High probability of yield gain through conservation agriculture in dry and cool regions for major staple crops

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Conservation agriculture (CA) has been promoted to reduce land degradation, improve the soil fertility, the soil structure and increase the level of soil organic carbon over time. It is expected to mitigate climate change and enhance the resistance of crops to the changing climate. Yet, its impacts on crop yields remains controversial. To gain further insight on the sustainability of CA, we mapped the probability of yield gain when switching from conventional tillage systems (CT) to CA worldwide. The range of yield changes were estimated with machine learning algorithms trained by 2828 paired yield observations on 8 crop species extracted from 323 publications. CA stands a more than 50% chance to outperform CT in dry and cool regions of the world, while it can lead to yield losses of up to 59% in warmer and wetter regions. Residue retention has the largest positive impact on CA productivity compared to other management practices. The promising and the risky regions for CA global implementation were identified. The productive performance of CA for different crops in future climate were also estimated and mapped globally, the results of different scenarios were compared and analyzed. Overall, with proper managements, CA appears as a sustainable agricultural practice for specific climatic regions and crop species.