CULTIVATION GUIDE

(PACKAGE OF PRACTISES)

RABI

BY:

SUPREME BREEDERS PRIVATE LIMITED

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SUPREME BREEDERS PRIVATE LIMITED
FATEHABAD

CONTENTS

Wheat

Wheat is one of the most important cereal crops cultivated globally, serving as a dietary staple in many regions. It is grown extensively across various agro-climatic zones due to its adaptability and vital role in food security. With proper management and use of improved varieties, wheat cultivation can yield high productivity and profitability for growers.

Climatic Requirements: Wheat thrives in cool-season environments.
Optimal yields are achieved when:

- Maximum temperatures during the vegetative stage remain between 15°C to 22°C, and during the grain filling stage between 21°C to 28°C.
- Minimum temperatures should ideally be in the range of 4°C to 11°C (vegetative phase) and 7°C to 13°C (grain development phase).

Exposure to high temperatures during early growth stages may reduce tillering and cause early flowering, while elevated temperatures during grain filling can lead to premature ripening and a decrease in grain weight.

Suitable Soil Types: Wheat can be cultivated on a wide range of soils, provided they are well-drained and non-saline. However, highly alkaline or waterlogged soils should be avoided. Durum wheat performs best on medium to fine-textured soils with good fertility.

Recommended Cropping Systems: Wheat fits well into a variety of crop rotations, which help maintain soil fertility and manage pests and diseases. Some common and effective rotations include:

- Rice – Wheat
- Maize – Wheat
- Cotton – Wheat
- Groundnut – Wheat
- Rice – Potato – Wheat
- Moong/Arhar/Mash – Wheat
- Green Manure – Wheat
- Fodder Crops – Wheat
- Soybean – Wheat
- Summer Moong – Wheat
- Pea/Toria – Wheat

High-Performing Wheat Varieties: The following varieties are recommended based on performance, yield potential, and disease tolerance. These are suitable for cultivation under timely sown and irrigated conditions:

1. **Supreme-1122:** Supreme-1122 is a research wheat variety developed by Supreme Breeders Private Limited. It has been bred for high productivity, robust performance, and adaptability to the growing conditions of the North Western Plain Zone, except the regions of Udaipur and Kota divisions.

Key Features:

- Duration: 150–155 days (maturity period).
- Sowing Time: Recommended from November 1 to November 15 for optimal results.
- Plant Height: Approximately 100 cm with excellent lodging resistance (does not fall).
- Tillering: Profuse tillering ensures better canopy coverage and plant density.
- Spike Characteristics: Produces a higher number of panicles (spikes) per plant, leading to more “toodi” (straw) as well as grain yield.
- Yield Potential: Recorded yields of 26–32 quintals per acre under proper management practices.

2. PBW-826: Average plant height: 100 cm

- Maturity: Approx. 148 days
- Disease tolerance: Moderate resistance to yellow and brown rust
- Grain: Lustrous and bold
- Average yield: 24.0 quintals/acre

3. DBW-222: Average height: 103 cm

- Maturity: Approx. 152 days
- Disease profile: Moderately susceptible to yellow rust, resistant to brown rust
- Average yield: 22.3 quintals/acre

4. DBW-187: Average height: 104 cm

- Maturity: Approx. 153 days
- Disease profile: Moderate resistance to yellow rust, resistant to brown rust
- Average yield: 22.6 quintals/acre

5. HD-3086: Average height: 96 cm

- Maturity: Approx. 148 days
- Disease profile: Susceptible to newer yellow rust races; moderately susceptible to brown rust
- Average yield: 23.0 quintals/acre

6. DBW-3386: Plant height: ~95 cm

- Maturity: ~140–145 days
- Disease resistance: Yellow & brown rust
- Grain: Amber, medium-bold, hard, lustrous
- Avg yield: ~20 quintals/acre (~50 q/ha)
- Sowing: Nov 15 – Dec 5

7. DBW-303 : Avg. plant height: 101 cm

- Maturity: Medium duration (~155 days)
- Disease tolerance: Resistant to yellow and brown rust
- Grain quality: High protein (~12.1 %), excellent chapati quality; chapati score ~7.67/10.
- Average yield: 81.2 q/ha (\~32.8 quintals/acre)
- Potential yield: Up to 97.4 q/ha

8. DBW-327: Avg. plant height: 98–100 cm

- Maturity: Approximately 155 days
- Disease tolerance: Highly resistant to stripe rust, leaf rust, Karnal bunt; heat and drought tolerant
- Grain quality: Iron ≈39 ppm, Zinc ≈40.6 ppm; strong chapati/bread quality
- Average yield: 79.4 q/ha (~32 qtl/acre)
- Potential yield: Up to 87.7 q/ha (\~35 qtl/acre)

9. HD-2851 : Maturity: 120-125 days

- Yield: 6-7 tons/ha
- Disease Resistance: Resistant to powdery mildew and leaf rust.
- Recommended for: North Indian plains and irrigated areas

10. HD-2967

- Avg plant height: 101 cm
- Maturity: ~157 days
- Disease tolerance: Resistant to yellow & brown rust; susceptible to Karnal bunt & loose smut
- Avg yield: 21.5 qtl/acre (~51 q/ha)

Agronomic Guidelines for Wheat (Irrigated Conditions)

Field Preparation

Tillage for Timely Sowing

Proper field preparation ensures healthy germination and uniform crop stand. Follow these steps based on the previous crop:

A. After Paddy Harvest

1. Straw Retained (Combine-Harvested Fields)

- If paddy straw is left in the field after combine harvesting, it can be chopped with a straw chopper-cum-spreader and incorporated into the soil using conventional tillage.
- Alternatively, wheat can be directly sown in standing stubble using implements like the Happy Seeder, Super Seeder, Smart Seeder, or Surface Seeder.
- Long-term incorporation of paddy straw (for over 3 years) improves soil structure and wheat yield.
- In such fields, 20 kg of urea per acre can be saved annually.
- If soil has high organic carbon, apply 27 kg of DAP per acre at sowing.

2. Straw Removed

- Use a stubble shaver followed by sun drying and baling with a straw baler.
- If soil moisture is adequate, proceed with tillage. Otherwise, give pre-sowing irrigation (Rauni).
- Conduct one round of disc harrowing and planking, followed by cultivation with a cultivator.
- In heavy soils, an extra cultivation may be needed.
- Tractor-drawn cultivator with pulverizer-roller is recommended for ideal seedbed formation.

B. After Other Kharif Crops

- Provide pre-sowing irrigation (Rauni) followed by two cultivations and planking.
- Use a cultivator with a pulverizing roller to create a well-prepared dry seedbed.

Optimal Sowing Time:

- The first fortnight of November is ideal for sowing wheat to achieve the best yields.
- Long-duration varieties can be sown from the last week of October to avoid high temperatures at maturity.
- Delayed sowing beyond the optimum window leads to significant yield losses — about 150 kg per acre for each week's delay.

Seed Rate Recommendations:

Conventional sowing:

- Use 45 kg/acre for PBW 869 and Unnat PBW 550.
- Use 40 kg/acre for other varieties.

Happy Seeder sowing:

- Use 50 kg/acre for Unnat PBW 550.
- Use 45 kg/acre for others.

Note: Ensure seed is cleaned and properly graded before sowing.

Seed Treatment Protocols:

A. For Termite Protection

Treat seed with any one of the following per kg of seed:

- 1 g Cruiser 70 WS (thiamethoxam)
- 2 ml Neonix 20 FS (imidacloprid + hexaconazole)
- 4 ml Dursban/Durmet/Ruban 20 EC (chlorpyriphos)

NOTE: Dry treat seed in the shade. Neonix also offers protection against wheat smuts.

B. For Loose Smut (per 40 kg seed)

Choose one:

- 13 ml Raxil Easy/Orius 6 FS dissolved in 400 ml water
- 120 g Vitavax Power 75 WS
- 80 g Vitavax 75 WP
- 40 g Tebuseed/Seedex/Exzole 2 DS

C. For Flag Smut

- Same treatment as for loose smut.

Note: Treat seed no earlier than one month before sowing to avoid poor germination. Use a seed treating drum for efficient coverage.

D. Seed Inoculation with Biofertilizers

- Apply consortium biofertilizer at least 6 hours after pesticide treatment.
- Mix 500 g biofertilizer with 1 litre water and coat seeds for 1 acre.
- Dry in shade and sow immediately.
- Biofertilizers enhance yield and improve soil health.

Sowing Methods and Spacing

i. Conventional Sowing

- Use a seed-cum-fertilizer drill at 4–6 cm depth, spacing rows 15–20 cm apart.
- For late sowing, keep row spacing to 15 cm.
- Lucky Seed Drill can be used to apply pre-emergence herbicide along with sowing.
- Soaking seeds for 4–6 hours and sowing them after 24 hours can improve emergence under late sowing.

ii. Bi-directional Sowing

- Sow half the seed and fertilizer in one direction, and the remaining half perpendicular to it.
- Maintain 20 cm spacing with 4 cm sowing depth.
- This method reduces lodging and improves light distribution.

iii. Raised Bed Planting

- Use a bed planter with 30 kg seed per acre.
- Plant two rows 20 cm apart on 37.5 cm wide beds, with 30 cm furrows in between.
- Benefits include better water management, nutrient use, and weed control.

iv. Zero Tillage Sowing

Wheat can be directly sown in unprepared fields using Zero Till Drill or Strip Till Drill.

For weedy fields, pre-spray 500 ml Gramoxone 24 SL (paraquat) in 200 L water per acre.

Benefits:

- Fuel and time savings
- Lower weed pressure (especially Phalaris minor)
- Reduced lodging
- Earlier sowing window

After 3 years of zero tillage, plough the field to control perennial weeds and rodents.

v. Sowing with Happy Seeder / Super Seeder / Smart Seeder

Suitable for combine-harvested paddy fields without burning or straw removal.

Ensure final irrigation of paddy is done two weeks before harvesting.

Maintain sowing depth at 1.5 to 2.0 inches.

Machine Options:

- Ordinary Happy Seeder: Spread loose straw uniformly before sowing.
- Upgraded Happy Seeder: With press-wheel assembly; improves mulch placement and crop establishment.
- Super Seeder and Smart Seeder: Use after harvesting combined with Super SMS.

Additional Notes:

- Use 5 kg more seed per acre than conventional sowing.
- Apply 65 kg DAP per acre at sowing.
- Prefer PBW 869 for this method.
- Implement rodent control measures promptly.

vi. Wheat Sowing in Standing Rice/Basmati Fields

In areas with high pH soils and poor water infiltration:

- Broadcast 55–60 kg/acre of wheat seed in standing rice/basmati just before or after the last irrigation (10–25 Oct).
- Ensure uniform seed distribution and adequate soil moisture.
- Harvest rice manually or with combine (with Super SMS preferred).
- Apply full phosphorus and half nitrogen with first irrigation; the rest with second irrigation, ideally within 50–55 days of sowing.

vii. Surface Seeding-Cum-Mulching

- A cost-effective solution for paddy residue management and timely wheat sowing.
- Broadcast wheat seed (45 kg/acre) and basal DAP (65 kg/acre) in combine-harvested fields.
- Use a cutter-cum-spreader to chop straw at 4–5 inches height.
- Irrigate immediately to activate germination.

  Equipment Option:
- Use Surface Seeder, which combines seed and fertilizer placement with straw cutting or use combine harvesters with seeding attachments to complete sowing during harvest itself. If machinery is unavailable, manual broadcasting followed by cutter-cum-spreader and irrigation is an alternative.
- > Important: Ensure the rice field is levelled and divided into smaller plots before transplanting. Final irrigation should be applied 10–15 days before rice harvest to support smooth surface seeding.

Fertilizer Management for Wheat

Supreme Breeders Pvt. Ltd. - Nutrient Advisory

Maximize wheat yields and maintain soil health by adopting a balanced and integrated nutrient management approach. Use a combination of organic inputs, bio-fertilizers, and chemical fertilizers as per the recommendations below:

I. Organic Inputs

1. Farmyard Manure (FYM)

- Apply well-decomposed FYM before sowing.
- For every 1 tonne of FYM used, reduce the recommended fertilizer dose by 2 kg nitrogen (N) and 1 kg phosphorus (P_2O_5).
- If wheat follows a potato crop that received 10 tonnes/acre of FYM, skip phosphorus application and apply only 25 kg nitrogen/acre (equivalent to 55 kg urea).

2. Poultry Manure, Biogas Slurry, or Press Mud:

>If 2.5 tonnes/acre of poultry manure or 2.4 tonnes/acre of dried biogas slurry was applied to the previous rice crop:

- Reduce nitrogen by 25%
- Reduce phosphorus by 50%
- Apply: 37 kg N/acre (80 kg urea) in two equal doses — first at first irrigation, second at second irrigation AND 75 kg SSP or 28 kg DAP at sowing

>If 6 tonnes/acre of press mud was added to the rice crop:

- Drill 28 kg DAP or 75 kg SSP per acre at sowing
- Apply 75 kg urea/acre in two split doses

3. Post-Leguminous Crops

If wheat follows legumes, apply 80 kg urea/acre in two equal split doses.

4. Rice Husk or Bagasse Ash

- Apply 4 tonnes/acre before final tillage.
- Reduce phosphorus by half to 12 kg P_2O_5 (28 kg DAP or 75 kg SSP/acre).
- Enhances soil fertility and crop performance.

5. Biochar from Crop Residues (Prali Char)

- Apply 2 tonnes/acre before sowing.
- Reduces nitrogen requirement by 35 kg urea/acre, while enhancing soil health and productivity.

II. Bio-Fertilizers

Use of biofertilizers in wheat is encouraged as a supplement to chemical fertilizers, as they help improve nutrient availability and soil health. Based on recommendations from ICAR and State Agricultural Universities, the following are generally used in North India:

- **Azotobacter**
  - Non-symbiotic nitrogen-fixing bacteria suitable for wheat.
  - Enhances seed germination and early growth.
  - Contributes additional nitrogen to the crop.
- **Phosphate-Solubilizing Bacteria (PSB)**
  - Makes fixed soil phosphorus more available to plants.
  - Improves root growth and tillering.

Method of Application

- Seed treatment: Treat 10 kg of seed with ~200 g culture of Azotobacter or PSB (use jaggery or gum solution as adhesive), dry in shade, and sow immediately.
- Soil application: 4–5 kg biofertilizer culture mixed with 40–50 kg well-decomposed FYM/compost at the time of sowing.

Note:

- Biofertilizers are only a supplement, not a substitute for recommended NPK fertilizer doses.
- Store in a cool, dry place; avoid exposure to direct sunlight.
- Do not mix biofertilizers with chemical fungicides or pesticides during seed treatment.

III. Chemical Fertilizers

Standard Dose for Medium Fertile Soils (In absence of a soil test)

Nutrient	Amount (kg/acre)	Fertilizer Equivalent
Nitrogen (N)	50	110 kg Neem Coated Urea
Phosphorus (P_2O_5)	25	55 kg DAP **or** 155 kg SSP **or** 125 kg Nitrophosphate
Potassium (K_2O)	Conditional	20–40 kg MOP (based on soil test results)

Additional Guidelines:

- Apply **12 kg K_2O (20 kg MOP/acre)** in potassium-deficient soils.
- In **high-deficiency zones**, apply **24 kg K_2O (40 kg MOP/acre)** at sowing.
- If using **125 kg Nitrophosphate**, reduce **Urea by 50 kg/acre**.

Application Timing & Methods

At Sowing:

- Drill all phosphorus and potassium (based on soil test)
- No urea needed if using DAP; otherwise, apply 20 kg urea/acre with SSP

At Irrigation:

- For timely sown crops, broadcast 45 kg urea/acre in two equal splits (at first and second irrigation)
- For crops sown after mid-December, reduce to 35 kg urea/acre per split
- If second irrigation is delayed by rain, apply second dose at 55 days after sowing
- If water stagnation occurs, avoid broadcasting urea — instead, spray 7.5% urea solution (15 kg urea in 200 L water/acre) at 42 and 54 days

Special Guidelines for Different Straw Management Methods:

- Drill 65 kg DAP/acre at sowing
- Broadcast 45 kg urea/acre before each irrigation

In Happy Seeder-sown fields (3 years continuous use):

- Use an integrated nutrient approach
- Apply 90 kg urea and 55 kg DAP per acre
- Add potassium only if deficient
- Correct micronutrient deficiencies
- Use Green Seeker or Leaf Colour Chart (LCC) for nitrogen decisions
- Spray potassium nitrate or salicylic acid during grain filling to offset heat stress

From the 4th year onwards, reduce 20 kg urea/acre

Nitrogen Management Tools

1. Green Seeker Method

Establish a nitrogen-rich reference plot with:

- 55 kg DAP + 45 kg urea/acre at sowing
- 65 kg urea/acre at first irrigation
- At 50–55 DAS, record readings from the Green Seeker device over both the main field and reference plot
- Enter data into the “Urea Guide” mobile app to get exact nitrogen requirement
- Spray urea solution instead of broadcasting if standing water prevents granular application.

Always apply on healthy fields (free of pests/disease) for accurate readings.

Fertilizer Use Tips

- For crops in saline-alkali soils, increase nitrogen dose by 25%
- For late-sown crops (post mid-December), reduce nitrogen by 25%
- If deficiency appears after full urea application, spray 3% urea solution (9 kg in 300 L water/acre)
- Apply phosphorus mainly to wheat, not to the succeeding kharif crop
- In case of DAP/SSP unavailability, alternate P sources like sulphated phosphate (13:33:0:15) or ammonium phosphate (12:40:0:10:1) may be used

2. Leaf Colour Chart (LCC) Method

🌱 Leaf Colour Chart (LCC) Method

- Match the **topmost fully opened leaf** of 10 plants to the LCC under shade.
- At **second irrigation (≈ 50–55 DAS)**, apply urea based on average leaf colour.

Leaf Shade	Urea Dose (kg/acre)
> Shade 5.0	15
Shade 4.5 – 5.0	30
Shade 4.0 – 4.5	40
< Shade 4.0	55

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 $FeSO_4$ + 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.

Weed Management

Weed infestation can significantly reduce wheat yields if not managed effectively. Manual methods, such as two rounds of hoeing — first before and second after the first irrigation — using tools like a wheel hoe or khurpa, remain effective. However, integrated weed control strategies, including cultural practices and herbicides, offer more consistent results.

A. Managing Grass Weeds

i. Controlling Phalaris minor (Gulli Danda)

Cultural Methods:

- Opt for fast-growing wheat varieties sown in narrow 15 cm rows between the last week of October and the first week of November.
- In heavily infested fields, consider crop rotation using alternatives like berseem, potato, mustard, or gobhi sarson for 2–3 years.
- Creating a soil mulch at sowing helps suppress early weed emergence.

Herbicidal Options:

Pre-Emergence Herbicides (Apply within two days of sowing or just before first irrigation):

- Pendimethalin (30 EC): 1.5 L/acre
- Pyroxasulfone (85 WG): 60 g/acre
- Pendimethalin + Metribuzin (385 SE or 48 EC): 1.0 L or 900 ml/acre

Good soil moisture is essential. For pre-emergence spraying, flat fan or flood jet nozzles are recommended. Machines like the 'Lucky Seed Drill' can integrate sowing with herbicide application.

Post-Emergence (Before First Irrigation, at 2–3 Leaf Stage):

- Isoproturon (75 WP): 300–500 g depending on soil texture
- Sulfosulfuron (75 WG): 13 g/acre (Brands: Leader, SF-10, etc.)
- Avoid sulfosulfuron if a broadleaf crop is intercropped or if sorghum/maize will follow wheat.

Post-Emergence (After First Irrigation, 30–35 Days After Sowing):

- Isoproturon (75 WP): 500 g
- Clodinafop (15 WP): 160 g (Brands: Topik, Moolah, etc.)
- Pinoxaden (5 EC): 400 ml (Brand: Axial)
- Fenoxaprop-p-ethyl (10 EC): 400 ml (Brand: Puma Power)

ii. Controlling Wild Oats (Avena ludoviciana)

All herbicides effective against Phalaris minor also provide good control of wild oats.

B. Managing Broadleaf Weeds

Herbicidal Options:

- **2,4-D** (80 WP or 38 EC): 250 g/ml per acre.

Effective against: bathua, billi booti, pitpapra, and other common broadleaf weeds
Application: 35–45 DAS (timely sown); 45–55 DAS (late sown)

- **Metsulfuron** (20 WP): 10 g/acre (Brand: Algrip)

Effective against: kandiali palak

- **Carfentrazone-ethyl** (40 DF): 20 g/acre (Brand: Aim/Affinity)

Effective against: button booti

- **Metsulfuron + Carfentrazone** (50 DF): 20 g/acre (Brand: Lanfda)

Avoid if any broadleaf crops are present in the field.

C. Combined Control of Grass and Broadleaf Weeds

Combination Herbicides:

- Sulfosulfuron + Metsulfuron (75 WG): 16 g (Brand: Total, Markpower)
- Mesosulfuron + Iodosulfuron (3.6 WDG): 160 g (Brand: Atlantis)
- Fenoxaprop + Metribuzin (22 EC): 500 ml (Brand: Accord Plus)
- Metribuzin + Clodinafop (21-11 or ACM-9/EMEK): 200–240 g

Avoid on PBW RS1 and Unnat PBW 550; not suitable for light soils

Tank Mix Recommendations:

Combine Topik/Moolah/Puma Power with 2,4-D or Algrip — follow individual dosages
Mix Isoproturon with 2,4-D if no resistance and no broadleaf crop is grown in rotation

D. Integrated Weed Management (IWM)

Sowing with a Happy Seeder in standing rice stubble significantly reduces the weed burden. Combining this method with appropriate herbicides and manual removal of escaped weeds helps suppress weed seed banks.

E. Weed Control in Durum Wheat

Durum wheat can be treated with most herbicides listed above, except: Total, Markpower, Atlantis, Accord Plus, Shagun 21-11, and ACM-9/EMEK
Isoproturon: 500 g applied 40–45 DAS in medium to heavy textured soils. Avoid use in light soils.

Important Spray Guidelines:

- Use herbicides on clear, non-windy days
- Use flat fan nozzles (post-emergence) and flood jet nozzles (pre-emergence)
- Do not irrigate heavily post-spray; light irrigation is ideal
- Clean sprayers thoroughly after use
- Rotate herbicide groups annually to prevent resistance
- Manually uproot any escaped weed plants before seed setting

Irrigation Scheduling:
Apply a 10 cm deep pre-sowing irrigation, especially where wheat follows rice. To enable early sowing, consider irrigating standing rice 5–10 days before harvesting (except when using a combine).

💧 **Recommended Irrigation Schedule (Loam to Heavy Soils)**

Sowing Dates	2nd Irrigation	3rd Irrigation	4th Irrigation
Up to Nov 21	5–6 weeks	5–6 weeks	4 weeks
Nov 22 – Dec 20	5–6 weeks	3–4 weeks	2 weeks
Dec 21 – Jan 15	4 weeks	3 weeks	—

Notes:

- Advance irrigation for light soils; delay for heavy paddy soils
- Adjust intervals by ±2–3 days as per weather
- Each 1 cm of rainfall delays next irrigation by 5 days (till Jan), or 2 days (after Jan)
- Continue irrigation till March-end for early-sown crops and until April 10 for late-sown ones

Mitigating Heat Stress & Boosting Yield

To reduce the negative impact of high temperatures during grain filling:
Spray 2% Potassium Nitrate (13:0:45): 4 kg in 200 L water at boot leaf and anthesis stages
OR two sprays of Salicylic Acid: 15 g in 450 ml ethanol + 200 L water per acre at boot leaf and early milk stages

Producing Quality Wheat Seed

- Begin with certified or foundation seed
- Treat seed against loose smut with recommended fungicides
- Routinely remove off-type or diseased plants
- Apply 200 ml Tilt 25 EC in 200 L water per acre to prevent Karnal bunt
- Prevent admixtures during harvest, threshing, and storage

Harvesting and Threshing

- Harvest at full maturity to avoid grain loss. Delayed harvesting leads to higher shattering. Combine harvesters are commonly used for simultaneous cutting and threshing.
- Use straw combine to collect wheat stubble into straw (turi) — recovery rate: \~60%
- Manual harvesting is also viable
- For threshing, use power threshers with safety precautions. Toka-type threshers work for wheat with up to 20% moisture.

Storage and Post-Harvest Handling

Proper storage is crucial for maintaining the quality and viability of wheat grains. If the harvested grain contains more than 10% moisture, it should be thoroughly dried before storage to prevent spoilage caused by mold and excessive internal heating. Seed intended for future sowing should be cleaned and graded using seed-cleaner-cum-grader machines for optimal quality.

Plant Protection Guidelines

A. Insect Pest Management in Field Wheat

1. Termites

Damage occurs shortly after sowing and near crop maturity, causing wilting and easy uprooting of affected plants. Late-stage infestation results in white earheads.

Control Measures:

- Treat 40 kg seed with: 40 g Cruiser 70 WS (thiamethoxam) OR
- 160 ml Dursban/Ruban/Durmet 20 EC (chlorpyriphos) OR
- 80 ml Neonix 20 FS (imidacloprid + hexaconazole) in 1 litre of water.

Apply to seed spread thinly on a solid surface (e.g., tarp or polythene).

In sandy soils or under severe infestation, broadcast:

- 7 kg Mortel 0.3 G (fipronil) OR
- 1.2 litres Dursban 20 EC with 20 kg moist sand per acre before first irrigation.

2. Aphids

Aphids discolor leaves and typically attack during earhead formation.

Control Measures:

- Spray two applications of 2 litres of homemade neem extract weekly OR
- Single spray of 20 g Actara/Taiyo 25 WG (thiamethoxam) in 80–100 litres water per acre.
- Focus initial sprays on field borders where aphids first appear.

Preparation of Neem Extract:

Boil 4 kg fresh neem shoot tips in 10 litres of water for 30 minutes. Strain through muslin and spray as directed.

3. Armyworm
Active in March–April or earlier where paddy straw residue is high. It attacks leaves and earheads.
Control Measures:
Spray:

- 40 ml Coragen 18.5 SC (chlorantraniliprole) OR
- 400 ml Ekalux (quinalphos) in 80–100 litres of water.
- Apply in evening for better effectiveness.
- Alternatively, broadcast 7 kg Mortel 0.3 G or 1 litre Dursban with 20 kg moist sand per acre before irrigation.

4. Pink Stem Borer
Affects seedlings by boring into central shoots, causing "dead heart."
Control Measures:

- Delay sowing if severe rice crop damage was observed.
- Prefer daytime irrigation to attract predatory birds.

For active infestations:

- Spray 50 ml Coragen 18.5 SC in 80–100 litres water OR
- Broadcast 7 kg Mortel 0.3 G or 1 litre Dursban with moist sand per acre.

5. Gram Pod Borer
Appears near crop maturity, especially where wheat follows cotton.
Control Measures:
Spray 800 ml Ekalux 25 EC in 100 litres of water per acre.

6. Brown Mite
A minor pest in rainfed areas, causing leaf discoloration.

B. Disease Management in Wheat

1. Yellowing at Seedling Stage
Causes include nutrient deficiencies, soil nematodes, poor drainage, or weather.
Management Strategies:

- Zinc Deficiency: Apply 25 kg zinc sulphate per acre (effective for 2–3 years).
- Sulphur Deficiency: Apply 100 kg gypsum per acre.
- Nitrogen Deficiency: Spray 3% urea (3 kg in 100 litres of water).
- For nematodes: Apply 13 kg Furadan 3G at sowing.

2. Yellow or Stripe Rust (Puccinia striiformis)
Appears in cool, humid conditions. Yellow stripes form on leaves.
Integrated Management:

- Grow resistant varieties: PBW Biscuit 1, PBW Zinc 2, WHD 943, PBW 725, etc.
- Avoid early sowing in susceptible areas.
- Monitor from December onward.

Spot-spray infected patches with one of the following in 200 litres of water/acre:

- 300 g Taqat 75 WP
- 120 g Nativo 75 WG
- 200 ml Opera 18.3 SE or Custodia 320 SC
- 200 ml Tilt 25 EC or alternatives

3. Brown Rust (Puccinia triticina)
Orange pustules appear on leaves and sheaths.
Control:

- Grow resistant varieties.
- Spray 200 ml Tilt 25 EC or similar fungicide in 200 litres of water/acre.

4. Karnal Bunt (Neovossia indica)
Few grains turn black, powdery, and emit a foul smell.
Control:

- Use resistant varieties: WHD 943, PDW 291.
- For seed wheat, spray 200 ml Tilt 25 EC at ear emergence.

5. Powdery Mildew (Blumeria graminis)
White spots develop on leaves and turn grey or red-brown.
Control:
Grow resistant varieties.
Spray 300 g Taqat 75 WP or 120 g Nativo in 200 litres of water/acre.

6. Loose Smut (Ustilago segetum)
Destroys ears, turning them to black powder.
Control:

- Use resistant varieties.
- Sun-dry soaked seeds for 4 hours in May/June.
- Alternatively, treat seeds with fungicide.

7. Flag Smut (Urocystis agropyri)
Grey-black streaks form on leaves.
Control:

- Sow shallow.
- Remove infected plants and burn them.
- Treat seed with fungicide.

8. Head Scab (Fusarium spp.)
Bleaching or brown discoloration of ears.
Control:

- Avoid growing durum wheat in humid regions.
- Clean affected seeds to remove shrivelled grains.

9. Leaf & Glume Blights, Black Tip
Brown blotches and black-tipped grains.
Control:
Use clean, disease-free seeds.

10. Ear Cockle and Yellow Ear Rot
Caused by nematodes and bacteria. Ears contain galls instead of grains.
Control:

- Soak and stir seed in water; skim off floating galls.
- Burn removed galls.

11. Molya (Heterodera avenae)
Causes stunted plants and reduced roots.
Control:

- Practice deep tillage in summer.
- Rotate with non-cereal crops.
- Apply 13 kg Furadan 3G at sowing.

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 (≈ 8 t FYM).
- Medium: 120 kg N/acre (≈ 12 t FYM).
- Low: 160 kg N/acre (≈ 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.

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.

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 m^2, 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 & Timing
Conventional tillage fields: Mid-February to early March (before milky stage) is most critical. Place zinc phosphide or bromadiolone @ 400 g/acre on paper pieces.

Zero tillage fields:
- First baiting in burrows before sowing (late Oct–early Nov).
- Second baiting in mid-Feb to early March.

Happy Seeder fields:
- Two baitings with zinc phosphide in burrows at 10–15 day intervals (Nov–Dec).
- Second baiting in mid-Feb to early March with zinc phosphide or 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 (availabat 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.

Storage & Management of Stored Grain Insects

1. Storage of Wheat

(a) Home Consumption

Improved storage structures: Metal bins (1.6–15 quintals).

Advantages: Airtight (no insects/rodents), economical, portable, easy to fabricate.

Practices for storage in Metal bins:

- Clean bins thoroughly, check gaskets.
- Clean/sort grains → remove broken kernels & impurities.
- Don’t mix new with old grains.
- Store only dry, uninfested grains (≤9% moisture).
- Fill to full capacity & close lid tightly.
- Keep closed for first 30 days → later open fortnightly.
- Inspect grains frequently.

(b) Commercial Storage
Use State Warehousing Corporation or Central Warehousing Corporation.

2. Management of Stored Grain Insects

Major Pests:

- Khapra beetle (Trogoderma granarium)
- Lesser grain borer (Rhizopertha dominica)
- Rice weevil (Sitophilus oryzae)
- Flour beetles (Tribolium spp.)
- Pulse beetles (dhora) – Callosobruchus spp.
- Grain moth (Sitotroga cerealella)

Preventive Measures

- Dry grains properly.
- Seal cracks/holes in godowns.
- Store in clean godowns/receptacles.
- Use new gunny bags.
- Disinfect godowns → 0.05% Malathion spray OR fumigate (25 AlP tablets/100 m³, 7 days).

For pulses (against dhora) → cover bulk grain with 7 cm layer of sand/sawdust/dung ash.

Curative Measures

- **Aluminium phosphide** (Phostoxin/Delicia/Celphos) →

1 tablet (3 g) per tonne OR 25 tablets/100 m³ space (7 days).

>For Khapra beetle → double dose required.

Caution

Clean & sun-dry bins before use.

Only trained persons should fumigate → fumigants are highly poisonous.

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.

Wheat Cultivation in Paddy Straw–Managed Fields

1. General Guidelines

- Machine operators (Super SMS, Happy Seeder, Smart Seeder, Super Seeder, Chopper/Mulcher, Mouldboard Plough) must be trained.
- Soil type: All methods suitable for medium & heavy soils; prefer straw incorporation in light soils.
- Grow short/medium-duration rice varieties → more time for straw management + less straw load → reduces pink stem borer infestation in wheat.

2. Guidelines for Paddy Crop Before Wheat

- Prepare ≥2 plots per acre before transplanting paddy (for ease in Happy/Smart Seeder sowing).
- Sept–Oct: Regular monitoring → control armyworm & pink stem borer to prevent carryover to wheat.

Mulcher use:

- Not required before Smart/Super Seeder.
- Avoid in heavy soil with high straw load before Happy Seeder.

3. Wheat Sowing (Happy Seeder, Smart Seeder, Super Seeder)

- Ensure last irrigation in paddy leaves adequate moisture for wheat sowing.
- Sowing depth: 1.5–2.0 inches (Happy/Super Seeder).
- Seed rate: With Happy Seeder → +5 kg/acre (except PBW 869).

Fertilizers:

- Drill 65 kg DAP/acre at sowing.
- Apply 45 kg urea/acre before 1st & 2nd irrigation.
- In heavy soils (if irrigation delayed) → give two foliar sprays of 10% urea (20 kg urea in 200 L water/acre) at 42 & 54 DAS.
- Avoid sowing in October if pink stem borer/armyworm was present in paddy.

Irrigation:

- Light soils → 1st irrigation at 25–30 DAS.
- Medium–heavy soils → 30–35 DAS.
- Super Seeder wheat → follow conventional irrigation.
- Prefer daytime irrigation → promotes bird predation of insects.

Field care:

- Prevent clogging of tubes (tap with stick if needed).
- Monitor crop in Nov–Dec for insect-pest, disease, rodent problems.

Weed control:

- Happy/Super Seeder → pre & post-emergence herbicides.
- Smart Seeder → only post-emergence herbicides.

4. Wheat Sowing After Straw Incorporation
Depends on machinery & water availability.

- Chopper/Mulcher → chop straw & spread uniformly.
- If enough soil moisture → incorporate with Mouldboard Plough → prepare with rotavator.
- If 2–3 weeks gap before wheat → give shallow irrigation, then mix chopped straw with Disc Harrow/Rotavator.

Major Problems of Wheat Crop

1. Nutrient Deficiencies

- Nitrogen deficiency → pale green/yellow leaves, stunted growth, low tillering.
- Phosphorus deficiency → dark green/purplish leaves, poor root growth, delayed maturity.
- Potassium deficiency → scorching of leaf tips, weak stems → lodging.
- Zinc deficiency → interveinal chlorosis, reduced leaf size, stunted plants.
- Manganese deficiency → greyish/whitish specks on leaves (common in sandy soils, straw-incorporated fields).

2. Insect-Pests

- Termites → attack seedlings and roots, causing drying patches.
- Armyworm / Ear-cutting caterpillar → cut earheads and reduce yield.
- Pink stem borer → carryover from paddy, causes dead hearts in wheat tillers.
- Aphids → suck sap from leaves & ears, also transmit viral diseases.
- Shootfly (occasionally) → causes dead hearts in young crop.
- Grasshoppers → chew leaves in early stages.

3. Diseases

- Rusts (fungal)
- Yellow rust (Stripe rust) → yellow stripes on leaves in cool, humid areas.
- Brown rust (Leaf rust) → brown pustules on leaves.
- Black rust (Stem rust) → black elongated pustules on stems/leaves.
- Karnal bunt → black powdery grains with fishy odor.
- Loose smut → black dusty spores replacing earheads.
- Powdery mildew → white powdery growth on leaves.
- Alternaria blight → brown spots with concentric rings.
- Flag smut → black streaks on leaves → shriveled plants.
- Ergot (rare) → black, hard fungal bodies in place of grains.
- Root rots & seedling blights (in poorly drained soils).

4. Physiological & Abiotic Problems

- Lodging (due to excess nitrogen, wind, rain).
- Moisture stress / drought → shriveled grains, reduced yield.
- Heat stress (terminal heat) → poor grain filling, forced maturity.
- Waterlogging → poor root aeration, yellowing, stunted plants.

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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