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Means-End Chain approach to understanding farmers' motivations for pesticide use in leafy vegetables: The case of kale in peri-urban Nairobi, Kenya

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ABSTRACT

Peri-urban farmers play a significant role in the production of vegetables consumed in the urban centers in most African countries. The production of vegetables in the peri-urban areas in these countries is strategic with most farmers targeting the lucrative and better-paying urban markets. However, the decline in agricultural land in the peri-urban due to competition from housing for urban workers has led peri-urban farmers to use intensive means of agricultural production. Decreasing land sizes imply that peri-urban lands are continuously under production resulting in the build-up of pests and diseases. Further, the tropical climate generally increases the outbreak and rapid multiplication of pests and diseases. These problems and the urban consumers' demand for clean and spotlessness vegetables encourage the excessive use of pesticides. Additionally, the desire to reduce losses and waste can cause farmers to violate the recommended intervals between pesticide application and harvest. Consequently, there have been concerns about the excessive application of pesticides in vegetables produced in the peri-urban areas. The study applies the Means-End Chain (MEC) approach accompanied by the laddering technique to assess the motivations for peri-urban farmers to use pesticides as opposed to other crop protection methods in the production of fresh vegetables. It specifically examines the relevant attribute–consequence–value relations by setting up relevant hierarchical value maps. The study is based on a random sample of 54 kale farmers in three peri-urban areas of Nairobi. It finds that farmers apply pesticides at different times mainly for the purpose of improving their efficacy in protecting kale against pests and diseases. Protection of kale improves its aesthetic quality attributes resulting in higher prices and hence profit margins. Examination of the hierarchal value maps further reveals that the other motivations for pesticide use include benevolence value (being helpful and honest to trading partners), power (social recognition or good reputation as a good farmer), hedonism (happiness for being a successful farmer), security (having good health) and self-direction (independence or being self-supporting from vegetable income). Clearly, the motivations suggest a dilemma in safe use of pesticides. While some motivators dictate less use of pesticides, others can promote indiscriminate use of pesticides. The study discusses the implication of these findings for sustainable and environmentally friendly production of safe leafy vegetables in peri-urban areas.

1. Introduction

An urban population surge in most developing countries has increased demand for food in major urban centers/cities. In many of these cities, urban farming has provided an important source of food supplies. However, some countries, notably Kenya, have legislation that forbid/restrict urban farming (Ayaga et al., 2005). As the demand for food by urban dwellers has continued to increase while urban farming remains outlawed, peri-urban areas have stepped in as major suppliers of food to urban populations. These areas focus on the production of high value commodities (Nyamwamu, 2009). In particular, the peri-urban farming areas have focused on horticulture crops that fetch higher prices in urban centers such as fresh vegetables, herbs and spices.

The production of fresh vegetables in most of the peri-urban areas has become highly intensive. Nyamwamu (2009) indicates that peri-urban farmers depend heavily on the use of irrigation, fertilizers and pesticides to produce fresh vegetables. A number of studies have also documented the heavy reliance of farmers on

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pesticides in the production of fresh vegetables in developing countries (Thrupp et al., 1995; Ohayo-Mitoko, 1997; Okello and Swinton, 2010).

Many developing countries (notably the European Union (EU)) have formulated regulations to stem the heavy application of pesticides. The EU legislation relating to use of pesticides for crop protection is directed to the choice of insecticides and mainly addresses environmental protection, human safety and maximum residue levels. Past studies have highlighted how European food safety regulations and standards have reduced the use of pesticides in fresh export vegetables with positive health and economic impacts (Okello, 2005; Asfaw et al., 2009; Okello and Okello, 2010). These studies indicate that European standards have encouraged judicious use of pesticides in the production fresh vegetables for export by developing-country farmers by promoting the application of less toxic pesticides and promoting strict observation of the interval between pesticide application and harvest. These European standards however emanated from consumer concerns about the safety of vegetables sold in European green grocery markets. To the contrary, there is currently very little focus by developing-country governments on pesticide use practices in the production of domestically traded vegetables. The little attention given to the safety of vegetables, especially those sold in urban areas, has been from private fresh vegetable retail supermarkets. These supermarkets control their sources and pay attention to the irrigation water and pesticide usage by their suppliers. Nonetheless, the demand for aesthetic quality attributes (e.g., spotlessness) by urban consumers has tended to increase the use of pesticides in combating pest and disease problems.

Pests and diseases are the major constraint to production of horticultural crops in developing countries (Odour et al., 1998; Jaffee, 2003). They cause serious crop losses and where chemicals are used to control them, the costs can be prohibitive. Hence peri-urban farmers use a combination of pest control strategies involving pesticide use as well as biological and cultural control measures. Nonetheless, the use of chemical control methods continues to dominate other methods because farmers consider them to be more effective (Ogol and Makatiani, 2007). A survey of peri-urban farmers growing vegetables for sale in Nairobi found that 98% use pesticides (Harris et al., 1998). A more recent study further found that 96% of peri-urban kale farmers use pesticides in crop protection (Ngigi et al., 2011).

The widespread use of pesticides in developing countries has led to concerns about the medical health of farm workers and the ultimate end-users (consumers) who are increasingly demanding food of certain safety attributes (Thrupp et al., 1995; Farina and Reardon, 2000; Okello and Swinton, 2010; Ngigi et al., 2011). These attributes include freedom from harmful pesticide residues, heavy metals and pathogens. Yet producing vegetables that meet these quality attributes is extremely difficult under the tropical climate which generally encourages outbreak and rapid multiplication of the pests and diseases (Okello, 2005). Thus while the market desires safe produce, the conditions under which vegetables are grown encourages the use of pesticides, some of which are toxic. In the peri-urban conditions the geographical closeness of production areas to urban centers and the short time it takes for products to move through the marketing chain increases health risks to consumers of exposure to toxic pesticide residues. Late spraying and failure to observe the recommended interval between pesticide application and the harvesting of produce means that produce containing residues enters the marketing chain (De Guzman and Navarro, 2003).

Past studies on crop protection practices used in peri-urban fresh vegetable production have mostly focused on host plant resistance, alternatives to chemical control e.g. bio-pesticide methods, integrated pest management (IPM), optimal chemical application levels and testing of introduced chemicals in trial plots (Asaba, 2000). No study has examined the motivations behind the choices made by farmers when deciding to use pesticides in producing vegetables. Yet farmers differ from one another in personality, attitudes and values and these differences are likely to be reflected in the farm management decisions, including crop protection decisions, made by farmers. There is considerable evidence that individuals' psychological differences affect economic behavior as well as decision-making (Austin et al., 2001; Hershey and Mowen, 2000). The overall objective of this study was to gain insight into motivations behind farmers' choice of crop protection methods. The specific objective was to use the Means-End Chain (MEC) approach to determine the relevant attribute–consequence–value relations through setting up farmers' hierarchical value maps that can facilitate the understanding of farmers' choice of crop protection practices. The MEC approach can complement the understanding of crop protection practices based on the neoclassical household production models and the economic development literature in general (Becker, 1965; Chayanov, 1966; De Janvry and Sadoulet, 1991). Current research has addressed behavioral responses within the farm household decision-making process. Yet the extent to which the behavioral trade-offs with respect to risk and benefits of production decisions is not well known (Mendola, 2007). The interesting contribution by the MEC approach is that it offers a way to describe qualitatively what objective (i.e. utility) the growers are maximizing.

The study focuses on kale farmers in peri-urban of Nairobi. Kale is one of the most widely consumed vegetables in urban areas of Kenya and has high nutritional value while at the same time acting as an important source of income to peri-urban farming households. Kale is a fast growing crop that is susceptible to many pests and diseases thus requires use of pesticides. The major kale growing areas in Kenya are Kiambu and Nyandarua. One of the peri-urban areas targeted with this study (namely Wangige) lies in Kiambu district. The major pests of kale are the Diamond Black Moth (DBM) (i.e., *Plutella xylostella* (L)) and various species of aphids. The former causes serious cosmetic damage to the leaves and can result in heavy economic losses. The pest is mainly controlled by chemicals (Ogol and Makatiani, 2007). Intensive use of chemicals has wiped out natural enemies of DBM while it has at the same time developed resistance to most chemicals resulting in even greater application of pesticides (Seyd and Fauziah, 1996). Head rot (Botrytis) and black rot are the most significant diseases of kale. Both are soil borne fungal diseases spread by spores and can be devastating during wet weather. Biological control of pest is often promoted especially for control of pests. At the same time integrated pest management and safe use of pesticides in the production of vegetables are promoted in Kenya (Okello and Swinton, 2010). However, the ineffectiveness of biological control strategies has led to heavy reliance of chemicals.

2. Conceptual framework

This study used the Means-End Chain (MEC) approach developed by Gutman (1982) and Reynolds and Olson (2001) based on the personal construct psychology developed earlier by Kelly (1955). The MEC approach has been used widely in the fields of marketing and psychology to study factors influencing choice or decision-making by individuals and consumers. Consumer oriented applications of the MEC approach for fresh food are vast (see Santosa and Guinard (2011), for an overview of the existing literature).

The MEC theory can be applied to analyze the farmer's decision-making process. In the context of the farming environment, the