

INTSORMIL

**Recent Change In Villages
and Rainfed Agriculture In
Northern Central Kordofan:
Communication Process and Constraints**

Report No. 4

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with the research assistance of Abdel Rahman Ahmed, Muktar Mohammed Ahmed,
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Summary and Recommendations

The main purpose of this report is to present the findings and recommendations from the diagnostic, first-phase study of changing agricultural techniques of farmers in the rainfed area of North Kordofan. This study focused on the process of change in agriculture, farmers' knowledge of sorghum and millet, and changes in village and environmental characteristics. The data were collected in July and August of 1984 in interviews with 84 men and 56 women farmers living in 15 villages in the area around el-Obeid. The general description of the economic conditions in villages does not reflect the effects of the disastrous drought during the summer of 1984.

A. Overview of rural villages and agriculture

The population in rural settlements in North Kordofan, according to official census figures, increased by 34 percent between 1973 and 1983. For the much shorter period between the INTSORMIL surveys of 13 villages in 1981 and 1984, villages gaining population outnumbered losers by 2 to 1. The villages changed in other ways between 1981 and 1984. The level of economic activity, as reflected in the numbers of shops and institutions, increased in about one-half of the villages, twice as many as suffered declines. In general, economic activity in medium-sized and larger rural settlements increased while it declined in some of the smallest villages. The expansion of the el-Obeid market is reflected in a decline in the markets of nearby villages.

The picture of modest overall growth of the village economies is in sharp contrast to the decline of agriculture in recent years due to below-normal average rainfalls and inflation. Below-normal crop yields have compelled villagers to rely more on income from off farm work and the sale of assets. While this temporarily stimulates the cash economy, the economic well-being of families has declined.

Millet is still the principal food crop in the el-Obeid area with sorghum a distant second in importance. Sesame is the most important cash crop in all villages; where gardud soils prevail groundnuts rank second, in other places karkadee (roselle) is the second most important cash crop. The availability of water, forage, and subsistence crop production affects both the mix of livestock and the dependence of villagers on livestock--cattle, sheep and goats. If subsistence crops fail villagers become more dependent on their livestock for subsistence. Given a choice, villagers would sell goats or sheep and keep cattle because of their greater social and economic value. But, as environmental conditions deteriorate, the farmer may lose his cattle or be forced to sell them and rely on sheep or goats.

Farmers generally are aware of a decline in several types of vegetation, especially of native forage plants. However, actual desertification in this area may be less extensive than many experts have tended to conclude.

The earlier study of farming systems by Reeves and Frankenberger reported that the average size of cultivation was 18 mukhammas, and 34 percent of families cultivated less than 10 mukhammas. Information obtained in the present survey indicates that 20 to 25 percent of farm operators are women who

are widowed, divorced, or never married. In addition, 10 to 20 percent of the married women have their own fields. Almost invariably women operate small farms. Indeed, the majority of farmers operating less than 10 mukhammas are women. Women farmers grow the same types of crops as men but may less often raise the more labor-intensive food and cash crops such as sorghum and groundnuts.

Farmers generally recognize four types of sorghum--zunaari baladi, zunaari HireeHri, najaad, and feterita. Both z. baladi and z. HireeHri refer to locally-grown, goose-necked, large seeded varieties, but HireeHri varieties mature about 10-15 days earlier than baladi varieties. Najaad varieties not only mature in three months (90 days) but also have straight necks. Feterita varieties also mature early, have straight necks, and small seeds. Farmers classify as feterita sorghums originating in the south and/or sorghums that have a dark testa. In local terms, the najaad and feterita varieties thus are not consistently distinguished.

Z. baladi varieties of sorghum are the most popular by far for making the principal human foods--9asiida (fermented porridge) and kisra (crepe). Najaad varieties are preferred for 9abree (non-alcoholoc drink), mariisa (beer), and for livestock feed. The need for early maturing (najaad) sorghum varieties that have food quality equal to the traditional baladi varieties is clearly evident.

Millet is the preferred and most widely-grown cereal grain in the area. Local long-season (baladi) and early-maturing (HireeHri) varieties are commonly recognized. Several other varieties--Aish bornu and Dajawi--are grown by particular tribes. The traditional long-season baladi varieties are much preferred to other varieties both as food and as construction material for houses. Early maturing varieties that possess comparable grain and stalk qualities are badly needed. Varieties that are more disease and pest resistant also are desired.

B. Issues of agricultural change

1. Does agriculture in a "traditional" farming area change?

The general assumption is that agriculture in such areas changes rarely if at all. However, the farmers mentioned 24 new varieties of seeds and several kinds of implements that had been tried in recent years. Sesame, a cash crop, and sorghum, a food crop, lead in number of new seeds tried. Several of the new seeds, which were evidently superior to existing varieties, were grown by most farmers in the village in which they were introduced within three years. Men identified more agricultural innovations than women farmers, and men most often obtained information about innovations sooner than women. However, women farmers were as quick to adopt these agricultural innovations once they heard about them as were the men.

2. Are farmers motivated to change farming practices?

As indicated by the variety and speed of innovations adopted by men and women farmers, the motivation to accept improved varieties has been quite high. However, no major shift in the system, as contrasted with the practice, of agriculture or gains in productivity has occurred.

None of the innovations that has been widely adopted involve annual cash outlays for inputs or large initial investments. Available capital is a major constraint (as well as the infrastructure to sustain such innovations).

3. What kinds of new seeds have farmers been most interested in?

The greatest interest is in crop varieties that are higher yielding, or earlier maturing, or both. These attributes facilitate adaptation to the major environmental, demographic, and economic pressures farmers have confronted in recent years. In addition to these characteristics, farmers look for new varieties of sorghum and millet that are more bird, pest, and disease resistant.

Due to their interest in higher-yielding and earlier-maturing varieties, most farmers expressed willingness to buy new seed, such as hybrid sorghum (hageen dura), or to travel some distance to obtain seed with these characteristics. However, the inability to save hybrid seed for planting the following year, which is the customary pattern, or to sell seed of a successful variety to friends and relatives, dampens the interest of farmers who primarily use the crop for subsistence.

4. What are the sources of information and new seeds?

Except for farmers who have been cooperating with Tareke Berhe in trials of new sorghum and millet varieties, relatives are the most important source of information about new seeds for both men and women farmers. For men, merchants are the second most important source, followed by friends. For women innovators merchants are less important than friends as sources of new information, but going to market is an important occasion for contacting friends as well as merchants. In supplying new seeds merchants are the most important sources. It seems to have taken about a decade for new sorghum varieties, which have been developed by researchers for mechanized farming, to move from mechanized schemes to villages in the el-Obeid area.

5. What is the pattern of distribution of new information and seeds?

Due to the influence of kinship networks, an innovation tends to flow from its original source outward to other farmers of the same kin group. For example, several new varieties of sesame originated in the Umm Ruwaba area and were transmitted to kinsmen in the el-Obeid area. This contrasts with the movement of innovations from large centers, such as el-Obeid, to intermediate-sized towns and thence to smaller villages which is the pattern in developed countries.

6. What do farmers think about the Agricultural Extension Service?

The Department of Agricultural Extension Service has been active in the distribution of new farm inputs, such as Aldrex-T and Barberton groundnuts, as related to its goal of introducing agricultural innovations to farmers. Educational activities of the Agricultural Extension Service, however, have been very limited due in part to lack of transportation facilities.

Very few farmers in any of the villages associated the Agricultural Extension Service with the distribution of farm inputs or remembered representatives ever visiting the village. Activities of the Agricultural Extension Service are often attributed to the Agricultural Bank or local farmer cooperatives with which AES cooperates. Most farmers don't recognize either the name or location of AES. Those who do recognize the AES complain about unfulfilled promises of seeds or chemicals, or the failure to provide answers to their problems of pest control.

7. What do farmers think of on-farm trials and Tareke Berhe?

Tareke Berhe has used the on-farm trials primarily to select adaptive varieties rather than to demonstrate successful ones. Farmers possess surprisingly little information about the trials. Only about one-third of the farmers interviewed, all of whom were close relatives of the cooperating farmer, had any knowledge about the trials despite this being the third season of trials in some villages. Only a small minority of these knew Dr. Berhe by name. Only a few thought he was sponsored by a university in the United States.

Those who know of Dr. Berhe's work view it favorably primarily because he has given seeds to some farmers. However, some are critical that seeds weren't given to more farmers or to persons who would distribute them more widely. The purpose of the trials thus is not well recognized by farmers.

The lack of information about the new seeds is in part due to the suppression of information by the cooperating farmers. They wait to tell other farmers about the new seeds until after the seeds prove successful. Recent droughts have handicapped the evaluations and slowed the spread of information.

C. Constraints to, and recommendations for, more effective development of technology among farmers in the rainfed area.

1. Illiteracy and inadequate radio

Use of print in communication is constrained by illiteracy. Although even in the smallest villages it was said that five or more adults could read a newspaper, rarely are one-sixth of the adults literate. Use of radio is constrained by three factors: (a) lack of radios: in some villages there is none and rarely do one-fifth of the families have radios. (b) The weak radio signal from el-Obeid station which has a range of 10 kilometers, and (c) poor scheduling of the agricultural broadcast when farmers are working in the field.

Recommendation: Since few are literate, most educational programs must be planned on the assumption that farmers are illiterate. Use of pictures, drawings, movies, slides, film strips, and videos thus are the most important educational tools. Despite the shortage of radios, radio could be an important information source if the radio station had a stronger signal and the program was scheduled to coincide with a time that most farmers were in the village.

2. Shortage and cost of vehicular transport

Lack of vehicles and benzine constrain visits of researchers and of extension workers to villages. Many villagers, however, expressed willingness to come to el-Obeid to obtain information about high-yielding varieties of seed. But, cost of transportation is an important constraint for villagers, too. The average cost per kilometer of a truck ride to el-Obeid is about 7 piasters in the wet season and 5 piasters in the dry season. A round trip to el-Obeid for a farmer living 30 kilometers distant thus costs as much as might be earned weeding millet during a morning work period.

Recommendation: Extension workers can maximize contacts with villagers by planning trips on market day to villages that have periodic markets. This does not, of course, necessarily provide opportunities to contact particular farmers unless planned in advance. But, the market provides the most cost-effective place and occasion for contacting large numbers of farmers, many from surrounding villages. El-Obeid and the regional markets (e.g., Kazgail, Abu Haraz, Umm Ramad) are prime sites. It is also an occasion in which, with proper planning, two-way communication between professionals and farmers could be fostered.

3. Gender as a barrier to communication

Although male researchers and extension workers have little difficulty in contacting and working with male farmers, contacts and communication with female farmers are much more difficult due to cultural attitudes and social norms regulating and limiting contacts between men and women. Within villages contacts between adult men and women are regulated by family and kinship ties.

Recommendation: The market place is an arena in which men and women talk freely to each other. Such places provide researchers and extension workers opportunities for dispensing information freely to both men and women alike.

For most effective work with women farmers, which comprise two-fifths of the clientele, women extension agents and/or assistants are necessary. Moreover, women cooperators in on-farm trials are needed to assure equal access to information about new seeds. Without this, women farmers will be discriminated against in the dissemination of agricultural innovations.

4. Lack of improved and recommended technology

None of the new seeds or techniques tried by farmers in el-Obeid area in recent years had been developed by scientists specifically for farmers in this area, although some had been developed for farmers in other areas and brought by farmers to el-Obeid. The lack of improved techniques to promote is the most critical constraint to a more effective extension service.

Recommendation: With establishment of a research station and continued research, an increased flow of improved farming techniques is expected. But, extension workers can be more than a mere conduit of information. This study has shown that farmers themselves have discovered a number of

new seeds that are better than existing varieties. Aggressive extension agents could collect and promote the exchange and testing of such new seeds thereby speeding the spread of improved local varieties as well as fostering recognition by farmers of the usefulness of extension workers.

5. Limited number of on-farm-trial sites

On-farm trials provide both a critical test of the comparative cost-benefits of new techniques at the farm level and an essential opportunity for scientists and/or extension workers to listen to farmer experiences and problems. This past year, Dr. Tareke Berhe had farm trials at 29 sites in 15 villages and Bakheit Musa carried on trials at additional sites. However, there are 4,000 villages in North Kordofan and farm trials must be expanded if the rapid development and spread of new techniques is to occur.

Recommendation: Farm trials are, in part, an extension function and can be carried out with properly trained extension workers. To do this, extension workers must have both understanding of the new techniques being developed, i.e., the questions needing answers at the farm level, and training in carrying out farm-level experimental and demonstration trials. To gain these understandings, extension workers should be involved in early stages of technology development. Training in farm-level experimental and demonstration trials can be provided by farming system scientists.

6. Withholding of information about new seeds by farmers

Contrary to what many assume, most men and women farmers in el-Obeid area do not openly discuss new seeds or other techniques which they have privately acquired. The three principal motives in keeping information about new seeds secret are the desire to (a) determine first that the new seeds or techniques are successful in order to avoid blame for contributing to the failure of a relative or friend, (b) avoid "begging" of some seed for planting by relatives or close friends or the embarrassment of refusing to share valuable seed, and (c) profit from sale of seed if it is successful.

Recommendation: In the case of new seeds, the active suppression of information becomes inconsequential when a successful crop has been produced. Then other farmers will see the "good" crop and the new seed will be offered for sale and discussed. Due to variability in weather and other conditions, an improved variety might fail on one field but be successful on another. Two strategies for increasing the chance of successful outcome of trials of new seeds are recommended: (a) Provide seed in sufficient quantity so that cooperating farmers will be encouraged to share seed, and/or (b) seek several cooperators in a village. As large quantities of new seed become available, distribution by merchants or farmer cooperatives helps ensure its wide distribution.

7. Lack of seed and adoption of new varieties

Reeves and Frankenberger (Report No. 2, pp.98-9) cite difficulty in gaining access to new seeds as an important reason that farmers continue to plant long-season varieties rather than earlier maturing varieties of

millet, sorghum, sesame, and karkadee which are highly desired. In this study, more than one-half of the men and three-fourths of the women farmers mentioned the lack of availability and/or high cost of seed as a reason for the failure of all farmers to plant the new variety in question. Availability and cost, of course, are related aspects of seed supply. Most farmers in the rainfed area obtain new seed from other farmers or merchants. If crops are poor in the local area in a given year, there will be little seed to distribute. Lack of an adequate supply of seed is the single most important reason given for the slowness of farmers in adopting a new variety once it is recognized as successful.

Recommendation: Expansion of seed production is critical to more rapid adoption of improved varieties. Although governmental agencies have responsibility for seed production of officially released varieties, these agencies do not reproduce "local" or "farmers'" varieties. The establishment of seed production businesses dealing with improved local varieties should be encouraged by the Agricultural Bank.

8. Saving seed and hybrids

The traditional practice of self-sufficient farmers is to select the best seed heads, thresh them separately, and save the seed for planting next year's crops. Farmers purchase seed only when they run short and cannot borrow extra seed or new seed can be obtained only by purchasing it. Although self-sufficient farmers are highly interested in new high-yielding, early-maturing varieties of sorghum and millet, interest slackens when farmers recognize that new (hybrid) seed must be purchased each year. (Unlike commercial producers, production incentives of subsistence producers are limited by immediate family needs.) Lack of cash to purchase seed or other inputs is especially a problem for women farmers and many small farmers generally.

Recommendation: In developing a supply system for hybrid seed, provision should be made for farmers to trade "surplus" hybrid grain produced for hybrid seed for next year's crop and/or to sell to an agency to obtain seed.

9. Distrust of merchants

Merchants are a source of last resort for seed primarily due to poor quality standards. Merchants primarily sell grain rather than seed. Farmers thus often do not receive "pure" seed of the type desired. Moreover, in the case of new seed, the merchant may know little about its performance, especially locally. Farmers thus prefer to obtain seed from other farmers. A neighbor or relative also may sell for a lower price.

Recommendation: Several alternatives may be pursued to strengthen the credibility of merchants as suppliers of quality seed including (a) expansion of the National Seed Certification Agency so that privately-produced seed can be certified and (b) establishment of private firms who sell seed under a brand name. The availability of high-quality, improved seed at a reasonable cost would help in the establishment of a seed market.

10. Tribal identity as a barrier to communication

Association with kin is the most important source of information about innovations in traditional society. Since marriages are usually arranged with persons of the same tribal group, kinship relationships are almost invariably with other members of the same tribe. Ties between villages are much stronger when the villages are occupied by members of the same tribe. Itinerant merchants who are sometimes important in disseminating innovations primarily travel among villages of the same tribe. Within larger towns, e.g. Kazgail, tribal groups occupy separate areas and communicate more with members of their own tribe than with others. Hence, tribal identity is a barrier to the flow of agricultural information.

Recommendation: In selecting cooperating farmers for farm trials as well as villages for farm trials or information programs, care should be exercised to obtain representatives of various tribes in order to assure equal access to information.

11. Lack of available cash

Although self-sufficing farmers in el-Obeid area are being increasingly drawn into the money economy, availability of cash is a problem. This is especially so at the beginning of the cropping season when new inputs must be acquired. At this time supplies of grain from the previous year often become short and are needed to provide food. There is little to sell to obtain cash to purchase inputs. This will become a more critical problem as nonfarm-produced inputs become increasingly available.

Recommendation: Ways of expanding the availability of credit at low cost need to be explored. (See Edward B. Reeves and Timothy Frankenberger, Farming Systems Research in North Kordofan, Sudan. Lexington, KY: Department of Sociology, University of Kentucky Report No. 2, 1982.)

12. Lack of integration of research and extension

One of the most critical constraints to the effective spread of information about new agricultural techniques is the lack of effective communication between researchers and extension workers. The tendency to perform one's responsibilities within the narrow orbit of one's own department or office is a common failing of professional workers. This seriously hampers effective two-way communication about technical advances on the one side and problems confronting and farmers extension workers on the other. It is essential that strenuous efforts be made by research and extension administrators as well as scientists and extension workers to bridge the communication gap.

Recommendation: Periodic workshops and seminars involving researchers and extension personnel are, of course, useful in the exchange of information. However, more broadly based interpersonal relationships are needed for researchers and extension workers to perform satisfactorily in inter-related roles. One of the most effective ways of developing such relationships is for extension workers to become involved as early as possible in the process of the development of new technology. When it

becomes available they are then not merely already informed, they are fully knowledgeable of the innovation's potential and limitations in relation to existing techniques. Extension workers thus can become more confident and effective agents of change through demonstration and instruction. In addition, the existence of working relationships with scientists makes possible the ready feedback of any problems with new technology which shows up in its wider applications. (It should be recognized that for the most effective working relationships between research and extension workers to develop, the basic education of key extension personnel must become more nearly equal to that of researchers.)

I. INTRODUCTION

The general purpose of the University of Kentucky INTSORMIL project in Sudan is to support the development of traditional agriculture through research on the socioeconomic constraints to improved sorghum and millet production and consumption. Two of the three University of Kentucky INTSORMIL studies have been conducted in North Kordofan. In this respect the University of Kentucky project is within the scope of interest of the Western Sudan Agricultural Research Project (WSARP). WSARP aims to strengthen the agricultural research capability of the Agricultural Research Corporation (ARC) in Kordofan and Darfur. The present research, which is being conducted under a Memorandum of Understanding with WSARP, complements research conducted by the ARC.

Improvements in agricultural technology are essential but not sufficient to agricultural development. Constraints to development may exist at many levels from farm and village to research centers and urban markets. The University of Kentucky project as a whole focusses on socioeconomic constraints at several of the levels where change must occur in order for development to take place.

Each of the University of Kentucky INTSORMIL sub-projects has a specific purpose, and the present project is concerned with problems of the effective dissemination of new ideas. The communication of a new idea or innovation to farmers and its evaluation and acceptance by them is the final step in the process of technology adoption. All formal institutions of technology development, whether in developing or developed countries depend in varying degree on local, informal networks of communication to spread new ideas. When the formal and informal systems are effectively linked and mutually supportive the transfer of technology from research and development centers to farmers occurs rapidly and with a minimum of disruption. The formal system provides a continuing supply of appropriate innovations for farmers to increase production efficiency. The informal system spreads information about the innovations and feeds back information on their local applicability and on other needs of farmers which stimulates further research and development. To a degree, most formal and informal systems of technology development operate this way. In efficiently functioning systems, however, the formal and informal systems mesh in such a way that blockages, distortion, and loss of information are minimized while its interpretation, evaluation, and utilization are enhanced. In traditional agriculture by definition, formal institutions of technology development and its transfer to farmers do not exist or are ineffective. Innovative change occurs mainly by borrowing ideas and practices from other cultures. Change is slow and erratic. This has characterized agriculture in much of North Kordofan until quite recently. Now, however, the components of a formal system of technology development have been established by the ARC, WSARP, INTSORMIL, and the Kordofan Regional Ministry of Agriculture. As new seeds, cultural practices, and other innovations become increasingly available, the need to develop effective linkages with indigeneous village networks of communication becomes more urgent.

To do this it is essential to understand the indigenous system, how it functions to spread agricultural information among traditional farmers, and how effective linkages with the formal system may be established.

A. Objectives of the Study

The objectives of the research were developed in 1983 during a visit to Sudan by the senior researcher and Dr. Edward Reeves. At that time, various research priorities and objectives were explored with Dr. El-Tag, Regional Minister of Agriculture, Dr. Dafalla, Director of WSARP, and James Beebe, USAID, Khartoum. The general purpose of studying local communication networks was accepted although the specific statement of the objectives was not developed until later. Research related to these objectives was carried out in two phases. There were three initial objectives of the first-phase, diagnostic study:

1. To study what specific innovations, e.g., new varieties of sorghum/millet, have diffused in the recent past.
2. To study how specific innovations have spread from village to village and farmer to farmer.
3. To study local knowledge of sorghum and millet.

Since the initial phase of the research on which this report is based involved a survey of 13 of the 18 villages studied by Edward Reeves and Timothy Frankenberger in 1981, changes in the socioeconomic characteristics of the villages and living condition of villagers could be noted. Consequently, change in the conditions of life and their probable cause became the fourth purpose of this study. Moreover, since Dr. Tareke Berhe has been conducting experimental trials with new varieties of sorghum and millet in nine of the villages surveyed, a fifth purpose of the study focused on the degree to which villagers understood and accepted the purpose and importance of this type of work, i.e., local farm trials.

In April 1984 el-Obeid radio began a weekly 15-minute program of general information of interest to farmers. The information in this program is developed by the Department of Agricultural Extension Service. Since farmers in villages surrounding el-Obeid were being interviewed, an audience survey of awareness of the radio program and of the interest in its messages was possible and became the sixth purpose of the study.

Finally, since North Kordofan has experienced several years of relatively low rainfall, the seventh purpose of the study was to investigate ecological changes as perceived by villagers and their impacts on patterns of living.

B. Relationship to Other Projects

In June, soon after the project team's arrival in Khartoum, a Memorandum of Understanding (MOU) was signed by INTSORMIL and WSARP officials. It specifies the responsibilities of each organization with respect to INTSORMIL's research in North Kordofan. In general, INTSORMIL provides professional leadership and the financial resources needed to conduct specific

research projects. WSARP supplies logistical support in the form of transportation on the WSARP plane, communication facilities, and other forms of needed assistance as available. The MOU covers the University of Kentucky and Kansas State University projects planned for 1984-85. WSARP's logistical support has been important in enabling the research team to get into the field in a timely fashion at minimum expense. Since the team's arrival in el-Obeid, WSARP has continued to provide logistical support.

The KSU/SUDAN project under the direction of Dr. Tareke Berhe is the companion INTSORMIL project in North Kordofan. There has been continuous project coordination and cooperation since 1982 when Dr. Berhe arrived in el-Obeid. This relationship has been important to this research in two ways. First, since Dr. Berhe has been conducting on-farm trials for three years, it is possible to assess the extent of farmer knowledge and acceptance of these trials. The information about the trials, which farmers possess, is an important indicator of the effectiveness of the local communication system--one of the objectives of this project. It also provides insights into the problems faced by research administrators in disseminating information to farmers.

Second, Dr. Berhe has been personally very helpful to the research team: renting a vehicle for the team's use, acquiring temporary housing, and assisting the research team in getting settled and acquainted with el-Obeid. Representatives of other projects, such as the Regional Development Project, CARE, UNICEF, and the like, have been similarly helpful in speeding adjustment to the living and working conditions in el-Obeid. It is clear to these researchers that INTSORMIL owes a considerable debt to many friends without whose help the research program could not have proceeded according to its schedule.

This research project is intentionally dependent on the previous studies of the farming and marketing systems in north Kordofan conducted by Edward B. Reeves and Timothy Frankenberger.* The earlier study provides the essential baseline information on which the present study is based. For example, without the detailed information about the marketing system and the roles of merchants, one could not confidently ask the specific questions contained in this study about merchants as sources of innovations.

*Edward B. Reeves and Timothy Frankenberger, Socio-Economic Constraints to the Production, Distribution, and Consumption of Millet, Sorghum, and Cash Crops in north Kordofan, Sudan Lexington, Ky.: Department of Sociology, College of Agricultural, University of Kentucky, Report No. 1, November 1981; Edward B. Reeves and Timothy Frankenberger, Farming Systems Research in North Kordofan, Sudan Lexington, Ky.: Department of Sociology, College of Agriculture, University of Kentucky, Report No. 2, November 1982; Edward B. Reeves, An Indigenous Rural Marketing System in North Kordofan, Sudan Lexington, Ky.: Department of Sociology, College of Agriculture, University of Kentucky, Report No. 3, October, 1984.

The present study is complementary to the study of the organization and practices of the ARC conducted by William B. Lacy, Lawrence Busch, and Paul Marcotte.* Their study was designed to address constraints to appropriate agricultural scientific research and the communication of results to interested farmers, fellow scientists, and others. One of the recommendations of that study was an increase in on-farm trials of the type being conducted by Dr. Tareke Berhe and others. The appropriateness of that recommendation depends in part on assumptions about the effectiveness of such trials in initiating farmer acceptance of new seed. This is a question that the present study addresses.

Both Dr. el-Tag, former Regional Minister of Agriculture and Natural Resources, and Dr. Bashier, the present Regional Minister have been helpful in planning this research project. Especially helpful, too, has been Dr. Abelgassim, former Director of the Department of Agricultural Guidance (extension) and the present Acting Director General of Agriculture, who has kept us advised of changes in their programs for farmers, and especially in making available members of his staff to work as research assistants during the data collection phase of this project. Their assistance enabled us to avoid making errors of judgement in the field and speeded the data collection process.

C. Overview of the Model of Technology Development

Understanding of the process of technology development for farmers has undergone considerable change during the last decade or so. The older model of agricultural development, still widely accepted by many development officials, assumes that technological transfer takes place as a one-way process in the movement of information from scientists who develop improved techniques, through the mass media or by agricultural advisors, to farmers who function as opinion leaders in convincing fellow farmers to adopt the new technology. This model had the merit of focussing attention on the interface between the formal and informal systems of information dissemination. It recognized too the key roles played by mass media and/or agricultural advisors on the one hand and certain key farmers in villages on the other hand. The model held that farmers' opinions and beliefs about ordinary ways of farming, which constrain the adoption of improved technology, must be changed by persuasive messages through mass media and/or agricultural advisors.

Research and the experiences of agricultural development programs during the 1970's, however, have pointed up critical weaknesses of this model of technological transfer. First, the original model, sometimes referred to as the two-step model of diffusion, did not adequately recognize the different functions of media and interpersonal networks in the process of technological change at the village level. While mass media primarily functions to make people aware of innovations (new ideas), the task of evaluation through which

*William B. Lacy, Lawrence Busch, and Paul Marcotte, the Sudan Agricultural Research Corporation: Organization, Practices, and Policy Recommendations. Lexington, Ky.: Department of Sociology, College of Agriculture, University of Kentucky, October 1983.

farmers decide whether to adopt is the main function of interpersonal communication among farmers. These differences were masked in the old model, and, because of this, the time sequence -- from awareness to evaluation and confirmation of decision to adopt -- of the decision process was ignored.

Second, the old model assumed that the flow of information was unidirectional. An active source constructed messages to influence the knowledge and attitudes of passive receivers. Cause resided in the source and the effect occurred in the receiver. The problem with this assumption was primarily the refusal of the receivers to be passive reactors. Experience has shown that they insisted on taking active roles in evaluating information which might change the economic and social conditions of life. Moreover, they were capable of pointing out inadequacies of new technology.

Third, while the two-step model assumed that communication is all about how to do something in order to obtain greater benefits, and little else, most communication also conveys, or seeks to convey, the message that the source is highly credible and ought to be believed and obeyed. The issue of the trustworthiness or credibility of the source is quite important in countries where government controls the mass media and the public is skeptical of what it transmits.

Fourth, the old model failed to recognize the after-effects of the innovation on the farm, family, and community which may result in rejection or in dislocations. Positive net benefits are not automatic for either the individual farmer or the village community.

An overall criticism of the old, two-step model, is that it did not tell us enough. The flow of communication is more complex. It usually includes many steps, flows in more than one direction, and has several components in addition to its cognitive or knowledge components. The weaknesses of the old model have led to revisions that emphasize the importance of the social networks and communication among local people to the process of technological transfer.

While the old model of technology diffusion was changing due to recognition of its weaknesses, the old model of a research and development system was also changing.* An R&D system, which has been thought to operate on the basis of the rational choice of means to produce innovations desired by everyone, is seen instead to select the best available means to produce innovations desired by the most vocal groups of farmers and agribusinessmen. Sometimes too, innovations are developed not so much because of the high priority of the need for them by farmers but because the means are available to develop them, and not others. In the new model of a R&D system, an innovation is the outcome of the rational pursuit of ends of technology development which are established through a process of negotiation among scientists and various interest groups.

The diffusion process may begin as soon as the process of developing a new agricultural innovation, e.g., new variety of seed, has proceeded to the point that a prototype is ready for testing. When a prototype is available

*Lacy, Busch, and Marcotte, p. 4-5

variety trials, on-farm experiments, demonstrations, etc. may be conducted through which the process of adoption may begin.

The new model of technological diffusion is the process (1) by which information about an innovation and the R&D system which developed it are (2) transmitted through channels (3) to the informal system where farmers participating in social networks develop information about the innovation and its source, (4) over time, (5) until opinions regarding its use and relative benefits become established.

This model recognizes that there are two quite different systems -- the formal R&D system and the informal system of farmers. They have different origins, purposes, and operate on the basis of different rules. The R&D (formal) system is established by legislative or administrative action; the informal system has developed over centuries. The formal system is maintained to produce innovations; the informal system survives because it enables people to make a living. The formal system operates semi-rationally with specialized means to attain limited ends; the informal system operates semi-rationally with a wide range of means to attain a broad range (indefinite number) of ends. Because of these differences, innovations are only partially, not fully, developed in the formal system. Full development in the sense of applicability in the informal system for which they were designed, can only be provided by the informal system. Once fully developed in one informal system, the innovation may be more easily adopted by members of other informal systems (villages).

In the new model, the information flow between the formal and informal systems is bi-directional. The formal system directs messages regarding the innovation to the informal system while the informal system can, if given the opportunity, transmit information regarding the applicability and usefulness of the innovation to the formal system. (It is a process of technology transfer only in the arbitrary sense of the main content of an original idea and the prototype moving from one system to another.)

The principal issue is not so much the sending and receiving of messages or items of information as it is a problem of the convergence of opinions (knowledge, attitudes, and beliefs) about a technological object. The social networks in the informal system play an active role in obtaining a convergence of opinions regarding the utility of an innovation. It is a creative process since the collective experience of the members of the informal system determines the outcome.

The idea of the informal system acting creatively in the final development of the innovation is a point of view that is also espoused by proponents of farming systems research and development. Both recognize the importance of constraints operating at the local level in the final adoption decisions of farmers. In overcoming these constraints the farmers who use the innovations actively take part, whether recognized by development officials or not, in adapting the innovation to their particular set of ecological and socioeconomic conditions. If this adaptation cannot be made, using the collective wisdom of the local village group, the innovation will not be adopted.

II. RESEARCH STRATEGY

The methodological aims of the first, or diagnostic, phase were: (1) development of interview technique, (2) training of researchers, and (3) development of questionnaire items. The first phase of the study would be conducted in villages until researchers were receiving redundant information, i.e., no new types of information or research experience was being obtained.

The second phase of the study, coming after some of the data from the first phase had been compiled and analyzed, would be an intensive study of social networks in two or more villages depending on the availability of time and resources. It would concentrate on obtaining information necessary to attain the main purposes of the research project. Results of the second phase study will be reported in another publication.

A. Phase I Methodology

1. Approach to the Interviews

The combination of research purposes in the diagnostic study dictated a flexible interview structure. With the list of village characteristics already available from the Reeves and Frankenberger studies, a check list could be used in obtaining most of the information about the socioeconomic characteristics of villages. Such information could be obtained from either the sheikh or the chairman of the village council. The sheikh is the traditional village leader, a position usually acquired by inheritance. The chairman of the village council is elected.

The greater uncertainty about other types of information, however, made a semi-ethnographic approach more desirable. For example, we wanted to know whether farmers had started using any new seeds in recent years. Since we did not know whether they had done so, or if so, what they might have been, we began with a general question, "Have farmers in this village planted any new seeds in recent years?" This was followed by a patterned series of questions which were designed to obtain further information about any new seeds thus identified. (See the copy of the questionnaire in the appendix.)

With respect to other types of information even less structure could be provided. One of the issues of interest was the types of occasions when villagers may exchange information about any new crops, equipment, or cultural practices. These occasions are undoubtedly quite varied. We wanted villagers to let their minds ramble over past experiences in learning about a new innovation. We wanted to prompt them to think about the events, how they had happened, under what circumstances, where, and when. This dictated an unstructured approach with varied, but occasionally insightful, questions. The objective was to obtain a list of types of occasions when information was obtained which might be used in constructing the questionnaire for phase two.

2. Selection of Informants and Interviewing Procedure

The strategy for conducting interviews evolved rather quickly during the first week of village contacts. Initially, we located the village sheikh and asked him for assistance in locating other men and women farmers who could be interviewed. Then one of us with one of the Sudanese assisting interviewed the sheikh. In the course of the initial village contacts, however, it became

apparent, first, that the village sheikh or chairman of the village council was the best source of the information about the village per se.

Second, Saadi Nazhat quickly gained sufficient familiarity with the local dialect to conduct interviews without the assistance of a Sudanese research assistant. Mr. Nazhat's interest in the problem of desertification also expanded to include a broader range of issues connected with changes in the ecology and related economic life of villagers.

Finally, the Sudanese research assistants rapidly became competent to conduct interviews with men and women farmers on their own. Consequently, after interviews in the first few villages, the procedure followed was to locate the village sheikh (or one of them if the village had more than one), indicate the purpose of our visit and ask for assistance in locating men and women farmers for the Sudanese research assistants to interview. After they had left to begin interviews, Coughenour and Nazhat, with Nazhat conducting the interview, interviewed the sheikh about the socioeconomic characteristics of the village and discussed questions contained in the questionnaire "supplement". When this had been completed, Mr. Nazhat interviewed the sheikh and/or others with respect to perceived evidence of desertification and associated changes.

Each male and female Sudanese research assistant normally interviewed two farmers. The sheikh or another person assisted in locating the first person to be interviewed, and the latter helped the assistant in locating a second respondent. No effort was made in the first phase study to obtain "representativeness" of informants. After the first few village contacts, the research assistants omitted questionnaire items 1-8, beginning the interview with question 9.

3. Topical Outline of the Initial Questionnaire

The sample questionnaire in Appendix II represents to a substantial degree the final questionnaire used. The final questionnaire is the outcome of the experience in the field and with various governmental and USAID officials. The principal topics and the questionnaire items that relate to them are as follows:

- (1) Socioeconomic characteristics of villages (items 1-11)
- (2) Agricultural innovations
 - a. Seeds (item 12)
 - b. Implements (item 13)
 - c. Cultural practices (item 14)
 - d. Other (item 15)
- (3) Sources of new ideas (item 16)
- (4) Dissemination vs. withholding of information
 - a. New seeds (item 17)
 - b. When to plant millet (item 18)
- (5) The system of local knowledge of sorghum

(6) The system of local knowledge of millet

4. Additional Issues

Before going into the field, visits with Dr. Abelgassim, Director of Agricultural Extension Service, Dr. Tareke Berhe, INTSORMIL agronomist, and Eric Witt and Elizabeth Martella, USAID, led to inclusion of several other issues in the first phase of survey.

(1) Institutionalization of extension -- Institutions like technical innovations must be accepted to become effective. Potential users must be able to identify them, understand their purpose, and have a favorable attitude toward them. From the standpoint of the possible future development of extension, it would be desirable to have some current information regarding farmers knowledge and attitudes about extension.

(2) Opinions of farmers about the agricultural radio program.

(3) Literacy -- One way of obtaining an estimate of the extent of functional literacy is to ask about the number or percent of the village adult population that can read a newspaper.

(4) Institutionalization of research -- The extent of understanding and acceptance not merely of the distribution of new seeds by Dr. Tareke Berhe, but also the more general understanding of who he was, what he was doing, and why.

(5) Knowledge of hybrid "HYV's" -- The development of hybrid sorghum (hageen dura) is a new idea in traditional agricultural. Questions were included to assess the understanding of villagers of "hageen," their readiness to purchase more expensive seed if it produced more, their readiness to obtain information about HYV's and their attitudes about various sources from which they obtain seed for planting purposes.

(6) Women farmers -- Unfortunately, the information collected by Reeves and Frankenberger about the role of women in agriculture is not yet available. Information from other sources about the extent of involvement of women in Sudanese agriculture is not widespread. A minimum of additional information about the involvement of women in agriculture, was sought including the proportion adult women who have their own fields, the proportion who operate their own farms and the size of farms, the extent to which women work for wages in fields, and their wages compared with the wages for men.

(7) Desertification -- Farmers were questioned as to whether desertification was a problem in the area, who was responsible for corrective action, and whether anything was being done about it. Midway in the village survey the questioning was expanded to include information on perceived ecological and economic changes.

B. Schedule of Research Activities

1. Development and reproduction of the Questionnaire

The first 18 questionnaire items and the two pages of questions on the indigenous knowledge of sorghum and millet were developed in Lexington, Kentucky. Initially, it was assumed that 60 questionnaires would be sufficient, and with the assistance of personnel in the USAID, Khartoum office the initial questionnaire was reproduced. As new items were added to the questionnaire a "Supplement" was prepared and reproduced.

When the number of research assistants expanded to five and the number of interviews to ten per village, more than 120 questionnaires had to be produced. Due to the limited facilities available for the reproduction of typed copy in el-Obeid, the reproduction of questionnaires and other materials was a continual problem.

2. Selection of Villages

The selection of villages for the first phase study was much debated and not finally resolved until the last village was visited. Several criteria were used in the selection of villages. One of the early decisions was that time and resources precluded visiting villages more than a 50 kilometer distance from el-Obeid where home base was to be located. With this decision limiting the range of villages, the amount of information available on the 18 villages studied by Reeves and Frankenberger was a major factor in the selection of many of the same villages for the first phase study. Two factors mitigated against selecting only these villages, however. One was the possibility of villagers becoming "fed-up" with the periodic invasions of social scientists with their lengthy questionnaires. Indeed, this was said to be true of farmers in El-Kharta, and it was not studied. The other consideration was that these villages might have become atypical as a result of the earlier study and the resulting attention some had received. This could complicate the evaluation of changes over the intervening three-year period. It also constituted an argument for the selection of some villages that had not been studied by Reeves and Frankenberger in 1981 in order to assess whether "experimental effects" had occurred. Another argument favoring the selection of villages outside the Reeves and Frankenberger list was that Dr. Berhe had established field sites in other villages. A final consideration was the selection of villages across the range of types of soil encircling el-Obeid on which sorghum as well as millet were important crops.

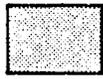
The outcome was selection of the 15 villages shown on Figure 1. All of the villages except Fertengol and Faraj Alla were studied by Reeves and Frankenberger. Eight of the 15 villages have been used by Dr. Tereke Berhe as sites for on-farm variety trials of sorghum and millet -- al-Hammadiya, el-Geifil, Kazgail, Umm 'Arada, Umm Ramad, Abu Haraz, Wardass, and Fertengol. The villages are located in a fan shaped area from north around to the west of el-Obeid, ranging in distance from 15 to 40 kilometers, and in number of inhabitants from 250 to 3,786 according to the 1983 census.

3. Selection and Training of Sudanese Research Assistants

In attempting to locate prospective research assistants the project leaders sought the assistance of Drs. Brian D'Silva and Ahmed Humeida Ahmed of

FIGURE 1. Villages Studied and Type of Vegetation, North Kordofan.

- | | |
|-----------------|----------------|
| 1. Umm Sot | 9. Umm 'Arada |
| 2. Demokia | 10. Umm Ramad |
| 3. Umm Kuka | 11. Wardass |
| 4. El Hammadiya | 12. Abu Haraz |
| 5. El Geifil | 13. 'Ayara |
| 6. El Filia | 14. Kazgail |
| 7. Burbur | 15. El Timaid |
| 8. Fertengol | 16. Faraj Alla |



Woodland savannah
on clay

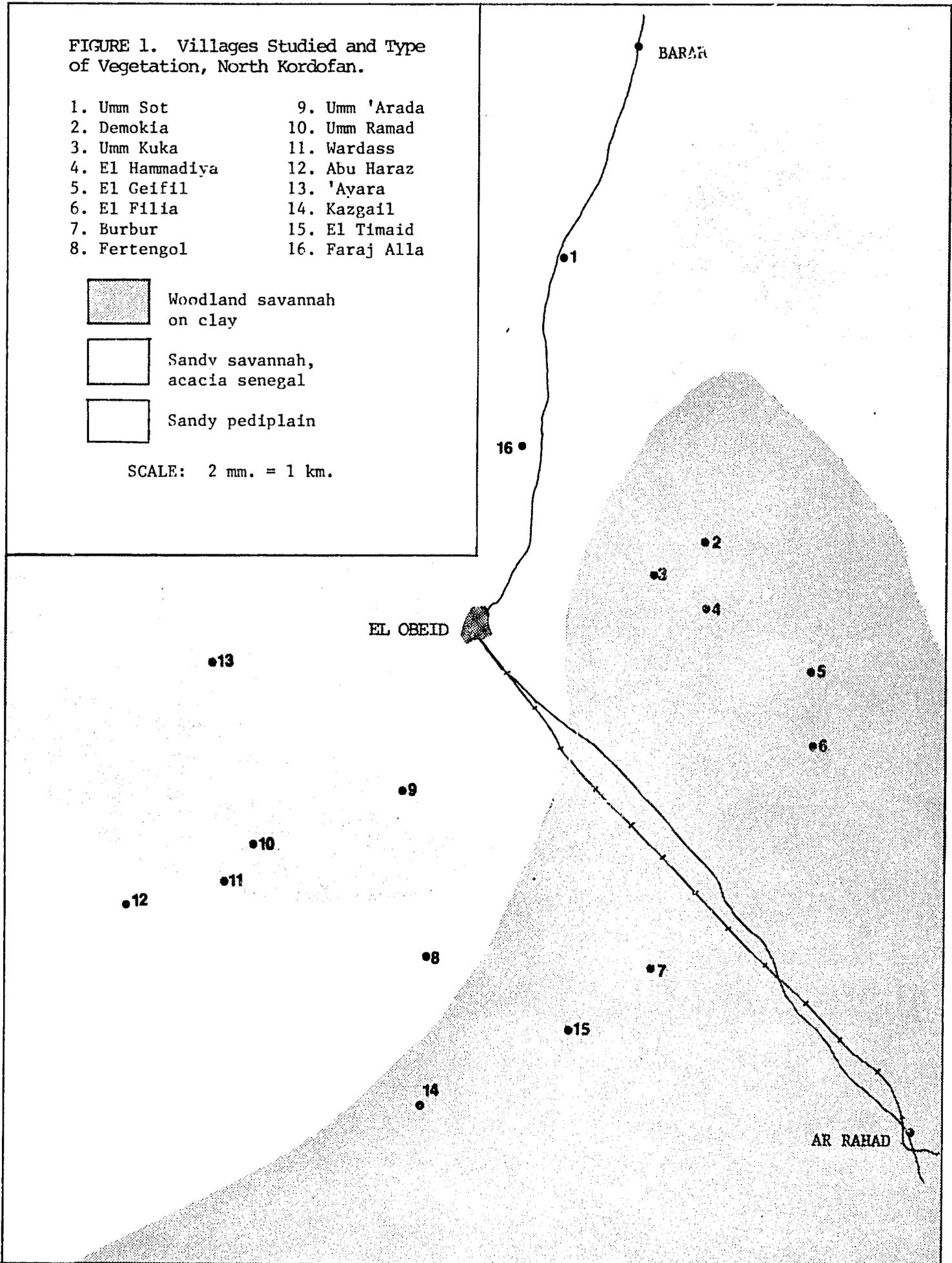


Sandy savannah,
acacia senegal



Sandy pediplain

SCALE: 2 mm. = 1 km.



the Department of Rural Economy and Dr. Mohammed El-Hadi Abusin, Chairman, Department of Geography, Dr. Jalal Altaib, Department of Geography, and Dr. Yagoub Abdullah Mohammed, Director of the Institute for Environmental Studies, University of Khartoum. We wanted men and women graduate students with whom we could communicate satisfactorily in English, who had had some previous research experience, and who were familiar with North Kordofan. They also had to be available for full-time employment from early July to late November. Despite these rather stringent requirements we were successful in locating three persons -- two men and a woman who were qualified and interested in the research. Moreover, when we arrived in el-Obeid, Dr. Abelgassim expressed the hope that we might be able to employ two members of his staff -- a man and a woman -- so that they could receive training and gain understanding of the villages. After discussing the research project with them and satisfying ourselves that they were well-qualified for the role of research assistant, we hired them. This increased our Sudanese research assistants to five persons -- three men and two women. We believe we have been particularly fortunate to have the two women -- Widad Mutaal and Afaṛ Hassan -- since with their assistance we obtained information about women farmers and their sources of agricultural information which could not have been obtained otherwise.

Since all the research assistants had had experience interviewing Sudanese villagers, they were ready to begin trial use of the questionnaire with a minimum of orientation about the nature and purpose of the field interview and the particular questions. We did not expect perfection at first since the first phase itself was to develop the questionnaire and gain experience. Instead, we expected to improve as we went along.

To check on progress, correct errors, and improve question wording, as well as to add or delete questions as the experience seemed to indicate, we followed a particular routine. On the day we planned to visit a village, we met together for about 45 minutes to go over the questionnaire, especially those questions which were to be added and any other procedural changes. In addition, the research assistants were briefed on the village we were going to visit based on the information contained in Reeves and Frankenberger's first report.

The day after interviewing in a village, two hours were spent going over the interviews, discussing the data that had been obtained and any problems that had arisen. Such sessions were particularly useful for training purposes as responses of farmers to particular questions were discussed. The purpose of the question was reiterated and ways of coping with a particular problem, if it should arise again, were discussed.

By alternating a day in the field and a day in el-Obeid three villages were visited and the outcomes discussed each week until all 15 villages had been visited. However, Umm Ramad, the first village visited, was contacted three times. The second visit to Umm Ramad was made for the purpose of obtaining information omitted in the first visit. The third visit was made after all of the other villages had been contacted for the purpose of determining whether we had been "stonewalled" in our first visit. The problem, which was first identified in Umm 'Arada, is discussed at greater length in Section VII.

C. Data Processing

A total of 140 interviews -- 84 male and 56 female farmers -- were obtained during the initial visits in the 15 villages. In the third visit to Umm Ramad partial interviews were taken with four more farmers, which were substituted for the first set of interviews. In addition, partial interviews were taken with sheikhs in 12 of the villages to obtain information on village socioeconomic characteristics and other issues: 22 persons in the 15 villages were interviewed with respect to their perceptions of ecological changes and accompanying changes in village life.

The initial step in data reduction was to compile summaries of the interview information. Most of the tabular material in the main body of this report has been prepared by selecting information or hand tallies from these summaries.

The data obtained on the indigeneous system of knowledge of sorghum and millet has been handled separately. Raw data from the interviews was first compiled into a single table. Frequency counts and simple cross-tabulation were obtained by hand from this master data file.

Needless to say, this process of data reduction is laborious, time-consuming, and subject to occasional error. Unfortunately, modern computer equipment was not available.

III. THE VILLAGES: 1981 AND 1984

Edward Reeves and Timothy Frankenberger* indicate that the 18 villages, which they studied, were selected for diversity with respect to type of soil, access to water, market facilities, and institutional complexity. Thirteen of the original villages, and two new ones have been included in this study. The heterogeneity with respect to rainfed agriculture inherent in the original list of 18 villages does not seem to have been reduced in any substantial way by these deletions and substitutions.

Since thirteen of the villages have been studied twice, the stability or change of the socioeconomic characteristics of the villages can be examined. Even though the two studies are separated by only three years -- a relatively short time for major changes to occur -- the direction of change may be evident. It has been a period during which there has been recurrent drought and relatively high inflation. The cost of living in Sudan roughly doubled between 1980-81 and 1982-83.** It has continued to rise since then. For the years 1981 to 1983 rainfall at el-Obeid, which over many years has averaged 347mm., was 317.5mm., 199.0mm., and 381.8mm., respectively.*** Both of these conditions have adversely affected the well-being of families in the villages around el-Obeid.

*Report No. 1

**International Monetary Fund, "Sudan-Recent Economic Developments." September 1, 1983.

***In 1984, the rainfall at el-Obeid was a disasterously low 155.0mm. See Tareke Berhe and Mirghani Saeed Mohamed, KSU/SUDAN INTSORMIL Project: Agronomic Research on Sorghum and Millet in North Kordofan, Sudan. Progress Report No. 5, Annual Report, 1984.

This section is organized to compare first the socioeconomic characteristics of the villages in 1981 and 1984 and then to examine some of the ecological changes.

A. Socioeconomic Characteristics of Villages: 1981 and 1984

The population of a village is a relatively sensitive barometer of the conditions of survival -- water supply, productivity of the land, and location of markets. Unfortunately, population is not as easily estimated as one might suppose. Settlements are often close to each other, and when this is so, it is often customary to think of them as a single village. A single village council usually is the governing body for several settlements, which may have separate names. Consequently, if one asks the sheikh how many people (or families) are in the village, the figure reported may represent either the immediate settlement or the combined population of two or more settlements.

From the population figures reported in Table 1, it is apparent that the difference in the population in 1981 reported by Reeves and Frankenberger* and in this study is often a function of a difference in the choice of village unit. For example, the estimated population of 'Ayara in 1981 was 800 while in 1984 it was estimated at 480 persons. It is most likely that more than one settlement was included in the 1981 estimate. Much of the discrepancy between the relatively high 1984 population estimates for the larger towns, such as Abu Haraz and Kazgail, and the lower federal census figures for 1983, which are shown in parentheses, has a similar basis. The census policy is to report only the population of the central village, i.e., excluding the populations of satellite villages.

An additional complication is that the estimates of village population were obtained during the summer when it should be at maximum while the federal census was taken as of the first of February when many adults were absent due to seasonal employment. An estimate of the difference in the population of these villages in February and when all adults are present may be obtained by multiplying the general census count of 2,792 families in these villages by 6.02 which is the average number of persons per family in North Kordofan. This gives an estimated population of 16,808, or 9.5 percent larger than the 15,353 reported by the census. Even the larger of these two figures may be less than the village population during the summer months since it could be swelled by whole families of migrants that had returned to raise crops.

As a result of these difficulties, only general population trends can be noted with much confidence. The population that calls a particular village home is probably larger in most cases, and substantially larger in some cases, than the general census figures. In view of this, some villages, such as Demokia, el-Geifil, al-Hammadiya, and Umm 'Arada, have probably experienced population increases since 1981. There is some evidence from interviews with village leaders to support this contention. In Demokia, for example, the sheikh stated that the local situation had become more difficult recently due in part to the arrival of migrants from areas where the drought had been more severe. By contrast, el-Filia and 'Ayara probably have lost population while the remaining villages seem to have remained relatively stable. Overall,

*Report No. 1

TABLE 1
CHARACTERISTICS OF VILLAGES, 1981 AND 1984

	Abu Haraz		"Ayara		Burbur		Demokia		El-Filia	
	1981*	1984	1981*	1984	1981*	1984	1981*	1984	1981*	1984
1. Population **	5,000 10,000	9,600 (3,786)	800	480 (205)	500	560 (251)	750	1,200 (776)	500	350 (250)
2. Number of shops	30	40	8	7-8	2	3	4	6	0	0
3. Village institutions										
Cooperative	1(mill)	1(mill)	0	1(credit)	0	0	0	1	0	0
Mosque	3	3	1	1	0	1	1	1	0	0
Flour Mill	2	3	1	1	0	0	0	0	0	0
Oil Press	?	0	?	0	0	0	0	0	0	0
Health dispensary	1	1	1	1	0	0	3	0	0	0
Primary school	3	4	1	1	0	0	1	1	0	0
Intermediate school	2	2	0	0	0	0	0	0	0	0
Police station	1	1	0	0	0	0	0	0	0	0
Cheese factory	2	3	0	0	0	0	0	0	0	0
Generator for electric power	1	1	0	0	0	0	0	0	0	0
4. Village professions										
Carpenter	4-5	5	1	1	0	0	0	0	0	0
Tailor	15-20	40-50	2	1	3	2	2	2	0	0
Shoemaker/repairer	10-20	8-10	3	1	0	0	0	0	0	0
Gov't midwife	?	2	1	2	0	0	0	0	0	0
Butcher	?	5	5	1(3 unlicensed)	0	0	0	0	0	0
Mason/builder	?	10	0	1	0	1	1	1	0	0
5. Price of water										
Rainy season	0.01/tin	0.10/tin	0.08/tin	free	free	free	free	free	free	free
Dry season	0.06/tin	0.15/tin	0.20/tin	0.40/tin	free	free	0.16/tin	0.40/tin	6.00- 10.00/season	4.50/barrel
6. Gov't crop market used most often	Abu Haraz, el-Obeid	Abu Haraz	'Ayara, el-Obeid	'Ayara, el-Obeid	el-Obeid, Aradeib	Kazgail, el-Obeid	Umm Kuka, el-Obeid	el-Obeid	Geifil	Geifil, Umm Hamaira

TABLE 1 (CONTINUED)

	El-Geifil		al-Hammadiya		Faraj Alla		Fertengol		Kazgeil	
	1981*	1984	1981*	1984	1981*	1984	1981*	1984	1981*	1984
1. Population**	600	500 (1310)	1200	1700 (1165)		986 (792)		1500 (382)	5000	3000-5000 (2748)
2. Number of shops	4	2	6	8		3		1	20	50
3. Village institutions										
Cooperative	1(mill)	1(mill)	0	0		0		1(Ag.bank)	1(mill, store, bakery)	1(mill, store)
Mosque	1	1	1	1		0		0	2	2
Flour Mill	1	1	1	1		0		0	1	2
Oil press	2	1	?	0		1		0	3	1
Health dispensary	1	1	1	1		1		0	1	2
Primary school	1	1	0	0		0		0	2	2
Intermediate school	0	0	0	0		0		0	2	2
Police station	1	0	0	0		0		0	1	1
Cheese factory	0	0	0	0		0		0	1	1
Generator for electric power	0	0	0	0		0		0	1	1
4. Village professions										
Carpenter	0	0	0	0		0		1	2	2
Tailor	3	2	0	1		0		0	27	22
Shoemaker/repairer	0	0	1	0		0		0	6	6
Gov't midwife	0	1	0	1		0		0	?	1
Butcher	0	0	0	2		1		0	7	7
Mason/builder	0	0	0	0		0		0	?	1
5. Price of water										
Rainy season	free	free	0.50/ season	free		Hafir free 0.35/tin		free;0.10/tin delivered	free	free
Dry season	0.07- 0.20/tin	0.40/ tin	0.10- 0.15/tin	0.30/tin		0.35- 0.40/tin		free;0.20-0.25/ tin delivered	0.08/tin	0.10/tin
6. Gov't crop market used most often	Geifil	Geifil, el-Obeid	Umm Kuka	el-Obeid		el-Obeid		el-Obeid, Kazgail	Kazgail	Kazgail, el-Obeid

TABLE 1 (CONTINUED)

	Umm 'Arada		Umm Kuka		Umm Ramad		Umm Sot		Wardass	
	1981*	1984	1981*	1984	1981*	1984	1981*	1984	1981*	1984
1. Population**	1000	1100 (1247)	400	465 (200)	3700	--- (1648)	700	582 (776)	400	500 (215)
2. Number of shops	20	17	4	4	13	15	2	1(permanent) 3(seasonal)	2	1
3. Village institutions										
Cooperative	2(mill, shop)	1(mill, shop)	0	0	1(mill)	1(mill, shop)	1(mill, pump)	1(mill)	0	0
Mosque	2	1	1	1	1	1	1	2	1	0
Flour Mill	2	2	1	1	1	1	1	1	0	0
Oil press	6	7	0	0	3	3	?	0	?	0
Health dispensary	1	1	1	1	1	1	0	0	0	0
Primary school	1	1	0	0	2	2	0	0	0	0
Intermediate school	0	0	0	0	0	0	0	0	0	0
Police station	0	0	0	0	0	0	0	0	0	0
Cheese factory	0	1	0	0	0	1	0	0	0	0
Generator for electric power	0	0	0	0	0	0	0	0	0	0
4. Village professions										
Carpenter	3	1	0	0	0	0	n/a	1	n/a	0
Tailor	3	4	0	0	5	5	n/a	2	0	0
Shoemaker/repairer	2	2	1	0	1	1	n/a	1	n/a	0
Gov't midwife	1	1	0	0	1	1	n/a	1	n/a	0
Butcher	1	1	2	0	4	4	n/a	0	0	1
Mason/builder	0	1	0	0	0	2	n/a	0	n/a	0
5. Price of Water										
Rainy season	free	free; 0.10/tin	0.02/tin	0.40/tin	free	free;0.10/ tin delivered	0.02/day	0.04/tin	free	free
Dry season	free	free; 0.10/tin	0.15- 0.20/tin	0.40/tin	free	free;0.20/ tin delivered	0.02/day	0.04/tin	free	0.40/tin
6. Gov't crop market used most often	el-Obeid	el-Obeid	Umm Kuka, el-Obeid	el-Obeid	Umm Ramad, el-Obeid	Umm Ramad	el-Eidat, el-Obeid	el-Obeid	Umm Ramad, Abu Haraz, el-Obeid	el-Obeid,

TABLE 1 (CONTINUED)

	Abu Haraz		"Ayara		Burbur		Demokia		El-Filia	
	1981*	1984	1981*	1984	1981*	1984	1981*	1984	1981*	1984
7. Price of transport of crops to market										
Heavy (sesame)	0.50- 0.60/sack, el-Obeid	---	---	2.00/sack, el-Obeid	0.50- 0.75/ sack Suweileib, Aradeib	1.50- 2.00/ sack Kazgail, el-Obeid	0.50/sack el-Obeid	2.00/ sack	0.50/sack, Geifil	1.00/sack, Geifil
Light (karkadee)	0.20- 0.25/sack, el-Obeid	---	---	1.00/sack, el-Obeid	0.30- 0.40/ sack Suweileib, Aradeib	1.50- 2.00/ sack Kazgail El-Obeid		0.50/ sack	0.20-0.30/ sack, Geifil	0.50/sack, Geifil
8. Price of truck ride to el-Obeid										
Rainy season	1.00	2.00	1.00	1.50	1.00	3.00	0.50	1.50	1.00	2.50
Dry season	0.75	1.50	0.50	1.00	1.00	3.00	0.50	1.25	1.00	2.50
(Distance, Km.)	(47)		(24)		(40)		(25)		(40)	
9. Ranking of crops by importance										
Millet	1	<u>Food-Cash</u> 1	1	<u>Food-Cash</u> 1	1	<u>Food-Cash</u> 1	1	<u>Food-Cash</u> 1	2	<u>Food-Cash</u> 1
Sorghum	2	2	4	2	2	2	3	2	4	2
Sesame	3	1	2	1	3	1	2	1	1	1
Groundnuts	4	2	3	2	4	2	5		5	
Karkadee	5			3	5	3	4	2	3	
Watermelon	n/a									2
Okra										3
Gum arabic important	yes	yes	yes	yes	no	no	yes	yes	yes	no
10. Ranking of livestock by importance										
Cattle		1		1	1	2		1		2
Sheep		2		2		1		2		3
Goats	1	3	1	3		3	1	3		1

TABLE 1 (CONTINUED)

	El-Geifil		al-Hammadiya		Faraj Alla		Fertengol		Kazgeil	
	1981*	1984	1981*	1984	1981*	1984	1981*	1984	1981*	1984
7. Price of transport of crops to market										
Heavy (sesame)	---	---	?	1.00/sack		1.00/sack		1.00-1.50/sack	---	1.00/sack, ei-Obeid
Light (karkadee)	---	---	?	0.50/sack		0.50/sack		0.50/sack	---	0.50-0.60/sack, ei-Obeid
8. Price of truck ride to el-Obeid										
Rainy season	1.00	4.00	0.50	2.50		2.00		1.00	0.75	2.00
Dry season	1.00	2.00	0.50	1.00		2.00		1.00	0.75	2.00
(Distance, Km.)	(33)		(22)			(22)		(35)	(43)	
9. Ranking of Crops by importance										
Millet	2	<u>Food-Cash</u> 1	1	<u>Food-Cash</u> 1		<u>Food-Cash</u> 1		<u>Food-Cash</u> 1		<u>Food-Cash</u> 1
Sorghum	4	2	2	2		2 3		2		2
Sesame	1	1	3	1		1		4 1		3 1
Groundnuts	5		4			2		5 2		3 2
Karkadee	3	2	5					5 3		4 3
Watermelon										
Okra								3 4		
Gum arabic important	yes	yes	yes	yes		no		yes	no	no
10. Ranking of livestock by importance										
Cattle		1		2		1		1	1	2
Sheep		3		3		2		3		1
Goats	1	2	1	1		3		2		3

TABLE 1 (CONTINUED)

	Umm 'Arada		Umm Kuka		Umm Ramad		Umm Sgt		Wardass	
	1981*	1984	1981*	1984	1981*	1984	1981*	1984	1981*	1984
7. Price of transport of crops to market										
Heavy (sesame)	0.40/sack	1.00/sack	0.50/sack, el-Obeid	2.00/sack	0.50/sack, el-Obeid	1.00/sack el-Obeid	0.50/sack	2.00/sack	0.50/sack, Umm Ramad	1.50-2.00/ sack, el Obeid
Light (karkadee)	0.20/sack	1.00/sack	---	2.00/sack	0.50/sack, el-Obeid	0.50/sack, el-Obeid	---	1.00/sack	0.40/sack, Umm Ramad	0.50/sack, el-Obeid
8. Price of truck ride to el-Obeid										
Rainy season	0.40	1.00	0.75	1.25	0.50	1.50	1.00	3.00	1.00	2.00
Dry season (Distance, Km.)	0.40 (25)	1.00	0.75 (20)	1.00	0.40 (30)	1.00	1.00 (40)	3.00	0.50 (37)	1.50
9. Ranking of crops by importance										
Millet	1	<u>Food-Cash</u> 1	1	<u>Food-Cash</u> 1	1	<u>Food-Cash</u> 1	1	<u>Food-Cash</u> 1	3	<u>Food-Cash</u> 1
Sorghum	3	2	2	2	2	2	2	3	4	2
Sesame	3	1	3	1	4	3	1	2	1	1
Groundnuts	3	3	4		3	4	2	5	2	3
Karkadee		2	5	2	5	2		4	5	4
Watermelon										3
Okra										4
Gum arabic important	no	yes	yes	no	yes	yes	yes	yes	yes	no
10. Ranking of livestock by importance										
Cattle		3		2				2		2
Sheep	1	2	1	1				3	1	1
Goats		1		3	1		1	1		3

TABLE 1 (CONTINUED)

	Abu Haraz		"Ayara		Burbur		Demokia		El-Filia						
	1981*	1984	1981*	1984	1981*	1984	1981*	1984	1981*	1984					
	men	women	men	women	men	women	men	women	men	women					
11. Wages for hired labor															
by Makhammas	10.00	goz. 20.00- 30.00 gardud: 60.00- 70.00	---	5.00- 10.00	10.00- 20.00	---	7.00 10.00	15.00- 17.00	---	8.00- 15.00	8.00- 16.00	---	4.00- 10.00	10.00	10.00
by Dahwa	1.00	3.00	---	2.00	---	2.50	2.00	---	2.50	1.50	1.00	1.00- 3.00	1.00- 2.00		
12. Seasonal labor migration	el-Obeid, Khartoum, Gezira	Gezira, Habla	Habila	Khartoum, Gezira, Umm Rawaba	Khartoum, El-Obeid	Same	el-Obeid, Khartoum	el-Obeid, Khartoum	Habila, Khartoum, Gezira	Habila, Gezira					
13. Transport/ Communication															
Vehicles	4	10	1	3	0	0	5	4	0	0					
Cart driver	20	40	0	0	0	1	0	0	0	0					
Radio/recorders	several hundred	1,200	10-12	15	10	10	7	10	4	0					
TVs	1	12	0	0	0	0	0	0	0	0					
14. Adults able to read newspapers***	---	10%	---	11-35	---	7-10	---	30	---				2-6		
15. Living conditions compared to two years ago	---	worse	---	worse	---	worse	---	worse	---				worse		

TABLE 1 (CONTINUED)

	El-Geifil		al-Hammadiya		Faraj Alla		Fertengol		Kazgeil				
	1981*	1984	1981*	1984	1981*	1984	1981*	1984	1981*	1984			
11. Wages for hired labor													
by Makhammas	5.00- 10.00	10.00- 15.00	10.00- 15.00	6.00- 12.00	15.00	---	15.00 20.00	---	15.00 20.00	---	8.00	10.00- 15.00	---
by Dahwa	---	2.00- 5.00	1.00- 2.00	1.00	3.00	---	2.00	2.00	2.00- 3.00	2.00- 3.00	---	2.00- 3.00	2.00- 3.00
12. Seasonal labor migration													
	Khartoum, Habibla, Rahada	Habila Rahad	el-Obeid, Khartoum	el-Obeid, Khartoum			el-Obeid, Khartoum		Gezira, el-Obeid	Khartoum, el-Obeid		Gezira, Khartoum	
13. Transport/ Communication													
Vehicles	0	0	6	8			0		0	7		8	
Cart driver	0	0	0	7			3		4	30-40		25	
Radio/recorders	15	15-20	15	15			7-10		10	200		150	
TVs	0	0	0	0			0		0	2		10	
14. Adults able to read newspaper***	---	10%	---	5%			20-40		15%	---		5%	
15. Living conditions compared to two years ago	---	---	---	---			---		---	---		worse	

TABLE 1 (CONTINUED)

	Umm 'Arada		Umm Kuka			Umm Ramad			Umm Sot		Wardass				
	1981*	1984	1981*	1984		1981*	1984		1981*	1984	1981*	1984			
	men	women	men	women		men	women		men	women	men	women			
11. Wages for hired labor															
by Makhammas	6.00- 10.00	12.00- 15.00	---	6.00 10.00	10.00- 15.00	---	3.00 12.00	15.00- 18.00	15.00- 18.00	5.00- 10.00	10.00- 15.00	10.00- 15.00	10.00- 14.00	15.00	---
by Dahwa	---	3.00	3.00	1.00	1.50- 2.00	1.50- 2.00	1.00	2.00- 3.00	1.50- 2.50	---	1.00- 1.50	1.00- 1.50	---	---	---
12. Seasonal labor	Khartoum, Habila	Habila, Khartoum,	el-Obeid, Khartoum	el-Obeid Khartoum		Gezira, Habila, el-Obeid	Khartoum, el-Obeid	Khartoum, Gezira	Khartoum, Gezira	Khartoum, Gezira	Khartoum, Gezira				
13. Transport/ Communication															
Vehicles	3	4	0	0	2	1	0	0	0	0	0	0			
Cart drivers	?	4	0	3	2	3	0	0	1	1	1	1			
Radio/recorders	6	25	10	5	50-60	30	4	15	3	0	0	0			
TVs	0	1	0	0	0	0	0	0	0	0	0	0			
14. Adults able to read newspaper***	---	75-150	---	10-25	---	15%	---	15	---	---	---	4-10			
15. Living conditions compared to two years ago	---	worse	---	worse	---	---	---	---	---	---	---	---			

Footnotes: Table I

*Source: Edward B. Reeves and Timothy Frankenberger. Socioeconomic Constraints to Production, Distribution, and consumption of Millet, Sorghum, and Cash Crops in North Kordofan, Sudan. Lexington, Ky: Department of Sociology, College of Agriculture, University of Kentucky, Report No. 1, November 1981.

**Estimates of village population were obtained in 1982 and 1984 by asking informants about the number of families and/or persons in the village. Population figures from the Census of Sudan, February 1983, are shown in parenthesis below the 1984 estimate for each village.

***Number unless otherwise indicated.

according to general census figures, the population in rural settlements in North Kordofan increased by 34 percent during the period 1973 to 1983.

The number of shops in a village reflects the size of the market with the small villages being completely in the market area of larger villages and having no shops. A number of the villages in the population size range of 500 to more than 1,000 are able to support 3 to 6 shops while villages with populations around 1,500 to 2,000 support 8 to 10 shops. The larger towns at some distance from el-Obeid, such as Abu Haraz and Kazgail, have become regional markets with many shops. Some of the smaller towns that have favorable locations, such as Umm 'Arada, are able to maintain an unusually large number of shops for the size of the resident population. Seven of the 13 villages for which comparative data are available registered increases in the number of shops during the past three years, and this is one of the strongest measures of modest economic development available. By contrast, only el-Geifil, Umm 'Arada, and Wardass seem to have suffered an economic decline as indicated by loss of shops.

The institutions and professions also indicate the socioeconomic development and vitality of the village. The smallest villages, like el-Filia and Wardass, do not have any of these specialties which enrich collective life while the larger regional centers have them in abundance. The most common of the institutions in the villages are mosques, flour mills, oil presses, health dispensaries, and primary schools. Tailors and shoemakers are the most prevalent professions.

In so far as can be determined, the total number of the institutions (and small businesses) in these villages increased slightly during the three-year period between the surveys. While this indicates some overall growth, the villages which registered gains and the institutions which gained or lost ground provide the most interesting information. Abu Haraz, the largest of the villages, was the only one to have a net increase of more than one institution. Demokia and el-Geifil, on the other hand had a net loss of two institutions each. Cooperatives, flour mills, health dispensaries, primary schools, and cheese factories increased in number while the number of oil presses and police stations declined. Gainers and losers were neither all private nor all public. The decline in the number of oil presses occurred mainly in villages to the east and the northeast of el-Obeid where recent droughts have reduced the production of sesame. Farmers also are marketing more of their crop in el-Obeid than locally due to the higher prices in el-Obeid.

Difficulties of enumeration preclude accurate recording of the number of the more numerous professions in the larger towns. Moreover, no record was made in the 1981 survey of the number of professions in some of the villages. Even so, it is quite apparent that the tailors and shoemakers, who keep the population clothed, are the most numerous of the village professions. The professions, however seem to have declined in number in the villages during the past three years perhaps due to the competition of mass produced goods. On the other hand, there has been an increase in the number of midwives, butchers, and masons or builders. Overall, the numbers of professionals increased in Abu Haraz, al-Hammadiya, and Umm Ramad but decreased in Umm Kuka and, perhaps, Kazgail.

Some patterns of change are apparent when all of the indicators of village socioeconomic development -- population, number of shops, institutions, and professions -- are considered together (Table 2). Some development is apparent in the medium-sized and larger centers such as Abu Haraz, al-Hammadiya, and Umm Ramad. Kazgail perhaps is not the exception which it appears to be since some of the loss in the number of professional people (e.g., tailors) may be accounted for by the increase in shop keepers. Small villages, especially those close to larger market towns, have lost ground.

Table 2. Change in Socioeconomic Characteristics of Villages, 1981 to 1984

Village	Population	Shops	Institutions	Professions
Abu Haraz		+	+	+
'Ayara	-		+	
Burbur		+	+	
Demokia	+	+	-	
El-Filia	-			
El-Geifil		-	-	
al-Hammadiya	+	+		+
Kazgail		+		-
Umm 'Arada	+	-		
Umm Kuka				-
Umm Ramad		+	+	+
Umm Sot			+	?
Wardass	+	-	-	

Key: + = increase in number
 - = decrease in number
 blank = no change

The direction of change in these respects is not unlike that which has occurred historically elsewhere in response to the general socioeconomic development of markets. The el-Obeid market in particular seems to have become more dominant in the area. This is apparent from the responses of informants in villages like Umm Kuka who said that nowadays they usually purchase meat and other foodstuffs from el-Obeid rather than from the local market. El-Obeid's increased importance is apparent too from the comparison of responses of the 1981 and 1984 informants to the question about which government crop market was most often used by farmers. Informants in seven of the villages in 1984 gave a relatively more important role to the el-Obeid market than it was given in the 1981 survey.

To determine the relative importance of various crops in 1981, Reeves and Frankenberger asked people in the villages to rank the crops regardless of the purposes for which they were grown, primarily for sale or for home consumption. When we attempted to have farmers do this, it became evident that they ordinarily evaluated food and cash crops separately. We, therefore, allowed farmers to rank crops for each purpose separately.

Reeves and Frankenberger report that "millet is the first or second crop in all the villages. Sorghum and sesame also assume a great importance;

groundnuts....are most important in the south and southwest parts of the study area."* As food crops, millet was rated first and sorghum second in all villages except Umm Sot-- the most northerly village studied-- where sesame was rated ahead of sorghum. Sesame is the most important cash crop in all the villages, and its importance in this respect seems to have increased in recent years due to relatively favorable prices. Groundnuts is the second most important cash crop grown in villages to the south and southwest of el-Obeid where gardud (sandy clay) soils prevail. On goz (sandy) soils to the west, north, and east of el-Obeid, karkadee, from which a fruity drink is made, is typically the second most important cash crop. The relative importance of gum arabic may have changed in some of the villages since 1981, but the lack of pattern to the changes makes such a conclusion tentative.

In 1981, Reeves and Frankenberger reported the type of livestock that was most numerous in each of the villages. This usually turned out to be goats. Cattle were most numerous in only four of the villages. Greater numbers, however, do not necessarily mean greater economic importance. In the present survey, informants were asked to rank livestock in importance as they had crops. Cattle were rated most important in six villages, sheep and goats in four villages each.** Rarely are sheep and goats first and second in importance in the same village. The most frequent arrangement is cattle first and sheep second, followed by sheep first and cattle second in importance.

There is no obvious spatial pattern in these livestock arrangements. Reeves and Frankenberger*** suggest, however, that the availability of water is the most important factor regulating the number of cattle in a village, and for the most part this seems so. Clearly, cattle and sheep are the most desired animals and farmers choose to have one or the other if they can. Goats are substituted for sheep in areas (goz soils) where both water and forage supplies are limited.

The mix of livestock in villages results from the inter-action of economic and environmental conditions. For example, a farmer faced with the necessity of selling livestock to obtain income will sell goats rather than cattle (if he has both) because of the social as well as economic value of cattle. But, if due to drought the environmental conditions (forage and water) become inadequate for cattle, the farmer may lose his cattle or be forced to sell them and keep or buy goats.

The typical household in the villages around el-Obeid contains two farm management units, usually consisting of fields that the man and his wife manage independently.*** Food and/or income from the wife's plot is used by the wife as she desires. The women interviewed in the present study contended that most married women had their own fields, which they managed independently, in addition to helping in their husband's fields. From 30 to 40 percent of the adult women -- divorcees, widows, unmarried and married-- had their own farming operations. The areas farmed by women ranged from one to three mukhammas at the lower bound to about ten mukhammas at the upper end with the larger areas being farmed by women who were completely independent.

*Report No. 1, p. 19.

**With few exceptions the rankings of livestock by number and by economic value are the same.

***Reeves and Frankenberger, Report No. 2.

Women farmers thus fall into the category of the smallest cultivators as determined by the Reeves and Frankenberger survey. A study of women farmers in six villages conducted by the Kordofan Regional Ministry of Agriculture* indicates that 90 percent of the women farmers obtained the land they operated as an inheritance. The remainder were given land by their parents or their husbands.

The study conducted by the Ministry of Agriculture indicates that women participate extensively in farming activities either on their own or someone else's fields (Table 3). Indeed, there is little overall difference in the

Table 3. Percentage Distribution of Agricultural Activities by Sex in Six North Kordofan Villages

Activity	Female %	Male %
Land clearing	44	56
Weed prior to cultivation	45	55
Planting	51	49
Supervision	48	52
First Weeding	50	50
Second Weeding	49	51
Cutting	50	50
Collection	55	45
Thrashing	65	35
Sacking	44	56

Source: Regional Ministry of Agriculture, June 1984.

roles of men and women farmers although men may devote more time to farming while women devote more time to food preparation, care of children, and various crafts. The marketing of crops is usually a male activity.

*The Role of Women Farmers in Traditional Agriculture in Kordofan. el-Obeid: Ministry of Agriculture, June 1984. The six villages studied are Khor Taggat, Dajo, Betaitikh, Shoshay, el-Jekka, and Abu Haraz.

Women often work for wages in planting and weeding. Women most often work on a "dahwa" basis (morning work period), rarely by mukhammas. Women also most often weed the previously cultivated (saroya) land rather than the newly cultivated (boor) land which is more difficult to weed. For this reason the wages paid women are sometimes less than men. But, in six of the villages, especially those where goz soils predominate, women reported that they received the same wages as men.

The economic squeeze, resulting from inflated costs and recent droughts, is readily apparent. Costs have gone up more rapidly than wages. The price of water, a critical consumption item, has more than doubled in three years. The cost of a trip to el-Obeid, riding on a truck, has doubled or tripled, and the cost of transporting crops to market has increased two to four times. Meanwhile, perhaps due to the increased numbers seeking wage work, the wages paid men for the first weeding of millet have doubled at best; at worst they have not changed.

The impact of the economic squeeze manifests itself in a widespread feeling of declining economic fortunes. The sheikh in nine of the villages was asked whether the living conditions of people in the village were generally better, worse, or about the same as two years ago. Invariable, the reply was that they were worse off than before. Worsening conditions are reflected too in the decline, even the disappearance in some villages, of important consumer items, such as radios. The recent droughts and poor crops was on everyone's mind as the principal cause of the present hard times. Rising costs are less frequently perceived to be a source of difficulty.

In the area around el-Obeid, as in many traditional agricultural areas, the principal connective tissues among villages are formed by the movement of people and goods (1) along transportation routes between markets, (2) to areas with employment opportunities, and (3) to other villages to visit kin or for family events. Despite the recent problems of agriculture, the transportation system as reflected in the number of vehicles and animal drawn carts has become stronger, doubtless reflecting the increased commercial activity. It may reflect too a greater dependence on a cash economy associated with recent shortages of home grown subsistence crops and relatively greater cash incomes from wages and sesame which is a drought tolerant cash crop.

One dimension of the problem of communication in this area is revealed by the number of radios and TVs. Only in the larger towns, like Abu Haraz and Kazgail, do substantial numbers of families have radios, and almost no TV sets exist outside these towns. There are no radios in two of the villages. The proportion of families in a village with radios can be estimated by comparing the number of radios to the number of families reported in the general census of 1983. On this basis, about one out of ten families has a radio in those villages which report any radios. In some of the larger towns, like Abu Haraz and Kazgail, this proportion rises to three or four out of ten.

To obtain some indicator of the extent of functional literacy in the villages, village leaders were asked how many adults, or what percentage of adults, in the village could read a newspaper. In some villages, informants' estimates of the number or percent varied rather widely. The figure in Table 1 represents the authors' best estimate based on the information obtained. Regardless of the precise accuracy of the reported figure, literacy is

low.* Where numbers of literate adults, rather than the percent is reported, an estimated percentage can be obtained by dividing the number given by one-half the number of people in the village. On this basis, estimated functional literacy ranges from 2-3 percent to about 15-20 percent of adult villagers. The presence of a school in the village has had a positive impact although perhaps less than one might expect due to the out-migration of educated adults. The estimated literacy levels in villages with schools generally range above 10 percent while in villages without schools the levels generally fall below 10 percent.

B. Recent Ecological Change: Probable Causes and Consequences

The villages in this study are located in the low rainfall, savannah areas of north central Kordofan (Map 1). People in all of the villages studied perceive symptoms of environmental stress although they do not always believe that the change has been significant. The situation does not differ greatly from that described in the recent University of Khartoum and Clark University study of an area around three towns in north central Kordofan west of el-Obeid.** In this more westerly area ecological deterioration is indicated both by the disappearance of a number of plant species (both grasses and trees) and the increased domination of other, less desirable species. It is shown too by the longer distances traveled by nomads to areas not frequented by them in search of pasture for their animals, by the declining fertility and productivity of soils, and the increased frequency of crop failure.

In the area around el-Obeid, circumscribed by the 15 villages, the farmers have observed many of the same changes. Several of the native herbs and grasses, which livestock eat, are reportedly decreasing or have disappeared; the varieties of plants are listed below along with the number of villages in which people mentioned their decline.

HERBS AND GRASSES DISAPPEARING	Number of villages
Briohaila (Bepharis linarii folia)	9
Defra (Echinocloa colonum)	5
Abu Asabie (Dactyloctenium aegyptium)	3
Simima (Aristida pollida)	2
Dambalab (Seteria Barbata)	2

Villagers also reported that the prevalence of a number of trees was declining .

TREE VARIETIES DECLINING	Number of villages
Kitter (Acacia mellifera)	3
Hijleej (Balanites aegyptiaca)	3
Tebeldi (Adasonia digitata)	2
Nabig (Ziziphus mucronata)	2
Hashaab (Acacia senegal)	2
Kidhim (Gregia tenax)	2

*Eight percent of the women farmers in the six villages studied by the Ministry of Agriculture had elementary or more schooling.

**M.O. El Sammani and others (D. L. Johnson, ed.), Baseline Data and Potential, Physical-Biological and Socio-Economic Indicators. Khartoum: University of Khartoum, Clark University, USAID, 1983.

The vegetation in general is less abundant. When questioned about the failure to construct fire lanes, which had been a common practice in the past, villagers contended that it was no longer so necessary since there was little vegetation to burn. The changing habitat affects the prevalence of wildlife. It is not surprising therefore, that farmers have noticed the decline of a number of animal and bird species: wolves, deer, foxes, rabbits, and a species of bird referred to locally as Dajaj el-Khala.

Villagers differ in their views of the severity of the problem partly because historically they have fallowed land which has become unproductive, and allowed the natural vegetation to become reestablished. The distinction between the ordinary process of declining fertility through continuous cultivation and more serious ecological damage, which may not be reversible, thus is not easily made. Only one out of four men and one out of eight women interviewed think that any of the village land has been permanently lost to the desert. Those feeling that some loss has occurred most often cite the cutting of trees, the loss of vegetation, and increased wind erosion as the principal indicators of desert encroachment. But, the people who feel this way are in the minority. In only two villages does a majority of the people interviewed think that some village land has been permanently lost to the desert.*

According to the most astute observers, the causes of ecological change are subtle, and their relative importance is not easily assessed. It is clear, however, that both the low rainfall levels and increases in the human and animal population in North Kordofan in recent decades has intensified pressure on the local ecology. Traditional shifting agriculture and livestock raising are the dominant economies. So far, as Sammani points out, these two economies have depended on the inherent fertility of the land.** The use of modern technological inputs has been very limited. Under such circumstances, increased food production has been obtained only through increased exploitation of the environment. Without increases in inputs, a further decline in fertility appears inevitable.

The effort to wrest more food for animals and people from the environment has not been helped by a secular decline in the average annual rainfall. Since 1968, the annual rainfall at el-Obeid has averaged 33mm, below (10 percent) the long term average of 347 mm. The relatively low rainfall is the problem most commonly mentioned by farmers. Indeed, most farmers are inclined to feel that a return to more nearly normal levels of rainfall is both necessary and sufficient to heal the ecological system and the economy as well.

*Despite the widespread opinion among various experts that desertification is occurring, landsat photographs of North Kordofan provide no evidence of increased desertification between 1961 and 1979. See Ulf Hellden, Drought Impact Monitoring. A Remote Sensing Study of Desertification in Kordofan, Sudan. Lund, Sweden: Lund Universitets Naturgeografiska Institution, 1984.

**M.O. El Sammani and other (D. L. Johnson, ed.), Base Line Data and Potential, Physical-Biological and Socio-Economic Indicators. Khartoum: University of Khartoum, Clark University, and USAID, 1983. Edward Reeves and Timothy Frankenberger, Farming System Research in North Kordofan. Sudan. Report No. 2. Lexington, Ky: Department of Sociology, College of Agriculture, University of Kentucky, 1982.

Even so, many villagers who recognize that there is an ecological problem also recognize that it is not merely a problem of inadequate rainfall. When asked whether anything can be done to stop desert encroachment, almost all of the respondents said "Yes", by planting tree seedlings. Most (70 percent) felt that it is the government's responsibility to provide tree seedlings; 30 percent said that both government and the farmer are responsible.

Awareness of governmental programs to promote the planting of hashaab seedlings as a way, in part, of arresting environmental deterioration is surprisingly low. Only three out of ten farmers interviewed are aware of governmental efforts to protect the environment through the planting of seedlings. They were even less involved themselves in efforts to protect or preserve the environment. When asked whether they, the farmers, were doing anything to stop desert creep, 91 percent said "No." Only one out of twelve persons claimed to be doing something, namely, planting seedlings distributed by government officials.

The principal socioeconomic consequence of progressive environmental deterioration, exacerbated by prolonged low-rainfall levels, is failure of the natural resource base to sustain the existing population. In 1982, Reeves and Frankenberger* reported that in 40 percent of the families surveyed someone had migrated for seasonal employment to supplement farm income. In the present study one to two persons in each of 14 villages were asked about the adequacy of the food and cash crops grown last year, i.e., 1983. (The distribution of the 20 farmers as to small, medium, and large area of cultivation was almost identical to the Reeves and Frankenberger sample*.) None of these farmers claimed that their production was sufficient for the needs of the family. All had to purchase foodstuffs from the market, and they earned the necessary extra cash primarily in two ways. Eight of the farmers (40 percent) sought employment, and eight more sold some of their livestock; three sold wood and/or charcoal. These means of supplementing earnings from crops are not exceptional. The findings in fact are almost identical to the Reeves and Frankenberger findings. If there is a difference it is that in 1982 those seeking outside employment were primarily the small farmers while in 1983 equal proportions of small and large farmers worked off the farm.

The general census figure for the villages in 1983 provide another indicator of the extent to which families sought outside employment. The average family in the villages studies contained 5.5 persons in February 1983 compared with an average family size of 6.02 in North Kordofan as a whole. On the average, in other words, one person was absent from 50 percent of the families in the villages if the family size was the same as for the region (in actual fact village families may be larger since Reeves and Frankenberger report that average household had 7.7 members). February, of course, is the time of the year when the adult male in many families has seasonal employment elsewhere, but it is possible that some may already have returned from harvesting crops in the mechanized farming areas, such as Habila. It is also possible that some may have left the village due to the shortage of water. Consequently, one must be cautious in attributing the smaller family size in the villages solely to seasonal migration for employment.

*Report No. 2, p.50.

Although the objective data are inconclusive with respect to a decline in the effective capacity of the environment to support the population, the people in the villages are not. They are uniformly of the opinion that living conditions have become worse. As already noted, they attribute their problems primarily to the relatively low rainfalls in recent years.

IV. VILLAGES AS CENTERS OF INNOVATION

A traditional agricultural system is usually characterized as having low productivity and a technology that is essentially static. Changes are rare and spread slowly. There is little forward or developmental movement in productivity. In many respects this characterization applies to farming in the rainfed area around el-Obeid. It is still primarily a system of hoe agriculture with human beings as the principal source of power. Animals are used for transporting goods (or for food). There are almost no non-farm produced (modern) agricultural inputs, and the cultural practices seemingly have changed little in decades or longer. Nevertheless, in other respects the system of agricultural technology has changed, and against the image of a static agricultural technology the amount of change is surprising.

A. Extent and Nature of Technical Change in Traditional Agriculture

Men and women farmers were asked about changes during the past five years with respect to new seeds, implements, and cultural practices. The innovations mentioned are recorded by village, type of innovation, and year of introduction in Table 3. (Since our informants did not always agree as to the year an innovation was first introduced in the village, we have systematically chosen to report the earliest year mentioned. Although this may result in some innovations being recorded as having appeared earlier than they did in fact appear, the rule is simpler to apply than attempting to calculate an average and does not alter the conclusions to be drawn in any important respect.) Altogether 26 new kinds of seeds were mentioned, not including the new varieties recently introduced by Dr. Tareke Berhe, which some villagers also were aware of. Some of the innovations mentioned, of course, represent different names for the same variety. Several different kinds of implements have been introduced although only one--the garwaal for winnowing grain -- is widely used. Some changes in cultural practices also were mentioned, such as closer planting and a decline in intercropping.

It can safely be assumed that the number of innovations in agriculture in the area is even larger than that recorded in Table 3 since neither the method of sampling nor of inquiry was designed to obtain a total identification of all agricultural innovations. The new seeds and cultural practices involved women as well as men farmers. In some villages women farmers mentioned the introduction of varieties of new seeds which the men did not mention although the reverse was more often the case. Generally, in other words, the men in each village mentioned a larger number and greater range of recent agricultural innovations than did women farmers. The new seeds which women farmers have planted are not confined to the food crops -- millet and sorghum. Women farmers also plant simsim (sesame) and karkadee (roselle) for cash sales.

In considering the total quantity of recent innovations, the technology of so-called traditional agriculture seems much more dynamic than might have been supposed. Moreover, instead of resisting technical change, both men and women farmers seem to be remarkably receptive to it. In both of these

Table 4. Indigeneous Agricultural Innovations By Village, Type, and Year Introduced

	<u>Before 1979</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>No date given</u>
<u>El-Filia (15)*</u>								
Seeds:								
Sesame	--	HireeHri	Wad el-Mardi	Jabarook	Balwa	--	--	--
Millet	--	--	--	--	HireeHri	--	--	--
Sorghum	--	Wad Abu Sidairi	--	Wad Abu Gosara, Tagarib	--	Gadam el-Hamam	--	--
Karkadee	--	--	Kalimbo	--	Umm Gabon	--	--	--
Groundnuts	--	--	--	--	Barberton	--	--	--
Implements:	Ironrake	--	--	Garwaal	--	--	--	--
Cultural Practices:	--	--	--	--	Stopped inter-cropping cowpeas and sorghum	--	--	Sanamaka with sesame, closer planting
<u>Burbur (10)</u>								
Seeds:								
Sesame	--	--	--	HireeHri	Wad el-Awad, Jarbarook	Balwa	--	--
Millet	--	HireeHri	--	--	--	--	--	--
Sorghum	--	--	Umm Benin	--	Tagarib, Karamaka, Gadam el-Hamam	--	--	--
Implements:	--	Garwaal	--	--	--	--	Plow, Saw	--
Cultural Practices:	--	--	--	--	--	--	--	Close planting
<u>Kazgail (9)</u>								
Seeds:								
Sesame	--	Jabarook	--	Balwa	Wad Sandoog	--	--	--
Millet	--	--	--	HireeHri	--	--	(New Release)	--
Sorghum	--	--	Wad Abu Gosara	Gadam el-Hamam	Wad Merghani	--	(New Release)	--
Karkadee	--	--	--	--	--	--	--	Umm Gabon
Implements:	--	--	--	--	--	--	--	--
Cultural Practices:	--	--	--	--	--	--	--	Alternating years of intercrop and single crop

Table 4. (Continued)

	<u>Before 1979</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>No date given</u>
<u>Demokia (11)</u>								
<u>Seeds:</u>								
Sesame	--	Jabarook	HireeHri	--	--	--	--	--
Sorghum	Wad Abu Sidairi	Zunaari HireeHri	--	--	Wad Rabih	Balwa, Wad el-Mardi	--	--
<u>Implements:</u>								
Karkadee	--	--	--	--	--	--	--	--
Implements:	Sonki	Garwaal	Umm Shalatim	--	--	--	--	--
<u>al-Hammadiya (11)</u>								
<u>Seeds:</u>								
Sesame	--	Jabarook	--	Balwa, Wad Rabih	--	--	Wad Merghani	--
Millet	--	--	--	--	--	--	--	--
Sorghum	--	--	--	Wad Abu Sidairi	--	Abu Suf	HireeHri	--
Karkadee	--	--	Umm Gabon	--	--	--	--	--
Groundnuts	--	--	Barberton	--	--	--	--	--
<u>Implements:</u>								
Implements:	--	Garwaal	--	Sonki	--	--	--	Weeding machine
<u>Umm Kuka (9)</u>								
<u>Seeds:</u>								
Sesame	Jabarook	--	--	--	--	Balwa	--	Wad Umm Kajama
Millet	--	HireeHri	--	--	--	--	--	--
Sorghum	Wad Abu Sidairi	--	--	--	--	--	Zunaari Baladi	--
<u>Implements:</u>								
Implements:	Sonki, Garwaal	Umm Gabon	--	--	--	--	--	--
<u>Umm 'Arada (12)</u>								
<u>Seeds:</u>								
Sesame	--	Jarbarook	--	--	Wad Sandoog, Balwa	--	--	--
Millet	--	HireeHri	--	--	--	--	--	--
Sorghum	--	--	Zunaari HireeHri	Gadam el-Hamam	--	Umm Beniin	Abu Suf Hageen, Feterita	--
<u>Implements:</u>								
Implements:	Garwaal, Sonki	--	--	--	--	--	--	--

Table 4. (Continued)

	<u>Before 1979</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>No date given</u>
<u>Umm Ramad (7)</u>								
<u>Seeds:</u>								
Sesame	--	--	--	Jabarook	Wad Sandoog	Balwa	(New Release)	--
Sorghum	Zunaari HireeHri	--	--	--	--	--	(New Release)	--
Karkadee	--	--	Umm Gabon	--	--	--	--	--
<u>Implements:</u>	--	--	--	--	--	--	--	Sonki
<u>Cultural Practices:</u>	--	--	--	--	--	--	--	Closer planting
<u>'Ayara (6)</u>								
<u>Seeds:</u>								
Sesame	--	--	--	Balwa	--	--	--	--
Millet	HireeHri #1	HireeHri #2	--	--	--	Jabarook Abu Suf	--	--
<u>Implements:</u>	Sonki	--	--	--	--	--	--	--
<u>Faraj Alla (7)</u>								
<u>Seeds:</u>								
Sesame	--	Jabali, Jabarook	--	Wad el-'Awad	--	--	--	--
Millet	--	--	--	--	--	--	HireeHri	--
Sorghum	--	--	--	--	--	--	--	--
<u>Implements:</u>	Garwaal	--	Sonki	--	Durra el-Sabi	--	--	--
<u>Abu Haraz (7)</u>								
<u>Seeds:</u>								
Sesame	Jabarook	--	--	--	--	--	Wad Sandoog, Balwa	--
Millet	--	--	--	HireeHri	--	--	--	--
Sorghum	--	Zunnari HireeHri	--	--	--	--	(New Release)	--
<u>Implements:</u>	--	--	--	--	--	Sonki	--	--
<u>Cultural Practices:</u>	--	--	--	--	--	--	--	Intercropping vogs. & maize

Table 4. (Continued)

	<u>Before 1979</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>No date given</u>
<u>Wardass(5)</u>								
Seeds:								
Sesame	--	--	--	--	--	Wad Sandoog	--	--
Millet	--	--	--	--	--	--	Abu Suf	--
Sorghum	--	Zunaari HireeHri	Wad Merghani	--	--	--	Feterita	--
<u>Fertengol (6)</u>								
Seeds:								
Sesame	--	--	--	Wad-el-Mardi	Wad Sandoog	--	--	--
Millet	--	--	--	--	--	--	--	--
Sorghum	--	--	--	--	--	--	Unnamed	--
Implements:	--	--	--	--	--	--	--	Tractor
Cultural Practices:	--	--	--	--	--	--	--	Stopped Mixing Sesame & ?
<u>El-Geifil (4)</u>								
Seeds:								
Millet	--	--	--	--	Abu Suf	--	--	--
Sesame	--	--	--	--	Unnamed	--	--	--
Implements:	--	Garwaal	Sonki	--	--	--	--	--
<u>Umm Sot (3)</u>								
Seeds:								
Sesame	--	--	Wad Merghani	Sawdana	--	--	--	--
Implements:	Sonki	--	--	--	--	--	--	--
<u>El-Timaid **</u>								
Seeds:								
Sesame	Jabarook	--	--	Wad Sandoog	Wad el-'Awad	--	Balwa	--
Sorghum	--	Zunaari HireeHri	--	Gadam el-Hamam	--	--	--	--

*Number of recent innovations mentioned

**Only innovations of new sesame and sorghum seeds were obtained

respects, the behavioral evidence runs counter to received wisdom about the passivity, even the opposition, of such farmers to agricultural innovations. This conclusion has an important qualification, however. With the exception of the tractor and plow, which one or two farmers in Burbur and nearby villages have recently used, none of the innovations is developmental in the sense either of bringing a substantial increase in productivity or of heralding a new system of agriculture. Missing from the list of innovations are the modern inputs -- chemicals and hybrid seeds -- that dramatically increase yields. Even the seed dressings, such as Aldrex-T and dawa suweit, which were introduced some years ago, were not acknowledged as recent agricultural innovations although some of the farmers occasionally use them. It is apparent from the comments of farmers themselves that much of the change has been in response to declining rainfall levels and the shorter rainy seasons. Farmers have been seeking earlier maturing varieties of millet, sorghum, sesame, and karkadee. In sesame, for example, a shift began in the mid-1970s from the traditional baladi, or late maturing, variety to Jabarook which matures more quickly. More recently, the early maturing variety -- Wad Sandoog -- has begun to replace Jabarook. In millet and sorghum, HireeHri -- early maturing -- varieties also have become increasingly popular.

The change in agricultural practices thus has been partly a response to environmental pressures and has left the traditional system of hoe-agriculture intact. With the newer, earlier maturing, varieties and the accompanying changes in cultural practices, the system has been maintained; it has not evolved to a more productive system which is needed to provide food for a growing population. The data, however, provide considerable insight into the process of technical change in traditional agriculture.

1. Village Innovativeness

If the innovativeness of farmers in a village is reflected in the number of innovations introduced in the village in recent years, the villages differ in receptiveness of their residents to new ideas. The villages are listed in Table 4 according to the number of innovations mentioned. Although the method of data collection, which depends on the informed memory and cooperativeness of a relatively small number of villagers for accuracy and inclusiveness, renders the relatively meaningless small differences in the number of innovations between many of the villages, there is clearly a difference of some importance between el-Filia or al-Hammidiya on the one hand and Umm Sot on the other. The issue of what this difference may be attributed to is rather important.

The villages differ in population, location, market development, and in other ways which may affect the number of innovations flowing into the village. But, el-Filia, Burbur, and Umm Kuka are small villages with very few shops, but with substantial numbers of innovations. Abu Haraz and Umm Ramad, on the other hand, are villages of substantial size and market development with only modest records of innovation. It does not seem therefore that market development of itself has much bearing on the reported number of agricultural innovations. Location of the village is the one factor that seems to be of some importance. Nearly all of the villages with the most outstanding records of innovativeness lie to the south, southeast and east of el-Obeid while most of the villages with less distinguished records are located to the southwest, west, or north.

The principal factor making location important in this case is nearness of the village to centers of agricultural research and the mechanized farming schemes where a number of the sesame and sorghum varieties, which have made their way into the el-Obeid area, were originally developed and released. From these centers new varieties are carried by stages to other areas where they are tried and, if successful, adopted. The process has, to some extent, been documented by previous research and also is indicated by the information on the sources of innovation provided by our informants. This is discussed at greater length below.

Another factor accounting in part for the number of new varieties tried by farmers in some of the villages is the very severity of the environmental and economic pressure which the farmers have experienced. On the one hand, the dire consequences of low yields of long maturing crops in recent years have impelled farmers to search frantically for better adapted, i.e., early maturing, varieties. These same circumstances also have driven larger numbers from their villages to the larger towns and to various areas, including the mechanized farming areas, for work. In these places, the migrant farmer-laborer on occasion hears about or sees new varieties that he brings home to try out on his farm the next season. While this occurs to some extent in all of the villages, the point is that in some of the smallest, most poverty stricken villages the number of migrants is out of proportion to the size of the village, providing a regiment of innovation-seekers equivalent to that of villages that are several times larger.

2. New Seeds and the Pace of Diffusion

Millet, sorghum, and sesame -- the major crops -- are native to the area or have been grown here a very long time. The environmental pressures that favor the selection of new adaptive varieties from native stocks also encourage the human cultivators of these crops to identify and propagate them. Consequently, new "local" or "farmers'" varieties of these crops originate periodically somewhere in the region. If a new variety possesses desirable characteristics, it gradually spreads throughout the area to which it is adapted. Since the late 1940's the new varieties of these crops, especially sorghum and sesame, have been augmented by the work of plant breeders at various research stations.* Although nearly all of these "research" varieties have been developed to suit the needs of commercial, mechanized agriculture, the self-sufficient farmers sometimes find that the varieties are suited to their needs also.

The name by which a particular variety is known in a village sometimes indicates its origins. In other cases, the name may refer to the person who promoted and propagated it in the area. Often the variety is known only by its general type, i.e., HireeHri (early maturing). In the absence of botanical analysis one cannot be certain that different names are not being used to refer to the same variety in different villages. In the case of millet the problem of identification is compounded due to the ease with which different varieties cross-pollinate. New varieties rapidly lose their unique characteristics and become indistinguishable from the predominate variety in the area. Consequently, villagers rarely make finer distinctions than the

*Lacy, Busch, and Marcotte, Op. Cit.

general varietal types of millet -- beledi (traditional, dominant, long maturing variety), HireeHri (early maturing), and Aish Bornu (southern variety).

Despite these difficulties, Dr. el-Hag, Acting Director of WSARP research station in el-Obeid, was able to identify one of the sesame varieties and seven of the sorghum varieties, which have been introduced in the area villages, as probably originating at a research station. Most of the sesame varieties and the remaining varieties of sorghum, however, seem to be local varieties whose origins are obscure.

With information about the origins of some of these varieties the broad pattern of diffusion can be described. This is best seen with sesame since it is an important, widely grown cash crop. Jabarook is a medium-maturing variety with good yield. By the early 1970's according to Dr. el-Hag, it was being planted extensively in the Umm Ruwaba area. It continued to spread to Rahad and nearby villages. The earliest mention of Jabarook being planted in any of the villages which we visited was el-Timaid in 1976 (Table 5). Seeds had been obtained from the Umm Ruwaba area. In a few years Jabarook began appearing in other area villages with the seeds having been obtained from

Table 5. Diffusion of Three Sesame Varieties
Among Villages, el-Obeid Area

Year	Jabarook	Balwa	Wad Sandoog
Early 1970's	(Umm Ruwaba area)		
1976	El-Timaid		
1977			
1978	Abu Haraz, Umm Kuka		
1979	Kazgail, Hammadiya, Faraj Alla, Demokia, Umm 'Arada	(Umm Ruwaba, Rahad Area)	
1980			(Rahad Area)
1981	Umm Ramad, El-Filia	'Ayara, Kazgail, Hammadiya	El-Timaid
1982	Burbur	El-Filia, Umm 'Arada	Umm 'Arada, Fertengol, Umm Ramad, Kazgail
1983	'Ayara	Umm Ramad, Umm Kuka, Burbur	Wardass
1984		Abu Haraz, El-Timaid	Abu Haraz

villages in the Umm Ruwaba and Rahad areas. In so far as can be determined, the pattern of the diffusion of Balwa was quite similar although it has not become as popular a variety as Jarbarook. The striking fact in both cases is that the chain of diffusion was primarily from the Umm Ruwaba and Rahad areas to each of the villages rather than from the originating area to one of the larger villages in the area which became a center for the spread of the variety to other villages. How and why this occurs will become clear in the discussion of channels or mechanisms for transmitting innovations.

The diffusion of Wad Sandoog contrasts in this respect with both Jabarook and Balwa. Wad Sandoog is a high yielding, early maturing variety which was being planted in the Rahad area in the late 1970's from which it was obtained and brought to el-Timaid. It was grown successfully in 1981 and subsequently has spread quickly to a number of other villages.

Since the origins of some of the sorghum varieties are better known, the time lag between their release and appearance in the local area can be better estimated (Table 6). Umm Beniin is an early maturing, feterita type, dwarf variety developed in the late 1960's by Dr. Mahmoud at the Abu Na'ama research station for use on the mechanized farming schemes. Sometime during the 1970's it was being planted in the mechanized scheme at Habila where the seeds were obtained and brought to Burbur and Umm 'Arada. Doubtless, Umm Beniin was known for several years by people in the el-Obeid area villages before it was actually planted in response to the pressure of climatic change.

Table 6. Diffusion of Three Sorghum Varieties
Among Villages, El-Obeid Area

	Umm Beniin	Gadam el-Hamam	Wad Abu Sidairi
Circa 1967	Abu Na'ama		
Circa 1970		Abu Na'ama	
Mid-1970's	Habila Area	Habila Area	el-Kara
1978			Demokia, Umm Kuka
1979		el-Timaid	el-Filia
1980	Burbur		
1981		Kazgail, Umm 'Arada	al-Hammadiya
1982		Burbur	
1983	Umm 'Arada	el-Filia	
1984			

Gadam el-Hamam also was developed at the Abu Na'ama research station by Dr. Mahmoud for use on the mechanized farming schemes. It is a semi-dwarf, large headed variety with a reddish tint which was released in the early 1970's. Normally, sufficient seed is produced in three to four years after release for extensive planting. It may be assumed that Gadam el-Hamam was being planted in the Habila area by the mid to late 1970's where it was noticed by migrant workers who brought it to el-Timaid to plant as early as 1979 and to other villages for this purpose in the years that followed.

Wad Abu Sidairi is a local variety which was planted in el-Kara village in the late 1970's and also acquired by merchants in el-Obeid from whom it was purchased for trial in several of the villages.

The interesting points about these cases are first that the varieties began appearing in villages around el-Obeid about a decade after their release from the research station. Second, the diffusion had been primarily from a single source, e.g., Habila, where the varieties were grown extensively. Third, el-Obeid with its large market has played a relatively minor role in the diffusion process. However, village markets have been more important to the process of diffusion than is apparent here, and this role is discussed more extensively in a later section. Fourth, since these innovations -- sesame and sorghum -- tend to spread primarily from some one central source, e.g., ar-Rahad area or Habila, rather than in a chain fashion from larger to smaller centers, as do consumer or producer goods, the process proceeds more slowly and the coverage is less thorough than would be the case otherwise.

In several of these cases -- Jabarook, Wad Sandoog, and Gadam el-Hamam -- the village of el-Timaid stands out for the quickness with which these varieties were introduced and because it also is the source, in some instances, of the spread of the innovation to other villages. In these respects it is somewhat unique, and its distinctiveness prompted us to make a special effort to determine why this is so.

3. The Case of el-Timaid

El-Timaid is a village of 1,600 people located about 7 to 8 kilometers northeast of Kazgail. The people are Bideriya which is the predominant tribal group to the south and southwest of el-Obeid. The village has seven shops, two mosques, two flour mills, two oil presses, a health dispensary, and a primary school with about 270 pupils. It was reported that 30 adults could read a newspaper. El-Timaid seems to be able to support somewhat more commercial activity than some other villages of its size, and the people seem slightly more affluent. For example, they estimated that 70 families had radios, a larger number than any of the other villages visited except the largest. The principal food crops are millet and sesame; sorghum and sesame, millet, and groundnuts are the principal cash crops.

It is their activities, rather than their socioeconomic characteristics, that have made el-Timaid an innovative center for sesame and an early adopter of other new varieties of crops. Both from inclination and necessity, el-Timaid residents are extraordinarily mobile. The sheikh and other villagers indicated that about two-thirds of the adults migrate to the cities and the mechanized farming schemes for work. This is not a recent phenomenon in this village, but rather a long standing one. To some extent the multitude of

migrants are sentinels for the real innovative leaders. These leaders are mobile individuals--notably three oil press operators and one large farmer. The farmer reportedly cultivates 150 mukhammas (270 acres) and has a tractor. (The tractor is occasionally used by the farmers in Burbur to prepare land.) He heard about Gadam el-Hamam being grown in Habila in 1977 through friends who were working in el-Obeid and in contact with men who had harvested Gadam el-Hamam. He sent one of his employees to Habila to get some seed.

Kingpins of the sesame industry in el-Timaid have been three farmers who also operate oil presses. They built and began operating the oil presses because they needed extra income. To operate profitably they realized that they had to have an adequate supply of sesame from el-Timaid and other villages which they visit to buy sesame and to sell the oil. They further realized that farmers should be planting high yielding, early maturing varieties of sesame if production was to be maintained or to grow. One of the oil press operators travels to five or six villages during the season, the other two primarily buy and sell in el-Timaid and Kazgail. In traveling to other villages and through contacts with friends these oil press operators learned about new improved varieties of sesame which they obtained. They distributed the seeds among friends at el-Timaid who tried them and sold the seeds to other villagers and the harvest to the oil press operators. In this way the Jabarook, Wad el'Awad, Wad Sandoog, and Balwa varieties of sesame were discovered, introduced to el-Timaid, and subsequently to other Bideriya villages.* The collection and distribution of new seeds in this case was not regarded as important per se, but rather as a means of having a profitable local oil business.

B. Sources of Innovative Information to Villages

When farmers in a village mentioned a new variety of seed, implement, or cultural practice, we asked from whom it had been obtained, where this had occurred, and under what circumstances. There are three proximate sources of innovations that farmers in these villages have used. One source is the government institutions who typically send representatives or agents to the villages to inform, demonstrate, and sometimes distribute an improved practice. Village markets with their merchants and traders selling various products are another important source. And, of course, farmers in other villages are the third principal source. Among the latter it is useful to distinguish between the occasions when the innovation was discovered in the course of visiting relatives or friends from the occasions of migratory work. The source of an innovation to a village by type of innovation and type of source, which is summarized from the interview data, is presented in Table 7.

*Ethnicity in this case apparently has structured trading contacts of the mobile traders.

Table 7. Village by Type Agricultural Innovation and Source of the Innovation for Men

Type of Source	Sesame	Millet	Sorghum
Institutional (WSARP; INTSORMIL; Agricultural Bank; Forestry, Gum Arabic Research) (25)*		Kazgail Umm Arada al-Hammadiya 'Ayara Wardass Fertengol El-Geifil Abu Haraz	Kazgail Umm 'Arada Umm Ramad Abu Haraz Wardass Fertengol El-Geifil Hammadiya
Market (Merchant/ Trader) (23)	El-Filia Burbur Kazgail Demokia Umm Ramad 'Ayara Faraj Alla Abu Haraz Umm Sot	Burbur Umm Kuka 'Ayara	Burbur Kazgail Wardass
Farmer Migration (3)		al-Hammadiya	El-Filia
Kinship Contacts & Visiting Friends (31)	El-Filia Kazgail Demokia Umm Kuka al-Hammadiya Umm 'Arada Umm Ramad 'Ayara Abu Haraz Wardass Fertengol Umm Sot	El-Filia Kazgail 'Ayara	Burbur Kazgail Demokia Umm Kuka Umm Ramad Faraj Alla Abu Haraz Wardass

Table 7 (Continued)

<u>Type of Source</u>	<u>Groundnuts</u>	<u>Karkadee</u>	<u>Implements</u>
Institutional (WSARP; INTSORMIL; Agricultural Bank; Forestry, Gum Arabic Research) (25)*	El-Filia al-Hammadiya Faraj Alla		Kazgail Umm Kuka al-Hammadiya Umm Ramad 'Ayara Abu Haraz Umm Sot
Market (Merchant/ Trader) (23)		El-Filia	El-Filia Demokia Umm Kuka Umm 'Arada Faraj Alla El-Geifil Umm Sot
Farmer Migration (3)		Demokia	
Kinship Contacts & Visiting Friends (31)		Umm Kuka al-Hammadiya Umm Ramad	El-Filia Burbur al-Hammadiya Faraj Alla Fertengol

*The number of villages in which an innovation has been introduced by type of source. Note that the villages influenced by institutional sources is exaggerated due to the way villages were selected.

1. The Function of Institutional Agents

Due to the deliberate selection of villages in which Dr. Tareke Berhe has conducted farm trials, INTSORMIL is one of the important institutional sources of agricultural innovations in the villages studies. Dr. Berhe has conducted farm trials in 1982, 1983, and 1984. Except for Umm Ramad where only sorghum was distributed the trials included both millet and sorghum. (See Appendix I) In addition, Dr. Berhe cooperated with Bakheit Musa, Ministry of Agriculture, in research with Ugandi millet in 'Ayara in 1983. For trial purposes, each farmer was given two to three kilograms of each variety in March or April and was told how the seed should be planted. Since the farmer, if he chooses, can retain the seed produced, he can gradually expand production of the varieties that do well. He can, if he chooses, also give or sell seed of the successful varieties to relatives and friends in the village.

Among the governmental agencies involved with rainfed agriculture, four are notable for activities affecting agricultural technology or the environment around el-Obeid. The Department of Agricultural Extension Service has the general mission of introducing innovations and technical knowledge in the rainfed agricultural area and of encouraging the development of favorable attitudes toward agricultural innovations. It has distributed Barberton groundnuts and Aldrex-T to farmers in recent years. The Department of Forestry has the general purpose of protecting the environment against deforestation and desert encroachment while establishing new stands of trees for lumber and charcoal. In connection with these purposes, the Department of Forestry in 1981 began to distribute gum arabic (hashaab) seedlings to 129 villages. Since 1978 the Department of Forestry also has tried to establish mesquite belts in certain areas endangered by desert encroachment.

In 1958 the Gum Arabic Research Station (G.A.R.S.) was established to improve the gum arabic species (*Aracia senegal*) and to improve the practical technology of harvesting gum. While G.A.R.S. has made many improvements over the years, one of the most visible to rural people is the sonki. Use of the sonki damages the cambium and woody layers of the tree less than does the light axe (faraar). The sonki was developed in 1963 and was promoted by G.A.R.S. and then by the Department of Forestry.

As was pointed out earlier, many of the villagers recognize that the environment has changed in various ways, but relatively few recognize these changes as representing a serious problem. Even so, the "government" is widely, although not universally, recognized as having an important role along with the farmer in helping prevent deterioration of the environment. Some of the people in at least 12 of the 15 villages recognized this role of government. Of the government agencies the Department of Forestry's program of distributing hashaab seeds and seedlings was most often mentioned.

When asked whether any new implements had been tried in the villages, farmers in seven villages mentioned the sonki (Table 7). In five of these villages the sonki was introduced, according to their account, more than six

years ago. It is also possible that it may have been introduced at an earlier date in some of the other villages and that the farmers we interviewed did not regard it as a recent innovation. While the sonki is rarely used at the present time due to its weight and specialized use, the important point for present purposes is that those who knew about the sonki also recognized the role of the Department of Forestry in promoting it.

While the main function of the Agricultural Bank is to assist the establishment of institutions, e.g., Farmers Union, for the provision of agricultural credit, the Bank also has been active in distributing agricultural inputs, such as Barberton groundnuts and Aldrex-T seed dressing. The latter is recommended for groundnuts (as well as other crops) to control soil insects. The Department of Agricultural Extension Service, however, was involved in the initial distribution of Barberton groundnuts and Aldrex-T. Officials of the Plant Protection Department of the Ministry of Agriculture also have worked with Farmers in the use of D.D.T. and poison bait to control insects and rodents around stored grain.

Unfortunately, the extensiveness of these programs in villages in the el-Obeid area is not known. Only the memory of the villagers can be used to assess the impacts of the programs. In many of the interviews the respondent denied knowledge of the activities of any of these agencies. However, at least one informant in three of the villages recalled the activity of the Agricultural Bank through the Farmers Union in introducing Barberton (barbatai) groundnuts. In four of the villages the Bank also was credited with having introduced seed dressing (Aldrex-T). The Plant Protection Department was identified in five villages as having provided assistance in the use of D.D.T. and poison bait. According to these informants, these were one-time efforts which have not been repeated. Farmers in these villages generally do not recall activities of the Agricultural Extension Service unless questioned specifically about the agency's involvement.

2. Function of Merchants, Periodic Vendors, and Mobile Merchants

Except for el-Filia, all of the villages studied have one or more shops. The merchants (tujjaar) aim to supply the village population with daily necessities, including cereals. They sell a standard set of items in so far as supplies will allow. The medium-sized and larger villages with markets also are frequented by periodic vendors (kayyaal) who sell grain and various other items often produced on their own farms. Reeves and Frankenberger* have given considerable attention to the activities of merchants and periodic vendors. The mobile merchant (taajir motagawil) differs from the merchant with a shop or the periodic vendor in having one or more commodities that he buys and sells while traveling from village to village. Most, if not all, villages regardless of size are frequented by mobile merchants. The oil press operator in el-Timaid who travels a circuit of several villages is a mobile merchant.

Merchants and traders play important roles in the diffusion of new seeds and implements (Table 7). The initial source of one or more of the new

*Reports/No. 2 and No. 3

varieties of sesame was a merchant or trader in 12 of the 14 villages reporting a new sesame variety. Merchants and traders also have brought various implements to the attention of farmers in the villages.

Merchants have been relatively more important than is apparent in Table 7 in the diffusion of new varieties of sorghum and millet. Institutional sources seem more important than in general they are, due to the way the villages were selected. It is undoubtedly true, in other words, that for the region as a whole, merchants and traders have been as important a source of the new millet varieties as any other type of source. On the other hand, merchants seem not to have been important in providing new varieties of groundnuts or karkadee. The principal reason for this is the limited number of new varieties of these crops. Barberton (barbatai) is virtually the only new variety of groundnuts, and institutional sources played a prominent role in its distribution initially. Similarly with karkadee only two new varieties have been introduced in this area which provides little opportunity for merchants to become involved. Moreover, the flower rather than the seed is marketed. Only merchants who raise their own karkadee would have seed. That is, there is no karkadee seed market since farmers save their own seed.

3. The Function of Seasonal Migration of Farmers

From 40 to 75 percent of the adult males and many women migrate after the harvest to cities and mechanized farming schemes for seasonal employment. Because of the opportunity this provides to meet farmers from other areas and to observe new varieties, especially of sorghum, that have been developed for mechanized farms, seasonal migration would seem to provide excellent opportunities for the diffusion of innovations. However, as Table 6 indicates, the occasions in which seasonal migration has been directly instrumental in the spread of new seeds to traditional farmers are relatively rare. Why this is the case is not obvious since the mechanized schemes are early recipients of new varieties, especially of sorghum.*

4. The Function of Kinship Contacts

Social contacts among kin -- brothers, sisters, parents, children, aunts, and uncles -- are the principal mode of social interaction among people in this area. Of the villages studied, only five have representatives of more than one ethnic or tribal group. Villages of less than 1,000 persons are generally inhabited by only one ethnic group and regard each other as kin.

While people in the villages thus have large numbers of kin nearby with whom to associate, the more important consideration for present purposes is the relationships among kin living in different villages. Weddings, funerals, and ceremonies on the occasion of the birth of a son (semaya), circumcision, or requests for special spiritual dispensation (karama) and holidays provide relatively abundant opportunities to travel to other villages to visit kin or

*Data from the second phase study provides at least a partial explanation. Many farmers believe that the sorghum varieties grown in Habila would not grow well on the gardud and goz soils in al-Obeid area. Moreover, most migrants tend to represent the least innovative stratum of villagers.

friends. There is a surprising amount of travel among villages for these purposes, and as the data in Table 7 indicates these are often occasions for gaining information about innovations. In a kinship-oriented society, such as this, the contacts among kin in different villages are the most important avenues for the diffusion of new ideas. This is the reason, incidentally, that many innovations have spread from some original source outside the area to several villages rather than to a market center and thence to satellite villages.

V. THE PROCESS OF DIFFUSION

In rudimentary form diffusion occurs when someone with a better idea comes in contact with another who desires a better way of doing things. Problems arise, however, in facilitating contact between those with new ideas and those desiring it. Farmers ordinarily spend very little time searching for new ideas. Their time and interests are focussed on routine work and social activity. Unless the routines of a potential giver and receiver intersect by chance the new idea may lie dormant. The aggressiveness of the source in seeking potential users thus is critical to the efficient flow of information. This is one of the principal differences between institutional and most other sources of new ideas. Institutional sources take an aggressive stance with respect to the promotion of innovations. They search out potential adopters. Non-institutional sources of innovations for the most part are relatively passive with respect to the innovation even though they may take considerable initiative in selling a product.

Another difference between institutional and non-institutional sources is that innovation is the "business" of institutional sources while the non-institutional sources -- relatives, merchants, other farmers -- are concerned with the social relationship, or the exchange of commodities. Institutional sources having a specific purpose legitimize themselves through the delivery of beneficial innovations. The establishment of a recognized, legitimate role is important too in order to secure the farmers' trust, which eases the transfer of information, and the feedback of results of trials. This favorable opinion also makes easier the establishment of effective informational relationships with other farmers.

The distinction between institutional and non-institutional sources of innovations is the basis for the organization of this section. Another basis is the difference between the process of innovation diffusion for men and women. Since 20 to 25 percent of the independent farmers are women and an additional 10 to 20 percent, although married, have their own fields on which they make the planting and cultivating decisions, the process by which women farmers obtain information about new practices is an important one. It has been almost totally neglected in previous research. The institutional relationships in agriculture are almost exclusively with men, but women as well as men obtain new ideas through non-institutional sources. Thus, the discussion of institutional sources of new information is followed by separate sections dealing with the non-institutional sources for men and women.

A. Innovation with Institutional Sources

Although the Gum Arabic Research Station, Department of Forestry, the Agricultural Bank, and the Department of Agricultural Extension Service have

actively promoted new ideas to farmers over the years, we have focussed primarily on the relationships established by Dr. Tareke Berhe.

1. Berhe's Farm Trials: Purpose and Activity

Although Dr. Berhe started variety trials on a few farms late in the 1982 season, the program really became established in 1983 with trials in nine villages (ten sites). This was expanded to 15 villages and 29 farms in 1984. (See Appendix I) The principal purpose of this work is quite standard, viz., to find out whether various promising varieties developed at the experiment stations could adapt to conditions in the field. To what extent, if any, are they better yielding, and/or drought, pest, and disease resistant than local varieties under local conditions? A second purpose, related to the first, is to assess the adaptability of different varieties to the range of soil and climatic conditions existing in the area. The third purpose is to assess the severity of various problems of particular varieties so that improvements can be made.

To accomplish these purposes certain things had to be done and recorded. The seed given to the farmer for trial had to be planted (in some cases somewhat differently than existing varieties), cultivated, and harvested. In order to determine the adaptability of a new variety, it was necessary to know the area planted, planting date, plant emergence, and production. In addition, it was useful to know the general adequacy of rainfall and any other unusual conditions that may have affected the crop.

It was necessary, of course, to find farmers who could be counted on to fulfill these conditions. In some cases persons recommended by Reeves and Frankenberger were contacted. In other cases, relatively accessible and prominent farmers were identified and their cooperation elicited. Initially, the farmers were told: "Here is good seed. I would like to know how large an area you plant with it; what type of soil it is planted on; and how it does." The various characteristics of each variety were described and discussed with the farmer as well as the conditions which Dr. Berhe would like for the farmer to satisfy. All this was explained after Dr. Berhe had introduced himself and his assistants, explained who they represented, and what basis for the requests they were making.

The new seeds were distributed to farmers during March and April, well before the planting season. Periodically, after the rains began, Dr. Berhe and/or his research assistant visited the farmers and the fields to review the progress of the crop.

During these first years, Dr. Berhe has adopted a low-key approach with respect to the different varieties of millet and sorghum distributed to farmers. He has said only that this is "new" seed or it is "good" seed which might be better in particular respects than the traditional varieties. "Try it and see how it does. You can keep whatever is produced." As a result of the experience acquired from the field trials in 1983 and 1984, however, Dr. Berhe has become increasingly confident that some of the varieties, notably Ugandi millet, do perform better under marginal seasonal conditions than the traditional varieties. Consequently, a new phase of the program can be developed in which selected varieties are more confidently and more widely promoted.

2. Who Received the New Seeds?

The farmers with whom Dr. Berhe has worked are among the more prominent persons in the village having moderate to large sized farms. Of the 17 cooperating farmers in the nine villages (including 'Ayara in which Bakheit Musa has worked) five are also merchants or businessmen; three are sheikhs and/ or a Chairman of the village council, and two are son's of sheikhs. As a group, one should expect them to be dependable, to be able to carry out the field trials as instructed. What is important for purpose of the dissemination of information, however, is that more than one-half of these cooperating farmers have positions in which they see virtually everyone in the village over a period of time as a result of their normal activities. One may also expect individuals with the position of councilman, sheikh, merchant, or businessman to be more gregarious than the ordinary villager. One or more persons of this type was a cooperator in seven of the nine villages that we visited.

3. Awareness of Other Villagers of the Farm Trials

We interviewed 59 male and 31 female farmers in the nine villages. Only two of these, however, were farmers who have been cooperating with Dr. Berhe in the farm trials. Nevertheless, since these trials have been conducted for two or three years in six of the nine villages, there has been sufficient time in most cases for other villagers to learn about the new seeds which some have planted. The knowledge of the trials provides a rudimentary assessment of the effectiveness of the system of informal communication in the village with respect to agricultural matters.

We asked several questions designed to tap farmers' current knowledge. We asked a general question whether farmers had planted any new varieties of sorghum, millet, sesame or other crops during the last five years. As tabulated in Table 4 Abu suf (Ugandi) millet was mentioned as a new variety by one or more farmers in six villages and one or more of the new sorghum varieties was mentioned in two villages.

In all except one of the villages in which Dr. Berhe and Bakheit Musa have worked, we also asked each respondent whether anyone had come to the village to distribute new seeds, and, if so, who were they and why did they come? The results are somewhat surprising (although this depends upon one's expectations). Although at least one person interviewed in every village indicated that someone had given new seed to one or more farmers for trial, only 35 percent of our non-random sample indicated awareness of this. Those possessing knowledge of the farm trials were equally proportioned between men and women.

Knowledge of who had brought the seeds was even more limited. Dr. Berhe was known by name by less than ten percent of the respondents although a few more knew that some foreigner (khawaaja) had brought the seeds. Sometimes he was identified as an American, occasionally as an Ethiopian. Our respondents accepted the fact that the purpose of the activity was somehow to help them but knowledge of who was sponsoring it or why was almost completely lacking. Those having any knowledge at all of the farm trials regarded them favorably even though they were skeptical of the outcome since they thought only two or three farmers, at most, in each village had thus far benefited from the new seeds.

4. What Do the Villagers Know About the New Seeds?

With the limited knowledge of the field trials and of the kinds of new seeds being tested, it is not surprising that knowledge of the characteristics of the new varieties is quite limited as well. Ugandi (Abu suf) millet has clearly attracted the most interest. It interests farmers because it is early maturing and bird resistant. These, and only these characteristics, were mentioned by all respondents. The only negative feedback came from 'Ayara where lower yields and insect problems were noted.

The names given by farmers to the new sorghum varieties -- hageen and feterita -- provided some indication of the identifying characteristics recognized by villagers. But, we were not able to elicit knowledge of any other characteristics from the persons interviewed.

5. How Have Farmers Found Out About the New Seed?

In every instance those with information about the new seeds (other than the recipients of the seeds themselves) were close relatives of Dr. Berhe's cooperating farmers. This is true of the women as well as of the men. In other words, in so far as our present information permits us to judge, the spread of information about the field trials and the new seeds is largely the privileged knowledge of particular families.

B. Innovation Without Institutional Sources -- the Process for Men

Although the role of institutional sources in the spread of new agricultural information hopefully will increase, the most important sources thus far for the so-called traditional farmers have been merchants, mechanized farming scheme operators, and other farmers who are relatives or friends. Based on the reports of villagers as to the occasion or source of new seeds and other innovations, which were not brought by institutional sources, the process of diffusion in about 40 percent of the cases was initiated when a farmer from the village visited a relative in another village who knew about or had the innovation. In about one-third of the instances the initial source was a merchant or trader who either had the new seed in another village or brought it to the local village. Often the merchant was also a relative. Farmers visiting friends in another village or traveling somewhere were about equally responsible for the remaining instances of stumbling on to an innovation. With the exception of some of the new sesame seeds distributed by oil press operators or mobile traders, all of the occasions of innovation diffusion thus were coincidental.

There are two somewhat contrasting models of how an innovation gets introduced into a village. In one, which might be called the single source, innovator model, a person from village A finds out about an innovation used by someone in village B, tries it in village A where it is observed, discussed and adopted (or rejected) by others in the village. A variant of this model is that the innovation is brought by someone, perhaps a merchant, to village A where one or a few farmers see and try it. Other villagers observe the

results and, if they are favorable, adopt the innovation. Something akin to this model is what we assumed in setting up the questionnaire for the first phase investigation.

The second model might be called the multiple innovator-source model. In this model there are several, perhaps many, potential sources of a particular innovation often in more than one village. Several individuals from village A discover the innovation from several sources outside the village, bring it to the village for trial and eventual adoption. Again, a variant of this model is that the innovation is brought to village A by one or more merchants and sold to many potential adopters.

The two models differ in several respects. The first model assumes that villages are closely knit social systems with relatively dense networks of communication with the village. The ties between villages, however, are assumed to be relatively limited. Thus, the flow of information between villages is relatively slow and uncertain, but once new information somehow leaps the barrier between villages it spreads from the initial receiver to others like water through a piping system. The second model assumes that ties among persons in the same village are looser, more contingent, on the one hand, and that contacts between persons in different villages are relatively frequent and widespread. In consequence, there is likely to be several relatively independent innovators, who have obtained the innovation from different sources, rather than only one or two innovators.

The data which have been obtained in the first phase of research are not sufficient to permit a thorough evaluation of these two models. What is clear is that when two or more respondents identified the same innovation as having been introduced in the village, they more often than not identified two or more persons as innovators and different external sources from which the innovators obtained information. The issue is: did these respondents simply lack accurate information about the person responsible for introducing a new variety of seed and where he got it, or were there in fact several individuals who obtained the new seed, from the same or different sources, which they subsequently sold or gave to others? It may be recalled in this regard, that respondents also often disagreed as to the particular year that a new variety was introduced and that many lack information about Dr. Berhe's activities.

As we proceed in the analysis and presentation of the data we will argue paradoxically that both sides of the issue presented above are true. Namely, we will present further evidence that the information about many seemingly important events relating to agriculture, which the members of even the smallest villages possess, tends to be restricted to selected individuals or groups. Inconsistencies in these matters, if recognized, are often not reconciled. The collective (village) memory of the events with which we are concerned is a mosaic of various events rather than a consensual structure of an ordered sequence. Moreover, because villagers often lack information of what has taken place or experienced by some people in the village and because they act independently, several persons may come in contact with the same or different sources of a particular innovation. In this way, there often are multiple sources and innovators of the same innovation. This is especially likely to be so if the innovation represents a significant advance and is highly desired.

We now turn to several other issues connected with the spread of information about innovations in villages -- the advantages and/or disadvantages of the innovations, the characteristics of the innovators, how information spreads within the village, and the pace or speed of diffusion.

1. Advantages and Disadvantages of New Seeds

The downward trend in rainfall which started more than a decade ago and the difficulties farmers have had with the traditional long-season varieties of millet, sorghum and other crops already has been pointed out. Moreover, the early maturing characteristic of the new sesame, millet, sorghum, and karkadee seeds which farmers have adopted in recent years, is generally recognized. One would expect farmers to be especially aware of this characteristic too and that it should be one of the major elements in seed selection.

We asked farmers in what respects each new variety was better than existing varieties, and in what respects was it worse. The farmers variously characterized ten of the new sesame varieties as early maturing, high yielding, heavy oil content, drought resistant, pest resistant, and performing well on poor soils. Three-fourths of the comments were that the varieties in question were "early maturing," and "high yielding." Drought resistance is related to early maturation, and the ability of the variety to perform under low, rainfall conditions was mentioned about one-fifth of the time. The Jabarook, Wad Sandoog, and Balwa varieties were especially notable in this respect.

The only new variety of millet introduced through non-institutional sources is universally referred to as "HireeHri," for an early maturing variety.

Early maturation clearly had higher priority than high yield for nearly all of the new sorghum varieties which farmers have picked up in the past several years. This is especially so for Gadam el-Hamam and Zunaari HireeHri. Wad Merghani, by contrast, is thought by those planting it to be high yielding and drought resistant.

Umm Gabon is the only new variety of karkadee that has been introduced in this area to any extent. By comparison with existing varieties it is noted first for its higher yields and second for its earlier maturation.

Zunaari HireeHri was the only new variety of any crop for which farmers mentioned negative aspects, and it was said by one respondent to be relatively difficult to harvest.

Although farmers were reticent in mentioning disadvantages of any of the new seeds, they were somewhat more forthcoming as to the reasons why all farmers were not planting some of the new varieties. The men interviewed gave 54 responses to the question: Why weren't all farmers planting "X" variety? Since the same kinds of reasons seem to apply to each type of crop, the

distribution for all crops -- sesame, millet, sorghum, and karkadee -- is presented.

	<u>percent of responses</u>
Not enough seed -----	52
Better alternative variety -----	28
Needs different type of soil -----	10
Insufficient knowledge -----	5
Insufficient rain -----	5
	<u>100</u>
	(N = 54)

Notable, of course, is the frequency of mentioning the lack of a sufficient quantity of seed. This is, perhaps, not unusual with new, locally produced varieties. Bad weather, pest problems, and only a few producers all can limit seed production. Farmers also recognized that many of these varieties had similar characteristics but were not clearly superior to other varieties or were not well-adapted to local soils. It is a reflection of the relatively rapid adoption of most of these varieties in the villages, which is a topic for later discussion, that relatively few mentioned "lack of knowledge" as a constraint to adoption.

2. The Innovators: Who Are They?

In the villages, even the larger ones like Kazgail and Abu Haraz, it is hardly an exaggeration to say that "everyone farms," meaning, of course, that every household has a farm regardless of what else the head of the household may do. It is also true that farming and agricultural wage labor are occupations of the big majority of adult villagers. Our informants were somewhat reticent in describing the innovators; the majority were simply said

to be "normal farmers." As Reeves and Frankenberger* report, however, there is a considerable range in the size of farms operated, and it seems likely that nearly all of the innovators come from the upper half of the farm-size continuum. Although comparative data on other occupations is lacking, it seems that a disproportionate number of local innovators have non-farm occupations. About one-fourth are merchants, traders, or businessmen; 8 percent are village sheikhs, and 4 percent have other nonagricultural jobs.

The role of merchants and mobile individuals in the discovery of innovations already has been emphasized. It is not surprising, therefore, to find these kinds of people disproportionately represented among innovators. In this respect, the innovators in this traditional society do not seem to differ from those in other societies; they come from the upper socioeconomic strata of the villages in which they live.

3. How Do Other Farmers in the Village Find Out About the Innovation?

The process by which information about innovations spreads within a village is the principal objective of the second phase of this research

*Report No. 2

project. Nevertheless, we were interested in finding out in a general way how this occurs. The places and occasions when information about innovations is exchanged, to the extent that farmers can identify them, provides helpful insights into the diffusion process (and aids the second phase of the study).

We attempted to identify the occasions when farmers learned of innovations in the village in two different ways. In the first instance, when an informant mentioned an innovation that had been introduced in the village in recent years, we asked how other farmers in the village had found out about it. Later in the interview, we asked a general question: how do farmers in this village find out about innovations? The responses to the two questions are as follows:

How farmers find out about:		
	Specific innovation %	Innovations generally %
General talk in village	17	11
At planting and harvesting	40	25
On market days (market)	19	18
Visits with relatives (wedding, funerals)	11	31
Seasonal migration or while traveling to work	7	8
Farm work (nafir)	6	7
	<u>100</u>	<u>100</u>
	(N = 82)	(N = 104)

From these questions six types of occasions during which farmers in the village find out about new seeds or other innovations were identified. Although the six categories are somewhat more abstract than the actual responses of the farmers, no attempt was made to force the answers into particular molds. The same categories apply to both sets of responses. Moreover, with two exceptions the relative importance (frequency) of the various occasions is the same, thereby increasing confidence in the reliability of the findings.

Farmers in the villages often get together at a meeting house (rakuuba) for breakfast or lunch. This is an occasion for intense discussion of current events. However, observations made at planting and harvesting times, conversations at the market, and on the occasion of a visit with relatives, are the most important occasions when information about anything new is obtained. Observations made or information obtained while traveling or working are much less important although both occasions probably occur at planting or harvesting time and thus overlap with these seasonal events.

The biggest differences in responses to the two questions is between the planting and harvesting times, which is the occasion when much information about specific innovations was exchanged, and visits with relatives, which

looms larger in the minds of villagers when the general issue is considered. Similar differences occurred in the responses of women farmers, and a plausible interpretation of the difference is presented at that point.

4. The Speed of Diffusion in the Village

Once an innovation has been introduced in a village five factors constrain the speed with which it becomes accepted -- (a) the speed with which experience is gained about its local comparative advantage, (b) the magnitude of the advantage, (c) the generality of this advantage across the cultivated area, (d) the speed with which this information becomes known, and (e) the availability of the new seed or whatever the innovation may be. Other things equal, the build up of experience with a new seed is greater the larger the number of initial trials, and one might suppose this to be greater for seeds available through the market than through relatives in another village. The greater the number of initial trials the better the prospect that information about the success of the new seed will become quickly and widely known, and that the supply of the new seed will be quickly increased.

While this argument favors a quicker pace of diffusion in the village when the innovation is introduced by merchants or through the market, we have already seen that there are many instances in which two or more individuals obtain the innovation from relatives in other villages. This provides conditions of initial trial that may not differ greatly from those in which the innovation comes via the market.

We do not, of course, possess data to evaluate all these constraints reliably. We do, however, have information on the sources of the innovation, the innovators, the approximate date of introduction, and subjective assessments of the extent of current usage. From this a qualitative judgement might be made as to whether the market-originated innovations have had an advantage in speed of adoption. Moreover, differences in the pace of adoption of innovations can be examined for different types of new seeds -- sesame, millet, and sorghum.

However, the available evidence as to the comparative advantage in speed of diffusion of innovations introduced by merchants over ordinary farmers is largely inconclusive. In four of six comparisons there is no difference in the pace of diffusion within the villages. In the other two comparisons, both involving Jabarook sesame, the pace of diffusion was as rapid or more so in the village with the market origin than in the villages with a farmer as the initial source. At best, there is weak evidence for the superior performance of market originated innovations.

In the case of some of the sesame varieties, the importance of mobile traders and oil press operators already has been noted. But in many cases the initial contact was made just as quickly through visits among relatives. Consequently, no consistent case can be made for the superiority of the market as the initiator of innovations.

As might be expected the pace of diffusion of some innovations has been very rapid and of others quite slow. For instance, Jabarook sesame is reported to be planted by "most" or "all" farmers in seven of the eleven

villages in which it has been introduced. "All" or "most" farmers are reported to be planting Wad Sandoog except in Abu Haraz where it was introduced only this year. By contrast, however, Balwa sesame has been tried in nine villages and was introduced in several villages as early as 1981. But, "all" or "most" farmers plant it in only three of the villages while "some" or a "few" farmers reportedly plant it in the other villages.

The situation with respect to other seeds is similar. Wad Abu Sidairi -- a local variety of sorghum introduced in several villages in the late 1970's--is said to be planted by "all" or "most" farmers. Gadam el-Hamam, which was introduced in Kazgail and Umm 'Arada in 1981 and in Burbur and el-Filia in successive years thereafter, is reportedly planted by only a "few" or "very few" farmers.

HireeHri millet has had a very checkered career. It is not now planted by any farmers in Burbur and Umm Kuka -- two of the four villages where it was first introduced in 1979 -- but is planted by "most" farmers in Umm 'Arada and 'Ayara. "Few" plant it in Kazgail where it was first planted in 1981 but "most" do in Abu Haraz which started the same year. "Very few" farmers planted HireeHri millet in el-Filia this year after two years of experience with it.

Clearly, the farmers have not found some of these new seeds particularly well-adapted to local conditions or to represent much of an advantage over other varieties of the same crop. Although our interviewing procedures were not sufficiently refined to provide as good quality of information as one would like, the lack of adaptability to local soils, in the case of Gadam el-Hamam, and lack of superior performance to Jabarook or Wad Sandoog, in the case of Balwa, are the principal reasons for the slow acceptance of these crops. These factors have been more important than lack of availability of the seed.

Finally, if the subjective assessments of farmers of the extent of current utilization of these crops are reasonably accurate, the speed of diffusion of a new variety of seed in a village can be rapid indeed. This is not to say that the constraints are not important, but rather that under some conditions the constraints are minimal.

C. Innovations Without Institutional Sources -- the Process for Women

The highest priority tasks of women in villages are thought to be the care of children, preparation of food, and other items for family use. Their role in food production and marketing is often overlooked. Even the farming system study by Reeves and Frankenberger* gives scant attention to women farmers. Fifteen percent of their survey was women, but the sample was too small to independently analyze. These women were widowed or divorced and operated independent farm units. In addition, they indicated that men often gave their wife a block of land to cultivate and manage on her own. Reeves and Frankenberger also note that 68 percent of the periodic vendors in the Abu Haraz and Umm Ramad markets were women.

*Report No. 2. A larger number of women farmers were studied in the final survey, but the findings have not been reported.

While we are collecting data more systematically on women farmers during the second phase of the research, the data thus far suggest that one-fifth to one-fourth of the household heads are women farmers and 10 to 20 percent more are married women who independently manage blocks of land. Nearly all of these farms are small, less than 10 mukhammas. They grow the same types of crops as do the male farmers, but may raise sorghum and karkadee less often. This assumption, which is based on some of the data to be presented below, can be more adequately verified by data from the second phase of the study.

The strong separation of mens' and womens' spheres, which one usually finds in traditional groups, is reinforced in this case by Islamic culture and religious teachings. Consequently, men and women come in contact with each other primarily within the family and kinship group and in the market. In other circumstances, contacts are highly stylized. More to the point of the present discussion, however, is the extent to which this separation affects the spread of information about agricultural innovations. Ultimately, the constraints to the adoption of innovations, especially of the kinds under consideration here, are the same for women as men. Thus, it is important to know whether the constraints to the introduction of innovations to women farmers are different or greater than for men; whether the separation of spheres of activities constrains the flow of agricultural information between women and men such that the development of collective consensus is inhibited or the supply of new seeds restricted.

To explore these issues the discussion is organized in terms of the following topics: the innovations identified by women farmers, sources of information and new seeds, the characteristics of the innovators, the process of diffusion within the village, and the pace of diffusion among women.

1. Recent Agricultural Innovations Among Women Farmers

While Table 4 is a comprehensive list of all innovations used by women and men in the villages, those specifically mentioned by the women farmers interviewed are listed in Table 8. Several kinds of innovations are notably absent in Table 8. None of the new seeds introduced in villages by Dr. Berhe appear in the list, nor does Barberton groundnuts which the Agricultural Extension Service has promoted. Moreover, the new implements are largely limited to the garwaal which is traditionally used by women during harvesting. These "missing" innovations, of course, have been selectively introduced to men, in the case of the new "experimental" seeds, or are innovations that require larger amounts of capital than women possess in the case of the new implements.

Although it cannot be determined from an inspection of Table 8, overall the men farmers identified more than twice the number of innovations as did the women. To some extent this doubtless reflects a real difference in innovative activity by men and women farmers, but the magnitude is misleading. On the one hand, it is not that the men farmers mentioned all the innovations identified by the women plus an equal number that women did not mention. The women farmers identified some innovations that the men did not mention. It is also true that the number of innovations identified is to some extent related to the number of men and women interviewed. Consequently, the ratio

of innovative activity of men and women farmers may be more nearly on the order of 3 to 2 instead of 2 to 1. The exact ratio, of course, is less important than the overall imbalance.

Table 8. Innovations Mentioned by Women Farmers by Village and Year

<u>Abu Haraz</u>	<u>Demokia</u>
Seeds: Sesame: Jabarook, 1981 Balwa, 1984 Wad Sandoog, 1984 Millet: HireeHri, 1981 Sorghum: Zunaari, 1984 Cultural Practices: Intercropping vegetables and maize	Seeds: Sesame: Jabarook, 1979 Balwa, 1983 Wad el-Mardi, 1984 Sorghum: Wad Abu Sidairi, 1978 Implements: Sonki, 1978 Garwaal, 1981
<u>al-Hammadiya</u>	<u>Umm 'Arada</u>
Seeds: Sesame Jabarook, 1979 Wad RabiH, 1981 Sorghum: Wad Abu Sidairi, 1981 Implements: Garwaal, 1979	Seeds: Sesame: Jabarook, 1979 Balwa, 1981 Wad Sandoog, 1982 Sorghum: Zunaari HireeHri, 1980 Gadam el-Hamam, 1981
<u>El-Filia</u>	<u>Burbur</u>
Seeds: Sesame: HireeHri, 1980 Balwa, 1982 Karkadee: Kalimbo, 1980 Cultural Practices: Stopped Intercropping cowpeas and sorghum, 1982	Seeds: Sesame: Wad el-'Awad, 1983 Millet: HireeHri, 1979 Implements: Garwaal, 1980

Table 8. (Continued)

Kazgail

Seeds:
 Sesame:
 Jabarook, 1982
 Wad Sandoog, 1983
 Balwa, 1983
 Millet:
 HireeHri, 1983
 Karkadee:
 Umm Gabon, ?

Faraj Alla

Seeds:
 Sesame:
 Jarbrook, 1979
 HireeHri, 1980
 Wad el-'Awad, 1984
 Millet:
 HireeHri, 1984
 Implements:
 Garwaal, 1978

Umm Kuka

Seeds:
 Sesame:
 Jabarook, 1978
 Balwa, 1984
 Sorghum:
 Wad Abu Sidairi, 1978
 Implements:
 Garwaal, 1978

Umm Sot

Implements:
 Sonki, 1981

'Araya

Seeds:
 Sesame:
 Balwa, 1983

El-Geifil

Seeds:
 Millet:
 HireeHri, 1984
 Implements:
 Garwaal, 1979

Fertengol

Seeds:
 Sesame:
 Wad Sandoog, 1981
 Wad el-Mardi, 1981

Umm Ramad

Seeds:
 Sesame:
 Wad Sandoog, 1983
 Cultural Practice:
 Changed Intercropping pattern

Wardass

Seeds:
 Sesame:
 Wad Sandoog, 1983

It already has been suggested that part of this difference is due to the actions of institutional sources, rather than to the farmers themselves. Some of the women farmers knew that Dr. Berhe had given new seeds to certain farmers in the village even though they had not yet had an opportunity to try them (as most of the men also had not). Thus, the current awareness of women farmers of innovations is somewhat greater than their actual usage.

Part of the difference also is due to differences in farm size and cropping patterns. Women have smaller acreages and probably less often grow groundnuts, sorghum, or tap gum arabic trees.

Even so, the list of innovations by women is impressive. Women farmers in some of the villages have tried seven out of the eleven new varieties of sesame that have been recently introduced. They have tried four of the ten varieties of sorghum as well as HireeHri millet. Except for groundnuts, women farmers have been substantially involved in innovative activities with all the major subsistence and cash crops.

One question is whether women farmers are as quick to try new seeds as the men. This is indicated by the year in which the new seed was reportedly introduced. A tally of the 28 comparative dates when the same seed was reportedly introduced into the village indicates that in 29 percent of the cases women farmers reported an earlier date for the initial trial than did the men. Twenty-one percent of the time the two dates were the same, and in 50 percent of the cases the men reported an earlier date for the initial trial. Although it appears that the men most often are the first to try a new practice in the village, the situation is not entirely one-sided. The more important point, perhaps, is that there is rarely a big difference either way in the reported dates of initial trial of innovations, indicating that the non-institutional sources of new ideas do not seriously discriminate against the flow of information to women.

2. Innovators' Sources of Information and New Seeds

The women farmers were asked who (woman) first planted the new seed, which they had identified, how she had learned about it, and where the new seed came from. Unfortunately, the women were often uncertain as to which woman in the village was the first to plant a particular kind of new seed. Their answers thus sometimes provide information about how they themselves had learned of the new seed or had obtained it. If the woman was among the early users, we arbitrarily considered her to be the innovator for present purposes. The lack of information about first users indicates something about the importance and extent of this information among women.

The types of non-institutional sources of information and new seeds for women farmers -- merchants, relatives, and friends or acquaintances -- are the same as for men farmers. One of the issues of some importance, in addition to the relative importance of these three types of sources, is whether the source of innovative information or seed is from the same village or some other village. In other words, do women farmers have sufficient opportunities to travel to other villages to learn about new seeds, or are they village bound to such an extent that new information and new seeds mostly come from other villagers, i.e., men farmers? The second important issue is the extent to which women get new information and seeds from men or from other women

farmers. The issue has to do with the effectiveness of the linkages between men and women farmers compared with those among women in the transmission of new information and seed.

Interview information bearing on these issues is presented in Table 9. Overall, relatives are the most important sources of information about new seeds (42 percent) followed in importance by friends or acquaintances (34 percent) and merchants (24 percent). The order of importance changes somewhat when it comes to the acquisition of the new seed itself. In this case merchants and friends or acquaintances are equally important sources (34 percent) while relatives supply the new seed in 30 percent of the cases.

Table 9. Sources of New Information and Seed for Women Farmers

	Total %	MERCHANT		RELATIVE				FRIEND/ACQUAINTANCE			
		Other Village %	Local Village %	Other Village Man/Woman		Local Village Man/Woman		Other Village Man/Woman		Local Village Man/Woman	
				%	%	%	%	%	%	%	%
Information (N=47)	100	15	9	13	21	4	4	4	6	17	7
New Seed (N=47)	100	25	11	11	13	4	2	6	9	15	4

The fact that relatives are the most important source of information while merchants or friends most often supply the new seed itself is consistent with expectations for a society in which kinship ties are of great importance in daily life. The surprise in these data, if such it may be, is in the relative importance of friends or acquaintances as information sources. It reflects a wider or more diverse range of contacts than might have been supposed.

A contact with a merchant or relative in some other village (than the village of residence) is much more often important as a source of new information and new seed than a contact within one's own village. Only for contact with friends or acquaintances, which result in information about innovations or seeds, are the local ties more often important than those elsewhere. The issue of how spatially circumscribed women farmers are in their movements thus is clearly resolved in favor of substantial mobility. Indeed, this must be case if the reported year of innovation in the village is at all accurate. If the sources were primarily local the dates of innovations almost invariably would be later for women than for men farmers.

Women, like their male counterparts, move about frequently to visit relatives or to participate in some family event such as a wedding or funeral. Visiting kin in other villages is more common than visiting friends, but both are opportunities for learning about innovations and acquiring new seeds. Visiting kin and going shopping in the market often occur together, and not infrequently the new seed which one learns about from one's kinfolk can be obtained in the local market.

Women innovators seem somewhat more likely to obtain information from female relatives in other villages (21 percent) than do male farmers (13 percent); but in the local villages, women more often get information from male (17 percent) than female farmers (7 percent), friends and acquaintances. Overall, however, other women and men are equally important sources of information for women innovators. In this respect, contacts between the sexes as effectively transmit information about agricultural innovations as do those involving the same sex.

The situation seems a little different with respect to obtaining new seeds. In this case, women innovators more often obtain new seed from men farmers (36 percent) than from other women (28 percent). This difference is primarily due to the relatively greater importance of male relatives and friends as seed sources in the local village. This is consistent with earlier information about the relatively greater quickness of men to try innovations. If men, more often than women, are the first to try a new seed, they are more likely to be the first to have seed to give or sell to others. But, the advantage is not great.

3. Women Innovators: What Are Their Characteristics?

Most women farmers operate small tracts, and the limited data available about women innovators does not suggest that they differ from the average woman farmer in this respect. Only one had more than 10 makhammas. This size of farm suggests that they may have been widowed or divorced, i.e., independent rather than married with a small tract which they cultivated independently. More than one-half of those for which data are available are less than 50 years old.

The small size of farm is probably not much of a handicap to the adoption of the kinds of new seeds with which we have been concerned. The most important limitation is probably the availability of funds to purchase new seeds. The size of the farm, (and available capital) of course, becomes more of a constraint as more expensive kinds of seeds, such as hybrids, and the number of nonfarm produced inputs begins to rise. Consequently, although women innovators do not suffer much of a comparative disadvantage under the present system of agriculture, this is quite likely to change as a more "modern" system of agriculture is introduced. The danger is that small farmers -- male and female -- will be left behind.

4. How Do Other Women Farmers Find Out About the New Seeds?

We attempted to determine the occasions and kinds of persons from whom other women farmers in the village found out about the innovations. We asked questions relating both to the specific innovations identified by the women

and about new ideas in general. The comments made by women farmers were coded and tallied, but the findings show only general tendencies.

The main types of occasions when women in the village obtain information about new seeds and other innovations are much the same as for men: while marketing, planting or harvesting; at gatherings either in the village or at another village with relatives and friends. The relative importance of the various types of occasions are as follows:

	<u>Occasions when women farmers find out about:</u>	
	<u>Specific innovations</u> <u>%</u>	<u>Innovations generally</u> <u>%</u>
Marketing (total)	39	57
Local village	(21)	(33)
Another village	(18)	(24)
Working: planting, harvesting	20	33
Village gatherings	41	10

The two questions resulted in rather different kinds of responses. When questioned about how women farmers had found out about the specific innovations which they mentioned, marketing occasions, either locally or in another village, and the general talk that takes place at gatherings of local people or when visiting relatives in other towns are most commonly mentioned. These are also occasions when the women innovators themselves reportedly had most often found out about new seeds. It may be primarily a matter of who happens on to the new seed first instead of the processes for women innovators and for other women occurring under different circumstances.

Responses to the general question about how women farmers find out about innovations more frequently refer to the activities of marketing and working in the fields during planting and harvesting times, including participation in work parties (nafir). The importance of general village gatherings and visiting was downplayed. It seems clear that in answering the general question the women farmers were thinking about occasions when everyone's interest in crops is heightened, i.e., when harvesting or selling the crop in the market. On these occasions there is much to observe and to discuss: the crops that produced the most, survived the drought best, etc. Doubtless it is a time when farmers find out much information in general, and if new seeds have produced a bountiful harvest, other farmers are most likely to find out about it at these times. Thus, the first set of responses seem to reflect the occasions when innovators happened to find out about new seeds while responses to the second question more nearly represent how farmers generally get farm information.

The information obtained to the general question about how women farmers find out about agricultural innovations also was coded to indicate the types

of persons mentioned as sources. These were as follows:

	%
Other farmers (relatives & friends)	43
Relatives specifically	14
Merchants	26
Hired laborers, migrants	17

Marketing is an occasion for meeting and talking to other farmers; as much as it is an occasion to talk with merchants. Thus, merchants as a source of information are less important than is marketing as an occasion. Other farmers are the main source of new information, and in talking about this the women farmers did not deem it important to distinguish between other women and men. The relatively equal importance of both as sources is consistent with information obtained in response to the initial question on how women farmers in the village had found out about specific innovations. However, when the women farmers mentioned specific relatives as sources of information about new ideas they usually specified a male relative: father, brother, or husband.

Hired workers, many of whom are migrants from other villages, are regarded as important sources of new ideas by women farmers. Such workers are often hired to work in the harvest, and they bring information about new seeds which they have seen in other villages.

There are some notable differences between men and women in the relative importance of the various types of occasions mentioned. Marketing looms as a much more important occasion for women than men while harvesting is most important for men. With respect to specific innovations village gatherings (general talk and visits with relatives) are of relatively equal importance to both. Seasonal migration is of some importance to men in getting new information while the migrant laborers themselves are occasionally sources of new ideas for women farmers.

As an occasion for getting information about new seeds or farming practices generally, visits with relatives on the occasion of a wedding or funeral seem to serve somewhat different functions for women and men. Apparently, the men spend much time talking about farming while the women are more interested in the occasion itself and in preparing food. But, if information is circulating about an innovation of particular importance, the women farmers will hear about it too.

5. The Pace of Diffusion of Innovation Among Women Farmers

It seems that women farmers often find out about new seeds after the men have found out about them. But, once some women have begun to plant a new seed are other women any slower to imitate them than are men? The general constraints are the same for both, but women tend to have smaller farms (probably less available cash) and somewhat different sources of information. However, since the women farmers sometimes get a later start than the men, they may more often be able to obtain a small quantity of new seeds for initial planting as a gift, or in exchange. Thus, there does not seem to be a strong basis for expecting that women farmers will be slower than men to adopt an innovation once it is known.

Women farmers have been subjected to the same kinds of economic and environmental pressures as their male counterparts. Consequently, like the

men, women farmers have been looking primarily for the same characteristics in the new varieties of crops they have adopted. Early maturity and high yields are about equally important characteristics whether it is sesame, millet, or sorghum. Drought resistance, which is related to early maturation, is the third most important characteristic desired. After this triumvirate of desired properties, characteristics are more crop specific. Umm Gabon (karkadee), for example, is attractive because it is relatively easier to harvest than other varieties.

Not all women farmers, of course, are planting each of the new varieties. The principal reasons for this are less related to undesirable characteristics, which are noted, than to other types of problems. Of the 35 statements by women farmers for failure to plant the new varieties, three-fourths are related to the lack of availability or the high cost of seed. Seventeen percent had to do with reluctance to plant the new variety because of lack of knowledge or uncertainty of the crop's performance. These factors contrast somewhat with those given by men farmers since the men mentioned lack of seed only one-half of the time and lack of knowledge only 5 percent of the time. On the other hand, 24 percent of the men farmers cited the availability of a better variety compared to 3 percent of the women farmers.

As in the case of the male informants, we asked for a qualitative estimate of the number of farmers planting each of the new varieties mentioned. The economic and environmental pressures have encouraged the women farmers to make changes quickly. For example, Jabarook sesame, which was introduced in the late 1970's and early 1980's, is now planted by "all" or "most" women farmers. To illustrate the apparent speed of change, Wad Sandoog sesame was introduced in Umm Ramad and Wardass in 1983 and was planted this year, according to the informants, by "all" and "most" women farmers, respectively.

But, there are cases in which the adoption of new varieties has been slower. Balwa sesame, reportedly, was introduced in el-Filia in 1982, but only a "few" women planted it this year. It was introduced in Kazgail and 'Ayara in 1983 where "most" women farmers planted it this year.

Earlier we noted that women farmers more often were later, rather than earlier, than men in the initial planting of a new variety. A related issue is whether the speed of adoption in the village is as fast among women as men once the new seed has been planted by men and women innovators. In 15 comparisons of new sesame varieties introduced in villages in the same year, the women farmers have achieved the same degree of adoption in nine cases. In the other six cases the men appear to have made faster progress. For example, Wad Sandoog was introduced in Kazgail in 1983 among both men and women. This year it was reportedly planted by only a "few" women farmers but by "most" men farmers.

In searching for explanations of this difference, the most salient factor is the difficulty and cost of new seed which is so often mentioned by women informants. It is doubtless also related to the problem of gaining knowledge or experience with the new variety although some of the difference between the information sources for men and women, e.g., the lesser usefulness of "village gatherings" for women, also may have some bearing on the difficulty women have

in gaining information about the new seeds. It is important to recognize that there is both an availability and a cost problem in the acquisition of new seed. Availability of the new seed is primarily a problem of seed production which is affected by drought and the number of producers. The sheer quantity of seed merges with the economic problem of cost in these cases where there may be an abundant quantity but at a town some distance away. Cost is a factor if seed must be purchased from merchants or neighbors. It is a special problem for women farmers whose cash incomes are very low.

VI. LOCAL KNOWLEDGE OF SORGHUM

Naming is most importantly a way of identifying objects of interest. A name conveys information both about important characteristics of the object and how it relates to other objects. A system or class of names of objects, e.g., of sorghum, thus contains important information to those who have developed and maintained the system in their memories. Because of their functional value the systems are dynamic. New names are created and old ones become obsolete as the object loses value or is abandoned. There also is variability in the so-called system which creates difficulties for those, the authors included, seeking to establish an orderly scheme of knowledge of sorghum varieties.

In their second report, Reeves and Frankenberger (p. 110) provide a typology of 27 local, varietal names of sorghum grown in the el-Obeid area of North Kordofan. They do not claim that the varieties differ, only that the names differ. Moreover, they do not claim that the varietal names are inclusive, i.e., that there are no other local names (varieties). However, Reeves and Frankenberger indicate that farmers tended to organize these "varieties" in two major classes -- zunaari/mareeg and najaad/feterita -- with two sub-classes each. The two major classes tend to distinguish the traditional, local varieties from more recent introductions. Most of the newer varieties are localized, at least so far as the name is concerned. The number of apparently new varieties and the localized use of most of them has two important implications for establishing a typology of varietal names. One is that the idea of a system of local knowledge is misleading. While the knowledge of sorghum varieties may be relatively well organized on a village basis, it becomes more and more tenuous the greater the number of villages included. The result of combining responses from several villages, as in Table 10, is a composite rather than a system of local information.

Despite this, a glossary of local names of sorghum varieties can be helpful. First, it gives a list of the "varieties" of sorghum that farmers identify. Second, the underlying principles used to distinguish among varieties can be discerned.* Third, the changes in the glossary of current terms provides information on the direction of development. As we shall see this corroborates and expands some of the observations made earlier in this report.

*In the development and organization of the glossary the authors are much indebted not only to our many informants but also especially to Dr. El-Hag Abalgassim, Acting Director of the WSARP research station in el-Obeid and Mirghani Saeed Mohamed, Research Assistant to Dr. Tareke Berhe.

Table 10. Local Names of Sorghum Varieties in
El-Obeid Area, North Kordofan

-
- A. ZUNAARI (Usually curved neck, large seeds)
- 1.00 HireeHri (Early maturing, 110-114 days)
 - 1.01 Abyad (White)
 - 1.02 Aswad (Black)
 - 1.03 Ahmar (Red)
 - + 1.04 Wad Abu Sidairi (Son with the chest)
 - 1.05 Farrik (Cooked on fire)
 - + * 1.06 Wad Marghani (Son of Merghani)
 - * 1.07 Mugud (Red)
 - + * 1.08 Tajareb (Experimental)
 - * 1.09 Abu Gomash (Father of the Cloth)
 - * 1.10 Mayo (May)
 - * 1.11 Wad Yabis (Son of Dryness)
-
- 2.00 Baladi (Local, late maturing, 120 days)
 - 2.01 Abu Sineita (Father of small sunmet tree)
 - 2.02 Nachott (Ripe)
 - 2.03 Wad Abu Khadra (Son of the green father)
 - 2.04 Ahmar, Abu Hamra (Red, Father of Red)
 - 2.05 Abyad (White)
 - 2.06 Gelb Jamal (Heart of the Camel)
 - 2.07 Farrik (Cooked on fire)
 - 2.08 Bakil (Crying)
 - 2.09 Wad el Fahal (Son of the potent male)
 - 2.10 Aswad (Black)
 - 2.11 Abu Dahrein (Father of two backs)
 - 2.12 Umm Tul (Mother of Tul)
 - 2.13 Tageil (Heavy)
 - 2.14 Gaduum et Taitel (Mouth of a wild goat)
 - + 2.15 Wad el (Abu) Gosari (Son of short people)
 - 2.16 Semin Safi (pure butter)
 - 2.17 Wad Aker (Son of dirty hand)
 - * 2.18 Gasabi (Father of stalk)
 - * 2.19 Wad el-Kulum (Son of Kulum)
- B. NAJAAD (Early Maturing, 90-100 days, usually small seeds, straight neck)
- 1.00 Abyad (White)
 - 1.01 JinaI el-Gumri (Wing of Gumri bird)
 - 1.02 Anaga (Female camel)
 - 1.03 Forr (Shoots up)
 - * 1.04 Ziraizira (Small bird)
 - + * 1.05 Karamaka (Personal name)
 - * 1.06 Safra/Habashia (Yellow/Ethiopian)
 - * 1.07 Dura'a el-Sabi (Hand of the young man)
 - * 1.08 Shaham el-Ganam (Far of the sheep)
 - * 1.09 Amizoki (Local name)
 - 1.10 Wad Tandaik (Son of Tandaik)

Table 10. (Continued)

- 2.00 Ahmer (Red)
- 2.01 Dar Mali or Maldi (Place of Maldi)
- 2.02 Sojeib (Personal name)
- * 2.03 Batingae (Personal name)
- * 2.04 El-ehaimir (The red)
- * 2.05 Turuk Shado (Ready to go)
- * 2.06 Amsik Maratuk or Baituk (Keep your wife or household)
- * 2.07 Dagoga (Personal name)

C. FETERITA (Early maturing, 100 days)

- 1.00 Abyad (White)
- 1.01 N. Abyad
- + * 1.02 Gadam el-Hamam (Leg of Pidgeon)
- + * 1.03 Umm Beniin (Mother of Sons)
- * 1.04 Gishais (Small grass)
- * 1.05 Aryana (Naked)

D. HYGEEN (Hybrid)

*Names of local varieties not reported by Reeves and Frankenburger, Report No. 2, p.110.

+Varieties mentioned as having been introduced in the past five years.

A. A Glossary of Sorghum Varieties

Farmers use two terms in referring to sorghum: mareeg and dura. Although both are general terms of reference, mareeg is usually used in reference to the plant while dura refers more particularly to the grain. The meanings of these words have become more generalized since the Reeves and Frankenberger study due to the introduction of new varieties in the villages. The greater inclusiveness of the present denotative meaning of mareeg contrasts with its earlier, more restricted, meaning which was nearly synonymous with zunaari. Zunaari has retained its earlier meaning, generally referring to the goose necked, large seeded sorghum varieties traditionally grown around el-Obeid. They are primarily caudatum-bicolor in Harlan and de Wet's classification of intermediate races of sorghum.*

Baladi and HireeHri are the two important sub-classes of zunaari. Baladi, which in Arabic means "local", refers to the long maturing (120 days) varieties which are predominant locally. HireeHri refers to varieties that mature somewhat earlier (e.g., 105-110 days) than the traditional baladi varieties.

*J.R. Harlan and J.M.J. de Wet, "A simplified classification of cultivated sorghum." Crop Science 12 (March-April 1972): 173

The najaad and feterita varieties of mareeg differ from zunaari in having straight necks and usually smaller heads and seeds. They also are earlier maturing. Najaad, Arabic for "early maturing", reach maturity in 90 days. Feterita lacks the specific meaning of najaad, although it refers to straight necked, small seeded mareeg. Feterita is sometimes used in reference to varieties that have been grown in the more southerly areas of the Sudan. It also refers to sorghum varieties that have a dark testa -- the lining between the endosperm and the external cover of the seed (pericarp) -- and produce a dark colored flour when milled. Harlan and de Wet* say that feterita is used in the Sudan for "cultivars that vary from guinea-caudatum through caudatum to durra-caudatum... (But probably most of the feterita of the Sudan are the caudatum race." In Harlan and de Wet's classification caudatum and durra are different races of sorghum.** The latter, although including many long-season varieties, also includes "the most ephemeral, short-season cultivars of all the sorghums." Najaad varieties have durra characteristics and mature early.

In Table 10 an attempt has been made, with Dr. el-Hag's assistance, to separate the feterita and najaad varietal names. The classification may not be entirely accurate since samples of the new local varieties were not available for inspection. In attempting to separate the najaad and feterita varieties, we have introduced greater structure in the classification than have local farmers, since they tend to confuse the two. For example, Safra (yellow) and Habashia (Ethiopian) are used in different villages to refer to the same variety of sorghum. Some villagers think of this variety as a feterita, because of its origin in the south of Ethiopia. Other villagers call it a najaad because it is early maturing. However, it is a durra rather than a caudatum variety, i.e., najaad rather than feterita as the term is used in Table 10. Since farmers do not consistently distinguish najaad and feterita varieties, a classification based on local knowledge alone would simply indicate a single class of najaad/feterita varieties. So long as we remember this point there seems to be little harm in separating najaad and feterita types as in Table 10.

While feterita varieties almost invariably have a white outer covering, najaad varieties may be either white (abyad) or red (ahmar), and this is used to sub-classify the najaad varieties. A new class of sorghum that farmers have begun to recognize is hageen (hybrid) which is undergoing field trials in several of the villages. Doubtless, it will become more important in the future.

Table 10 includes 51 varietal names -- 24 more than were listed by Reeves and Frankenberger. The additional varietal names are identified by an asterisk. Of these, two-thirds are najaad or feterita varieties with early-maturing characteristics. Of the remaining names of "new" varieties, all but two are HireeHri which also mature relatively early. Stated another way, more than 9 out of 10 of the "new" varieties identified in the present survey are early maturing varieties. Whether the additional varietal names represent an actual increase in these varieties or simply an increased interest in such

*J. R. Harlan and J.M.J. de Wet, p. 175

**Note that use of the term "dura" to refer to one the races of sorghum differs in this case from local usage of dura as a generic term for all types of sorghum.

varieties is an important issue. It may be recalled that farmers reported the introduction of seven new sorghum varieties and two new general types of sorghum when questioned about crops planted in the past five years. (The seven varieties mentioned are indicated by a cross in Table 10.) Thus, the farmers mentioned a greater number of varieties, which Reeves and Frankenberger had not identified, when questioned in detail about sorghum varieties that were being grown than when talking about new varieties of crops. Why did this occur? Although this question cannot be resolved without further research, it seems reasonable that the substantial increase in names of early maturing varieties is in part a function of heightened interest in such varieties in recent years. In other words, it seems likely that many of these genotypes were in the area all along but farmers did not identify or select them until recently when the need for early maturing varieties became salient.

B. Principal Uses and Characteristics of Types of Sorghum

Not all farmers in villages in the el-Obeid area raise sorghum. Reeves and Frankenberger* report that three-fourths of the farmers were growing some sorghum in 1981, and the proportion has not changed much despite the apparent increase in najaad varieties mentioned. In interviewing farmers we did not attempt to select only those who were growing sorghum. We assumed that farmers were generally knowledgeable about the sorghum varieties grown locally and their characteristics. This does not imply that farmers' views of the characteristics of sorghum varieties are entirely alike. Individual differences are to be anticipated. However, we assumed that the importance of sorghum was such that everyone would know about it and be able to respond to the questions about its various uses and characteristics.

Farmers were asked first about the different types of sorghum that were grown in the village. Then, they were asked a series of questions about which variety of sorghum was best in various respects. It soon became evident that despite the large array of names of different varieties, most farmers tended to think in terms of the four major types of sorghum: Zunaari baladi, (z. baladi), Zunaari HireeHri, (z. HireeHri'), Najaad and Feterita. This was so not only of the types grown but also of the kinds of sorghum regarded as best for various purposes. Consequently, most of the information obtained is about the major types of sorghum rather than the specific varieties. This information is summarized in Table 11.

As Reeves and Frankenberger reported earlier, z.baladi is the most widely grown type of sorghum. It has been, of course, the most popular type of sorghum in this area for many years. It may be losing some of its popularity, however, to the z. HireeHri and najaad varieties. Z. baladi seems to be somewhat more widely grown among women than men although this conclusion must be considered tentative in view of the nature of the data.

Two of the most important reasons for the popularity of z. baladi can be found in farmers' views of the sorghum that makes the best 9asiida (fermented porridge) and kisra (crepe) which are the two most important foods prepared with sorghum flour. Three-fifths to two-thirds of all farmers regard z. baladi as best for these purposes. The women interviewed are substantially

*Report No. 2, p.13

Table 11. Type of Sorghum Variety Considered Best by Purpose and Sex of Respondent

Purpose	Varietal Type	All Farmers (N=140)	Men (N=84)	Women (N=56)
---percent mentioning---				
1. Planted most	Z. baladi	52	46	61
2. Best for 9asiida	Z. baladi	60	52	71
3. Best for kisra	Z. baladi	65	52	84
4. Best for 9abree	Najaad	67	57	80
5. Best for mariisa	Najaad	40	31	55
6. Best for farrik	Z. baladi	69	61	82
7. Best for cattle fodder	Najaad	66	57	80
8. Best for grain for cattle	Najaad	67	63	69
9. Best (highest) yield	Z. baladi	46	35	64
10. Earliest maturing	Najaad	73	71	75
11. Highest price	Z. baladi	57	52	66
12. Most bird resistant	Najaad	44	46	39
13. Most insect resistant	All the same	48	43	57
14. Most resistant to disease	All the same	47	42	55
15. Stores best	Z. baladi	54	53	57
16. Best germination	All the same	46	42	54
17. Most drought tolerant	No difference	--	--	--
18. Easiest to harvest	Najaad	51	48	59
19. Grows best on goz	Z. baladi	63	--	--
20. Grows best on tain	Najaad	62	--	--
21. Grows best on gardud	Najaad	54	--	--

more uniform in their opinions about the desirability of z. baladi for 9asiida and kisra than are the men. It may be that their greater certainty derives from the first-hand experience in food preparation.

Najaad, rather than z. baladi, is preferred for the two favorite drinks made from sorghum: 9abree, a non-alcoholic spiced drink, and mariisa, sorghum beer. Although two-thirds of all respondents favored najaad for 9abree, the women once again more uniformly favored najaad than the men. For mariisa, less than a majority felt najaad was the best sorghum primarily due to the lack of an opinion on this question by those adhering to strict Islamic teaching on the non-use of alcohol in any form.

Z. baladi also is most often preferred for farrrik, the late dough stage of the development of sorghum when it can be first used as food. Despite the importance of having such a source of food as soon as possible in the growing season, z. baladi is preferred as farrrik presumably for the same reasons that baladi varieties are preferred when the grain is fully mature.

As a whole, more of the farmers (46 percent) believe that the z. baladi varieties give the highest yields, but men and women are actually quite divided in their opinions on this issue. More of the men (42 percent) believe that the najaad/feterita varieties have the highest yields than the baladi varieties (35 percent). However, only 22 percent of the women farmers think that the najaad/feterita varieties are highest yielding compared with 64 percent who believe that baladi varieties produce more.

One might expect farmers' beliefs about planting rates to be related to their beliefs about yields, and for both baladi and HireeHri, this is so. Seventy-nine percent of the men and women farmers who say that z. baladi gives the highest yields also say that these varieties are planted most. Similarly, 74 percent of the farmers who believe HireeHri yields best believe it to be the most planted. But, this is not true of najaad/feterita varieties; only 41 percent who believe these varieties yield best also believe they are the most planted. Evidently, the planting rates of the najaad/feterita varieties are not strongly linked to potential yields.

The general preference of farmers for the baladi varieties is reflected in their views of the prices that the different varieties bring. Most (57 percent) believe that baladi brings the highest price, and, in fact, the current price of baladi per mid in the el-Obeid market is 14 percent higher than the price of feterita. While all farmers are aware of this price differential, not all of the najaad varieties have a very dark testa and high tannin level which gives the less preferred flour. Its availability early in the season may account for the opinion of some farmers that najaad brings the highest prices.

Although najaad varieties are less desired than baladi as human food, they are held in higher regard as cattle feed. A majority of both men and women farmers indicated that najaad/feterita is the best grain and fodder for cattle. Cattle, of course, are highly prized, and providing adequate feed is a perennial problem. If baladi is preferred for human consumption, perhaps farmers are turning to najaad varieties in part to satisfy the requirements for cattle feed.

This linkage is supported by the data. The belief that najaad/feterita is "most planted" is related to the belief that it provides good cattle feed, especially grain for cattle. Thirty-six percent of the farmers who believe that najaad is the best (grain) for cattle say that it is "most planted", compared with only 6 percent of the farmers who believe that z. baladi is the best.

It is hardly surprising that the majority of the farmers regard najaad varieties as early maturing because that is the meaning of najaad. Nearly all of those who do not mention najaad as early maturing indicate this characteristic is possessed by the HireeHri varieties. Most farmers (51 percent) also think of najaad/feterita varieties as easier to harvest than baladi and HireeHri. On the other hand, most farmers (54 percent) believe that baladi varieties survive storage somewhat better than do the najaad/feterita types. Explanation of these differences will require further investigation.

Although more farmers (44 percent) regard najaad varieties as more resistant to birds than any of the other varieties, this is not particularly helpful because of the diversity of the najaad varieties. Among the latter, Sojeib is regarded relatively higher by both men (23 percent) and women (18 percent) as a variety that birds tend to avoid. Sojeib is the local name for a variety of red najaad, and red sorghums tend to have higher tannin content.

None of the varieties possess characteristics that particularly distinguish them as resistant to either insects or diseases. The most common responses to questions about which variety was most resistant to insects or diseases were that all the varieties were the same or that they didn't know.

Both HireeHri and najaad/feterita varieties are often preferred when the rainfall is low since the rainy season may be short, giving a quick maturing variety an advantage over a longer maturing variety. However, the men and women farmers do not seem to regard the HireeHri and najaad/feterita varieties as superior to baladi in drought tolerance. During years when there are severe mid-season droughts, as happened this year in the el-Obeid area, none of the varieties may be especially notable for its survival capacity. The question we asked thus may have been too general for farmers to discriminate among varieties with respect to particular types of low rainfall conditions. Farmers seem to have been attracted to the early maturing varieties because of the faster production rather than their capacity in general to survive drought.

Most farmers (46 percent) do not differentiate among the varietal types in rates of germination although 30 percent do regard najaad/feterita varieties as having relatively good germination rates.

One important aspect which farmers -- men and women -- associate with each sorghum variety is the type of soil on which it grows best. Most farmers (63 percent) clearly believe that baladi varieties grow best on the goz (sandy) soils that are common in the el-Obeid area while the najaad/feterita types do best on the tain (clayey) and gardud (sandy clay) soils (62 percent and 54 percent, respectively).

Since the clayey soils are quite extensive in areas to the south and southwest of el-Obeid, it would seem that farmers would be increasingly attracted to najaad/feterita sorghum varieties, and to some extent this seems to have been the case. However, grain quality is an important issue. People like the traditional baladi varieties for 9asiida and kistra, the two most important foods. Consequently, there are two problems that require the attention of sorghum breeders. One is the development of better, early maturing, drought tolerant varieties, which perform well on qoz (sandy) soils. The other is to improve the quality of the najaad varieties for human consumption.

VII. LOCAL KNOWLEDGE OF MILLET (DUKN)

The reasons for investigating local knowledge of millet are basically the same as those for studying sorghum, namely, (1) to compile a list of the terms used by farmers to identify different kinds of millet; (2) to gain understanding of the principles used by farmers in distinguishing among varieties; and (3) to note the changes in the lexicon which is indicative of the direction of development.

Although there are many varieties of millet, the number of types identified locally are quite limited. This is primarily due to the dominance of one major type -- baladi or dembi -- and the strong cross-fertilization characteristic of millet whereby genotypes rapidly become mixed. Consequently, not only do farmers have difficulty in maintaining distinct varieties of millet other than the dominant type in the area, but also the dominant type comes to have varied characteristics.

A. A Glossary of Millet Varieties

Six kinds or varieties of millet were identified in the survey (Table 12). Baladi (local variety) or Dembi is the most used variety in the el-Obeid area. It is a long season variety. HireeHri millet differs from the popular Baladi primarily in maturing more quickly and in having a tuft at the tip of the seed candle. Due to its early maturing characteristic, its use has become more widespread in recent years. Although both the baladi and HireeHri varieties have smooth candles, heads with a hairy appearance occasionally can be found. Farmers use various names, such as Abu suf (Father of hair), Sufi (Hairy), Es Suf (The hair) and Lisan et Tair (Bird tongue), in describing baladi with hairy glumes.

Table 12. Local Names of Millet (Dukn) Varieties
in El-Obeid Area, North Kordofan

-
1. Baladi/Dembi (Local, long maturing)
 2. HireeHri (Local, short maturing)
 3. Aish Bornu/Aish el-Gharaib/Maang (From Bornu tribe)
 4. Maneih (Grown in hills south of Abu Haraz)
 5. Dajawi (Grown by Dago tribe)
 6. Abu Suf (Father of hair; Ugandi variety)
-

Some tribes maintain particular varieties of millet. Aish bornu is a variety of millet with very compact heads which is grown by the Bornu tribe. Due to the compactness of the seed it is resistant to nafaasha (the worm that attacks millet heads) and to birds as well. Maneih and Dajawi also are varieties grown by different tribes. Ugandi millet has been released by the Agricultural Research Corporation and distributed in field trials by Dr. Tareke Berhe and Bakeit Musa. It has shown promise of producing some millet even in the years when rainfall is low. It matures early and is resistant to attacks by birds due to the hairy glumes. Farmers in villages where field trials have been conducted and who were familiar with it invariably referred to it as Abu suf (Father of hair). Dajawi was not included in the list of millet varieties compiled by Reeves and Frankenberger.*

B. Principal Uses of Varieties of Millet

As with sorghum the farmers were questioned as to the variety of millet that was best for various purposes. The responses are summarized in Table 13. The dominance of baladi is indicated by the percentage of our respondents (80 percent) who said it was the most widely planted variety. In fact, about fourteen percent of the farmers said that baladi was their only variety. Among the "most planted" varieties, HireeHri (12 percent) is the only other variety which was recognized by more than a small number of respondents.

Table 13. Millet Variety Considered Best by Farmers by Purpose and Sex of Respondent

Purpose	Variety	All Respondents		
		Men	Women	
--percent mentioning variety--				
1. Planted most	Baladi	80	80	80
2. Best for 9asiida	Baladi	64	71	54
3. Best for house building	Baladi	87	84	90
4. Best yield	Baladi	69	68	69
5. Most stalk	Baladi	86	84	87
6. Matures earliest	HireeHri	58	62	54
7. Bird resistant	Baladi	41	35	50
8. Disease resistant	All the same	39	40	36
9. Resistant to santa	All the same	47	50	41
10. Earliest to harvest	HireeHri	39	37	43
11. Best for storage	Baladi	61	71	46
12. Highest price	Baladi	49	52	45
13. Germinates best	Baladi	36	43	27
14. Drought tolerant	Baladi	49	54	41

*Report No. 2, p. 109

Baladi is felt to be the best for 9asiida (64 percent), for building material for houses (87 percent), and has the most stalk (86 percent). Most of the men and women agree about the usefulness of baladi in these respects although a somewhat smaller proportion of women farmers favor baladi for 9asiida primarily because more are inclined to feel that all varieties of millet are equally good. Perhaps because baladi is not strongly preferred to other varieties for 9asiida, farmers are divided in their opinions as to which variety brings the best market price although a plurality (49 percent) believe baladi does. One-third of our respondents said that all varieties of millet bring the same price.

HireeHri is recognized by most farmers (58 percent) as being early maturing, and failure to mention it more often in this respect seems to be primarily due to lack of familiarity with the variety. Those familiar with HireeHri also feel that it is the easiest to harvest (39 percent).

Despite its early maturation (before the migratory birds arrive) HireeHri is not as often considered as bird resistant as baladi. It may be that farmers do not recognize early maturation as providing bird resistance per se. Lack of familiarity with other varieties keeps them from being more often mentioned for resistance to birds although Aish Bornu and Abu suf are mentioned by 12 percent and 2 percent, respectively, of the men.

The predominant opinion is that none of the varieties is especially resistant to disease or to the santa beetle although those who only know baladi feel it is best in these respects. Most (61 percent) think of baladi as storing best and more (49 percent) believe it tolerates drought better than any other variety despite its long growing period. Only 15 percent mention HireeHri as best in drought tolerance.

Although baladi is regarded by most farmers (36 percent) as having superior germination qualities, almost as many (33 percent) say that all varieties are the same in this respect.

These data confirm the dominance of baladi, or dembi as it is often called in the area around el-Obeid. Although valued as a source of food for human consumption, its dominance over other varieties seems to be due more to its great value for other purposes, i.e., the construction of houses and other buildings and as forage for livestock. In the development of alternative varieties which are more resistant to birds and various insect pests and diseases, the maintenance of stalk quality will be as important a consideration as grain quality.

VIII. CONSTRAINTS TO THE TRANSFER OF TECHNOLOGY TO NORTH KORDOFAN FARMERS

As technology adapted to farming conditions of North Kordofan becomes available, the organizations for producing and distributing the inputs, e.g., seed production and distribution, and for providing the knowledge and skills necessary for their use become increasingly important. Inadequacies of either system constrains technology transfer. But, the problems that may exist or arise in these public and private institutions, vital though they are, have not been the focus of this research and are not dealt with here. Instead, the focus is primarily on constraints at another level, that of the farmers and the rural village. Even if the infrastructure performs effectively in

providing inputs and information about their use, but farmers cannot purchase the inputs or do not learn about their use, the technology will not be adopted and the system of agriculture will not be improved.

One important issue with so-called traditional farmers is the strength and scope of the desire to improve, to adopt new technology. Unless the interest or motive to improve is present, innovations will not be sought nor will funds, if available, be spent on new inputs. Farmers' interest in new technology thus is the first issue addressed in this section. It is followed by discussion of constraints to the spread of information both through formal and informal channels.

A. Farmers' Interests in Innovations

The principal indicator of the strength and scope of farmers interests in new technology is the practices adopted during the past several years. As reported earlier, farmers have been quite active in adopting new seed varieties of the major crops. None of these new varieties has been developed specifically for this area. Barberton groundnuts is the only variety specifically introduced into the area by external agencies. Thus, the local farmers have shown considerable initiative in finding and testing new varieties of crops. It reflects a relatively high level of interest in new seeds, especially for the cash crops. The desire to participate more in the cash economy is quite evident.

In adopting new seeds, farmers have sought varieties that are earlier maturing and higher yielding. Drought tolerance has been desired. Varieties that are resistant to pests and disease are both needed and wanted, but not at the sacrifice of higher yields or food quality of the grain. In these respects the scope of interest in new seeds is quite broad as well as strong.

In the attempt to assess farmers' interest in new high yielding varieties (HYV's), we asked each farmer whether he (or she) would be willing to pay twice as much for a new variety of seed if it would yield 50 percent more than his (or her) present variety. Three-fourths of the men and nine out of ten women indicated that they would be willing to buy such seeds. The others pointed out realistically that their willingness to buy such seed was contingent on the availability of funds. Although the lack of funds is likely to be a larger constraint to acquisition of HYVs than recognized in these responses, they reinforce the conclusion that farmers are indeed interested in new seeds.

However, the strength of farmers' interests in new cultural practices is less readily apparent. For example, although new seed dressings became available several years ago, only a minority of farmers are using them at the present time, perhaps due to a short money supply. Little change has occurred in planting rates or plant spacing. Only a very few farmers have tried intercropping legumes with sorghum or millet. Farmers shift from intercropping to mono-cropping depending on the availability of seed and/or labor rather than to improve productivity.

As was pointed out earlier, only the simplest implements are still used. Even though labor shortage is a serious constraint to many, even more limited capital constrains the acquisition of even the least expensive inputs. This

grim reality dampens interest in development. Consequently, none of the recently adopted innovations herald a marked change in the system of hoe agriculture.

B. The Problems of Hybrid: An Example of a Knowledge Gap

Due to the farm trials conducted by Dr. Tareke Berhe and Bakheit Musa, a new word -- hageen -- for hybrid has begun to creep into the vocabularies of some of the villagers. The number is still quite small. Only about a third of the people interviewed in the villages in which Dr. Berhe has worked had even heard of his work, and only a minority of these knew that he had given seeds, which they called hageen, to someone for planting. None of the women farmers we questioned had heard of hageen.

Those who have heard the word do not know its meaning. It is simply a label by which a certain kind of sorghum is known. A few have heard that this kind of sorghum is supposed to be early maturing and high yielding, but what it is that might make hageen sorghum uniquely different they do not know. In particular, they do not know that the seeds of the hageen crop cannot be saved for planting the next year. Some of the farmers who have received hybrid seed from Tereke Berhe do not recognize that the seed cannot be saved even though he has explicitly told them so. Others who know that the seed from the previous crop cannot be saved for re-planting do not understand why this is so despite the careful explanation he has given. It is apparent that the understanding of hageen (hybrid) seed in the villages is almost completely lacking.

If the new hybrid sorghum developed by Gebisa Ejeta is adapted to the clayey soils in the area, as it seems that it might be, this lack of understanding will be a serious constraint. Both the failure of understanding by those cooperating in the farm trials and the potential for its rejection despite its superiority over existing local varieties derives from two strongly entrenched normative patterns of behavior -- the practice of saving seed and the practice of profiting from the sale of the seed of successful varieties. Both of these deserve brief discussion.

1. The Practice of Saving Seed

The universal practice with the local varieties of crops is to save seed of the present crop, if there is any yield, for planting the next season. Both men and women farmers do this, and both are skilled in selecting the best seed for the next year's crop. The common practice is to select the best heads of sorghum (or millet), those that exhibit the desired characteristics of the particular variety, e.g., color, shape and size of head, size of kernels, etc. These heads are threshed separately from the remainder of the crop and the seed is saved either in a tin with a tight fitting lid, if the quantity is small, or in a burlap sack if it is a larger quantity. The seed is stored in the farmer's house until planting time. If it is in a sack, the ground underneath the sack is usually sprayed with DDT to protect against insects. Traps are set as a protection against rats and mice which are the most harmful pests. A worm (diraina) also can damage millet seed by coating it with a substance that inhibits sprouting.

By saving the "good" seed, it is not only unnecessary to purchase seed the following season, one also can plant the seed with assurance of its quality

and confidence in the future harvest, provided that Allah brings the rain. The psychological aspects are no less important than the economic. A farmer can ordinarily obtain seed from another farmer in the village, either by exchange or as a gift if the quantity is small, with considerable confidence in the quality of the seed. However, other farmers may not have enough seed for their own use. Thus, having one's own seed is preferable. When asked whether they would be interested in a new variety of seed, which might yield well, if they couldn't use the seed next year, many farmers said that they would not be interested in it.

2. The Sale of "Good" Seed

One of the important incentives to the trial of new seed is the possibility of discovering a successful variety which would be noticed and desired by other farmers. The seed from the crop thus would bring a very good price. The possibility of profiting from the sale of seed was mentioned by many farmers when asked what they would do if they obtained some seed which might be superior to existing varieties. A farmer who raises hageen is denied the possibility of profiting except through the sale of any surplus as grain for ordinary consumption. Hageen reduces the options of these traditional farmers who try to keep as many options as possible to spread risks.

As earlier pointed out, most farmers would be willing to pay a premium for new seed if it was high yielding. But, this is contingent on being able to save the seed for planting the following season. It is quite a different matter to be convinced of the desirability of paying a premium price for the seed of a particular variety every year. The lack of knowledge and experience with hybrids in general, and hybrid sorghum in particular, may constrain its speedy acceptance, especially as a subsistence crop. As a cash crop, a different incentive -- greater productivity -- becomes important, but sorghum for sale is not the aim of sorghum growers in this area.*

C. Merchants and Markets as Information Sources for Innovations

Because they are ubiquitous, accessible, and interested in buying and selling products, merchants are an important source of information about new seeds and other inputs. Moreover, there are several different types of merchants: mobile merchants, periodic merchants, and, in the larger markets, merchants that open daily. Thus, any product that is available will be sold by one or more different types of merchants. They do not hesitate to describe the desirable qualities of their products to customers.

In addition to the merchants, the market itself is an important place for the exchange of information. On market days, people from the villages both near and far weave in and out around the shops, restaurants, rest areas, and the like. Groups form when anything new is being discussed and then disperse. Market day is an important occasion for the acquisition of information from other persons -- men and women -- whom one may or may not know. The opportunities for these kinds of casual information exchanges enables farmers to transcend the boundaries of kinship, tribal, and gender affiliations.

*The possibility of growing sorghum profitably in competition with the mechanized schemes seems questionable.

Nevertheless, there are equally important constraints to the functioning of merchants and the market as sources of and the occasion for the dissemination of information about agricultural innovations. Despite the ubiquitousness of merchants, the smaller villages have only a few, sometimes no, shops and do not have a periodic market. They are only visited occasionally by mobile merchants who have only a limited range of products, e.g., sesame oil. Contact with a merchant thus must be made in villages that have periodic markets.

A related constraint, which applies to all the information sources in traditional villages, is the random, unsystematic nature of communication. There is no particular source of reliable, non-traditional information. New ideas come by chance, from unexpected sources. Thus, information seeking cannot be planned or systematically pursued.

As pointed out earlier, the predominant pattern in acquiring seed to plant next year's crop is to save the best seed from this year's crop. Farmers purchase seeds for planting if this year's crop is destroyed, if the germination of the seed is poor and additional seed is needed, or if there is a new variety of seed which they cannot obtain in any other way. The principal implication of this traditional pattern of obtaining seed for planting is that the size of the market is small. It is made even smaller by farmers' distrust of merchants as a source of seed for planting purposes. Both men and women farmers prefer to buy seed from other farmers rather than merchants. The only notable exception to the preference is the farmer who may require a large quantity of seed, i.e., more than another farmer would be able to supply.

Farmers in villages around el-Obeid prefer other farmers to merchants as a source of seed for several reasons. They believe the local farmer has more direct experience with the particular seed; he or she is more flexible in the quantity sold, is less likely than merchants to cheat and/or sell a mixture of seeds rather than "pure" seed, and is likely to sell for a lower price than a merchant. Of these considerations price and quality of the seed are the most important. But the end result is that merchants are a source of last resort.

From the merchant's standpoint when the market is small, the marketing margin must be relatively large (and the price relatively high) for sales of the item to be profitable. This is all the more so for items that require special handling, i.e., separate from other seed in his inventory. It is not clear that many farmers would be willing to pay the higher price for seed of "guaranteed" quality. In any event, it would take some time for a merchant on his own to establish a reputation for quality, and evidently the number who have done so is quite small. For the most part, merchants sell grain, rather than seed for planting, and the establishment of a seed business will require considerable time and effort with both merchants and their customers.

D. Institutional Sources

For any institution to operate smoothly, with a minimum of conflict and dissatisfaction, agreement between institutional agents and their clientele on expected purpose and activities is an essential prerequisite. Put otherwise, to the extent that the representatives of institutions fail to understand the needs, interests, and outlooks of their clientele, there is a high potential

for frustration, anger, cynicism, distrust, and various other sentiments all of which are destructive of effective institution-client relationships.

At the present time there is a gulf of substantial proportions between villagers' understanding of "government" and its various roles or functions and the reality. On the one hand, governmental activities are far more diverse than farmers comprehend, and on the other hand, the resources of government to satisfy any specific need is much more limited than villagers recognize. Both of these circumstances breed misunderstanding and frustration. We only attempted a limited assessment of farmers' views of the role of institutional agents, those pertaining to protection of the environment, the provision of agricultural information, and the conduct of farm trials of new seeds. However, several problems of institutionalization, i.e., understanding of institutional roles, became apparent.

1. Ignorance and Dissatisfaction

The lack of knowledge of governmental activities in each of the areas is massive. As already mentioned, only 30 percent of the men and women farmers interviewed are aware of efforts of the Department of Forestry to protect the environment through encouraging the planting of hashaab trees, and none is aware of any other activity. The prevailing attitude is that the "government isn't doing anything" to try to prevent environmental deterioration even though they believe this is a responsibility of government.

Only a minority of similar size is aware of the activities of Tareke Berhe and Bakheit Musa in conducting farm trials of new seeds. Understanding of the purpose or sponsorship of the trials is almost totally lacking. This is not to suggest that a major effort should be mounted to this end, but rather that in the current situation misunderstandings will arise. For example, there is evidence of some resentment that the seeds have been given to one or two persons instead of being more widely distributed. Moreover, we were told by the sheikh in one village that a bad mistake had been made in giving the seeds to Mr. X if we wanted many people to know about them since Mr. X never told anyone about the new seeds. Instead, they should be given in the future to him, i.e., the sheikh.

In the past, when new agricultural inputs have become available, the Department of Agricultural Extension Service has been involved in their distribution and the demonstration of their use. The Department mounted this kind of effort several years ago when new seed dressings, such as Aldrex-T, became available.

In the initial interviews with farmers, we asked what they thought about the distribution of chemical inputs as a way to begin discussing the role of the Department of Agricultural Extension Service. However, few farmers could recall any activity by a governmental agency in promoting chemicals or Aldrex-T in particular, and most of those who did so either mentioned the Agricultural Bank or only recognized the activities of local merchants. In response to more direct questioning about whether people from the Agricultural Extension Service had visited the village, a few farmers in some villages said a visit had been made several years ago. When asked what they thought of the agent's activities, some complained about the unfilled promises to provide seeds or chemicals; others complained about the failure to provide answers to the problems of pest control, and one commented that the activity was all

right since the agent seemed sincere. Clearly, lack of understanding of the Department's mission and activities has contributed to dissatisfaction, discreditation, and denial of the Department's efforts.

2. Simplistic Views, Hostility, and "Stonewalling"

People with relatively little education or involvement in the larger arenas of socio-political life experience considerable difficulty in comprehending the complexity and variation in the institutions with which they are occasionally confronted. A common, indeed inevitable, outcome is oversimplification, distortion, and confusion which breeds frustration, hostility, and other maladaptive responses.

There are two fairly common misconceptions which we encountered at various times during the field work. One is that almost anyone coming to the village who is not part of local society, whether Sudanese or foreign, is identified as coming from the "government". The distinction between governmental organizations, quasi-governmental groups, such as INTSORMIL, and various international organization, such as CARE or UNICEF, is not easily made. When we made our initial visits to the villages, we were sometimes identified as governmental representatives. This immediately elicited certain expectations which if unrecognized created difficulties, and, if recognized was difficult to effectively counteract.

To many villagers, governmental officials come to the villages either to get something (favors or payments) or to give something to the village or its people. In fact, governmental departments and other organizations tend to be stereotyped in this way: those that want farmers or villagers to do something and those that (may) provide some form of assistance. Due to failure to credit the Agricultural Extension Service with its activities in distributing chemical inputs and groundnut seed, farmers either think of it as the former type of organization, or complain that it has not fulfilled its promises to provide various inputs in a timely manner. This problem arises in part because the Agricultural Extension Service obtains the inputs and then either allows Farmer Cooperatives to distribute them or sells the input in the market where the Department's staff may be indistinguishable from ordinary merchants. When farmers fail to recognize the work of the Agricultural Extension Service after hearing that the Department will be providing inputs, the result is anger, cynicism, and hostility.

We also encountered this feeling. In one village, after introducing ourselves as representing INTSORMIL and interested in the problems of farmers, the sheikh indicated that their major problem was the lack of an adequate water supply. Were we going to help them obtain water, he asked? When we said that it was not possible for us to do this, the sheikh unceremoniously informed us that they were tired of governmental representatives coming to the village and making promises that were not fulfilled. He advised the farmers, which he helped select to be interviewed, to ask for help in solving their water supply problem. This resulted in resistance to providing the information we desired, making the interviews difficult and our research assistants quite happy to be "getting out of town." (Subsequently, we returned to this village for the second phase of intensive study and were able to cope with their preceptions and exceptions, establish very good rapport and obtain quite satisfactory interviews.)

Another response to misperception stemming from over-simplification, which we experienced, was "stonewalling." In the first village visited, we identified ourselves as representatives of INTSORMIL and interested in the problems of farmers and recent changes in agriculture. Apart from first-time nervousness, the interviews seemed to go well. The farmers were seemingly cooperative and responsive. Later, however, when the information was reviewed, we were surprised to discover, contrary to expectations, that the men did not mention any new seeds or other changes in agriculture during recent years, and the women mentioned only one new variety of sesame which had been tried. Since this was the first village visited, we had little reason to suspect anything amiss. Perhaps, indeed, there had been no change in traditional agriculture in this area.

However, in subsequent visits to other villages we discovered that a considerable number of new seeds had been tried in recent years. Eventually, we visited another village in which to our surprise and puzzlement the farmers mentioned few or no innovations. When we commented on this to a shopkeeper, he said that we had been misinformed as several new varieties, which he mentioned, had been introduced in recent years. Finally, one of the women farmers said to an interviewer that they (the farmers) did not want to mention the planting of any new seeds in recent years because they believed that then we would give them new seeds. Only then did we realize that we had been systematically "stonewalled," and that this probably also had occurred in the first village visited. After completing the interviews in the 15 villages, we returned to the first village and interviewed a new set of farmers. We were pleased, and not surprised, that they were able to recall the recent introduction of several new varieties of sesame, sorghum, and karkadee.

Although some of the examples cited have an amusing side, they have serious implications. They illustrate some of the difficulties and failures which can occur in attempting to establish effective bridges or linkages between modern governmental and quasi-governmental institutions and the members of a society which have little experience with such institutions. If the modern institutions are to become effective agents of developmental change, it will be as necessary to engage local people in the process of understanding the nature and purpose of these new institutions as it is to involve them in the process of accepting the new products and services. Without this understanding resentment, dissatisfaction, hostility, deliberate distortion, and non-cooperation will be a constant headache for agricultural development administrators and agents.

E. Constraints to the Communication of Information

A stronger system of communication and education is not by any means the only solution to the problem of developmental change identified in this diagnostic survey. But, the lack of satisfactory channels of communication for educational purposes between the formal and informal systems and constraints to the flow of information within the informal (village) system itself constitute constraints of major proportions to the rapid dissemination of new technology (assuming that appropriate technology becomes available). The purpose of this section is to review and elaborate some of the constraints to the formal channels of communication often used by institutional agents and then to discuss some of the constraints to communication within the informal (village) system.

1. Formal Media

Institutions that have a literate clientele can develop a wide array of instruments for communicating information which are largely denied to institutions with a largely illiterate clientele. The school, of course, is the principal institution for producing a literate population. The larger villages, towns, and cities have schools while most of the smaller villages do not. In our non-random sample of 15 villages six had primary schools for boys and girls, but only the two largest towns had intermediate schools. Only one of the villages with a population less than 1,000 had a primary school. Since most schools are boarding schools, boys and girls from outlying villages can obtain an education. However, schools in several of these villages have been established only within the past decade, and the impact in raising the level of literacy among the adult population in rural villages is still small. Doubtless, it is further eroded by the tendency of educated youth to find employment in the larger cities.

The consequence is that the farmers -- men and women -- who are the principal clientele of the new research station and of various departments in the Kordofan Regional Ministry of Agriculture and Natural Resources are mostly illiterate. As reported earlier, estimates of functional literacy among adults, by village range from 3 percent to 15 to 20 percent. Literacy levels in villages with schools range above 10 percent while in villages without a school literacy falls below this level. Although most are illiterate, written information, if gotten into the hands of the literate members of the village, might be transmitted to others. This depends on the effectiveness of the informal system of communication which is discussed in the next section. Although illiteracy is a major constraint, other visual means of communication -- pictures, charts, slides, drawings, film strips, etc. may be appropriate.

With a largely illiterate clientele development, institutions often turn to radio as the primary medium of communication, and there is little doubt that radio broadcasts could become important in North Kordofan. The Department of Agricultural Extension Service has begun producing a program of agricultural information for radio broadcast on a weekly basis. The experience gained will lead to improvements and stimulate more and more people in the Kordofan Ministry of Agriculture and Natural Resources to contribute information to the program.

Unfortunately, there are formidable constraints to the effectiveness of radio as a medium of communication in the region. On the radio transmission side, our survey indicates that the el-Obeid radio signal is too weak to be heard consistently outside the ten kilometer range. Consequently, very few of the 15 villages studied which range from 15 to 40 kilometers from el-Obeid, could receive el-Obeid radio. The number who had heard the agricultural program, of course, was even more limited. The program which is aired at 4:30 p.m. is poorly timed to reach a maximum audience since during the growing season many farmers are usually in the fields at this time.

On the receiver side, only about 10 to 15 percent of the households in most villages have radios. The percentage is higher in some of the larger towns, but in the poorest villages none may have a radio. Even the best radio program will not be received in such villages. Nevertheless, radio holds the greatest promise for reaching many farmers with agricultural information

either directly or indirectly. But a more powerful transmitter and a better timed program will be required to make this a reality.

Another means of communication with one's clientele, if the available resources do not permit direct personal visits, is for the clientele to come to the source. With this in mind, we asked farmers whether they would be willing to come to el-Obeid for information about new HYVs. Nine out of ten of the women as well as the men said they would go to el-Obeid for such information. When asked how many farmers in the village were likely to do this, about one-half said "many" or "most" would go and the others said that they would send one or two representatives from the village for the information or seeds. Since the price of a truck ride of 30 to 50 kilometers to el-Obeid is about the same as the wages earned in weeding on a dahwa basis, the cost is significant, and there is reason to doubt that the actual behavioral response would be as great as the verbal responses suggest.* Nevertheless, some of the villagers do go to el-Obeid periodically, and for certain purposes, substantial numbers of villagers might be attracted to el-Obeid if the information about the reward for doing so could be gotten to them. For many other purposes, which might be important for long-run development, however, such a response would be quite unlikely.

2. Informal Communication Channels Between Villages.

The main thrust of the analysis has been that channels of informal communication between and within villages do function to bring villagers information about innovations, and, compared with a model that assumes the villages are essentially isolated, the system of communication is surprisingly efficient. However, there also is evidence that the system of informal communication both between and within villages has gaps or barriers which direct the flow of information to some groups and away from others. It results in a patchy and irregular distribution of information among villages and to groups within villages.

With respect to the flow of information between villages, relatives are the most important single source for both men and women innovators. Relatives, of course, not only have kinship ties but also are members of the same tribe. This means that the channels of information about new practices tend to be closed or function less effectively between tribal groups. For instance, Wad Sandoog is the best new sesame variety to come into the area in recent years. Starting in el-Timaid in 1981, it has been quickly adopted in six other villages. With one exception, the Bideriya are the dominant tribe in all of these villages. Although the mobile (oil) merchants have been an important factor in the rapid spread of Wad Sandoog, they spread it to other Bideriya villages. Although this is an exceptional case of the spread of a variety of sesame among a particular tribal group, there are other instances of tribal varieties of particular crops. For example, Aish Bornu and Dajawi are millet varieties grown by the Bornu and Dajo tribes, respectively. These varieties have distinctive characteristics but have not spread to other tribal groups.

*The presence of a good road is quite important in reducing these costs, especially during the summer wet season when the cost of a truck ride for Kazgail, and Fertengol, which are near a hard surfaced road, averages one-half the person per kilometer cost of the average for the remaining villages.

Another indication of the ineffectiveness of the indigenous system of communication is the fact that some varieties of new seeds seem to spread primarily from an original source, e.g., Habila, ar-Rahad, or Umm Ruwaba, rather than from village to village. This in part occurs because seed production may be higher in a particular area than in villages nearby, but it also indicates that a village may be a good source of information about a new variety only for villages settled by the same tribe and then only if the variety is widely adopted. Possibly related to this constraint is the fact that we did not find a single instance of the mention of one of Tareke Berhe's new sorghum and millet varieties in a village other than the village in which a cooperating farmer was located.

3. Informal Communication Within Villages

The market, if there is one, or the shops and restaurants are places in villages where people gather to discuss newsworthy events. There is also a continual circulation of relatives from home to home. According to the testimony of some who have lived in small villages, any happening is a fitting topic for intense discussion. Nevertheless, there is evidence that the discussion or communication of topics and issues of importance to developmental change in agriculture is subject to a variety of constraints.

As already mentioned, only a few farmers in villages where Tareke Berhe and Bakheit Musa have conducted farm trials were aware of it even though this was the third year of the trials in some cases. Considering the visibility of events in the village and the reported interest in new seeds, the lack of knowledge seems astonishing. The lack of knowledge, incidentally, is not due to advice from Dr. Berhe not to tell anyone about the trials. He had indicated to the farmer cooperators that they could tell others about the trials and could, if they desired, share the seed with others. It thus seems that in most of the villages information about the trials has been suppressed.* But why?

We asked men and women farmers whether other farmers would find out if a farmer planted a crop that gave a high yield. Almost invariably they said other farmers would find out about it, mostly by observation in the field, or the harvest, or when the farmer began talking about the successful crop produced. But, when we asked whether the farmer would talk about the crop he had planted or keep it secret, more than one-half of the men and three-fifths of the women said they would keep it secret, at least until after the harvest. There were three major motives for secrecy: first, to be certain that the new seeds are high yielding, i.e., successful. The most important sentiment associated with the desire to determine that the crop is successful before talking about it is fear of being blamed by others for having encouraged the planting of a crop that failed. About one-half of both the men and the women farmers mentioned this in explaining their interest in keeping the new seed secret.

Second in importance among men and third in importance among women farmers was the desire to avoid "begging." The social obligation to share seeds for planting, especially with a close relative, is very strong. In the

*Timothy Frankenberger reports that information about Aldrex-T also was initially suppressed, at least, in some villages.

smaller villages, nearly everyone is related in some degree. Consequently, if a farmer has a relatively small quantity of new seed, it can be easily dissipated if many ask for some to plant. The easiest way to avoid embarrassment, guilt, and blame for breaking the social norm by refusing to share is simply not to let anyone know about it.

The third most important motive for men, but second in importance for women is the profit motive. If one successfully produces a new high yielding variety of an important crop, such as sesame, millet, sorghum or karkadee, others will want to pay a relatively good price for it. To avoid competition and to create the most persuasive climate for such sales, it is desirable to keep secret knowledge of the new seed until it proves itself.

The farmers who would talk about a new crop which they have planted, rather than keep it a secret, are primarily motivated by the social obligation to enable others, especially relatives, to participate in the successful venture. For them the fear of blame for possible failure is less salient. Others would talk about it to avoid being condemned for having kept something good a secret from relatives.

The two keys to the response of farmers in this case are the quantity of seed obtained and whether it is successful. The larger the quantity of seed, the easier it is to obey the social obligation to share. Moreover, the greater the confidence in the performance of the new seed, the easier it is to talk about it without fear of being blamed for having induced a relative or friend to plant a crop that failed.

Both factors have worked against, or constrained, the flow of information about the new seeds distributed by Tareke Berhe and Bakheit Musa. The quantity of seed distributed, i.e., two to three kilograms, is relatively small, and low seasonal rainfalls have prevented any of the varieties, including the traditional ones, from demonstrating successful performance under "normal" conditions. Moreover, the seed was distributed to farmers on a "trial" basis: no claims were made by the scientists that these varieties had proven records of success under local conditions. Consequently, for the reasons given the farmers receiving the new seeds have been exceedingly cautious in talking about them.

The flow of information about agriculture also is constrained in other ways. More than one-half of the women farmers and three-fourths of the men plant millet before the rains come (remeel). When asked whether they would tell anyone about planning to plant, or having planted, millet (if planted before the rain), about nine out of ten said they would not tell anyone about it. When asked why they were reluctant to discuss actual planting decisions, the most common response was that "everyone knows when to plant" (68 percent of the men and 76 percent of the women). The next most frequent response was that "it was a personal decision" or "everyone plants according to his will." (22 percent of the men and 16 percent of the women).

In a sense, of course, everyone does know when to plant millet remeel, i.e., sometime during May and the first half of June. The appearance of clouds and a change in the wind direction signal the approach of the summer rainy season. But, within this rather broad six-to-eight-week span, in fact no one knows precisely when to plant remeel. It remains a personal and rather risky decision. The potential reward is high because if one has planted just

before the rains come, the new millet plants can take advantage of the initial release of nitrogen from decayed plant residues, less competition from weeds, a longer growing season and will mature early. But, the risk of failure to obtain a good strike, i.e., germination, due to pests and too little rain, is relatively high. Fear of being blamed for making a decision that turns out badly, or, if it turns out well, blamed for getting ahead of others, suppresses communication except among those who perforce must talk about it. The need for help from one's relatives or others in planting is in fact the reason given for talking about planting by the minority who do so.

In Sudanese society, as in any society, social status or respect is very important. One seeks to maintain or enhance his (or her) social status. Actions that might cause a loss of social respect are to be avoided. Social respect is primarily a function of social relationships. One gains social status within the web of kinship and tribal social relationships which is one reason why these ties are so important in traditional society. There are many occasions (weddings, funerals, Karama, Id's holiday celebrations, etc.) when these relationships are activated and cemented.

Blaming (alloum) someone for failing to fulfill social relationship responsibilities is a pervasive mechanism of social control. A person can be blamed for failing to share with a relative, for failure to invite a relative to a wedding or for failing to come to a wedding or funeral, if told about it. One can be blamed for egoism, for trying to appear better than one's peers, for causing injury or loss of social respect to another, etc. The one incurring blame for disapproved social behavior loses social respect. Consequently, a "good" Sudanese takes great care to avoid committing or omitting, actions that would incur blame. The process of social control thus can function to suppress communication in various ways as the foregoing examples illustrate.

Appendix i

KSU/SUDAN INTSORMIL PROJECT 1984 ON-FARM TRIALS

NO.	VILLAGE	LOCATION	FARMER	KIND AND QUANTITY OF SEED		REMARKS
				Millet	Sorghum	
1.	KAZGAIL	45 KM S	MUBAREK NORAIN	UGANDI (2Kg)	IS - 9830 (3Kg) HAGEEN DURA (3Kg)	SECOND YEAR OF PARTICIPATION FARMER HAS A SHOP IN THE MARKET
2.	FERTENGOL	35 KM S	SHEIKH ALI MOHAMMED	UGANDI (2 1/4Kg)	IS - 9830 (2 1/4Kg) HAGEEN DURA (2 1/4Kg)	VILLAGE HAS FARMERS COOP AND CREDIT FROM AGRIC. BANK
3.	UMM 'ARADA	15 KM SSW	AHMED MOHAMMED ALKAMOON	UGANDI (2 1/4Kg)	HAGEEN DURA (2 1/4Kg) UM BENIN (2Kg)	MERCHANT: PLANTED IS - 9830 LAST YEAR
4.	WARDASS	40 KM SW ABU HARAZ RD.	MOHAMMED ALI MUSA MOHAMMED	UGANDI (2Kg)	HAGEEN DURA (2Kg) P - 898012 (2Kg) IS - 9830 (2Kg)	FIRST YEAR OF CONTACT
5.	ABU HARAZ	50 KM SW	MIRGHANI HASSAN SHIEK ALI ZARAG	UGANDI (2Kg) UGANDI (2Kg)	HAGEEN DURA (2Kg) EISH BORNU (0.25kg) IS - 9830 (2Kg) P - 898012 (2Kg) P - 898012 (2Kg) HAGEEN DURA (2Kg)	FARMER HAS WOODCRAFTS SECOND YEAR OF PARTICIPATION

Appendix I (Continued)

NO.	VILLAGE	LOCATION	FARMER	KIND AND QUANTITY OF SEED Millet	Sorghum	REMARKS
6.	UMM RAMAAD	33 KM SW	HARDOON AHMED MOHAMEDIEN	---	P - 898012 (2Kg) IS - 9830 (2Kg) HAGEEN DURA (2Kg)	THIRD YEAR OF PARTICIPATION FLOUR MILL OPERATOR
7.	AL-HAMMADIYA	20 KM E	SHEIK ALI AHMED ABDELKADIR ALI (SON)	UGANDI (2Kg) ---	P - 898012 (2Kg) HAGEEN DURA (2Kg)	SECOND YEAR OF PARTICIPATION
8.	EL GEIFIL	35 KM E	SHEIK ALI AHMED	UGANDI (2Kg)	IS - 9830 (2Kg) HAGEEN DURA (2Kg) SRN -39 (2Kg)	BUTCHER THIRD YEAR OF PARTICIPATION

7/10/20

Appendix II

INTSORMIL/WSARP
Study of Communication
1984 Village Survey

Village: _____ Date: _____

Introduction: I am Professor Milton Coughenour. This is
Who is (are) the sheik(s)? Where is his home?

	<u>Name</u>	<u>Age</u>	<u>Tribe</u>
a.	_____	_____	_____
b.	_____	_____	_____
c.	_____	_____	_____
d.	<u>Respondent</u> _____		

You may remember Mr. Edwards Reeves and Mr. Timothy Frankenberger. They were here about two years ago talking to farmers about the crops and how they are grown. I am interested in knowing what has happened in this village in the past two years.

1. How many people/families in village? _____

2. How many shops in village? _____

3. Ranking of Crops:	<u>Food</u>	<u>Cash</u>	<u>Livestock:</u>
millet	_____	_____	Cattle _____
sorghum	_____	_____	Sheep _____
sesame	_____	_____	Goats _____
groundnuts	_____	_____	
karkadee	_____	_____	

a. Truck gardens? _____ no _____ yes

b. Gum arabic important? _____ no _____ yes

c. Other important? _____

d. In general, do you think living conditions in this village during the five years have become better, worse, or not changed? Better: _____

Worse: _____

Not Changed: _____

4. Village institutions (number):

_____ mosque	_____ cheese factory
_____ flour mill	_____ primary school
_____ oil press	_____ intermediate school
_____ electric generator	_____ health dispensary
_____ police station	Other _____
_____ cooperatives:	
_____ What? _____	

5. Village professions (number):

_____ carpenter	_____ mason/builder
_____ tailor	_____ cart driver
_____ shoemaker/repairer	Other _____
_____ government midwife	_____
_____ butcher	

6. a. Number of motor vehicles _____
b. Number of radios/recorders _____
c. Number of TV's _____

7. Water Price: a. rainy season _____
b. dry season _____
c. delivered to house? _____

8. Principal government crop market? _____
a. Price of transport of heavy crops (sesame) _____
b. Price of transport of light crops (karkadee) _____

9. Within-village hired labor is more important than labor hired from outside? _____ No _____ Yes

10. Wages paid for first weeding of millet: Men Women
a. by makhammas _____
b. by dahwa (morning work period) _____

11. Where do people go outside the village for work?
Villages/towns/areas? _____

12. Have farmers in this village planted any new kinds of sorghum, millet, or other crops in this village? _____ No _____ Yes

- 12.1 What?
12.2 Who first planted? (Name, farm size, ethnic/tribe, residence)?
12.3 Where did seed come from?
12.4 How did he learn about it?
12.5 When first planted?
12.6 How many planted last/this year in this village? _____
12.7 How did these farmers find out about.....?
a. occasions?
b. time/place?
c. relationships?
12.8 How is it better than others?
12.9 Why isn't everyone using it?
12.11 What?
12.12 Who first planted (name, farm size, ethnic/tribe, residence)?
12.13 Where did seed come from?
12.14 How did he learn about it?
12.15 When first planted?
12.16 How many planted last/this year in this village?

- 12.17 How did these farmers find out about?
 - a. occasions?
 - b. time/place?
 - c. relationships?
- 12.18 How is it better?
- 12.19 Why not everyone using?
- 12.111 What?
- 12.112 Who first planted (name, farm size, ethnic/tribe, residence)?
- 12.113 Where did seed come from?
- 12.114 How did he learn about it?
- 12.115 When first pnted?
- 12.116 How many planted last year in this village?
- 12.117 How did these farmers find out about.....?
 - a. occasions?
 - b. time/place?
 - c. relationships?
- 12.118 How is it better?
- 12.119 Why not everyone using?

13. Have farmers in this village been using any new of different implements or tools in recent years?

_____ No: Does anyone have a surwaal or garwaal? _____ No _____ Yes
 _____ Yes: What things?

- 13.1 How used?
- 13.2 Who first had this (name, farm size, ethnic/tribe, residence)?
- 13.3 How/when did he get one?
- 13.4 How did he learn about it (place, occasion, person)?
- 13.5 How many in this village have one now?
- 13.6 Where do they get them? How much cost?
- 13.7 How is it better?
- 13.8 Why not everyone using?

14. Have farmers in this village made any changes in the way crops are planted or types of crops in a field? _____ No _____ Yes

a. Do any farmers plant groundnuts, cowpeas, clitoria, guar or greengrau with millet or sorghum? _____ No _____ Yes

- 14.1 Why do farmers mix(legume) with sorghum or millet?
- 14.2 Who first began doing this? (name, farm, residence, tribe)?
- 14.3 Where did he learn to do this (place, occasion, relationship)?
- 14.4 How many in this village do it this way?
- 14.5 How/Why is it better?
- 14.6 Why not everyone using it?

15. Have farmers tried any other new things?

a. _____
 b. _____

- 15.1 Who tried?
- 15.2 When first tried?

- 15.3 How/why better?
- 15.4 How/where learn about it?
- 15.5 How many now?
- 15.6 How/where learn?
- 15.7 Why not everyone using?

16. How/when/where do farmers get information about new things (varieties, implements, etc.)?

- a. How? _____
- b. When (occasions)? _____
- c. Where? _____

17. If a farmer planted a crop that gave a high yield, would other farmers find out about it?

- a. _____
- b. How would they learn about it? _____
- c. Would the farmer talk about it or try to keep it secret?
 Talk: _____
 Secret: _____
 Why: _____

18. How does a farmer decide when to plant millet?

- a. _____
- b. Would he tell anyone about? _____ No _____ Yes
- c. Why or why not? _____

Village Survey

A. Sorghum (Dura)

1. What kinds of mareeg/zunaari HireeHri were planted by farmers in this village?
2. What kinds of mareeg/zunaari baladi were planted in this village?
3. What kinds of majaad/feterita were planted in this village?
4. What kinds of dura are planted most?
5. Which sorghum makes the best 9abree?
6. Which sorghum makes the best marissa?
7. Which sorghum makes the best 9asiida?
8. Which sorghum makes the best kisra?
9. Which sorghum makes the best farrik?
10. Which sorghum makes fodder for cattle?
11. Which sorghum is best for grain for cattle?
12. Which sorghum produces the most grain (yields best)?
13. Which sorghum produces the most fodder?
14. Which sorghum matures earliest?
15. Which sorghum brings the best price?
16. Which sorghum is most resistant to bird damage?
17. Which sorghum is most resistant to insects?
18. Which sorghum is most resistant to disease?
19. Which sorghum stores best?
20. Which sorghum has best germination?
21. Which sorghum survives drought best?
22. Which sorghum is easiest to harvest?
23. Which sorghum grows best on Goz?
24. Which sorghum grows best on Gardud?
25. Which sorghum grows best on Clay?

B. Millet (dukñ)

1. What kinds of baladi/dimki were planted by farmers?
2. What kinds of HireeHri were planted?
3. What kinds of 9ish barnu were planted?
4. What kinds of millet are planted most by farmers?
5. Which millet makes the best 9asiida?
6. Which millet is best for house construction?
7. Which millet produces the most grain (yield best)?
8. Which millet produces the most stalk?
9. Which millet matures earliest?
10. Which millet is most resistant to bird damage?
11. Which millet is most resistant to disease?
12. Which millet is most resistant to sinta?
13. Which millet is easiest to harvest?
14. Which millet keeps best?
15. Which millet brings the best price?
16. Which millet germinates best?
17. Which millet survives drought best?
18. Which millet grows best on Goz?
19. Which millet grows best on Gardud?
20. Which millet grows best on Clay?

SUPPLEMENT

1. How many adults in this village can read a newspaper? _____
2. Has any land of this village been permanently lost to the desert?
 - a. IF YES: No Yes What have you seen that makes you think the land is lost? _____
 - b. What is being done or can be done to prevent the land being lost? _____
 - c. Who is responsible for doing this thing? _____
 - d. Is the government doing anything? What? _____
 - e. Are you, or anyone in this village, doing anything to stop the loss of land? No Yes What is being done? _____
3. Do you have a radio? No Yes
4. Do you or people in this village hear the radio broadcast from el-Obeid?
 - a. IF YES: Do people in this village listen to the agricultural program broadcast over the el-Obeid radio station? No Yes
 - b. IF YES: What do people think of the program? _____
5. Has anyone visited this village to distribute chemicals, such as Aldrex-T?
 - a. IF YES: No Yes What do you think of this? Is it good or bad? _____
Why? _____
 - b. Who are these people? Who sent them? _____
 - c. Why did they come to this village? _____
6. Has anyone come to this village to give seeds to farmers? No Yes
 - a. Who are these people? _____
 - b. Why did they come to this village? _____
 - c. Who sent them? _____
 - d. What do you think of what they are doing? Why do you feel this way? _____
7. Do people in this village buy seeds? No Yes
 - a. Why do they do this (or why don't they do it)? _____
 - b. Do farmers most often buy seeds from farmers or from merchants?
 from farmers from merchants
 - c. How many farmers in this village would be willing, do you think, to buy seeds that cost twice as much as ordinary seeds if these seeds would yield 50 percent more at harvest? _____
 - d. Would people be willing to go to el-Obeid to get such seeds?
 No Yes How many of this village would be willing? _____
 - e. Would people be willing to go to el-Obeid for information about high yielding seeds? No Yes How many? _____
 - f. Do you know Hageen seeds? What are they? How they differ from ordinary seed? _____