A CASE STUDY OF KNOWLEDGE TRANSFER IN THE GUSAU PILOT EXTENSION PROJECT OF NORTHERN NIGERIA

by

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CHAPTER I

INTRODUCTION

Statement of the Problem

For most developing nations the road to economic growth and development begins in the agricultural economy.[1] This is due to the fact that agriculture is typically their major industry. Unfortunately, the agricultural systems of underdeveloped nations are usually unproductive, tradition-bound, and stagnant. Subsistence production, primitive technology and capital, and slowness of change are hallmarks of the traditional agricultural economies which keep over one-half of the world's population near subsistence standards of living.

How to transform traditional agriculture has become a leading issue for governments and scientists alike. Agreement on the goals of agricultural development policies is not hard to reach: higher productivity, greater commercialization, and a progressive farm population emerge as a few of the leading objectives. There is less consensus, however, on the nature and relative importance of the problems obstructing agricultural development and on the type of agricultural

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[1]For a discussion of the contribution of agriculture to economic development see: Bruce F. Johnston, "The Role of Agriculture in Economic Development," American Economics Review, Vol. 4, No. 4 (September, 1961), pp. 566-593. Also Simon Kuznets, "Economic Growth and the Contribution of Agriculture: Notes on Measurement," International Journal of Agrarian Affairs, Vol. III, No. 2 (April, 1961), pp. 56-75.

policies required to achieve the foregoing goals.

Agricultural productivity can be increased by either a more efficient allocation of traditional resources or by the introduction of more productive farm practices, e.g., fertilizers or irrigation. Of these two the introduction of new farm practices probably offers the most potential. Within traditional agriculture production possibilities are quite limited, and it is unlikely that more intensive use of one or more "traditional" factors of production will substantially raise agricultural productivity.[2] However, the introduction of more modern factors and farm practices can often bring about significant gains in productivity.[3]

Improved forms of capital and new agricultural techniques must, however, be accepted by the farmer before they can be effective in raising agricultural productivity. Oftentimes the prevailing culture of an underdeveloped country has inherent rigidities which are inimical to change. These rigidities, or barriers, can be social, physical, economic, political, or educational. Their existence gives new importance to "the process of 'producing' and distributing new production techniques"[4] and places a major share of

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[2]Theodore W. Schultz, Transforming Traditional Agriculture (New Haven and London: Yale University Press, 1964), p. 176.

[3]Zvi Griliches, "Research Costs and Social Returns: Hybrid Corn and Related Innovations," Journal of Political Economy, Vol. 66 (October, 1958), pp. 419-431.

[4]Theodore W. Schultz, Economic Organization of Agriculture (New York, 1953), quoted in Bruce F. Johnston and G. S. Tolley, "Strategy for Agriculture in Development," Journal of Farm Economics, Vol. 47, No. 2 (May, 1965), p. 365.

the task of transforming traditional agriculture upon the shoulders of research, extension, and education.

Programs of research, extension, and education are often severely handicapped in playing a more effective role in the process of agricultural development. This stems from the fact that there is a lack of knowledge and understanding of the problems which prevent the successful communication and acceptance of recommended farm practices.[5] This is especially true in the developing world where adoption involves cross-cultural change and traditional agricultural systems unaccustomed to change.[6] The problem is aggravated by a lack of agricultural data and by research and extension services which are short of staff and forced to employ inadequately trained manpower. Lacking sufficient knowledge about the nature of the obstacles to the introduction of new technology, the research, extension, and education services are often forced to rely on experience gained in developed countries. This may be quite an unsatisfactory solution given the special conditions existing in most developing countries.

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[5]Two studies similar in nature to this one and focusing on the adoption of new technology in an underdeveloped country are by Carl C. Malone, "Some Responses of Rice Farmers to the Package Program in Tanjore District, India," Journal of Farm Economics, Vol. 47, No. 2 (May, 1965), pp. 256-269; Daniel W. Sturt, "Producer Response to Technological Change in West Pakistan," Journal of Farm Economics, Vol. 47, No. 3 (August, 1965), pp. 625-633.

[6]Arthur H. Niehoff and J. Charnel Anderson, "The Process of Cross-Cultural Innovation," International Development Review, Vol. 6, No. 2 (June, 1964), pp. 5-11; George M. Foster, Traditional Cultures: and the Impact of Technology Change (New York and Evanston, Illinois: Harper and Row, 1962).

This study was undertaken to explore some of the obstacles to the transfer of agriculturally productive knowledge in a traditional agricultural environment.

Purpose of the Study

The purpose of this study was to explore and analyze some of the barriers to the communication and acceptance of recommended farm practices in the Gusau Pilot Extension Project of Northern Nigeria. One of Northern Nigeria's two pilot projects launched in 1963, the Gusau Pilot Extension Project, carries out an intensive educational program in several districts of the Eastern Division of Sokoto Province (Fig. 1), in order to convince farmers of the benefits of a wide range of recommended farm practices.[7]

In Northern Nigeria there is still only rudimentary knowledge about the traditional agricultural system, farm management practices, and the response of farmers to extension programs. Therefore, any efforts to transfer more productive knowledge to the farmer may be unsuccessful for unknown reasons and perhaps for reasons which could have been avoided.

Little is known about farmers' perception of the extension worker, of the methods and materials used in extension

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[7]Since the completion of the author's data gathering work in Nigeria (December 2, 1965), there has been a military coup d' etat. The new military regime dissolved the regions which previously formed the basis of the Federation of Nigeria. In this text the author will therefore refer to Northern Nigeria and assume that all previous agricultural programs are still operating.

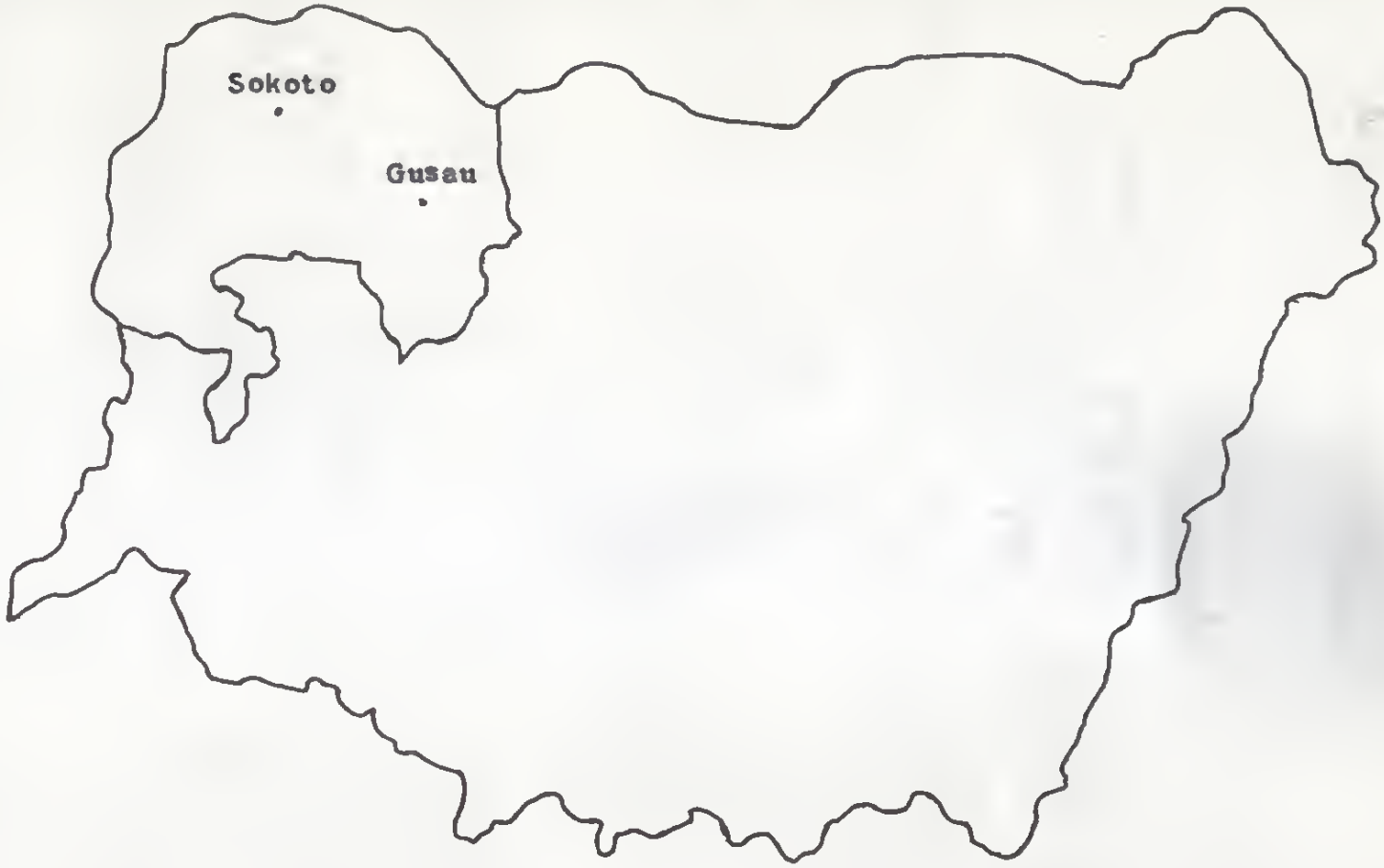

Fig. 1. Map of Northern Nigeria showing Sokoto Province.

programs, or of the new farm practices. There is little understanding of the motivations and attitudes of farmers toward agricultural investment and technological change. There is also uncertainty about the extent of the communication problems caused by illiteracy and lack of education of farmers and of extension workers.

Similarly, little is known about the type of practice farmers will adopt and the type they will reject, or why the farmer adopts some practices, while rejecting others. There is lack of knowledge about the congruity, or "agricultural fit," of recommended practices with the traditional agriculture, as well as with social and cultural values. There is even some question of the applicability of some research programs to the real needs of the farmer.

These are only a few of the questions which plague knowledge transfer in Northern Nigeria, as well as in most underdeveloped countries. In light of this lack of knowledge and in light of the great paucity of agricultural data in Northern Nigeria, the study which seemed to offer the largest potential contribution to raising agricultural productivity in Northern Nigeria was one which would explore some of these major obstacles to the communication and acceptance of recommended farm practices.

The Study Area

Northern Nigeria is largely a tribal society with approximately 80 per cent of its thirty million people living

in villages. Islam is the predominant religion, and Hausa is the predominant spoken language.

Agriculture is the primary occupation of 75 to 80 per cent of the population of Northern Nigeria[8] and contributes approximately 60 per cent of the gross domestic product.[9] Per capita income is less than one hundred dollars a year.[10] These facts underscore the relative underdevelopment of the Northern Nigerian economy.

Low level technology and lack of change are major determinants of the unproductiveness of traditional agriculture in Northern Nigeria. These factors result in low crop yields, subsistence production, and low per capita incomes. Hand hoes, axes, and knives are the most advanced man-made implements used in crop production (Fig. 2). The wheel is foreign to the traditional agriculture, and animal and human power have been the traditional mode of transport. Farm operations are carried out by hand labor, and there has been little acceptance of the use of bullocks for draft power.

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[8]Northern Nigeria, Ministry of Economic Planning, Statistical Yearbook 1964 (Kaduna, Northern Nigeria Ministry of Economic Planning, 1965), p. 21.

[9]Ibid., p. 37.

[10]Food and Agricultural Organization and International Cooperation Administration, Report on the Agricultural Survey of the Northern Region of Nigeria, A Report of a mission organized by the Food and Agricultural Organization of the United Nations at the request of the Government of the Northern Region of Nigeria (Rome: Food and Agricultural Organization, 1960), p. 22.

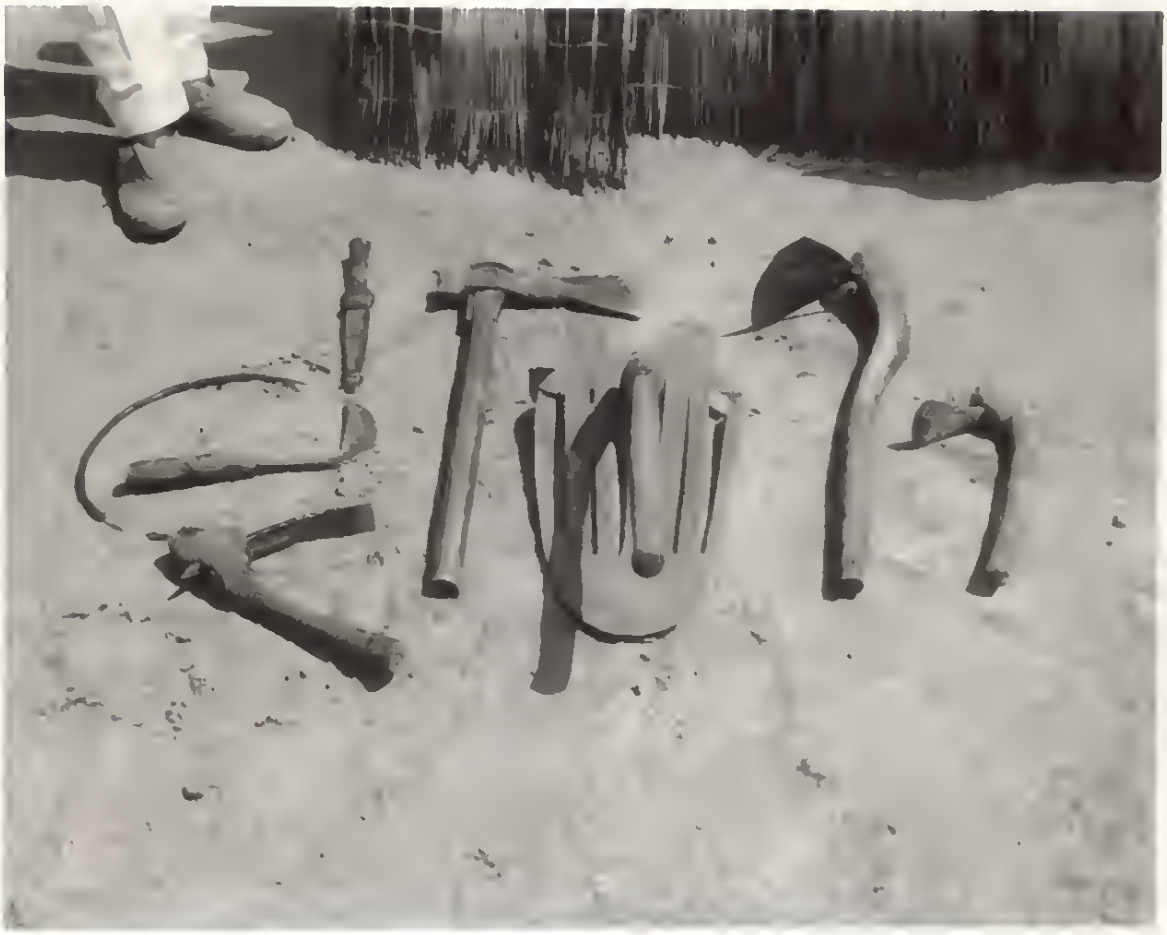

Fig. 2. Primitive hand tools used in agricultural production in Northern Nigeria.

Agricultural production is divided between food crops and cash crops. The two major food crops in the region where this study was undertaken are millet and guinea corn. Production of food crops is almost entirely devoted to family subsistence. The two major cash crops are groundnuts and cotton. Together they account for about 90 per cent of Northern Nigeria's exports.[11] Crop yields for these crops are quite low in comparison to yields obtained on experimental farms using recommended practices.

Under traditional farm practices one acre can provide enough food on the average for 1.4 persons.[12] The average farm size in Northern Nigeria is four acres,[13] and the average family has six to eight members. Of the total acreage cultivated in 1957, over 50 per cent was devoted to the production of food crops.[14]

The predominant system of cultivation in Northern Nigeria is shifting cultivation, or sometimes called bush fallowing. Permanent cultivation exists where man/land ratios are quite high and also in a narrow perimeter around most villages. The general features of this system are field rotation vis à vis crop rotation, use of the hoe as the most

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[11] Ibid., p. 2.

[12] Ibid., p. 21.

[13] Northern Nigeria, Ministry of Economic Planning, Statistical Yearbook 1964, p. 48.

[14] Ibid., p. 49.

advanced tool of cultivation, short periods of land occupancy, and long fallow periods. In a region where soil fertility is low and readily exhausted and where technology is primitive, this system possesses many advantages. The land is cultivated as long as an adequate level of fertility persists. The fallow period allows the natural vegetation to reclaim the land and restore soil fertility. This system also reduces soil erosion. The main disadvantage of shifting cultivation lies in the increasing man/land ratio which reduces fallow periods, thus tending to diminish the long-run soil fertility level.[15]

Farming in Northern Nigeria dances to the rhythm of the seasons. Crops are planted with the onset of the rainy season (in May or early June). Traditional practice dictates that the farmer plant his food crops, usually millet and guinea corn, first.[16] Cash crops, usually groundnuts and cotton, follow in that order. Yields on cotton are often depressed because of the late planting date due to the necessity of planting the food crops first. June and July are the peak-labor period. The land must be prepared; and crops must be planted, replanted, and weeded. Farmers will put farmyard manure on land planted with food crops if they can

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[15]Keith M. Buchanan and J. C. Pugh, Land and People in Nigeria (London: University of London Press Ltd., 1955), pp. 101-125.

[16]For a good account of traditional farm practices see H. A. Luning, An Agro-Economic Survey in Katsina Province (Kaduna: Ministry of Agriculture, 1961).

afford the cost or if they have their own supplies. Millet is harvested in September; guinea corn, in October and November; groundnuts, in November; and cotton, in December and January. Many farmers have "compound farms" where they grow vegetables; onions, potatoes, carrots, pepper, and okra are among a few of the vegetables grown. There is very little crop production during the five- to seven-month dry season.

The major source of cash income for most farmers is from the sale of groundnuts and cotton. These crops are purchased by the Northern Nigeria Marketing Board at prices fixed at the start of the growing season. Cotton is usually purchased at five pence a pound; groundnuts, at £34 per ton.

Marketing and credit facilities impose severe restrictions on most farmers. There is a dire lack of roads, storage facilities, and transportation; and interest rates are very exorbitant.[17]

Land tenure is less of a problem. Most tribes recognize the right of every farmer to have sufficient land to support his family. A communal system of land ownership exists, and farmers are given usufructory rights to the land. The land has traditionally been inalienable, although this practice is gradually breaking down.[18]

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[17]Food and Agricultural Organization and International Cooperation Administration, Report on the Agricultural Survey of the Northern Region of Nigeria, pp. 102-113.

[18]Charles Kingsley Meek, Land, Law, and Custom in the Colonies (London and New York: Oxford University Press, 1949), p. 149.

The Gusau Pilot Extension Project will eventually operate in the entire Eastern Division of Sokoto Province. The characteristics of agriculture in this region are typical of those for Northern Nigeria as a whole. The total area of this division is 12,095 square miles; and 55 per cent of the land area is arable. The total population is approximately 850,000. There are 297 miles of all season roads and 362 miles of dry season roads.

Prior to the establishment of the Gusau Pilot Extension Project there were no government extension staff members involved in extension work in the Eastern Division. Extension work was carried out by Native Authority (local government) agricultural mallams who were untrained and had very little formal education. There were approximately twenty of these mallams in the Eastern Division prior to 1963. The main emphasis of extension had been on the introduction of improved seeds, fertilizers, and seed dressing. Also the enforcement of certain conservation measures, such as the "cotton-closed" season (this refers to the burning of cotton stalks to kill infestation), was a part of the responsibility of extension mallams. Contact with farmers had actually been quite infinitesimal, as is true for all Northern Nigeria.

Northern Nigeria has had the benefit of an outstanding research program which dates from the 1920's. While most attention has been devoted to improving yields on groundnuts and cotton, the research program has developed a package of recommended practices on all four major crops -- millet,

guinea corn, groundnuts, and cotton. The nature of these practices will be elaborated on in Chapter III.

CHAPTER II

RESEARCH PLAN AND METHODOLOGY

Methods of Study

The research plan for this study was divided into two phases. First, background information was collected from secondary sources on the agricultural environment of Northern Nigeria, including cultural, economic, and political factors influencing the agricultural economy. Special emphasis was given to traditional farming patterns and production techniques. The organization of programs for research, extension, and education were also studied.

Secondly, the empirical phase of the research was carried out. Interviews and a case study approach were used to collect data on the problems of knowledge transfer in the Gusau Pilot Extension Project. This phase included an investigation of the organization and programs of the pilot project. Information was collected on this aspect of the pilot project through examination of the records kept at the pilot project's headquarters in the town of Gusau and by interviews with extension supervisors in charge of the pilot project.

The actual empirical work was done in a case study of two villages. Maru village is a participant in the Gusau Pilot Extension Project; while Kagara, the second village selected, has not participated in the pilot project. It is, however, in the same general vicinity as Maru village (Fig. 3).

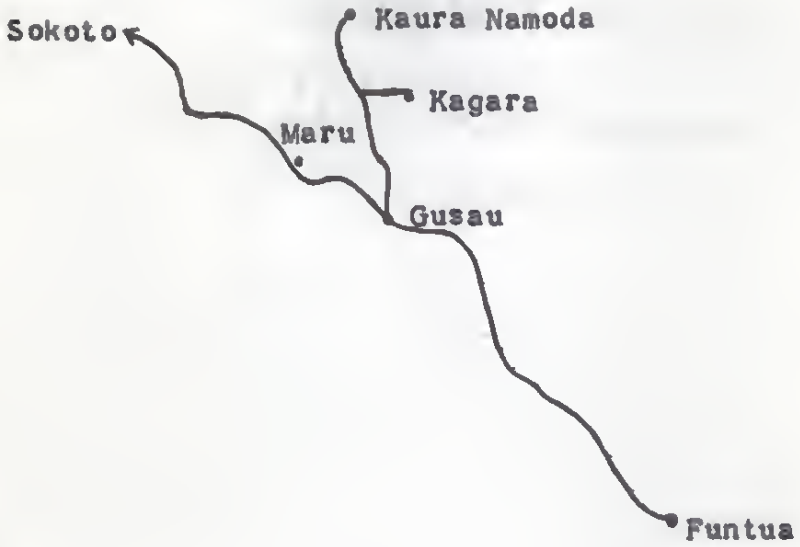

Fig. 3. Road map showing location of Gusau and two survey villages.

Data were collected by interviewing farmers selected at random from the male-adult population of each village. This part of the research enabled a microanalytical investigation of the problems of communication and acceptance of recommended farm practices in the traditional agricultural environment.

Statement of Objectives

The stated objectives of this study were the following:

1. To determine the type of knowledge transfer problems which arise from the lack of education of farmers and of extension workers.
2. To determine the type of knowledge transfer problems which arise in connection with the organization, extension methods, and extension materials of the pilot project.
3. To determine the type of knowledge transfer problems which arise from a conflict between the recommended farm practices and agricultural or economic factors of the traditional agricultural economy.
4. To determine the type of geographical and locational barriers to communication and acceptance of recommended farm practices.
5. To determine the type of cultural and motivational barriers to knowledge transfer.

6. To determine the extent and type of changes being accepted by farmers.
7. To evaluate the success of the Gusau Pilot Extension Project in surmounting knowledge transfer problems.

Statement of Hypotheses

The purpose of this research was less concerned with hypothesis-testing than with gaining familiarity with the nature and type of problems which impede the transfer of agriculturally productive knowledge in a traditional agricultural setting. Only when there is a greater understanding of these problems and a larger reservoir of agricultural data will statistically-refined studies of hypotheses become more feasible in Northern Nigeria. In the meantime, descriptive and exploratory studies are necessary to delineate research problems and to develop concrete hypotheses.

Nevertheless, it is possible to cite one general hypothesis which did influence the nature of this study.

A primary barrier to raising agricultural productivity in Northern Nigeria is, in the opinion of the author, lack of knowledge and/or lack of education on the part of farmers, extension workers, research workers, economists, and most other individuals interested in the problem of agricultural development. Thus, the general hypothesis follows that the success of programs to raise agricultural productivity will increase in direct proportion to the increase in educational

levels and the increase in knowledge and understanding of the traditional agricultural environment. This hypothesis is based on a general observation stated most succinctly by Bradfield:

> The nations that are most advanced agriculturally are, in general, those that have made a substantial investment in science and education during the past century.[19]

A well-developed extension program serves a vital need in a developing country by helping to bridge the gap between highly educated agricultural leaders and research scientists and uneducated, illiterate farmers. As such, an extension program represents an investment in education, the results of which can serve to refute or verify the hypothesis stated above.

Procedure and Methodology

A comparative study of extension results and farming practices in two villages was used to investigate knowledge transfer problems in the Gusau Pilot Extension Project. The following criteria were set as guidelines to the selection of the two villages:

1. One village must be a participant in the Gusau Pilot Extension Project; while the second village

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[19] Richard Bradfield, "The Role of Educated People in Agricultural Development," Agricultural Sciences for the Developing Nations, ed. Albert H. Moseman (Washington, D. C.: American Association for the Advancement of Science, 1964), p. 112.

must not be a participant in the pilot project, although some extension work in the village through previous extension programs was desirable.

2. Extension work in the pilot project village must have commenced before 1965.
3. The non-participant village must have participated in an agricultural sample survey conducted annually by the Federal Office of Statistics. (This condition was made with the intention of using the collected data in this study; however, this possibility never materialized.)
4. Both villages must be accessible by car, in close proximity to each other, and in close proximity to the town of Gusau.
5. Both villages must be willing to participate in the study.
6. The participant village should have an agricultural assistant in charge of its extension program.
7. The participant village should be among those villages showing above average response to the pilot project's extension program.

The two villages selected were Maru and Kagara. Maru village is a participant in the pilot project; Kagara village has had only minimal contact with an agricultural mallam. (A more detailed description of these two villages is found in Chapter IV.)

Random samples of farmers were selected from each village. There was no stratified sampling since it was desired to have a cross-section of each village. However, since Maru village was more populous than Kagara, random samples were selected from two of Maru's five village quarters. These quarters are fairly self-contained and homogeneous. This fact made it admissible and even preferable to sample on a quarter rather than a village basis.

Sauiawa quarter was chosen on the basis of its probably being the most advanced quarter in the application of recommended practices. It is the center of village activity and the headquarters of the extension worker and of the village head. The second quarter selected was Kaura Duma. The reason for its selection lay in the fact that it had recently been populated and built up. Therefore, because of preoccupation with domestic tasks, its farmers had probably not participated as actively in the pilot project's extension program as farmers from other quarters.

Twenty farmers were randomly selected from tax lists from each quarter and from Kagara village. Table 1 shows the population, sample size, and actual number of interviews for each village and quarter. Lack of time prevented taking larger samples. It was felt, however, that the sample sizes used were adequate to make valid inferences to the total population of each village.

Table 1. Population, sample size, and number of interviews.

Village	Number of Tax-Paying Male Adults, 1964	Sample Size	Actual Number of Interviews
Maru	1028	40	39
Quarters:			
Saulawa	205	20	19
Kaura Duma	297	20	20
Kagara	165	20	20

Interviews were conducted with the sample farmers with the aid of a questionnaire. Information was collected under the following headings: (1) General Information; (2) Inventory of Land, Livestock, and Capital; (3) Production Data; (4) Awareness and Adoption of Practices; (5) Contact with Extension Programs; (6) Comprehension of Extension Methods and Recommendations; (7) Identification of Extension Materials; and (8) Allocation of Extra Income. (A full account of the objectives of this interviewing is given in Chapter V.)

Interviews were carried out with the assistance of an interpreter and lasted from forty-five minutes to one hour.

The data were summarized and totaled for each sample. This allowed for comparisons of results among samples. Percentage magnitudes were the basis for deductive and inductive conclusions about the nature and type of problems to the transfer of recommended farm practices. The findings of this part of the study were also combined with the information

obtained from pilot project supervisors and records.

Definitions

Extension work in Northern Nigeria is carried out jointly by the Ministry of Agriculture (Field Services Division) of Northern Nigeria and by the local government, known as the Native Authority. The following definitions apply to the different grades of extension staff in Northern Nigeria:

Assistant agricultural superintendent (A.A.S.):--An extension worker employed by the Ministry; an A.A.S. has five or six years of secondary education and three years of agricultural training at the Ministry's School of Agriculture; an A.A.S. may be raised to the rank of agricultural superintendent on the basis of performance.

Agricultural assistant (A.A.):--An extension worker employed by the Ministry; an A.A. has completed five or six years of secondary school and has received a two-year training course at the School of Agriculture; qualified A.A.'s may be returned for another year of training to become A.A.S.'s; both the A.A.S.'s and A.A.'s are literate in English, as well as their native tongue.

Agricultural instructor (A.I.):--Ministry or Native Authority extension worker; an A.I. generally has completed seven years of primary school, and some have a few years of secondary education; A.I.'s are

given an eleven-month training course at the School of Agriculture; very few A.I.'s are literate in English.

Agricultural mallam (A.M.):--An extension worker employed by the Native Authority; an A.M. has little, if any, secondary education and no formal agricultural training.

The following definitions apply to certain crops and agricultural practices of Northern Nigeria:

Groundnuts:--Peanuts.

Guinea corn:--A type of grain sorghum.

Millet:--A type of grain crop.

Mixed farming:--A system of farming which uses bullocks for draft power and farmyard manure.

Interplanting:--The practice of planting two or more crops on the same plot of land, so that they are mixed together.

Ridging:--The practice of building ridges on which to plant crops.

Cross-tying:--The practice of building small bunds at certain intervals in the ridge furrows.

CHAPTER III

A DESCRIPTION AND ANALYSIS OF THE GUSAU PILOT EXTENSION PROJECT

Purposes

The major purposes of the Gusau Pilot Extension Project are: (1) to introduce farmers to recommended farm practices which will raise agricultural productivity; (2) to raise the competence of extension field workers through in-service training; (3) to develop more effective extension materials and methods; (4) to develop local leadership in villages to provide a cadre of progressive farmers; and (5) to develop a system of "benchmarks" for evaluating extension results.[20]

Organization and Staffing

The pilot project was established in the Eastern Division of Sokoto Province in 1963.[21] Although "pilot" in name, this project represents the Ministry of Agriculture's long-range plan to provide a ratio of one extension worker to every two thousand farm families for all of Northern Nigeria.[22] The

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[20]Interview with Tom Reynolds, U.S.A.I.D. Extension Advisor to the Gusau Pilot Extension Project.

[21]All of the following information pertaining to the pilot project was collected through interviews and questionnaires and by inspection of records of pilot project activities kept at Gusau headquarters.

[22]Ministry of Agriculture of Northern Nigeria, Country Report: Training of Technical Staff in the Ministry of Agriculture, Northern Nigeria, A Report to the Seminar on Agriculture Education and Training in Africa Organized by the Food and Agricultural Organization of the United Nations (Zaria, Northern Nigeria: The Seminar, 1965), p. 2.

Ministry's Training and Educetion Division hopes to have trained enough agricultural extension workers by 1973 to reach this goal.[23] In the meantime, the Ministry has made plans to launch several pilot projects like the one in Guseu.

Having an inadequete number of extension workers to epply the 1:2,000 ratio over the entire Eastern Division, the Gusau Pilot Extension Project only operates in the number of districts in which it is possible to realize this ratio. In 1963 and 1964, there were three districts and fourteen and twenty-two villsges, respectively, included in the pilot project. With the avsilability of more manpower extension work was expanded to six districts and thirty-two villages in 1965. (Extension work was cerried out on a modest scale in an additional sixteen villeges in 1965.)

While under the auspices of the Ministry of Agriculture, the pilot project seeks close cooperation with the Native Authority Agricultural Department in planning and executing the extension program. The Ministry of Information and the Extension Information Branch of the Research Liaison Section of the Institute for Agricultural Reseerch also cooperate by preparing educational programs and materials.

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[23] R. Rowat, The Development of Educetion and Training in the Field of Agriculture and Releted Subjects, A Report to the Federal and Regional Governments of the Federal Republic of Nigeria (Rome: Food and Agriculture Organization, 1964), pp. 35-37.

An extension advisor from the United States Agency for International Development has supervised the organization of the pilot project. He is assisted by the agricultural officer of the Eastern Division of Sokoto Province and by a Native Authority agricultural officer. Assistant agricultural superintendents also occupy supervisory roles. These officers reside in the town of Gusau but make frequent inspection tours of the districts.

Extension work is carried out on a district and village basis. An agricultural assistant supervises the extension program in each district and carries out his own extension work usually in the major village of the district. Agricultural instructors work in one or two villages. The pilot project has been forced to rely on several untrained agricultural maliams to fill the existing manpower gaps. They will eventually be replaced by agricultural instructors. Their present role is quite limited.

It is intended that one assistant agricultural superintendent will supervise four agricultural assistants and that one agricultural assistant will supervise three to five agricultural instructors.

Table 2 shows the staffing position of the pilot project from 1963 to 1965.

Table 2. Extension staff for the Gusau Pilot Extension Project, 1963-1965.

Staff Category	1963	1964	1965
U.S.A.I.D. Extension Advisor	0	1	1
Assistant Agricultural Superintendent	1	1	2
Agricultural Assistant	2	3	6
Government Agricultural Instructor	0	3	9
Native Authority Agricultural Instructor	0	0	6
Native Authority Agricultural Mallam	18	18	21

Extension Methods and Materials

The pilot project aims at providing intensive contact with farmers through individual, group, and mass contact approaches. Extension workers live in the villages and encourage village leaders to participate actively in the village's extension program.

The introduction of farm practices is built around a "package approach" and result demonstrations. The package approach emphasizes the adoption of a set of farm practices applicable to a crop. This is often a necessity to obtain maximum yield increases caused by beneficial interactions among new practices.

The result demonstration is the pillar of the extension program. Recommended farm practices are carried out by volunteer farmers on "result" plots, while the farmer applies his traditional farm practices on a "check" plot. The

extension worker is responsible for the following duties in conjunction with the result demonstration:

1. Furnishing demonstration materials.
2. Helping to keep records of the demonstration.
3. Giving close supervision of each phase of the demonstration.
4. Making tours of the result demonstration with local farm groups to explain the demonstration and recommended practices.
5. Providing a sign board to identify the demonstration.
6. Publicizing results.

The participating farmer is responsible for the following:

1. Furnishing land, labor, and tools.
2. Cooperating in furnishing data for records.
3. Carrying out the demonstration as the extension worker directs.
4. Assisting in explaining to others the recommended practices applied on the demonstration.

Mass contacts have been experimented with in the form of a news letter and mobile units using microphones, leaflets, cinemas, and tape recorders. A newsletter in Hausa is issued once monthly. In cooperation with the Ministry of Information, the Pilot Project has made extensive contact with mobile cinema units which feature movies of improved farming practices and method demonstrations by extension workers using microphones and flip charts, posters, and leaflets.

Group contacts have included village educational meetings conducted by each village's extension worker. These meetings are usually method demonstrations or conducted tours of result demonstration plots. Also included are the establishment of village agricultural councils and Young Farmers' Clubs and tours of Native Authority or government farm centers. Leaflets, posters, village notice boards, photos, flip books, and charts are common extension materials used in group contact sessions.

Individual contact is possible since extension workers have established living quarters and offices in each village. Farmers are encouraged to make office calls; and extension agents, to visit the farms of village farmers requesting help.

The Extension Program

The supervisors of the Gusau Pilot Extension Project have incorporated the importance of planning into an annual work plan. All levels of extension staff are responsible for planning their monthly and weekly activities. These plans must coincide with the activities of the farmer. A summary of the annual work plan by month follows:

January and February:

The first assignment is the posting of all extension staff to their respective villages, followed by the selection of a new village agricultural council. The previous year's extension program is discussed and criticized by village farm leaders, result demonstration participants, agricultural

council members, the extension worker, and other interested parties; and plans are formulated for the current year's program. Special attention is given to publicizing the results of successful result demonstrations. Finally, the extension worker continues supervision of dry season farming demonstrations and of the harvesting of cotton demonstrations.

March and April:

Extension work begins in earnest in March. Extension plans are finalized; and general educational meetings are begun in each village to attract farmers' attention to the recommended practices. Work is begun reorganizing or organizing new Young Farmers' Clubs and assisting them in planning for their current annual activities. In-service training programs for agricultural assistants, agricultural instructors, and agricultural maliams are held. Finally, participants in result demonstrations are selected, and arrangements are made for the delivery of demonstration packets.

May and June:

The educational aspect of the extension program is in full gear during May. Special emphasis is given to seed dressing, fertilizers, and seed varieties. Method demonstrations are performed to educate farmers in the use of new improved practices. The result demonstrations for millet, guinea corn, groundnuts, and sprayed cotton are established. Leadership training in Young Farmers' Clubs is also undertaken.

July and August:

The follow-up phase of extension work begins in these two months. Supervision is given to the care of the result demonstrations and farmers are taken on tours of these plots to observe the results. Extension workers continue to supervise the activities of the Young Farmers' Clubs. All unsprayed cotton demonstrations are established in July, and cotton spraying demonstrations are carried out in August. Another in-service training program for all extension workers is held; and plans are laid for the farm center tours by farmers. Finally, harvesting of millet demonstrations is begun in late August.

September and October:

The harvesting of millet demonstration plots and the spraying of cotton plots are continued. Millet storage demonstrations are begun. Farmer tours to farm centers and Native Authority demonstration unit farms are conducted. A third round of in-service training programs is held in September. Harvesting of groundnut demonstration plots is begun in October; and educational meetings on the control of aflatoxin in groundnuts and on groundnut decortication are held.

November and December:

The harvesting of groundnuts is completed, and the harvesting of guinea corn and cotton demonstration plots is begun. Preparation of dry season farming demonstrations is

begun. A Young Farmers' Club camp session is held in late November, and agricultural fairs are held in December.

Recommended Farm Practices

The Gusau Pilot Extension Project has centered its efforts around four crops -- millet, guinea corn, groundnuts, and cotton. These crops have received the major attention of the Institute for Agricultural Research as they are of substantial economic importance to Northern Nigeria.

The major recommended practices for each of these crops follow:

Millet and Guinea corn

1. Ridging and cross-tying.
2. Planting at two- to three-foot intervals when sole planting and planting at six-foot intervals when interplanting.
3. Applying fifty-six pounds of superphosphate and fifty-six pounds of ammonium sulphate fertilizer per acre.
4. Applying Aldrex T seed dressing.
5. Thinning to two stalks per stand.
6. Weeding early and frequently.
7. Pulling and burning diseased plants.
8. Applying Gammalin A pesticide when storing.

Groundnuts

1. Using K-50 seed variety.
2. Applying sixty pounds of superphosphate fertilizer per acre.

3. Applying Aldrex T seed dressing.
4. Spacing two seeds at nine-inch intervals.
5. Planting in early June.
6. Cross-tying.
7. Weeding early and frequently.
8. Removing diseased plants.
9. Harvesting when mature.
10. Rotating.
11. Shelling with a properly adjusted decorticator.

Cotton

1. Applying 112 pounds of superphosphate and 112 pounds of ammonium sulphate fertilizer per acre.
2. Planting in June or before July 15 at the latest.
3. Spacing six seeds at eighteen-inch intervals.
4. Cross-tying.
5. Weeding early and frequently.
6. Thinning to two.
7. Spraying with insecticide cotton planted before June 15.
8. Rotating.
9. Observing close-season (burning old cotton stalks).

The pilot project is also trying to introduce farmers to mixed farming and dry season farming plus a few other minor activities, e.g., bee keeping. However, these efforts are of secondary importance.

A Survey of Extension Efforts

The following data summarize the major extension efforts made by the Gusau Pilot Extension Project in 1963, 1964, and 1965.

The number of agricultural groups organized by the pilot project and their membership are given in Table 3.

Table 3. Organized groups in the Gusau Pilot Extension Project and their membership, 1963-1965.

Group	1963	1964	1965
Agricultural Councils	9	14	29
Membership	45	118	174
Young Farmers' Clubs	1	6	25
Membership	40	240	512
Old Farmers' Clubs	0	1	1
Membership	0	32	32

Source: Data compiled at the pilot project headquarters in Gusau.

Table 4 summarizes the various types of extension programs conducted in the pilot project area in 1963-1965. These data do not, however, include the establishment of result demonstrations.

Table 4. Extension programs conducted in the pilot project area, 1963-1965.

	1963	1964	1965
Tours with Farmers			
Native Authority Farms	0	8	0
Attendance	0	791	0
Gusau Farm Center	5	5	13
Attendance	300	482	634
Bee Keeping Demonstrations	0	3	3
Attendance	0	157	120
Meetings in Villages			
General Educational	0	120	50
Attendance	0	151,000	50,000
Program Planning	9	11	29
Attendance	225	360	570
Meetings Held at Result Demonstration Plots	25	600	850
Attendance	150	6,220	9,300
Other	0	16	32
Attendance	0	172	720
Farm Visits			
Farm Visits Made by Extension Workers	650	7,560	11,000
Number of Farms Visited	193	660	1,230
Mass Media Programs			
Publications Distributed			
Bulletins	0	1,250	250
Posters	500	5,000	7,500
Leaflets	0	7,000	2,000
News Stories Published	0	21	52
Radio Programs	0	8	0

Source: Data compiled at pilot project headquarters in Gusau.

Educational meetings and farm tours are intended to explain or demonstrate the use of recommended farm practices. Table 5 shows the kinds of practices being demonstrated and the number of demonstrations of each practice over the entire pilot project area.

Table 5. Kind and number of demonstrations of recommended farm practices, 1963-1965.

Kind of Practice	1963	1964	1965
	(No. of times demonstrated)		
Fertilization	42	199	260
Seed Variety	68	49	200
Soil Preparation	48	183	260
Seed Dressing	42	178	240
Tie Ridging	42	199	150
Seeding Rate	42	199	260
Spacing	114	199	260
Cultivation	42	199	260
Date of Planting	42	178	260
Insect and Disease Control	15	39	57
Decorticator Adjustment	365	--	140

Source: Data compiled at pilot project headquarters in Gusau.

Result demonstrations constitute an important part of the extension program. There are usually two or three result demonstrations on groundnuts, cotton, millet, guinea corn, and cotton interplanted with millet established in each village. Table 6 shows the number of result demonstrations carried out in 1963, 1964, and 1965.

Table 6. Number and type of result demonstrations conducted, 1963-1965.

Type	1963	1964	1965
	(No. of Result Demonstrations)		
Cotton Production	29	49	57
Guinea Corn Production	48	50	70
Groundnut Production	38	44	70
Millet Production	0	35	15
Yam Production	2	12	10
Sugarcane Production	0	4	8
Beekeeping	0	2	3
Rice Production	0	2	8
Dry Season Gardening	1	2	6

Source: Data compiled at the pilot project headquarters in Gusau.

Crop yields are measured on both result and check plots of result demonstrations, and these results are used to support extension recommendations. Table 7 gives the average yields obtained on result and check plots for the three districts in which result demonstrations were conducted in 1964.

Table 7. Average result and check plot yields by district for millet, guinea corn, groundnuts, cotton, and cotton interplanted with millet, 1964.

Crop	Maru District			Kotorkoshi District			Anka District		
	No. of Plots	Result	Check	No. of Plots	Result	Check	No. of Plots	Result	Check
Millet	15	1,328	673[a]	9	1,288	741	9	1,000	705
Guinea corn	14	1,440	671[a]	7	965	486	11	1,151	887
Groundnuts	15	1,224	605[b]	7	1,039	701	10	837	492
Cotton	6	761	283[c]	2	724	396	2	812	364
Cotton interplanted with millet	4	528	212	3	669	388	6	493	250

Source: Data compiled at the pilot project headquarters in Gusau.

Note: The size of result and check plots is one-eighth of an acre. Yields are based on samples of one-fortieth of an acre.

[a]Pounds of threshed grain per acre.

[b]Pounds of shelled nuts per acre.

[c]Pounds of cotton per acre.

Table 8 shows the percentage increase in yields on result plots vis a vis check plots for these three districts.

Table 8. The percentage increase in yields on result versus check plots by district, 1964.

District	Crops				
	Millet	Guinea Corn	Ground-nuts	Cotton	Cotton/ Millet
Maru	97%	113%	102%	169%	148%
Kotorkoshi	74%	99%	48%	83%	72%
Anka	42%	30%	70%	123%	97%

While yield comparisons are subject to a few distortions, e.g., farmers occasionally apply fertilizer to the check plot contrary to instructions, any such distortions will probably average out over several demonstrations. Therefore, it would seem that these findings verify the yield-increasing potential of new, recommended farm practices.

Profitability of Recommended Farm Practices

On the basis of the percentage yield increases of Table 8, it is possible to calculate the net returns to recommended farm practices.

First, it is necessary to consider the cost per acre of applying the new inputs. The subsidized prices of superphosphate and ammonium sulphate are five and seven shillings, respectively, per fifty-six pound bag. The price of a bag of K-50 groundnut seed is twenty-five shillings. (One bag

is sufficient for planting one acre.) Gammalin A pesticide costs two shillings and six pence per box. (The author is uncertain of the number of boxes required for grain storage.) The cost of Aldrex T seed dressing is six pence per packet; the per acre cost of applying seed dressing does not in all likelihood exceed five shillings. The per acre cost of pesticide for spraying cotton is £4. (The author is unaware of the cost of a sprayer.)

Secondly, it is necessary to know the prices of each crop in order to calculate net returns. The price of groundnuts is usually £34 per ton; the price of cotton, five pence per pound; and an average price per ton for millet and guinea corn is £20 and £18, respectively.

On the basis of an average yield increase for groundnuts of 73 per cent and an average yield under traditional practices of 670 pounds per acre, the net profit from applying the recommended farm practices would be approximately £8 per acre.[24]

If traditional yields on cotton are three hundred pounds per acre and if an average yield increase of 125 per cent is possible, the net profit from using the recommended practices is approximately £2 per acre.[25]

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[24]These calculations did not allow for the extra labor cost involved, e.g., ridging or more frequent weeding, as these costs would be very difficult to estimate.

[25]These calculations did not include the cost of a sprayer or extra labor costs.

For millet and guinea corn an average net return of approximately £ 4-0-0 per acre is possible, assuming traditional yields of approximately seven hundred pounds per acre and yield increases of 71 and 81 per cent, respectively.[26]

In conclusion, it is apparent that the application of recommended farm practices on all crops, with cotton a marginal case, yields a positive return to farmers. It would also seem likely that the magnitude of these net returns, with the possible exception of cotton, is sufficient to motivate farmers to adopt the recommended practices, assuming there are no non-economic reasons (or even economic ones, e.g., credit) for not adopting them.

An Analysis of Extension Work in the Pilot Project

A thorough discussion of problems of knowledge transfer in the pilot project must be postponed until after the presentation of data pertaining to the village case study. However, a partial description and analysis of some of the problems will be presented here.

As part of the follow-up phase on all result demonstrations, a careful inquiry into the adoption of practices by the previous year's participants is undertaken. The following table summarizes the results by district and by crop of the survey taken in 1965 of 108 participants.

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[26]Again extra labor costs were ignored.

Table 9. Adoption of practices by crop and by district by farmers who carried out result demonstrations in 1964.

Crop	District							
	Maru		Anka		Kotorkoshi		Total	
	(Actual/Potential Adoptions)							
	A/P	%	A/P	%	A/P	%	A/P	%
Miliet	51/84	60.7	33/70	47.1	24/42	57.1	108/196	55.1
Guinea corn	55/98	56.1	29/77	37.7	29/49	59.2	113/224	50.5
Groundnuts	60/72	83.3	20/50	40.0	44/48	91.7	124/170	72.9
Cotton	8/28	28.6	12/30	40.0	6/14	42.8	26/72	36.1
Cotton interplanted with miilet	11/21	52.4	6/12	50.0			17/33	51.5
							388/695	55.8

Source: Data compiled at the pilot project headquarters in Gusau.

Notes: The practices reported in this survey were ridging, seed variety, fertilizing, spacing, thinning, spraying, cross-tying, and planting date.

Some distortion of the true number of adoptions could result from falsification of results or oversights by extension workers, adoption of the practice by the farmer previous to his participation in the experiment, and the infeasibility of adoption of some practices, e.g., ridging on sandy soil. It is not felt that any of these resulted in any significant distortion.

It was also possible to break down the adoption of farm practices by type of practice. Table 10 gives the results of such a breakdown.

These findings support the following observations:

1. If 50 per cent is accepted as a satisfactory level of adoption of new practices, the pilot project has been fairly successful. (It should be borne in mind that only result demonstration participants have been surveyed; as a group they would naturally tend to be more cognizant of the advantages of adopting certain farm practices than non-participant farmers.)
2. Farmers have shown a preference for adopting practices pertaining to groundnuts. Nineteen out of thirty farmers used superphosphate on their groundnuts the year following the result demonstration and twenty-four out of thirty used the recommended seed variety. Adoption of new husbandry practices on groundnuts showed the same high adoption levels.
3. Farmers showed little inclination to adopt practices related to cotton, except for the recommended spacing. The percentage of farmers applying superphosphate on cotton (41.7 per cent) was less than the percentage of farmers applying it on groundnuts (63.3 per cent); and only two out of twelve farmers applied ammonium sulphate. A very low percentage of farmers were able to plant cotton

Table 10. The adoption of practices according to type of practice.

District	Crops	Ridging	Variety	Seed Dressing	Superphosphate	Sulphate	Spacing	Thinning	Spraying	Crosstying	Planting Date
		(Farmers Adopting/Total Number of Participant Farmers)									
Maru	Millet	8/12		11/12	7/12	1/12	4/12	9/12		11/12	
	G'corn	4/14		11/14	8/14	2/14	5/14	13/14		12/14	
	G'nuts		11/12	10/12	8/12		11/12			10/12	10/12
	Cotton				2/4	1/4	4/4	0/4	0/4	0/4	1/4
	Cotton w/Millet				3/3	1/3	3/3	0/3	0/3	2/3	2/3
Anka	Millet	6/10		5/10	3/10	1/10	7/10	9/10		2/10	
	G'corn	5/11		6/11	3/11	0/11	5/11	8/11		2/11	
	G'nuts		5/10	3/10	3/10		6/10			3/10	--[a]
	Cotton				2/6	0/6	5/6	4/6	0/6	1/6	--[a]
	Cotton w/Millet				2/2	0/2	2/2	2/2	0/2	0/2	--[a]
Kotorkoshi	Millet	4/7		7/7	0/7	0/7	6/7	7/7			
	G'corn	2/7		7/7	5/7	4/7	3/7	6/7		2/7	
	G'nuts		8/8	8/8	8/8		8/8			6/8	6/8
	Cotton				1/2	1/2	1/2	2/2	0/2	1/2	0/2
	Cotton w/Millet										
All Districts	Millet	18/29		23/29	10/29	2/29	17/29	25/29		13/22	
	G'corn	11/32		24/32	16/32	6/32	13/32	27/32		16/32	
	G'nuts		24/30	21/30	19/30		25/30			19/30	16/20
	Cotton				5/12	2/12	10/12	6/12	0/12	2/12	1/6
	Cotton w/Millet				5/5	1/5	5/5	2/5	0/5	2/5	2/3
Totals		29/61	24/30	68/91	55/108	11/78	70/108	60/78	0/17	52/101	19/29
Percent Adoption		47.5%	80%	74.7%	50.9%	14.1%	64.8%	76.9%	0%	51.5%	65.5%

Source: Data compiled at the pilot project headquarters in Gusau.

[a]Incomplete data from Anka District.

when recommended; this is a key factor to gaining higher yields.

4. With regard to millet and guinea corn, farmers showed a preference for superphosphate (42.6 per cent adoption) versus ammonium sulphate (13.2 per cent adoption). Likewise, a higher percentage of farmers adopted spacing, thinning, and planting date recommendations than adopted ridging and cross-tying recommendations. The latter two are more labor-costly practices.
5. There is substantial variation among the districts in number of practices adopted. The exact cause of this was not determined, although it could be due to the quality of extension staff, interest and attitudes of the farmers, or supply lines for new inputs.

The following data were also compiled to shed further light on the performance of the pilot project.

The sale of K-50 groundnut seed, Aldrex T seed dressing, ploughs, and fertilizer for the entire pilot project area is presented in Table 11.

These data give further evidence of the progress being made by the pilot project in introducing new farm practices. Progress has been especially steady with respect to the sale of fertilizers and ploughs for mixed farming.

Table 11. Purchase of recommended inputs in the pilot project area, 1963-1965.

Input	1963	1964	1965
K-50 Groundnut Seed (lbs.)	45,919	39,289[a]	--[b]
Aldrex T Seed Dressing (doz. packets)	738	1,272	--[b]
Superphosphate (long tons)	50	150	242
Ammonium Sulphate (long tons)	5	15	23
Ploughs	0	50	150

Source: Data compiled at pilot project headquarters in Gusau.

[a]Supplies of K-50 seed ran out in 1964. Demand was much greater than could be satisfied.

[b]Incomplete data.

Responses by pilot project supervisors to questions posed during interviews and in questionnaires provided more detailed information about knowledge transfer problems and the results of various extension programs:

1. Extension supervisors thought that interest among farmers was running very high and that they expressed enthusiasm on visits to farm centers. Likewise, there has been a good response to many extension activities taking place in the villages, especially village agricultural councils, Young Farmers' Clubs, and cinema presentations.

2. Overall, the extension programs in the pilot project area have been carried out successfully, especially result demonstrations, educational meetings, and farm tours. This is due in large part to close supervision of field workers and programs of in-service training.
3. Lack of education and of training limit the capabilities of most agricultural instructors and agricultural mallams. Mr. Tom Reynolds, U.S.A.I.D. extension supervisor to the pilot project stated in an interview:

> It is evident that a short in-service training course is not adequate training to enable workers with no other formal agricultural training to establish and carry out extension demonstrations properly.

The pilot project has had to condemn twenty result demonstrations in two years (1963-1964) as a result of the ineptitude of some agricultural instructors and agricultural mallams. Furthermore, agricultural instructors and agricultural mallams have sometimes failed to prepare ridges for guinea corn and millet demonstrations and failed to space millet and guinea corn at the recommended two-foot intervals since they, themselves, are not convinced of the value of these practices. They are also slow in grasping the ideas taught in in-service training courses.

4. Lack of farm experience, of initiative, and of the ability to plan ahead have been present at all levels of the extension service but are most serious among the lower grade extension workers.
5. Result demonstrations on millet and guinea corn have sometimes failed because they were carried out near the farmers' compound so that they were able to apply large amounts of farmyard manure to the check plot. Farmers have also tended to associate a higher yield on result plots with one or two practices, especially superphosphate and seed variety in the case of groundnuts, ignoring the other recommended practices. Furthermore, many farmers have not been convinced that result plots give higher yields on guinea corn for the reason that the check-plot guinea corn has larger heads.
6. Many farmers do not believe that planting cotton the first week of July will raise yields. This is due to the fact that most farmers do not observe cotton close-season, and this permits early planted cotton to be attacked by bollworms which cannot be controlled by insecticides.
7. There is some difficulty in getting farmers to understand the concept of "yield per acre" since most farmers do not know how much an acre is.

8. Illiterate farmers cannot usually interpret extension posters without prior explanation by extension workers.

9. Village agricultural council members must often be prodded to get them to air their opinions or to examine their problems.

10. There has been a serious problem in supplying farmers with the inputs they have demanded. The pilot project had to order superphosphate five times in 1964 because it kept running short; supplies of groundnut seed ran out before all the demand was met. There has also been shortages of ploughs, seed dressing, and replacement parts for groundnut decorticators. Another part of this problem has been the difficulty in getting supplies to the farmer in his village. Farmers cannot afford long trips to pick up supplies, and so they are dependent on village middlemen. Middlemen will not purchase these supplies to sell in the villages unless they can buy on a credit basis; this is often not permitted.

11. Agricultural assistants are supposed to pay regular visits to inspect the work of agricultural instructors in their district. However, because of lack of transportation, an agricultural assistant may be forced to walk or bicycle thirty or forty miles to do this.

12. Finally, there has been a shortage of government loans for the purchase of ploughs and bullocks.

CHAPTER IV

A GENERAL DESCRIPTION OF THE TWO SURVEY VILLAGES

General Information

Maru village, located twenty-six miles north-west of Gusau on the road to Sokoto (Fig. 3, page 15), is the capital of Maru District. With a population of 8,256 in 1964, it is one of the largest "villages" in the Eastern Division of Sokoto Province. Maru is an important market for the purchasing of groundnuts and cotton and has its own primary school, dispensary, and post office. A secondary school and teacher training college are situated nearby.

Kagara village, lying fifteen miles north of Gusau and five miles off the road to Kaura Namoda (Fig. 3, page 15), has a population of approximately eight hundred. In contrast to Maru, Kagara is relatively isolated and quiet. The nearest market is six miles away, and there are no schools nearby.

The population of both villages is Muslim. Maru village is predominantly Fulani, while Kagara is predominately Hausa.

Crop production in both villages is typical of that described in Chapter I.

Age, Dependents, Education, and Literacy

All information contained in this and the following sections is based upon the interviews conducted in both villages; therefore all data pertain to the sample farmers from Saulawa and Kaura Duma quarters of Maru village and

from Kagara village. It should be borne in mind that only male-adult farmers of at least sixteen years of age were selected for interviewing.

It was desirable to collect basic information on age, dependents, education, and literacy for each sample, as these factors influence the communication and acceptance of recommended farm practices.

Table 12 presents basic information on age and number of dependents.

Table 12. Age and dependents of sample farmers.

	Saulawa	Kaura Duma	Kagara
Average Age	32.3	34.4	33.2
Range of Ages	18-67	20-60	17-55
Average Number of Dependents	4.4	4.5	3.5
Range of Dependents	1-12	0-9	0-9

Notes: A plausible explanation of the lower figure for average number of dependents in Kagara is the possible incidence of a higher infant mortality rate and the fact that Kagara sample farmers had fewer wives.

The low average age in all samples and the appearance of several farmers in their early twenties account for the lower figures for average number of dependents compared to the average family size of six to eight for all Northern Nigeria.

The only traditional education available in each village is instruction in Arabic. This is available to children of families who can afford it. Adult education classes to

teach literacy in Hausa have been organized by the Ministry of Information in both villages. Modern formal education is of fairly recent origin and available only to a select few. Table 13 summarizes the data on the educational background of the sample farmers.

Table 13. Kind of education of sample farmers.

	Saulawa		Kaura Duma		Kagara	
	No. of Farmers	%	No. of Farmers	%	No. of Farmers	%
Arabic	10	52.7	18	90	10	50
Adult Education	7	36.8	4	20	11	55
Junior Primary	1	5.3	2	10	0	0
Senior Primary	0	0	1	5	0	0
No education	7	36.8	1	5	4	20

These data confirm the fact that there has been a notable lack of formal education beyond language or religious training. Out of the thirty-nine farmers interviewed in Maru only four (or 10.3 per cent) had some elementary education. This fact is being mitigated somewhat by the rapid increase in enrollment begun in the 1960's. A second, more encouraging observation is the success of the adult education program in drawing a relatively high enrollment, especially in Kagara. The fact that 55 per cent of the Kagara sample farmers had participated in the program is evidence of a desire for education. The author is unaware of any explanation for the

variation of educational levels between the two Maru samples.

Farmers were also asked in which languages they were literate. Since no farmers were literate in English, answers pertained only to Arabic and Hausa. Table 14 summarizes this information.

Table 14. Literacy in Hausa and Arabic among sample farmers.

Language Literacy	Saulawa No. of Farmers	%	Kaura Duma No. of Farmers	%	Kagara No. of Farmers	%
Literate in Arabic	9	47.4	9	45	10	50
Illiterate in Arabic	10	52.6	11	55	10	50
Literate in Hausa	7	36.8	6	30	5	25
Illiterate in Hausa	12	63.2	14	70	15	75

Note: Data on literacy is partially diluted by the difficulty in measuring "effective" literacy. Both Arabic and Hausa literacy are subject to attrition through disuse. Therefore, these rates may be higher than they actually should be.

Of significance is the fact that literacy in Arabic is higher than in Hausa. This fact could be used to increase the effectiveness of the pilot project's extension programs which use posters and road signs printed in Hausa and English only. Literacy levels are much the same in each sample.

Inventory, Production, and Income Data

This section is a continuation of the general description of the two survey villages. The following data pertain to asset, production, and income magnitudes of the sample farmers.

An effort was made to assess various types of productive capital belonging to the farmers. Table 15 summarizes the results for the three sampling units.

Summarizing briefly, the data show that most farmers have two or more farms and two or more rumbus. Decorticators and bullocks for ploughing are scarce among each sample group, although the Sauiawa sample did turn up two farmers for both. (It was discovered during village introduction ceremonies that there were no mixed farmers in Kagara and only two decorticators.) Livestock production or ownership is very insignificant. However, several farmers own donkeys which they employ for transporting crops, manure, and other agricultural and household items. The average acreage per sample indicates that Sauiawa sample farmers are relatively better off in terms of farm size than are Kaura Duma and Kagara sample farmers.

Output data were collected for millet, guinea corn, groundnuts, and cotton. Farmers were asked how many bundles of guinea corn and millet and bags of groundnuts and cotton they harvested in 1964. Conversion was made into pounds after deducting for shelling and threshing loss. Since it

Table 15. An inventory of land, livestock, and capital belonging to sample farmers.

Inventory Classification	Saulawa	Kaura Duma	Kagara
	(Number of Farmers)		
Farms (number)			
1	2	1	6
2	8	9	6
3	6	5	6
4	2	5	2
5	1	0	0
Groundnut Decorticator (number)			
0	17	20	19
1	2	0	1
Rumbus (number)			
0	1	0	0
1	4	3	8
2	11	13	8
3	3	3	2
4	0	1	2
Bullocks (number)			
0	18	20	20
2	1	0	0
4	1	0	0
Cattle (number)			
0	15	18	18
1-2	3	0	1
3-5	0	2	1
6-9	0	0	0
10	1	0	0
Donkeys (number)			
0	13	7	13
1	5	11	4
2	1	2	3
Total Acreage per Farmer			
2	1	4	2
2 4	6	6	4
4 6	2	3	2
6 8	1	3	1
8 10	2	1	
10	1		
Average acreage	4.8	3.6	3

Note: Most farmers were unacquainted with the term "acre;" therefore, they were told how to estimate an acre in rough fashion. Nevertheless several farmers were still unable to estimate their acreage; in these cases no answer was recorded.

was not possible to obtain reliable acreage figures per crop, the output data shown here pertain to output per farmer.

Table 16. The average output per farmer of millet, guinea corn, groundnuts, and cotton.

Crop	Saulawa	Kaura Duma	Kagara
		(Pounds per Farmer)	
Millet	1302	1008	1242
Guinea corn	1245	1009	774
Groundnuts	752	383	528
Cotton	500	230	380

Note: A bundle of millet or guinea corn weighs on the average seventy pounds; bags of groundnuts and cotton weigh on the average 110 and 100 pounds, respectively. Variation in the weight of bundles is likely to have averaged out over the sampling unit.

Farmers who did not grow one or more of these crops were naturally not included in calculating the average output.

The higher output of all crops in the Saulawa sample is quite obvious and offers further evidence of the relatively higher standing of Saulawa farmers. Surprisingly, average output per farmer is higher in Kagara than in Kaura Duma for all crops except guinea corn. While this fact could be due to agronomic reasons, assuming close similarity in the size of farms, it is probably in part caused by the preoccupation of Kaura Duma farmers with other activities than farming. Furthermore, the larger average number of dependents in the

Kaura Duma sample may force farmers to allocate more land to food crops and less to cotton and groundnuts.

Seasonally hired labor plays an important role in crop production; therefore farmers were asked the amount of extra labor they hired in 1964, as well as the number of family members engaged on their farms. (Wage rates vary from thirty-four cents to fifty-eight cents per day depending on the kind of work.) Some farmers are unable to afford extra labor; however, the average farmer employs some hired labor during the peak-labor seasons. Wealthy farmers may use hired labor throughout the growing season.

Table 17. Hired and family labor for sample farmers.

	Saulawa	Kaura Duma	Kagara
	(Number of Farmers)		
Family labor (number)			
1	13	10	16
2	1	6	0
3	3	2	4
4	2	2	0
Hired Labor (number of man-days)			
0	7	9	10
(1-5)	0	3	1
(6-10)	1	2	2
(11-15)	3	1	0
(16-20)	2	3	3
(21-30)	4	0	4
(30)	2	2	0
Average Number of Man-days Hired	17.9	7.85	8.75

Note: Farmers by custom quote hired labor in terms of man-days worked; for example, a farmer would state: "two laborers twice," which meant four man-days.

These data illustrate once more the wealthier status of Saulawa farmers who could afford to employ more hired labor than their counterparts in Kaura Duma and Kagara.

Income data were collected for each farmer by asking how much was earned on the sale of groundnuts, cotton, millet, and guinea corn, and from other 'secondary' sources. None of the sample farmers sold any food crops; therefore, only income from the sale of groundnuts and cotton is given (Table 18).

Average income in the Saulawa and Kagara samples is quite similar; both samples show a significantly higher average income than is to be found in the Kaura Duma sample. The principal difference arises in the case of cash crops, which Kaura Duma farmers presumably slighted to grow more food crops.

Table 19 presents the various secondary occupations named by farmers.

Table 18. Average income per farmer from cash crop sale and secondary sources (in Nigerian pounds).

Income Source	Saulawa		Kaura Duma		Kagara	
	(N)[a]		(N)		(N)	
Groundnuts	(17)	£ 11-2-0	(18)	£ 7-10-0	(20)	£ 8-2-0
Cotton	(14)	£ 8-18-0	(17)	£ 3-12-0	(16)	£ 7-9-0
Average Income from Sale of Cash Crops	(19)	£ 16-10-8	(20)	£ 9-15-3	(20)	£ 14-1-8
Secondary Sources	(17)	£ 11-13-0	(11)	£ 9-16-0	(19)	£ 9-8-0
Average Income per Farmer from All Sources	(19)	£ 25-12-0	(20)	£ 15-3-0	(20)	£ 23-0-0

Notes: Farmers who did grow either groundnuts or cotton but reported zero income from them because of a poor harvest were still counted in calculating average income from the sale of cash crops.

The average income from farming was obtained by summing individual farm incomes and dividing by the total number of farmers in the sample. The average income from secondary sources was obtained by adding together all secondary incomes and dividing by the number of secondary income earners. The final average was obtained by summing all income sources and dividing by the total population.

In most cases stated farm income corresponded with the magnitude of output. However, farmers showed reluctance to reveal the size of earnings from secondary sources. The absence of permanent records also made it difficult to estimate these earnings.

[a](N) refers to the number of farmers reporting an income from the stated sources.

Table 19. Secondary occupations mentioned by sample farmers.

Secondary Occupations	Saulawa	Kaura Duma	Kagara
	(Number of Times Mentioned)		
Trading	9	3	12
Farm Labor	2		2
Begging	1		2
Tailoring	1	1	2
Fadama Farming			2
Butcher	4		1
Porter			1
Bicycle Rental			1
Blacksmith		2	
Arabic Teacher		1	
Musician		1	
Scribe		1	
Village Official		1	
Barber		1	
Shepherd	1		
Shoemaker	1		
Selling Firewood	3		

Note: Some farmers mentioned more than one secondary occupation.

CHAPTER V

ANALYSIS OF DATA PERTAINING TO KNOWLEDGE TRANSFER AND ADOPTION OF RECOMMENDED FARM PRACTICES

Objectives

A comparative study of Maru and Kagara farmers was intended to fulfill the following objectives:

1. To measure and compare the level of awareness of recommended practices.
2. To measure and compare the rates of adoption of recommended practices.
3. To measure and compare the extent of contact with extension programs and other sources of extension information.
4. To measure and compare farmers' comprehension of extension methods and materials.
5. To measure and compare farmers' comprehension of recommended methods of application of new farm practices.
6. To examine and evaluate farmers reasons for the non-adoption of recommended practices.
7. To examine and compare the attitude of farmers toward agricultural investment.

On the basis of these findings it was possible to describe and analyze the types of knowledge transfer problems which arise in a traditional agricultural environment when introducing technical change. It was also possible to

evaluate the locational and geographical effects upon the diffusion and adoption of agriculturally productive knowledge in the Gusau Pilot Extension Project area.

Awareness and Adoption of New Inputs

Rather than investigate all phases of the adoption process--awareness, interest, evaluation, trial, and adoption (or rejection)--it was decided to investigate only awareness and adoption levels. Information pertaining to these two phases could be easily gathered by interviewing; and furthermore, a knowledge of awareness and adoption levels would serve as a useful indicator of the effectiveness of the pilot project's extension programs.

Recommended farm practices were classified as new inputs--K-50 groundnut seed, Aldrex T seed dressing, superphosphate, ammonium sulphate, Gammalin A pesticide, and insecticide--and new husbandry (or cultural) practices--ridging, cross-tying, planting date, spacing and thinning rates, and sole planting. The investigation was facilitated by treating these two categories separately.

Tables 20 and 21 summarize the data pertaining to awareness and adoption of new farm inputs.

Table 20. Rates of awareness of new inputs, 1965.

Practice	Saulawa		Kaura Duma		Maru Total		Kagara	
	Farmers Aware of	%	Farmers Aware of	%	Farmers Aware of	%	Farmers Aware of	%
K-50	19	100	20	100	39	100	15	75
Seed Dressing	18	94.7	16	80	34	87.2	14	70
Superphosphate	19	100	20	100	39	100	19	95
Sulphate of Ammonia	18	94.7	16	80	34	87.2	5[a]	25
Gammalin A Pesticide	9	47.3	5	25	14	35.9	7	35
Insecticide	17	89.5	13	65	30	76.9	9	45

Note: With regard to awareness, an affirmative reply was recorded if farmers gave evidence of having heard about the particular input.

[a]Farmers in Kagara were confused about a second kind of fertilizer; this made it very difficult to interpret their responses. Only in clear-cut cases was an affirmative answer recorded.

Table 21. Rates of adoption of new inputs, 1965.

Practice	Saulawa		Kaura Duma		Maru Total		Kagara	
	Farmers Adopting	%	Farmers Adopting	%	Farmers Adopting	%	Farmers Adopting	%
K-50	12	63.2	7	35	19	48.7	0	0
Seed Dressing	12	63.2	11	55	23	58.9	1	5
Superphosphate	17	89.5	16	80	33	84.6	3	15
Sulphate of Ammonia	3	15.8	2	10	5	12.1	0	0
Gammalin A	3	15.8	3	15	6	15.4	3	15
Insecticide	2	10.5	2	10	4	10.3	0	0

Note: With regard to adoption, an affirmative reply was recorded only if the farmer had used the input in 1965. This procedure placed a check on farmers who used the input when it was free but failed to purchase it at regular prices. Only in a few instances did farmers use the input earlier but not in 1965.

The above data support the following observations:

1. Maru sample farmers showed a high overall rate of awareness of new recommended inputs; there was slight variation between the two Maru samples; and awareness rates in the Kagara sample were consistently below those of the Maru samples.
2. Awareness levels in all samples were highest for those inputs--seed variety, seed dressing, and superphosphate--introduced during the 1950's. (The other three inputs were introduced around 1962-1963; K-50 seed variety was introduced in 1962.)
3. There is a striking contrast in adoption levels between the Maru and Kagara samples with adoption among the Kagara sample farmers extremely limited.
4. Adoption levels in the Maru samples are high for K-50, seed dressing, and superphosphate and low for sulphate of ammonia, Gammalin A, and insecticide.
5. The only significant difference between Saulawa and Kaura Duma is in the adoption of K-50.

Some general conclusions may be drawn from the previous observations. First, results in Kagara confirm the ineffectiveness of the extension programs existing in the Eastern Division of Sokoto prior to the pilot project's establishment. Some extension contact has been made in Kagara in previous years, but it has been limited and uncoordinated and has not

affected adoption rates. Secondly, the pilot project has been very effective in getting farmers to adopt K-50, seed dressing, and superphosphate. Results were not as good for the other three recommended inputs. Thirdly, there appears to be a higher rate of adoption of those inputs that were introduced during the 1950's. Finally, even in Maru, awareness levels are not 100 per cent, except for two inputs, and there is variation in awareness levels between the Saulawa and Kaura Duma ssmples. This would indicate that the pilot project efforts are somewhat localized in a large village and that knowledge of new practices is not conveyed to all farmers even over two or more years.

The Use of Superphosphate Fertilizer

The introduction of artificial fertilizers is an important part of the pilot project's extension programs. Superphosphate is recommended on all four crops under discussion. Since superphosphate was used by a large percentage of Maru sample farmers and by three Kagara farmers, they were asked to identify the crops on which they applied it. Table 22 summarizes these replies.

The general observations to be made from these data are that the use of superphosphate is largely concentrated upon groundnuts and that most farmers apply it on one crop only. These results make sense in light of the fact that the extension service has for many years stressed the importance of fertilizing groundnuts. Thus, while the pilot project

Table 22. The use of superphosphate by farmers in 1965.

	Saulawa	Kaura Duma	Kagara
	(Number of Farmers)		
Applied On:			
Groundnuts	15	14	2
Cotton	0	3	1
Millet	1	5	0
Guinea Corn	1	2	0
Applied On:			
One Crop Only	15	9	3
Two Crops	1	6	0
Three Crops	0	1	0

hes succeeded in getting farmers to use superphosphate on groundnuts, it has been much less successful in convincing farmers to use it on their other crops. This may be partially explained by the fact that fertilizing groundnuts is the most profitable use of superphosphate. Furthermore many farmers put farmyard manure on their food crops, thus reducing the need for superphosphate. Also many fermers who plant cotton too late may realize that fertilizing would be barely economic.

The disparity of results between Saulawa and Kaura Duma is notable. Farmers in Keure Duma, perhaps being more enxious to ensure en adequate food crop output, may be more prone to use superphosphete on their food crops. It could also be possible that the comperative costs between farmyard manure and artificial fertilizer favor the use of superphosphate.

Awareness and Adoption of Recommended Cultural Practices

The recommended cultural practices of interest to this study were sole planting, ridging of millet and guinea corn, cross-tying, spacing of groundnuts and cotton, and earlier planting and thinning of cotton. It became evident after a few interviews that answers pertaining to awareness and adoption of these cultural practices were far less explicit than those answers pertaining to new inputs. For example, a farmer might sole plant a crop without being aware that sole planting was a recommended cultural practice; the same applies to other cultural practices such as thinning and spacing. It was therefore decided that direct responses would be sought from farmers with regard to their own practice. A high rate of conformity between actual and recommended practice would be a sign that extension had made an impact; the converse would be an indication of little extension influence. There are a few gaps in the data because of dubious replies to questions or no replies at all.

The pilot project encourages farmers to sole plant all crops. Traditional practice is to interplant nearly all crops. Table 23 shows the frequency of sole planting versus interplanting for 1964 and 1965.

Table 23. Sole planting versus interplanting, 1964 and 1965, and crops sole planted.

	Saulawa		Kaura Duma		Kagara	
	1964	1965	1964	1965	1964	1965
	(Number of Farmers Sole Planting)					
Level of Sole Planting						
1 Crop	9	11	8	7	6	6
2 Crops	3	4	5	7	4	6
3 Crops	1	1	1	1	3	2
4 Crops	0	0	6	5	0	0
No Crops	6	3	0	0	7	6
Crops Sole Planted						
Groundnuts	10	11	13	14	4	4
Cotton	5	9	12	9	5	6
Guinea Corn	2	2	14	15	8	7
Millet	0	0	6	6	5	5

The above information led to the following observations:

1. Cropping patterns differed significantly among all samples.
2. Since nearly all farmers did plant four crops, the rate of interplanting was significant, although it was far from being overwhelming.
3. Saulawa and Kagara farmers showed a higher incidence of interplanting than did farmers in the Kaura Duma sample.
4. Saulawa farmers concentrated on sole planting groundnuts and cotton, while Kaura Duma and Kagara farmers sole planted food crops as intensely as cash crops, except for millet in Kaura Duma.

In light of these findings the one possible conclusion is that Kaura Duma farmers have been more progressive in adopting sole planting, although Saulawa farmers have also picked up sole planting of groundnuts, and to a lesser extent cotton. Undoubtedly, traditional practice, size and location of farms, and available labor play a major role in influencing cropping patterns.

The extension recommendations on ridging apply to millet and guinea corn, as most farmers already ridge groundnuts and cotton. Cross-tying applies to all crops, but especially to groundnuts and cotton. Farmers were asked whether they ridged on millet and guinea corn and whether they put in cross-ties on cotton and groundnuts in 1965. Table 24 summarizes the results of this questioning.

Table 24. Ridging and cross-tying practices, 1965.

Practice	Saulawa		Kaura Duma		Kagara	
	No. of Farmers	%	No. of Farmers	%	No. of Farmers	%
Ridging on Millet and Guinea Corn	8	44.5	4	21.0	0	0
Ridging on Guinea Corn Only	0	0	3	15.8	1	5
Ridging on Neither	10	55.5	12	63.2	19	95
Cross-tying Cotton and Groundnuts	18	94.7	17	85	8	40
Cross-tying Neither	1	5.3	3	15	12	60

It may be observed that ridging was most practiced among Sauiswa farmers and least practiced among Kagara farmers. The same trend appeared with respect to cross-tying, although the differences were not as pronounced. Many farmers in Kagara explained that waterlogging made these two practices inappropriate on their farms.

There are three possible explanations for failure to ridge and put in cross-ties: (1) lack of knowledge of the importance of the practices, (2) lack of available labor or money to hire labor to adopt these practices, and (3) agronomic or hydrologic reasons. It is therefore difficult to make any definite conclusions as regard the introduction of these two practices. Tentatively, it is perhaps safe to say that the pilot project has convinced Maru farmers of the importance of these practices and that adoption of them

witnesses this fact, especially in the case of cross-tying. Fewer farmers ridged than put in cross-ties, which would indicate that they still remained unconvinced that the additional output from ridging paid for the extra labor cost. Kagara farmers probably reflected all three reasons for not adopting these practices.

Earlier planting of cotton is indispensable to higher crop yields. Most farmers traditionally plant cotton during late July and throughout August after the peak-labor period of June and July. The extension service recommends planting before July 15 since this is the crucial time; however, cotton planted in June does best of all, especially if it is sprayed with insecticide. Farmers who planted cotton in 1965 were asked when they planted it. Many farmers could only give approximate dates; therefore, it was attempted to specify the month of planting only. Table 25 presents this information.

Table 25. Planting date for cotton planted in 1965.

Date	Saulawa		Kaura Duma		Kagara	
	No. of Farmers	%	No. of Farmers	%	No. of Farmers	%
June	11	65	5	29	11	55
July or August	6	35	12	71	6	30
Tried to Plant Earlier					3	15

Saulawa and Kagara farmers planted substantially more cotton in June than did Kaura Duma farmers. Three farmers in Kagara replied that they had tried to plant cotton earlier, but it was not determined in which month they actually planted it. An agricultural maliam who had conducted a crop demonstration on groundnuts and guinea corn in Kagara in 1964 had apparently stressed the importance of earlier planting of cotton. Field observation of cotton plots in Kagara attested to the fact that farmers were generally planting this crop earlier. In conclusion, it would appear that the major obstacle to the adoption of earlier planting of cotton is not lack of knowledge of its importance but is lack of time, labor, and money for carrying out the practice. This is a case where result demonstrations and extension programs can easily show the potential of the recommended practices, but where adoption is blocked by tradition and lack of resources.

Farmers were also asked how many cotton plants did they usually leave per stand. The recommended thinning rate is two, although two to three seems equally popular among some extension workers. Table 26 presents this information.

While thinning rates varied, there was a preponderance of farmers in all samples naming two to three as their actual practice. Since some extension workers do tell farmers that thinning to two to three is satisfactory depending on agronomic and botanical factors, this rate is probably acceptable.

Table 26. Thinning rates on cotton.

Rate	Sauiawa	Kaura Duma	Kagara
		(Number of Farmers)	
1-2	2	1	1
2-3	13	10	9
2-4	1		1
3-4		2	
4-5			1
2	1	1	2
3	1	5	4
4		1	2

In any case farmers definitely prefer it to thinning to two only. The traditional practice has been to leave too many plants per stand; however, thinning rates have probably varied widely. Extension programs have probably been effective to some degree in standardizing this practice at two to three.

It was attempted to compare farmers' spacing rates on cotton and groundnuts to recommended rates. This part of the research plan resulted in inconclusive evidence, however, because of the author's failure to separate interplanted and sole planted crops. Therefore, the data had to be discarded.

Farmer Contact With Extension Programs

The pilot project tries to confront farmers with a great many extension programs in order to increase the frequency and intensity of contact with recommended farm practices. The purpose of this phase of the village interviews was to measure and compare the extent of farmers' contact with extension programs and other sources of extension information. As part of the interviewing, farmers were asked to identify the source of their initial acquaintance with recommended farm practices. Table 27 presents the findings of this questioning.

Table 27. Sources of information on farm practices mentioned by farmers.

Information Source	Saulawa		Kaura Duma		Kagara	
	No. of Farmers	%	No. of Farmers	%	No. of Farmers	%
Extension Worker	17	89.5	18	90	9	45
Demonstration	6	31.6	1	5	10	50
Other People	7	36.8	8	40	17	85
In the Market	1	5.3	3	15	6	30
Village Head	5	26.3	2	10	4	20
Saw on a Farm	1	5.3	5	25	5	25
Young Farmers' Club	5	26.3	2	10	0	0
Sales Agent	4	21.4	2	10	0	0
Agricultural Show	1	5.3	0	0	0	0
Cinema	2	10.5	0	0	0	0
Pamphlet	0	0	0	0	3	15

Note: Many farmers mentioned one source several times; however, this source was counted only once.

Answers were not categorized but recorded verbatim; therefore a few sources, such as "other people" and "in the market," overlap.

The significance of these data was in the contrast of answers given in Kagara and Maru. In Maru approximately ninety per cent of the farmers interviewed mentioned at least once (and actually many times) the extension worker as an original source of information about a recommended practice. Furthermore, Maru farmers mentioned a relatively greater number of sources of information than did Kagara farmers. In Kagara less than half (45 per cent) of the farmers sampled mentioned the extension worker, while 85 per cent mentioned "other people" at least once, compared to slightly less than 40 per cent in Maru. Half of the Kagara sample mentioned first seeing a particular practice on one of the few result demonstrations that have been carried out in Kagara. This was significant in that the extension service can expect to reach many farmers with even a small program when working in a relatively small village like Kagara. Otherwise, these results showed the overall success of the pilot project (and to a certain extent previous extension programs) in Maru in reaching the people directly and through several diverse channels.

As a second phase of this survey of contact with extension programs, farmers were asked to enumerate the number of their contacts in 1965 with result demonstrations, educational meetings, farm tours, and village cinema programs. Because of the absence of a full-fledged extension program in Kagara, most of this information was pertinent to Maru only.

There are usually twelve to fourteen result demonstrations conducted in Maru Village each year; several educational meetings are carried out before and throughout the growing season. Mobile cinema units visited Maru twice in 1964 and 1965. Finally, each year a group of thirty to fifty farmers is taken to visit government or Native Authority farm centers. In contrast about the only true extension contact in Kagara in 1965 was with an untrained agricultural mallam who conducted result demonstrations on guinea corn and groundnuts.

Since questioning was carried out in October and November, most extension activities had been concluded; therefore, the answers given at that time presented a fairly accurate picture of overall contact with extension programs.

Table 28. Individual farmer contact with extension programs in 1965.

Type of Program	Saulawa		Kaura Duma		Kagara	
	No. of Farmers	%	No. of Farmers	%	No. of Farmers	%
Result Demonstrations (number visited)						
0	3	15.8	9	45	10	50
1	4	21.1	5	25	10	50
2	3	15.8	2	10		
3	2	10.5	3	15		
4	7	36.8	1	5		
Educational Meetings (number attended)						
0	8	42.1	15	75	20	100
1 or more	11	57.9	5	25	0	0
Farm Tours						
1965	2	10.5	1	5	0	0
before 1965	2	10.5	3	15	0	0
Village Cinema						
Attended	18	94.7	13	65	0	0
Not Attended	1	5.3	7	35	20	100

It is plainly evident that an average farmer in Maru is much more exposed to extension programs than his counterpart in Kagara. However, because of the small size of Kagara, a fair percentage of sample farmers had come into contact with the result demonstrations established there in 1965. In Maru itself, the farmers of the Sauiawa sample showed a greater degree of contact with extension programs than did farmers in the Kaura Duma sample. Of the farmers in the Sauiawa sample 84.2 per cent visited at least one result demonstration, compared to 55 per cent in Kaura Duma. The respective figures for attendance at educational meetings for Sauiawa and Kaura Duma are 57.9 per cent compared to 25 per cent. The village cinema showings have been quite popular with farmers; and this is confirmed by the high percentages in both quarters of sample farmers seeing a cinema showing in 1965. In conclusion, the Gusau Pilot Project has been able to make extensive contact with farmers in Maru, although differential rates of contact between Sauiawa and Kaura Duma quarters were evident. The chief explanation for any disparity arises mainly from the more intensive work of the extension service in Sauiawa and the greater preoccupation of farmers in Kaura Duma with non-farming activities.

Comprehension of Extension Methods and Recommended Practices

Farmers who are illiterate and uneducated may have difficulty understanding simple instructions on how to apply a new practice; or similarly, they may not respond to extension

materials such as posters, pamphlets, etc. because they fail to understand the contents or message of the material. Such occurrences can undermine an extension program and farmers' confidence in a recommended practice or in the extension worker.

Two types of questions were used to measure farmers' comprehension of extension methods and recommendations. Farmers who had used artificial fertilizer, seed dressing, or Gammalin A pesticide were asked to explain their method of applying the ingredient. If the farmers' answers were consistent with the recommended application procedure, then knowledge transfer had been successful; if their methods deviated from recommended application, then knowledge transfer had been unsuccessful. Secondly, farmers were asked to identify parts of posters being used by the extension service. Failure to correctly identify a poster's message or content was interpreted as a potential roadblock to successful knowledge transfer and a sign of communication breakdown caused by a disparity in educational levels.

Farmers are told to apply fertilizer by either placing it in their old furrows and then splitting their old ridges to form new ridges over the fertilizer or to place the fertilizer with three fingers and a thumb three inches from the newly germinated plant. Seed dressing should be mixed with seeds in the ratio of three mudus of seed to one packet of seed dressing. Instructions on applying Gammalin A include careful cleaning of rumbus and application of a box of

Gammalin A to each layer of stored bundles. Table 29 summarizes the data pertaining to farmers' comprehension of recommended methods of applying fertilizer, seed dressing, and Gammalin A. A "yes" answer indicates a correct procedure, while a "no" means a wrong method of application was used by the farmer.

Table 29. Farmers' comprehension of recommended methods of application of fertilizer, seed dressing, and Gammalin A.

Practice	Saulawa		Kaura Duma		Kagara	
	No. of Farmers	%	No. of Farmers	%	No. of Farmers	%
Fertilizing						
Yes	12	75	8	40	3	100
No	4	25	12	60	0	0
Seed Dressing						
Yes	2	16.7	7	63.6	1	100
No	10	83.3	4	36.4	0	0
Gammalin A						
Yes	3	100	3	100	2	100
No	0	0	0	0	0	0

Limited adoption among Kagara farmers prevented any meaningful conclusions. It was learned, however, that one of the leading village councillors of Kagara was broadcasting superphosphate over his field and even placing it on top of the germinated plant. This does not suggest very successful knowledge transfer. However, the three sample farmers who used superphosphate all used the placement method of application correctly, although at least one of these farmers applied superphosphate later than he should have. Three Kagara

farmers reported using seed dressing as a house dust against insects rather than applying it to seeds to protect against disease.

In Maru the Saulawa farmers showed a higher percentage of correct answers for fertilizer application than did Kaura Duma farmers. Many farmers of the latter quarter were placing fertilizer right next to the plant or broadcasting it over their farm. Many Saulawa farmers gave two to one or four to one as their actual ratio of mudus of seed to Gammalin A. While deviating from the recommended ratio, this is not as serious an error as the wrong application of fertilizer. Kaura Duma farmers were relatively more successful in following the correct procedure of seed dressing application. All farmers applying Gammalin A used the correct method of application.

From the above findings, it is possible to conclude that definite problems do exist in getting farmers to understand and follow recommended methods of application of various practices.

The second part of the investigation of comprehension of extension methods and recommendations focused on farmers' comprehension of posters. The posters which were used in the experiment are shown in Figures 4, 5, and 6. They have been used in the pilot project for the last two years. For each poster the farmer was asked to identify the operation being performed and several individual aspects of the poster.

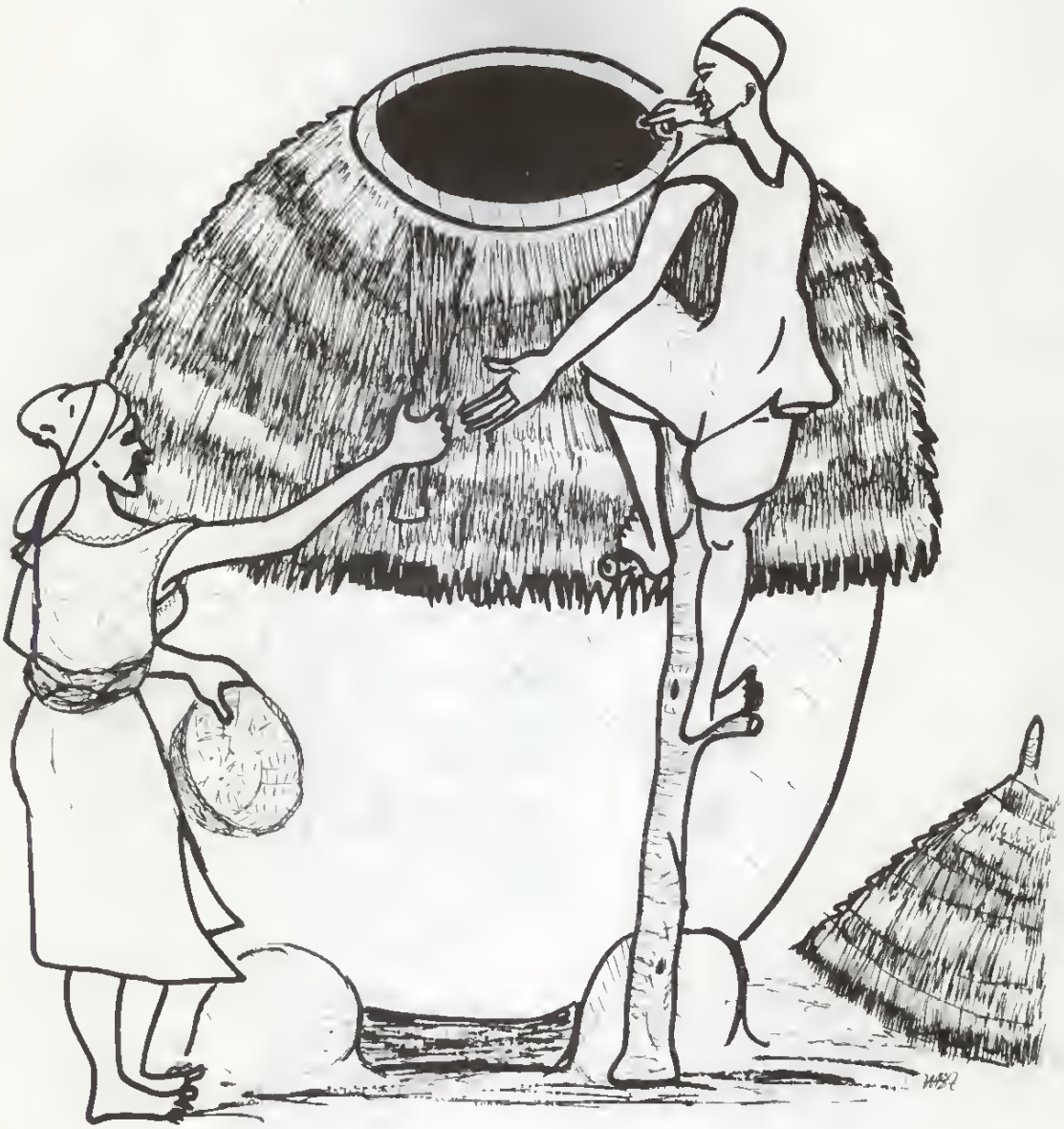

Fig. 4. Poster showing man preparing to clean a grain storage *rumbu*.

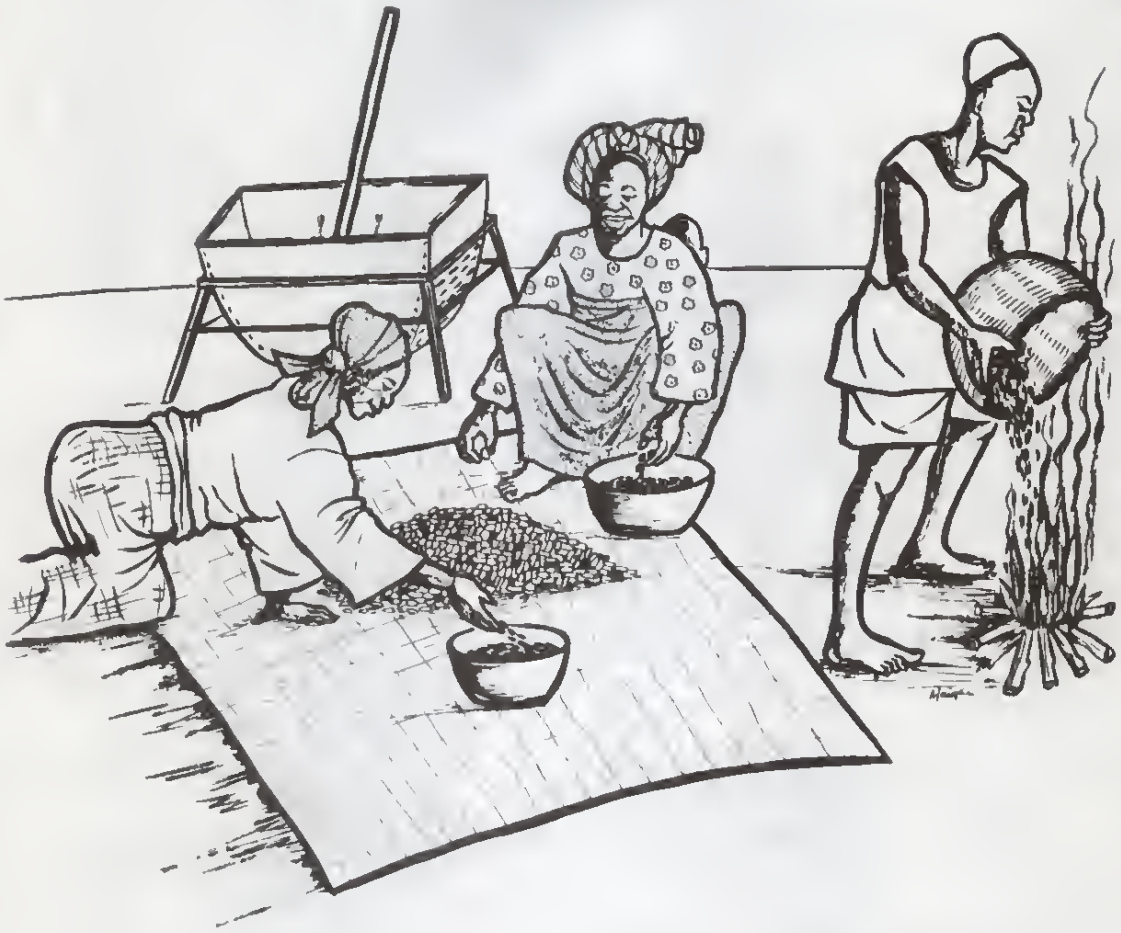

Fig. 5. Poster showing women separating groundnuts and man burning the bad nuts.

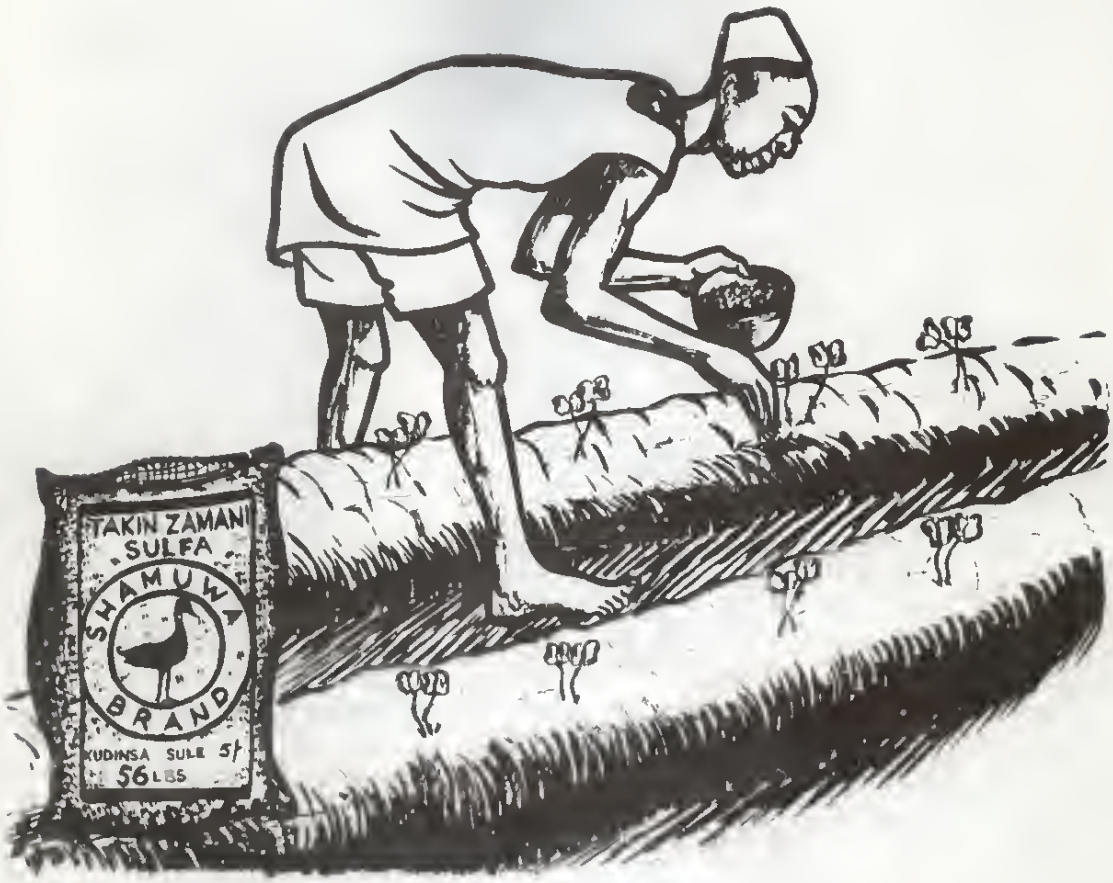

Fig. 6. Poster showing man applying ammonium sulphate fertilizer on cotton by placement method.

For example, in a poster showing a man burning bad groundnuts and women sorting the bad from the good decorticated nuts, farmers were asked to identify the decorticator, the fire, and the work of both man and women. Table 30 gives the number and percentage of right and wrong answers for Maru farmers only since poster identification in Kagara was experimental and yielded inconclusive results. A "yes" answer signifies a correct response; a "no," an incorrect response.

There are two possible roadblocks to comprehending the message in these posters. The first is the farmer's lack of acquaintance with pictorial representation; the second is the artistic quality of the poster in making clear what is to be conveyed. The broom in poster (1) is a good example of the latter type of problem. Results between Saulawa and Kaura Duma farmers did not differ substantially. However, farmers showed a good deal of difficulty understanding the contents and message of each poster. Rates of identification of objects were relatively higher than the recognition rates of the "operation" being performed in the poster, e.g. a higher percentage of farmers identified the bag of fertilizer in poster (3) than identified the man's work. This problem poses a serious challenge to the extension service to develop posters, pamphlets, and flip charts which farmers can easily comprehend and follow.

Table 30. Poster identification by Saulawa and Kaura Duma farmers.

Poster	Saulawa		Kaura Duma	
	No. of Farmers	%	No. of Farmers	%
(1) Grain Storage				
Rumbu				
Yes	12	60	11	55
No	8	40	9	45
Woman				
Yes	12	63.1	16	80
No	7	36.9	4	20
Broom				
Yes	8	40	7	35
No	12	60	13	65
Operation				
Yes	6	30	5	25
No	14	70	15	75
(2) Groundnuts				
Decorticator				
Yes	14	70	15	75
No	6	30	5	25
Fire				
Yes	2	10	11	55
No	18	90	9	45
Women's Work				
Yes	11	55	8	40
No	9	45	12	60
Man's Work				
Yes	4	20	5	25
No	16	80	15	75
(3) Fertilizer				
Ridges				
Yes	2	10	0	0
No	18	90	19	100
Bag of Fertilizer				
Yes	13	65	15	75
No	7	35	5	25
Man's Work				
Yes	9	45	2	10
No	11	55	18	90

Reasons Given for the Non-Adoption of Practices

Farmers who indicated awareness of a recommended practice but who failed to adopt the practice or to apply it in all its uses were asked their reason for not doing so. This questioning did not take account of the fact that farmers may not have reached the stage in the adoption process at which a practice is adopted or rejected. Thus many farmers, not having reached this stage, may have felt obliged to give a superficial reason before having really had time to make up their minds. Nonetheless the pattern of the replies still revealed some factors impeding knowledge transfer and adoption of new farm practices.

The lack of an effective extension program in Kagara prevented any conclusive interpretation of farmers' replies as to why they did not adopt a practice. Most Kagara farmers said that lack of supply was the reason for not adopting new inputs such as fertilizer, seed dressing, etc. Similarly, it proved too difficult to collect answers with respect to recommended cultural practices, except for sole planting and ridging. Because of these problems only results from Maru village are presented. Tables 31 and 32 summarize these results for Saulswa and Kaura Duma.

The differential rates of adoption should be borne in mind when examining these figures. Sauiawa farmers, with a slightly higher rate of adoption of most practices, counted fewer in number in this questioning. Also, it should be

Table 31. Reasons given by Kaura Duma farmers for the non-adoption of recommended practices.

Reasons for Non-adoption	Practice							
	K-50	Seed Dressing	Super-phosphate	Ammonium Sulphate	Gamma-lin A	Insect-icides	Sole Planting	Ridging
	(Number of Times Mentioned)							
Lack of Money	4	3	12	9	1	6	2	14
Lack of Supply	5	2		1		1		
Uncertainty over Results	1							
Confusion over Use		2	3	5		1		
No Need for		4			1	2		2
No Time (to buy or do)		1	3	1				
Already Satisfied	2							
Tradition								1
Lack of Land							5	
Greater Output							1	
Depends on Crops and Land							3	

Note: Answers were recorded verbatim.

Table 32. Reasons given by Saulawa farmers for the non-adoption of recommended practices.

Reasons for Non-adoption	Practice							
	K-50	Seed Dressing	Super-phosphate	Ammonium Sulphate	Gamma-lin A	Insect-icides	Sole Planting	Ridging
	(Number of Times Mentioned)							
Lack of Money		2	4	5	1	6		7
Lack of Supply	8		2	1		2		
Uncertainty over Results		2	1	2	2			
Confusion over Use		1	3	4				
No Need for		1	3		2			
No Time (to buy or do)		1			1	1		4
Already satisfied							2	1
Tradition							6	
Lack of Land							7	
Greater Output								
Depends on Crops and Land								

Note: Answers were recorded verbatim.

kept in mind that some answers may overlap, e.g., lack of money in the case of ridging could be interpreted as a lack of labor, in which case the farmer might have replied that he had "no time."

These data lead to the following observations:

1. Lack of money and lack of supply, ostensibly, were important reasons for non-adoption. (In the case of K-50 groundnut seed a lack of supply was corroborated by pilot project extension supervisors.)
2. Lack of money was a relatively more serious problem among Kaura Duma farmers. (This fact is substantiated by the figures on farmers' income in these quarters.)
3. There was a substantial number of farmers who were dubious or confused about the use and value of the recommended inputs. (Several farmers thought that superphosphate was used only on groundnuts and that ammonium sulphate was used only on cotton.)
4. Sole planting is unacceptable to most farmers because they feel that they get a greater output from interplanting.
5. Lack of money and lack of labor are barriers to ridging millet and guinea corn.

The most significant conclusion to be drawn from these findings is the fact that several farmers still remained ignorant of the use and value of some of the recommended practices in spite of the intensive efforts made by the pilot

project. This is due in part to the failure of some farmers to inform themselves about the recommended practices by attending educational meetings and participating in similar extension programs. However, part of the problem lies in the communication barriers which are educational and cultural in nature, e.g., farmers' problems in interpreting extension posters.

The many farmers who indicated that lack of money was their reason for not adopting a practice probably reflected the low rate of savings among farmers, especially in Kaura Duma, and the high cost of borrowing. However, it is also possible that some of these answers only reflected the lack of farmers' knowledge about the value of the recommended practices. This is especially likely in light of the fact that many of the recommended inputs are not expensive. This does, however, indicate a major barrier to technical change in a subsistence-based agriculture: that is, the difficulty of measuring the returns to investment in new practices when output is not measured in dollar terms but in bags or bundles which have no true market value for the subsistence farmer.

Finally, these findings support the conclusion that the research service has not adequately investigated the advantages and disadvantages of sole planting versus interplanting. Until more conclusive evidence is made available the farmer will continue to interplant the majority of his crops and the extension service will continue to make futile efforts on practices which require farmers to abandon interplanting.

Farmers' Attitudes Toward Agricultural Investment

To examine and compare farmers' attitudes toward agricultural investment, each farmer was asked how he would spend £50 if it were given to him as a gift, no strings attached. Answers were recorded verbatim and later categorized in six classes: (1) household and personal, including clothing, building and repairs, bride price, and household goods; (2) food, which included food for the family and for hired laborers; (3) business and trading, which included expenditures on such vocations as tailoring, butchering, hauling, etc., and for trading in food and other items; (4) education, including Islamic training, elementary schooling, and books; (5) livestock, which included any expenditure on livestock, except for bullocks for mixed farming, and expenditures to feed and house livestock; and (6) farming, including expenditures on farm supplies, labor, land, and bullocks.

Table 33 gives the number of farmers mentioning items falling into the various categories and also gives the total amounts which they would allocate to those categories. Table 34 shows the breakdown of expenditures on farming.

These data led to the following basic observations:

1. Maru farmers were more favorable toward agricultural investment than Kagara farmers who favored commercial investments.
2. There were no other significant differences among samples.

Table 33. The allocation of £ 50 by sample farmers by expenditure category.

Category	Saulawa			Kaura Duma			Kagara		
	Farmers Mentioning	Amount Allocated	%	Farmers Mentioning	Amount Allocated	%	Farmers Mentioning	Amount Allocated	%
Household and Personal	8	£ 111	11.7	10	£ 157	15.7	10	£ 159 5/6	17.9
Food	8	£ 86	9.1	7	£ 105	10.5	12	£ 107 1/3	11.9
Business and Trading	4	£ 105	11.1	5	£ 80	8.0	14	£ 330	36.9
Education	0	£ 0	0	5	£ 49	4.9	0	£ 0	0
Livestock	12	£ 185	19.5	7	£ 76	7.6	11	£ 185	20.7
Farming	17	£ 463	48.7	17	£ 533	53.3	6	£ 113	12.6

Note: It was impossible to contact one Kagara farmer to complete this phase of the interviewing.

Table 34. The allocation of farming expenditures by farming category.

Category	Saulawa		Kaura Duma		Kagara	
	Farmers Mentioning	Amount Allocated	Farmers Mentioning	Amount Allocated	Farmers Mentioning	Amount Allocated
Land	11	£ 127 1/2	13	£ 285	2	£ 17
Labor	8	£ 106	8	£ 56	4	£ 41
Bullocks	6	£ 110	1	£ 20	1	£ 20
Fertilizer, Seed Dressing, and K-50	5	£ 16	8	£ 40 1/2	1	£ 5
Farming Operations	7	£ 90 1/2	9	£ 100		
Manure	1	£ 9	1	£ 5		
Bullock Ploughing	1	£ 3	2	£ 13		
Tools and Equipment	1	£ 1	2	£ 13 1/2		

3. The largest amounts of money in each sample were placed in investment goods rather than consumer goods.
4. Investment in education carried a low priority in all samples.
5. Kaura Duma farmers would devote a large portion of their agricultural expenditures to buying more land. (This substantiates the economically inferior position of Kaura Duma farmers versus Saulawa farmers.)
6. Many farmers were interested in hiring more labor. (Labor is also hidden in the category "farming operations.")
7. Maru farmers showed substantial interest in investing in new inputs--bullocks, fertilizer, seed dressing, and K-50.

The major conclusion to be drawn from these findings is that Maru farmers are more impressed with the investment opportunities in agriculture than Kagara farmers. To exactly what degree this can be attributed to the pilot project would be difficult to say. It is, however, quite probable that the extension efforts being made have brought hope and encouragement to Maru farmers, thus ameliorating the farmers' attitudes toward their primary occupation--farming.

Secondly, it would appear that farmers in Maru desire to expand the scale of their farming operations in order to maximize their welfare. There is no doubt that using bullocks

on larger farms will raise the farmer's productivity; it would be, however, a more dubious proposition that farmers will gain more by expanding the size of their operations rather than by investing in new farm practices.

CHAPTER VI

CONCLUSIONS AND SUMMARY

In writing out the major conclusions which were drawn from this study, the author has attempted to suggest some guidelines to the efforts being made to stimulate agricultural development in Northern Nigeria, and especially in the Gusau Pilot Extension Project. The conclusions which follow pertain to the stated objectives as set down in Chapter II.

With regard to knowledge transfer problems arising from the lack of education of farmers and of extension workers, this study drew the following conclusions:

1. Illiteracy and lack of formal education are not insurmountable barriers to the communication and acceptance of new farm practices. They do, however, impose certain problems to the transmission of knowledge.

Forced to depend on a group-contact approach, the Gusau Pilot Extension Project faces definite communication problems. These problems include farmers' inability to completely understand the ideas conveyed by pictures; farmers' unfamiliarity with concepts like "acre" and "yield;" the superficiality with which farmers view a demonstration, e.g., associating higher yields on a result demonstration with only one or two practices of a "package" of new practices or being misled by the size of the heads on a guinea corn demonstration; farmers' confusion over the use of a new practice, e.g., many farmers thought that superphosphate was applied

on groundnuts only, or the recommended procedure for applying a new practice.

Farmers who hear a new idea second-hand, or even first-hand, by word of mouth and hear the idea only a few times are bound to misunderstand to some extent what was said. This fact is confirmed in the findings of this study. In a static culture this problem is probably worse than in a culture which is entirely adjusted to change, especially in its economic life. The nature of this problem requires a long-run program of education to raise farmers' literacy levels and understanding of the environment in which they live. For the short run, more intensive contact with the farmer promises the most success in securing the adoption of new farm practices.

2. Lack of education and of training hinder the performance of agricultural instructors and agricultural mallams. This conclusion is the opinion of extension supervisors of the pilot project. These two categories of extension workers are less adept at employing extension materials and conducting extension programs and often fail to understand the "why" behind an idea or new practice. This does not imply, however, that these workers do not serve a useful purpose; to the extent that they can carry out instructions, agricultural instructors and mallams fulfill a vital role. It would appear, however, that a secondary education and two years of agricultural training are the long-run educational requirements for training effective extension workers.

With regard to knowledge transfer problems arising from the organization, extension methods, and extension materials of the pilot project, the major problem arises in connection with the maintenance of an adequate supply of new inputs which are available to the farmer; and this is not really so much of an "extension" problem.

Lack of farm experience makes all grades of extension workers less cognizant of the nature of the farmers' problems and occasionally results in a condescending attitude toward farmers. Furthermore, some problems in carrying out the annual work plan have arisen because of lack of initiative and responsibility of extension workers.

There is a need for studies on the educational value of cinema shows since these are able to gain wide audience appeal.

The pilot project could also make use of itinerant subject-matter specialists who could visit all the pilot projects to be established.

The organization of extension programs is probably one of the best possible as all extension activities coincide with the farmers' work schedule. As has already been mentioned, extension materials, e.g., posters and flipcharts, and extension methods, e.g., result demonstrations, are subject to a certain amount of misunderstanding by the average farmer. There is room for improvement in the use of these materials and methods; and more careful evaluation of their effectiveness could pay long-run dividends.

The findings of this study supported several conclusions with regard to knowledge transfer problems created by a conflict between the recommended farm practices and agricultural or economic factors of the traditional agricultural economy. In this connection the traditional practice of interplanting most crops interferes with the adoption of several recommended practices. This problem is aggravated by the lack of knowledge about the merits of interplanting versus sole planting. Certainly, the large majority of farmers believe that they optimize their output or minimize their risk by interplanting. This is a problem which the research service needs to investigate thoroughly.

Secondly, a major problem involves the traditional pattern of subsistence production. Subsistence production forces farmers to adhere to an inflexible cropping pattern, and this sorely affects the yields on both cotton and groundnuts. The strict sequence of planting crops further impedes the adoption of practices on cotton and groundnuts and also of labor-intensive practices, e.g., ridging and cross-tying. Subsistence production, whereby the farmer concentrates on three, and usually four crops, probably reduces the chances of farmers employing all the recommended practices on any one crop. Finally, production for subsistence probably makes it more difficult for farmers to evaluate the yield-increasing potential of recommended practices since returns are not measured in monetary terms. (This would be more true for food crops than for cash crops.)

It is probably harder to get a farmer to adopt a new husbandry practice than to adopt a new input. The former requires a definite break in previous farm practices while the latter requires only an addition to what is already being done. Furthermore, farmers are generally more impressed by a new input than they are by a new husbandry practice. However, there are other causes for the non-adoption of new cultural practices which are of equal importance, if not more important than the "tradition" argument. The extra labor involved in weeding more frequently or ridging can deter a farmer from carrying out these practices.

There are a few new inputs which are beyond the means of most farmers. These would include the purchase of bullocks, of a groundnut decorticator, of a cotton sprayer, and of insecticide. Greater availability of credit would allow more farmers to adopt these inputs, although other problems, such as lack of land in the case of mixed farming, always exist.

With regard to geographical and locational barriers to knowledge transfer, the most striking fact is the wide disparity in adoption rates between Maru and Kagara farmers. This leads to the conclusion that the impact of the pilot project has been highly localized. (It is also quite obvious that previous extension work carried out in Kagara village has netted very meager results.)

Awareness levels in Kagara were fairly high, yet farmers had made hardly any adoptions of new inputs or of new cultural

practices, with the exception of earlier planting of cotton. One problem which hinders adoption in Kagara is the lack of supply of new inputs, even though Kagara farmers are only twenty miles from Gusau. However, three sample farmers were able to purchase superphosphate, and it is known that seed dressing and Gammalin A pesticide were available in the local market, which is six miles from Kagara. Therefore, a second problem must be the lack of sufficient extension efforts to convince farmers to adopt the recommended practices.

There is further evidence of a localized effect of extension work in Maru village. Saulawa farmers showed slightly higher awareness and adoption levels than Kaura Duma farmers and also a higher rate of participation in extension programs. This leads to the conclusion that village size has an important role in the communication of new ideas. The pilot project might possibly consider decentralizing its extension programs in a large village like Maru, such that each village quarter would be more actively involved.

Cultural and motivational factors also influence the communication and acceptance of new ideas. The most important finding of this study relevant to these aspects was the different attitudes between Maru and Kagara farmers toward agricultural investment. Maru farmers were overwhelmingly in favor of investing in agriculture, while Kagara farmers favored commercial investments. This may be due in large part to the impact of the pilot project which has successfully demonstrated the large potential returns to better

farming practices.

Next, there are certain cultural factors which impede the transmission of new ideas. One of these is a certain laxity on the part of some farmers in seeking out information about recommended practices. The Maru extension worker stated that very few farmers call upon him for advice; and extension supervisors reported that village leaders are slow to recognize problems and to suggest solutions. Furthermore, the fact that awareness levels for certain practices are not at a high level, even after two years of extension publicizing, suggests that channels of communication in villages are not as effective as would be supposed.

Finally, the problem of cultural isolation is very significant in impeding knowledge transfer. This is best illustrated in the case of Kagara farmers who remain isolated in their village, while only twenty miles away in Gusau supplies and knowledge are available which could greatly increase their agricultural productivity. This is in part a cultural phenomena since most farmers do not consider or dare venturing into a foreign environment. This is another problem which can best be overcome by education.

With regard to the extent and type of farm practices being adopted by Maru sample farmers, it was found that there was a quite satisfactory rate of adoption of practices pertaining to groundnut production (84.6 per cent of the sample farmers applied superphosphate, and the large majority applied it on groundnuts; the percentage of farmers using K-50

groundnut seed, 48.7 per cent, probably would have been higher if more supply had been available.) Adoption of ammonium sulphate, Gammalin A pesticide, and insecticide has been very limited for reasons already mentioned. These items should receive more emphasis in future extension programs.

In general the adoption of cultural practices has been mixed. It appeared, however, that there is a tendency toward adoption of these new practices and that what is blocking their adoption is principally economic and agricultural factors. For instance, many farmers are sole planting groundnuts and cotton, although they are not sole planting as much millet and guinea corn. It appeared that farmers were trying to plant cotton earlier but that this is impeded by the traditional labor pattern. Some farmers have ridged their millet and guinea corn crops; however, the majority complained about the high labor cost of ridging. On the other hand, cross-tying groundnuts and cotton has been widely accepted.

Kagara sample farmers showed a very low rate of adoption of recommended inputs. This is due primarily to the lack of an effective extension program in Kagara and lack of supplies of new inputs. The earlier planting of cotton was the primary practice adopted as a result of the minimum amount of extension work in Kagara village.

Finally, the findings of this study support the conclusion that the Gusau Pilot Extension Project has been largely successful. Awareness and adoption levels among

farmers in a cross-sectional sample of two quarters of Maru village were satisfactory overall. Furthermore, there is definite interest among farmers in raising their agricultural productivity as evidenced by participation in extension programs and adoption of new practices. Village leaders have also expressed strong approval of the ambitions of the pilot project.

Educational, economic, agricultural, and cultural barriers impede the communication and acceptance of new farm practices by lesser and greater degrees according to the kind of practice or extension method used. Nonetheless, significant advances have been made in getting farmers to adopt new practices, which is the most important step. More extension activity should increase the levels of adoption, especially if supported by better credit, marketing, and supply facilities.

Lack of education and of training in the extension ranks have been largely overcome by providing close supervision and programs of in-service training. Lack of education and illiteracy among farmers have been satisfactorily met by providing intensive, group-contact extension programs. While the majority of farmers are out of reach of written publications, method and result demonstrations repeated several times are proving to be effective in teaching farmers.

In summary, the traditional agricultural system of Northern Nigeria poses many problems to the transfer of agriculturally productive knowledge. In the long run higher

average levels of formal education will increase the farmers' receptiveness to new ideas. For the immediate period it is necessary to emphasize extension educational programs in order to raise agricultural productivity. However, the barriers to adoption of recommended farm practices within a traditional agricultural system are often more complex than those in a commercial agricultural economy which is accustomed to change. Therefore, it is necessary to align programs of extension and research with the conditions which exist in the traditional economy. The efforts of the Gusau Pilot Extension Project have reflected to a large extent the planning and organization which is necessary for successful knowledge transfer in Northern Nigeria.

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A CASE STUDY OF KNOWLEDGE TRANSFER IN THE GUSAU PILOT EXTENSION PROJECT OF NORTHERN NIGERIA

by

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Economists have of late been exploring the role of investment in farm people as a means of transforming traditional agriculture. In this regard the efforts of the Ministry of Agriculture of Northern Nigeria to raise agricultural productivity by launching two "pilot" extension projects should be regarded with special interest by economists.

The purpose of this study was twofold:

1. to investigate problems of transferring agricultural knowledge in the traditional agricultural economy of Northern Nigeria; and
2. to evaluate the role of the Ministry's Gusau Pilot Extension Project in transferring agricultural knowledge to the farmer.

Personal interviews were conducted in two villages--one (Maru) a participant in the pilot project and the second (Kagara) a non-participant. Additional data were collected from extension headquarters in Gusau.

The pilot project maintains a ratio of one extension worker per two thousand farm families (compared to 1:28,000 for Northern Nigeria as a whole in 1958). Close technical supervision and in-service training programs also strengthen its effectiveness. Concentrating upon millet, guinea corn, groundnuts, and cotton, its extension program uses a package approach in introducing recommended practices (categorized here as new inputs--K-50 groundnut seed, seed dressing, superphosphate and ammonium sulphate fertilizers, insecticide, Gammalin A pesticide--and new cultural practices--spacing and

thinning rates, planting dates, ridging, cross-tying, and sole planting).

Village interviews produced the following general findings:

1. Low educational and literacy levels prevailed in both villages.
2. Extension contact, awareness, and adoption levels were substantially higher among the Maru sample farmers than among Kagara sample farmers.
3. Maru sample farmers showed a keen desire to invest in agriculture while Kagara sample farmers did not.
4. Lack of money, of supply of inputs, and of knowledge were frequently mentioned reasons for non-adoption.
5. Most farmers had difficulty identifying the contents of extension posters.
6. Several farmers did not understand the proper use or application of some practices.
7. In Maru 84.6 per cent of the sample farmers used superphosphate in 1965, 58.9 per cent used seed dressing, 48.7 per cent used K-50, 15.4 per cent used Gammalin A, 12.1 per cent used sulphate, and 10.3 per cent used insecticides.
8. Farmers tended to select from the recommended package of practices those practices to which they attributed the higher yields.

The following findings pertain to the overall work of the Gusau Pilot Extension Project:

1. The pilot project has made intensive contact with all participating villages.
2. Result demonstrations clearly evidence the superiority of "package" recommendations to traditional practices.
3. Adoption of practices by farmers who carried out result demonstrations has been high, except for cotton.
4. Farmers have favored recommendations on groundnuts.
5. The extension staff has performed effectively when given close supervision and in-service training.

The following general conclusions emanated from these and other research findings:

1. Lack of education and illiteracy are not insurmountable barriers to achieving the adoption of relatively small agricultural innovations.
2. Lack of education and illiteracy can be overcome by a well-organized extension program which makes intensive contact with farmers.
3. Extension materials and methods are subject to a certain degree of misinterpretation by farmers because of cultural and educational differences.

4. Secondary schooling is the minimum requirement for producing good extension workers, although less-educated personnel can play an important role in extension.
5. Most of the research findings being passed on to farmers are capable of yielding high returns if adopted *in toto* and are within the average farmer's reach.
6. Better supply facilities will raise adoption rates for new inputs.
7. Certain recommended practices because of conspicuousness and compatibility with the existing agricultural system are more readily adopted than practices not possessing these attributes.
8. There are grounds to believe that an effective extension program has a stimulating effect upon the attitude of farmers toward agricultural progress.