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Farmers' knowledge, perceptions and management of diseases affecting sweet potatoes in the Lake Victoria Zone region, Tanzania

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ABSTRACT

The purpose of this study was to assess farmers' knowledge, perception and management of sweet potato (SP) diseases, and to determine factors associated with farmers' satisfaction with sweet potato planting material in Mwanza and Mara sites within the Lake Victoria Zone region of Tanzania. We used multiple methods and data sources, principally a survey of 621 households spread across nine districts, and in-depth interviews with farmers in three villages located in three different districts. Our study revealed four main findings. Firstly, we found that although farmers were able to identify unhealthy SP plants, they were unable to tell the specific type of disease affecting the plants both from direct and photographic observations. Secondly, there exists considerable heterogeneity in the way farmers manage unhealthy plants in the field; some farmers were observed to follow management methods prescribed by plant pathologists, while others used traditional methods of managing a diseased plant. Thirdly, the following three factors were found to be the determinants of farmers' knowledge and management of SP diseases and plant root damage: (i) farmers' training in SP production and management; (ii) the number of plots which the woman of the household has control over; and (iii) household membership to a crop production association. Lastly, the location of farms is a strong determinant of farmers' satisfaction with SP vines; residing in areas in which sweet potato vines are widely available and in a village that is accessible by a primary road or tarmac road increases a farmer's satisfaction with sweet potato vines that are available in the farmers' farm during planting time.

1. Introduction

It is estimated that 80% of the Tanzanian population, the majority of whom live in rural areas, depend on agriculture for their livelihoods and by and large, rely on farming tools and technologies that can be characterized as indigenous, traditional and informal (Ishengoma and Mbwilo, 2009). Given this situation, understanding the agricultural knowledge structure, operations, and challenges faced by rural farmers is critical because their livelihoods depend substantially on their ability to make accurate agronomic assessment.

In Africa, crop losses due to pests and diseases are very high (Oerke and Dehne, 2004). Virus diseases alone can lead to sweet potato yield reductions in the range between 56% and 98% (Mukasa et al., 2003). Thus understanding farmers' knowledge related to perceptions of crop diseases, practices of pests, and their management is essential for the development of management strategies, supported by government and non-governmental organizations, which cater to farmers' needs and have a high probability of being adopted by the intended users (Chitere and Omolo, 1993; Rubia et al., 1996; Tanzubil and Yakubu, 1997).

Oswald et al. (2009) assert that in Africa, weevils and viruses are crucial biological factors that hinder both sweet potato quality and yield. They further note that the impact severity of weevils and viruses on sweet potato varies by agro-ecological zones. In Tanzania's Lake Zone region two viruses have been found to be prevalent: *Sweet potato feathery mottle potyvirus* (SPFMV) and the whitefly borne *Sweet potato chlorotic stunt virus* (SPCSV) (Gibson et al., 2000; Schaefers and Terry, 1976). The synergistic combination of the SPFMV and SPCSV leads to a severe viral disease called *Sweet potato*

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virus disease (SPVD) that causes the degeneration of most local sweet potato landraces (Gibson et al., 2000; Karyeija et al., 2000; Oswald et al., 2009). While farmers are able to positively select against infection of sweet potatoes by the SPVD, they are unable to select against the SPFMV when infecting alone because the latter virus does not exhibit any symptoms when it infects a plant.

The most common weevils that affect sweet potatoes in Africa are *Cylasformicarius*, *Cylaspuncticollis*, and *Cylas* (Ames et al., 1997). The infection symptoms exhibited by all three species are similar. The adult sweet potato weevils feed on the outermost part of the vines and leaves, and on the external surfaces of storage roots causing "round feeding punctures" (Ames et al., 1997). These weevils cause damage to storage roots diminishing sweet potato commercial viability (Ndunguru et al., 1998).

Studies have shown that the increase in sweet potato productivity (based on yield per unit area) is largely dependent on farmers' knowledge of the type of causative agent responsible for decreased yield and the appropriate disease control measures to mitigate the problem (Ebregt et al., 2004). Farmers in North-Eastern Uganda, for example, associated infected planting material with drought, instead of pest infestation, and despite the fact that sweet potato virus disease can be controlled by using clean planting material, use of resistant varieties, and crop rotation, these farmers in Uganda had little access to new technology, such as improved seed varieties and pest management training (Ebregt et al., 2004).

The challenge of controlling SP pests is prevalent in sub-Saharan Africa because farmers rarely use pesticides to control weevils (Oswald et al., 2009). Some farmers practice appropriate and timely hilling-up, which involves covering the cracks at the base of the plant with soil to prevent weevils reaching storage roots that are developing deep in the soil. Furthermore, whenever farmers practice piecemeal harvest, their sweet potatoes are in danger of being damaged by weevils.

Despite the established critical role of farmers' knowledge in the control and mitigation of pests and diseases, very few studies have focused on this subject. Thus, there remains a serious knowledge gap in the assessment of farmers' knowledge and practices of controlling pests and assessment of planting material quality in sweet potatoes in particular.

Farmers' knowledge of diseases are well documented for cash crops, such as cotton (Ochou et al., 1998), rice (Norton and Rajotte, 1999; Price, 2001; Rubia et al., 1996) and food crops such as millet (Tanzubil and Yakubu, 1997; Youm and Owusu, 1998), beans (Trutmann et al., 1996), cowpea (Bottenberg, 1995), and vegetables (Chitere and Omolo, 1993; Norton and Rajotte, 1999; Obopile et al., 2008). However, similar documentation for sweet potatoes is scant and not up-to-date (Bashaasha et al., 1995; Gibson et al., 2000; Kapinga et al., 1995). Efforts to improve management and pest control measures for sweet potatoes are therefore likely to be hampered if farmers' knowledge of crop diseases and practices of handling them are not known and taken into account as appropriate. This paper seeks to contribute towards filling this knowledge gap, based on an empirical study of sweet potato farmers in Northern Tanzania. The paper addresses the following four main questions.

1. To what extent are farmers' knowledge of sweet potato diseases complete based on assessments of the whole plant? This question is informed by and builds on previous research efforts to differentiate knowledge that comes from local cultivators and knowledge derived from scientific approaches. Local knowledge is noted to be holistic (look at the whole plant and make judgment based on that) while scientific knowledge is considered as segmented (focusing on only a specific part of the plant and make judgment based on that) (Aikenhead and Ogawa, 2007; Mazzocchi, 2006; Dusseldorp and Box, 1993).
2. What are the situational factors that influence farmers' practices with regard to quality of planting material and varietal acquisition?
3. What are the factors that are associated with farmers' knowledge and management of sweet potato diseases and plant root damage? The underlying assumption behind this question is that all farmers are equally likely to be knowledgeable about the diseases that affect sweet potatoes irrespective of farmers' demographic, economic, or community-level characteristics.
4. What are the factors that are associated with farmers' satisfaction with sweet potato planting material? The underlying assumption behind this question is that irrespective of farmers' demographic, economic, or community-level characteristics, all farmers are equally likely to be satisfied with the quality of planting material they have available.

2. Methods

This study employed an integrated mixed methods approach taking individual farmers in selected households as the principal unit of observation, while at the same time contextualizing the analysis to consider the factors affecting individuals, households and the community at large. Mixed methods is defined as "the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study" (Johnson and Onwuegbuzie, 2004). The use of a mixed method approach therefore allowed for the integration of two types of research methods into a single study enabling a deeper understanding of the questions posed in the surveys.

Data collection was accomplished using the following three methods: a structured survey; in-depth interviews and photographic method. A survey dataset containing detailed quantitative data from 621 households in nine districts located in Mwanza and Mara regions of Tanzania was obtained from the International Potato Center (CIP). The household survey was conducted in 2010 and the sampled households were randomly selected using a stratified probability sampling method. The procedure for selecting the sampled households involved three stages. In the first stage, a list of wards participating in the Great Lake Cassava Initiative (GLCI) program[1] was drawn randomly from each of the nine districts. In the second stage, a list of villages was drawn randomly from the list of wards already drawn. In the third and last stage, a list of households that were members of either GLCI or Savings and Internal Lending Communities (SILC)[2] in these villages were drawn, through random sampling. In addition, the sampling was done to make sure that at least 30% of the sampled households were female headed; if the random sampling procedure in any village did not meet the required gender target, a list of female-headed households was drawn and, using random sampling, additional female-headed households were chosen to meet the required number of households targeted.

The survey questionnaire followed a predetermined and standardized list of close-ended questions in which questions were asked in the same order, for all respondents. Consequently, the

[1] GLCI is a program managed by Catholic Relief Services and supported by the Bill &Melinda Gates Foundation. The program goal is to distribute healthy cassava planting material to farm families in order to improve food insecurity issues.

[2] SILC is a savings-led program that Catholic Relief Services uses to provide financial services to the poor.