Challenges in Implementing Integrated Pest Management (IPM) Practices: Implications for Agricultural Extension

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Abstract

The impact of increased use of pesticides in agricultural production is now recognized as a threat to human and environmental health. Integrated Pest Management (IPM) is suggested as an alternative to conventional pest management practices. The implementation of IPM, however, encounters several challenges, especially in developing countries. The challenges in implementing IPM programs and adoption of IPM practices are closely linked to policy, social, and psychological factors, extension methods, and training and knowledge. The good will of the government in terms of supportive policy for alternative pest management is vital. Until clear policies are laid down, then it will be impossible to promote use of IPM.

New technologies and practices encounter resistance from those involved, especially farmers, and implementing IPM practices requires that psychological and social barriers be carefully considered. The delivery of new technologies is crucial and the nature of IPM requires participation calling for a paradigm shift in extension methods. IPM implementation also faces the constraints of training and knowledge experienced mostly by farmers and extension agents. The challenges in IPM implementation have implications for extension organizations to increase their role in educating farmers on the new practices. Extension organizations, however, cannot work alone in dealing with the challenges facing IPM and need support from other stakeholders. With reference to extension in Kenya, and on the basis of the literature review, a conceptual framework was developed summarizing the challenges that need to be overcome in order for the farmer to adopt IPM practices.
Introduction

There is increasing emphasis worldwide to change from conventional high external input agriculture into environmentally compatible, socially and economically acceptable agricultural practices (National Research Council, 1991). Increasing agricultural production through heavy use of pesticides and fertilizers is now recognized as a threat to the natural resource base. Environmental concerns such as depletion of natural resources, pollution of air and water, and chemical residues in foods have become important topics in agricultural production. Subsequently, the demand for integrated pest management (IPM) has increased due to negative effects observed from use of pesticides. Edwards et al. (1991) observed that only in systems that minimize chemical use can negative ecological and environmental effects arising from use of pesticides be minimized. Developing countries could, therefore, benefit in both quantity and quality in agricultural production, gain economically, and achieve public and environmental health. However, in developing countries where farming systems are subsistence in nature and with a growing need to increase food production, sustainable agricultural practices such as IPM present solutions and challenges at the same time.

The importance of IPM as a pest management approach that embraces safety and health in the agricultural production process is widely acknowledged. Pretty (2002) and Funderburk and Higley (1994) for instance regard IPM as one of the main regenerative elements for improving yields and sustainability of farming systems. IPM gained momentum back in the 1950s and its significance in pest control was realized in early 1980s, particularly in rice fields of South-East Asia (Pretty, 2002). It is argued that the IPM philosophy would not have been realized without the problems associated with pesticides, especially their polluting effect on the environment (Funderburk and Higley, 1994; Pretty, 2002, Morse et al, 2000, Carson, 1962). The effect of pesticides was in particular observed in the resistance of target pests to pesticides, ineffectiveness of pesticides, contamination of soil and water, and problems of unexpected pest outbreaks (Pretty, 2002; Funderburk and Higley, 1994).

IPM is defined as an approach to pest management, which combines cultural, biological, physical, and chemical control methods. IPM requires the integration of the different methods during pest control for effective, environmentally sound and socially acceptable management of diseases, insects and weeds. The objective of IPM is to keep pest populations at levels where they have minimum threat to the crops under production (Uhm, 2002, Morse et al, 2000). Unlike conventional methods of dealing with pests that focus on control, the IPM philosophy proposes a pest management strategy that emphasizes a certain tolerance level for pests (Morse et al, 2000; Pretty, 2002).

The potential of IPM with respect to favorable economic and ecological results in pest management seems to be great as noted by Funderburk and Higley (1994), Maxwell (1996) and Pretty (2002). Problems however, are acknowledged in implementing IPM practices. Kiss and Meerman (1991) and Knausenberger et al. (2001) indicate that adoption of IPM practices in developing countries especially in Africa has been slow. Inadequate support for IPM programs is still a major barrier to sustainable pest management. This paper examines the major problems and issues associated with IPM adoption in developing
countries. The challenges in implementation of IPM fall within the social, institutional, and organizational contexts. Reference is made to challenges in implementation of IPM arising from government policy decisions on crop protection, adoption process for new technologies, psychological factors, information delivery system, and training and knowledge in IPM practices.

**Purpose and Objectives**

The main purpose of this paper is to discuss challenges in implementing IPM in developing countries. The paper specifically focuses on: 1) factors associated with adoption of IPM practices, and 2) implication and potential for agricultural extension in facilitating IPM practices with special reference to the public extension service in Kenya.

**Methods and Data Sources**

The data for this paper are a result of an extensive literature review of journal articles and books addressing challenges and constraints in implementation of IPM in developing countries. Information from interaction and discussions with extension personnel and small-scale farmers in Kenya also provided information for this paper.

**Results and Discussion**

Various authors have identified several challenges in implementation of IPM. The challenges are discussed in the paragraphs that follow with an emphasis on developing countries.

**Government Policy and Regulations:** When governments prioritize market competitiveness, before sustainability and ecology protection policies, it becomes difficult for farmers to appreciate fully the unsustainable nature of their resource use (Rivera, 2001). Ineffective agricultural policies are often quoted as an obstacle to adoption of sustainable agricultural practices. When for instance, agricultural policies lay a lot of emphasis on increasing production, specialization in production, or extensive use of chemicals, they slow down the process for adoption of sustainable agricultural practices. Adoption of IPM practices is closely linked to the prevailing policy on pest management in a given country. The conceptualization and implementation of IPM will therefore, require identification and elimination of policy constraints (Brady, 1995).

Thrupp and Altieri (2001) underscore the importance of a supportive policy environment together with political commitment for effective development of knowledge and sustainable technology development. Sustainable agricultural practices cannot thrive where there is conflict of interests in the government regarding alternative approaches to agriculture. For example, contradictory messages from chemical companies, and biased or weak government policies work against the adoption of alternatives to chemical intensive methods of pest management. Clear policies make it possible to overcome barriers to adoption of IPM practices such as subsidies and credit for use of chemicals. Cuba, Indonesia and Philippines are examples of countries where IPM has thrived after government
declarations to support IPM as the national pest management strategy (Pretty, 2002; Matteson, 1996)

In Cuba, for instance, the ‘alternative model’ to agriculture provides an explicit policy direction for sustainable agriculture. The model emphasizes the importance of local knowledge, skills, and resources as opposed to imported agricultural production inputs. Prior to the implementation of this policy, Cuba depended on a heavily subsidized agricultural sector supporting importation of fertilizers and pesticides. The ‘alternative model’ emphasized among other things the need to replace pesticides with IPM practices in addition to promoting cooperation among farmers in the communities. In Indonesia, the government’s banning of several pesticides in rice and education on biodiversity through farmer field schools increased the adoption of IPM as a key method of pest management (Pretty, 2002).

The sustainability of IPM will depend on continuous effort to overcome skepticism among policy makers. Bottrell (1996) for instance notes that “policy makers and development agencies in developing countries will continue to promote pesticides on rice and other high yielding crops until they are convinced that alternative control methods will ensure long-term productivity and sustainability”, (p.187). A favorable policy environment must precede successful implementation of IPM practices. Unless governments develop policies that firmly support sustainable agriculture, response towards implementation of IPM will be slow. It is clear that without policy reform in pest management and pesticide procurement, it will be difficult for developing countries to overcome constraints that hinder the transition to and implementation of IPM practices.

IPM as a Process for Social Learning: The human factor has significant influence in innovation and adoption of sustainable practices. Implementing IPM practices in particular involves personal commitment and substantial interpersonal interaction. Pretty (2002) uses the concept of social learning to describe the way the farmers learn about new technologies. In social learning, farmers must participate and should not be forced or coerced to adopt new practices. Sustainable agricultural practices are not fixed technologies to be passed on to farmers but a process of social learning. Application of sustainable agricultural practices should be a continuous process of innovation whereby farmers adapt new practices into their farming systems. As opposed to conventional farming approaches, sustainable agricultural practices do not rely on prepared “recipes” or “technical packages” but on agro-ecological principles that vary with circumstances (Pretty, 2002; Thrupp and Altieri, 2001).

To reduce dependency on pesticides, the farmer must understand complex interrelationships among crops and diseases to overcome the risk of pest damage (Norton et al, 1999; Matteson, 1996; Pretty, 2002; Padgitt and Petzelka, 1994). Toness (2001) referred to (RÖling and Pretty, 1997) in noting that practices aimed at improving agricultural sustainability require farmers and extension agents to observe or monitor, anticipate, and intervene constantly to achieve desired results. The challenge is for extension institutions to change from teaching to a learning paradigm. Learning should be a participatory process that involves farmers and all stakeholders in decision-making, problem analysis and generation of solutions (Toness, 2001). Implementation of IPM must address the issue of developing
human capacity through active as opposed to passive learning. The farmers especially need to be closely involved in development of pest management practices to avoid conflict of interest.

**Psychological Factors in Adoption of IPM:** Overcoming psychological barriers occurs in any change process and IPM is no exception. Morse et al (2000) observed that decisions on practices associated with sustainability are value-laden and would therefore require reflection on the impact of personal preferences. IPM practices may promise ecological sustainability, environmental conservation and even better health for the society but they must undergo social acceptance by farmers. Until IPM practices are observed in farmers’ fields, then their potential in pest management will remain illusive. Farmers in developing countries are constrained by limited resources and depend on very small farms (usually less than 2.0 hectares) for income generation and food. Unless effectiveness of new practices is clear, adoption is unlikely to occur. Farmers in developing countries in particular focus on short-term goals, which Dreves (1996) regards as a major attitude problem incompatible with IPM practices. The farmers may therefore need greater convincing of the viability of the alternative practices in their specific farm operations to change from old pest management practices (Rogers, 1995; Pretty, 2002; Padgitt and Petrzelka, 1994; Bottrell, 1996).

The diffusion theory states that a new innovation is judged against the criteria of relative advantage, compatibility, complexity, trialability, and observability (Rogers, 1995). An innovation must be better than current practices, be consistent with the values system, easy to understand, and easy to conduct trials and give results that can be observed. Farmers will no doubt subject IPM practices to careful study before acceptance and eventual adoption. Farmers must further be convinced that a change from a pest management system dependent on pesticides to one based on natural control methods is worthwhile and profitable. In personal interviews and discussions with small-scale farmers in Kenya, the farmers had the following opinions about non-pesticide pest management practices:

- ‘I would use non-chemical pest control methods if they offered an effective alternative’;
- ‘It is difficult to make a choice on non-chemical methods because of little experience and information’;
- ‘Non-chemical methods are not reliable’;
- ‘Non-chemical methods are good, cheap, readily available but not very effective’.

It is clear that new technologies usually present a situation of risk and uncertainty, and farmers will rarely consider alternatives to pesticides when dealing with imminent pest problems. Farmers rather seek immediate prevention of crop loss and do not reflect on long-term consequences of continued pesticide use.

According to Padgitt and Petrzelka (1994), farmers had a distancing perception towards the problems associated with dependence on agricultural chemicals. Farmers recognize that agricultural production depends too much on agricultural chemicals but generalize the concern, and fail to acknowledge the contributions of their individual farm operations to the problem. Implementing IPM practices will require overcoming personal attitudes and misconceptions. Education and efforts to increase farmers’ awareness of environmental problems arising through pesticides is also needed to overcome the personal-related barriers to adoption of integrative pest management practices.
Delivery System for IPM: The success of IPM programs depends on the delivery system, which to a great extent determines the farmer’s response (Uhm, 2002; Dreves, 1996). The problem of transfer of IPM practices is regarded as a major barrier limiting progress of IPM worldwide (Dent, 1995). In developing countries, the Transfer of Technology (TOT) model for extension has been predominant. In TOT, research/scientists and extension develop new techniques, which are then transferred to farmers. The TOT model however is regarded as inappropriate in implementing IPM practices. IPM practices are not fixed prescriptions, but depend on the farmer’s ability to experiment and make decisions relative to prevailing location-specific agro-ecological conditions. IPM requires a facilitation and application process shifting from the technology-transfer model of adoption of innovations (van Huis and Meerman, 1997; RÖling and Wagemakers, 1998; Swanson, 1997). Extension organizations face the challenge to adopt a paradigm shift in information delivery that will create an enabling environment for adoption of sustainable agricultural practices.

A reciprocal, horizontal, inclusive relationship between extension agents and farmers as opposed to vertical (top-down) extension approaches is needed to increase success of sustainable practices such as IPM. It is more important than ever to appreciate the role of the farmer as a researcher, in testing and refining of sustainable technologies (Padgitt and Petrzelka, 1994). Matteson (1996) noted that IPM extension demands change in assumptions and procedures of agricultural development. Democracy and dialogue should be observed in agricultural development programs. Matteson further asserted that farmers, extension agents, and researchers must work together as equal partners towards development of appropriate pest management methods. Extension and scientists must be collaborators, facilitators, and consultants who take the responsibility of insuring that farmers understand, experiment, and make effective decisions for their specific farming situations.

Working in isolation is unlikely to generate the kind of response needed in adoption of IPM practices. Thrupp and Altieri (2001) for instance observe that linkages foster interdisciplinary and holistic approaches considered key to sustainable agriculture. Fragmentation of effort among stakeholders, lack of institutional and interdisciplinary collaboration is therefore, counterproductive to implementation of sustainable agriculture (Matteson, 1996; RÖling and Wagemakers, 1998; Pretty, 1998; Edwards et al, 1991; Funderburk and Higley, 1994). Governmental agencies, scientists, nongovernmental organizations, international agencies and farmers must all work together to develop the intensive knowledge and management practices characteristic of IPM.

Training/Knowledge: IPM presents an educational challenge for farmers, research and extension personnel in developing countries (Matteson, 1996; Edwards et al. 1991). Knausenberger et al (2001) singled out lack of IPM training and knowledge as major constraints to the implementation of IPM in Africa within the subsistence and emerging agricultural systems. Other limitations are specific crop and pest management information as well as access to information on alternative pest control practices. Abate et al (2000) in discussing pest management in Africa observed that farmers lacked biological and ecological information needed for exploratory approaches to pest management. Swanson (1997) noted that extension agents in the ranks of subject matter specialists lacked sufficient training and
experience in systems-based technologies, which are at the heart of IPM practices. In discussions with extension agents in Kenya, they expressed the importance of alternative pest management approaches but also indicated lack of access to information and training in IPM. When asked about IPM, the extension agents in Kenya observed that, ‘it is the kind of information we need to teach our farmers about pest management’, ‘I would want to learn more about IPM because I know little about the practices’.

As Bottrell (1996) pointed out, little may be attained through developing and evaluating IPM practices without complimentary efforts in extension and training. When extension agents do not have information on IPM practices, they are likely to be skeptical about their role towards sustainable agricultural practices. Extension agents are, however, important in facilitating adoption of new agricultural technologies. Overcoming the barriers in knowledge and training that extension agents face is one way of enhancing their role in adoption of IPM. The knowledge and management-intensive nature of IPM, therefore, requires means to ensure in-depth learning on the ecology of pests in the diverse agricultural systems of developing countries. Overcoming training and educational constraints in IPM programs for both farmers and extension agents is still a major challenge in many developing countries.

Collaborative Approach for Implementing IPM Practices: Kenya Extension Framework

As observed by Toness (2001), success in changing into process learning paradigms will require tools that facilitate an environment where all participants are involved in a continuous process of active, participatory sharing and learning. Uhm (2002) views “IPM as a unifying force” which should nurture interdisciplinary problem solving; understanding of social and economic impact of pest management and creation of IPM oriented farmer groups. Progress towards IPM implementation can benefit from a critical mass of individuals, groups and organizations driven by a common goal of agricultural development in a safe environment. Dreves (1996) notes, that IPM programs require formation of functional working groups for continuous communication and feedback. Dreves also emphasizes the importance of developing partnerships that give social, technical and political support.

The current Kenyan extension implementation framework, The National Agriculture and Livestock Extension Programme (NALEP), is a result of the recognition of the importance of the farmer in development and adoption of new technologies, the growing emphasis for strengthening linkages with all the stakeholders in the agricultural development process, and the need for interdisciplinary collaboration in agricultural development efforts. NALEP emphasizes partnerships with farmers, the Ministry of Agriculture and Rural Development (MOARD), research institutions, private agencies, and non-governmental organizations (MOARD, 2001). The modalities for implementation of the NALEP framework are drawn from and supported by the Kenyan National Agricultural Extension Policy (NAEP), (MOARD, 2001). Kenya, like any developing country, faces challenges in implementation of IPM practices. The comprehensive and participatory focus of NALEP is a model that can help to overcome challenges in implementing IPM practices in Kenya and is an example for other developing countries.
NALEP has a bottom-up philosophy of extension education with substantial appreciation of the knowledge of the farmer in solving local problems. The process of change must occur on the farmer’s farm and the farmer must understand the farm environment to be fully involved in the implementation of IPM practices. At the same time, there is recognition of the role of extension in creating awareness of problems in particular those related to the environment and facilitating the change process towards adoption of sustainable agricultural practices.

Using the information from the literature review and adapting the Kenya NALEP extension implementation model, the conceptual framework (Figure 1) was developed. The framework summarizes the challenges influencing implementing of IPM practices in developing countries into social, technical, and political factors.

![Figure 1: Political, Social, and Technical Factors Influencing Implementation of IPM Practices](image-url)
Social factors address the human-related issues that are barriers to adoption of IPM practices. Technical factors encompass knowledge, training and delivery processes crucial in furthering the cause for IPM practices. Political factors entail the goodwill of policy makers in creating an environment whereby implementation of IPM is supported by policies and regulations that promote sustainable pest management procedures. Only through coordination of the three broad factors will the farmers in developing countries gain confidence to venture into use of IPM.

Educational Importance and Implications for Agricultural Extension

Agricultural extension plays an important role in agricultural development in developing countries and is in the forefront of educating farmers on new technologies and improved farming practices (van den Ban and Hawkins, 1996). The relevance of IPM and its value in the agricultural production may therefore not be fully appreciated by farmers without the input of extension organizations. The intensive knowledge and dynamic quality of IPM, however, requires constant updating with current information and collaboration with all stakeholders for successful implementation to be realized. Extension organizations in developing countries must recognize the various challenges in implementation of IPM and lead in overcoming the challenges. Extension organizations can help reduce fragmentation of effort that is often observed in promoting IPM practices by fostering collaboration with other institutions. The NALEP-based conceptual framework appreciates the role of all stakeholders in agricultural development and is appropriate for implementation of IPM. The framework can, therefore, be used to address the challenges in implementing IPM practices. The framework further pays special attention to the visibility of farmers and acknowledges their contribution in implementing IPM practices.

References


