A PERENNIAL REVOLUTION OF AGRICULTURE – IS IT DESIRABLE, POSSIBLE, IMMINENT?

The Land Institute (USA) in collaboration with Birzeit University (Palestine), Lund University (Sweden), Yunnan University (China), and Swedish University of Agricultural Sciences (Sweden).

July 6, 2021 - Program

15:00 Setting the scene of a perennial revolution (Lennart Olsson, Lund University)
15:10 The prospects and approaches of developing perennial grain crops (Tim Crews, TLI)
15:25 Perennial sorghum (Pheonah Nabukalu, TLI)
15:35 Perennial rice (Fengyi Hu, Yunnan University)
15:45 Perennial grain crops for temperate climates (Anna Westerbergh, Swedish U. Agricultural Sci.)
16:00 A perennial vision (Aubrey Streit Krug, TLI, Omar Tesdell, Birzeit University)
16:10 Discussion
16:30 Closing the session

About 87% of the world's harvested area is cultivated with annual crops, mainly grains (cereals, oilseeds, and pulses) that must be resown every year/season. A shift to perennial grain crops would turn cropping into a carbon sink for decades, would likely reduce greenhouse gas emissions such as nitrous oxide, and would significantly reduce erosion and nutrient leakage (1). Continued climate change is rendering our existing cultivars increasingly vulnerable to stress and ultimately unfit for many regions of the world. Cropping systems involving new perennial cultivars have potential for better adaptation to climatic conditions towards the second half of this century. Perennial crops have the potential to drastically reduce the costs of farming by cutting the need for external inputs (seeds, fertilizers, pesticides, machinery, energy, and labor) and hence generate social and economic advantages particularly to farmers and rural societies.

Development of new perennial grain crops through de novo domestication and wide hybridization have advanced tremendously in the last decade thanks to scientific and technological advancements (2). The key benefits of perennial crops are that their widespread root systems help sequester carbon in the soils for extended periods of time, water and minerals are used more efficiently, and weeds are effectively managed. Some of them are also exceptionally drought resistant and can bring soil erosion and nutrient leaching to a practical minimum. There are already commercial cultivars of perennial rice as well as cultivars of perennial Intermediate Wheatgrass, a relative of wheat in early stages of commercialization under the name Kernza®. The yields of intermediate wheatgrass are still low compared to conventional wheat, but continued breeding can result in a competitive perennial alternative to wheat in 20-25 years. A range of other crops are already in the pipeline for domestication and breeding as perennial crops including oilseeds, and pulses. Equally important is the development of perennial polycultures, such as intercropping of perennial grains and legumes, making the system more self-sufficient in nitrogen. These results are proofs of concept that high yielding perennial cultivars can be developed in the timeframe of a few decades, but research on all aspects of such a "perennial revolution" are urgently needed.

References

1. T. E. Crews, W. Carton, L. Olsson, Is the future of agriculture perennial? Imperatives and opportunities to reinvent agriculture by shifting from annual monocultures to perennial polycultures. Glob. Sustain. 1, e11 (2018).

2. L. DeHaan, S. Larson, R. L. López-Marqués, S. Wenkel, C. Gao, M. Palmgren, Roadmap for Accelerated Domestication of an Emerging Perennial Grain Crop. Trends Plant Sci. 25 (2020), pp. 525–537.

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