Smart Fertilizer Use Can Boost Yields and Cut Pollution in South Asia’s Rice Farms

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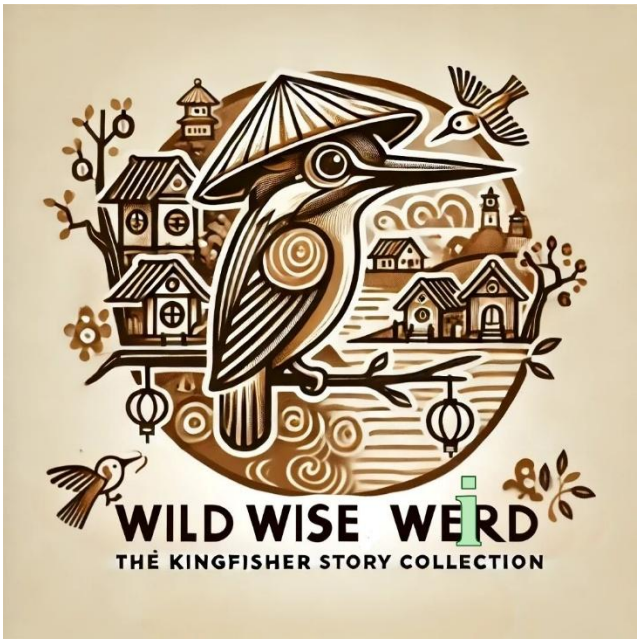

“There, Kingfisher and Cuckoo bask in the glorious vastness of the fields.

Standing on the side of the bountiful crops, Kingfisher leisurely starts a small talk. Oddly though, there are barely any answers. Some plants are busy flexing their muscles to counter the wind, while others are struggling to keep their heads intact or completely occupied with fighting off the rapacious birds. With their backs bent and faces down, no one is in the mood for idle chitchat.”

In “Light and Free”; *Wild Wise Weird* [1]

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Nitrogen fertilizers have long been credited with enhancing crop yields in South Asia, a region where rice farming supports food security for hundreds of millions [2-4]. However, new research published in *Nature Sustainability* [5] reveals a major inefficiency in current practices: over half of rice farmers (55%) in the region apply excessive nitrogen, leading to environmental degradation and wasted resources without improving harvests.

Drawing on a vast dataset of over 31,000 rice fields across India, Nepal, and Bangladesh, the study identifies two main strategies to improve nitrogen use efficiency (NUE)—a key measure of how effectively crops convert fertilizer into yield. The first, the nitrogen-saving pathway, involves reducing unnecessary fertilizer use. Researchers found that rice yields could be maintained while cutting nitrogen use by an average of 18 kg per hectare. This change alone could increase NUE by 22%, lower nitrogen pollution by 27%, and reduce government spending on fertilizer subsidies by 17%.

The second strategy, the yield-gain pathway, focuses on addressing non-nutritional barriers to productivity, such as water management and planting schedules. If all farmers achieved at least the average yield expected for their level of nitrogen input, overall rice production could increase by 8% while also improving NUE and reducing pollution. When both pathways are implemented together, the potential impact is even greater: a 32% improvement in NUE, an 8% increase in rice production, and a 36% reduction in nitrogen surplus.

Notably, the study found that conventional fertilizer management practices—such as adjusting source, quantity, timing, or placement—played a lesser role than broader agronomic improvements like earlier transplanting and better irrigation. These findings suggest that improving basic farming conditions may be more effective than simply tweaking fertilizer strategies.

However, change is not without obstacles. In countries like India and Bangladesh, heavy fertilizer subsidies reduce the financial motivation for farmers to optimize fertilizer use. The authors propose shifting these subsidies toward direct incentives for sustainable practices [6,7]. They also emphasize the need for region-specific strategies that account for diverse local conditions.

Sustainable agriculture is not just about producing more food but doing so in harmony with the environment [8,9]. By aligning agronomic practices with ecological realities, South Asia can simultaneously advance food security, environmental protection, and climate resilience.

References

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