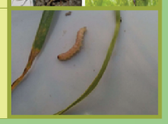
S. No	Diseases	Damage	Control	Reference
1	Rust (*Yellow, Leaf and Stem*)	• Rust infection is of three types; leaf, stem and stripe (yellow) • The obvious symptoms of leaf rust are dusty, reddish- orange to reddish brown fruiting bodies that appear on the leaf surface • Leaf rust cause the most damage by covering upper leaves before flowering	• Seed treatment with fungicide • Use of rust-resistant varieties • Scouting the field to remove rust-infected plant as rust can easily spread from one plant to another • Foliar application of fungicide (Azoxystrobin + Difenoconazole) @ 500ml/Ha, 20ml/15l knapsack sprayer	
2	Loose Smut (*Ustilago tritici*)	• Diseased plants usually ear earlier than healthy plants • Loose smut destroys the kernel of infected plants by forming spores on the ear • Loose smut lowers the quality of seeds of infected plants at harvest	• Use of certified smut-free seeds • Seed treatment with fungicide (DCMO and Benomyl) @ 2.5g/1kg of Seeds • Use of Azoxystrobin @ 400g/Ha, 20g/15L knapsack sprayer	
3	Karnal Bunt	• It causes normal kernel to be replaced by 'smut balls' containing powdery masses of brownish black spores • The spores are characterized by a dead-fish odor	• Avoid continuous cropping of wheat in the same field • Avoid excessive irrigation during flowering stage • Use of fungicides containing propiconazole or mancozeb or copper oxide @ 1kg/Ha, 50g/15L knapsack sprayer	
4	Powdery Mildew	• It appears as fluffy, white powdery growth of fungal spores on the leaf surface • The symptoms typically progress from lower leaves to upper leaves and infection can occur at any stage of the crop growth	• Crop rotation to avoid stubble borne infection • Foliar application of fungicide (Mancozeb 63% + Carbendazim 12% WP @ 1kg/Ha, 45g/15L knapsack sprayer)	

S. No	Pest	Damage	Control	Reference
1	Termites (*Odontotermes obesus and Microtermes obesi*)	• Termites feed on roots, underground portion of stem and dead plant tissues • In partially damaged roots, the crop becomes yellow • The severely damaged plants dry-up completely and can easily be pulled out	• Destruction of crop residues and application of fully decomposed farmyard manure • If the termite damage is noticed in the standing crop, apply Chlorpyrifos 20 EC @ 3 litre mixed in 50 kg of soil per hectare as soil application	
2	Wheat Aphids	• Wheat aphids are green, inert and louse and appear on young leaves or ears in large numbers during cold and cloudy weather • They cause damage through sucking the sap from wheat crop, especially the ears	• Avoid late sowing of wheat crop • Use of cypermethrin 3% + Dimethoate 25% EC @ 1L/Ha, 40ml/15L knapsack sprayer or Imidacloprid 20% SL @ 200ml/Ha, 10ml/15L knapsack sprayer	
3	Weevil	• The damage is caused by the adult weevil only by cutting the germinating seedlings at the base (ground level) • It can also cause damage by feeding on leaves and tender shoots of the wheat plant	• Seed treatment with 3ml of Imidacloprid per 1kg of seeds • Foliar application of dust carbaryl or Malathion 5% at 25kg/Ha	
4	Pink Stem Borer (*Sesamia inferens*)	• The larva bore into the stem of young plant, resulting in the drying up of the growing point and formation of 'dead heart' • At the ear emergence stage, due to its attack 'white ears' are produced which have little or chaffy grains	• Removal or destruction of the crop stubbles • Ploughing and flooding field is also effective in killing the larvae • Use of cypermethrin 10% EC @ 500ml/Ha, 25ml/15L knapsack sprayer	

S. No	Nutrient	Deficiency Symptoms	Reference	Healthy Wheat	Reference
1	Nitrogen	• Uniform yellowing (chlorosis) of older leaves (lower leaves) • Stunted growth • Poor crop stand		• Green Foliage • Vegetative Growth • Bumper harvest	
2	Phosphorus	• Purple coloration of older leaves • Low tillering • Poor crop stand • Stunted growth		• Good rooting system • High tillering • Well-developed panicles and kernels (ears)	
3	Potassium	• Yellowing of tips or margin of the leaves extending • Stunted growth • Weak stems and reduced disease resistance and drought tolerance • Crop lodging at maturity		• Strong Shoot system • Disease resistance • Drought tolerance • Bumper harvest	

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Wheat

Ruling Nigeria with the King Of The Grains or Crowning Glory, Nigeria's Wheat

Wheat is one of the most important food crops. Total area of the wheat production in the world is around 225.2 million hectares with a production of 685.6 million metric tons. About 1.0 million metric tons of wheat is produced annually in Nigeria. The major producing countries in the world are China, India, USA, Russia, Ukraine, Canada, Australia, France, Turkey, Pakistan, and Egypt. Agriculture department from Federal Government of Nigeria is making all efforts to increase the wheat crop production in the country with special emphasis in the states of Kano, Jigawa, Sokoto, Kebbi, Zamfara, Bauchi, and Kaduna.

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WHEAT CROP

Land Preparation and Soil Requirement

- Wheat requires cool weather with optimum temperature of about 25 °C.
- The cool weather is especially important during the early growth stage and tillering.
- Wheat is best grown during the harmattan season (November – February).
- The land selected should be void of debris or stubbles from previous crops.
- Wheat requires fertile loam and clay loam soils with high water holding capacity.
- Avoid heavy or sandy soils and select medium textured soils.
- Also, avoid acidic soils, wheat prefers neutral to slightly alkaline soils.
- Select site with permanent source of water for irrigation.
- The field should be harrowed to fine tilth.
- Raised beds are made just before sowing, followed by pre-sowing irrigation and land leveling.
- The raised beds should be divided into basins for easy irrigation.
- Pre-planting herbicide Pendimenthalin at 2-3 L/Ha should be sprayed two weeks to planting.
- Post-emergence herbicide 2,4-Dimethyl aminesate (shortly called 2,4-D) can be used.
- Organic manure should be incorporated into the soil two weeks before sowing at the rate of 8-10 tons/ha. This will improve the soil physical structure and maintain soil health.
- Irrigate at intervals of 5 – 10 days depending on weather and soil type.
- Irrigation is essential at sensitive growth stages (tillering, heading and grain filling).
- Excess water should be adequately drained as waterlogging reduces crop performance.

Seed Rate and Time of Sowing

- Obtain seed from reputable licensed seed companies or research institutes.
- Drill seeds at the rate of 80 kg ha-1 using 15 – 20 cm spacing between rows.
- The drilling method is the best practice.
- The optimum time for sowing is decided by temperature (optimum temperature of 25 °C).
- Seed should be treated with seed dressing chemical (such as 20 % Metalayxl + 20 % Imidacloprid) at the rate of 10 g chemical for 4 kg of the seeds.
- Some important varieties of wheat include;
  - LACRI WHIT-11 (ATTILA7) – heat tolerant, good baking quality and high yielding 7.1t/ha
  - LACRI WHIT-9 (PASTOR) – heat tolerant with good baking quality and high yielding 7.7t/ha
  - LACRI WHIT-7 (REYNA15) – resistant to Septoria leaf and glume botch diseases. yields 5.1t/ha
  - LACRI WHIT-5 (NORMAN) – adapted to irrigated Sudano-Sahelian zones. High yielding 6t/ha

Fertilizer Management with 4R Nutrient Stewardship

- Before fertilizer application, it is important to ensure that the soil is moist and weed free.
- Apply fertilizer at the rate of 120-150 kg Nitrogen: 40 kg Phosphorus : 40 kg Potassium/ha.
- Apply 8 numbers of 50 Kg bags (400kg) of Indorama NPK per hectare during land preparation.
- Top dress with 1.5 bags (75kg per hectare) of Indorama Neem Coated Urea at 3 weeks and 1 bag (50kg) at 6 weeks after sowing.
- Apply the fertilizer 10 cm away from the crop using dibbling method.

BEST FARMING PRACTICES

How to Reduce Fertilizer Loss

- Apply fertilizer early in the morning or in the evening time.
- Avoid fertilizer application when it is about to rain or when the weather is cloudy.
- Always apply Indorama Neem Coated Urea fertilizer in split doses for better efficacy.
- Always cover applied fertilizer with soil to prevent volatilization losses.
- Apply nitrogen fertilizer(ie Indorama Neem Coated Urea) after weeding to prevent weed invasion.
- Apply only the recommended dose of fertilizer.

Pests Control

- Field pest problems are minimal on irrigated wheat crop.
- Chlorpyriphos 20 EC at 2-2.5L per ha can be applied in irrigation water to control cutworms and termites attack.
- Employ seed treatment to control seed-borne diseases.
- Ensure field sanitation by removing weeds that could serve as alternate hosts to diseases.
- Use improved varieties that are resistant/tolerant to pests and diseases.
- Practice crop rotation with non-host crops.
- Use bio-pesticides such as neem-extracts to control insect pests.

Weed Control

- In wheat production, weeds are not a serious problem where good land preparation is done; in addition to timely sowing, good spacing, adequate irrigation and fertilizer application.
- Hoe weeding at 4 weeks after sowing could be done to control weeds.
- Chemical weed control using;
  - Pre-emergence herbicides such as Pendimenthalin, 2-3 L/Ha
  - Post-emergence herbicides such as Basagram 480EC at 2.5 L ha-1 at 3-4 weeks after sowing or Bentazone at the rate of 3-4 L/ha.
- Precaution must be followed to ensure safe use of herbicides.

Harvesting and Crop Storage

- Wheat is harvested when the grain and the straw are golden brown.
- Harvesting is done manually with a sickle or mechanically with a combine harvester.
- Manual threshing is done by beating the head with a stick on a floor or on a metal surface like drum.
- Where harvesting and threshing are done manually, winnowing must be done to separate the grain from the chaff.
- Drying to low moisture content (10-12 %) and thoroughly cleaning of the grains are required for storage.
- Storage structures and containers including bags should be treated with chemicals.
- Yield may reach up to 3-7 tons/ha depending on the variety and management.

Indorama Fertilizer: Improving Agriculture, Improving Lives