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Effect of Soil Surface Roughness and Crop Cover on Runoff and Soil Loss under Potato Cropping Systems, Kenya

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Abstract

Potato production is majorly carried out in sole stands in East African Highlands. This is despite the fact that the production of this crop entails a lot of soil disturbance associated with hilling which changes the soil surface roughness thereby concentrating surface runoff flow which induces soil erosion. A field study was carried out using runoff plots during the short (October to February) and long (March to September) rainy seasons of 2014/15 respectively at the University of Nairobi Upper Kabete Farm, Kenya. The objective was to assess the effect of soil surface roughness and crop cover on soil loss and runoff under sole and mixed potato cropping systems. The treatments comprised of Bare Soil (T1); Potato + Garden Pea (*Pisum sativa*) (T2); Potato + Climbing Bean (*Phaseolus vulgaris*) (T3); Potato + Dolichos (*Lablab purpureus*) (T4) and Sole Potato (*Solanum tuberosum*) (T5). Soil surface roughness and crop cover were monitored at a two weeks interval throughout the growing seasons. The amount of soil loss and runoff recorded in each event differed significantly between treatments ($p < 0.05$) and were consistently highest in T1 and lowest in T4. Mean cumulative soil loss reduced by 6.4, 13.3 and 24.4 t ha^{-1} from T2, T3 and T4 respectively compared to sole potato plots (T5), while mean cumulative runoff reduced by 8.5, 17.1 and 28.3 mm from T2, T3 and T4 respectively when compared with the sole potato plots (T5) indicating that T4 plots provided the most effective cover in reducing soil loss and runoff. Both runoff and soil loss related significantly with soil surface roughness and percent cover (R^2=0.83 and 0.73 respectively, $p < 0.05$). Statistically significant linear dependence of runoff and soil loss on surface roughness and crop cover was found in T4 ($p < 0.05$) indicating that this system was highly effective in minimizing soil loss and runoff. This study shows the need to incorporate indeterminate legume cover crops such as Dolichos lablab into potato cropping systems. These crops provide sufficient protective cover which can interact with soil surface roughness to minimize soil loss and runoff.

Keywords: Crop cover, cropping systems, runoff, soil erosion, soil loss, soil surface roughness

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