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SMALL SCALE FARMERS' KNOWLEDGE AND PERCEPTIONS OF MAIZE INSECT PESTS AND THEIR MANAGEMENT IN HIGHVELD AND MIDDLEVELD REGIONS OF SWAZILAND

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ABSTRACT

Farmers' perception of insect pests and effectiveness of their management tactics are crucial in improving yields of maize. Surveys were conducted in the small scale maize farmers in Highveld and Middleveld regions of Swaziland to gain insights into farmers' perceptions of maize pests and pest management practices. Interviews administered to 61 small scale farmers revealed households' age, educational background and years of experience in maize farming affects farmer's perception and pest management practices. The size of the farm owned by a household, household head's gender and family size had negligible and uneven effect on perception and on adoption of insect pest management practices. Importance of information on farmers' perceptions and the need for agricultural extension services to develop control strategies that meet farmers aspirations is discussed and priority areas for future research are identi ed.

INTRODUCTION

Maize, a staple food for most households in Swaziland, is grown on Swazi Nation Land (SNL) and Title Deed Land (TDL) in almost all agro-ecological zones. Swazi Nation Land is held in trust by traditional authorities for the Swazi people and about 90% of the crop is grown primarily under this system (Magagula *et al*., 2007). It is estimated that small scales use approximately 86% of land on Swazi Nation Land (SNL) for growing maize (Hlobsile *et al*., 2015) but produce only 10% of the total production (Dlamini *et al*., 2012). Domestic production has been steadily declining, and maize imports have been rising rapidly (National Maize Cooperation, 2013). The country is currently a net importer of maize as demand outstrips supply (Raufu *et al*., 2016) and this could be reverted by improving productivity in small scale farms. Maize insect pests are among the factors responsible for low maize production in small scale farms of eastern and southern Africa (Abate *et al*., 2000).

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Improved insect pest management practices are, therefore, critical if small scale farmers are to obtain high yields of maize (Jacobson and Myrh, 2013).Farmers are knowledgeable about pests of maize, but some of their perceptions do not agree with scienti c perceptions (Kamanula*et al.,* 2010). Farmers are more likely to assess a technology with criteria and objectives, which are different from criteria used by scientists. Complementary contributions of farmers and scientists are essential for effective research and technology development. Farmers' evaluations help scientists to design, test and recommend new technologies in light of information about farmers' criteria for usefulness of the innovation (Ashby, 1991). Linking small scale farmers'pest management practices and research outputs are the appropriate vehicle to reduce production costs and facilitate access of small-scale farmers to input and product markets that could promote their productivity and development. However, majority of small scales live in rural areas with poor road infrastructure (Assefa and Van den Berg, 2010), these attributes can generally limit their access to and comprehension of appropriate information necessary for creating awareness on pests and adoption of improved pest management practices (Jacobson and Myrh, 2013).

Additionally, small scale agriculture is characterized by small land holdings (Aheto *et al.,* 2013) and most farmers may be unwilling to invest on pest management tactics (Morris and Thomson, 2014). All these, coupled with a reluctance to diversify pest management practices because of the perception that alternative tactics are less cost-effective, limit the diversity of control options available. In order to develop integrated and sustainable pest management strategies in maize farms, it is imperative to have adequate information about these farmers' perceptions and management practices. Moreover, such information is also important for the development of farmers' participatory pest management strategies. Farmers' perceptions and management practices of maize insect pests have received limited attention in Swaziland and there is only negligible information. This paper will report farmers' perceptions to maize insect pests and their management practices in the Highveld and Middleveld regions of Swaziland. The paper also examines the factors that are responsible for variation in perception and adoption of Insect pest management practices in small-scale maize production in the two regions.

MATERIALS AND METHODS

Survey areas

Surveys were conducted in Ngwemphisi, Ludzeludze, Luve, Motjane and NtfonjeniRural Development Areas (RDA) (Figure 1). Motjane and Ntfonjeniare situated in the Highveld region which is located on the western side of the country and covers 29% of the total land area. The Highveld has an average altitude of 1300 metres above sea level and receive the highest rainfall in Swaziland averaging 1250mm per year. Ngwemphisi, Ludzeludze, and Luveare parts of the Middleveld region which lies to the east of the Highveld and covers 26% of the total land area of the country. It varies in elevation from 1000 to 500 metres above sea level. The climate is subtropical and annual rainfall ranges from 1150mm in the wetter western regions to 750mm in the drier eastern side (Ogle and Grivetti, 1985; CSO, 1997).

Survey methods

Surveys were conducted between December 2015 and February 2016, in the two main maize producingregions. Within these regions, surveyed RDAs were selected on the basis maize production statistics. The geographic coordinates (latitude and longitude) of each farmer interviewed was recorded using a GARMIN 12X portable Geographic Positioning System (GPS). A total of 61maize farmers were interviewed. The number of small scale farmers interviewed per RDA varied due to the variation on the size of the farming population between RDAs. Farmers were selected randomly and a farmer willing to participate in the survey was individually interviewed. A wide range of information on personal profile of household head and household size, small scale farmers' awareness of maize pests and pest management practices were carefully and patiently presented to the respondents in a well-structured questionnaire (Lewu and Assefa 2009). To obtain first-hand information about the maize cultivation practices, observations were made by survey personnel on the cropping activities of the communities visited. Farmers' responses to questions on family structure, small scale farmers' awareness of maize pests and pest management practices were recorded. For each question, the percentage of farmers who gave similar responses was calculated for each RDA and percentages calculated based on the total number of farmers who responded to each question. Those who did not respond to certain questions were excluded from the percentages. In instances where a farmer selected more than one reason for the use of certain method, percentages were calculated for each group of similar responses. The correlation between household characteristics and perception were analyzed by Pearson chi-square test (χ^2) using SPSS version 20 (IBM, corporation, USA).

RESULTS

Farmers' household and farm characteristics

More than half of the households of maize farmers (50.8%) interviewed were headed by females (Table 1).

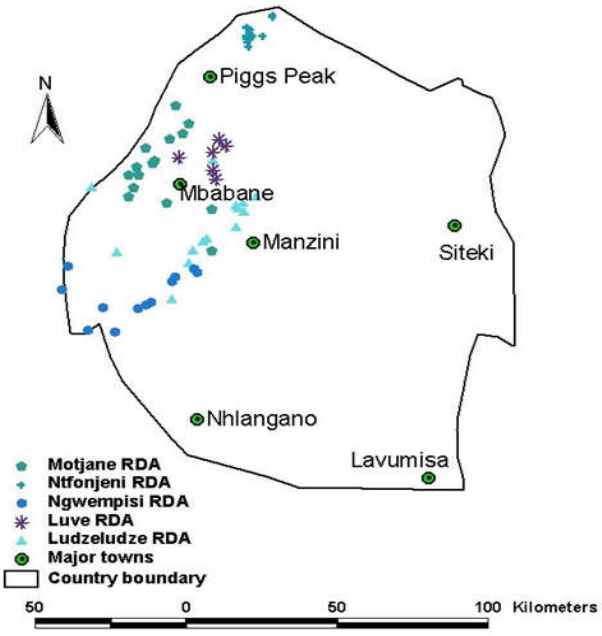

Figure 1. Map of Swaziland, showing Rural Development Areas and localities surveyed

Table 1. Household characteristics of the interviewed farmers in the five Rural Development Areas of the Highveld and Middleveld regions of Swaziland

	Middleveld				highveld			Overall Average (61)
	Ngwemphisi (12)	Luve (6)	Ludzeludze (14)	Average (32)	Motjane (15)	Ntfonjeni (14)	Average (29)	
Household heads' sex								
Male	50	33.3	50	46.9	60	42.9	51.7	49.2
Female	50	66.7	50	53.1	40	57.1	48.3	50.8
Households' age (years)								
30-45	8.3	33.3	21.4	18.8	26.7	50	37.9	27.9
46-60	41.7	33.3	50	43.8	40	42.9	41.4	42.6
>60	50	33.3	28.6	37.5	33.3	7.1	20.7	29.5
Range	36-77	40-69	35-67	35-77	39-74	31-63	31-74	31-77
Schooling level								
Primary	58.3	33.3	28.6	40.6	26.7	35.7	31.0	36.1
Secondary	25	50	35.7	34.4	53.3	57.1	55.2	44.3
Tertiary	0	0	14.3	6.3	20	7.1	13.8	9.8
Illiterate	16.7	16.7	21.4	18.7	0	0	0	9.8
Family size (number)								
1-5	16.7	0	28.6	18.8	20	14.3	17.2	18
6-10	75	83.3	50	65.6	60	78.6	69	67.2
>10	8.3	16.7	21.4	15.6	20	7.1	13.8	14.8
Range	4-10	6-13	1-19	1-19	5-22	3-10	3-22	1-22
Experience (years)								
0 – 15	25	50	42.9	37.5	20	35.7	27.6	32.8
15 -30	8.3	16.7	21.4	15.6	26.7	21.4	24.1	19.7
>30	66.6	33.3	35.7	46.9	53.3	42.9	50.7	49.2
Range	14-48	11-42	5-50	5-50	10-54	4-44	4-54	4-54
Land size (ha)								
0.5-1.5	41.7	16.7	28.6	31.3	20	85.7	51.7	41
1.6-2.5	33.3	66.7	42.2	43.8	46.7	14.3	31	37.7
> 2.5ha	25	16.7	28.6	25	33.3	0	7.3	21.3
RANGE	0.8-4	1-3	1.2-4.5	0.8-4.5	1-5	0.5-2.5	0.5-5	0.5-5

Table 2. Effect of household variables on small scale farmers' perceptions of pest problems in the study area

	Perception of insect pest problem				Perception of important insect pests			
Variables	x^2	df	P-value	sig. level	x^2	df	P-value	sig. level
Household heads' sex	1.051	1	0.305	ns	2.161	3	0.54	ns
Household heads' age	2.429	2	0.297	ns	7.793	6	0.254	ns
Schooling level	1.283	3	0.734	ns	80.32	9	0.00	**
Family size (number)	1.802	2	0.406	ns	2.04	6	0.916	ns
Experience (years)	3.413	3	0.332	ns	10.65	9	0.301	ns
Farm size	1.802	2	0.406	ns	4.458	6	0.615	ns

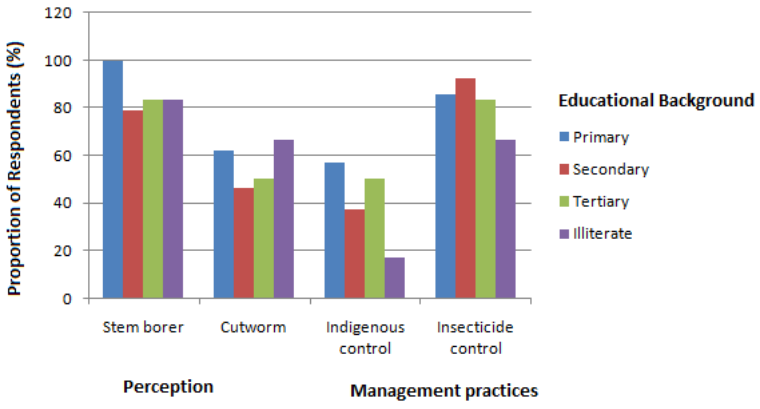

Figure 2. Variation in perceptions and insect management practices between farmers with different levels of educational background

The age of the household heads ranged between 31 and 77 years. Seventy percent of the household heads were between 30 and 60 years old and the remaining household heads were older than 60 years.

Most of the household heads (90.2%), had received at least primary school education and only a few (9.8%) were illiterate (Table 1). The number of illiterate farmers varied between regions with aaverage of 18.7% in Middleveld and with no illiterate in Highveld (Table 1).

Table 3 Effect of household variables on types of insect pest management practices used by farmers in the study area

	No of Indigenous methods used				Use of insecticides			
Variables	x^2	df	P-value	sig. level	x^2	df	P-value	sig. level
Household heads' sex	2.254	3	0.521	ns	0.132	1	0.717	ns
Household heads' age	64.257	6	0.00	**	20.151	2	0.00	**
Schooling level	13.009	6	0.043	*	8.703	3	0.034	*
Family size (number)	1.486	6	0.96	ns	0.523	2	0.770	ns
Experience (years)	29.247	9	0.001	**	7.033	3	0.071	ns
Farm size	9.058	6	0.17	ns	2.007	2	0.367	ns

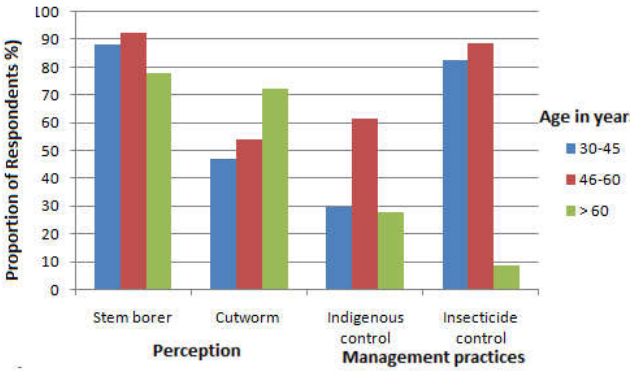

Figure 3. Variation in perceptions and insect management practices between farmers of different age groups

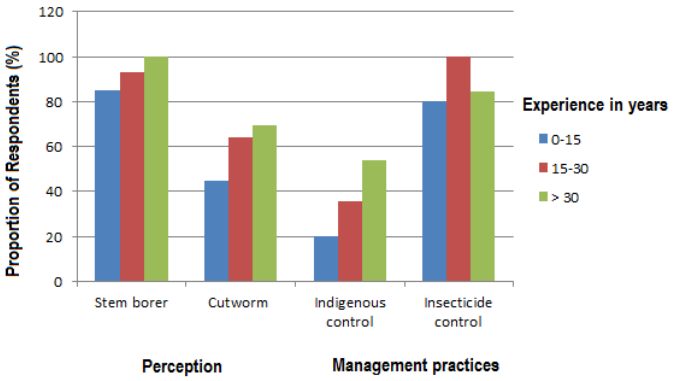

Figure 4. Variation in perceptions and insect management practices between farmers with different years of experience in maize farming

Family size of the respondents ranged between *one* and 22 members. Most of the households (67.2%) had between six and ten family members, while only a few (18%) had a family size of less than five members. The rest of the respondents (14.8%) had a family size of more than ten members (Table 1). Most of the farmers (68.9%) had over 15 years experience in growing maize (Table 1). For some of the respondents, maize cultivation was a tradition that they had inherited from their parents. Most farmers (95.1%) grow maizefor consumption, while a few (4.9%) sale their produce to their neighbors and/or peri-urban settlers. The least experienced farmer had produced maize for four years (Table 1). The farming system in the study regions was characterized by smallholdings with a maximum land size of 5 ha and a minimum land size of 0.5 ha (Table 1). More than three fourth of the respondents (78.7%) had a land size of less than 2.5 ha (Table 1).

Farmers' perception of insect pests as production constraints

Farmers mentioned insect pests to be the second most important constraintsto maize production, only preceded by draught. Insect pests were important maize production constraints for 68.9% of the respondents in the study area. Farmers considered stem borers and cutworms as the major insect pests of maize (Figures 2,3 and 4). The perception of insect pests as production constraints was not affected by gender, age, family size; experience and/or land size (Table 2). However, there was a highly significant ($P<0.001$) difference in perception on the importance insect pests of maize between farmers at different educational levels (Table 2), Stem borers and cutworms were both important pests of maize to illiterate farmers and farmers with primary school education, while farmers with secondary and tertiary level education consider cutworms less important (Figure 2).

Insect pest management practices

Only a limited number of the respondents (32.8%) practiced traditional control methods for the management of insect pests in maize. Farmers used Aloe ash and Blue jays fluid for the control of stem borers in maize. Traditional method used for the control of cutworms in the area is ploughing to expose the insect to sunlight and predators, Farmers also used traps and scares to control other pests. The number of traditional pest control measures used by farmers significantly varied with age, school level and experience in maize farming (Table 3). Older farmers (>60 years) employ more varieties of traditional control method than young ones. The proportion of Illiterate farmers and those with an educational level of primary school were also found to use more traditional control methods than the more educated farmers (Table 3).

The use of insecticides in the management of insect pests is a common practice in the study area. Majority of the interviewed farmers (83.6%) use insecticides for the management of insect pests (Figures 2, 3 and 4). Farmers with varying years of experience from both genders and with different family size uniformly practice insecticidal control of pests (Table 3). Educational background and age of the households' head, however, were found to have a statistically significant ($P<0.05$) effect on adoption of insecticidal control methods (Table 3). Only a few (8.3%) farmers who are older than 60 years (Figure 3) and relatively less proportion (66.7%) of the illiterate farmers (Figure 2) used insecticides for the control of maize pests. There was no significant variation in perception between less and more experienced farmers in the study area. However, the number of famers using all the available (three) traditional control method showed a highly significant difference (Table 2). A significant proportion of experienced farmers used all the three traditional control practice in the study area, while the less experienced (>30 years) used no or only one of the three traditional control methods.

DISCUSSION

The demographic characteristics of the farmers interviewed in the survey indicated that maize production in the study area is not gender bias with 50.8% female and 49.2% male headed households with an average family size of 6-10 members. This is in contrary to Assefa *et al*., (2008) and Lewu and Assefa (2009) who observed farming in Africa is gender sensitive to the male gender. It is often argued that women's lower levels of human and physical capital result in lower productivity or inability to respond to economic incentives (Quisumbing, 1996).

However, women produce 60–80% of the food in developing countries and their share of the measured agricultural labor force has a positive impact on national-level agricultural productivity (Doss 2014). The result of this survey is encouraging as the relatively greater involvement of females in maize production is crucial for future food security and alleviation of poverty in small scale farming in the country. Although there was no record of a farmer who is younger than 31 years, most of the respondents were (70.5%) in their active age (Atsan *et al*., 2009),

There observed a highly significant ($p<0.001$) variation in adoption of insecticides between these and the rest (29.5%) of the household heads whose age was more than 60 years. Studies show that planning horizons of farmers shrink as they age and their incentives for them to invest in the future productivity of their farms diminish (Marenya and Barrett, 2007). Younger farmers are more likely to adopt new practices that extension messages should be focused on younger age cohorts, especially in the early stages of technology development and dissemination (Adesina and Baidu-Forson, 1995). The absence of farmers younger than 31 years in the current study, therefore, raises an important extension policy issue. If the current trend continues farming population in the region could drop dismally within the next decade; with a resultant negative implication on future food security in the regions. There is need to encourage the younger members of the population to be involved in farming. Formal schooling may enhance or at least signify latent managerial ability and greater cognitive capacity (Marenya and Barrett, 2007).This study revealed the effect education on perception of insect pests, the use of indigenous pest management practices and synthetic insecticides.

The number of indigenous pest management practices was negatively and statistically significantly influenced by the educational level of a household heads. Significant number of the respondents with Tertiary and secondary school level education were not practicing indigenous pest control methods, where as a significant number of the illiterate and household heads with primary level education utilize all the available indigenous methods. Moreover, well educated small scale farmers differ in their perception of pests from the less educated and illiterate ones. Illiterate farmers also lag behind in adoption of insecticidal control methods. The implication would seem to be that extension systems and agricultural development projects in the region should seek not only to provide technological options to small farmers, but also to attempt to make up for low levels of educational attainment, perhaps through emphasis on management training and skills building. The number of traditional insect pest management methods used was statistically significantly and positively associated with the experience in maize farming. This would seem to reflect the important role that experience in the retrieval traditional farming knowledge.

Athough it may not be wise to over-optimistically present these indigenous knowledge systems as viable alternative ways of knowing (De Walt, 1994), there need to search for more effective and creative interactions between indigenous knowledge and scientific knowledge systems. In general, this study showed that farmers perceptions and adoption of insect management practices are affected by a range of household characters. Those with long years of experience, better educational background and who are at their active ages are considerably more likely to adopt new pest management tactics and view pests differently. Gender of the household head and variation in family size had negligible and uneven effects on perception and insect pest management practices. The results suggest the presence of a dynamic relationship between household structures and insect pest perception and management that merit further, rigorous research.

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