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The Fate of Surface Residue Mulch During Dry Winter and Spring Seasons on Conservation Agriculture Plots in Zimbabwe

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Abstract

Mulching is important in reducing erosion and increasing stability of poorly structured degraded soils. The high intensity short duration erosive rain storms experienced at the onset of the wet cropping season in Zimbabwe makes soil cover especially important. Maintaining soil cover under Conservation Agriculture (CA) systems also contributes to soil biota biomass build-up. Given competing uses of crop residues on the farm, knowledge of mulch losses through decomposition is important in maintaining and managing the minimum (30% soil cover) requirements under CA. Decomposition of surface applied mulch over the winter and spring seasons which precede the wet summer, determine the amount of soil cover at the beginning of the rainy season. Coarse meshed polyester litter bags were used to study the rate of maize litter loss from the soil surface. The aim of the experiment was to assess the rate of fauna driven mulch decomposition on CA and conventional ploughing plots. A total of 256 litter bags, mesh size 5 mm, were used to measure mass loss during winter and spring from one on-station (Henderson), four on-farm sites (two each from Shamva and Zimuto). The sites represented agro-ecological zones II and IV of Zimbabwe and were found on heavy clayey and sandy soils. At Henderson litter bags were applied on the soil surface on conventional ploughing (CP), direct seeder (DS), basins (BA) and Magoie ripper (MR) treatments. On-farm conventional ploughing, sub-soiling (SS) and direct seeder treatments were used. A negative exponential decay model $y = y_0 e^{-kt}$ described surface litter losses data adequately. At Henderson, daily k rates were in the order $BA > DS = CP > MR$ whereas at Chinyanga and Kajengo (Shamva) and Zhinya (Zimuto) $DS > SS > CP$. The influence of soil mulch on the microclimate explained the variation in decomposition between CA treatments and conventional ploughing. The measurements suggest low decompositions rates of surface applied maize litter during winter and spring. Losses can be managed by mulch supplementation to achieve adequate soil cover at the start of the rainy season. Further, the results show that decomposition during winter allow carryover of mulch on CA plots into the next season.

Keywords: Decomposition, maize stover mulch, reduced tillage, soil health, organic matter use