

## IMPACT: CROP YIELD

### Reference 7

Tiecher, T; Pias, OHD; Bayer, C; Martins, AP; Denardin, LGD; Anghinoni, I 2018 Crop Response to Gypsum Application to Subtropical Soils Under No-Till in Brazil: a Systematic Review *Revista Brasileira de Ciencia do Solo* 42:170025 10.1590/18069657rbcS20170025

### Background and objective

The use of gypsum to improve the root environment in tropical soils in the southeastern and central-western regions of Brazil is a widespread practice with well-established recommendation criteria. However, only recently gypsum began to be used on subtropical soils in South of Brazil, so available knowledge of its effect on crop yield is incipient and mainly for soils under no-till (NT) systems. Available studies span a wide range of responses, from a substantial increase to a slight reduction in crop yield. Also, the specific conditions leading to a favorable effect of gypsum application on crop yield are yet to be accurately identified. The primary objectives of this study were to examine previously reported results to assess the likelihood of a crop response to gypsum and to develop useful recommendation criteria for gypsum application to subtropical soils under NT in Brazil.

### Search strategy and selection criteria

Data were obtained from different publications, i.e., a book, two dissertations, 16 scientific papers, and a conference paper. The publications were retrieved from the databases Science Direct, Scielo, and Google Scholar, using keywords in Portuguese (gesso agrícola, gessagem, fosfogesso, plantio direto, produtividade de graos) and English (gypsum, no till, no tillage/no-till, crop yield, grain yield). The criteria for publication exclusion were as follows: (a) studies focused on biomass production only; (b) studies conducted in greenhouses and/or on soils under conventional tillage; and (c) studies not reporting the initial main chemical properties of the soils.

### Data and analysis

Crop data were divided according to two different criteria. One was crop response to gypsum application, classified as: (a) positive (yield increase) or (b) either negative (yield decrease) or absent (no response). The other criterion was the combination of the presence or absence of subsurface soil acidity with water deficiency, which led to four different possible scenarios, namely: (a) water deficiency and high subsurface acidity; (b) high subsurface acidity but no water deficiency; (c) water deficiency and low subsurface acidity; and (d) low subsurface acidity but no water deficiency.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
20	Grain yields in subtropical Brazil	Gypsum application	Specific treatment without gypsum, that induced the highest yield	Metric: Crop yield; Effect size: Ratio of the considered metrics in the intervention to the considered metrics in the control	0.4375

### Results

- Scenario I: water deficiency and high soil subsurface acidity. Only 3 of the 73 growing seasons examined had high acidity in the soil subsurface with water deficiency. Soybean was cultivated in all three. Under these conditions, gypsum application invariably increased crop yield.
- Scenario II: no water deficiency and high soil subsurface acidity. A total of 33 growing seasons corresponded to the scenario of high acidity in the soil subsurface layer in the absence of water deficiency (Scenario II). In 18 of the 33 seasons, soybean was cultivated, which responded positively to gypsum application in only one case. This scenario also comprised 12 growing seasons with corn, of which 10 (83 %) exhibited an increase in grain yield in response to gypsum application. Wheat crops responded positively to gypsum in two of the three growing seasons of this scenario.
- Scenario III: water deficiency and low soil subsurface acidity. Soils with low subsurface acidity associated to water deficiency (Scenario III) were studied in seven growing seasons. Five of them had a positive response to gypsum application and soybean was planted in only one.
- Scenario IV: no water deficiency and low soil subsurface acidity. Scenario IV comprised 30 growing seasons (41 % of all) (Table 2). Of these, 15 involved soybean, two black oat, two wheat, and one barley. No positive response to gypsum application was observed in any crop under these conditions.
- Response of grass and legume crops to gypsum application. The results of this systematic review confirm that soybean, which is the main cash crop in South of Brazil, is less responsive to gypsum than grasses such as corn and wheat.

### Factors influencing effect sizes

- No factors influencing effect sizes to report

### Conclusion

Irrespective of water deficiency, applying gypsum to soils with high subsurface acidity increased the average yield by 14 % in corn (85 % studied cases) and by 20 % in winter cereals (75 % of cases). Soybean only responded positively to gypsum in the simultaneous presence of high soil subsurface acidity and water deficiency (average increase 23 %, 100 % of cases). However, no proper statistical analysis is available in this work.