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RECENT ADVANCES IN WHEAT PRODUCTION

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Introduction

"Wheat, one of the world's most widely cultivated and consumed crops, has been a cornerstone of human civilization for millennia. As the global population continues to grow, ensuring sustainable and efficient wheat production is crucial to meet increasing food demands. Recent advances in wheat research and development have led to significant improvements in yield, disease resistance, and climate resilience. These breakthroughs, driven by cutting-edge technologies in genomics, precision agriculture, and plant breeding, are transforming the wheat industry. From high-yielding varieties to innovative farming practices, the latest developments in wheat are poised to address pressing global challenges, including food security, environmental sustainability, and climate change."

LASER LAND LEVELLING:

It is recommended that the land be leveled using a laser land leveler to create an optimal moisture distribution field that will support the root zone of the wheat crop. With a yield advantage of greater than 15%, it raises WUE by roughly 35–45% and boosts nutrient use efficiency by roughly 15–25%. This technology is a forerunner to resource conservation and is necessary for the correct deployment of other RCTs to increase profitability and productivity.

- Boosts crop yield
- Expands the area under cultivation
- Conserves water and other inputs
- Boosts factor productivity, and lowers production costs.

SURFACE SEEDING:

In regions where wheat is grown and the soil stays wet for an extended period of time following the harvest of rice, tillage activities cannot be completed in a timely manner. In regions such as the eastern section of India's Indo-gangetic plains, wheat seeds can be sown, either dry or wet, in moist or saturated soil, either a few days before to or right after the rice crop is harvested. The "surface seeding" method of planting wheat works best in low-lying places when the watering period has advanced the wheat's growth stage. This technique minimizes cultivation costs, minimizes resource consumption, and manages weeds, making it perfect for rotating rice and wheat.

- ✓ Requires no tillage
- ✓ Broadcast dry or soaked seed under saturated condition
- ✓ Scope in areas where soil remains wet after rice harvesting
- ✓ Doubles the cropping intensity

ZERO TILLAGE:

One of the largest and most prevalent agricultural systems in the Indo-Gangatic plains, the rice/DSR-wheat system covered about 11 million hectares. Sowing wheat using

the Zero Till fertilizer-Seed Drill can be used to encourage timely sowing of wheat within the range of optimum limit and to take use of available soil moisture for initial stand establishment.

In the Indo-Gangetic Plains, the practice is becoming more popular, although heavy clay soils shouldn't use it. The method can be used as a component of conservation agriculture methods, specifically in the rice-wheat system. This is the most extensively used RCT, with potential for expansion into other regions. It covers over 3 million hectares in the Indo-Gangetic plains rice-wheat system.

- ✓ Zero tillage drill is simple and affordable
- ✓ Direct drilling in untilled conditions
- ✓ Advances sowing time Ÿ Seeding at comparatively lower as well as higher moisture
- ✓ Saves more than 90% fuel energy and time compared to practices followed during nineties.
- ✓ Reduces drudgery to the farmers.
- ✓ Similar or higher yield at lower cost

FIRBS-FURROW IRRIGATED RAISED BED-PLANTING SYSTEM:

The FIRB approach increases NUE and other inputs for economically viable crop yield while saving irrigation water by up to 40%. Various teams working on the FIRB system have created several versions of the machine appropriate for planting wheat and other crops on raised beds. The technique is also perfect for rotating rice and wheat, which lowers production costs by reducing the need for basic inputs like fertilizer and seeds by 25%, increasing WUE, controlling weeds like Phalaris minor, and, most importantly, conserving resources. Particularly suitable for regions where water is scarce is this RCT. By putting additional land under irrigation, the amount of water conserved can increase production. This technology has given similar yield in case of wheat but 10-30% higher yields in case of oil seeds and pulses Saves seed and fertiliser nitrogen by about 25%.

- ✓ Lowers water requirement by about 30%
- ✓ Less weed population on bed tops
- ✓ Facilitates mechanized weed control
- ✓ Less lodging

ROTARY TILLAGE:

The Rotary Tillage Machine is a time and energy-saving alternative to conventional tillage because it completely pulverizes the soil, allows for simultaneous seeding and soil moisture conservation, and combines a rotary tiller, light planker, and fertilizer drill. The DWR Rotavator-cum-drill is a rotary-till-drill machine that can be used to sow wheat in both regular and late-sown situations. It saves fuel and valuable time, which is especially useful for sowing wheat following rice harvest, especially basmati rice.

This device allows wheat to be sown in only one tractor operation, saving a significant amount of diesel and time compared to traditional field preparation methods. This technology has been tested for growing wheat crop and has potential to be extended to other crops also.

CONSERVATION AGRICULTURE:

A machine named as “Rotary Disc Drill” has been developed for Conservation Agriculture (CA). This is suitable for growing crops under CA where loose residue is retained on the land surface.

- ✓ Single pass seeding using ferti-seed drilling under surface retained loose residue and zero tillage conditions
- ✓ Saves more than 80% fuel energy and time compared to practices followed during nineties.
- ✓ Only machine which can seed crops in sugarcane ratoons with full trash
- ✓ Comparatively costly farm equipment.

PREPAREDNESS FOR NEW THREAT OF WHEAT BLAST:

Recently discovered in Bangladesh wheat, wheat blast has the potential to quickly spread to regions of India. Appropriate quarantine procedures, ongoing monitoring and surveying in Bangladesh's border regions, attentive behavior, and awareness campaigns are all implemented to stop entry and spread. To lessen the effects of this disease, foliar sprays of fungicide are advised if blast-like signs are noticed. Additionally, at ICAR-IIWBR, Karnal, anticipatory breeding for wheat blast has been started in cooperation with other significant institutions.

MAXIMIZING YIELDS BY AGRONOMIC INTERVENTIONS:

Upscaling innovation on a big scale is necessary to guarantee the widespread adoption of conservation agriculture technology. It will be challenging to realize the full potential of new production technology and superior cultivars without more effective crop management. Greater emphasis needs to be placed on precision farming and enhanced agronomic management using ecosystem approaches, as these strategies will likely enable the production of more wheat with less resources and through the application of conservation agriculture technologies.

When these resource-saving technologies are fully developed, they will have a significant impact on being sustainable, lucrative, and kind to the environment. Therefore, using better varieties in conjunction with effective crop management techniques would lower input costs, boost yields, and guarantee smallholder wheat growers' larger net profits. In order to increase wheat production in farmers' fields, new resource conservation technologies, farm mechanization, irrigation management, fertilizer management, weed management, and optimal crop stand establishment all require particular technologies to be created.

Farmers must select suitable varieties for enhanced yields through matching technology. Seed rate depends on seed size, germination percentage, time, and sowing method. Late sown wheat and bold seeded varieties require a 25% increase. Seeding depth should be 5-6 cm, and seed drills are better than broadcasting. Wheat requires 40 cm water and 4-6 irrigations depending on rainfall and water use.

CONCLUSION

"In conclusion, recent advances in wheat have marked a significant milestone in the quest for sustainable and efficient food production. Through cutting-edge research and innovative technologies, scientists and breeders have developed high-yielding, disease-resistant, and climate-resilient wheat varieties that are transforming the agricultural landscape. As the global population continues to grow, these breakthroughs will play a critical role in ensuring food security, mitigating the impacts of climate change, and promoting environmental sustainability. As we look to the future, continued investment in wheat

research and development will be essential to address emerging challenges and unlock the full potential of this vital crop. With collaboration and innovation, we can build a more food-secure world, one wheat plant at a time."

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