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Unlocking legume intercropping technology in smallholder potato farming systems for climate change adaptation

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Abstract: A large portion of sub-Saharan Africa is situated in belts of uncertain rainfall and is characterized by low soil fertility with limited capacity to adapt to and mitigate the impacts of climate change. A study was conducted in semi-humid potato growing belt of Kenya to test the effect of legume intercropping and water soluble silicon (Si) on soil erosion control, and on use efficiency of light and water. Two forage legumes, Dolichos (*Lablab purpureus* L.) and hairy vetch (*Vicia sativa* L.), were intercropped with a heat and water stress tolerant potato (*Unica*) in a 2: 2 row arrangement. Silicon was applied to each cropping system in granular form at planting and as foliar at vegetative stage of potato growth and compared with no Si treatments. Intercropped potato subjected to Si application maintained significantly higher ($p \leq 0.05$) relative leaf water content, higher concentrations of chlorophyll and greater leaf area index. These treatments accumulated significantly higher proline content and thus alleviated heat load on potato. Intercropping reduced soil loss by up to 80% compared to sole potato. Yield measured in terms of potato equivalents was 2–3 fold greater in intercropping relative to sole potato. Productivity of water and light were 35–75% greater in intercropping than in sole potato and increased with Si application. Combined application of Si and legume intercropping is a novel technology to conserve soils, increase resource use efficiency, and thus adapt farmers to adverse effect of climate change.

References

Gitari HI, Nyawade SO, Kamau S, Karanja N, Gachene KK, Schulte-Geldermann E (2020). Agronomic assessment of phosphorus efficacy for potato (*Solanum tuberosum* L) under legume intercrops. Journal of Plant Nutrition, 43: 864–878.

Gitari, HI, Karanja NN, Gachene CKK., Kamau S, Sharma K, Schulte-Geldermann E (2018). Nitrogen and phosphorous uptake by potato (*Solanum tuberosum* L.) and their use efficiency under potato-legume intercropping systems. Field Crops Research, 222: 78–84.

Nyawade OS, Karanja NN, Gachene CKK, Schulte-Geldermann E, Parker LM (2018). Susceptibility of soil organic matter fractions to soil erosion under potato-legume intercropping systems in central Kenya. Journal of Soil and Water Conservation, 73: 5678–5767.

Nyawade SO, Gachene CKK, Karanja NN, Gitari HI, Schulte-Geldermann E, Parker ML (2019) Controlling soil erosion in smallholder potato farming systems using legume intercrops. Geoderma Regional 15 e00225.