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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

Carl Johan Lagerkvist [a], Marther Ngigi [b], Julius J. Okello [b,*], Nancy Karanja [b]

[a] Swedish University of Agricultural Sciences, P.O. Box 7013, Johan Brauners Vag 3, SE-750 07 Uppsala, Sweden
[b] University of Nairobi, College of Agriculture and Veterinary Sciences, P.O. Box 29053 – 00625, 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

* Corresponding author. Tel.: +254 727 869 515.
E-mail addresses: carl-johan.lagerkvist@ekon.slu.se (C.J. Lagerkvist), matherngigi@gmail.com (M. Ngigi), jjokello@gmail.com (J.J. Okello), nancy.karanja@cgiar.org (N. Karanja).

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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 theory posits that the farmer utilizes a certain production practice (means) to generate particular benefits that will ultimately serve to attain more abstract cognitive personal values (end) that the farmer associates with the benefits. Thus MEC approach facilitated the understanding of kale farmer's motivations in their decisions regarding crop protection measures.

The MEC approach states that perceived self-relevant product *attributes* lead to *consequences* which lead to certain personal *values* being fulfilled. Each *consequence*, in turn, supports one or more cultural values and/or existential or life goals. The *consequence* can be direct, indirect, physiological, psychological or sociological. Thus, farmers who make decisions about crop protection methods (representing *attributes* in our case) are expected to act so as to maximize the positive and minimize the negative consequences of doing so (Gutman, 1982). They then learn the attributes that are instrumental for achieving their desired consequences. In addition, the more important the consequence is, the more significant are the personal values (Gutman, 1997).

Values are the end states of the MEC and are cognitive representations of abstract goals, being similar to needs that motivate action and conceptually different from personality traits. Values represent standards that guide thought and action. They are trans-situational and inherently desirable (Roccas et al., 2002). Values play an important role in terms of an individual's behavior because they are cognitive representations of individual needs and desires on the one hand, and of societal demands on the other. That is, values are translations of individual needs into a socially acceptable form that can be presented and defended publicly.

The inter-linked attribute (i.e., production practice)–consequence–value chain forms an associative network of knowledge, which can function as a cognitive structure and/or as a motivational structure. When applied to the farmers' decision-making process concerning choices of production practices, the MEC approach assumes a hierarchy of goal levels guiding the actual behavior. This means that in thinking about a production-related action to be taken, i.e. application of pesticides for disease control, a farmer may gather and analyze information from the environment by relating it to information stored in his/her memory based on past experiences. The behavior of the farmer is then directed towards the attainment of a goal in mind by using the structure of the Means-End Chain as a roadmap. On the other hand, the motivational perspective gives emphasis to the intensity between either the attributes or consequences and the values. The more strongly this intensity is perceived, the larger will be the probability that the farmer gets motivated to take action. Therefore examining the MEC related to use of production practices can be useful in determining the drivers of farmer's choice of these practices. Thorough understanding of such drivers is imperative for the development of measures to improve food safety and quality.

3. Empirical research methods and data

3.1. Empirical methods

A proposition of this research is that studying the Means-End-Chains for farmers' choice of crop protection methods allows for detection of interactions between actual behavior, in the form of the choices made by the farmer in relation to crop protection, and the specific motivations behind the choices made by the decision-maker. Means-End Chains are elicited during the laddering interviews. This interview technique was originally developed by Hinkle (1965) and subsequently refined by Reynolds and Gutman (1988) who developed well-defined protocols for implementing this technique. Laddering has been widely used in personal construct research (Costigan et al., 2000), but has also been used in research on knowledge acquisition (Rugg and McGeorge, 1995), organizational research (Rugg et al., 2002), and within marketing, consumer research and food product design (e.g. Reynolds and Gutman, 1988; Grunert and Grunert, 1995; Costa et al., 2004). However, the application of the MEC approach and laddering technique to the study of the motivational structure of farmers remains very scarce. Notable exceptions include a study by Johnston and Healy (2006) who used the MEC to examine Australian farmers' choice of supply chain channels. A similar study by Salame (2004) assessed Lebanese farmer's motivations for choice of farming activity (i.e. organic or conventional). We are not aware of any previous studies that have used the laddering technique in relation to farmers' choice of production practices especially those relating to the use of pesticides.

The laddering technique builds on either a face-to face or a pencil-and-paper format. In the former alternative, individual, in-depth interviews are done in which the respondents are required to generate or verify associations between attributes–consequences–values (ACV) in sequences utilizing an a priori list of ACV's (hard laddering) or situations in which respondents are free in their associations and where ACV's are reconstructed during the interview (soft laddering). There is little agreement among researchers about which of the two types of laddering is more appropriate (Costa et al., 2004). Hard laddering entails a risk of discerning associations that were not there from the beginning, to generate a too restricted scope of motivations and thus of providing a mechanistic environment potentially risking the predictive ability by reducing the active involvement of subjects during interviews (Jonas and Beckman, 1998). Soft laddering, on the other hand, is more often employed in studies with a few subjects (<50) and where the focus is more explanatory. It is recommended for being more appropriate in revealing more complex underlying motivations for decisions taken (Reynolds and Gutman, 2001).

Laddering interviews consist of two stages: firstly, respondents are asked to indicate the most salient attributes associated with the topic(s) under study, and secondly, through a series probing questions in form of "why is that important to you?", respondents are led to reveal the importance of these attributes with respect to their consequences and values. In this study respondents revealed the linkages among pest/disease control practices (i.e., attributes), usage consequences and personal values which were then used to create "mental maps" of the farmers' views toward the target production practices. This attribute–consequence–value (ACV) relation forms a Means-End Chain. By combining the maps of similar farmers, a large, more exhaustive map can be developed. The hierarchical value map (HVM) is a graphical description of a laddering interview that is used to present the relationships between the attributes, consequences, and values.

This study used a semi-structured laddering approach in which elements of hard and soft laddering was combined. Following Reynolds and Gutman (1988), the respondents were informed that there would be no right or wrong answers and advised to answer the questions truthfully prior to starting the interviews. Hearing that the interviewer is not to judge what is right or wrong typically makes people more at ease thus making the respondent speak more freely and truthfully (Reynolds and Gutman, 1988). At the initial point of each laddering interview, kale farmers were asked to rank the crop protection methods they apply in order of preference. Specifically, the farmers were asked: "What are the strategies you use to protect your kale from pests and diseases?" After the different protection strategies were enumerated, a second question was posed to the farmer: "Among the strategies you have listed, what are the three most important ones, in order of importance, to you?" The response thus provided the ranking of crop protection strategies used by the farmer. This formed the study association and generated the attributes. Thus, the first step in the laddering interview used the hard laddering approach that helped identify the crop protection methods (i.e., attributes) farmers used in protecting kale from pests and diseases. These attributes included the use of: 1) agrochemicals or pesticides, 2) soil cultivation methods (e.g., weeding, mulching, watering, fallowing, furrows for drainage), 3) cultural methods (e.g., the use of ash, clean manure, bio-pesticides, traditional herbs) and 4) physical methods (e.g., manual killing of pests, uprooting/pruning of infested kale in the field). These crop protection methods are the most commonly applied by vegetable farmers in Kenya in general.

Secondly, the focus was then given to the use of pesticides since it was ranked the most important and the interviews were directed towards explaining the motivational factors related to use of pesticides, timing of pesticide application and observation of pre-harvest intervals. This was to aid in understanding the reasons why farmers observed or failed to observe pre-harvest intervals.

The interviewers used Dictaphones to record each interview. They also sketched the ladders on notebooks during the interviews and reviewed them after every interview session to ensure that all consequences were followed to the end. The sketches were again reviewed at the end of the day using the recorded interviews to validate their completeness. The generated ladders were used as reference points during the transcription of data. The ladders across the respondents were recorded on a separate coding form for the entire set of ladders and inspected to ensure completeness. A set of summary codes were developed to ensure that all the attributes, consequences and values that were mentioned by the respondent were covered. This was done by first classifying all responses into three categories namely, attributes, consequences and values in all the crop protection associations in order to produce consistency in content analysis.

The analysis of the laddering data was conducted following the recommendations by Reynolds and Gutman (1988). The values stated by the respondents were sorted according to the classification of values. The “Mecanalyst Software” was used for the analysis of the data collected during the laddering interviews. After entering and encoding the data, the software constructs an implication matrix that indicates how often concepts have been mentioned and linked to each other, both directly and indirectly. The Mecanalyst Software furthermore enables an aggregation of the Means-End Chains (MEC) into a Hierarchical Value Map (HVM). The attributes, consequences and values form chains that are put into a hierarchical value map (HVM) to depict the cognitive or motivational decision structure of the farmer (Grunert and Grunert, 1995).

3.2. Data

This study uses data collected from kale farmers in peri-urban areas of Nairobi. The farmers in the study areas (i.e., Athi River, Ngong and Wangige) practice intensive agriculture characterized by the use of manure, fertilizer and pesticides for kale production. The average land ownership in the study areas was about one acre per household, with only approximately 0.5 acre available for farming.

The respondents were randomly sampled from a list of the 120 farmers who had earlier participated in household survey conducted as the first phase of the study. The 120 farmers were randomly sampled from the lists of kale growers in the three study sites with weights proportional to the population of farmers in the respective study areas. For the laddering interviews, a random sample of kale growers was drawn from the list of household survey respondents in each of the study areas. This process yielded a total of 54 kale farmers (Athi River $n = 5$, Ngong $n = 24$ and Wangige $n = 25$).

Table 1 presents the summary statistics for the farmers interviewed during the laddering study. It shows that farmers interviewed had a relatively low and variable average monthly income (i.e., Kenya Shillings 16,882). The Table also shows that the farmers were older with an average age of 47 years. In addition, most of the respondents had, on average, primary level of education. Most of the respondents were male (75%) and had, on average 16.26 years of farming experience.

4. Results and discussion

The hierarchical value map in Fig. 1 presents the synthesis of the decision to use pesticides as crop protection measure in kale production by the 50 respondents. This aggregated decision map highlights similarities in farmers’ motivational structure and behavior in relation to use of pesticides for crop protection in kale production. A cut-off level of 4 was chosen to develop HVM, meaning that a link was drawn between two concepts if at least four respondents had mentioned it as a direct or indirect link. Choosing a cut-off level involved a trade-off between the amount of data represented by the map and the transparency of the map. It is suggested that a minimum of 70% of the relationships on the map should be represented (Gengler et al., 1995). Here, the HVM in Fig. 1 includes 93% of all direct links mentioned by the respondents. Only 7% of the respondents mentioned that they used the other methods crop protection against pests and diseases.

The three consecutive levels of the map represent attributes (at the bottom), consequences (in the middle) and values (at the top). The lines represent the MECs or the associations, with the thickness indicating the strength of the associations. Hence, a very thick line between two concepts means that many respondents made this association during the interview. Ladders or codes with an incomplete chain or missing antecedent were excluded in the implication matrix from being represented graphically in the HVM.

The results presented in Fig. 1 have only one attribute, namely pesticide usage, because our aim was to assess crop protection decisions that affected kale safety. This attribute was associated with ten consequences and five end values. The HVM indicates five motivational structures of ladders (i.e., personal values) with respect to pesticide usage namely, happiness, helpfulness, good health, comfortable life and independent.

The illustration shows that leafy vegetables farmers use pesticides to protect kale from pests and diseases. The motivation for applying pesticides therefore was to ensure that kale was good-looking or had high sensory quality attributes. This in turn attracted more buyers and also met buyers’ demands for aesthetic quality, usually sought-after by consumers. In addition, the use of pesticides protected kale from pests and diseases which increased the quantity of marketable kale thus generating more money or

Table 1
Summary statistics of the laddering interview respondents ($n = 54$).

Variable	Mean	Std. dev.
Age (years)	47.00	13.36
Gender (1 = male, 0 otherwise)	0.75	0.44
Farming experience (years)	16.26	12.23
Years of schooling	8.88	3.44
Highest education	1.49	0.70
Kids under 5 (1 = Yes, 0 = No)	0.52	0.45
Household size (head count)	3.45	1.97
Household income (Ksh[a])	16882.00	11618.00
Farm acreage (acres)	1.06	0.80
Kale growing acreage (acres)	0.49	0.40
Distance to nearest market (km)	3.48	3.58

Source: Author’s survey.
[a] Ksh = Kenya Shillings. 1 US dollar was equal to Ksh 71 at the time of this study.

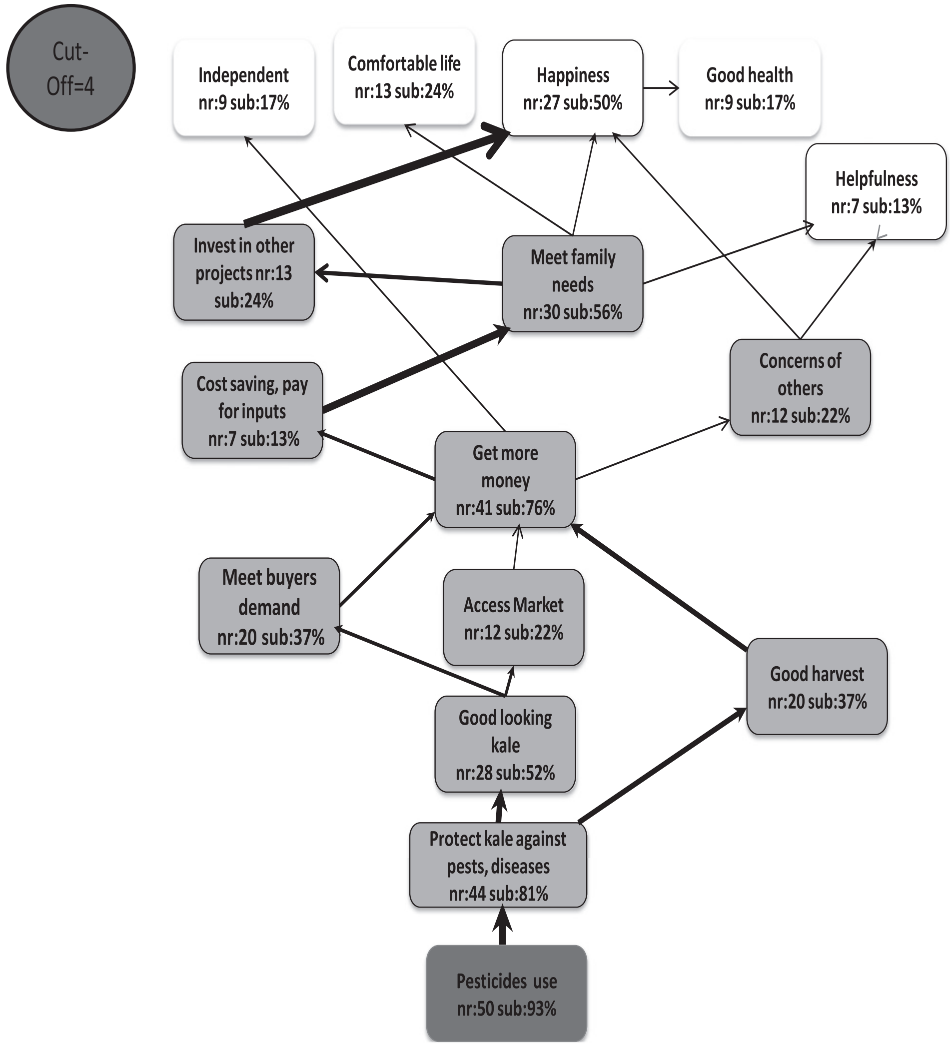

Fig. 1. HVM for the use of pesticides in kale production in peri-urban areas.

higher profit margins to growers. The consequence associated with making more money from kale production was the ability to meet family or personal needs. These needs include children's education, and the provision of food, clothing and shelter for the family. The consequence associated with meeting family needs was the ability to invest in other projects or expanding the farming business. As the HVM shows, the major value/benefit to the farmer of being able to meet family needs is happiness which subsequently leads to healthy life. In other words, farmers apply pesticides to protect kale from pests and diseases in order to avoid failure to meet family needs which can fuel disputes and degenerate into health problems. Indeed, the majority of the farmers that identified this consequence—value chain argued that the lack of happiness can result in stress-related diseases and hence bad health. This finding suggests that kale farmers' most important motivation for using pesticides in kale production is to live a happy life, free from stress-related diseases.

Pesticide application on kale can either occur prior to pest/disease infestation (i.e., preventive) or after pest/disease infestation (treatment). The former typically occurs where the farmer uses calendar-spraying (i.e., spraying based on growth stages of the plant) while in the latter, spraying is done only after noticeable pest/disease infestation has taken place. The hierarchical value map in Fig. 2 presents an analysis of the decision to spray pesticides after pest/disease infestation (i.e., the use of treatment spraying). As shown, 76% (39 farmers) of the respondents in this study applied the pesticides during this time.

The HVM for spraying after infestation highlights four motivational structures of ladders (i.e., personal values) that condition the preferred time of pesticide application namely, happiness, helpfulness, comfortable life and independent life. The HVM shows that leafy vegetable farmers apply pesticides after infestation of pests and diseases to increase the efficacy of pesticide use or protect kales from pests and diseases. The timing of application was also motivated by the desire to save the costs of crop protection. The figure shows that crop protection enables farmers to get good-looking (i.e., higher quality) kale and also increases the harvest of kale which subsequently leads to an increase in revenues generated from kale production. The last consequence of getting more revenues from kale was that the farmer was able meet family and/or personal basic needs such as food, clothing and education. The most ultimate value derived from ability to meet family and personal needs was happiness. The other values associated with having more income (revenues), in order of importance, were having a comfortable life, independence and being helpful to other members of the society.

The hierarchical value map in Fig. 3 represents the synthesis of the decision by farmers to apply pesticides on kale before

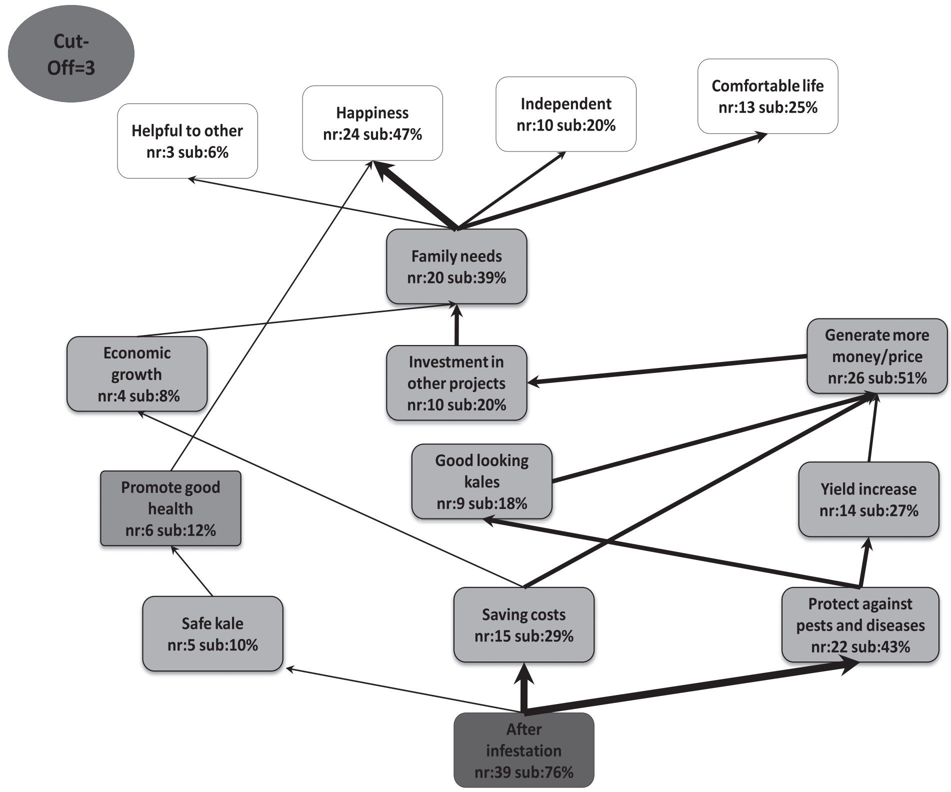

Fig. 2. HVM for the time of pesticides application in kale after pests/disease infestation.

infestation of pests and diseases (i.e., preventive treatment). Only 7% of the respondents applied pesticides on kale during this time. The HVM shows that three motives condition the decision by farmers to use pesticides for preventive treatment namely, i) to save on costs of pesticides since costs of prevention tend to be lower than the cost of treatment, ii) to prevent kale from pest or disease attack and iii) to increase the crop yields or harvest for a longer period due to likelihood of lower pest intensity. The

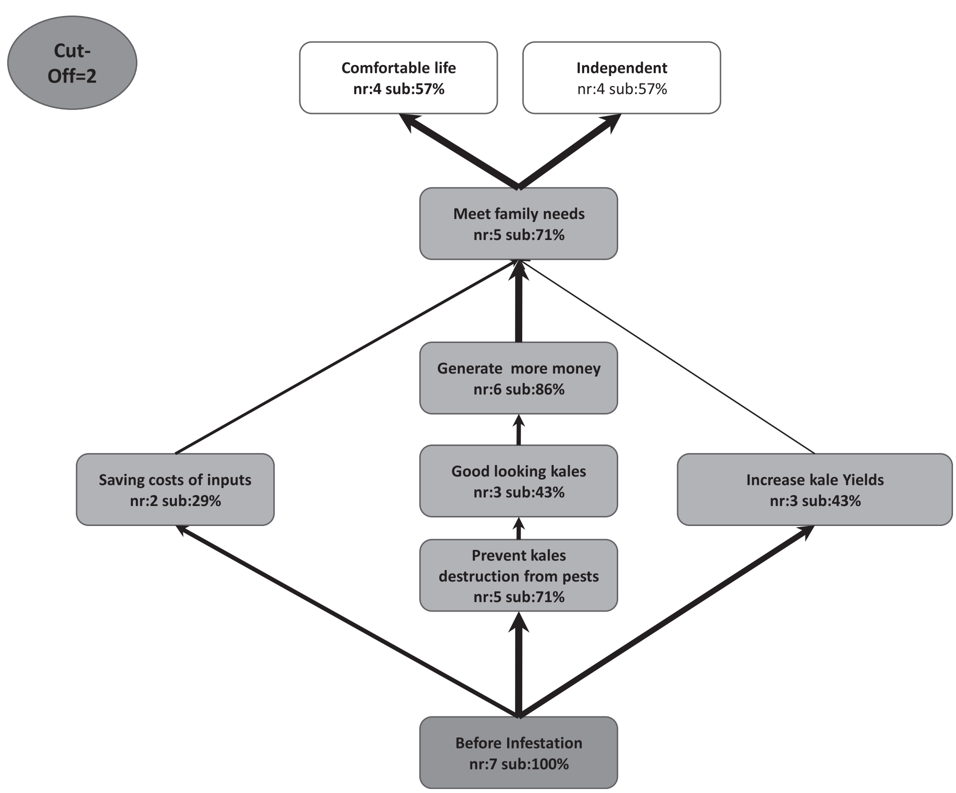

Fig. 3. HVM for the before pests/disease infestation time of pesticides application in kale production.

consequences of preventing pest attack was the good-looking (i.e., higher quality) kale which generated higher margins and helped meet family or personal needs such as school fees, food and clothing. The ultimate personal value related to being able to meet family needs was comfortable life and self-dependence. Fig. 3 also shows that the savings in the cost of pesticides also enabled farmers to meet family needs which subsequently led to comfortable life and independence as values.

Observing the intervals between pesticide application and the harvest (i.e., the pre-harvest intervals) is important in reducing exposure by consumers to pesticides through ingestion of residues in kale. The pre-harvest interval is the minimum time between pesticide application and harvest and is recommended at 15 days for most categories of pesticides. It determines the level of pesticide residues in leafy vegetables. The results of this survey showed that total of 15% of the farmers waited for 4–7 days while 70% of the interviewed farmers indicated that they normally waited for 8–14 days before harvesting kale. These results show that a significant number of peri-urban farmers applied pesticides between the harvests of kale. While this practice is common in vegetables that are harvested intermittently, it can pose significant risk of pesticide poisoning to consumers. The risk of pesticide poisoning is especially magnified in the case where the pesticide used has a long pre-harvest interval, considering that kale leaves grow very fast and that farmers are unlikely to let the produce go to waste while awaiting the expiry of pre-harvest interval.

The hierarchical value map for the observation of pre-harvest intervals in kale production is presented in Fig. 4. A cut-off level of 5 was chosen in developing this HVM. The HVM indicates that there are five motivational structures of ladders with respect to whether a farmer observed pre-harvest intervals or not. These are happiness, good reputation, comfortable life, honesty and good health. Contrary to the household survey results, 94% of kale farmers interviewed during this laddering exercise indicated that they observe pre-harvest intervals. The length of the pre-harvest intervals however varied, even though the farmers were aware of the recommended intervals necessary to protect consumers from exposure to toxic pesticides. The motivation behind the decision to observe pre-harvest intervals was to make kale safer for own or buyers' consumption and promote good health. The farmers interviewed indicated that they were motivated to promote good health of kale consumers by the need to maintain customer confidence with buyers. Doing so helped to reduce losses and also generated more money especially because buyers who associate their kale with safe healthy product will usually come back for repeat purchases. Having good health, on the part of the farmer, helped them save the money they would otherwise spend on treatment and medication of pesticide related illnesses. At the same time, promoting good health of the buyers was, to the farmers, a sign that they cared about the well-being of others (i.e., kale consumers). In addition to good health, the other values that motivated farmers to reduce the level of pesticide residues in kale by observing pre-harvest interval were the pursuit of comfortable life and honesty.

The ultimate value associated with caring for others welfare and saving treatment and medication costs was happiness. The other consequences that were associated with happiness as a value were meeting family needs and reducing kale losses. Among these, reducing kale losses contributed the most to happiness suggesting that farmers care a lot about post-harvest losses in kale production. Fig. 4 also shows that the ultimate personal value or motivation for kale farmers to maintain customer's confidence is good reputation or a good name. Only one kale farmer openly admitted that he does not observe pre-harvest intervals at all. The motivation for this farmer was the timely sale of the ready-to-harvest kale thus reducing losses. Interestingly, the ultimate value that motivated the disregard for observation of the pre-harvest intervals was wealth accumulation, suggesting that the farmer was driven by personal gain.

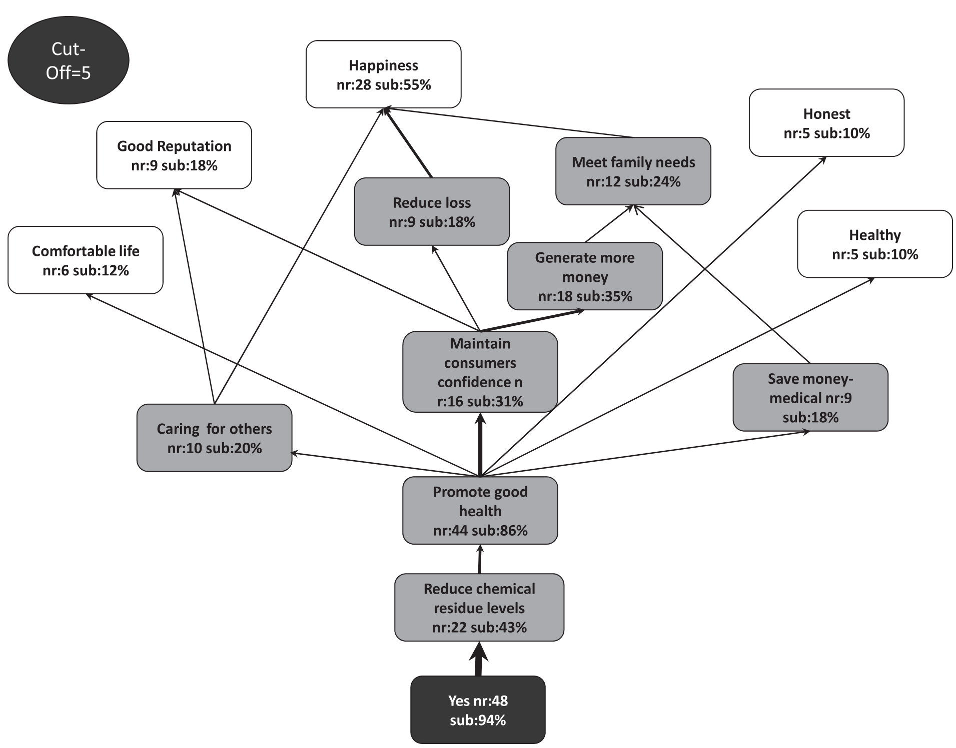

Fig. 4. HVM for the observation of pre-harvest interval in kale production.

5. Summary, conclusion and policy implications

This study examined the motivations for peri-urban farmers to choose crop protection practices used in the production of kale. The study focused on peri-urban kale growers around Nairobi and used a technique that leads the farmer to reveal the motivations (personal values) behind the choice of practices known as the laddering technique. It is, to our knowledge, the first study that applies this widely used technique of consumer studies to assess farmers' inner motives for the choice of crop protection practices. The study found that the choice of crop protection practices relating to pesticide usage is driven by a number of values including happiness, good health, independence, comfortable life, honesty, and also caring for and helping other people. Results indicated that farmers mostly applied pesticides in kale after pest/disease infestation in order to increase the effectiveness of pesticide use and hence obtain good-looking kale that earned them more money and enabled them to meet personal and basic family needs. These findings, to some extent, corroborate those of past studies (Thrupp et al., 1995) that suggest that farmers' excessive use of pesticides in fresh vegetables is driven by consumer demands for aesthetic quality attributes. They, however, in addition, reveal that the real motive for using pesticides is to meet family needs through earned income which ultimately results in happiness.

The results also indicate that majority of the farmers chose to observe the pesticides pre-harvest interval in order to promote the good health of their family members (who consume kale from the same plots) and that of their customers. The motivation to promote good health was however driven by personal goals namely, maintaining customer/buyer confidence and, ultimately, being able to sell in future. This enables the farmer to continuously meet family needs which results in happiness and a sense achievement. Thus the true motivation for the choice of timing of pesticide application and the decision to observe pre-harvest interval seems to be to make more money that is subsequently used to meet family needs with the result that the farmer lives a happy life. The other motivations for pesticide use included benevolence value (being helpful and honest to trading partners), power (social recognition or good reputation as good farmer), hedonism (happiness for being a successful farmer), security (having good health) and self-direction (independence or being self-supporting from vegetable income).

A closer examination of the motivations for the timing of pesticide application and the decision to observe pre-harvest intervals reveals a dissonance/conflict of varying interests: the motives that drive the timing of pesticide application (namely to make more money) can encourage greater use of pesticides whereas decision to apply pesticides only when there is pest/disease infestation reduces excessive use of pesticides. This conflict presents a major dilemma to farmers because while the desire to produce good-looking kale so as to make more money can potentially promote excessive use of pesticides, the desire to promote good health of kale consumers has the opposite effect of promoting judicious use of pesticides.

The findings of this study suggest the need for policies that control/regulate pesticide usage practices among farmers to ensure that the profit-making motives are not pursued at the expense of environmental cleanness especially in the form of medical health of kale consumers. The findings also suggest the need for policies that strongly and/or stringently promote observation of the recommended intervals between the time the pesticide is applied and the time of harvesting. Notably, the farmers interviewed in this study were aware of the need to observe the pre-harvest intervals but very few were aware of the recommended length of the interval. Hence farmer education that creates awareness of the latter is essential.

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