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A simple model to evaluate integrated vegetable production for food security in KwaZulu-Natal, South Africa

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ABSTRACT

The objective of this study was to investigate the effectiveness of combining agricultural science with local knowledge in developing a simple model to evaluate vegetable production for food security and small-scale economic development. Four sites were selected for a preliminary survey to determine local knowledge about vegetable production using semi-structured interviews. Then, agronomic trials were conducted with a reduced number of participants representing an average household to grow popular vegetables identified in the surveys with the aim of testing the hypothesis of year-round organic production under virtual dryland conditions. A food security evaluation model based on farmer crop yield, home consumption and local market value was developed. The situation analysis showed that on average the farmers used their crops mainly for home consumption (~76%) compared to local market (~24%). Crop yields from 0.1 ha were found to be adequate for food security needs of an average household in the rural areas of South Africa. The food security values of maize (the staple crop) and cabbage (a popular vegetable) were found to be about 52%. The study revealed clearly that for a household of five persons, an average fresh vegetable crop yield of 19 to 27 t ha^{-1} can be produced per annum if production occurs all year round. The study proposes the first simple linear food security value model based on crop yield and utilisation with farmer participation.

1. Introduction

Food insecurity is a global challenge affecting over 1 billion people to the extent of poverty and hunger. Campbell (1991) stated, "Risk factors for food insecurity include any factors that affect household resources and the proportion of those resources available for food acquisition. Potential consequences of food insecurity include hunger, malnutrition and (either directly or indirectly) negative effects on health and quality of life. The precise relationships between food insecurity and its risk factors and potential consequences need much more research now that there is an emerging consensus on the definition and measurement of food insecurity. Indicators of food security or insecurity are proposed as a necessary component of the core measures of the nutritional state of individuals, communities or nations". Despite that this statement is as true now as it was two decades ago (FAO, 2014), the approaches to address food production by poor communities have not reached the level of research suggested by Campbell (1991). A working model for rural development should be one that relies on both agricultural science and indigenous or traditional knowledge. The potential influence of such a model on a policy to address the new challenge of food insecurity is profound. Evidence of this is cited in early studies about the origins of agriculture: "The inventors of agriculture had previously acquired special skills in other directions that predisposed them to agricultural experiments", stated Harlan (1975).

Although food security is largely dependent on access to food (FAO, 2014) there is scarcity of literature that integrates agricultural sciences (especially, crop and animal production) with a study of food security as a discipline. A recent analysis by the Food and Agriculture Organisation of the United Nations (FAO, 2014) suggested that the world population is increasing to surpass 9 billion by 2050. Therefore, there is a greater challenge of feeding people with diets that have more energy, protein and other nutrients. This challenge means that farmers, and humanity as a whole, need to find farming systems that are truly sustainable and inclusive to support increased food access, especially for the poor. That analysis concluded that nothing comes closer to the sustainable food production paradigm than small-scale or family farming.

In a system where sustainable agriculture is the focus and food security is the goal, it is imperative that an integrated approach is preferred (FAO, 2014). That way, a combination of advances in agricultural science and local or indigenous knowledge can be used. Studies conducted in a number of years have shown that agriculture is a major contributor to overall economic development in developing countries, especially the lowest-income ones (International Food Policy Research Institute, 1995). Agriculture has also been shown to have a stronger effect on poverty reduction than do other sectors of the economy, because it offers possibilities for reducing risks of food

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shortages at all levels of society, increasing overall supply of food, creating economic opportunities for vulnerable people and improving dietary diversity and the quality of food consumed by farm households (Hendriks & Lyne, 2009). However the responses of the agricultural sector to the marginalised rural communities are often conceived of outside the community context and neglect the local resource base, both natural and cultural (Gari, 2004). The majority of the rural populations in southern Africa remain trapped in poverty and social exclusion, while policies and investments tend to focus on urban areas, industrial endeavours and agribusiness development. It is estimated that millions of small farmers worldwide live in marginal environments and lack policy and technical support for their indigenous farming systems (Altieri, 2002; Food Security and Nutrition Analysis Unit, 2015). Consequently, productivity levels continue to be generally low in the developing world (Reimers & Klasen, 2013). Also, while there is a perceived food security at national level for developed countries, there is still a significant household food insecurity (Meinzen-Dick et al., 2014). Increased attention should be given to the potential of indigenous knowledge and agro-biodiversity in these communities to combat agricultural constraints and enhance sustainable livelihoods (Gari, 2004).

Many circumstances that influence the decisions a farmer chooses are linked to personal experience that has developed over a life time, and even longer, including inherited traditional knowledge (Denison & Manona, 2007). However, research into rural development generally ignores traditional knowledge and focusses on transferring packaged methodologies that emerged as successes in the developed world. Consequently, projects are introduced with great success in the early stages, but they collapse soon after the artificial support is removed by the funders or through government extension support (Chambers, 1993; Didi, Ridha, Dadang, & Alfitri, 2015; Løvendal and Knowles, 2005; Lybbert, Barrett, Desta, & Coppock, 2004). It is for this reason that participatory research approaches are necessary to investigate issues of concern to resource-poor communities, and to plan, implement and evaluate rural development strategies jointly between agricultural scientists and rural communities (Leeuwis, 2000; Wiggins, Kirsten, & Llambi, 2010). Rapid rural appraisal emerged as a result of dissatisfaction with time consuming surveys as means of gathering information for solving policy-related issues in rural communities. The approach focussed on improving interview techniques by using key informants and semi-structured interviews with checklists and triangulation. It also promoted a spirit of open, cooperative enquiry in exchanging information on new techniques experimented with (Wiggins et al., 2010).

The objective of this study was to investigate the effectiveness of combining agricultural science with traditional knowledge principles in learning about sustainable vegetable agriculture production for food security and small-scale economic development in selected locations of KwaZulu-Natal. It was hypothesised that learning together with subsistence farmers can create an opportunity for those who seek to uplift them to implement sustainable strategies together with the beneficiaries.

2. Material and methods

2.1. Study sites

Four sites located in the three major regions of KwaZulu-Natal (Fig. 1) were selected, namely, Richards Bay (28°48′S; 32°06′E), Umbumbulu (29°58′S; 30°41′E and 25 km north of Amanzimtoti), Mpophomeni (29°28′S; 30°14′E, near Howick) and Swayimani (32°25′S; 27°23′E, near Wartburg). All the sites were tribal lands with community gardens. The premise of the study was that subsistence farmers have a goal to produce vegetables throughout the year to meet household food security and small-scale farming needs. This goal was presumably impeded by lack of skills and the inappropriate monoculture system. According to the bioresources analysis of KwaZulu-Natal (Smith, 2006) the sites are located in bioresource groups

Fig. 1. KwaZulu-Natal (South African province) map showing study sites of Richards Bay, Umbumbulu (25 km east of Amanzimtoti), Mpophomeni (at Howick), and Swayimani (at Wartburg) (http://www.bing.com/images/search?q=kwazulu-natal+map&FORM=HDRSC2).