# Perennial rye crop shows potential for greener agriculture

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Keunbae Kim monitors rye plots using devices that measure how much carbon dioxide and water vapor move up to the atmosphere or down to the plant canopy and the soil. The findings over two years showed that a four-hectare perennial rye plot can absorb an amount of atmospheric $CO_2$ equivalent to a vehicle burning 35,000 liters of gasoline. Credit: University of Alberta

Annual crops are the farmer's bread and butter, the crops they rely on most, but at least one type of perennial grain is proving much more beneficial to the environment.

A crop of perennial rye absorbed a substantial amount of carbon dioxide, or $CO_2$, a University of Alberta study showed, while an annual crop had no uptake of the greenhouse gas.

The discovery builds on previous research by the team that found environmental and other advantages for including perennial crops in farmers' planting lineup.

"While there's still much more research to be done, they're emerging as one more option that farmers could use in their tool kit to contribute to sustainable agriculture," said study co-author Guillermo Hernandez Ramirez, a soil scientist in the Faculty of Agricultural, Life & Environmental Sciences.

A four-hectare segment of perennial rye can absorb an amount of atmospheric $CO_2$ equivalent to a vehicle burning 35,000 liters of gasoline, according to the two-year experiment at the U of A's Breton Plots.

There are several possible reasons for this, said Keunbae Kim, who co-authored the study to earn his master's degree in soil science.

"The plant has more time to grow, so it has more and deeper root systems. There's also less disturbance related to having to plant every year," Kim said.

Perennial crops, which include other grains such as wheat, as well as legumes and oilseeds, remain productive for two or more years after being planted. Annual crops are planted every year.

The study also showed that the perennial plot didn't use more water than its annual cousin—another positive finding, Kim noted.

"We were concerned that perennial rye could lead to drought because of longer growing seasons and the fact it had more biomass."

Earlier research by the team showed that perennial rye also mitigates nitrous oxide, another greenhouse gas, and that the crop stores more carbon in the soil.

Other U of A research has shown that annual grain crops have the potential to sequester carbon—depending on factors like crop rotation, fertilizer supplements, and climate and soil conditions—but not as much as the perennial grain in the latest research, Hernandez Ramirez added.

Food producers are more comfortable using annual crops, but he believes further research will change that.

"Annual crops have been studied for decades, so there's a lot of knowledge available on how to manage them. There's still a gap with perennial crops."

Hernandez Ramirez said issues such as increasing yield, dealing with disease and improving winter survival still need to be addressed to make perennial crops more reliable, but producers are tuned to the potential.

"When we talk with farmers, they express a strong interest because they see some advantages, like less time spent seeding. As we start to gain efficiencies with perennial crops, we can be more environmentally friendly and also continue to meet the needs of society."

The research was published in *Agricultural and Forest Meteorology*.

**More information:** Keunbae Kim et al, Carbon and water dynamics of a perennial versus an annual grain crop in temperate agroecosystems, *Agricultural and Forest Meteorology* (2022). DOI: 10.1016/j.agrformet.2021.108805

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