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

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Abstract

Maize is one of the most important staples in the Tropics. The use of mulch in maize cropping is widespread and a plethora of trials have been conducted since the 1980s. Yet few studies have attempted to synthesise data to identify general patterns and research gaps. We hypothesised that mulching increases grain yield, depending on rainfall, the growing period of the maize, timing of mulch application, and that also applying mineral fertiliser might be synergistic. We conducted a systematic review in web of science. Inclusion criteria included that trials were monocultures, had a non-mulch control and were from the tropics. We found 54 papers fulfilling our criteria and from these we extracted grain yield data, as the proportion between relative grain yield and control, arcsine square root transformed them and analysed them in R v. 3.6.1.

The most commonly tested mulch was *Leucaena leucocephala* ($n = 13$). Treatments often involved additional factors, for example tillage, irrigation and fertiliser, whereas mulching was the only factor in 15 papers. Mulching improved maize grain yield (+30%), yet the % increase was significantly higher in areas where precipitation > 1500 mm p.a. (+48%) than where precipitation < 800 mm p.a. (9%). Where mulch was applied after sowing, the highest % increase was obtained (+44%), compared with mulch applied at (+29%) or before sowing (+18%). The shorter the maize growing season, the more pronounced the improvement with mulching. Where combined with mineral fertiliser, the improvement was accentuated, suggesting synergies from combining different inputs. Using fresh rather than dry material resulted in a greater % yield increase. Improvement with mulching over the control was greater in long-term trials compared to short-term trials. In conclusion, mulching increased grain yield, particularly for short season maize, optimally applied post-sowing, and showed synergisms with, rather than replacing fertiliser. Surprisingly, effects were most pronounced in higher rainfall areas, suggesting a role as a nutrient input rather than just a soil water conserving strategy.

Keywords: Mulch, systematic review, tropics, yield, *Zea mays*