Stabilizing nations' food production through crop diversity

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With increasing demand for food from the planet's growing population and climate change threatening the stability of food systems across the world, University of Minnesota research examined how the diversity of crops at the national level could increase the harvest stability of all crops in a nation.

The research, published Wednesday in the journal *Nature*, examined 50 years of data (1961-2010) from the Food and Agricultural Organization (FAO) of the United Nations on annual yields of 176 crop species in 91 nations to determine how stable and predictable the food supply is in each country. This is the first research of its kind to examine the relationship between crop diversity and food stability at the scale of nations.

"We found an intriguing pattern—nations that grow more crops tend to have more stable food supplies," said G. David Tilman, co-author of this study and director of the Cedar Creek Ecosystem Science Reserve in the College of Biological Sciences. "Our analysis also shows that nations with a variety of crops are less likely to experience a severe food shortage."

That type of shortage is described as a year in which a nation has a 25% or greater decline in the total yield all of its crops combined. After examining the FAO data, Tilman and Delphine Renard—a postdoctoral researcher at the University of California Santa Barbara—found that:

- nations with some of the lowest crop diversities experienced a severe food shortage about every eight years;
- countries with some of the highest diversities of crops experienced a severe food shortage about every 100 years;
- robust irrigation capabilities in nations also have significant stabilizing effects on crop production, leading to fewer years with severe food shortages.

The research suggests that nations that appropriately increase crop diversity may have more stable food supplies. In areas of the world where there are limited water resources or where increased irrigation is unaffordable, researchers suggest greater crop diversity may be particularly useful as it may allow farmers to not only help stabilize the

food supply, but their income as well.

The research also found:

- that the stability of a nation's food supply depended on the types of crops grown, with grains and legumes seeming to lead to more stable food supplies;
- food supply stability depended on having not just more crops, but rather having those crops be more evenly abundant;
- heat waves harmed yields and stability and while fertilization greatly increased yields, it did not increase stability.

"Food supplies are expected to become less stable because of climate change," Tilman said. "We encourage nations around the world to evaluate their crop diversity and determine if there might be some additional crops that would work well for them. Increasing crop diversity is one tactic to prepare for the potential impacts of climate change on crop production."

Tilman suggests that alongside crop diversity planning, nations should consider the benefits of new drought-tolerant crop varieties, increased irrigation, intercropping and more transparent agricultural trade.

"There are 7.7 billion people on Earth and we all depend on a stable, global food supply," said Tilman. "These tactics are just one of many we can follow to plan our future and better prepare future generations to live healthily on this planet."

Future research needs to be taken to understand which types and combinations of crops better suit specific climates and soils to enhance food supply stability.

More information: Delphine Renard et al, National food production

stabilized by crop diversity, *Nature* (2019). DOI: 10.1038/s41586-019-1316-y