

Using intercropping systems for sustainable global agricultural production

January 5 2023



Aerial view of crops around Chalon-sur-Saône (Region of Bourgogne, France) .
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With the increasing food demands of a growing world population, it is essential to increase agricultural production while reducing its

environmental footprint. Crop diversification techniques have often been proposed as agroecological solutions to achieve this goal. Among them, intercropping—the growth of several crop species in the same fields—seems to be particularly promising. This practice has always been uncommon in Europe and, although it has traditionally been used in countries of the Global South, it is currently declining due to urbanization and migration of rural populations.

Global conclusions drawn from global data

To objectively assess the performance of intercropping systems under modern conditions, a team of French, Dutch, and Chinese researchers performed a detailed analysis of a vast database, which brought together information from 226 agricultural experiments conducted worldwide. Based on a [meta-analysis](#), the scientists were able to compare the productivity of monocultures and different intercropping configurations. Their findings were published on 3 January in *PNAS*.

After analyzing grain yield data, the researchers used data on grain calories and protein concentrations to assess the relevance of intercropping for food and feed production. They were then able to quantify the differences between intercropping and monocropping, and identify crop combinations and [management practices](#) that result in higher grain, calorie and protein yields with intercropping than with monocropping.

Combining several crop species leads to equal or higher productivity on 19% less land

This research showed that intercropping resulted in mean protein levels that were similar to and often higher than those obtained with monocultures.

It also demonstrated that intercropping systems were more productive overall. To generate the same amount of grain, 19% less land was needed with two-species intercropping combinations than with monocultures of each species. Compared to the most productive species, grain yield and caloric content were 4% lower, on average, under intercropping versus monoculture conditions. In contrast, total protein levels are equivalent for both cropping systems, and are even higher for intercropping in 47% of cases, especially for moderately fertilized corn-legume combinations.

By reducing the need for farmland and fertilizers, intercropping can help sustainably meet increasing demands for feed and food as the world's population expands. Looking to the future, this study and its quantitative results can guide agricultural policies at the global scale.

More information: Chunjie Li et al, The productive performance of intercropping, *Proceedings of the National Academy of Sciences* (2023). [DOI: 10.1073/pnas.2201886120](https://doi.org/10.1073/pnas.2201886120)

Provided by INRAE

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