Popular Agriculture 2(5) 298-299(September, 2026)
Published at popularagriculture.com

Global E-Magazine
ISSN: 3139-7603

POPULAR ARTICLE

Cold stress in *rabi* rice: A growing concern for productivity

R. Rathod, Y.S. Parameswari, K. Chaitanya, P. Madhukar, K.P.C. Reddy

PJTAU – Regional Sugarcane and Rice Research Station, Rudrur – 503 188, Nizamabad, Telangana, India

Corresponding authors email: ramyarathod5@gmail.com

Manuscript received: September 24, 2026; Decision on manuscript, September 27, 2026; Manuscript accepted: September 30, 2026

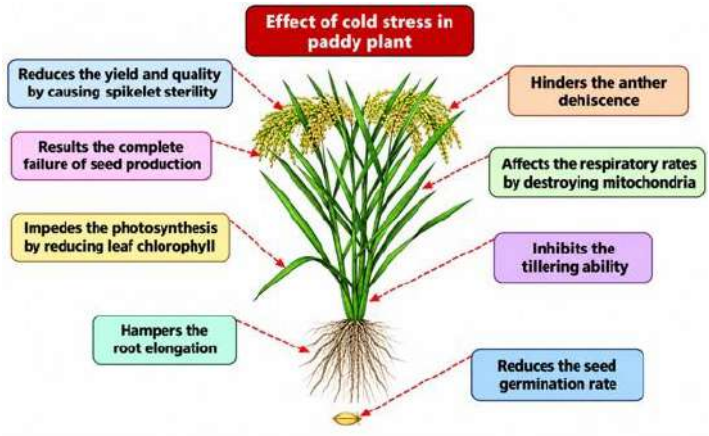
Intricacies of the subject

Rice, being a tropical crop, thrives best under warm and humid conditions. However, during the *rabi* season, when it is grown under relatively cooler temperatures, cold stress has emerged as a major constraint affecting growth and yield. In regions like Eastern and Southern India, rice experiences low night temperatures during December to February, often falling below 18°C. Such conditions adversely influence germination, tillering, and reproductive processes, leading to significant yield losses. The increasing frequency of cold spells due to climate variability has further intensified this problem, particularly as rice cultivation expands into new *rabi*-growing areas (Shahzad *et al.*, 2024; El-Refaee *et al.*, 2024).

Symptoms and impact on crop growth

Cold injury manifests differently depending on the growth stage. At the seedling stage, plants often show poor germination, yellowing, and stunted growth. At the reproductive stage, low temperature interferes with pollen formation and fertilization, resulting in spikelet sterility and poor grain filling. Panicles may remain partially filled or completely blank under severe stress (Bala *et al.*, 2025). Temperature fluctuations during the booting and flowering stages are especially harmful, directly reducing grain number and overall yield potential.

Figure 1: Effect of cold stress on paddy crop



Popular Agriculture 2(5) 298-299(September, 2026)
Published at popularagriculture.com

Global E-Magazine
ISSN: 3139-7603

Crop planning and variety selection

Recent research highlights that careful planning and varietal choice are the most effective ways to minimize cold-related losses. Adjusting sowing or transplanting time so that flowering does not coincide with the coldest months can protect the crop from severe injury (El-Refaee *et al.*, 2024). A difference of just ten to fifteen days in planting time can significantly alter the crop's exposure to low temperatures. Adopting cold-tolerant rice varieties such as Heera, Annapurna, Sahbhagi Dhan, CR Dhan 601, and CR Dhan 507 has shown good adaptability under cooler environments (Hossain *et al.*, 2023; ICAR-CRRI, 2024). In late planting situations, short-duration varieties are beneficial to escape cold during flowering.

Agronomic practices for cold management

Good agronomic management plays a crucial role in enhancing cold tolerance. Seed priming and shallow sowing improve germination under low temperatures. Maintaining a shallow water layer during cold nights stabilizes soil temperature and reduces chilling injury. Balanced nutrient management with zinc, boron, and moderate nitrogen application improves plant vigor and pollen fertility (El-Refaee *et al.*, 2024). The use of straw or organic mulch helps conserve soil warmth and protect roots from temperature shocks. During cold spells, a thin water film in the field at night can act as a thermal buffer. Foliar sprays of 2% DAP or micronutrients such as zinc and boron have been reported to aid recovery after exposure (Shahzad *et al.*, 2024). Avoiding heavy nitrogen top dressing during cold periods prevents lush vegetative growth that is more prone to damage.

Advances and future outlook

Research institutions like ICAR-NRRI, Cuttack, and ICAR-IIRR, Hyderabad are actively developing cold-tolerant rice varieties suitable for rabi conditions. Molecular studies have identified several key genes and QTLs such as qCTS12 and qCTB7 that enhance cold resilience, offering opportunities for breeding next-generation tolerant varieties (Shahzad *et al.*, 2024). Awareness and participation in Krishi Vigyan Kendra (KVK) demonstrations can further help farmers and stakeholders understand suitable variety selection and management practices.

Conclusion

An integrated approach combining improved varieties, optimum planting time, and balanced nutrient and water management can substantially reduce yield losses under cold stress. Studies indicate that adopting such practices can minimize yield reduction by 20–30% (El-Refaee *et al.*, 2024; Bala *et al.*, 2025). Strengthening cold-stress research and promoting adaptive practices will be essential for ensuring sustainable rice productivity during the *rabi* season under changing climate.

References

1. Shahzad, N., Khan, A. and Li, Y. 2024 The molecular mechanism of cold-stress tolerance in rice. Front. Plant Sci., 15:1401-1415.
2. El-Refaee, Y.Z., Ahmed, A.A. and Kim, S.Y. 2024 Mitigating cold stress in rice: genotype performance and adaptive responses. BMC Plant Biol., 24:310-322.
3. Hossain, M., Rahman, M.A. and Islam, T. 2023 Cold-tolerant and short-duration rice for Boro/Rabi season. Sustainability, 15:9850.
4. Bala, T., Zhang, X. and Singh, A.K. 2025 Genotypic variation and yield traits under cold stress in rice. Sci. Rep., 15:1189-1198.
5. ICAR-CRRI. 2024 Annual Report 2023-24.