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Comparative Nitrogen Use Efficiency of Urea, Manure and Different Mulch Types in Horticulture in Semi-Arid Bolivia

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Abstract

Onion (*Allium cepa*) is an important horticultural crop in Bolivia, where the main production region is in the semi-arid region of Cochabamba, in the inter-Andean valleys. Here, soils are degraded, due to overgrazing and agricultural intensification. Soil erosion and water availability as well as nitrogen (N), limits crop growth. We hypothesised that using locally available mulch might improve growth and finally yield more than the equivalent N application as either inorganic fertiliser or manure as it might also release nutrients more in synchrony with the developing crop as well as suppress weeds, increase soil moisture and reduce soil erosion. We also hypothesised that growth improvement due to adding nutrients would be less in the more shaded blocks where growth would be light-limited.

We tested three mulches *Dodonaea viscosa*, *Melinis repens*, and *Chamaecytus proliferus* (application rate 4 t DM ha⁻¹, equivalent to 44, 26 and 39 kg N ha⁻¹) versus farmyard manure (5 t DM N ha⁻¹ equivalent to 165.5 kg total N ha⁻¹); two urea treatments (40 and 80 N eq ha⁻¹) and an unfertilised, unmulched control in an onion monoculture, planted in January 2019 and manually weeded at 60 days after planting (DAP). We used a randomised complete block design (n=4) with shade and competition from a tree boundary as the blocking factor. Plant height, circumference, number of green and of newly produced leaves were evaluated every two weeks.

At 12 weeks after planting, onions were taller in the urea treatments (40 and 80 kg N eq ha⁻¹) than in the control with the 80 kg N eq ha⁻¹ urea treatment having the most weed biomass. In the least shaded block, weed biomass was lower than in the most shaded block (10.1 t fresh weight ha⁻¹ compared to 3.9 t fresh weight ha⁻¹). None of the mulch treatments significantly affected growth.

Keywords: *Allium cepa*, horticulture, mulch, nitrogen efficiency, semi-arid climate