

# Does Mulching Increase Maize Yields in the Tropics? A Systematic Review

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## Methods

Systematic review in Web of Science done in March 2020: TS =(mulch OR "green manure" OR "cover crop\*" OR covercrop\* OR "ground cover" OR groundcover OR "legume\* cover" OR "plant residue\*" OR "crop residue" OR "soil cover" OR "soil conservation" OR "climate smart" OR climate-smart) AND TS =(experiment\* OR study OR studies OR trial\* OR research\* OR plot\*) AND TS =(tropic\* OR "tropical countr\*" OR "tropical zone\*" OR "tropical climate\*" OR "tropical soil\*") AND TS = (maize) NOT TI =(review\*)

345 hits, 150 of which were trials on mulching maize in Tropics. 30 more papers were retrieved from sources cited in 150 papers  
Inclusion criteria: in Tropics, sole maize, mulch is biomass applied on soil surface, unmulched control: 54 papers selected (Fig. 1).

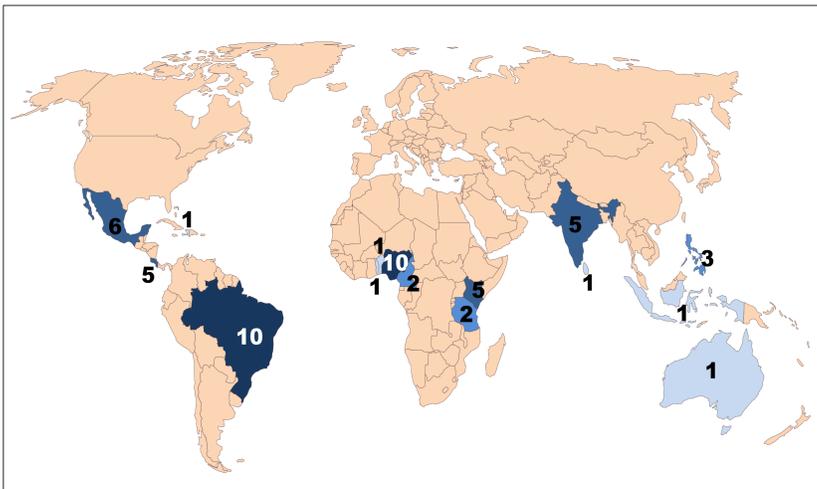


Fig. 1: Distribution of the 54 papers considered in the systematic review (numbers indicate # papers per country)

Information extracted: Rainfall, Trial length, Soil fertility level, Additional fertilizer, Soil preparation, etc., Grain yield and converted to yield ratios:

$$\text{grain yield ratio} = \frac{\text{yield of mulch treatment}}{\text{yield of control treatment}}$$

> 1: mulch with higher yield  
< 1: mulch with lower yield

### Data analysis

Arcsine sqrt transformation. Multiple regression in R.

## Results

Mulch increases maize yield: mean ratio > 1,77 (Table 1)

Table 1 Mean, media, minimum and maximum ratio of grain yield ratio (n=148)

Mean	Median	Minimum	Maximum
1.768	1.310	0.110	7.250

17 Variables with > 70 data points (Fig. 2). Multicollinearity so some variables were removed

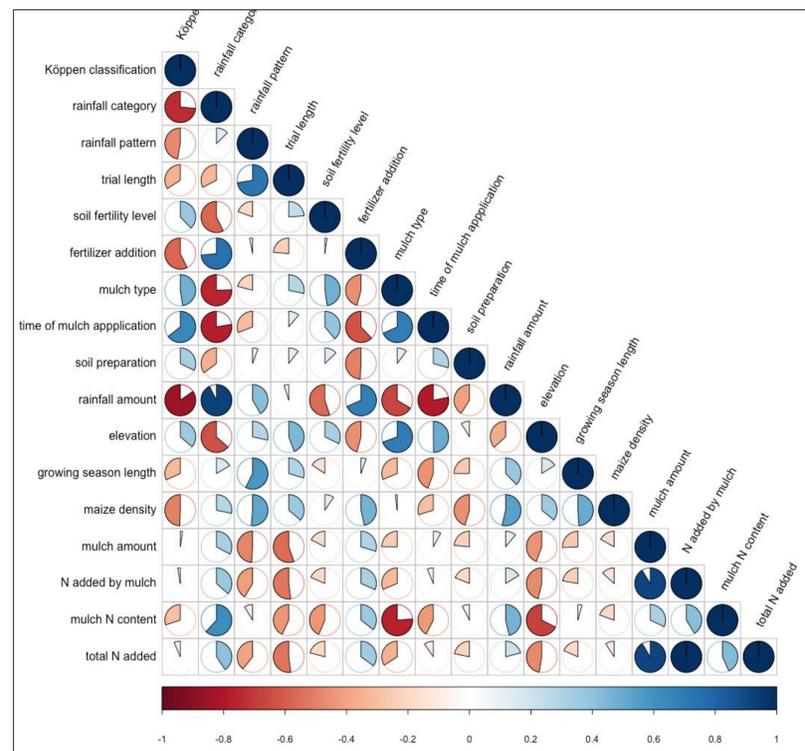


Fig. 2: Collinearity matrix of the variables of the systematic review (the closer to 1 or -1 and the darker the colour, the higher is the correlation)

Multiple regression model (n=76, R<sup>2</sup>: 0.39)

Significant factors and direction on grain yield ratio:

- Mineral fertilizer addition (+)
- Rainfall amount (-)
- Maize density (-)
- Mulch N content (-)

e.g. 1'500 mm rain, maize density of 50'000 ha<sup>-1</sup>, 2.5% N in mulch  
→ Without mineral fertilizer, grain yield ratio = 2.3  
→ With fertilizer: grain yield ratio = 2.7

## Conclusions

**Mulching does increase grain yield in the tropics**

**Highest increases when mineral fertilizer also added, so synergistic rather than substitutional**  
**At higher maize densities, mulching less effective, probably due to its impact on controlling weeds at low densities**

**Mulching recommended for intensified systems including mineral fertilizer**

