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IS FARMER INPUT INTO FSR/E SUSTAINABLE? THE ATIP EXPERIENCE IN BOTSWANA

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INTRODUCTION

The quest for sustainable agriculture has received much deserved attention in the last few years. Numerous definitions of sustainability have been offered. (For examples see: The Committee of Agricultural Sustainability for Developing Countries (1987); York (1988)) The dialogue on sustainability recognizes that current practices in developed countries are not sustainable because they rely too heavily on non-renewable resources and tend to contaminate the environment. Additionally, agricultural systems in many parts of the third world, which Chambers (1988) characterizes as complex, diverse, risk-prone (CDR), are under tremendous population and other pressures to increase present production at the expense of long term sustainability. (Mellor, 1988) The debate on sustainable agriculture may well lead to a working concept of "more sustainable agriculture" which Francis and Hildebrand (1989) suggest "would be more in tune with the local resource base, make maximum use of internal production inputs, and have potential for sustained production and profits further into the future."

Much of the debate on sustainability has been based on societal considerations. While sustainable agriculture may be a society goal, the practices that will provide sustainability can only be implemented at the farm level, where they must form a sustainable farming system. To insure relevancy at the farm level, it seems logical that the implementers of a sustainable farming system -- the farmers -- must be involved in the research leading to appropriate technologies.

An ISNAR review of nine national agricultural research systems (Merrill-Sands et al., 1989) found that "Strengthening the involvement of farmers, particularly resource-poor farmers, in the research process has been a central objective and responsibility of on-farm client-oriented, research programs." In Botswana, the Agricultural Technology Improvement Project[2] is one such farming systems research program working with limited resource farmers. In the ATIP-Francistown team, we have based our work with farmer groups partly on the assumption that the creation of sustainable farming systems requires the continued active participation of farmers in the formal research process. This paper will describe the mechanism ATIP-Francistown has used to include farmer participation in research, and examine some of the factors affecting the sustainability of this type of farmer input into the research structure.

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[2]. In 1982 the Government of Botswana and USAID initiated the Agricultural Technology Improvement Project to conduct on-farm research, primarily in crop production technologies. ATIP is funded by USAID and the Government of Botswana. The on-farm research programme of ATIP has had two primary goals: (a) to identify and test relevant, improved arable production technologies; and (b) to develop appropriate, low-cost methods for on-farm research and extension. ATIP took as its point of departure the farming systems approach to research.

IMPORTANCE OF FARMER INPUT TO AGRICULTURAL RESEARCH

The "transfer-of-technology" approach to agricultural research taken by many research organizations after World War II excluded farmer involvement almost totally. (Rhoades and Booth, 1982) For developing countries this approach was a top-down diffusion approach based on the transfer of technology from more developed, temperate zone countries. Problems with this approach led to the high payoff input model which was based on more locally appropriate research aimed at exploiting areas of good agricultural potential. This approach produced the "Green Revolution". Again farmer involvement in the research leading to the "Green Revolution" was minimal. In the 1970s there was an increasing recognition that the high input model did not apply to limited resource farmers working in CDR agriculture. The farming systems research (FSR) approach was developed to attempt to address the agricultural development needs of the resource poor farmers. Among the basic tenets of the FSR approach were building on the good points of the existing farming system and taking into account the indigenous technical knowledge of farmers. The FSR approach took the view that farmers were primary clients of agricultural research and development programs, and that on-farm research should incorporate the client's perspective when defining the research agenda. (Baker and Norman, 1988; Merrill-Sands et al., 1989)

In the mid-1980s a concern for the level and type of farmer involvement in agricultural research became evident. Some researchers argued that the farmer had always been doing his or her own research and should be afforded the central role in the research process. (Rhoades and Booth, 1982; Chambers and Ghildyal, 1985) The debate about how best to integrate farmers into the research process continues. (Farrington and Martin, 1988; Sagar and Farrington, 1988; Haverkort et al., 1988) Increasing recognition of the central role of the farmer in implementing a sustainable agriculture has produced a changing view of the farmer's role in agricultural research, from client to partner. The overall term being used to describe the process of bringing researchers, extensionists and farmers together as partners in the effort to improve agricultural technology is Participative Technology Development (PTD). PTD has been described as "the practical process for bringing together the knowledge and research capacities of the local farming communities with that of the commercial and scientific institutions in an interactive way." Thus in PTD, 'participation' implies that "people can, to a large extent, identify and modify their own solutions to their needs; it means that researchers and development workers support farmers to increase their capacity to manage changes in their farming systems." (Haverkort et al., 1988)

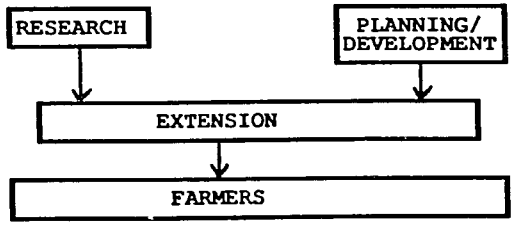
These trends towards increased farmer involvement support our contention that, if research is to be relevant in the quest for sustainable agriculture, the farmer, and farm family, must play a continuing, active role in agricultural research.

TRADITIONAL FARMER INVOLVEMENT IN AGRICULTURAL RESEARCH

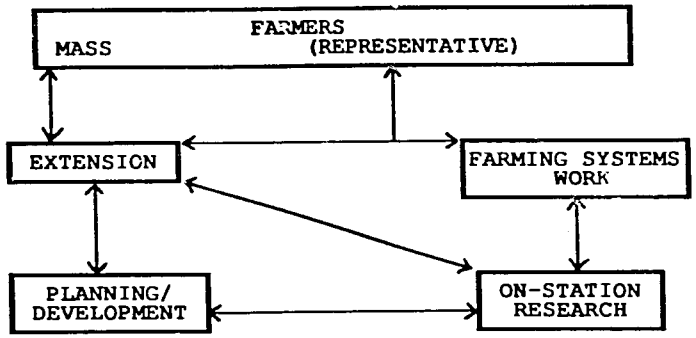
Norman (1989) has produced a set of diagrams (Figure 1) which outline the agricultural development process. As was discussed above, under the "traditional" transfer-of-technology approach to agricultural development (diagram "A"), the farmer had little or no involvement

FIGURE 1: PROCESS OF AGRICULTURAL DEVELOPMENT

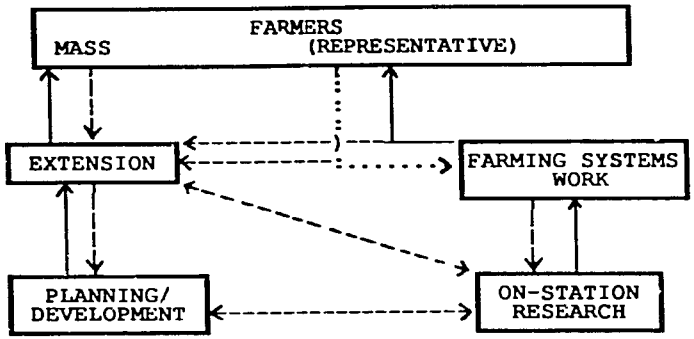
A. "TRADITIONAL" SYSTEM



B. "IDEAL" SYSTEM



C. "USUAL" SYSTEM



KEY: ——— INDICATE STRONG LINKAGES
------ INDICATE POOR LINKAGES
..... INDICATE REASONABLE LINKAGES

Source: Norman, 1989

in the research process. In Botswana, as well as most other countries, on-station research has traditionally had little farmer participation. Research agendas were set by the researchers, and field days were conducted for researchers and administrators. Under this system on-farm trials were few in number and followed researcher agendas. This is still the situation to some extent in Botswana, but it is changing.

With the arrival of farming systems projects in Botswana, participation by limited resource farmers in research moved towards the client stage, as depicted in Figure 1, "C". Most of the FSR projects had researcher managed, farmer implemented (RMFI) trials, as well as researcher managed, researcher implemented (RMRI) trials. The former took place on farmers fields, with farmers generally providing the labor and sometimes participating in the evaluation of the trials. However, the research topics and procedures were chosen by researchers and extension agents. Farmers did not have major input into the process and often tended to lose interest in participating with the research. Despite the lack of direct farmer input into the decision making process, the FSR projects did have a clear focus on farmers as the clients of research and they emphasized the diagnosis of constraints and setting research priorities in the context of the whole farm system. As Merrill-Sands et al. (1989) point out "on-farm, client oriented, research can help to provide these clients a voice -- a means to influence agricultural research in order to keep it focused on their priorities and relevant to their farming conditions." The FSR projects also had varying effectiveness in feeding farm-level information back to experiment station research.

The FSR approach led to more extension involvement in the research process. Extensionists continued to look on farmers as clients in the development process and extension activities tended to be limited to extension managed demonstrations, with field days to encourage farmers to visit the demonstrations. While some village level agricultural demonstrators had farmer extension committees to work with and advise them, there was no farmer representation at district, regional or national levels where, in a traditional hierarchical structure, decisions on the extension program were made. Hence, there was little farmer input into, or feedback through extension to research.

In Botswana, with the recent completion of an agricultural sector analysis (Edwards et al., 1989), a reorganization in the Ministry of Agriculture, and a pending ISNAR study of the Department of Agricultural Research, the whole question of the structure of agricultural research, and hence farmer involvement is being re-examined. Whether there will be a move towards Norman's "ideal" system (Figure 1, "B") remains unclear.

ATIP'S APPROACH TO FARMER INVOLVEMENT

Like most farming systems programs, ATIP initially focused on the farmer as the client for its research efforts and attempted to concentrate on problems directly relevant to farmers in the project area. Thus ATIP began its research work by on-farm investigation of the then recommended package of practices for cereal production and by conducting an in-depth diagnostic study of the farming system through a multi-year, multiple visit study. Limitations in the effectiveness of existing technologies meant that most trials work was aimed at answering technical questions and so was carried on in a researcher managed and implemented (RMRI) and researcher managed, farmer implemented (RMFI) mode. Trials were conducted on-farm but the agenda was set by the researchers and trials were generally managed by the researchers.

By 1985 there was a realization in the project that more farmer involvement in the research activities was needed. Beginning in the 1985-86 season ATIP began working with several

types of farmer groups. As described elsewhere (Norman et al., 1988) work was begun with three groups; design groups, focused-testing groups, and researcher managed options-testing groups. The next year extension managed options-testing groups were added. The characteristics of these groups are summarized in Table 1. The ATIP Francistown team has worked with the latter two groups.

The researcher managed options testing groups originated from a felt need to improve the research program in several ways (Worman et al., 1988).

(a). To increase researcher efficiency in order to test a broad range of innovations (technologies), under farmer managed and implemented (FMFI) conditions for increased productivity and grain yield dependability.

(b). To involve farmers and local extensioni staff more actively in the technology development process, particularly in the evaluation of technologies.

(c). To allow farmers to work with technologies of their choice, in order to determine what types of innovations are most appealing to farmers with different resource situations (recommendation domains).

(d). To further refine the use of the group process for including farmers input into farming systems research.

The extension managed options testing groups were formed with the extension service taking the lead and had several purposes. (Worman et al., 1988)

(a). To provide a method for AD's to increase their efficiency by addressing a large number of farmers (on technical issues) at once, rather than having to make numerous individual visits to households and fields. (The group format allows the AD to perform a teaching function at the beginning of the year, and a backup function throughout the cropping season, through monthly meetings.)

(b). To allow farmers to field test recommendations they choose, under extension guidance, and to provide a basis for local field days.

(c). To provide a forum for researcher backup in extension activities.

(d). To provide a test to see if farmer groups are practical under extension conditions.

In both types of groups the innovations presented to farmers to select from are proposed by researchers, extensionists and farmers.

The inclusion of farmer testing groups in the ATIP research structure has increased ATIP's ability to respond to requests for on-farm testing made by on-station researchers, thus facilitating the linkages between on-station and on-farm researchers, and farmers.

The actual operation of the researcher and extension managed options testing groups was described by Masikara (Masikara et al., 1989) last year at this Symposium. Some of the important elements of this operation are:

(a). Farmers choose to participate in the groups.

(b). Farmers select trials from a wide range of technologies.

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TABLE 1: TYPOLOGY OF FARMER GROUPS

CHARACTERISTIC	DESIGN	FOCUSED-TESTING	RESEARCHER MANAGED OPTIONS-TESTING	EXTENSION MANAGED OPTIONS-TESTING
OBJECTIVES	Farmer involvement in technology design.	Discuss farmer's own problems. Measure economic benefits. Farmer assessment.	Increased farmer and extension involvement. Large scale assessment.	Local farmer and extension testing for local adaptability & demonstration purposes.
NUMBERS OF TRIAL TYPES	1 to 3	4 to 6	10 to 12	4 to 6
TRIAL: PROPOSAL	Researcher	Researcher	Researcher/Extn.	Extension/Res.
SELECTION	Researcher	Researcher/Farmer	Farmer	Farmer
MANAGEMENT	Researcher	Farmer	Farmer	Farmer
IMPLEMENTATION	Researcher/Farmer	Farmer	Farmer	Farmer
QUANTITATIVE MEASUREMENT/a	Most	Middle	Least	Minimal
ASSESSMENT: RESEARCHER	Most	Middle	Least	Minimal
FARMER	Least	Middle	Most	Most
GROUP: SIZE	2-3 farmers	10-15 farmers	25-40 farmers	25-35 farmers
NATURE	Homogeneous	Homogeneous	Heterogeneous	Heterogeneous
SELECTION	Technical situation appropriate for design work.	Socio-economic situation for targeted technology.	Volunteers from village meeting.	Volunteers from Village meeting.
FREQUENCY OF MEETING	2-3 times a season	Monthly in season	Monthly in season	Monthly in season

a. Relative to the other types of groups.
Modified from: Norman, D., D. Baker, G. Heinrich, and F. Worman. "Technology Development Farmer Groups: Experiences From Botswana". Experimental Agriculture, 24(3): 321-331.

(c). Trials are implemented on small plots following an agreed upon procedure involving a comparison with traditional methods.

(d). Monthly group meetings are held where farmers report on their trials, and discuss problems, outcomes, and other topics with each other and with researchers and extensionists.

(e). Field days are held where farmers can show their trials and explain them to others farmers from their village and from other villages.

(f). Researchers record basic information on trials and weigh final harvests. Farmer assessment of technologies is obtained informally during monthly meetings and formally through an end-of-season survey.

HOW FARMER TESTING GROUPS CAN ENCOURAGE AND SUSTAIN FARMER PARTICIPATION IN THE TECHNOLOGY DEVELOPMENT PROCESS

One of the problems encountered when farmers are viewed only as clients in research and the technology development process is that they do not play an active role in the process and so tend to lose interest. There are several ways that the farmer testing groups serve to maintain farmer interest and hence longer term participation.

(a). The farmer testing groups serve farmer interests as well as researcher interests. Farmer's interests are kept in the forefront of group activity because farmers can propose trials, because they can choose topics for discussion at farmer group meeting, and primarily because they can choose the trials which they will conduct. Thus farmers have a partnership role in determining the course of farmer group activities, which ensures that farmers can work on topics in which they are interested and which can be accommodated within their resource structures. Because individuals can address their own particular constraints, each individual in the group has a vested interest in participating.

(b). Groups serve as a source of new information as farmers share their experiences with new technologies among themselves, and researchers present new technologies for consideration. During monthly meetings farmers show a great deal of interest in reports by others on the technologies being tested. Ways of dealing with problems are proposed by farmers as well as by researchers and extensionists.

(c). Groups have a very flexible format. They can change with changing farmer interests and circumstances and can respond quickly to new problems or to new research developments. Because groups can tap resources in both extension and research they are often able to obtain information to resolve problems in a timely manner.

(d). Groups are relatively simple to operate. For example, research input can be handled by experienced technical officers with assistance and advice from on-farm or on-station research specialists. A high level of education is not required. Groups can reduce the demands on highly trained staff thus avoiding problems of man-power shortages, so the approach is resource efficient.

(e). The groups have the potential to evolve into more formal production oriented groups, such as some form of cooperative which could serve as a centralized purchasing

agent for agricultural supplies, provide a basis for tractor purchase schemes, or promote plant protection or animal health.

EFFECTIVENESS OF ATIP'S APPROACH

ATIP's approach appears to have been effective in obtaining farmer participation in the research process. The approach has involved farmers with researchers, and extensionists in more of a partnership rather than in the previous technician-client format. There are several indications of the effectiveness of the approach. These include:

(a). Group Participation -- In 1985-86 the farmer group work began with twelve farmers in one village who tested one technology. The second year groups were formed in two additional villages and participation rose to 97. In 1987-88 researcher managed farmer groups included 130 members while the first extension managed farmer group had 25 members. During the most recent cropping season researcher managed farmer groups remained at approximately the same level, 128, while a second extension managed farmer group was added, bring the total participants in extension managed groups to 40. Membership in the farmer groups is voluntary, with farmers choosing to join. Members of the groups have decided that even though larger groups may cause problems in sharing equipment and may restrict somewhat the amount of discussion which can occur at monthly meetings, that it would not be fair to the rest of the community to limit participation to fixed numbers. Based on an analysis of household characteristics, members in the researcher managed farmer groups appear to be representative of the villages where they reside.

(b). Trials -- The number and variety of trials has increased from twelve trials of one technology in 1985-86 to over 150 trials of more than a dozen technologies in 1987-88. During the most recent year a total of 250 trials were attempted, involving five major and several minor technologies. In addition five different pieces of equipment were tested.

(c). Adoption -- The ATIP Francistown approach to researcher managed options testing groups has been to integrate them into the overall ATIP research program. There has been no attempt to encourage farmers to adopt any of the technologies being tested, nor is there a specific extension component in the researcher managed testing activities. Despite this lack of effort to promote adoption, cases of spontaneous adoption were noted in all villages. It was observed that adoption was occurring not only with tested technologies, which were usually single technologies, but that farmers were combining technologies into their own packages. During June and July 1989 a survey was made of farmers, who had participated in the researcher managed groups at some point during the last four years, in an effort to measure the amount of spontaneous adoption which was taking place. Ninety-six percent of the 165 farmers who had participated were interviewed. Of this group 25.9 percent (41) indicated that they had used a "new technology" (i.e., one they had not been using four years ago) this year. This "new technology" was used outside of the area they had allocated for ATIP trials. By village, spontaneous adopters ranged from 17 to 42 percent of the respondents in that village. The average area planted in new technologies by adopters was 3.4 hectares, representing 35 percent of the total lands they planted. Overall the average area planted to new technologies was 0.87 hectares -- 14 percent of all lands planted by the respondents. Double plowing (the addition of an additional plowing to break up the soil for improved water infiltration and storage) was the most popular new technology, chosen by 39 percent of the adopters,

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followed by double plowing plus row planting, chosen by 34 percent of the adopters. Seventy-eight percent of those using a new technology used double plowing alone or in combination, and 41 percent used row planting (a technology actively promoted by the extension service) alone or in combination.

(d). Influence on On-station Research -- In the second year one of the technologies tested were tested in collaboration with on-station researchers. This past year over 80 percent of technologies tested (approximately 75 percent of all trials) were undertaken in collaboration with on-station researchers and came directly out of commodity research programs. These included crop variety tests, tests of seed protection measures for groundnuts, and equipment tests.

(e). Influence on Extension -- The number of extension led farmer testing groups has increased. The extension service has assigned one technical officer to work with ATIP and back-up the local extension staff in farmer group activities. During the coming year two NGOs are planning to participate in the extension managed farmer group activities to gain experience for forming their own farmer testing groups in the future.

IS THE GROUP APPROACH SUSTAINABLE?

Given that active farmer participation is necessary in developing and implementing sustainable farming systems, there is a need to assure effective avenues of farmer participation in formal agricultural research structures. The primary emphasis of the ATIP Francistown group activity has been to develop a methodology with potential for including active participation by limited resource farmers in agricultural research on an on-going basis. Because the ATIP program is within the Ministry of Agriculture the emphasis has been on making farmer groups an integral part of the ATIP research program, and thereby including their input in the on-farm component of the overall agricultural research program in Botswana.

The farmer groups have been organized by the researchers as an integral part of the research program and are in essence new groups every cropping year.[3] Whether these groups will continue to provide an avenue for effective farmer participation within the research structure will depend to a great extent on the future direction of on-farm research in Botswana. ISNAR in its study of nine FSR institutionalization efforts found that the programs faced many problems in "developing sustainable mechanisms for involving farmers actively throughout the research process." (Merrill-Sands et al., 1989) Many of the factors which will favor or discourage the continuation of farmer testing groups are common to agricultural research in other developing countries.

Some of the factors which will impact, either favorably or unfavorably on the continuation of the groups are:

(a). Institutionalization of On-farm Research -- Many on-farm research efforts have been based on specific research projects of limited duration with no apparent commitment to their incorporation into any institutional framework. (Farrington and Martin, 1988) In the case of Botswana, the Department of Agricultural Research has indicated a commitment to continued on-farm research. The form of this research is currently

[3]. ATIP Mahalapye has worked with farmer groups which have their own organization independent of the research program. (Norman et al., 1988)

being decided. Some form of decentralized research structure could have a positive impact on the on-farm research program and direct farmer participation. Assuming that an on-farm team continues in the Francistown area, there is a strong commitment on the part of national staff currently associated with the project to continue the farmer testing groups. Despite commitments at all levels, a lack of resources within the research organization could severely limit the amount of on-farm research undertaken, and thus limit the ability of farmers to participate through the on-farm program.

(b). New Approach - Linkages -- Merrill-Sands et al. (1989) found that institutionalizing on-farm research focused on resource-poor farmers required developing a new set of research activities, establishing new communications channels and cooperative efforts among researchers, field staff, extension agents and farmers. To be successful this institutionalization also requires changes in research planning, programming and the process of systematically incorporating farm-level information into the research process (the role of on-farm research in feeding farm-level information back to experimental station research). The farmer testing groups have served as a mechanism to facilitate communications among researchers, extensionists and farmers. The formalization of the linkages through the institutionalization of the approach might lend stability to the groups over the long term. However, the continued interest of researchers, extensionists and farmers is probably more vital to viable communications than is a formalized set of linkages. Perhaps the lack of formal linkages between extension and research at the field level will present the greatest challenge to continued involvement of all three sets of actors in the group process.

(c). Professional Elitism -- Haverkort et al. (1988) point out that "Prejudices exist amongst professional agronomists and development workers against the assumption that rural population may have something to contribute." This is often a problem within research and extension organizations. Although this has not been a major problem in the past, if farmer groups are formally included in the research structure, working with group identified problems may be a problem for some senior research staff, particularly in accommodating feedback from farmers and field staff into the design of research plans.

(d). Cost Effectiveness -- Because groups are fairly simple and inexpensive to operate, because they can be operated by technical officers with back-up by senior researchers, and because they can increase the number of technologies being tested, they appear to be cost and manpower effective. In this regard, Farrington and Martin (1988) conclude that greater participation by farmers in the research process and their exercising a demand-pull on station-based work stands to enhance the cost-effectiveness of research.[4]

(e). "Empowerment" -- Sagar and Farrington (1988) report that in several of the participatory approaches they studied one of the underlying objectives was "that of 'empowerment' in the sense of increasing the capacity of farmers to identify the types of external technology that might be appropriate to their circumstances, to conduct experimentation and to combine usable components of external knowledge

[4]. One cautionary note is in order at this point. Much of the work with farmer groups is at the FMFI level. As Norman (1989) has pointed out, information at this level tends to be more qualitative and sometimes subjective in nature, in contrast to more quantative and objective type of data which have greater appeal for experiment station-based researchers.

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with their own indigenous knowledge systems." The group approach within the formal research structure offers one avenue to 'empowerment'. However, if there is no institutional framework available for the groups (due, for example, to lack of funding for on-farm research), it may be viable for non-governmental organizations or other organizations to help farmers start their own formally organized groups to carry on local adaptive research, and to put pressure on the research structure to produce relevant technologies.

Despite uncertainty as to the future of research and extension managed farmer groups in Botswana, there appears to be a commitment at all levels to continue the on-farm component of agricultural research, which will provide an institutional home for continued active farmer participation in the research process.

SUMMARY AND CONCLUSIONS

In Botswana, ATIP has shown that limited resource farmers are willing and eager to take an active part in the agricultural research process. Farmer testing groups offer one approach to improving communications among researchers, extensionists and farmers, to the advantage of all concerned. Whether this approach to including farmers in the agricultural research process will continue is unclear.

Whatever the approach taken in organizing agricultural research (in Botswana or elsewhere), to assure that research will be able to adequately address sustainability, research institutions will need "to find better ways to get meaningful inputs from farmers themselves, from the outset of research planning to the adaptation of this research to various ecological situations in which farmers must be involved." (Committee on Agricultural Sustainability for Developing Countries, 1987)

We conclude that research for sustainable farming requires active continuing farmer participation. Farmer groups, such as the farmer testing groups, provide one possible avenue to obtain this requisite farmer participation and integrate it into the formal agricultural research structure.

REFERENCES

Baker, D. and D. Norman. 1987. The farming systems research and extension approach to small farm development. (Forthcoming).

Chambers, R. 1988. Farmer first. International Agricultural Development. November/December.

Chambers, R. and Ghildyal, B.P. 1985. Agricultural research for resource-poor farmers: The farmer-first-and-last model. Agricultural Administration, 20: 1-30.

Committee on Agricultural Sustainability for Developing Countries. 1988. The transition to sustainable agriculture: An agenda for AID. (Unpublished).

Edwards, E., H. Amani, T. Frankenberger, and D. Jansen. 1989. Agricultural sector assessment: A strategy for the future development of agriculture in Botswana. Prepared for the Ministry of Agriculture. Government of Botswana.

Francis, C. and P. Hildebrand. 1989. Farming systems research and extension (FSR/E) in support of sustainable agriculture. Farming Systems Research-Extension Newsletter. 2: 4-5.

Farrington, J. and A. Martin. 1988. Farmer participation in agricultural research: A review of concepts and practices. Overseas Development Institute, Agricultural Administration Unit, Occasional Paper 9. London, UK: Overseas Development Institute.

Haverkort, B., W. Hiemstra, C. Reijntjes and S. Essers. 1988. Strengthening farmers' capacity for technology development. ILEIA Newsletter. 4(3): 3-7.

Masikara, S., F. Worman and G. Heinrich. 1989. The role of farmer testing groups in research and extension: Some experiences in Botswana. Selected Proceedings of 1988 Farming Systems Research/Extension Symposium. Fayetteville: University of Arkansas. (Forthcoming).

Mellor, J. 1988. The interwining of environmental problems and poverty. Environment 30(9): 8-13, 28-30.

Merrill-Sands, D., P. Ewell, S. Biggs and J. McAllister. 1989. Issues in institutionalizing on-farm client-oriented research: A review of experiences from nine national agricultural research systems. Staff Notes No. 89-57. The Hague, Netherlands: ISNAR.

Norman, D. 1989. Accountability: A dilemma in farming systems research. Culture and Anthropology. (Forthcoming).

Norman, D., D. Baker, G. Heinrich, and F. Worman. [illegible]. Technology development farmer groups: experiences from Botswana. Exp[illegible]l Agriculture, 24(3): 321-331.

Rhoades, R. and R. Booth. 1982. Farmer-back-to-farmer: A model for generating acceptable agricultural technology. Agricultural Administration 11: 127-137.

Sagar, D. and J. Farrington. 1988. Participatory approaches to technology generation: From the development of methodology to wider-scale implementation. Overseas Development Institute, Agricultural Administration Unit, Network Paper 2. London, UK: Overseas Development Institute.

Worman, F., Y. Merafe, and D. Norman. 1988. Increasing farmer participation in FSR/E: The ATIP experience with farmer groups. Proceedings Philippines Upland Research and Extension Training Workshop. ViSCA, Baybay, Leyte, June 9-24th, 1988.

York, E. 1988. Improving sustainability with agricultural research. Environment 30(9): 18-20, 36-40.