Uncovering the benefits of cover crops in temperate cropping systems: first results from a long-term experiment in the Rolling Pampa, Argentina

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Our aim was to disentangle the effects of cover crops in crop sequences in intensively managed cropping systems

Cover crop benefits have been largely studied in temperate cropping systems worldwide. Sowing cover crops during the cool-season, particularly before summer crops, presents several advantages, such as increasing annual carbon inputs, weed suppression, and nitrogen leaching reduction. Interestingly, cover crops are rarely grown in grain cropping systems in the Argentine Pampas, notwithstanding the investigations carried out in a wide range of conditions. Moreover, information about when including cover crops in rotational schemes is still scarce.

METHODS

A long-term experiment was started in 2014 in a commercial field in the Rolling Pampa, the Corn-Belt of Argentina(Pergamino, Buenos Aires, S33.9°, W60.6°). Before soybean, triticale-hairy vetch cover crops were sown, which had maize or soybean as preceding crops. Treatments without cover crops were also included. Only soybean crops in the second cropping season were compared. The experiment is a randomized block design with three replications. Size of all experimental units is 7.3m by 100m.

RESULTS & DISCUSSION

Cover crops and the preceding crop type significantly affected soybean yields ($p<0.001$), without significant interaction ($p>0.1$) (Fig. 1). Higher yields were obtained without cover crops (3254 kg ha-1 vs. 2984 kg ha-1). Soybean yields with maize as preceding crop (3503 kg ha-1) were higher than with soybean (2735 kg ha-1). Accumulated biomass of cover crops was higher when grown after soybean (5338 kg ha-1, SEM=943.4 kg ha-1) than after maize (3542 kg ha-1, SEM=410.5 kg ha-1).

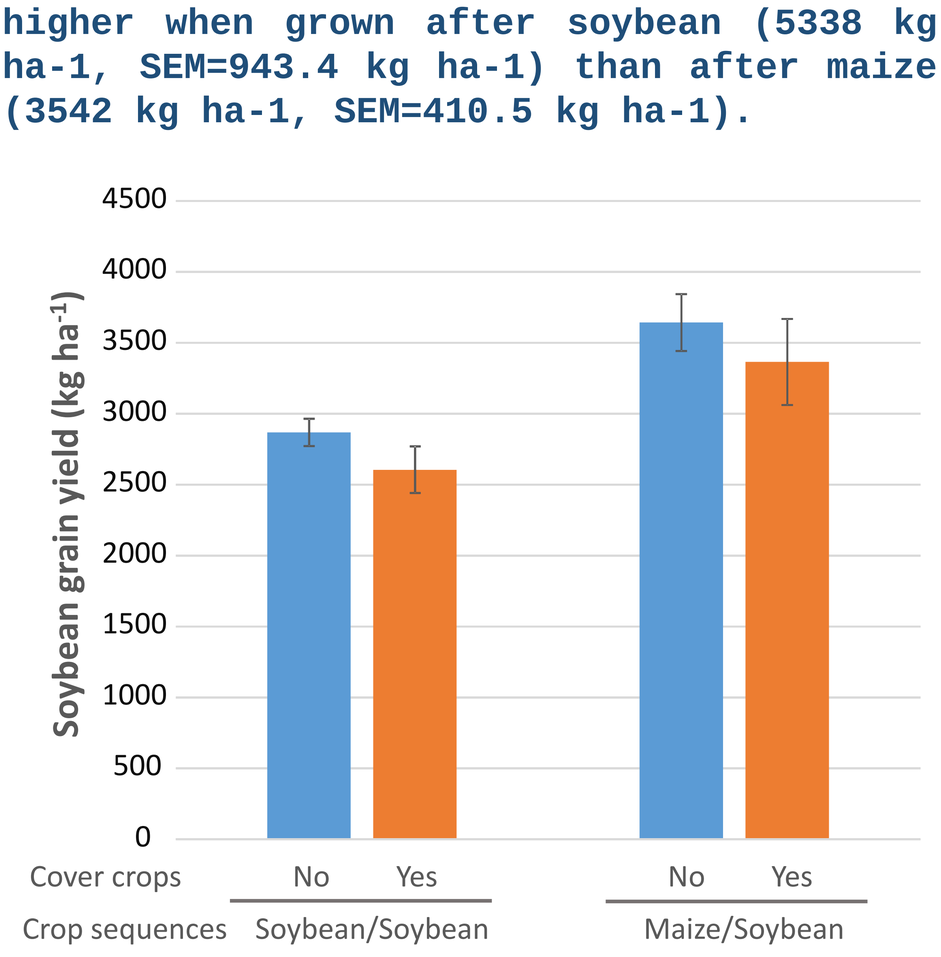

Figure 1: Grain yields of soybean crops grown after soybean crops or after maize crops, with or without cover crops during the precedent fallow period

Low yields of summer crops grown after cover crops have been reported under particular agronomical and environmental conditions. This could be attributed to water availability to the following summer crop and/or nitrogen immobilization during cover crop decomposition.

Nitrogen availability was lower when cover crops were killed, irrespective of the crop sequence (Fig. 2)

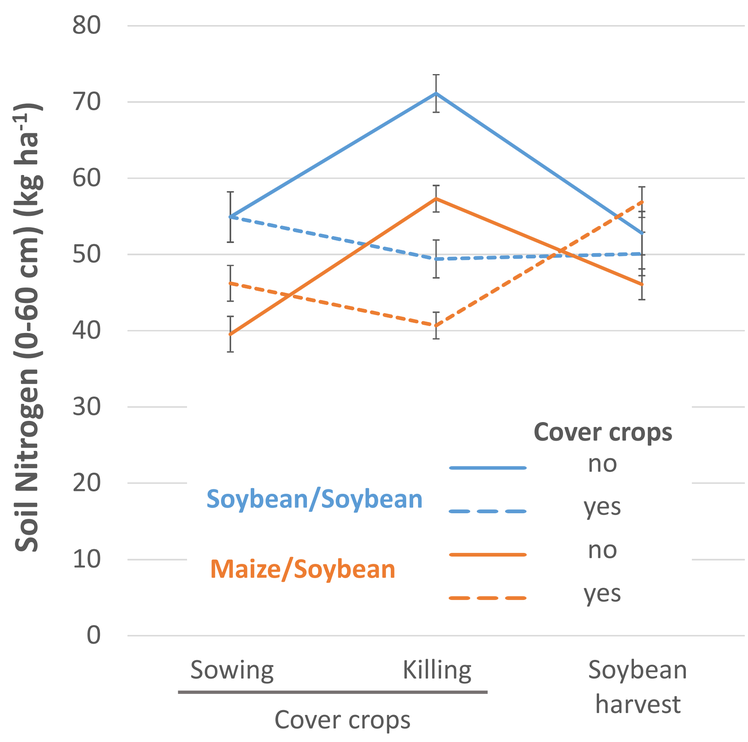

Figure 2: Nitrogen availability in the soil (kg ha^{-1}, 0-60 cm) at sowing (12 May 2015) and killing (5 Oct 2015) of cover crops and at the harvest of soybean crops (5 May 2016)

Although cover crops do increase annual carbon input in continuous cropping systems, avoiding yield losses requires to disentangle the intermingle effects between agronomical and environmental factors. Such yield losses could be mitigated by managing the sowing pattern and density of cover crop mixtures, fertility, timing between herbicide application to terminate cover crops and crop sowing date.

Widespread adoption of cover crop by farmers can be promoted by revealing their long-term benefits through uncovering the factors undermining yields.

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