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Package of Practices for Wheat (*Triticum aestivum* L.) Cultivation

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Wheat (*Triticum aestivum* L.) is oldest cultivated crops and have a prominent position in global agriculture. It belongs to the family Poaceae .Wheat serves as a staple food for nearly one-third of the world's population and provides approximately 20% of the calories and proteins consumed globally. In India, wheat is the second most important food grain after rice and is predominantly grown during the rabi season.The demand for wheat is due to population growth improved crop management practices that maximize productivity while maintaining soil health and environmental quality. A package of practices refers to the complete set of scientifically validated agronomic recommendations designed to optimize crop performance from land preparation to post-harvest handling.

Climate requirements

Wheat is best suited to cool and dry climatic conditions. The crop requires moderate temperatures during germination and vegetative growth, while warm and dry weather is desirable during grain filling and maturity.The optimum temperature for seed germination ranges between **20 and 25°C**, whereas temperatures of **16–22°C** are considered ideal for vegetative development. During grain filling, temperatures exceeding **30°C** may adversely affect grain quality and yield by shortening the grain-filling period.Rainfall of approximately **50–100 cm**, well distributed throughout the growing season, is considered suitable.

Soil Requirements

Wheat can be cultivated on a wide range of soils; however, well-drained loam to clay loam soils with good water-holding capacity are considered ideal. The soil should possess adequate organic matter and good fertility.The optimum soil pH for wheat cultivation ranges between **6.0 and 7.5**. Highly acidic or saline soils reduce nutrient availability and negatively influence crop growth. Proper drainage is essential because standing water affects root respiration and increases disease incidence.

Land Preparation

Proper land preparation creates a favorable environment for seed germination and root development. The field should be ploughed thoroughly to obtain a fine tilth. Generally, one deep ploughing followed by two to three harrowings and planking ensures a level seedbed.Laser land leveling is increasingly recommended because it improves irrigation efficiency, promotes uniform crop establishment, and reduces water losses.

Selection of Improved Varieties

The choice of suitable variety depends on the agro-climatic region, irrigation availability, and sowing time. Improved varieties should possess high yield potential, resistance to major diseases, and tolerance to abiotic stresses.

Seed Rate and Sowing

The recommended seed rate generally ranges from **100 to 125 kg ha^{-1}** for timely sown irrigated wheat. Late-sown crops often require a slightly higher seed rate to compensate for

reduced tillering.Timely sowing plays a critical role in determining final yield. Under North Indian conditions, wheat is generally sown between **late October and mid-November**.Proper seed placement ensures uniform germination and healthy crop establishment.

Seed Treatment

Seed treatment protects seedlings from seed-borne and soil-borne pathogens during the initial stages of crop growth. Fungicidal seed treatment significantly reduces diseases such as loose smut and seedling blight.Where termite infestation is common, appropriate insecticidal seed treatment is also recommended. In bio-intensive farming systems, beneficial microbial inoculants may be used to enhance nutrient availability and root growth.

Nutrient Management

Balanced nutrient management is essential for achieving high productivity.Nitrogen promotes vegetative growth and protein synthesis, phosphorus encourages root development, while potassium improves stress tolerance and grain quality.A general fertilizer recommendation for irrigated wheat is:

- Nitrogen: **120 kg ha^{-1}**
- Phosphorus (P_2O_5): **60 kg ha^{-1}**
- Potassium (K_2O): **40 kg ha^{-1}**

Nitrogen is usually applied in split doses to improve nutrient use efficiency. Half of the nitrogen and the entire quantity of phosphorus and potassium are applied as basal fertilizer, while the remaining nitrogen is top-dressed during the first and second irrigations.The addition of farmyard manure, compost, green manure, or crop residues enhances soil organic carbon and improves nutrient availability.

Irrigation Management

Water management is most important factors influencing wheat productivity.Although irrigation requirements vary depending on soil type and climate, critical growth stages requiring adequate moisture include:

1. Crown root initiation (20–25 DAS)
2. Tillering
3. Jointing
4. Booting
5. Flowering
6. Milk stage
7. Dough stage

Among these, irrigation at the crown root initiation stage is considered the most critical. Water-saving irrigation methods and precision irrigation technologies contribute to improved water-use efficiency.

Weed Management

Weeds compete with wheat for nutrients, water, light, and space, causing substantial yield losses if not effectively controlled.Integrated weed management combines:

- Timely field preparation
- Crop rotation
- Mechanical weeding
- Herbicide application

Common grassy weeds include *Phalaris minor* and *Avena ludoviciana*, whereas broadleaf weeds include *Chenopodium album* and *Melilotus indica*.Appropriate pre- or post-emergence herbicides should be selected based on weed flora and local recommendations.

Integrated Pest Management

Integrated Pest Management (IPM) emphasizes regular field monitoring, conservation of natural enemies, use of resistant varieties, biological control agents, and need-based pesticide

application.The use of economic threshold levels before pesticide application minimizes unnecessary chemical use and protects beneficial organisms.

Disease Management

Major diseases include:

- Rusts (leaf, stem, and stripe rust)
- Loose smut
- Karnal bunt
- Powdery mildew
- Spot blotch

Harvesting and Post-Harvest Management

Harvesting should be undertaken when grains attain physiological maturity and moisture content decreases to approximately **18–20%**.Delayed harvesting increases grain shattering, lodging, and weather damage.After harvesting, the crop is properly dried until grain moisture reaches approximately **12%** for safe storage. Proper cleaning, grading, and storage reduce post-harvest losses and preserve grain quality.

Conclusion

The adoption of a comprehensive package of practices is fundamental to achieving higher wheat productivity and ensuring sustainable agricultural development. Proper land preparation, timely sowing, balanced fertilization, efficient irrigation, integrated weed and pest management, and scientific harvesting techniques collectively contribute to improved yield and grain quality. In the face of climate variability and increasing food demand, integrating modern technologies with environmentally sustainable practices will play a crucial role in securing future wheat production. Farmers, extension agencies, and policymakers should work collaboratively to promote the widespread adoption of these recommended practices for enhancing both productivity and profitability.

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