 mL bottle; 1–2 applications/acre
- Neem oil/concentrate: ₹100–200 per liter; 1–2 applications
- Copper hydroxide/oxychloride: ₹200–300 per kg; 1 application/acre

Government Support:

- KVKS and State Agriculture Departments sometimes provide **biocontrol formulations at low cost** or free demonstrations.
 - Organic farmers may access **certified organic inputs** through government-assisted programs.
-

D. Integrated Treatment Approach (Recommended)

Keywords: integrated disease management, cultural + chemical + organic

Stepwise:

1. **Scout field** for early signs
2. **Correct nutrient deficiency** (potassium/silicon)
3. **Apply systemic fungicide** (propiconazole or strobilurin-triazole)
4. **Spray biocontrol** between chemical applications if needed
5. **Maintain sanitation** (residue management, clean tools, avoid wet-field movement)

Cost:

- Combination approach costs **moderate (~₹150–300/acre)** for chemicals + nutrients + labor
- Provides **best protection and yield recovery**

Government Support:

- Farmers may access **subsidized fertilizers, fungicides, and training** under NFSM and KVK programs.
- Some states provide **spray equipment or community sprayers** at low cost.

Quick Comparison Table

| Method | Cost Range | Government Support |
|-----------------------|--|---|
| Cultural & Preventive | Low–Moderate (₹10–300/acre) | Fertilizer subsidy, soil testing, KVK training |
| Chemical Fungicides | Moderate (₹80–250/acre per spray) | Subsidy under NFSM, purchase via cooperatives/KVK |
| Organic/Biocontrol | Low–Moderate (₹100–250/acre per spray) | KVK, state agriculture department supply |
| Integrated Approach | Moderate (~₹150–300/acre total) | Combines subsidies + training for maximum effectiveness |

Farmer Assistance Guide for Healthy Rice Leaves

1. Seed and Nursery Hygiene

Keywords: Certified seed, disease-free seed, hot-water treatment, nursery hygiene, leaf spot, brown spot, fungicide treatment

Simple Explanation:

Start with **healthy seeds** that are certified or free of diseases. Treat seeds in **hot water at 53–54°C for 10–12 minutes** to kill germs that cause **brown spot**.

In areas where **leaf scald** is common, treat seeds with fungicides like **benomyl, carbendazim, or thiophanate-methyl** to prevent early infections.

Grow seedlings in **clean, well-drained nurseries**. Avoid giving too much **nitrogen** in the nursery; overly lush seedlings are more likely to get leaf diseases.

2. Variety Selection and Planting Date

Keywords: Resistant varieties, blast, BLB, leaf spots, sowing time, local recommendation

Simple Explanation:

Choose rice varieties that are **resistant or tolerant** to major diseases like **blast, bacterial leaf blight (BLB), and leaf spots**. Resistance is the **easiest and cheapest** way to protect your crop.

Plant seeds **on time** according to local recommendations. Planting **after the first rains** and avoiding **late sowing** reduces exposure to weather that favors diseases.

Check with your **local agriculture office** to get a list of resistant varieties suitable for your area and season.

3. Fertility Management and Silicon Use

Keywords: Nitrogen, potassium, silicon, dense canopy, blast, brown spot, integrated fertility

Simple Explanation:

Avoid giving **too much nitrogen**, as it makes leaves **soft and dense**, which helps diseases like **blast and BLB** spread.

Give **balanced potassium** to keep plants healthy, and if your soil is low in **silicon**, consider adding it. Silicon strengthens leaves and helps fight **blast and brown spot**.

Tip: Using silicon together with fungicides works better than using either alone.

4. Water and Canopy Management

Keywords: Flooding, drainage, leaf wetness, plant spacing, air circulation

Simple Explanation:

Keep **shallow water** after transplanting and during critical growth stages to prevent **blast**.

Ensure **good drainage** so fields don't stay too wet, which can spread **BLB** and other leaf diseases.

Plant at the **recommended spacing** to let air and sunlight pass through, which dries leaves faster and reduces disease risk.

5. Field Sanitation and Residue Management

Keywords: Stubble, straw, ratoons, weeds, inoculum, crop rotation

Simple Explanation:

After harvest, **bury or plough under crop residues** and remove **infected ratoons**. This reduces leftover germs that can infect the next crop.

Control **weeds and grass hosts**, as they can carry **BLB bacteria**. Rotate crops and keep fields clean to reduce disease buildup.

Avoid moving infected debris from one field to another.

6. Targeted Protective Spraying

Keywords: Fungicides, copper oxychloride, triazoles, strobilurins, late boot to heading, leaf protection

Simple Explanation:

For **blast**, spray fungicides **from late boot to heading** to protect the **flag leaf** and panicles. Use fungicides like **triazoles or strobilurins** that are registered for rice.

For **leaf scald**, preventive sprays with **copper-based or systemic fungicides** help reduce infections.

For **BLB**, rely mainly on **resistant varieties, balanced nutrients, proper drainage, and sanitation**. Bactericides usually have **limited effect**.

7. Field Operations and Hygiene

Keywords: Wet canopy, splash spread, irrigation, biosecurity

Simple Explanation:

Avoid working in fields when leaves are **wet**, because water can **spread diseases**.

Control **irrigation flow** to prevent **BLB spread** and maintain **field-to-field biosecurity**.

Combine **clean field practices** with **residue management** after harvest to reduce diseases for the next season.

8. Monitoring and Decision Points

Keywords: Scouting, tillering to heading, IRRI scoring, upper leaves, flag leaf

Simple Explanation:

Check fields **weekly** from **tillering to heading**. Look for early disease symptoms and use the **IRRI scoring system** to track severity.

Focus on **upper leaves**, especially the **flag leaf**, because keeping them healthy is crucial for **grain yield and quality**.

9. Weather-Smart Scheduling

Keywords: Calm dry periods, rainfast, forecast, flooded conditions, high-risk weather

Simple Explanation:

Spray fungicides during **dry, calm weather** to ensure they stick to leaves.

Use **weather forecasts** to plan sprays rather than relying only on fixed dates. Combine with **balanced nutrition and silicon** for stronger protection.

During **critical blast periods**, maintain **flooded conditions** but avoid leaving the canopy too wet late in the day.

10. Integrated Approach Summary

Keywords: Layered defense, resistant varieties, clean seed, balanced nutrition, water management, sanitation, timed sprays

Simple Explanation:

Protecting rice leaves requires **multiple strategies together**:

- **Resistant varieties**
- **Clean seeds and nursery hygiene**
- **Balanced nitrogen, potassium, and silicon**
- **Water and canopy management**
- **Sanitation and residue control**
- **Timely protective sprays**

Following all these steps **together** keeps leaves healthy and prevents **BLB, brown spot, blast, leaf scald, and narrow brown leaf spot** effectively.