

Less rice, more nutritious crops will enhance India's food supply

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Credit: Columbia University

India can sustainably enhance its food supply if its farmers plant less rice and more nutritious and environmentally-friendly crops, including finger millet, pearl millet, and sorghum, according to a new study from the Data Science Institute at Columbia University.

The study, published in the *Proceedings of the National Academy of Sciences*, finds that diversifying [crop production](#) in India, in this case replacing some rice—India's main crop—with millets and sorghum, would make the nation's [food supply](#) more nutritious while reducing irrigation demand, energy use, and greenhouse gas emissions. Such

diversification of crops would also enhance India's climate resilience without reducing calorie production or requiring more land.

"To make agriculture more sustainable, it's important that we think beyond just increasing food supply and also find solutions that can benefit nutrition, farmers, and the environment. This study shows that there are real opportunities to do just that," says Kyle Davis, an environmental data scientist at the Data Science Institute at Columbia University and lead author of the study.

With nearly 200 million undernourished people in India as well as widespread groundwater depletion and the need to adapt to climate change, increasing the supply of nutri-cereals may be an important part of solving India's food shortage, Davis says.

Historical practices, especially the Green Revolution, have promoted the use of high-yielding seed varieties, irrigation, fertilizers, and machinery and emphasized maximizing food calorie production often at the expense of nutritional and environmental considerations. But Davis assessed India's crops according to multiple indices. He and fellow researchers evaluated alternative production decisions across multiple objectives using India's rice-dominated monsoon grain production as a case study.

The team performed a series of optimizations to either maximize the production of important dietary nutrients (i.e., protein and iron), minimize greenhouse gas emissions and resource use (i.e., water and energy), or maximize resilience to climate extremes. They found that planting more coarse cereals such as millets and sorghum could improve India's national food supply in myriad ways. On average, it would increase protein by 1 to 5 percent; increase iron supply by 5 to 49 percent; increase climate resilience (1 to 13 percent fewer calories lost during a drought), and reduce greenhouse gas emissions by 2 to 13

percent. The diversification of crops would also decrease the demand for irrigation water by 3 to 21 percent and reduce [energy use](#) by 2 to 12 percent while maintaining calorie production and using the same amount of cropland.

These findings show the many potential benefits of increasing millet and sorghum production in India, particularly in regions where rice yields are currently low, Davis says. "This work provides strong evidence that agriculture can be a powerful tool in helping to solve many of our planet's most important challenges, including malnutrition, [climate change](#), and water scarcity."

The Indian Government is also promoting the increased production and consumption of nutri-cereals, which will be important for farmers' livelihoods and the increased cultural acceptability of these grains.

More information: Kyle Frankel Davis et al. Assessing the sustainability of post-Green Revolution cereals in India, *Proceedings of the National Academy of Sciences* (2019). [DOI: 10.1073/pnas.1910935116](#)

Provided by Columbia University

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