Conservation agriculture improves nitrogen use in semi-arid climate in central Mexico

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Introduction
Nitrogen is a limiting factor in agricultural production in many regions of the world. Fertilization could greatly improve yields, but proper timing and good agronomic management are essential to achieve best use of nitrogen and reduce the risk of leaching. In semi-arid climates, water availability limits nitrogen use efficiency of crops. Conservation agriculture, based on minimum tillage, crop residue retention and crop rotations can significantly improve water availability under such conditions compared to agronomic management with conventional tillage.

Material and Methods
An experiment was established at CIMMYT’s experimental station El Batán in central Mexico, investigating the effect of different modes of nitrogen application on maize and wheat yields with and without tillage. Data were collected in four years. The experiment was divided into two main blocks consisting of tillage treatments; permanent beds (PB) and conventionally tilled beds (CB). The blocks were subdivided by crop rotations maize-wheat, wheat-maize and wheat monoculture. Four N treatments were applied; (1) control treatment without N fertilization, (2) 80 kg/ha basal banded, (3) 80 kg/ha at first node stage for wheat and at 4-5 leaf stage for maize, (4) 80 kg/ha divided between basal banded and first node/ 4-5 leaf stage.

Results
Maize yields were higher with PB than CB (Fig. 1). Nitrogen fertilization improved yields compared to the control treatment under PB. Under CB no yield improvement was observed with any of the fertilized options compared to the control. In wheat the results were similar (Fig. 2). Yields were highest with conservation agriculture, followed by yields on PB with monoculture. Fertilization improved yields on PB but not on CB.

Conclusion
Our results suggest that investing in inputs only makes sense when those inputs address the factors most limiting production. In the semi-arid environment studied here, addressing water stress through conservation agriculture had a larger effect on yield than N fertilization.