**Bern University of Applied Sciences**
School of Agricultural, Forest and
Food Sciences HAFL

# HAFL Master's Thesis Abstract

*Year:* **2020**

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*English Title:* **How mulch impacts crop yield in the tropics**
**A case study from Bolivia**

*English Summary:*

Land degradation and low soil fertility limit yields in the tropics. Mulch application is considered a strategy to increase soil fertility and / or to prevent further soil fertility loss and, especially under semi-arid conditions, can lead to higher water productivity by covering the soil. Maize (*Zea mays)* is an important staple crop in the tropics and yields are often far below the potential. The effect of the mulch on maize growth and yield was reported to be influenced by several factors, for example: soil fertility level, amount of rainfall, irrigation, etc., yet no systematization of these factors was found. Onions (*Allium cepa)* are sensitive to water stress, are the second most important vegetable produced in Bolivia and their main production area is in the semi-arid valleys of Cochabamba, where soil degradation, low soil fertility and low water availability are major challenges for smallholders. Those are tackled with the agroforestry systems and the use of mulch on smallholder farms in this semi-arid region. A field trial on onions and mulch was conducted in Cochabamba with the aim to assess the potential of organic mulching on growth, yield and weed parameters. A systematic literature review on organic mulching in maize in the tropics was done to identify general patterns of mulch effects on maize parameters and research gaps.

Three mulch types (*Melinis repens, Dodonaea viscosa, Chamaecytisus proliferus)* were compared to two urea (40, 80 kg N/ha) and a manure application in a randomized complete block design with four blocks. The parameters were analysed using a mixed effects models in RStudio (v. 1.2.5019). The grass mulch, *M. repens*, showed the highest potential of the three materials and its effect on the growth and yield of the onions was comparable or even higher than to those of the equivalent mineral fertilizer application. The application of 80 kg $N_{eq}$/ha urea gave the highest onion bulb individual weights. Regarding the total onion biomass, the application of 80 kg $N_{eq}$/ha urea and of *M. repens* showed equal potential. Mulched treatments had lower weed biomass and possibly a later nutrient release compared to the urea treatments.

The systematic review included 54 papers with trials on maize and organic mulching in the tropics and the effect of the mulch treatment on maize grain yield and total biomass, as well as explaining variables, were extracted and statistically analysed in a multiple regression in RStudio (v. 1.2.5019). The mulch effect on the maize grain yield and the total biomass was positive in the 54 papers assessed. The effect on the grain yield was

influenced by increased by fertilizer addition, a lower mulch nitrogen content and lower maize seeding densities. The mulch effect on the biomass was higher in low soil fertility, in low rainfall regions and with a longer maize growing season.

This trial only assessed the short-term effects of mulch on onion parameters and it would be important to also assess the effects on soil fertility, soil stability, etc., which are very relevant aspects in the view of declining soil fertility in the tropics. Several factors influence the effect of the mulch on the maize parameters and the models assessed could potentially be useful in extension services.

*Keywords:* mulch, *Zea mays, Allium cepa,* tropics, trial, systematic review

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