Acta Tropica 175 (2017) 42–49

Contents lists available at ScienceDirect

Acta Tropica

journal homepage: www.elsevier.com/locate/actatropica

Agroecology and healthy food systems in semi-humid tropical Africa: Participatory research with vulnerable farming households in Malawi

Hanson Nyantakyi-Frimpong[a,*], Joseph Kangmennaang[b], Rachel Bezner Kerr[c], Isaac Luginaah[d], Laifolo Dakishoni[e], Esther Lupafya[e], Lizzie Shumba[e], Mangani Katundu[f]

[a] The Integrative Agroecology Group, University of Toronto—Scarborough, 1265 Military Trail, Toronto, Ontario, M1C 1A4, Canada
[b] Department of Geography and Environment, University of Waterloo, 200 University Avenue West, Waterloo, Ontario, N2L 3G1, Canada
[c] Department of Development Sociology, Cornell University, Ithaca NY, United States
[d] Department of Geography, University of Western Ontario, London, Ontario, N6A 5C2, Canada
[e] Malawi Farmer-to-Farmer Agroecology (MAFFA) Project, Ekwendeni Hospital, Malawi
[f] Chancellor College, University of Malawi, Zomba, Malawi

ARTICLE INFO

Article history:
Received 13 October 2016
Received in revised form 27 October 2016
Accepted 27 October 2016
Available online 29 October 2016

Keywords:
Agroecology
Crop diversity
Food security
Diversified diets
Human health
Malawi

ABSTRACT

This paper assesses the relationship between agroecology, food security, and human health. Specifically, we ask if agroecology can lead to improved food security and human health among vulnerable smallholder farmers in semi-humid tropical Africa. The empirical evidence comes from a cross-sectional household survey ($n = 1000$) in two districts in Malawi, a small country in semi-humid, tropical Africa. The survey consisted of 571 agroecology-adoption and 429 non-agroecology-adoption households. Ordered logistics regression and average treatment effects models were used to determine the effect of agroecology adoption on self-reported health. Our results show that agroecology-adoption households (OR = 1.37, $p = 0.05$) were more likely to report optimal health status, and the average treatment effect shows that adopters were 12% more likely to be in optimal health. Furthermore, being moderately food insecure (OR = 0.59, $p = 0.05$) and severely food insecure (OR = 0.89, $p = 0.10$) were associated with less likelihood of reporting optimal health status. The paper concludes that with the adoption of agroecology in the semi-humid tropics, it is possible for households to diversify their crops and diets, a condition that has strong implications for improved food security, good nutrition and human health.

1. Introduction

The current global food system is often described to be in crisis because it is failing to provide safe, nutritious, and affordable food to the world's most vulnerable groups (Akram-Lodhi, 2013; Rosin et al., 2012). Despite marked growth in per capita food production in recent years, many people remain hyper-vulnerable to food insecurity and chronic malnutrition. On a global scale, the statistics are staggering: as many as 795 million people (one out of every nine persons on this planet) live in near-constant hunger and malnourishment (FAO, 2015). Furthermore, lack of dietary diversity is a major issue for too many households (FAO, 2015; Sibhatu et al., 2015). Paradoxically, almost half of the world's most food insecure and malnourished people are full-time smallholder farmers (FAO, 2015). Of even greater concern is the harsh reality that "every seven seconds, a child under five dies somewhere because they have not had enough to eat" (Akram-Lodhi, 2013). Indeed, childhood malnutrition accounts for almost 2.6 million deaths each year (Black et al., 2013; Smith and Haddad, 2015). Among under-five children suffering from malnutrition, the impacts are likely to be life-long, including higher risks of mortality and permanently damaging effects on cognitive development (Ahmed et al., 2012).

There have been mounting questions over how best to effectively address these food-related challenges in an environmentally sustainable manner, while recognizing human values around food. Some analysts have called for industrial agricultural approaches, including the development of biotechnology, increased fertilizer usage, mechanized monocultures, and the adoption of high-yielding crop varieties (e.g., see Juma, 2011). Yet, a second group of analysts suggests that this pathway is deeply contradictory, for while it can succeed in producing greater food surpluses, it cannot address nutritional security and hidden hunger (e.g., see Akram-Lodhi, 2013; De Schutter, 2013). Of even greater concern is the fact that industrial approaches to farming undermine the very biophys-

* Corresponding author.
E-mail address: hansonkojo@gmail.com (H. Nyantakyi-Frimpong).

http://dx.doi.org/10.1016/j.actatropica.2016.10.022
0001-706X/

ical foundations of agriculture, including soils, water, and genetic resources. For example, the heavy use of fertilizer, irrigation and mechanized monocultures can lead to fertilizer runoff, the silt loading of terrestrial and aquatic ecosystems, and the loss of plant species diversity (Weis, 2010). Added to the problems of industrial farming methods are high levels of greenhouse gas emissions, which could magnify climatic changes (Lin et al., 2011). In view of these ecological costs, there is now a growing concern that agricultural intensification is essential, but it does not have to encompass increased use of fertilizer, genetically modified seeds, and fossil fuel inputs. Rather, farm production can be intensified with the use of agroecological techniques, including more varied cropping systems, increased integration of leguminous crops, and the incorporation of organic material into soils (Gliessman, 2015; Kremen and Miles, 2012; Nelson and Coe, 2015; Pretty and Bharucha, 2014).

There is a well-established research on agroecological farming (see Gliessman, 2015 for a review). Recent empirical evidence suggests that agroecology and diversified farming systems ensure beneficial inter-species interaction, improved weed suppression, and the breaking of the life cycle of pests (Cong et al., 2015; Gliessman, 2015). Furthermore, these farming practices do not only lead to judicious use of land, water and other farming resources, but they are among the most environmentally sustainable strategies for addressing food and nutritional insecurity (Frison et al., 2011; Kremen and Miles, 2012; Snapp et al., 2010). In the African semi-humid tropics, agroecological practices, including crop diversification and intercropping, serve as an effective climate change adaptation and mitigation strategy (Niang et al., 2014; Rusinamhodzi et al., 2012). Recent experiments in southern Africa suggest that diversified farming systems, particularly with increased legume integration, can provide substantial ecosystem services such as nitrogen fixation, soil enhancement and carbon sequestration (e.g., Snapp et al., 2010). However, despite these benefits, there is limited concrete evidence on whether and how agroecology could lead to improved nutritional and food security, as well as human health and well-being. Recent reviews have called for more rigorous empirical research in this area in order to further the debate on whether agroecology can be used to improve dietary diversity, nutrition and human health (Kremen and Miles, 2012).

The main goal of this paper is to contribute to addressing this knowledge gap. We aim to answer the question: Can agroecology lead to improved food security and human health among vulnerable smallholder households in semi-humid tropical Africa? We answer this question by using evidence from participatory research on agroecology in Malawi. The term *agroecology* is used in this paper to refer to a set of farming practices that attempt to mimic natural systems through in-depth knowledge of crop, insect and disease ecology, increased agrobiodiversity, and attention to interactions with adjacent natural landscapes (Gliessman, 2015). It is a farming approach that puts stronger emphasis on the social, economic, and political dynamics shaping agricultural production systems (Altieri et al., 2012). As an alternative form of agriculture, some analysts see peasant or smallholder agroecology as a method not feasible to addressing issues of malnutrition and hunger (e.g., see, Bernstein, 2014; Collier and Dercon, 2014). Thus, by empirically demonstrating the links between agroecology, food security and human health, we aim to contribute to understanding how small-scale agroecology could transform food systems.

2. Research setting and methods

2.1. The research setting

We conducted this research in Malawi, a small landlocked country in south-eastern Africa, with a population of about 16 million people (Government of Malawi, 2012). The country is bordered by Zambia, Tanzania and Mozambique, as well as the 587 km long Lake Malawi (see Fig. 1). Households in Malawi are highly dependent on agriculture as the main source of occupation and livelihood. Agricultural production is primarily rain-fed and occurs during the single rainy season from October to April on small plots averaging approximately one hectare (Denning et al., 2009). Common cultivated food crops include maize, groundnuts, beans, cassava, potatoes, and different kinds of green leafy vegetables. The main cash crop is tobacco. Over 70% of the people live below the poverty line, with higher rates in rural areas (World Bank, 2014). Almost one-third of Malawian households experience severe food insecurity and calorie deficiencies (Ecker and Qaim, 2011), and half of children under age five are stunted (National Statistical Office and ICF Macro, 2011). In addition, 60% of preschool-aged children are deficient in Vitamin A (World Health Organization, 2009) and nearly three-quarters are anemic (World Health Organization, 2008). Adult HIV prevalence rate is estimated at 12.9% of the population, and infection rates are highest amongst young women between the ages of 15 and 49 (World Health Organization, 2009). HIV-related deaths have led to several orphans and youth-headed households, many of who struggle with food security (Nyantakyi-Frimpong et al., 2016). Apart from HIV/AIDS, other major health problems include malaria and diabetes (Chanda et al., 2016; Msyamboza et al., 2014).

The country is divided into three regions: north, central and south. We conducted fieldwork in the northern and central regions. In the north, we collected data from villages near a major town called Ekwendeni (Mzimba District), while in the south, we worked near the Lobi area (Dedza District) (see Fig. 1). These two sites have almost 6000 farmers engaged in different agroecological farming practices under a farmer-researcher collaborative scheme called the Malawi Farmer-to-Farmer Agroecology (MAFFA) Project. With funding from the Canadian government, the MAFFA project began in 2012 and is aimed at improving food security and malnutrition through sustainable farming practices, including intercropping, stubble mulching, no-till farming, and the use of organic composts (Bezner Kerr et al., 2016; see also Fig. 2).

2.2. Data and sample

This paper relies on primary data collected through fieldwork from July to September 2014. We conducted a survey of 1000 households. All sample households are diversified smallholders, with farm sizes less than 3 acres. Household heads, spouse or another well-informed adult within the household were interviewed using a structured questionnaire specifically designed for this study. The questionnaire was pretested before data collection to ensure content validity and clarity. Surveys were conducted in the local language by a group of trained enumerators, and were supervised by the researchers. The survey collected data on household demographic characteristics, agricultural practices, well-being, food security status, and asset ownership. The data was initially entered into SPSS version 11.0, and later converted to STATA 13 for analysis. The questionnaire included a HFIAS module to explore household food insecurity, details of which are described further below. Ethics approval was obtained from the Non-Medical Research Ethnic Board at Western University, Canada (Protocol Number 105142). In addition, informed consents were obtained from each participant prior to the survey. For comparative purposes, we randomly sampled 571 households engaged in agroecological farming (all from the MAFFA project), and a control group of 429 households not engaged agroecology.