SINGLE-IMPACT FICHE
SOIL AMENDMENT WITH LIME OR GYPSUM

IMPACT: SOIL PHYSICAL-CHEMICAL QUALITY

Data extracted in April 2021

Note to the reader: This fiche summarises the impact of soil amendment with lime or gypsum on Soil physical-chemical quality. It is based on 3 peer-reviewed synthesis research papers. Each synthesis paper includes a number of individual studies, which in this case is of 39, 59 and 175.

1.WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT:

Soil amendment with both gypsum and lime, compared to no amendment, showed a positive effect on Soil physical-chemical quality in the 3 synthesis papers reviewed (see **Table 1**).

From the 3 reviewed synthesis papers, only 1 includes data collected in Europe (on lime).

Table 1. Summary of effects. The effect with the higher score is marked in bold and the cell coloured. The numbers between parenthesis indicate the number of synthesis papers with a quality score of at least 50%. Details on quality criteria can be found in the next section.

Impact	Intervention	Control	Positive	Negative	No effect	Uncertain
Improve soil-physical quality	Gypsum	No gypsum	**1 (1)**	0	0	0
	Lime	No lime	**2 (2)**	0	**0**	0

- QUALITY OF THE SYNTHESIS PAPERS: *The quality score summarises 16 criteria assessing the quality of three main aspects of the synthesis papers: 1) the literature search strategy and studies selection; 2) the statistical analysis; 3) the potential bias. Details on quality criteria can be found in this document* →.

As shown in the "Quality score" in **Table 2**, the quality level ranges from 62% to 94%. The least frequently satisfied quality criterion was "Publication bias analysed".

2. IMPACTS

The main characteristics and results of the synthesis papers are summarized in **Table 2**. Detailed results of each synthesis study are reported in the summary reports.

Table 2. Main characteristics of the synthesis papers reporting impacts of soil amendment with lime or gypsum on Soil physical-chemical quality. The references are ordered chronologically with the most recent publication date first.

Reference	Population	Geographical scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Wang Y, Wang Z, Liang F, Jing X, Feng W 2021	Saline-sodic and alkaline soil types	China	59	Soil amendment with flue gas desulfurization gypsum (FGDG)	No gypsum control under identical experimental conditions	Soil pH, Soil exchangeable sodium percentage (ESP)	Application of flue gas desulfurization gypsum (FGDG) significantly reduced soil pH (−8.1%) and ESP (−37.4%).	62%

Reference	Population	Geographical scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Kong L, Guo Z, Peng C, Xiao X, He Y 2021	Rice cultivation	Asia	39	Liming treatment, including $CaCO_3$, $Ca(OH)_2$, and CaO	No-liming control under identical experimental conditions	Soil pH	Liming significantly increases acidic-soil pH in rice cultivation.	94%
Li Y.; Cui S.; Chang S.X., Zhang Q. 2019	Field-studies, laboratory incubation or greenhouse pot studies	Global (including Europe)	175	Liming treatment, including dolomite ($CaMg(CO_3)_2$), calcium hydroxide ($Ca(OH)_2$), calcium carbonate ($CaCO_3$), and calcium oxide (CaO)	No-liming control under identical experimental conditions	Soil pH, Cation exchange capacity (CEC), soil nutrients availability	To effectively neutralize soil acidity, the optimum liming duration, rate, and material type were < 3 years, 3–6 Mg ha−1, and $Ca(OH)_2$, respectively. Liming significantly ameliorated soil Al_3+, increased basic cations (Ca_2+ and Mg_2+), neutralized soil pH across different cropping systems, and improved the soil nutrient status (increasing exchangeable nitrogen, potassium, and phosphorous).	81%

3. KNOWLEDGE GAPS

Li Y.et al. The complexity of responses identified in this study emphasizes the need for adopting more advanced data-science algorithms coupled with high-dimensional data sets in the future that could enhance our understanding of the underlying mechanisms of liming on an agroecosystem basis.

4. SYSTEMATIC REVIEW SEARCH STRATEGY

Keywords	Search equations WOS	*TOPIC: ("liming" OR "limest*" OR "chalk*" OR "marl*" OR "gypsum") AND TOPIC: (soil) AND TOPIC: ("meta-analy*" OR "systematic* review*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis")*
	Search equations SCOPUS	*TITLE-ABS-KEY (("liming" OR "limest*" OR "chalk*" OR "marl*" OR "gypsum")) AND TITLE-ABS-KEY (soil) AND TITLE-ABS-KEY (("meta-analy*" OR "systematic* review*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis"))*
Search dates	No time restrictions	
Databases	Web of Science and Scopus, run in March 2021	
Selection criteria	The main criteria that led to the exclusion of a synthesis paper were if the paper: (1) was out of the scope; (2) was not a meta-analysis; (3) was a MA of experimental trials (i.e. no systematic review process); (4) did not deal with soil amendment with lime or gypsum; (5) did not deal with environmental or productivity outcome; (6) did not clearly stated the intervention and comparator treatments; (7) was not written in English. Synthesis papers that passed the relevance criteria were subject to critical appraisal carried out on paper-by-paper basis. The systematic search provided 35 synthesis papers (after removing the duplicates) potentially relevant for the practice object of our fiches. From this set of potentially relevant synthesis papers,	

	7 synthesis papers were selected, among which 3 were relevant for the impact considered in this fiche.