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Using Mulch to Increase Productivity of Tomato Crops to Respond to Livelihood Development Constraints: A Case Study in Nanjara-Kibaoni, Tanzania

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Abstract

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The transition from subsistence agriculture to integration into a market economy creates social, economic, and ecological challenges for residents of the northern slopes of Tanzania's Mt. Kilimanjaro. I investigated this transition, specifically opportunities and constraints to vegetable production in a case study of Nanjara-Kibaoni, a remote village in Tarakea District. Unlike the southern and eastern slopes, which are in closer proximity to urban areas, Tarakea, which shares a border with Kenya, has limited exposure to tourism, development projects, and government infrastructure, so residents continue to farm to meet most of their dietary needs. Meanwhile, environmental degradation and recent changes in seasonal rainfall patterns are inhibiting farm productivity. This project began by asking key informants to identify the most important constraints to their farming schemes, and they unanimously stated difficult access to water due to the cost and limited availability of piped water; deforestation and inconsistent rain events have reduced stream flows. When asked what they would do with a more consistent water supply, residents unanimously expressed a desire to plant vegetables for home use and to market any surplus. Tomatoes are particularly valued due to market demand and extensive use in local cuisine. An experiment was designed using randomized block sampling in three sites to examine whether applying locally available mulch would allow tomatoes to grow with limited irrigation during the cold, dry months of June, July, and August. Tomato plants received one of four treatments: no water & no mulch, no water & mulch, water once a week & no mulch, and water once a week and mulch. One on-farm site (E-site) was designed with two runs of 24 plants each, assigned randomly to one of the four treatments, in units of 3 plants. Another on-farm site (J-site) could only accommodate 12 plants that were randomly assigned to one of the four treatments. The third site (T-site) was located on land belonging to an NGO and was able to accommodate 312 plants in 12 runs randomly assigned to each of the 4 treatments, in units of 4 plants. Village residents planted the sites and managed the treatments, so each treatment was not equally represented because they had difficulty understanding and applying the map. A Kruskal-Wallis Test was performed for T-site and the discrepancy was not significant. For T-site, plants that were watered once a week and mulched yielded an average 38% more kg of fruit per plant ($p=0.01$) than those watered once a week but not mulched. Plants mulched but not watered yielded 56% more kg of fruit per plant than plants neither watered nor mulched ($p=0.01$). E-site was not managed carefully throughout the experiment, so its results are not viable. J-site was managed with great care, but the sample size was too small to create results at $p=0.01$. At $p=0.1$, plants that were mulched and watered produced an average 89% more kg of fruit per plant than those that were only watered, while those that were mulched but not watered produced an average 72% more yield than those that were neither watered nor mulched. Residents requested to experiment with a natural pesticide due to the high cost of chemical pesticide, as well as health concerns. We developed a pesticide from cow urine, tobacco, hot peppers, the fruit of *Solanum incanum*, *Tagetes minuta*, and *Tephrosia vogelii*, and used it exclusively in the experiment.

Residents concluded that it works as well as chemical pesticides, and have planted a nursery to grow these plants. The results of this experiment encouraged residents of Nanjara-Kibaoni to plant with mulch, and they plan to experiment with the natural pesticide. Nevertheless, they recognize that market integration is difficult due to increasing vegetable production and thus competition from nearby Kenya.