

CULTIVATION GUIDE

(PACKAGE OF PRACTISES)



KHARIF

BY:

SUPREME BREEDERS PRIVATE LIMITED

CULTIVATION GUIDE (PACKAGE OF PRACTISES)

KHARIF



**SUPREME BREEDERS PRIVATE LIMITED
FATEHABAD**

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Rice

Rice is one of the most important staple food crops of India, forming the dietary base for a large section of the population. Cultivated across diverse agro-climatic zones, from the rainfed uplands of eastern India to the irrigated plains of the north and south, rice demonstrates exceptional adaptability.

India is the second-largest producer of rice in the world, with cultivation spread over more than 40 million hectares. Its share in national food grain output is significant, making it a cornerstone of food security, rural livelihoods, and the agricultural economy. Rice is not only consumed domestically in large quantities but also forms a key component of India's agricultural exports.

Rice cultivation in India ranges from traditional varieties grown in localized regions to modern high-yielding types that have improved productivity over the past few decades. With advancements in breeding, disease resistance, and input-responsive varieties, rice continues to evolve as a crop that sustains millions of farming households.

Categories of Rice in India

Broadly, rice in India can be classified into two main categories:

I. Non-Basmati Rice (Parmal / PR Rice)

Refers to the large group of non-aromatic, high-yielding rice varieties widely cultivated across India.

Locally and commercially known as Parmal rice or PR rice.

Includes popular varieties like PR-11, PR-14, PR-106, PR-113, PR-121, and PR-126, among others.

Typically characterized by medium- to long-grain size, good cooking quality, and high yield potential.

Forms the bulk of rice consumed in India, especially in mid-income and rural households, and is also a major component of government food security schemes.

In export markets, PR/Parmal rice is often sold under labels such as "Long Grain Non-Basmati Rice," "Raw White Rice," "Steam Rice," or "Parboiled Rice", depending on the milling and processing method.

Cultivation:

To optimize yield, conserve water, and simplify residue management, follow these best practices validated by Supreme Breeders Private Limited:

Choose Short-Duration Varieties: Select early-maturing, high-yielding varieties that reduce water use and improve field turnaround time for the next crop. Our proprietary varieties like SUPREME-110 and SUPREME-610 are ideal for this.

Avoid Long-Duration Varieties: Refrain from growing varieties such as Pusa 44 and its derivatives (e.g., Peeli Pusa, Dogar Pusa). These consume 15–20% more water, generate excessive straw, and require additional pesticide applications—leading to lower overall profitability.

Timely Nursery & Transplanting: For optimal results, sow nursery between May 20 and June 20, and transplant seedlings between June 20 and July 10. This schedule aligns well with monsoon patterns and minimizes pest pressure.

Transplanting for Supreme-610: For this short-duration variety, transplant 25–30-day-old seedlings to ensure better grain filling and yield.

Direct Seeding (DSR): For regions with water scarcity or labor constraints, begin DSR in a moist (tar-wattar) field from June 1 onwards to save irrigation costs and time.

Fertilizer Application:

Always base fertilizer application on soil testing.

- Phosphorus: Skip application if wheat in the previous season received the recommended dose.
- Nitrogen: Apply judiciously using the Leaf Colour Chart (LCC) to avoid excess, which can attract pests and diseases.

Region-Specific Advice: Avoid planting PR 131 in sub-mountainous zones due to susceptibility concerns.

Fertilizer Adjustment for PR 132: This variety performs well with 25% less nitrogen, resulting in cost savings without compromising yield.

Disease Management – False Smut: Start spraying recommended fungicides at the booting stage for effective control.

Insect Monitoring: Watch out for planthoppers, which feed at the base and are often unnoticed until crop burn occurs. Avoid synthetic pyrethroids as they may increase hopper populations. Monitor fields regularly for early detection.

Irrigation Management: Discontinue irrigation roughly 15 days before maturity to aid in proper grain development and uniform ripening.

Harvesting: Harvest variety-wise at full physiological maturity. Avoid nighttime harvesting to ensure grain quality and reduce shattering losses.

Climatic Requirements:

Rice thrives in warm, humid environments with high solar radiation and assured water supply. Optimal productivity is achieved when:

- Vegetative Stage: Max temp 34–40°C; Min temp 23–28°C; Sunshine 7–11 hrs/day
- Flowering Stage: Max temp 33–35°C; Min temp 25–27°C; Sunshine 6–10 hrs/day
- Grain Development Stage: Max temp 32–35°C; Min temp 20–25°C; Sunshine 7–10 hrs/day

Soil Requirements:

Rice grows best in loamy soils with low permeability and a pH range of 5 to 9. Such soils retain water well, making them suitable for flooded rice cultivation.

Effective Cropping Rotations:

Incorporate rice into diversified rotations to improve soil health and manage pest/disease cycles:

- Rice – Wheat / Berseem / Linseed / Gram / Barley
- Rice – Wheat – Summer Moong / Green Manuring
- Rice – Celery
- Rice – Potato / Peas – Celery
- Rice – Potato – Summer Moong / Sunflower / Wheat / Cucurbits
- Rice – Toria – Sunflower
- Rice – Gram – Summer Moong
- Rice – Gobhi Sarson – Summer Moong
- DSR – Potato – Mentha / Onion
- DSR – Wheat – Summer Moong / Green Manuring

High-Performance Rice Varieties from Supreme Breeders Pvt. Ltd.:

SUPREME-110:

A robust, high-yielding variety with excellent adaptability and dependable disease resistance.

- Duration: 135–140 days
- Yield: 33–38 q/acre
- Resistance: Strong against major diseases
- Transplanting Window: June 15 – July 15
- Plant Height: Medium; no lodging

SUPREME-610

An early-maturing variety delivering consistent performance and high yields.

- Duration: 125–130 days
- Yield: 32–38 q/acre
- Resistance: Strong
- Transplanting Window: June 25 – July 15
- Plant Height: Medium; no lodging

SUPREME-710

A stable, mid-duration variety designed for balanced performance across regions.

- Duration: 128–133 days
- Yield: 32–38 q/acre
- Resistance: Strong
- Transplanting Window: June 25 – July 15
- Plant Height: Medium; no lodging

SUPREME-810

A dependable, medium-duration rice variety with a high yield potential and ease of management.

- Duration: 135–140 days
- Yield: 36–38 q/acre
- Resistance: Strong
- Transplanting Window: June 15 – July 15
- Plant Height: Medium; no lodging

Other Standard Varieties:

PR-126

An early-maturing variety ideal for both transplanting and DSR, with exceptional water-use efficiency.

- Duration: 123–125 days
- Yield: 32–37.2 q/acre
- Water Use: ~25% less than long-duration varieties
- Sowing Window:
 - – Nursery: Late May to Late June
 - – Transplanting: 25–30-day-old seedlings in early July
- Fertilizer Schedule: Apply urea in 3 splits (7, 21, 35 DAT) for maximum productivity
- Suitability: Excellent fit for timely wheat sowing
- Straw Management: Low straw; easy to manage
- Grain Quality: Matches or exceeds popular hybrid standards

PR-131

A medium-duration, lodging-tolerant variety with excellent grain recovery and strong disease resistance.

- Duration: ~110 days
- Yield: Avg. 31 q/acre
- Plant Height: ~111 cm
- Grain Quality: Long, slender, translucent grains
- Resistance: Bacterial blight (all 10 prevalent pathotypes)

PR-114

A resilient, early-release variety known for exceptional grain length and milling quality.

- Duration: ~115 days
- Yield: Avg. 27.5 q/acre
- Plant Height: ~102 cm
- Leaf Type: Narrow, dark green, erect
- Grain Quality: Extra-long, clear translucent grains
- Resistance: Resistant to 5 major bacterial blight pathotypes

Avoid These Varieties

Pusa 44, Peeli Pusa, and Dogar Pusa are long-duration varieties that:

- Consume 15–20% more water
- Are highly susceptible to major bacterial blight strains
- Require multiple pesticide sprays
- Produce heavy straw, complicating residue management
- Ultimately reduce net profitability

Agronomic Guidelines for Paddy

I. Nursery Raising for Conventional Transplanting

Optimal Time for Nursery Sowing (20 May – 20 June)

Sowing Window	Recommended Varieties
May 20–25	PR 132, PR 131, PR 129, PR 128, PR 122, PR 121, PR 114, PR 113
May 25–31	PR 127, PR 130, HKR 47
May 25–June 20	PR 126

Seed Rate & Treatment

Seed Selection:

Soak seeds in water and remove floating (immature) grains. Use 8 kg of heavy, healthy seed per acre.

Fungicide Treatment:

- Treat seed with Sprint 75 WS (Carbendazim + Mancozeb):
- Mix 3 g per kg seed (i.e., 24 g in 80–100 mL water for 8 kg seed).
- Make a slurry and coat seeds before sowing.

Land Preparation for Nursery

- Mix 12–15 tonnes/acre of well-rotted FYM or compost.
- Pre-irrigate to germinate weeds.
- Plough twice to destroy weed flush.
- Spread treated seeds over wet gunny bags, cover with another layer, and keep moist (sprouting in 24–36 hrs).

Fertilizer Application at Sowing

Per acre:

26 kg Urea

60 kg SSP

40 kg Zinc Sulphate Heptahydrate (21%)

or 25.5 kg Zinc Sulphate Monohydrate (33%)

Broadcast 8 kg seed on 160 sq.m. (6.5 marla) nursery bed per acre of transplanting.

Irrigation and Follow-up Nutrition

- Apply another 26 kg Urea ~15 days after sowing.
- For aged nursery (45+ days), apply additional 26 kg Urea at 4 weeks.
- Keep soil moist with frequent irrigation.
- Control bird damage: broadcast thin layer of decomposed FYM after sowing.

Nutrient Deficiency Management

- Yellowing of new leaves: Spray 0.5–1% Ferrous Sulphate (0.5–1.0 kg/100 L water) x 3 sprays at 7-day intervals.
- Rusty brown leaves: Spray
 - 0.5% Zinc Sulphate Heptahydrate (500 g/100 L water) or 0.3% Zinc Sulphate Monohydrate (300 g/100 L)

Weed Control in Nursery

Weed Control in Nursery

Herbicide	Dose/acre	Application Timing
Butachlor 50 EC	1200 mL + 60 kg sand	7 days after sowing
Sofit 37.5 EC (Pretilachlor + Safener)	500 mL + sand	3 days after sowing
Nominee Gold/Taarak/Macho 10 SC (Bispyribac)	100 mL in 150 L water	15–20 days after sowing

Note:

Please perform a **germination flush** to ensure a pure crop.

A **germination flush** means giving controlled irrigation before sowing fresh seed, so that volunteer seeds and leftover seeds from previous years sprout. Once they germinate, they can be destroyed before the actual crop establishes. This process helps prevent contamination, ensures purity of the crop, and reduces the risk of mixed/impure plants in the field.

II. Nursery for Rice Transplanter – Mat-Type Nursery

Site Selection

- Fertile, well-leveled land with irrigation access.
- Avoid stones/tree roots.
- Prefer laser-leveling and keep 20 m from tube well/trees.

Materials & Setup

- Polythene Sheets:
 - 50–60 gauge, 90 cm wide, perforated (1–2 mm holes)
 - 15 m sheet = ~150 mats for 1 acre
- Iron Frames:
 - 45x21x2 cm for engine-operated transplanters
 - 58x28x2 cm for self-propelled models

Sowing Process

- Fill frames with moist soil.
- Sow 50–60 g pre-germinated seed per mat (2–3 seeds/cm²).
- Use drum-type nursery seeder for uniformity.
- 10–12 kg seed = ~150 mats (for 1 acre).
- Cover with thin soil, sprinkle water gently.
- Irrigate same day; maintain uniform moisture.

Maintenance & Nutrition

- Spray 200 g Urea in 15 L water on 150 mats after 10 days.
- Mats ready in 25–30 days.
- Cut mats cleanly, transport carefully to field.

For mechanized sowing, tractor-operated seeder is also available

Pre-Transplanting Operations

Organic Manures (per acre)

Material	Dose	Urea Saving
FYM	6 t	35 kg
Press Mud	6 t	55 kg
Poultry Manure	2.5 t	55 kg
Gobar Gas Slurry	2.4 t	35 kg
Prali Char	2.0 t	35 kg
Green Manure	–	55 kg
Moong Residue	–	35 kg

Green Manuring (Alt. to FYM)

A. Sow by early May

- Dhaincha (20 kg/acre, pre-soaked 8 hrs)
- Cowpea (12–20 kg/acre)
- Sunnhemp (20 kg/acre)
- Bury at 6–8 weeks of growth, 1 day before transplanting.
- Prefer Dhaincha for saline (kallar) or reclaimed soils.

Rice Straw Incorporation

- Continuous use improves soil health & yields.
- If soil organic carbon is high, reduce urea by 20 kg/acre.

Transplanting

Dates

Ideal: 20 June – 10 July

Seedling Age

Medium-duration varieties: 30–35 days

Short-duration (PR 126): 25–30 days

Older seedlings reduce yield and quality.

Before Transplanting

- Irrigate nursery & wash roots.
- Dip in Azospirillum bio-fertilizer ($\frac{1}{2}$ kg/100 L water) for 45 mins before transplanting.

Transplanting Methods

A) Flat Puddled Transplanting

Spacing

20 × 15 cm (33 hills/m²)

15 × 15 cm (44 hills/m²)

When to Use

Normal transplanting & PR 126 late transplanting

Other varieties under late transplanting

- 2 seedlings per hill, 2–3 cm depth, upright.

B) Bed/Ridge Transplanting (Unpuddled)

For heavy soils with water-saving focus.

Transplant on 60 cm spaced ridges (10 cm plant spacing) or 67.5 cm beds (9 cm spacing).

C) Mechanical Transplanting

Use mat-type nursery.

Spacing: 30 × 12 cm

Use mechanical paddy transplanter or remote-controlled 2-wheel transplanter.

Weed Control in Main Field

Chemical Weed Management

Timing	Herbicide (Sample Products)	Dose
Pre-emergence (2–3 days)	Butachlor 50 EC, Fast-Mix 50 EW	1200 mL
	Arozin 30 EC (Anilofos)	850 mL
	Stomp 30 EC (Pendimethalin)	1000–1200 mL
	Rifit 50 EC (Pretilachlor)	600–750 mL
	Sathi 10 WP (Pyrazosulfuron)	60 g

Use gloves. Apply in standing water with 60 kg sand.

Chemical Weed Control in Transplanted Rice

1. Pre-emergence & Early Post-emergence Herbicides (2–3 days after transplanting)

Apply pre-emergence herbicides in standing water by mixing with 60 kg sand per acre.

Effective against swank and moderately against other weeds:

- Butachlor (50 EC / 50 EW): 1200 mL
- Anilofos (18 EC): 850 mL
- Anilofos (30 EC): 500 mL (Better for kanki)
- Pendimethalin (Stomp 30 EC): 1000–1200 mL (lower for light soils, higher for heavy)
- Pretilachlor (50 EC / 37 EW): 600–750 mL
- Pyrazosulfuron ethyl (Sathi 10 WP): 60 g

Safety: Wear gloves during application.

2. Early Post-emergence (10–12 days after transplanting)

Penoxsulam (Granite 240 SC): 40 mL/acre in 150 L water
Effective against grass weeds, swank, motha, broadleaf weeds

✓ Do not spray in standing water

✓ Irrigate 1 day after spray

3. Post-emergence Herbicides (20–25 days after transplanting)

Apply in 150 L water/acre when weeds are at 2–4 leaf stage. Avoid spraying in standing water.

Herbicide	Dose/acre	Target Weeds
Bispyribac sodium (Nominee Gold 10 SC)	100 mL	Swank, paddy mothas
Fenoxaprop-p-ethyl (Ricestar 6.7 EC)	400 mL	Chini gha, kanki
Metsulfuron (Algrip 20 WG)	30 g	Mothas, broadleaf weeds
Ethoxysulfuron (Sunrice 15 WG)	50 g	Broadleaf weeds
Bensulfuron methyl (Londex 60 DF)	40 g	Broadleaf weeds
Almix (Metsulfuron + Chlorimuron)	8 g	Mothas, broadleaf weeds
Novixid (Florpyrauxifen + Penoxsulam)	500 mL	Swank, mothas, broadleaf weeds
Eketsu (Bispyribac + Chlorimuron + Metsulfuron)	40 g	Broadleaf weeds, mothas, swank

 **Herbicide Rotation:** Use different herbicide groups to avoid resistance.

Fertilizer Application

a) Organic Manures & Residues

Use before transplanting to save nitrogen:

Organic Source	Dose (t/acre)	Urea Saved (kg)
FYM	6	35
Pressmud	6	55
Poultry Manure	2.5	55
Gobar Gas Slurry	2.4	35
Prali Char	2.0	35
Green Manure	-	55
Summer Moong Residue	-	35

 Prali Char also boosts yield by 10%

b) Bio-Fertilizers

Treat nursery roots with recommended bio-fertilizer before transplanting.

c) Chemical Fertilizers

Variety	N (kg)	P ₂ O ₅ (kg)	K ₂ O (kg)	Urea (kg)	DAP (kg)	SSP (kg)	MOP (kg)
PR 132	31.5	12	12	67.5	27	75	20
Others	42	12	12	90	27	75	20

Nitrogen Application Timing (Split Doses):

- 1st split: within 7 days of transplanting
- 2nd split: at 21 days
- 3rd split:
 - PR 126: at 35 days
 - Others: at 42 days
 - Apply when field is not waterlogged; irrigate 3 days later

Special Notes:

- Use Leaf Colour Chart (LCC) for need-based urea application
- Avoid nitrogen overuse → causes lodging and sterility
- Reduce urea by 10 kg if 27 kg DAP is used
- Skip phosphorus if applied to preceding wheat crop
- Apply P & K before puddling or up to 21 days post-transplanting

Micronutrient Deficiency Management

Zinc Deficiency (2–3 weeks post-transplant):

- Symptoms: Rusty brown lower leaves, stunted, tillerless
- Apply:
 - Zinc sulphate heptahydrate (21%) – 25 kg/acre
 - OR zinc sulphate monohydrate (33%) – 16 kg/acre
 - For patches: Apply 10 kg heptahydrate or 6.5 kg monohydrate with soil

Iron Deficiency (under water stress):

- Symptoms: Chlorosis in youngest leaf, seedling death
- Treatment:
 - Irrigate thoroughly
 - Spray 1% ferrous sulphate (1 kg in 100 L water) weekly × 2–3

Irrigation & Drainage

- Keep standing water only for first 2 weeks after transplanting
 - Afterwards, irrigate 2 days after water infiltration
 - Use tensiometer (150 ± 20 cm tension) to time irrigation
 - Do not exceed 10 cm water depth
 - Drain before interculture/weeding
- Stop irrigation 15 days before harvest for better grain quality

Harvesting & Threshing

- Harvest when: Grains ripen, straw turns yellow
- Avoid dead ripe stage to prevent shattering and quality loss
- Use:
 - Combine with PAU Super SMS → enables direct wheat sowing with Happy Seeder

Seed Production

- Select a pure crop section, remove off-types and diseased plants
- Harvest and store separately in disinfected bins

Marketing & Storage of Harvested Rice

Marketing Tips

- Moisture Standard: Ensure paddy moisture is $\leq 13\%$ at sale time.
- Charges: Farmers are responsible only for unloading and cleaning costs.
- Documentation: Obtain the 'J' form from the commission agent for smooth transactions.

Home Storage Practices

- Drying: Spread the harvest in sunlight for about a week to thoroughly dry.
- Storage Moisture: Store only once the grain reaches 12% moisture, using bins or clean, dry heaps indoors.

Management of Paddy Straw

The burning of paddy straw is wasteful and harmful: it destroys valuable nutrients and emits toxins. Avoid burning and adopt the following sustainable alternatives:

1. In-Situ Straw Utilization

a) Happy Seeder

- Sow wheat directly into combine-harvested paddy fields without burning.
- Compatible with PAU Super Straw Management System (SMS) to spread straw uniformly.
- Requires a 45 HP tractor, covering 0.75–0.80 acre/hour.

b) Super Seeder

- Operate with 55 HP+ tractor, achieving 4.5–5.5 acres/day.
- Paired with SMS-equipped combine harvesters.

c) Smart Seeder

- Works with 45 HP+ tractor, covering 7–8 acres/day.
- Ideal after harvesting with SMS-equipped combines.

d) Surface Seeding–cum–Mulching

- A low-cost option: broadcast wheat seed and basal fertilizer directly on straw, then use a cutter-spreader to mulch and irrigate.
- Recommended rates: 45 kg wheat seed + 55 kg DAP per acre.

e) Incorporation into Soil

- Chop straw using a chopper-spreader, mix into soil with a rotary tiller and light irrigation. Fields ready for wheat sowing in 2–3 weeks.

2. After Straw Removal

Straw Baling

Baled straw offers multiple uses such as:

- Biomass Power – Eleven power plants in Punjab generate electricity using straw bales.
- Biogas Production – A batch of 16 quintals straw + 4–5 quintals dung produces 3–4 m³ biogas/day for 3 months.
- Straw “Geyser” – Can heat 100 L of water to ~45–50°C in 3–4 hours; stays hot for 24+ hours.
- Phospho-Compost – Used in organic farming (details in “Organic Farming” chapter).
- Prali Char – A carbon-rich product produced from partial combustion of straw, rich in C (~30–36%), N (0.5–0.6%), P (0.16–0.22%), and K (1.6–2.2%); applying 2 t/acre saves 35 kg urea and improves soil and yield.

Plant Protection: Insect Pests & Diseases

A. Insect Pest Management

Pest	Description & Threshold	Control Measures
Stem Borers	Dead hearts in >5% plants = action level	Spray effective insecticides; use neem-based biopesticide Ecotin at outset
Leaf Folders	Cause 10% leaf damage	Sweep canopy with ropes; spray same chemicals as stem borers
Planthoppers	≥5 per hill = ETL	Use targeted sprays; apply neem extract early, spot-treat hopper-burn areas
Others	Grasshoppers, Hispa, Root Weevil, Ear-Cutting Caterpillar	Use similar sprays; clip nursery leaf tips for hispa; avoid severe impacts

B. Disease Control Measures

Disease	Signs	Recommended Control
Sheath Blight	Greyish lesions on leaf sheath	Apply fungicides (e.g., kresoxim-methyl mix; propiconazole/mancozeb mix); destroy straw/stubbles
False Smut	Yellowish spore-balls on grains	Spray fungicide at boot stage
Brown Leaf Spot	Oval spots with dark centers	Treat at boot and re-treat after 15 days
Blast	Lesions and neck rot	Spray at boot and ear-emergence
Bunt / Kernel Smut	Black powder filling grains	Prevent via early monitoring and minimal N use
Sheath Rot	Rots on latest leaf sheath	Use disease-free seed; two sprays at boot and 15 days later
Stem Rot	Black sheath lesions; lodging	Reduce excess water and N; remove debris
Bacterial Blight	Stripe and wilting symptoms	Grow resistant varieties; limit N; avoid overwatering/shading
Bacterial Leaf Streak	Interveinal translucent streaks	Use disease-free seed
Root-Knot Nematode	Yellow patches; root galls	Apply mustard cake before sowing; puddle nursery

C. Rodent Control in Rice Cultivation

Rodents are one of the most destructive pests of rice in North-West India, particularly in Punjab and Haryana. The predominant species such as the lesser bandicoot rat (*Bandicota bengalensis*), soft-furred field rat (*Millardia meltada*), and Indian mole rat (*Bandicota indica*) cause heavy damage to nurseries, transplanted fields, and even stored grains. Losses in rice yields due to rodents in this region can range from 5–15%, and may reach higher levels in localized outbreaks.

Key Stages of Rodent Damage

1. **Nursery Stage** – rodents pull out seedlings for feeding and nesting.
2. **Transplanting to Vegetative Stage** – burrows are established along bunds, irrigation channels, and in crop fields.
3. **Reproductive Stage** – rodents cut tillers and feed directly on developing panicles.

Rodent Management Strategies

1. Community Approach

- Rodents breed quickly and migrate, so area-wide campaigns involving entire villages or farmer groups are most effective.
- Synchronised control operations in May–June (lean season) give best results.

2. Field Sanitation

- Regular cleaning of bunds, field margins, and water channels to reduce hiding/burrowing sites.
- Destruction of weeds and grasses that provide cover.

3. Burrow Management

- Identify active burrows (freshly excavated soil, reopened holes).
- Close burrows in the evening and treat only those reopened the next morning.
- Deep burrow baiting (6 inches inside) is effective against bandicoot rats, which are common in rice areas.

4. Baiting Practices

- Lean Season (May–June):
 - Place zinc phosphide (2%) or bromadiolone (0.005%) baits in reopened burrows.
 - Use about 10 g bait per burrow.
- Transplanted Rice (August–September):
 - Apply 400 g poison bait per acre before the milky grain stage, during dry days.

- Direct-Seeded Rice:
 - Burrow baiting immediately after sowing.
 - Repeat at the dough stage if burrow density exceeds 10 burrows/acre.
 - In case of heavy infestation (>20 burrows/acre), double baiting may be required (zinc phosphide followed by bromadiolone).

5. Trapping & Fumigation

- Traditional bamboo traps or modern mechanical traps can be used in low-intensity infestations.
- Burrow fumigation with aluminium phosphide tablets is useful in fallow fields and bunds (never in standing crop to avoid phytotoxicity).

Precautions During Rodent Control

- Use fresh bait prepared with quality cereal grains (e.g., broken rice, wheat flour).
- Avoid contaminating bait with human scent or moisture.
- Rotate rodenticides to prevent resistance.
- Ensure safety of non-target animals and humans by marking treated fields and disposing of dead rodents safely.

Rice Cultivation in Alkali Soils

Alkali soils (pH > 9.3) need special care for successful rice cultivation.

1. Soil Management

- Gypsum Application: Apply gypsum based on soil test results.
- Follow with 1–2 heavy irrigations to leach down sodium.

2. Seed Bed Preparation

- No puddling. These soils absorb water slowly.
- Method: Irrigate the tilled field and lightly plank to break down clods.

3. Transplanting

- Early Transplanting: Plant 7 days earlier than normal—plants grow slowly initially.
- Seedlings: Use 40-day-old seedlings, 3–4 per hill to offset higher mortality.
- Avoid PR 127 under alkali soil conditions.

4. Fertilizer Application

- Nitrogen: Use 20–25% more nitrogen than in normal soils.
 - Apply 60 kg N using 130 kg urea per acre, in three equal splits:
 - $\frac{1}{3}$ at transplanting
 - $\frac{1}{3}$ at 3 weeks
 - $\frac{1}{3}$ at 6 weeks post-transplanting
- Phosphorus: Apply same dose as for normal soils.
- Zinc: Apply either:
 - 25 kg zinc sulphate heptahydrate or
 - 16 kg zinc sulphate monohydrate per acre during land prep.
- Green Manure (Dhaincha): If used, add the phosphorus dose to dhaincha instead of rice.

II. Basmati Rice

Basmati rice is globally renowned as the “King of Rice”, celebrated for its long slender grains, exquisite aroma, soft texture, and delicate flavor. It holds a special place in Indian agriculture, cuisine, and culture, and is considered a premium rice category both domestically and internationally.

Cultivation Regions

Basmati is traditionally cultivated in the Indo-Gangetic Plains, covering parts of Punjab, Haryana, Himachal Pradesh, Uttarakhand, Western Uttar Pradesh, and Jammu & Kashmir. These regions provide the unique agro-climatic conditions—fertile alluvial soils, favorable temperature, and irrigation support—that impart Basmati rice its distinct fragrance and grain quality.

Economic & Export Significance

- India is the largest producer and exporter of Basmati rice in the world, accounting for a major share of the global trade.
- Basmati exports contribute significantly to India’s foreign exchange earnings, with strong demand from the Middle East, Europe, North America, and South-East Asia.
- Within India, Basmati commands a premium price in markets due to its superior cooking and eating qualities.

Characteristics of Basmati Rice

- **Aroma:** Natural fragrance due to aromatic compounds (like 2-acetyl-1-pyrroline).
- **Grain Length:** Extra-long grains that elongate further upon cooking.
- **Texture:** Soft, fluffy, and non-sticky after cooking.
- **Varietal Diversity:** Includes traditional landraces as well as improved varieties such as Pusa Basmati 1121, 1509, 1718, 1401, and 1637.

Consumer & Culinary Preference

Basmati rice is widely preferred for premium dishes such as biryani, pulao, and festive meals, making it a staple for households, restaurants, and international cuisines that demand high-quality rice.

Cultivation

Climatic Needs

- Requires prolonged sunshine, high humidity, and steady water supply.
- Cooler temperatures during grain filling improve grain quality.
- Avoid high temperatures at grain filling stage—they reduce cooking and aroma traits.

Recommended Crop Rotations

- Basmati–Wheat/Sunflower
- Basmati–Wheat–Summer Moong
- Basmati–Mentha
- Basmati–Berseem (Fodder/Seed)
- Basmati–Celery–Bajra (Fodder)
- DSBR–Potato–Mentha
- DSBR–Wheat–Summer Moong or Green Manure

Premium aromatic long-grain Paddy Varieties developed by Supreme Breeders Private Limited

1. SUPREME-66

- Duration: ~150 days
- Yield: 24–27 q/acre
- Strength: Resistant to most major diseases
- Transplanting Window: July 1–20

2. SUPREME-77

- Duration: ~140 days
- Yield: 28–32 q/acre
- Strength: Broad-spectrum disease resistance
- Transplanting Window: July 5–20

3. SUPREME-88

- Duration: 145–150 days
- Yield: 29 q/acre average, up to 33 q/acre
- Strength: High yield, disease resistance
- Transplanting Window: July 1–20

Other Notable Basmati Varieties

Variety	Duration	Yield	Key Traits
PB-1886	143 days	~4.49 t/ha	High aroma, strong elongation, blast & blight resistant
PB-1885	140 days	~4.68 t/ha	Excellent cooking quality, minimal chalkiness
PB-1847	120 days (short duration)	~5.7 t/ha	Best aroma & cooking quality, early harvest
PB-1718	136–138 days	18–20 q/acre	Widely used in Punjab/Haryana, blight resistant
PB-1637	130 days	~4.2 t/ha	Strong blast resistance, good grain elongation
PB-1121	145 days	~4.5 t/ha	Most popular , longest cooking elongation
PB-1509	115 days	~5 t/ha	Water-saving , early maturity for timely wheat sowing
PB-1401	140–145 days	~5 t/ha	Improved PB-1121 with better agronomy & aroma
PB-1	135–140 days	5–5.5 t/ha	First high-yielding semi-dwarf Basmati
PB-1692	110–115 days	20–24 q/acre	Early maturity, ideal for wheat sowing prep
PB-1985	115 days	52 q/ha (irrigated), 45.7 q/ha (dry seeded)	First herbicide-tolerant Basmati , adaptable for DSR



✓ Summary Tips for Basmati Success

- Select region-appropriate varieties based on GI status and climate.
- Time sowing and transplanting for cooler grain-filling conditions.
- Choose early-maturing varieties (like PB-1509 or PB-1985) if wheat sowing or water-saving is a priority.
- For higher yield + aroma, PB-1885 and PB-1847 are top performers.
- For disease resistance + yield stability, SUPREME-66, SUPREME-77 and SUPREME-88 offer robust options.

Agronomic Practices for Basmati Rice (Puddled)

1. Seed & Seedling Treatment

Foot Rot Management (*Fusarium moniliforme*)

- Mandatory treatment to prevent foot rot (common in Basmati).
Treatment Options:

A. Biological

- Trichoderma asperellum 2% WP (PAU strain):
 - Seed Treatment: 15 g/kg seed (smear just before sowing).
 - Seedling Dip: 15 g/litre water for 6 hours before transplanting.

B. Chemical

- Sprint 75 WS (Carbendazim + Mancozeb):
Use 3 g per kg seed in 10 mL water slurry

2. Nursery Sowing & Transplanting Schedule

Varieties	Nursery Sowing	Transplanting
PB-7, PB-5, PB-1847, PB-1121, PB-1718	1st fortnight of June	1st fortnight of July
CSR 30, PB-1509	2nd fortnight of June	2nd fortnight of July

3. Seedling Age

Ideal: 25–30 days old or at 5–6 leaf stage.

For PB-1509: ~25 days is optimal for better tillering.

Avoid older seedlings – leads to node formation & reduced tillering.

4. Transplanting Method

Irrigate nursery before uprooting; wash seedlings to remove soil.

Spacing:

Normal: 20 × 15 cm (33 hills/m²)

Late transplant: 15 × 15 cm (44 hills/m²)

Use 2 seedlings per hill in well-puddled field.

5. Irrigation Management

- First 2 weeks: Continuous ponding.
- Later: Irrigate 2 days after water infiltration.
- Critical Stage: No water stress at flowering.
- Stop irrigation 15 days before harvest for:
 - Easier harvesting
 - Timely sowing of next (Rabi) crop

6. Fertilizer Application

A. Organic Manures

Green manuring with:

- Sunnhemp/Dhaincha (45–55 days old) or
- Summer moong straw (post pod picking)
- Skip urea if green manure has been incorporated.

B. Chemical Fertilizers

- Soil test-based application.
- Skip phosphorus if applied to preceding wheat crop.
- In P-deficient soils: Apply 75 kg superphosphate/acre before last puddling

Urea Doses by Variety:

Variety	Recommended Urea
CSR 30	18 kg/acre
PB-7, PB-5, PB-1121, PB-1718	36 kg/acre
PB-1847, PB-1509	54 kg/acre

Apply urea in 2 splits:

- Half at 3 weeks
- Half at 6 weeks post-transplant

Irrigation: Apply when no standing water; irrigate 3 days after urea application.

7. Leaf Colour Chart (LCC) – Need-Based Nitrogen Application

Step	Instructions
Start monitoring:	After 21 days of transplanting, every 7 days
Leaves to check:	10 fully exposed, healthy leaves per plot
LCC Shade Threshold:	- CSR 30: Shade 3.5 - PB-7, PB-5, PB-1121, PB-1509, PB-1718: Shade 4
Action:	- If ≥ 6 leaves are lighter than LCC → apply 9 kg urea/acre - If ≥ 6 leaves match or are darker → skip urea
Stop LCC Use:	At flowering initiation

LCC improves nitrogen efficiency, especially in organic amended fields.

8. Harvesting & Threshing

Harvest when:

- Ears mature
- Straw turns yellow
- Avoid delays → reduces quality due to:
- Over-ripening
- Shattering
- Low head rice recovery
- Thresh same day or next day after harvest

9. Plant Protection

A. Insect Pests

◆ Stem Borers (Yellow, White, Pink)

- **Monitoring Threshold:** >2% dead hearts
- **Control Measures:**

Biopesticide	Dose/acre
Ecotin (Azadirachtin 5%)	80 mL
Achook/Neem Kavach (0.15%)	1000 mL

Chemical Options	Dose/acre
Fame 480 SC	20 mL
Takumi 20 WG	50 g
Coragen 18.5 SC	60 mL
Supremo 50 SP	400 g
Mortar 75 SG	170 g
Chlorpyrifos 20 EC (Dursban, Coroban, etc.)	1 L
Fipronil 80% WG	15 g

Also controls **leaf folder** — use **alternately** to prevent resistance.

◆ **Granular Insecticides (Apply in standing water with gloves):**

Product	Dose/acre
Ferterra/Marktera 0.4 GR	4 kg
Vibrant 4 GR	4 kg
Padan/Caldan/Marktap/etc.	10 kg
Regent/Mortel/Mifpro-G	6 kg
Dursban 10G	4 kg

◆ **Other Pests:**

- **Planthoppers, Hispa, Leaf Folder:** Use the same above insecticides following ETLs.

B. Diseases

Foot Rot

- Symptoms: Yellowing, elongation, drying of seedlings, pink growth on sheaths.
- Management:
- Use disease-free seed
- Seed & seedling treatment (Trichoderma or Sprint 75 WS)
- Rogue out infected plants

Blast (Leaf & Neck Blast)

Spray at: Tillering & Ear Emergence stages

Fungicide Options:

- Amistar Top 325 SC: 200 mL/acre
- Indofil Z-78 (Zineb): 500 g/acre
- PB-1847: Moderately resistant to neck blast

Bacterial Blight

- Resistant Varieties: PB-7, PB-5, PB-1847, PB-1718
- Follow general rice disease management guidelines

Reminders

- Regular monitoring is key.
- Always rotate pesticides to prevent resistance.
- For pest & nutrient diagnosis, consult Farm Advisory Centres.

Direct Seeded Rice (DSR) in Unpuddled Fields

Water-saving rice cultivation for Punjab farmers

Why DSR?

- Saves 10–20% irrigation water
- 10–12% higher groundwater recharge
- Saves labor (no nursery & transplanting)
- Lower disease incidence (e.g., foot rot, sheath blight)
- 100 kg/acre higher yield of wheat after rice

Recommended DSR Techniques:

Year	Technique	Highlights
2010	Conventional DSR	First irrigation within 1–2 days
2020	Tar-wattar DSR	First irrigation after 21 days → better roots, fewer weeds
2022	Tar-wattar DSR on Raised Beds	Maximum water saving, better soil structure

1. Suitable Soils

Only for: Medium to heavy textured soils (sandy loam, loam, silt loam, clay loam)

Avoid: Light sandy soils → iron deficiency + poor yield

2. Laser Land Leveling

Improves water distribution and seed germination

Procedure: Disc harrow → cultivator → planking → laser leveling

3. Suitable Varieties (Non-Basmati)

Short and medium duration high-yielding varieties

4. Sowing Window

1st – 15th June

5. Seed Rate & Treatment

- Seed Rate: 8–10 kg/acre
- Pre-treatment:
 - Potassium Nitrate (2%) soak: 12 hrs
 - (200 g KNO₃ in 10 L water for 8 kg seed)
 - Fungicide treatment: 3 g Sprint 75 WS/kg seed

6. Methods of Sowing

6.1. Tar-wattar Flat Field Sowing

- Apply rauni irrigation, then sow at tar-wattar condition
- Use Lucky Seed Drill (sows & sprays herbicide)
- Row spacing: 20 cm, seed depth: 3–4 cm
- Avoid sowing during noon hours

6.2. Tar-wattar Raised Bed Sowing

- Form 67.5 cm wide beds (37.5 cm top, 30 cm furrow)
- Apply rauni in furrows only
- At tar-wattar condition, reshape & sow (2 rows/bed) with bed planter
- Apply pre-emergence herbicide immediately

6.3. Dry Field Sowing

- Sow in dry field at 2–3 cm depth
- Irrigate immediately after sowing

7. Weed Management

Pre-Emergence (Spray after sowing)

Product	Dose (per acre)	Remarks
Stomp/Bunker 30 EC (pendimethalin)	1.0 L	For grass weeds
PEPE 25 SE (penoxsulam + pendimethalin)	1.0 L	For mixed weed flora

- Prefer **Lucky Seed Drill** for **simultaneous sowing + spraying**
- In **dry field sowing**: Spray after irrigation brings **wattar**

Post-Emergence (15–25 Days After Sowing)

Herbicide	Dose/acre	Controls	Weed Stage
Nominee Gold 10 SC	100 mL	Swank, paddy mothas	2–4 leaf
Novlect 12 EC	500 mL	Broad spectrum	2–4 leaf
Ricestar 6.7 EC	400 mL	Gha (grasses)	2–4 leaf
Almix 20 WP	8 g	Broadleaf, sedges	2–4 leaf
Eketsu 43 WG	40 g	Mixed weeds	2–4 leaf
Vivaya 6 OD	900 mL	Broad + grassy weeds	1–2 leaf
Council Activ 30 WG	90 g	All types	1–2 leaf

Important:

- Spray in moist field at correct weed stage
- Maintain wattar for 1 week after spray
- Uproot leftover weeds before seeding

8. Fertilizer Management

- Standard Dose (Non-Green Manured)
- Urea: 130 kg/acre in 3 splits (at 4, 6, 9 weeks after sowing)

Green Manure Adjustments

Organic Practice	Urea Required
Green manuring with sunnhemp or FYM @ 6 t/acre	90 kg/acre
Summer moong straw after pod picking	110 kg/acre

- Apply **Phosphorus & Potash** as per soil test
- Manage **Zinc/Iron** as per puddled rice guidelines

9. Leaf Colour Chart (LCC) for Nitrogen

- No urea at sowing.
- Apply 25 kg urea/acre at 4 weeks
- Then:
 1. Every 7 days, compare topmost fully exposed leaf of 10 plants
 2. If 6+ leaves are lighter than LCC shade 4, apply 30 kg urea/acre
 3. Stop use at flowering stage

10. Irrigation Schedule

Method	1st Irrigation	Subsequent
Tar-wattar (flat/bed)	After 21 days	Every 5–7 days
Dry field sowing	Immediately after sowing	4–5 days, then every 5–7 days
All methods	Stop 10 days before harvest	

11. Rodent Management

- Rodents attack at germination stage
- Destroy burrows and rebuild bunds
- Do burrow baiting during May–June (lean period)

Direct Seeded Basmati Rice (DSBR)

Same as DSR for:

- Soils
- Laser levelling
- Field prep
- Weed control
- Irrigation

Differences in Varieties, Time & Fertilizer

Recommended Varieties:

- Supreme-66
- Supreme-77
- Supreme-88

Sowing Time:

- 15–30 June

Fertilizer Dose

Practice	Urea Dose
No green manure	54 kg/acre (in 3 splits at 3, 6, 9 weeks)
After sunnhemp	18 kg/acre
After summer moong	36 kg/acre

- Apply P & K as per soil test
- Manage Zn & Fe as in puddled Basmati (see earlier section)

Final Reminders

- DSR is not for light soils
- Ensure tar-wattar condition before sowing
- Use herbicides carefully and rotate for resistance management
- Monitor LCC and soil moisture regularly
- DSBR is best suited for water-saving Basmati cultivation

Soil Test-Based Fertilizer Application

Importance of Soil Testing

Soil testing is the most reliable method to ensure balanced and efficient use of nutrients. Proper fertilizer management not only improves crop productivity but also prevents soil degradation and environmental pollution. A soil test typically determines:

- Organic carbon content (indicator of soil fertility and nitrogen supply).
- Available nutrient levels.
- Soil pH and salinity (electrical conductivity).

Based on test values, soils are classified as low, medium, or high for different nutrients. Fertilizer recommendations are then adjusted according to crop requirements and soil nutrient status.

Fertilizer Guidelines by Nutrient

Nitrogen

Indicator: Organic carbon content of soil.

Categories:

- Low: <0.40% organic carbon
- Medium: 0.40–0.75%
- High: >0.75%

Recommendations:

- Low OC soils → apply 25% more nitrogen than standard dose.
- High OC soils → apply 25% less nitrogen than standard dose.
- Medium OC soils → apply standard recommended dose.

Phosphorus

Categories:

- Low: <5 kg/acre
- Medium: 5–9 kg/acre
- High: 9–20 kg/acre
- Very High: >20 kg/acre

Recommendations:

- Low → apply 25% more phosphorus than standard dose.
- High → apply 25% less.
- Very High → skip phosphorus for 2–3 years, then retest.

Special Notes:

In cereal-legume rotations, if phosphorus was adequately applied to the previous crop, the succeeding crop may require little or no phosphorus. In long-duration crops like sugarcane, apply phosphorus only when soil tests low.

Potassium

Categories:

- Deficient: <55 kg K₂O/acre
- Sufficient: >55 kg K₂O/acre

Recommendation: Apply potassium only in deficient soils. Regular soil testing is essential to avoid hidden deficiencies.

Micronutrients

Zinc:

- Deficient if <0.6 kg/acre.
- Apply 25 kg zinc sulphate heptahydrate (or 16 kg monohydrate) per acre for rice and groundnut.
- Apply 10 kg heptahydrate (or 6.5 kg monohydrate) per acre for maize and cotton.
- Foliar sprays may be used if deficiency symptoms appear late.

Iron:

- Deficiency often occurs in rice (light soils) and sugarcane (alkaline soils).
- Spray 1% ferrous sulphate solution at symptom appearance, repeating 2–3 times at weekly intervals.
- Green manuring (e.g., dhaincha before rice) helps reduce iron deficiency.

Salt-Affected Soils

- **Alkali (sodic) soils: pH > 9.3**
 - Apply gypsum along with other management practices.
 - Use 25% more nitrogen than standard dose.
 - Crops in these soils often require higher zinc application.
- **Saline soils: EC > 0.8 mmhos/cm**
 - Apply 25% more nitrogen.
 - Incorporate organic manures or green manures.
 - Gypsum should not be applied to saline soils.

Collection of Soil Samples

For Field Crops

- Remove surface litter.
- Cut a V-shaped pit (6-inch depth).
- Collect 7–8 subsamples from uniform areas.
- Mix thoroughly, retain ~500 g soil in a clean cloth bag, and label with field and farmer details.
- Preferably collect samples after crop harvest. For standing crops (except rice), samples may be taken from between rows.

For Problem Soil Reclamation (e.g., sodic soils)

- Dig pits up to 3 feet.
- Collect samples at different depths (0–6, 6–12, 12–24, 24–36 inches).
- Pack separately and label properly.

For Orchards

- Dig up to 6 feet.
- Collect samples at regular depth intervals (0–6, 6–12, 12–24, 24–36, 36–48, 48–60, 60–72 inches).
- If a hard or concretion layer is present, sample it separately.

Irrigation with Poor Quality Water

In many regions, groundwater contains high salts, which can affect soil health and crop yields. Such waters may be saline (chlorides/sulphates of sodium) or sodic (carbonates/bicarbonates of sodium). Testing irrigation water is essential before long-term use.

Guidelines for Safe Use

- **Ensure drainage:** Prevent salt accumulation in the root zone.
- **Level fields:** Promotes uniform water distribution and salt leaching.
- **Use on light soils:** Coarse-textured soils allow better salt leaching.
- **Crop selection:** Prefer salt-tolerant crops (barley, wheat, mustard, guar, spinach, sugar beet, millets). Avoid highly sensitive crops.
- **Apply gypsum:** Corrects sodicity (when Residual Sodium Carbonate >2.5 me/l). Dose should be calculated based on test results.
- **Add organic matter:** Use farmyard manure, green manure, or crop residues to improve soil quality.

- **Alternate furrow irrigation:** Helps reduce salt buildup in crops like cotton.
- **Conjunctive use:** Mix or alternate good and poor-quality water to reduce risk.
- **Regular monitoring:** Test soils periodically to track salinity/sodicity buildup.
- **Pond water use:** Village pond water may supply nutrients but should be tested for salts and pathogens before use.

Spray Technology

Efficient control of weeds, insect-pests, and crop diseases depends largely on the correct use of spraying techniques. The following guidelines should be followed to ensure maximum effectiveness and safety in pesticide application.

1. Selection of Pesticide

- Correctly identify the target insect, disease, or weed before selecting a pesticide.
- Always use only recommended brands of herbicides, insecticides, and fungicides.
- Ensure authenticity of products by purchasing from reliable dealers and retaining invoices.

2. Selection of Spray Pump and Nozzle

- Pesticides may be applied using:
 - Knapsack sprayers (manual or battery-operated).
 - Tractor-mounted sprayers for large fields.
- Nozzle choice:
 - Flat fan or flood-jet nozzles → pre-emergence herbicides.
 - Flat fan nozzles → post-emergence herbicides.
 - Cone-type nozzles → insecticides and fungicides.

3. Quantity of Water

- Herbicides:
 - Pre-emergence → 200 L/acre.
 - Post-emergence → 150 L/acre.
- Diseases: 200 L/acre.
- Insect-pests: 100–150 L/acre.
- Electrostatic sprayers: Only 15 L/acre required.

Formula for calculating spray water requirement:

$$\text{Water required (L/acre)} = \frac{\text{Volume used (L)} \times 4000}{\text{Area sprayed (m}^2\text{)}}$$

4. Preparation of Spray Solution

- Based on total water needed per acre, calculate the number of spray tanks required.
- Example: If 150 L water is needed and the pump capacity is 15 L → 10 tanks per acre.
- Dissolve the pesticide for one acre in a small amount of water, make up the solution to a manageable volume, and distribute equally into spray tanks.
- For tractor-mounted sprayers, prepare solution as per tank capacity.

5. Method of Spray

- Nozzle height: Maintain ~1.5 ft above crop canopy or soil surface (for pre-emergence).
- Technique:
- Spray in strips, keeping the lance steady and upright.
- Avoid swinging the lance back and forth.
- Use multi-boom nozzles for uniform application.
- For electrostatic sprayers:
- Keep nozzle 1–1.5 ft above crop canopy.
- Do not raise nozzle above shoulder level.

6. Safety Precautions During Spraying

- **Before spraying:**
 - Use only recommended pesticide doses.
 - Read and follow label instructions.
 - Clean sprayers thoroughly before and after use. Keep separate sprayers for herbicides and other pesticides if possible.
 - Use scissors/knives to open packets – never tear them by hand.
- **While preparing solution:**
 - Use clean water to prevent nozzle clogging.
 - Mix concentrated pesticides in drums using long sticks, to avoid splashes.
 - Wear protective clothing: gloves, long sleeves, trousers, and a face mask.
 - Only healthy individuals without wounds should handle pesticides.
- **During spraying:**
 - Do not spray on an empty stomach.
 - Avoid spraying in windy conditions; spray along the wind direction.
 - Do not blow into clogged nozzles – dismantle and clean properly.
 - Replace nozzles if discharge rate exceeds 10–15% of the original flow.
 - Operators should not spray for more than 8 hours a day.
 - Do not eat, drink, smoke, or chew during spraying.
- **After spraying:**
 - Wash hands, feet, and face thoroughly with soap and water.
 - Dispose of empty containers safely – puncture them and never reuse.
 - Store pesticides only in labeled, original containers.
 - Keep pesticides locked away, out of reach of children, pets, and food supplies.

Micronutrient Management

1. Manganese (Mn) Deficiency

- Common in light soils and rice-wheat rotations
- Symptoms: Interveinal chlorosis, greyish/pinkish spots on leaves
- Remedy: Spray 0.5% manganese sulphate (1 kg in 200 L water)
- First spray 2–4 days before first irrigation, followed by 3 weekly sprays

Do not grow durum wheat on sandy soils as it is more prone to Mn deficiency. Avoid soil application of manganese – foliar spray is more effective.

2. Zinc (Zn) Deficiency

Signs: Stunted, bushy growth, middle leaf chlorosis, drooping leaves

Apply 25 kg zinc sulphate (21%) per acre (effective for 2–3 years)

OR foliar spray:

0.5% solution = 1 kg zinc sulphate + 0.5 kg lime in 200 L water

Repeat 2–3 sprays at 15-day intervals

To increase zinc in wheat grain:

Spray 0.5% zinc sulphate heptahydrate (21%) once or twice between anthesis and early grain fill (evening only).

3. Sulphur (S) Deficiency

Common in sandy soils or prolonged early-season rains

Symptoms: Yellowing of younger leaves, while older ones remain green

If DAP was used instead of SSP, apply:

100 kg gypsum or

18 kg bentonite-sulphur (90%) per acre before sowing

If gypsum was applied to the previous groundnut crop, reduce to 50 kg/acre

Gypsum may also be applied during the crop season if sulphur deficiency is observed

4. Iron (Fe) Deficiency

- Occurrence: Sometimes seen in calcareous and alkaline soils (pH > 8).
- Symptoms: Interveinal chlorosis of young leaves (they turn pale/yellow while veins remain green).
- Remedy: Foliar spray of 0.5% ferrous sulphate + 0.25% lime (1 kg FeSO₄ + 0.5 kg lime in 200 L water per acre), 1–2 sprays at 10–15 day intervals.

5. Copper (Cu) Deficiency (rare)

- Occurrence: Occasionally in sandy soils of arid/semi-arid regions.
- Symptoms: Twisting and wilting of leaf tips, poor grain filling, sometimes "white heads" without grains.
- Remedy: Foliar spray of 0.1% copper sulphate solution if deficiency symptoms are observed.

Organic Farming

Organic farming eliminates the use of synthetic agrochemicals and instead builds soil fertility and crop health through natural inputs such as crop residues, farmyard manure, composts, green manures, legumes, and on-farm waste recycling. Plant nutrition is maintained by biological sources, while pests and diseases are managed through bio-pesticides and cultural methods.

Basic Standards of Organic Farming

- **Conversion Period:** Transitioning from conventional to organic farming requires a conversion period of about three years, during which only organic practices must be followed.
- **Buffer Zone:** A protective buffer strip should be maintained around organic fields to avoid contamination from adjoining conventional farms.
- **Seed Source:** Only untreated, organically produced seed should be used. Chemical seed treatments are prohibited, and genetically modified (GM) crops are not permitted.
- **Crop Practices:** Standard agronomic practices such as seed rate, sowing time, and spacing can be followed as in conventional crops unless otherwise specified.
- **Weed Management:** Chemical herbicides are not allowed. Weeds should be managed using mulching, crop rotations, intercultivation, and need-based manual weeding.
- **Input Restrictions:** Use of synthetic fertilizers, pesticides, and growth regulators is strictly prohibited.

Organic Crop Production Systems

Rice / Basmati Rice – Wheat System

Rice/Basmati Rice

- **Biofertilizers:** Dip nursery seedlings (sufficient for 1 acre) for 45 minutes in a solution prepared from one packet of Azospirillum biofertilizer mixed with water, then transplant immediately.
- **Nutrient Management:** Grow a green manure crop such as cowpea, sunnhemp, or dhaincha (@ 20 kg seed/acre). Incorporate it into the soil at 50 days for nitrogen enrichment before transplanting rice. Alternatively, sow the green manure with a no-till drill after wheat harvest.

- **Weed Control:** Maintain standing water in the field for the first 20–25 days. One manual weeding may be done if needed.
- **Insect-Pest Management:** Stem Borers: Release two tricho-cards each of *Trichogramma japonicum* and *T. chilonis* per acre, at weekly intervals, starting 30 days after transplanting. Each card should be cut into strips and stapled on the underside of leaves in the evening. Additionally, spray neem-based bio-pesticides such as azadirachtin formulations at pest initiation stage.
- **Leaf Folder:** Pass a coir/jute rope across the crop canopy before flowering to dislodge larvae. Neem sprays and tricho-card releases are also effective.
- **Planthoppers:** Monitor by tapping plants 25–30 days after transplanting. On observation of hoppers, spray neem-based biopesticides (e.g., 80 ml azadirachtin 5% or equivalent neem extract in 100 L water per acre). Apply with a knapsack sprayer directed towards the plant base.
- **Grasshoppers:** Neem formulations recommended for planthoppers also work effectively.

Wheat (after rice)

- **Sowing Method:** Raised bed sowing (2 rows on 37.5 cm bed with 30 cm furrows) is preferred for better weed management.
- **Seed Inoculation:** Treat seed for one acre with 500 g consortium biofertilizer or a mix of 250 g *Azotobacter* + 250 g *Streptomyces* (Azo-S) in 1 L water, shade-dry, and sow immediately.
- **Organic Manures:** Apply FYM, vermicompost, or castor cake as per soil organic matter status.

For instance:

- High organic matter soils: 80 kg N/acre (\approx 8 t FYM).
- Medium: 120 kg N/acre (\approx 12 t FYM).
- Low: 160 kg N/acre (\approx 16 t FYM).

For desi varieties, use half these amounts. A balanced supply can also be ensured using a combination of FYM (1.7 t/acre), vermicompost (1.1 t/acre), and castor cake (0.7 t/acre).

- **Weed Management:** Adopt cultural methods such as stale seedbed, mulch, manual weeding, and removal of weeds before seed set.
- **Insect-Pest Control:** Aphid infestation can be checked by natural predators like ladybird beetles. If aphid levels exceed 5 per earhead, spray neem extract (prepared at farm level) at weekly intervals.
- **Disease Control:** For yellow rust, spray 20% fermented buttermilk solution (40 L in 200 L water per acre) after one month of sowing, followed by 3 additional sprays at 10-day intervals on moderately resistant varieties.

Certification of Organic Produce

The Government of India has developed national organic standards and authorized inspection and certification agencies to certify organic farms. Farmers who wish to get their land certified as organic should contact one of these accredited agencies. The complete list of certification bodies is available on the official APEDA website: www.apeda.gov.in.

Preparation of Phospho-Compost:

Materials Required:

- Rice straw (about 500 kg per heap)
- Cow dung (1 kg per 1000 litres of water)
- Low-grade rock phosphate (~6% of dry straw weight, i.e., 30 kg per 500 kg straw)
- Tree branches/sticks (2–6 cm diameter) for aeration

Step-by-Step Process:

- Collect rice straw and tie into convenient bundles (10–15 kg each).
- Prepare a soaking solution by mixing 1 kg cow dung in 1000 litres of water. Dip each bundle for 2–3 minutes.
- Drain excess solution on a sloped surface lined with plastic; recycle drained liquid into the tank.
- Prepare raised beds (15 cm high, 5 m long, 1.5 m wide) to aid uniform watering and drainage.
- Place tree branches/sticks on the bed for aeration, then stack wet straw uniformly until 500 kg is piled (approx. 1.5 m high).
- Sprinkle powdered low-grade rock phosphate uniformly while stacking.
- Cover the heap with a 20–30 cm layer of dry rice straw to reduce water loss and allow airflow.
- Maintain about 70% moisture by watering with a lance connected to a pump. Ensure water penetrates deep into the heap.
- Composting takes 80–90 days. At this stage, the C:N ratio stabilizes around 15:1, and straw strands become weak and brittle, indicating readiness for field use.

Preparation of Vermicompost (from Paddy Straw):

Bed Construction:

- Build cemented beds of about 6' × 3' × 2' (length × breadth × height). Size can be adjusted depending on resources.
- Floors must be solid (pucca) to prevent seepage.

Layering Process:

1. Spread a 1-foot layer of chopped or whole paddy straw. Moisten to maintain 60–70% moisture.
2. Add a layer of 4–5 days old animal dung up to 2 feet depth.
3. Introduce earthworms (*Eisenia foetida*) at a rate of 1 kg per 6 ft bed length.
4. Cover with a 2-inch layer of soaked paddy straw to reduce evaporation.

Management:

- Turn the bed weekly for aeration and faster decomposition.
- Apply water regularly: twice daily in summer, and every 2–3 days in winter.
- Vermicompost is ready in 60–70 days.

Precautions:

1. Avoid using fresh animal dung, as its heat and gases can harm earthworms.
2. Keep beds under a shed to protect from direct sun, rain, or extreme cold.
3. Maintain 60–70% moisture throughout the process.

Multiple Cropping

Multiple cropping is a system of growing more than two crops in quick succession on the same field within a single year. The aim is to maximize land use efficiency, generate higher returns, and improve soil health by diversifying cropping patterns.

The success of multiple cropping depends on:

- Careful selection of short-duration, high-yielding crop varieties,
- Timely availability of labour, machinery, irrigation, and inputs,
- Efficient management of tillage, sowing, intercultural operations, and harvesting,
- Strong planning and managerial skills of the farmer.

By adopting multiple cropping, farmers can successfully grow one or two additional crops between the major seasonal crops without compromising yields.

Key Practices for Successful Multiple Cropping

- Select short-duration varieties for quick crop turnover.
- Use older nursery seedlings for timely transplanting of rice under delayed conditions.
- Adopt minimum tillage and relay cropping techniques to save time.
- Harvest wheat or maize 5–7 days earlier than full maturity to create space for the next crop.
- High-Intensity Rotations Recommended

1. Green Manuring (Dhaincha / Cowpea / Sunnhemp) – Rice – Wheat

After harvesting wheat, apply a preparatory irrigation and sow:

- Dhaincha @ 20 kg seed/acre (soaked in water for 8 hrs), or
- Sunnhemp @ 20 kg/acre, or
- Cowpea @ 12 kg/acre.

Incorporate the green manure crop into the soil after 6–7 weeks, just 1–2 days before transplanting paddy.

This saves ~25 kg nitrogen/acre for rice and improves soil fertility.

For maximum rice productivity, combine green manuring with the recommended nitrogen dose (50 kg N/acre) in sandy to sandy-loam soils.

Alternatively, sow summer moong immediately after wheat harvest (April end). After pod picking, plough the stover into the soil before rice transplanting. This boosts paddy yield and reduces nitrogen requirement by about one-third.

2. Cowpea / Bajra / Maize (Fodder) – Maize or Rice – Wheat

- Grow a **summer fodder crop** (cowpea, bajra, or maize) immediately after wheat harvest in late April.
- These fodders mature in **45–55 days**, yielding **80–100 quintals/acre of green fodder**, ensuring feed availability during the lean summer months.
- Early harvest of these fodders vacates the field in time for sowing of the succeeding **maize or rice crop**, ensuring no delay in the main cropping cycle.

3. Cotton–Wheat Cropping System under Drip Irrigation

System Design

- Install drip inlines with emitters at 20 cm spacing, buried at 20 cm depth.
- Maintain lateral-to-lateral spacing of 67.5 cm.
- Crop geometry:
 - Cotton: one row per drip line (67.5 cm spacing).
 - Wheat: three rows per drip line (22.5 cm spacing).

Irrigation & Fertigation Schedule

For Cotton

- Begin irrigation 30–35 days after sowing (DAS).
- Irrigation frequency: every 5 days.
- Fertigation: 100 kg urea per acre (\approx 45 kg N), applied in 10 equal splits at 10-day intervals starting from 30–35 DAS.

For Wheat

- Irrigation frequency:
 - Every 7 days up to mid-February.
 - Every 5 days thereafter.
- Fertigation: Apply 80% of the recommended NPK dose.
 - At sowing: 1/5 of the total dose as basal.
 - Remaining: fertigate in 8 equal splits at 7-day intervals, beginning at the crown root initiation stage.

Suggested Irrigation Duration (for drippers with 2.2 L/hr discharge)

Crop	Month	Irrigation Time (Minutes)
Cotton	May	40 min
	June	40 min
	July	35 min
	August	30 min
	September	25 min
Wheat	December	30 min
	January	65 min
	February	70 min
	March	50 min
	April	50 min

Note: If the dripper discharge is different from 2.2 L/hr, adjust irrigation time proportionally using the formula:

$$\text{Adjusted Time (min)} = \frac{2.2 \times \text{Standard Time (min)}}{\text{Actual Discharge (L/hr)}}$$

Conservation Agriculture Rice–Wheat System

Long-term retention or incorporation of both rice and wheat residues in the rice–wheat cropping system has shown clear benefits over managing only rice straw. Continuous practice for 12 years has resulted in:

- Higher wheat yield – about 22.7 quintals per acre
- Improved system productivity – about 50.9 quintals per acre (combined rice–wheat output)
- Better soil health – enhanced organic matter and fertility, supporting sustainable crop production.

Integrating both rice and wheat residues into the soil, instead of burning or removing them, is a proven practice for improving yields, conserving resources, and maintaining long-term productivity in the rice–wheat system.

Rational Use of Poor-Quality Irrigation Water

In many agricultural regions of India, underground tubewell water often contains a high concentration of salts that can harm soil health and reduce crop productivity. Such water may be:

- Saline: containing chlorides and sulphates of sodium.
- Sodic: containing carbonates and bicarbonates of sodium.

In some cases, it may also have toxic elements such as boron or fluoride. Before use, underground irrigation water should always be tested in a soil and water testing laboratory to determine its quality. Highly saline water is unsuitable for irrigation. However, water with low to moderate salinity or sodicity can be used safely by following proper management practices.

Guidelines for Safe Use of Poor-Quality Water

1. Ensure Adequate Drainage

Good drainage is essential to prevent salt build-up in the root zone. Poorly drained soils or soils with hard pans accumulate salts faster. Surface drains are economical compared to subsurface drains.

2. Proper Land Levelling

Well-levelled land ensures uniform water distribution and leaching of salts.

Even small variations in field slope can cause uneven salt accumulation.

3. Prefer Light-Textured Soils

Light soils allow better leaching of salts due to higher infiltration.

Heavy soils promote stagnation, leading to faster salinity/sodicity build-up.

4. Crop Selection

Grow salt-tolerant or semi-tolerant crops such as barley, wheat, mustard, guar, senji, spinach, turnip, sugar beet, raya, and millets.

Cotton is sensitive at germination but can be grown with pre-sowing irrigation using good-quality water.

Pulse crops are highly sensitive and should be avoided with poor-quality water.

High water-demanding crops such as rice, sugarcane, and berseem should be avoided in poorly drained soils.

5. Apply Gypsum

- Sodic water (high in bicarbonates, expressed as Residual Sodium Carbonate or RSC) reduces soil permeability and structure.
- Apply gypsum when RSC > 2.5 me/l.
- For every 1 me/l RSC, apply 1.5 quintals of gypsum (70% purity) per acre for four irrigations of 7.5 cm each.
- Apply gypsum in one dose after the previous crop harvest, mix into topsoil (0–10 cm), and follow with heavy irrigation.
- Both mined gypsum and yellow gypsum are effective.

6. Use Organic Amendments

- In calcareous soils (>2% calcium carbonate), apply:
 - FYM @ 8 tonnes/acre/year, or
 - Green manure or wheat straw @ 2.5 tonnes/acre/year.
- This reduces adverse effects of sodic irrigation water.

7. Ridge Planting & Alternate Furrow Irrigation

- In cotton areas, use ridge planting with pre-sowing irrigation from good water.
- Apply poor-quality water in alternate furrows, which reduces salt stress and saves water.

8. Alternate Use of Saline & Good Water

- When fresh canal water is limited, use it conjunctively with poor-quality water.
- Options: apply alternately, or mix good and poor water.
- Use good water at sensitive crop stages (germination, early growth) and poor water at later stages.

9. Mitigating Salinity with Biochar

- In saline water irrigation (EC up to 10 dS/m), apply 16 quintals/acre rice-residue biochar to reduce salinity stress and improve cotton yield.

10. Monitor Soil Health

- Regularly test soils to monitor salt build-up when using poor-quality water long-term.
- This helps prevent irreversible soil degradation.

Management of Rodents

Rats and mice are among the most serious crop pests. Their adaptability, intelligence, and rapid multiplication make them a constant threat, particularly during the seedling and ripening stages. Effective management requires timely and integrated control measures.

Methods of Control

i. Mechanical Control

Killing: During irrigation of vacant harvested fields, kill rats coming out of flooded burrows with sticks.

Trapping:

- In fields: Place 16 traps/acre along runways, damage sites, and activity areas.
- In houses, godowns, and poultry farms: Set 1 trap/4–8 m², along walls, corners, and behind bins/boxes.
- Kill trapped rats by drowning in water. Keep at least 30 days gap between trappings at the same site. Avoid placing traps repeatedly in the same spot.

ii. Cultural Control

- Remove weeds, grasses, and bushes that provide food and shelter.
- Periodically rebuild highly infested bunds, channels, and pavements to destroy burrows.
- Maintain minimum height and width of bunds and avoid crop lodging.

iii. Biological Control

Conserve natural predators: owls, kites, hawks, falcons, eagles, snakes, monitor lizards, cats, and mongoose.

iv. Chemical Control

- Poison Bait Preparation
- Zinc phosphide bait (2%):
- Mix 1 kg bajra/sorghum/cracked wheat with 20 g vegetable oil, 20 g powdered sugar, and 25 g of 80% zinc phosphide powder.

Caution: Always prepare fresh bait, never mix with water. Maintain 2-month gap between baitings. Pre-bait with grains mixed with oil + sugar @ 400 g/acre for 2–3 days before poison baiting.

>Bromadiolone bait (0.005%):

Mix 1 kg bajra/sorghum/cracked wheat/flour with 20 g vegetable oil, 20 g powdered sugar, and 20 g of 0.25% bromadiolone powder.

Poison Bait Placement and Timing

1. Baiting during lean period (May–June)

The lean summer months are the most effective time to organize rodent control on a large scale. Rat burrows are easily visible in fields, bunds, irrigation channels, and nearby wastelands.

- Close all burrows in the evening.
- On the following morning, identify reopened burrows and insert a paper packet containing about 10 g of zinc phosphide or bromadiolone bait about 6 inches deep.
- For the lesser bandicoot rat, carefully remove fresh soil from the burrow entrance, trace the tunnel, and place the bait deep inside.

2. Baiting in crop fields

- Distribute 10 g of poison bait on small paper pieces at 40 bait points per acre.
- Place baits on dry spots, bunds, rodent runways, and inside standing crops where rodent activity is visible.

3. Transplanted rice

- Apply 400 g of zinc phosphide or bromadiolone bait per acre during August–September, choosing dry days.
- Baiting should be completed before the milky grain stage to ensure effectiveness, as rodents tend to ignore baits once fresh grains are available.

4. Direct-seeded rice

- Carry out burrow baiting immediately after sowing.
- Repeat baiting at the dough stage if more than 10 burrows per acre are observed.
- If burrow density is very high (>20 burrows/acre), conduct double baiting:
 - Option 1: Zinc phosphide at sowing, followed by bromadiolone later.
 - Option 2: Two successive baitings with bromadiolone.

Management of Birds

Birds are both beneficial and harmful. Of ~300 bird species in North India, only a few cause serious crop damage.

Harmful Birds:

- **Parakeet:** Major pest, highly damaging to sunflower, maize, and cereals.
- **House crow:** Damages sprouting maize, sunflower, and maturing maize.
- **Doves & pigeons:** Attack pulses.
- **Sparrows & weaver birds:** Damage stored grains, rice nurseries, bajra, and sorghum.

Management Techniques

a. Mechanical Control

- Use firecrackers at intervals to scare birds.
- Fix scarecrows (earthen pot heads with clothes) at 1 m above crop height. Change position/dress every 10 days.
- Use automatic bird scarers and rope crackers in the center (sprouting stage) or periphery (maturing stage) of fields.

b. Cultural Practices

- Plant 2–3 border rows of cheaper crops (millet, maize, dhaincha) to divert bird pressure.
- Avoid sowing maize/sunflower near bird resting sites (trees, wires, buildings).
- Prefer block sowing (2–3 acres) of sunflower/maize to reduce parakeet pressure.

c. Alarming Calls

- Play distress/flock calls of parakeets and crows (available at peak volume for 30 minutes, twice daily (7–9 am and 5–7 pm), with 1-hour pauses).
- Effective for 15–20 days. Works best when combined with other methods. Use amplifiers and extra speakers for larger areas.

Conservation of Useful Birds:

- Predators like owls, falcons, hawks, and kites consume large numbers of rats/mice (a single owl eats 4–5 rats/day).
- Insectivorous birds (drongos, babblers, shrikes, lapwings, mynas) help suppress insect pests.
- Even sparrows and weavers feed hundreds of insects daily to their young.
- Useful birds should never be killed. Instead, attract them to fields as natural pest managers.

Agricultural Accidents

Preventive & Curative Measures

1. First Aid During Pesticide Poisoning

- Swallowed poisons → induce vomiting with salt water (unless in coma).
- Inhaled poisons → move to fresh air, loosen clothing, artificial respiration if needed.
- Skin contamination → wash with water + soap immediately.
- Eye contamination → wash with running water continuously.

Prevention of collapse → raise feet, cover with blanket, give tea/coffee, IV saline if available.

2. Snake Bites

Prevention → wear long trousers, shoes, gloves, watch where stepping.

First aid → reassurance, rest, apply tourniquet above bite, suction of venom (rubber bulb preferred), antiseptic incision.

3. Honey Bee & Wasp Bites

- Apply ice pads, remove sting, clean with soap & water.
- Avoid perfumes/bright colors.
- Give anti-allergics. Severe cases → risk of anaphylaxis → immediate medical help.

4. Electric Injuries

Prevention → educate, proper wiring, grounding, use rubber gloves & shoes.

First aid → switch off current, remove victim with non-conductor, avoid direct touch.

5. Threshing Safety

- Avoid loose clothes, alcohol, distractions.
- Feeding chute: 90 cm long, 45 cm covered, 5–10° incline.
- Max working hours: 10/day.
- Avoid feeding wet crop or ear heads (ghundian).
- Keep fire control + first aid kit nearby.

6. Tractor-Trolley Safety

- Tractor with safety structure & weight balance.
- Use triangular reflectors & lights at night.
- Avoid oversize trolley loads.
- Be careful on slopes & unmanned railway crossings.

7. Chaff-Cutter Safety

- Buy machine with safety features (flywheel lock, covers, reversal gear).
- Feeding chute: 90 cm long, 45 cm covered.
- Install on firm foundation with proper lighting.

8. Fire Accident Safety

- Tractor silencer → vertical position.
- Threshing away from electric wires.
- Keep water/sand ready nearby.
- Don't burn wheat straw → use straw combine instead.

Major Problems of Paddy Crop

Paddy crops often face challenges from nutrient deficiencies, insect-pests, diseases, and weeds. Early identification and timely management are critical to ensure high productivity and grain quality.

1. Nutrient Deficiencies

a) Zinc Deficiency

- Symptoms: Yellowing of leaves, stunted growth, formation of brown spots, poor tillering.
- Management: Apply zinc sulphate ($\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$) @ 10–12 kg/acre mixed with 25 kg sand as basal dose. In standing crop, 0.5% zinc sulphate foliar spray (5 g/litre) can correct deficiency.

b) Iron Deficiency

- Symptoms: Chlorosis (yellowing) between veins of younger leaves, poor plant vigor. Common in alkaline soils.
- Management: Apply ferrous sulphate @ 10 kg/acre or spray 0.5% ferrous sulphate solution on affected crop. Maintain proper water management to avoid excess alkalinity.

2. Major Insect-Pests

a) Stem Borer

- Symptoms: Dead hearts in vegetative stage, white ears in reproductive stage.
- Management:
 - Avoid excessive nitrogen application.
 - Spray recommended insecticides at early signs of attack.
 - Encourage natural predators like spiders and parasitoids.

b) Leaf Folder

- Symptoms: Leaves folded lengthwise, with larvae feeding inside, giving a white papery appearance.
- Management:
 - Avoid dense planting.
 - Use light traps to monitor moth activity.
 - Spray recommended insecticides if infestation exceeds ETL (Economic Threshold Level).

3. Major Diseases

a) Sheath Blight

- Symptoms: Oval lesions on leaf sheaths near water level, later spreading to upper parts. Can cause lodging.
- Management:
 - Avoid overcrowding and excessive nitrogen.
 - Apply recommended fungicides at disease initiation.

b) False Smut

- Symptoms: Greenish spore balls replacing grains, later turning yellowish-orange. Reduces grain quality.
- Management:
 - Seed treatment with fungicides before sowing.
 - Preventive fungicidal sprays at booting stage.

4. Major Weeds in Direct-Seeded Rice

Weeds compete aggressively with rice, particularly under direct-seeded conditions, reducing yields significantly if not controlled. Common weeds in India's rice fields include:

- Grassy Weeds: Swank, Swanki (*Echinochloa* spp.), Madhana (*Leptochloa chinensis*), Takri gha (*Ischaemum rugosum*).
- Broad-leaved Weeds: Chupati (*Ammania baccifera*), Tandla (*Digera arvensis*), Chulai (*Amaranthus* spp.), Chini gha.
- Sedges: Chatri wala motha (*Cyperus difformis*), Gandi wala motha (*Cyperus iria*).

Weed Management Strategies:

- Use pre-emergence herbicides at sowing and post-emergence herbicides at 2–3 weeks after sowing.
- Maintain optimum plant density to suppress weed growth.
- Combine herbicide application with manual/mechanical weeding for effective control.
- Rotate herbicides to avoid resistance buildup.

Disclaimer & Sources

The information provided in this guide has been compiled from field observations by our team and R&D staff, published recommendations from recognized agricultural research bodies, inputs from State Agricultural Universities, KVKs, District Agriculture Departments, and insights from local farmers, along with data available from credible online resources.

While every effort has been made to ensure accuracy and reliability, the performance of crop varieties and the outcomes of suggested practices may vary depending on local agronomic conditions, soil type, climate, fertilizer management, and individual farming practices.

This guide is intended solely for educational and advisory purposes to support farmers in making informed decisions. **Supreme Breeders Pvt. Ltd.** and its representatives do not guarantee specific results or crop performance and shall not be held liable for any loss, damage, or unsatisfactory outcome arising from the use of the information provided herein.

Sources referenced include: ICAR, IARI, IIWBR, State Agricultural Universities, Krishi Vigyan Kendras (KVKs), District Agriculture Departments, and local farmer feedback.



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