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CONFIDENCE IN TEACHING INTEGRATED PEST MANAGEMENT (IPM) CONCEPTS, ACCESS TO AND PREFERRED SOURCES OF INFORMATION: A CASE STUDY OF AGRICULTURAL EXTENSION OFFICERS IN KENYA

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ABSTRACT

Integrated Pest Management (IPM) has assumed a central position in the quest for sustainable agricultural practices. IPM is an analytical and knowledge intensive approach to pest management that requires combining different methods of pest control aimed at reducing dependence on synthetic pesticides. Extension agents as educators on innovations in agriculture are an important focus group in the implementation of IPM practices. The main purpose of the study was to investigate how confident agricultural extension officers in Kenya would be to teach IPM concepts in extension programs. The study also sought to determine the level of access to IPM training and information and preferred sources of information of extension officers. The data were collected using a questionnaire from a census of agricultural extension officers in Kenya. The results showed that extension officers had low to moderate confidence in teaching the IPM concepts, especially at advanced levels. Findings also showed that the extension officers had minimal access to information and training in IPM. Based on the results from this study, there is need to improve the knowledge and skills of the extension officers in IPM through seminars, workshops, and in-service training to enable them to effectively promote IPM practices among farmers.

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1. INTRODUCTION AND THEORETICAL FRAMEWORK

Agricultural sustainability and the protection of the environment have gained impetus, and as a result there has been a paradigm shift emphasizing adoption of sustainable agricultural practices in pursuing agricultural development throughout the world. Hence, improving agricultural productivity at the present should not occur at the expense of future potential agricultural output. This could be a likely outcome if there is failure to take into cognizance environmental implications of current agricultural practices. Sustainable agricultural practices encompass production interventions that minimize the use of external inputs with the aim of reducing adverse problems of environmental pollution and degradation. Sustainable practices include efforts to curb soil erosion, and contamination of air, water and soils by harmful agrochemicals (Ramasamy & Sekar, 2003 and Pretty, 1999). The use of pesticides in agriculture, in particular, has been a key issue and interventions have been sought that will effectively counteract the negative effects that have resulted from increased use and at the same time maintain agricultural productivity. The exploration for environmental friendly alternatives to pesticides use in agriculture has positioned Integrated Pest Management (IPM) at the heart of sustainable agriculture. IPM which entails combining a variety of control methods and reducing dependence on synthetic pesticides is viewed as a viable means of minimizing the spiraling use of pesticides in agriculture. The guiding principle in IPM is to incorporate cultural, physical, chemical, and biological pest management methods and to ultimately minimize the use of synthetic pesticides in agriculture. Some of the specific practices recommended in IPM are cultural methods such as crop rotation, intercropping, field hygiene/sanitation, mixed cropping, and soil cultivation; physical methods like manual and mechanical killing of pests; biological methods that include natural enemies; and selective chemical methods (Stoll, 1995; van Huis and Meerman, 1997). IPM has, for instance, been proposed as an important pest management approach and a possible future plant protection model for developing countries and more so for the smallholder farms (Schwab, Jäger, Stoll, Görgen, Prexler-Schwab, & Altenburger, 1995).

In developing countries, adoption of IPM may not be fully realized without understanding the preparedness of the extension agents who play a key role in educating and facilitating change among farmers.

Intervention through extension is especially important in furthering the understanding and adoption of sustainable practices (Swanson and Samy, 2002 & Agunga, 1995) a fact that becomes even more crucial among smallholder farmers who depend on public extension services. Extension agents should be able to participate in planning educational programs and in developing learning resources and activities through which farmers will learn, practice, and adopt improved and sustainable agricultural practices. The government of Kenya has singled out and funded the public extension service as an important tool in agricultural development to achieve government goals that include, increased food production, sustainable agriculture, and improved welfare of rural people. The Kenyan agricultural extension policy outlines the goal of the agricultural extension service as to improve knowledge, change attitude and behaviour, lead to the adoption of new technologies, and improve skills of farmers with a view of increasing and improving farmer incomes and productivity on a sustainable basis. The extension service is further charged with the responsibility of strengthening training programs and developing relevant messages that will raise awareness on environmental matters (Ministry of Agriculture and Rural Development (MOARD), 2001). Among the extension professionals, training and educational challenges to cope with new agricultural technologies and innovations are therefore emerging each day. To continue being relevant as educators, extension professionals must embrace and understand new sustainable agricultural practices and facilitating their adoption.

Studies on sustainable agriculture in which IPM is a key component serve as an important basis in understanding progress in IPM implementation. In a study of sustainable agriculture within the Cooperative Extension Service in the United States, Sisk (1995) noted that prior to the implementation of a new technology or concept, the training needs and expertise of extension personnel, the adequacy and sufficiency of current teaching materials, and the changes needed in qualifications for new extension professionals should be addressed. Sisk examined competencies in sustainable agriculture of extension agents in the United States and the influence of demographic characteristics. There were no statistically significant differences in competencies in sustainable agriculture by age, college major and agricultural background of the extension agents. A related study by Cottrell and Graefe (1997) on the influence of socio-demographic variables on

general responsible environmental behavior (GREB), found a significant positive correlation between perceived knowledge of ecology and GREB. The findings indicate that people will tend to evaluate a new concept on the basis of the knowledge they have and when knowledge is consistent with values, then positive opinions develop towards the subject under focus. Experience and knowledge are singled out as important variables in determining opinions towards sustainable agricultural practices (Delgado-Hernández, 1998 and National Research Council (NRC), 1991). From these findings, it can be inferred that extension agents' ability to discuss and promote with confidence IPM implementation among farmers is a factor of the training and information they have acquired or can access on IPM concepts. Until the technical preparedness of extension officers to integrate IPM concepts into extension activities is understood, facilitating implementation of IPM through public extension systems may not be realized especially for smallholder farming systems which depend substantially on information from the public extension service. The need to assess the preparedness of extension agents in promoting IPM practices is thus timely.

1.1 Purpose and objectives of the study

The main purpose of this study was to examine how confident agricultural extension officers would be to teach Integrated Pest Management (IPM) concepts. The study also sought to find out the officers' access to and preferred sources of training and information in IPM. The specific objectives of the study were to:

1. Describe demographic characteristics of extension officers;

2. Assess agricultural extension officers' confidence to teach IPM concepts;

3. Examine the extension officers' level of access to IPM training and information;

4. Determine the amount of variance in the agricultural extension officers' confidence to teach IPM concepts explained by selected demographic characteristics;

5. Identify the current sources and preferred sources of IPM training and information for the extension officers.

1.2 Methodology

The research design was descriptive correlational. This study was conducted in 10 districts in the Central and Eastern provinces of Kenya. The population of the study was made up of extension officers who are subject matter specialists with extension program responsibilities in general crop production, agriculture and home economics, horticulture and farm management. The population of extension officers in the study was 228 all of whom were included in the study. A survey questionnaire developed from the literature review was used for data collection. One section of the questionnaire contained items on how confident the officers would be to teach IPM concepts measured on a scale that ranged from 1= very low, 2= low, 3= moderate, 4= high and 5= very high. A second part contained six items assessing the availability of training and information on IPM measured on a scale of 1= none, 2= low, 3= moderate, 4= high and 5= very high. A third section had questions on the sources of IPM training and information and preferred sources of such information. Another section carried items on demographic information. The questionnaire was reviewed for content and face validity by a panel in Agricultural and Extension Education. A pilot study was conducted with graduate students in agricultural and extension education from developing countries studying in universities in the USA. Cronbach's alpha reliability coefficient ranged from 0.70 to 0.90 for training and information and confidence to teach IPM concepts respectively. A total of 228 questionnaires were distributed to the extension officers through the heads of agricultural extension in the districts of study. The useable questionnaires returned were 193 for a response rate of 85 percent.

Data were analyzed using descriptive statistics such as means, percentages and frequencies to summarize demographic as well as information from the Likert-type scales. Regression analysis was used to establish the variance in the confidence of agricultural extension officers to teach IPM concepts explained by selected demographic characteristics. Choice for regression analysis was based on Huck (2000) proposition on use of inferential statistics on data collected from a population. Huck indicates that when it is ascertained that future

members in the target population will be similar regarding important characteristics to the current population under study then inferential statistics are acceptable. The current population is, therefore, regarded as a representative accessible sample of similar individuals who will exist under similar circumstances in the future. Using Huck's argument, the population of extension officers in this study was considered as abstract, meaning; the population of interest is not specific but extends into the future and regression analysis applied.

2. FINDINGS AND DISCUSSION

2.1 Objective One: Demographic profile of Extension Officers

Approximately 73 percent of the extension officers were 40 years of age or younger. The average age was 38.5 years, indicating the officers were relatively young. Few (14.8%) were over 45 years. More than half (52.9 %) of the extension officers were male. Female officers were 47.1 percent indicating a near gender balance among agricultural extension officers. Approximately 52 percent of the extension officers had a bachelor's degree and another 43 percent a college diploma indicating a well trained extension workforce. Agricultural extension personnel in officer positions typically have a college diploma as the minimum education level. One third (33.9 %) of the extension officers specialized in general agriculture followed by a further 26.6% in agriculture and home economics. About 68 percent of the extension officers had crop production oriented program responsibility within the extension service. The rest of the extension officers (32 %) were involved in agricultural management activities. Almost two thirds of the officers (67.5%) had worked for 15 years or less, only 15 percent of the extension officers had worked in their current position for more than 20 years. The majority (79%) of the extension officers worked in the divisions or administrative regions smaller than a district and 18.2 % worked at the district level.

2.2 Objective Two: Confidence of Extension Officers to teach IPM concepts in Extension Programs

The results in Table 1 show that overall, extension officers indicated moderate confidence to teach IPM concepts in extension programs

judging from the mean range of 2.74 to 3.90. The highest mean score was 3.90 for "crop rotations" and the lowest 2.74 for the "role of natural enemies." From the results, it is clear that agricultural extension officers were more conversant with concepts of IPM that are commonly used in conventional agriculture such as crop rotations, field sanitation, resistant crop varieties and selective use of chemicals. The extension officers expressed a somewhat low confidence in handling the more complex concepts of IPM such as the role of natural enemies, economic injury levels, and economic thresholds as seen in the mean ranges of 2.74, 2.75 and 2.78 respectively. It is evident from the results that the extension officers had basic knowledge about IPM but were less prepared to deal with the more advanced and complex components of IPM. Most of the extension officers graduated from agricultural colleges and universities in Kenya, where the curriculum covers basics of pest management including IPM. This can explain the familiarity of the extension officers with common or conventional IPM concepts and the fact that in general they have an average understanding of IPM principles.

Table 1: Means and standard deviations of confidence to teach IPM concepts as rated by Agricultural Extension Officers

IPM Concepts	Number of Respondents	Mean*	SD
Crop rotations	193	3.90	0.90
Field sanitation	193	3.63	0.84
Resistant crop varieties	192	3.50	1.05
Selective use of chemicals	193	3.48	1.03
Importance of planting dates	193	3.21	1.06
Use of mulches	193	3.19	0.93
Field cultivation/tillage	193	3.09	0.99
Principles of IPM	193	3.01	1.02
Intercropping	191	3.00	1.00
Use of trap crops	193	2.81	1.01
Use of Economic Thresholds (ET)	193	2.78	1.09
Use of Economic Injury Levels (EIL)	191	2.75	1.16
Role of natural enemies	191	2.74	1.00

**Mean computed on a scale of 1 = "very low" through 5 = "very high"*

2.3 Objective Three: Training and Information on Integrated Pest Management (IPM) practices

The respondents were asked to indicate on a scale of 1=none to 5=very high, the availability and access to training and information on IPM. The findings in Table 2 show that the mean scores ranged from a low of 1.71 for "participation in short courses focused on IPM practices in crop production" to a high of 2.29 for the item "access to bulletins that explain pest management methods such as IPM." Overall, the respondents reported "none" to "low" access to training and information on IPM practices through seminars, research, publications, and short term courses. The results also indicate that not much information and training was available through even usual means of communication such as bulletins judging from the low mean of 2.29. From the respondents' assessment not much training or information on IPM was available to the extension officers. The findings imply that any skills and knowledge the extension officers had on IPM were those which had been acquired from basic training in colleges and universities and there were hardly any supplemental sources in the course of their daily extension duties.

Table 2: Training and access to information on Integrated Pest Management (IPM) practices

Training and information on IPM	Number of respondents	Mean*	SD
Access to bulletins that explain pest management methods such as IPM	191	2.29	0.80
Participation in training on awareness of IPM concepts	192	2.09	1.00
Seminars about non-chemical methods of pest management in crops	192	1.83	0.85
Interacted with research personnel for up-dates on alternative pest management methods.	190	1.78	0.86
Used research publications on IPM practices to plan training on pest management	192	1.72	0.81
Participation in short courses focused on IPM practices in crop production	192	1.71	0.89

** Mean scores: 1 =None, 2 =Little, 3 =Moderate, 4 =High, 5 =Very High*

2.4 Objective Four: Regression of Agricultural Extension officers' confidence to teach IPM concepts and selected demographic characteristics

Regression analysis was used to determine the variance in the agricultural extension officers' confidence in teaching IPM concepts explained by selected demographic characteristics. The mean values for the confidence of the extension officers to teach IPM concepts were summated. Regression analysis was applied to determine the influence of the demographic characteristics on the extension officers' self rated confidence in teaching IPM concepts. The regression model was statistically significant ($F=4.286$ df= 6,154; $p<.05$) accounting for 14.3% of variance in the confidence of the extension officers to teach IPM concepts in extension programs. The findings (Table 3) show that educational level, field of specialization and age were statistically significant in contributing to the variance in the extension officers' confidence to teach IPM concepts. Extension officers with a university degree expressed higher confidence in teaching IPM concepts as opposed with the officers having a diploma. Extension officers with agriculture production orientation indicating a higher rating for confidence in teaching IPM concepts in comparison with their counterparts whose qualifications tended towards agricultural management. Older extension officers were more confident than the younger ones. The findings imply that education level and field of specialization are important factors that determine the confidence of extension officers in IPM. Extension officers with degree qualifications may have had the opportunity to learn more about IPM than their colleagues with a diploma. Extension officers with college majors that have more focus on agricultural production seem to have a better grasp of IPM concepts which can be attributed to a stronger focus in agronomic practices in their training. These findings are contrary to results by Sisk (1995) indicating that agricultural background and college majors were not significant in extension agents' competence in sustainable agriculture. Older extension officers were likely to be more confident in teaching IPM because of possible experience in the course of their work. Other variables like gender, extension program area assigned and work location did not contribute to the variance in the extension officers' confidence in teaching IPM concepts.

Table 3: Regression of Agricultural Extension officers' confidence in teaching IPM concepts and selected demographic characteristics

Variable	b	Standard error	Beta (Standardized coefficient)	t
Education level *Degree (1) vs. Diploma (0)*	6.754	1.752	.374	3.854**
Field of specialization (major) in college *Production- related (1) vs. Other (0)*	4.598	1.891	.217	2.431*
Age in years	.392	.144	.251	2.725**

*R =.378; R^2 =.143; F =4.286; df =6, 154; p<. 05; * significant at .05 level; ** significant at .01 level; (Other) Agricultural management related majors*

2.5 Objective Five: Sources and preferences for acquiring skills and knowledge on IPM practices

Respondents were provided with a list of six categories of location and activities through which they may have acquired knowledge and skills about IPM practices and were asked to indicate all the categories that were applicable resulting in multiple responses. The respondents were also asked to indicate how and where IPM concepts should be learned. The multiple response procedure was used to summarize the data obtained. Universities/colleges were ranked first as the main source of IPM skills and knowledge which is an indication that they are the primary and hence a vital source of information regarding IPM practices. The second in ranking were workshops, newsletters, and seminars albeit with less than 50 percent of the officers acquiring knowledge from these sources. In-service training, field days, media, tours, experience, and research stations featured least as sources of skills and knowledge on IPM. The results imply that these means of teaching and learning in extension have not been used for additional information on IPM. These results affirm the earlier findings noted in this paper indicating that the extension officers had little access to publications, seminars and short courses on IPM practices.

Regarding the question on how and where they want to get knowledge and skills on IPM, seminars were the first preference followed by workshops, in-service training, and newsletters. Ongoing training in extension work has been used as the most practical means of imparting new skills and knowledge in extension officers. There is indication that, seminars, workshops and newsletters are considered fastest and most effective means through which IPM information can be gained and can be used to effectively supplement knowledge and skills on IPM practices acquired in the university or college.

Table 4: Frequencies, percentages and rankings of sources and preferred sources of IPM skills and knowledge

	Selected Sources			Preferred Sources		
Categories	**Fre-quency**	**%**	**Rank**	**Fre-quency**	**%**	**Rank**
University/College	117	66.5	1	40	22.0	5
Workshops	75	42.6	2	130	71.4	2
Newsletters	75	42.6	2	99	54.4	4
Seminars	72	40.9	3	137	75.3	1
In-service Training	40	22.7	4	100	54.9	3
Other (media, tours, field days, research, field experience)	37	21.0	5	28	15.4	6

3. CONCLUSIONS AND RECOMMENDATIONS

The results show that the extension officers have some skills and knowledge on the basic concepts of IPM which were likely acquired from training programs presented at colleges and universities etc. There is, however, evidence that the extension officers had generally a low confidence to teach IPM concepts and especially the more advanced and complex combinations of IPM tactics, judging from the low ratings reported by the officers. The results further indicate that the extension officers had little access to training and information on IPM. As the need for the extension officers to play an active role in promoting sustainable agriculture practices increases, their knowledge on IPM needs to improve beyond the basics. The extension officers have a sound foundation in agriculture and therefore have the capacity to deliver on IPM if provided with the necessary resources. The challenge

for the Ministry of Agriculture is, to establish means by which the basic skills and knowledge on IPM, of the extension officers can be supplemented. This needs to be in line with the agricultural extension policy, of placing the officers at the frontline, in raising awareness of environmental conservation.

The nature of IPM is that it is a dynamic approach to pest management with a need for continuous updating on current findings. The role of the extension officers in facilitating IPM implementation would, therefore, be impossible without ongoing training and information and even more so, on the emerging and more complex IPM concepts. The ability of the extension officers to teach IPM concepts can further be improved through preferred methods like in-service training, seminars and workshops. Seminars and workshops are quite appropriate for addressing immediate needs after which more intense training can be done by sending the officers for in-service courses or advanced training at colleges or universities. There is also the need for developing curricula in agricultural programs at colleges and universities to be improved beyond introductory courses in IPM, to incorporate advanced and contemporary issues on IPM. To use the extension service as a tool to ensure adoption of sustainable pest management, clear policy must further link agricultural training institutions, research and the extension service providers to prioritize training and flow of information on advances on IPM. Lastly, the position of IPM in pest management and its emphasis in extension programs is a policy issue which the government of Kenya through the Ministry of Agriculture needs to provide direction. The results indicate that the extension officers had little access to training and information in IPM.

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