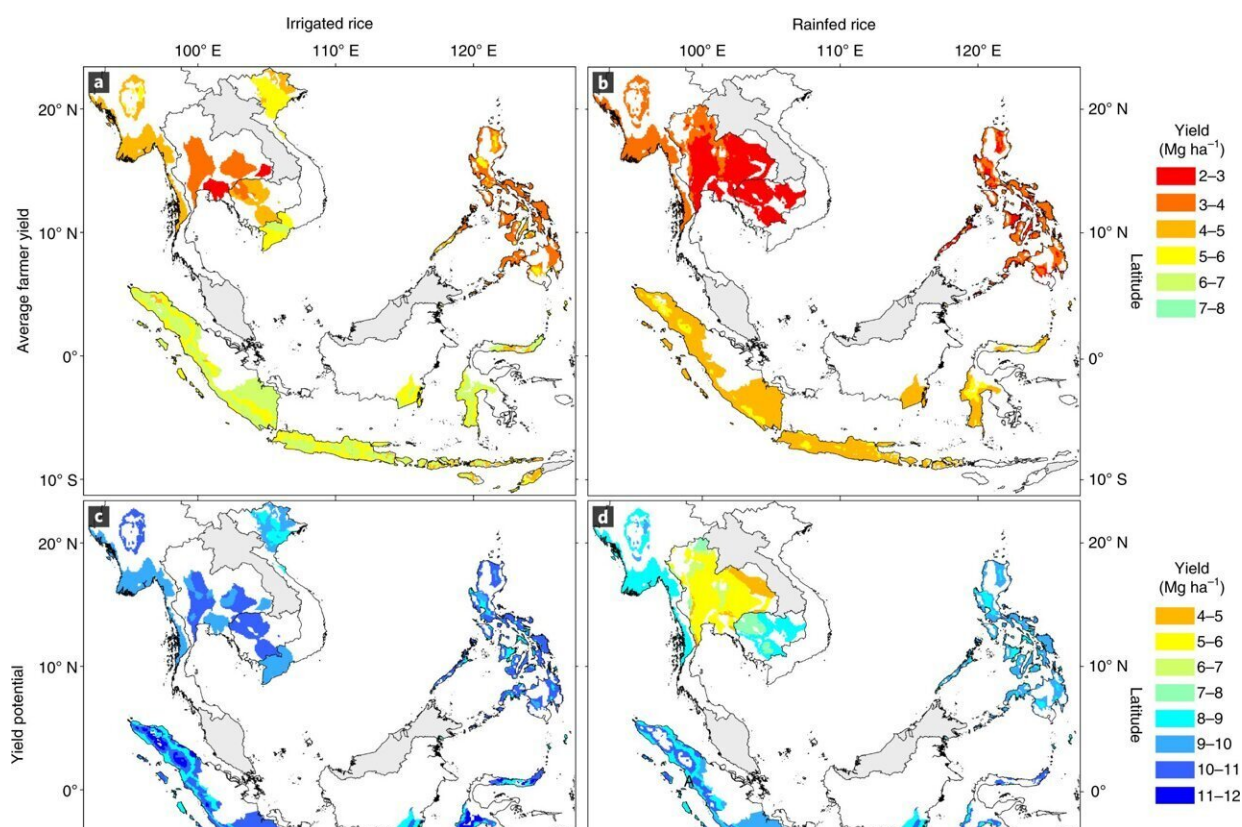


# Southeast Asia must close yield gap to remain a major rice bowl

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Average farmer yield, yield potential and yield gap (as a percentage of yield potential) for irrigated and rainfed rice. a–f, Panels show average farmer yield (a,b), yield potential (c,d), and yield gap (as a percentage of yield potential) (e,f) for irrigated (a,c,e) and rainfed (b,d,f) lowland rice for the six major rice-producing countries in Southeast Asia at the climate zone level. Other countries in Southeast Asia not included in our yield-gap analysis are shown in gray. Data provided in Source Data Fig. 3. The base map was applied without endorsement using data from the Database of Global Administrative Areas. Credit: *Nature*

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At least 40% of global rice exports come from Southeast Asia, making the region a major rice bowl. The region helps feed other parts of the world such as Africa and the Middle East.

Projections show that global [rice](#) demand is set to increase by 30% by 2050. With the continuing rice trade and limited scope available for other main rice-producing countries like China and India to generate a rice surplus, Southeast Asia faces a challenge in stepping up to ensure adequate global rice supply.

But [crop yields](#) stagnate, land allotted for agriculture does not increase, and [climate change](#) remains a looming threat, raising concerns about the capacity of the region to remain a large net exporter.

In a recent study published in *Nature Food*, an international team of researchers, including those from the major rice-producing nations in Southeast Asia, estimated the difference between yield potential and average farmer yield across the six countries: Cambodia, Indonesia, Myanmar, Philippines, Thailand and Vietnam.

The initiative was led by the University of Nebraska-Lincoln in the U.S. and the International Rice Research Institute (IRRI) in the Philippines and multi-institutional collaborators.

Results from the project are available via the Global Yield Gap Atlas ([www.yieldgap.org](http://www.yieldgap.org)), a collaboration between the University of Nebraska–Lincoln and Wageningen University designed to estimate the difference between actual and potential yields for major food crops worldwide.

"Over the past decades, through renewed efforts, countries in Southeast Asia were able to increase [rice yields](#), and the region as a whole has continued to produce a large amount of rice that exceeded regional demand, allowing a rice surplus to be exported to other countries," said lead author Dr. Shen Yuan, a postdoctoral research associate at Huazhong Agricultural University in China. "The issue is whether the region will be able to retain its title as a major global rice supplier in the context of increasing global and regional rice demand, yield stagnation and limited room for cropland expansion."

Through a data-intensive approach, the researchers determined that the region has the potential to increase production on existing cropland and remain a major global rice supplier—but changes in production and [management techniques](#) will be key, and producers could stress natural resources in the process.

Researchers found that the average yield gap represents nearly half of the yield potential estimated for the region, but it is not the same for every country. Yield gaps are larger in Cambodia, Myanmar, the Philippines, and Thailand, but comparably smaller in Indonesia and Vietnam.

"We used an approach that consists of a combination of crop modeling, spatial analysis, and use of detailed databases on weather, soil, and cropping system data," said Dr. Patricio Grassini, associate professor at the Department of Agronomy and Horticulture, University of Nebraska-Lincoln. "The regional extent of the study together with the level of detail in relation to spatial and temporal variation in yield gaps and specificity in terms of cropping systems is unique, providing a basis for prioritizing agricultural research and development and investments at regional, national and sub-national levels"

According to the study, the region needs to close the existing yield gap

substantially to reduce the need for rice imports, allowing for an aggregated rice surplus of 54 million tons available for exports.

"Our analysis shows that Southeast Asia will not be able to produce a large rice surplus in the future without acceleration of current rates of yield gains," Grassini said. "Failure to increase yield on existing cropland areas will drastically reduce the rice exports to other regions and the capacity of many countries in the region to achieve or sustain rice self-sufficiency. It will also put additional pressure on land and water resources, risking further encroachment into natural ecosystems such as forests and wetlands."

Researchers suggest a number of interventions needed to close the gap, including improvement of crop management practices, such as the use of fertilizer and irrigation, nutrients, water, and [pest management](#), as well as mitigation of production risks in lowland rainfed environments.

"The challenge is how to increase yield while minimizing the negative environmental impact associated with intensive rice production. For example, tailoring nutrient management to each environment will help increase yield and farmer profits while reducing nutrient losses. Likewise, integrated pest management is a knowledge-intensive but valuable approach if applied correctly and holistically to reduce yield losses to weeds, pests and diseases while minimizing excessive use of pesticides and associated risks to the environment and people," said IRRI Senior Scientist Alice Laborte.

"Closing the rice yield gaps requires the concerted effort of policymakers, researchers, and extension services to facilitate farmers' access to technologies, information, and markets. Continued investment in rice research is crucial," she added.

**More information:** Patricio Grassini, Southeast Asia must narrow

down the yield gap to continue to be a major rice bowl, *Nature Food* (2022). [DOI: 10.1038/s43016-022-00477-z](https://doi.org/10.1038/s43016-022-00477-z)

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