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The Role of Indigenous Knowledge and Agricultural Education in Agriculture Production System: Implications to Sustainable Agriculture and Environment Education

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농업생산체계에서 농업 재래지식과 농업환경교육

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요 약

이 연구의 목적은 농업 재래지식(indigenous knowledge)이 농업생산과 환경에 미치는 중요성을 알아보고 농업 및 환경교육에 그 필요성을 제시하는데 있었다. 우리 나라에서 농업재래지식은 조상 대대로 농업작부체계에서 매우 유용한 농업기술로 이어져 왔다. 그러나 현대의 과학 농업기술에 의하여 최근에 농업 재래지식의 활용은 급감하였고, 이에 대한 체계적인 연구나 보전이 매우 미흡한 상태에 있다. 그러나 미국, 일본, 케냐 등 많은 국가에서는 여전히 농업 재래지식이 농업생산 및 농촌개발 과정에서 그 적용율이 9~27% 정도로 나타나고 있다. 농업 재래지식은 자연농법 및 유기농법과 함께 중요한 환경보전 기술이므로 실태 파악과 그 보전 방안이 강구되어야 할 것이다.

Ⅰ. Introduction

Indigenous Knowledge (IK) has been defined as local knowledge that is unique to a given culture or society (Warren, Slikerveer & Brkensha, 1995). Local people have always had inherent knowledge and idormation about crops, plants, animals and local situations which they are associated. Local people determine which problems affect them directly and conduct constant experimentation to discover solutions to these problems. Case studies focused on farmer experimentation (Rhoades, 1984; McCorkle & McClure, 1995) have shown that farmers adopt and try several experiments to answer questions regarding how technology works, whether it will fit into their existing systems, or if it is profitable. Agricultural extension agencies and traditional scientific research have long ignored the indigenous knowledge of local people. The vast majority of the agricultural researchers and Extension Professionals have been skeptical about the use of indigenous knowledge (Brokensha & Warren, 1980). However, recent studies have shown the value of indigenous knowledge in agricultural development (Warren et al., 1995; Scoones & Thompsons, 1994).

The purpose of this paper is to assess the role of indigenous knowledge systems and agricultural extension education in agriculture. Recognition of indigenous knowledge systems by Extension educators, researchers, and development agencies can enhance knowledge, contribute to cross-cultural understanding, encourage participation of all members of the community, and promote sustainable approaches to development (Warren et al., 1995).

Ⅱ. Indigenous Knowledge

According to Knight (1980), local farmers are often aware of problems and constraints on productivity. They respond positively to opportunities that are environmentally, economically, and socially sound, given appropriate material and institutional necessities. Farmers have always relied upon their knowledge systems. The study of the efficacy of neem seed extract as a biopesticide against locusts and grasshoppers in the African Sahel region is one example of the value of indigenous knowledge systems. Neem, the tree that is used for a multitude of purposes is found to be immune to attack by desert locusts. The kernel extract provides excellent protection of millet seedlings from grasshoppers and locusts (Radcliffe, 1995). This is one example of a simple and easily available technology.

Traditional farming systems use and manage resources available to them in several ways. For instance, Alcorn (1995) ascertained that wild plants are not necessarily weeds. This depends on where they grow and what they can offer. Weeds that are difficult to control have been integrated into cropping systems. Indonesian farmers have developed effective ways to control impart grasslands that agricultural extension agents believed can only be managed by the use of expensive herbicides (Dove, 1987).

Notwithstanding the value mentioned, indigenous knowledge has its own limitations: a) "it is local, empirical, concrete and largely intuitive, b) it is a very nearly closed system which depends only on what the farmer can observe directly, c) it has no access to science' s methods of abstract reasoning, its body of theoretical knowledge or its specialized techniques have limited access to materials and genetic resources from outside, and d) the disse- mination of IK is constrained to what can be remembered and transmitted orally" (Hall, 1993:16).

Intercropping is an indigenous technique of crop production, which is widely practiced by small scale farmers. Although the benefits of mixed cropping have been recognized even by scientists, a majority of the research and the extension professionalsin most developing countries encourage pure stands of crops. In Kenya, farmers intercrop maize and beans and do not follow the recommended pactice of planning two rows of beans between maize rows. Farmers plant maize in lines and scatter beans between raise rows randomly. They also diversify their crops depending on whether it is the short or long rainy season. This decision is a deliberate attempt to avoid single crop failure in the case of drought. Researchers have always wondered how farmers managed weeds in an intercropping situation, but what researchers might consider a terrible weed might be utilized by a farmer in so many ways. Weeds are fodder for livestock, food for the family in times of

drought, and medicine as the need arises. In dealing with such complex farming systems, researchers must understand these varying production objectives of farmers before any experiment is designed.

Since the 1980's some researchers have begun to understand and recognized the incorporation of farmers' technical knowledge into agriculture (Brokensha, et al., 1980). It all began with the work of anthropologists at the International Research Center (CIP) who developed diffused light post-harvest storage technologies for seed potatoes. This initial result of storage technology has led to farmers in more than 50 countries to use the procedure (Rhoades, 1984). The incorporation of indigenous knowledge perspectives into agricultural research systems has faced many obstacles. "Outsiders normally come to an area of their study with a preconceived notion. They are hindered from appreciating and learning from rural people's knowledge by the forces of power, professionalism, prestige, lack of contact, problems of language, sheer prejudice, and gaps between practitioner and academic cultures" (Chambers, 1983:83).

At the International Rice Research Institute (IRRI), researchers have conducted on-farm trials for improving upland rice systems at Clavaria in the Philippines where a majority of the farmers are migrants. The results of this study indicated that farmers readily shared their knowledge concerning the local environment, identified crop production problems, discussed related changes in land and soil, and described what they had tried to do about the problem (Fujisaka, 1995). The study confirmed that although farmers came from different areas of the country, they had acquired a shared knowledge base pertaining to the local conditions. They tested land, soil, crop, cultivar and input combinations. Land was classified by slope and elevation, and friability. In Northern Zambia farmers viewed soils in relation to drainage, associated vegetation, crop suitability labor constraint, available technology and proximity to the settlement (Kerven and Sikana, 1988). But researchers were not aware of what farmers viewed as important differences in the properties of the soil they selected for a particular crop. In Clavaria, the Philippine farmers took drastic measures with soil erosion by planting perennials on upper slopes, they diverted canals and planted bananas in gullies to trap soil and utilize eroded nutrients. A system of farmer-to-farmer communication was then introduced, where by farmers from Clavaria shared their knowledge about contour bands, ditches, hedgerows of fodder grasses and legume trees with farmers from Cebu, another area in the Philippines. Not only did these farmers gain from each other, but they also tried several modifications of what they learned.

On-farm research can be utilized for coordinating the contribution of farmers and scientists in developing, adapting, and disseminating appropriate innovations. And in order for this to succeed Fujisaka (1989) suggested the following: 1) understanding existing farmer practices in terms of underlying technical knowledge and as adaptations to local agro-ecosystems, 2) identify problems based in part on such understanding, 3) learn from farmers and their problem-solving adaptive experimentation, as a starting point for technology generation, 4) encourage participation of

farmers who have demonstrated interest in solving the identified problems, 5) encourage technology transfer from adapter-adopters to farmers wanting solutions, and 6) develop methods by which national programs can implement the same type of technology generation and transfer.

Ⅲ. Extension

In assessing Extension alternatives in Tropical Africa, Morries (1991) posed several questions related to farmer involvement in research. Morris (1991:128) reported that colonial approach to dealing with farmers, and the field staff mainly acted to convey technical recommendations formulated by professionals. The system did not trust farmers' own indigenous technical knowledge and preferred recommendations which can be promoted irrespective of local conditions.

In developing countries, the majority of the agricultural extension services offer technical advice to farmers and growers, and supply them with inputs and services needed for increased production. They provide information to farmers, and convey to them new ideas and techniques developed by research stations (Gabriel, 1980). This role of Extension has not changed in most of the developing countries. In contemporary Extension practice, Gabriel (1991:56) described four components:

1. Advice and Information:

Technical advice and information: price, credit or marketing information help farmers take action when conditions are most favorable to them. Timely advice about technical inputs like fertilizer applications can also help raise yields. However, to be effective the transfer of information must take account of indigenous technical knowledge of the local people.

2. Skills and Knowledge:

Rural Extension offers knowledge to which farmers would not otherwise have access. This may mean that they have to acquire new skills, perhaps in farm management, organizational issues, or in operating new technical equipment. The Extension services has to discover what skills and knowledge local farmers possess and how these are used, as well as what they do not know, before arranging appropriate services or learning experiences.

3. Confidence Building:

Isolation and the feeling among a rural population that they can do little to effect improvements in their lives or livelihood are widespread problems. A central task of the Extension services is to convince farmers that they do have the ability to do things for themselves.

4. Farmer Institutions:

Farmers' effectiveness and productivity can be improved through other means than just knowledge or advice. Representation of farmer's interests, opportunities for collective action, and channels for future communications with farmers are all improved through effective farmer organizations. The Extension service

often uses their resources to initiate or to strengthen farm institutions with these goals in mind. In this process, knowledge about indigenous technology is required before new plans can be formulated.

Extension workers should therefore develop appreciation for the total social context within family farms are conducted and information shared. It is important that sustainability is emphasized. Extension agents should ensure that plans and solutions are relevant to the local economic, social, cultural and administrative structure. Dependency on a particular program should be avoided. Programs should help and support farmers, but not create dependence for them or their livelihood on the program. A program will only be effective if better communication and the needs of the people are identified. The study of indigenous knowledge can effectively work in improving communications and the flow of information between the local people and the agencies advocating development in the area. The programs should be targeted to the right section of the population. It has been observed that individuals within the traditional setting have wide knowledge, depending on gender, social status and age (Sharland, 1995) and this knowledge has to be fully utilized if Extension Programs are to succeed.

In some cases the problems encountered by local people are not immediately perceived to be a program. For instance Sharland (1995) observed that Moru farmers of Southern Sudan do not recognize cassava mosaic virus as a disease because it afects all cassava. Therefore, it is up to the Extension professionals to tackle the problematic situations experienced in an area. Farmers in developing countries have many problems to deal with, including; baboons, birds, foxes, squirrels, and drought, so if Extension does not provide solutions it cannot be trusted.

The role of extension is then questionable. It is necessary to clearly define whether the purpose of extension is to deliver technology or engage in functions that would include educational delivery and problem-solving. Other roles suggested include feedback and participation in adaptive research, provide institutional technology to help farmers organize into associations and cooperative activity (Rivera, 1991). Rivera (1991) further argued that since extension involves many activities, it sholuld be looked at as part of the technology system. Extension is an institutional and human development strategy, whereby linkages and implications for educational, agricultural policy, and economic development policy are all considered.

Table 1 shows that some selected countries use of indigenous knowledge in their extension implementation.

Table 1. Use of Indigenous knowledge in Extension of some Selected Countries

Country	Percentage use of IK (%)
Mexico	17.0
U.S.A	11.0
Russia	17.5
Kenya	27.0
Indonesia	22.0
Japan	9.0

source : Iowa State University Extension(white paper), 1994.

In the analysis of the agricultural technology development, technology transfer, and technology utilization by farmers are important camponents that emphasize the interconnection of policy, research, extension and client utilization. While it might be difficult to accomplish all these roles at the same time, with a well focused goal some of the components can be handled. For example, it makes sense to perfect one component at a time, rather than spreading a few resources all over without any accomplishment. Apparently, the problem that the developing countries seem to face is lack of proper focus, and the role that Extension workers are suppose to play. Extension in developing countries occasionally serves conflicting interests. It plays the role of the government law enforcement, as well as delivery of technologies and information. Several agencies are also involved in different programs within the Extension system of the country. Different programs for both crops and livestock production can be in separable divisions within the same ministry of agriculture.

Ⅳ. Development Perspective

In analyzing international agricultural extension to development a more people-centered and sustainable development, Gonsales (1991) argued that food security at the family level must be viewed as an important indicator of success of a program of agricultural extension. He considered food, nutrition and energy as the most basic needs. And in order to strengthen the program, emphasis through the medium of the indigenous knowledge specialist should be encouraged. For instance, Extension specialist could select local knowledgeable persons recognized by the community that they serve and make them resource persons in order to serve as linkages and facilitators of technology. Table 2 reveals that six countries use of indigenous knowledge in community development.

Table 2. Use of Indigenous knowledge in Community Development of some Selected Countries

Country	Percentage use of IK (%)
Mexico	17.0
U.S.A	15.0
Russia	21.5
Kenya	27.0
Indonesia	21.0
Japan	11.0

source : Iowa State University Extension(white paper), 1994.

All sectors of the community need to be involved in the development of Extension. In some communities, religion and certain traditional taboos play a major role in the lives of the people. People have to be incorporated and wherever the society might have ceremonial or festival activities, information could be shared. The other aspect that increases the awareness of agriculture technology is to involve women. Agriculture Extension should therefore, design educational programs to fit the needs of women, and probably one way to alleviate the problem is to encourage more women in Agriculture Extension. That means girls have to be given opportunities to pursue agriculture as their career.

Love (1989), while emphasizing international topics in the undergraduate curriculum, also strongly advocated that in order to succeed, agriculture extension education must understand the true needs of the people in local communities. It is obvious that we need to emphasize education and encourage development projects in an area, but at times the idea of a gigantic projects often overlooks the basic human needs. In an area has to incorporate several mini-projects, including health, infrastructure, and improved formal and informal opportunities for education.

V. Conclusion

Since farmers have access to the abundant knowledge and information passed from one generation to another, they are able to determine which problems affect them directly. They try the unknown with the intent of answering questions regarding whether technology works, will fit into their existing systems, or is profitable. Practices that work for the farmer are likely to be adopted.

Research and extension recommendations should target farmers instead of crops. The failure to adopt extension recommendations by farmers as indicated in the intercropping recommenda- tions is clear indication that farmers know what they want.

Existing agriculture education, research, and Extension systems and problems should be coordinated. The challenges that face agriculture in general are many, ranging from growing international trade and competition in the marketing of agricultural commodities to changes of attitudes of consumers. The direction is now towards multi-disciplinary teams of researchers on a priority area so as to accomplish mutual goals and consolidate resources. Agriculture education, therefore, has to accommodate these changes, through curriculum development and stronger linkages with extension and research. In order to be of any value, research has to be made available to other researchers and practitioners. A strategy needs to be formulated that could utilize informal and formal mechanisms of sharing research findings. Sharing of information could occur through several methods including: presentations, seminars and conferences.

VI. Recommendations

Indigenous knowledge in agriculture is still an area that needs further research. Studies that report the value of indigenous knowledge systems are specially confined to a particular region bound by unique cultural identity. Researchers should encourage wide use of this knowledge. Collaborative efforts between researchers, extension specialists, educators and communities that preserve such knowledge need to be initiated.

Agriculture educators understand that agriculture has a big impact on the economy, the environment, personal health and the society as a whole. Therefore, research issues related to agriculture should be clearly identified and improved.

Agricultural education researchers should collaborate with other units in research, and professionals in other fields, agencies, and industries, in order to address common key issues and to consolidate the indigenous

knowledge resources available. This could be done through joint research and even through networking as a way of sharing information. The information sharing approach (farmer back-to farmer approach) should be encouraged.

While recruitment of students for enrollment in agricultural education wilt still remain the main priority for agricultural education departments, knowledgeable adults in a non-formal setting, especially those who possess indigenous knowledge should be incorporated into the system. Agricultural extension, therefore, should widen its scope and take leadership in guiding the programs in secondary schools, provide facilities for teacher training, expose students to agriculture at an early age, introduce indigenous knowledge into the curriculum and determine appropriate goals and methods to educate the general public.

Agricultural extension education should be flexible to the needs of the learner, and the departments should diversify the major areas of study and create degree programs that are pertinent to the needs of the changing society and agricultural industry.

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