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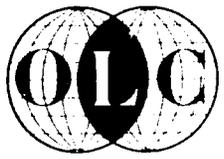


Inter-Disciplinary Research on Rural Development

The Experience of the Rural Economy
Research Unit in Northern Nigeria

by

David W. Norman
Rural Economy Research Unit
and
Agricultural Economics Department
Ahmadu Bello University
Zaria, Nigeria



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Preface

Although he is only 34 years old, Dr. David Norman has already made a major impact on agricultural economics research in Africa, and on a legion of students whom he has "touched". He is a quiet and dedicated scholar who has been working at Ahmadu Bello University over the past nine years.

After David Norman completed his Ph.D. in Agricultural Economics at Oregon State University in 1965, he joined Ahmadu Bello University and launched the Rural Economy Research Unit (RERU). RERU has utilized an inter-disciplinary approach to the organization and conduct of village studies. When Dr. Norman and his colleagues laid out the research program for RERU, they noted that policy prescriptions on how to increase the output on small farms in the Northern States of Nigeria were not supported by socio-economic research findings. The results of RERU's village level studies now provide a solid underpinning for policy prescriptions for small farmers in northern Nigeria. Also, RERU's findings have helped redirect the priorities of technical agricultural researchers at the Institute of Agricultural Research at Ahmadu Bello University and have encouraged researchers to supplement their experiment station testing with research at the farm level. Finally, RERU's publications are now standard references on how to organize socio-economic research in rural areas of Africa.

Dr. Norman's approach to research - from the bottom up - is consistent with the theme - Development From Below - of the Ethiopia field trip/workshop on Rural Development for which this paper was prepared in October, 1973. The participants in the field trip/workshop strongly urged the bilingual publication of Dr. Norman's paper.

The OLC is honoured to publish Dr. Norman's paper and to call attention to his numerous publications which are cited in the bibliography of the paper.

Carl Keith Eicher, Chairman
Overseas Liaison Committee
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"The hallmarks of an interdisciplinary study are that it seems overpriced, it shows that everything depends on everything else, (and that) nobody really understands what it says!"-P.A. Morrison, Rand Corporation.

I. INTRODUCTION*

The term interdisciplinary approach and rural development are frequently used in the developing world. The phrase rural development can, and in fact is, defined in many ways and can include all aspects of rural life. In a meeting in West Africa rural development was defined as the "process whereby a series of quantitative and qualitative changes brought about within a given rural population result in improved living conditions for the population through an increased production capacity" (UNESCO, 1970).

*This paper was originally prepared for the Development From Below Field Trip/Workshop which was held in Ethiopia from October 12-20, 1973. The permission of the Director of IAR to publish this paper is gratefully acknowledged.

Discussion in this paper is limited to agriculture although it is appreciated that its development is influenced to a great extent by other facets of rural development, e.g., infrastructural development (roads, health and educational facilities), and non-agricultural employment opportunities in rural areas (Byerlee and Eicher, 1972).

Rural development is a complex process involving the solution of technical, ecological, economic and social (human) problems with limited administrative, financial, and manpower resources. Rural development projects have often been carried out in Africa in a milieu in which knowledge about how to solve problems has been absent or at the best limited or ill-conceived (Baldwin, 1957). Implementation of integrated rural development involves many disciplines while knowledge required to solve the problems of development also crosses discipline boundaries. These disciplines often have "symbiotic" relationships with each other. Therefore the tendency for each discipline to work in isolation from others is increasingly giving way to a cooperative approach. There is a move away from a multi-disciplinary approach (which implies researchers from more than one discipline who do not necessarily communicate with one another) to that involving an inter-disciplinary emphasis (which implies greater integration of disciplines through joint projects). It is unfortunately probably true to say the inter-disciplinary approaches have generally been more successful in the implementation stage rather than the knowledge accumulation (research) stage of rural development. This is possibly due in part to the fact that, unlike the individuals involved in implementation who are faced with day to day realities of rural development, the research worker who is often academically orientated in a single discipline makes great efforts to preserve what he considers the "integrity" or "supreme relevance" of his discipline which is not "softened" by his contact with the practical realities.

There has been an increasing number of pleas for inter-disciplinary approach to research in the developing world. Lipton (1969, 1970)

has forcefully argued for an inter-disciplinary approach because of the inability of conventional economic theory, based on a profit maximisation goal, to adequately explain the behaviour of traditional farmers in the developing world. Two possible explanations for this are: first, the profit maximisation goal may be conditional on a strategy which has both economic and non-economic connotations, i.e., security which can be interpreted as producing sufficient food for the family on the farm without recourse to the market (Norman, 1967-72); or secondly, the profit maximisation goal may be ignored and the crop not grown for essentially non-economic reasons, e.g., the refusal of some Moslem farmers to grow a profitable crop--tobacco--in parts of northern Nigeria due to religious scruples. Supporting Lipton, Roling (1966) has convincingly argued on theoretical grounds for an inter-disciplinary approach to the village studies on the part of social scientists, particularly economists and sociologists. He also notes that rural sociology is very important in the early stages of development prior to the emergence of "economic man" (Blair, 1971). In general economists are being accepted as having an important role to play in the developing world and more agricultural research institutions are including them on their staff. However the role of the rural sociologist or social anthropologist has been more difficult to sell.¹ Roling (1966) implies and De Wilde (1967) states that this has in part been due to the reluctance of many such individuals to focus on relevant research, e.g., on those facets of human behaviour of particular

¹For example even in the international research centres, i.e., CIMMYT, IITA, IRRI, CIAT, etc., economics is more strongly represented than sociology.

relevance to agricultural innovation (UNESCO, 1970) and defining the priorities of the traditional system (Collinson, 1968).¹ De Wilde (1967) also mentions the importance of the inter-disciplinary approach not only between different disciplines in the social sciences but also between the social sciences and the technical sciences involved in agriculture.

The objective of this paper is:

- (a) To describe the evolution of the inter-disciplinary research programme of the Rural Economy Research Unit (RERU) of Ahmadu Bello University in the northern part of Nigeria.
- (b) To examine some of the problems of farmers in the northern states of Nigeria, which have become apparent through the research work undertaken by RERU.
- (c) To discuss in the light of (b) the types of programmes that could result in improving agricultural incomes under the present administrative and financial constraints in the area.

II. BACKGROUND TO THE INSTITUTE OF AGRICULTURAL RESEARCH AND RERU

Research work by technical scientists on agricultural problems was initiated by the Department of Agriculture in the northern part of Nigeria in 1924. In 1957 this research became the responsibility of the Research and Specialist Division of the Ministry of Agriculture of the Northern Region of Nigeria. The Institute for Agricultural Research and Special Services (IAR) was established when this division was transferred from the Ministry of Agriculture to the Ahmadu Bello University

¹See also Mosher (1964)

(ABU) in October, 1962.

The Institute is responsible for carrying out agricultural research for the six northern states in cooperation with the Ministry of Natural Resources in each state. Administratively the research arm of IAR is divided into a number of departments which are further subdivided into sections on the basis of discipline. Many members of the departments have split teaching (in the Faculty of Agriculture) and research (in IAR) appointments. Such an arrangement permits the complimentary effects of teaching and research to be exploited while at the same time ensuring that research funds are available to academics to do research relevant to the needs of the country.¹

In addition IAR has a distinct extension arm, the Extension and Research Liaison Division (ERLS) which serves as a link between the research staff and the extension workers in the Ministry of Natural Resources in each of the six northern states.

In terms of size the IAR now has a senior staff establishment of 220 positions and an annual budget of over ₦3,000,000.² In terms of the social scientists in IAR, the first were appointed under the auspices of RERU in 1965, with the initial support coming from a Ford

¹Some academics resent the idea of "directed research" as an infringement on academic freedom. However this author believes that the developing world cannot afford the luxury to finance work not relevant to development problems. Whenever possible encouragement should be given to using the intellectual talent and available financial resources to work on priority research problems. It is unfortunate that in some academic circles, such talents are not fully utilized due to lack of finances for supporting research. This constitutes a big advantage of the administrative set up at IAR, ABU.

²That is approximately US \$4,500,000.

Foundation grant.¹ Since then financial support for social science research has increased substantially under the auspices of the Agricultural Economics Department which has continued most of the research work initiated by RERU. At present 10.5 percent of the research senior staff positions in IAR are in the social science area, while social science research accounts for 8.3 percent of IAR's research budget.

III. DETERMINING RESEARCH PRIORITIES IN THE INSTITUTE OF AGRICULTURAL RESEARCH

One of the biggest problems has been, and still is, how to decide what factors agricultural research should focus on, i.e, what is the most relevant research in terms of encouraging rapid agricultural development. The following steps have been taken by the IAR, to develop a relevant research program and a close working relationship with the government:

- (a) The membership of the Board of Governors of the IAR, which is chaired by the Vice Chancellor of ABU, is dominated by prominent agriculturalists working in Ministries of Natural Resources in the states. The Board establishes broad policy guidelines for research and has the final word in approving the estimates and research programme.
- (b) The Professional and Academic Board of the IAR, whose chairman is the Director of the IAR, draws up the detailed research programme within the guidelines given by the Board of Governors. It consists of department and section heads of IAR plus the provost of agriculture, deputy directors, and staff representatives.

¹Such a time discrepancy between the appointment of the first technical and social scientists, i.e., in this case 41 years, is alas typical of most agricultural research institutes in Africa.

(c) Financial estimates drawn up by the various departments of the IAR are approved by the Professional and Academic Board before being transmitted to the Board of Governors. The research programme is drawn up by a number of sub-committees of the Professional and Academic Board which are mainly organised on a crop basis. Membership of these sub-committees is open to anyone who is involved in research considered by the committee in question. Representatives of RERU and the Extension and Research Liaison Division (ERLS) are represented on all these sub-committees. As well as encouraging an inter-disciplinary approach to problems and initiating plans for the research programme, these sub-committees act as a first step in assessing the suitability of proposed recommendations which must eventually be approved by the Professional and Academic Board before being disseminated to farmers through the ERLS.

IV. RESEARCH PROGRAMME OF RERU

RERU and later the Agricultural Economics Department have used an inter-disciplinary approach in their research programme which draws on the disciplines of rural sociology, geography and agricultural economics. Two basic underlying factors have been taken into consideration in determining RERU's research programme:

(a) Rural development programmes in the northern states in general have emphasized working with the farmer within his traditional setting rather than moving him to irrigation schemes, settlement schemes, etc. Voluntary participation and working largely within the traditional setting necessitates research that seeks to obtain an understanding of the problems and constraints faced by farmers at the village level.

(b) The desirability of deriving a micro rather than a macro-oriented

research programme. The reasons for the micro emphasis were:

- i. There is a paucity of accurate data at the village (micro) level in the northern states.
- ii. Expertise at the macro level is available at other Nigerian socio-economic research institutions.
- iii. The work of technical researchers and extension specialists at IAR can best be complimented by such village or micro level studies.

There is, of course, nothing new about advocating such micro-oriented studies. Many research workers have strongly urged them to be undertaken (Bunting, 1970; Eicher, 1968; Belshaw and Hall, 1968) in order to help determine what changes should be introduced and how they should be introduced.

V. FOUR PHASES OF RERU'S RESEARCH PROGRAM

RERU has adopted a basic work plan of village studies which consists of four phases.¹ These are:

- (a) Positive phase, i.e., determining what farmers are doing.
- (b) Hypothesis testing phase, i.e., determining why farmers do things in the way they do.
- (c) Normative phase, i.e., determining what farmers ought to do.
- (d) Policy phase, i.e., determining how the changes suggested under phase (c) should be brought about. This may also involve a consideration of phase (b) to determine whether the suggested policy is in conflict with the farmers' reasons for doing things in the traditional way.

¹It is of course appreciated that there is likely to be considerable overlapping in terms of timing between the four phases, but conceptually it has proved to be a useful division.

Much of RERU's research during the 1965-71 period concentrated on the positive and hypothesis testing phases. With this foundation derived from the "basic studies", emphasis is now shifting more and more towards "change studies" which concentrate particularly on the normative and policy phases.

Conceptually the types of research work carried out by RERU and the degree of inter-disciplinary work involved can be considered as follows.¹

Basic studies

These studies seeking to describe, explain and understand the agricultural environment have concentrated to a great extent on very detailed village studies in five different areas of the northern states. Inter-disciplinary research work has been confined to cooperation among social science disciplines, i.e., geography, rural sociology and agricultural economics. Not all the work has been inter-disciplinary in nature although initial demographic and land utilization analysis was usually done cooperatively and efforts were made to ensure that research done by different disciplines fitted into the aims of the RERU research programme.

Change studies

These studies seek to assess the potential value of the technology that is being produced by the research workers and to assess the value

¹A brief summary of the actual studies undertaken by RERU appears in Appendix A while a list of publications emanating from that work is available elsewhere (RERU, 1973).

of the various programmes that have been used and are to be used in introducing change. The research programme of change studies can be divided into three broad groups:

(a) Assessment, at the farmers' level, of the recommendations put out by IAR to determine their technical feasibility, economic profitability, and social acceptability. This approach is usually single crop enterprise in orientation, e.g., cotton, maize, while emphasis is laid on investigations at the farmers' level rather than on the experimental station. One of several reasons for this is the false picture given of the value of the recommendation under experimental conditions where managerial levels are so much higher (Table 1) than found under village farming conditions. For example, Table 1 reveals that maize yields of farmers are 322 lbs. per acre as compared with 8000 lbs. per acre under IAR experimental station results. Although research is only just commencing in this area there are already promising results:

- i. The inter-disciplinary nature of the research is proving to be very valuable. As well as cooperation between the social and technical disciplines at IAR, government has been willing to provide financial assistance and extension workers for the projects thereby confirming the relevance of this work in assisting their agricultural programs.
- ii. These studies are getting the technical scientists off the experimental stations onto farmers' fields where they can see with their own eyes the problems faced by and the strategies employed by the farmers. This could have a long run impact in the determination of even more relevant research priorities.

Table 1. Examples of inputs, yields and net returns per acre of crops under different conditions in the North Central State of Nigeria^a

Crop	Indigenous practices ^b	Demonstration plots ^c	RERU working with farmers ^d		Experimental station ^e
Sorghum:					
Yield (lbs.)	701	991	1097		3000
Costs (₦) ^f	0.40	2.87	2.81		11.48
Net return (₦)	17.84	22.90	25.71		66.52
Hours	134	154	154		
June - July hours	47	53	53		
Maize:					
Yield (lbs.)	322		2136	3512	8000
Costs (₦)	0.44		3.34	14.31	17.13
Net return (₦)	7.29		47.92	69.98	174.87
Hours			367	552	
June - July hours			133	298	
Groundnuts:					
Yield (lbs.)	524	869	933		1500
Costs (₦)	1.41	2.28	1.94		7.52
Net return (₦)	15.87	26.40	28.85		41.81
Hours	217	247	247		
June - July hours	101	107	107		
Cotton:					
Yield (lbs.)	190	457	438	746	1300
Costs (₦)	0.09	7.05	7.48	7.48	15.52
Net return (₦)	6.75	9.40	8.29	19.38	31.28
Hours	138	94	206	305	
June - July hours	28		58	69	
Millet/Sorghum:^g					
Yield (lbs.)	ML 320 SG 685				
Costs (₦)	3.83	Not available			
Net return (₦)	26.34				
Hours	247				
June - July hours	59				

- Blanks in the table indicate information is not available. Costs and net returns exclude labour costs. Fertiliser is costed at subsidised prices. Prices of products used represent those prevailing in 1966-67. They are now much higher for cash crops.
- Used as indigenous practices in Table 2. Maize was not used since it is not a common crop. Other crop enterprises not listed in the table were also used. Most of these were crop mixtures.
- Used as improved technology in Table 2(b). These figures were obtained from demonstration plots carried out on farmers fields by extension workers in North Central State.
- Used as improved technology in Table 2(a).
- These estimates were obtained from discussions with technical scientists at IAR and represent what is average on the experiment station.
- One Naira (₦) is approximately equal to \$1.50 (US).
- Recently research workers at IAR have been looking at some crop mixtures under experimental conditions. Much of this work undertaken by Andrews, De Wolf, Kassam, and Baker has still to be published.

iii. The doubtful validity of recommendations based purely on experimental station results has increasingly been recognized by the Professional and Academic Board of IAR which has now approved of the idea in principle that whenever possible and where relevant, potential "recommendations" should be tested at the farmers' level before being finalized.¹

(b) Assessment of government programmes to introduce change among farmers. With reference to mechanisation De Wilde (1967) has noted the tendency to repeat mistakes because there is no proper and easily accessible recording and analysis of past experience. The same criticism can be applied to many other government programmes which often have little idea of the benefit/cost ratios involved.² RERU is commencing a number of such studies which will involve a considerable amount of cooperation from government in terms of provision of information. To date little difficulty has been experienced in this regard but it is anticipated that government may be reluctant to release financial information.

(c) Assessment and evaluation of different ways of introducing change. This study which is the proposed culmination of much of RERU's work will seek to determine the best operational way to bring about betterment of incomes from rain-fed agriculture when faced with the administrative, financial and manpower constraints experienced by government. The project which will involve knowledge accumulation through implementation

¹It is recognised however, that this must not result in undue delay in finalising the recommendation.

²One could argue that assessment of such programmes should be done by planning units in government. Unfortunately these are poorly developed in the northern states at the present time.

will involve both social, i.e., extension, rural sociology and agricultural economics, and technical scientists, and also government which will provide the field extension workers.

In summary, the inter-disciplinary nature of RERU's research programme is much more evident in the "change studies" which involve several social and technical disciplines, than in the "basic studies" which are confined to social science cooperation.¹ In addition it has been easier to obtain financial and manpower support from government for the "change studies", in which they can soon see definite results, than it has been for the "basic studies". Finally RERU, is now beginning to be involved in the implementation stage of governmental projects. For example, RERU is represented on the Rural Development Bureau Committee² of North Central State.

VI. OVERVIEW OF RERU'S MAJOR FINDINGS: PROBLEMS FACED BY FARMERS IN THE NORTHERN STATES OF NIGERIA

Before being able to determine ways of helping the farmer improve his income it is important that his problems are understood so that

¹There is little doubt that it is often easier to work with disciplines that are completely different from ones own, e.g., the human element in agricultural economics compared with its absence in entomology, than one which is closely allied, e.g., the human element in rural sociology and agricultural economics. Presumably this is because allied disciplines often overlap and have different ways of looking at the same thing, while disciplines which are completely different look at different things. It is therefore even more essential that people of allied disciplines working together have an appreciation of each other's discipline and are also compatible in terms of personality.

²This consists of representatives of several ministries in North Central State; it is concerned with bringing about a coordinated approach to rural development.

strategies can be designed to overcome them. The studies carried out by RERU have helped highlight some of the problems farmers face in the northern parts of Nigeria.¹ It is impossible to consider these in detail but a few can be summarised under four main headings which are inter-related and cannot be considered in isolation.

(1) Low investment in Traditional Agriculture

Investment in traditional agriculture tends to be low for two main reasons: first, the supply of funds for investment is small since savings from the farmers' low incomes are minimal, credit from institutional sources has in the last few years been almost non-existent, and credit from local moneylenders is costly (Vigo, 1965); second, the returns from investment are low, partly because many forms of capital goods can be formed directly from labour, e.g., land improvements, hand tools, etc. and partly because the low level of technology greatly reduces the productivity of capital goods, e.g., investment in fertilizer without better seeds or management, compared to the returns in a technologically advanced agriculture. The result of the low investment means the level of technology remains low and few inputs are purchased.

The problem of low returns from investment can be partially overcome with adequate extension contact and a "package deal" approach to the adoption of improved technology. The problem of increasing the supply of investment funds from savings is, initially at least, difficult.

¹It is appreciated that many of these problems were already known but these studies have given empirical support for those which were previously based on "conventional wisdom" statements.

A consumption study undertaken by Simmons (1973) has verified that savings are low.¹ This problem is accentuated by the recent tendency for the traditionally preferred complex family units (gandaye) breaking up into simple family units (iyali) with more young decision-makers, who may be more open to change, but are less able to provide the necessary savings, due to young family responsibilities (Buntjer, 1970; Goddard, 1969; Hedges, 1963). A credit programme may therefore be essential to encourage greater investment in agriculture.

(2) Land and labour allocation

Since capital inputs are very low in traditional agriculture, production is mainly limited by the amount and quality of land available and the amount of labour provided by the farming family.

The land tenure system is often cited as being a critical bottleneck to initiating change in traditional agriculture. In most parts of Nigeria, land is legally a communal asset, and individuals only possess usufructuary rights to that land. However, it is apparent that inherited land is considered to be very secure (Goddard, 1972). Therefore, it is unlikely that the land tenure system itself is a critical constraint on the willingness of farmers to invest in improvements in the land. However, under the present system land cannot be used as collateral and, as a result, farmers cannot usually obtain loans from commercial organisations. This makes it difficult for government lending agencies to take any punitive action for default

¹This is implied by comparing expenditure patterns derived by Simmons with incomes estimated in other studies using the same farmers (Norman, 1967-1972).

in payment. One cannot help but think that the lack of a viable credit system for small farmers and low potential returns from investment are more critical constraints on the expansion of agricultural output than the land tenure system.

There are, of course, other problems in the existing land tenure system such as rigidity in the distribution and use of land and fragmentation of farm holdings. However, in general, farmers in the northern states find that the amount of land their family can cultivate is not limited by the availability of land but rather by the labour they can supply to cultivate it (Ogunfowora, 1972; Norman, 1970). Since little hired labour is employed, the labour supply is essentially from family sources. Capital goods which could substitute for labour, i.e., herbicides, oxen, etc., are very seldom used because of the lack of technical know-how and the unavailability of funds.

The unavailability of capital to purchase new types of technology such as improved seed, fertilizer, etc., is likely to be even more critical in a few parts of northern Nigeria, e.g., Kano State where high population densities have caused land to be more limiting than labour. Increasing agricultural production on the extensive margin, i.e., through increasing acreage, is no longer possible.¹ Instead future increases in agricultural production in such areas can only be achieved through

¹Helleiner (1966) has noted that this has been the traditional way Nigerian farmers have responded. Buntjer (1973) has obtained empirical evidence that farmers responded to higher cotton prices in this manner rather than adopting the improved technology available for growing cotton.

increasing the productivity of land.¹ Any substantial increases in land productivity can only be brought about by new technology, most forms of which cost money. Where such new technology is not available, e.g., parts of North West State, there is no option but for individuals to migrate seasonally (Goddard, 1973) and then permanently out of the area.

(3) Seasonal Labour Constraints

The pronounced seasonal variation in rainfall means that agricultural activity in the northern states reaches a distinctive peak during the weeding period in June and July. There is little activity during the dry season (November to April) when only low lying land (fadama) can be cultivated. The amount of upland (gona) a family can handle during the June-July period determines to a great extent their level of agricultural activity during the rest of the year. The restricted agricultural activity during the dry season means farming families often supplement their incomes with rural non-farm jobs, e.g., traditional crafts, services, etc. Ready cash is most available after the cash crops have been sold, i.e., mainly December and January. Because of the slackening of work activities during the dry season, most of the cash is spent and little is left for purchasing improved inputs, e.g., seed, fertiliser at the beginning of the rainy season, i.e., April and May, and for hiring labour during the weeding bottleneck period, i.e., June and July.

¹Boserup (1965) has hypothesised that population pressure is very important in the adoption of land intensification types of improved technology.

(4) Low Incomes and Risk Aversion

The above three problems (which is by no means an exhaustive list) lead to low farm incomes. Often it is assumed in economic theory that people wish to maximise profits. However, where incomes are low and spent largely on consumption, farmers are unlikely to take risks. Farmers in the northern states of Nigeria give priority to the provision of family food requirements and are cautious about introducing new crops and patterns of production.¹ The goal of most farmers in the northern states is one of profit maximisation subject to a risk constraint.²

(5) Implications of these problems

Some of the implications are as follows:

- (a) Research workers should bear in mind the following when determining their research priorities.
 - i. For many farmers labour, particularly seasonal, rather than land is the major constraint on increases in production. This supports research which seeks to break the weeding bottleneck in June and July (e.g., herbicides, oxen) and innovations which do not require greatly increased labour inputs, particularly during that period.

¹As far as the farmer is concerned there is an element of risk attached to any change from the traditional ways of doing things which have ensured his survival (Wharton, 1969).

²Under certain circumstances these two goals may not be in conflict. For example, there is some evidence that growing crops in mixtures under indigenous technological conditions is consistent with these goals (Norman, 1973).

ii. Because of low incomes and limited managerial capacity¹ it follows that innovations which are very profitable, dependable and cheap (because the margin of their incomes over subsistence levels is very small) are most likely to be adopted (Wharton, 1969). This supports the idea of research that will fulfill these conditions. Unfortunately as Jones (1960) and Eicher (1968) have emphasized, "single trait" innovations are rare and consequently research workers are usually pushed towards advocating the more complex "package" type of approach (Milliken and Hapgood, 1967).

(b) Government agencies concerned with rural development in the northern states should bear in mind:

- i. The problems that prevent the small farmer from increasing his income are many and complex. There is, because of limited resources and administrative capacity, no hope of the government being able to solve all the problems. The challenge facing the government is to decide which are the major constraints on raising incomes and then to devise viable policies and programs to overcome these constraints.
- ii. When improved technology is available, government needs to concentrate on three broad priorities: policies to convince and encourage farmers to change; programmes to

¹Little can be taught the farmer on how to improve his farming operations under indigenous conditions; however he is not familiar with improved technology and requires extension assistance.

ensure that the farmers will be able to purchase the inputs to bring about change; and programmes to deliver the inputs in sufficient quantities at the right time and in the right place.

VII. STRATEGIES TO IMPROVE AGRICULTURAL INCOMES

The remarks at the end of the previous section implied that the adoption of new technology was the only way to improve incomes from agriculture. Before considering this possibility in more detail it is necessary to establish that this is indeed the main approach that should be emphasized. Wharton (1968) has observed that in general two broad approaches can be used in bringing about agricultural development. These are:

- (a) Those which rely upon making fuller use of existing unrealised opportunities and the elimination of existing economic inefficiencies.
- (b) Those which involve marked changes in one or several of the factors held largely constant under (a), e.g., new technology, changes in infrastructure, changes in demand, changes in prices or the terms of trade between the agriculture and non-agriculture sectors, changes in the motivation of people and changes in institutions.¹

RERU has undertaken some preliminary analysis on assessing the potential for increasing agricultural incomes in four different ways. Two of these fall into category (a) above and two into category (b).

¹Agricultural development may in fact involve a combination of these two approaches. For example, as was emphasized earlier, the development of the infrastructure, i.e., roads and railways in Nigeria created previously unrealised opportunities for farmers in producing export products (Eicher, 1967).

(1) Reallocation of resources presently committed to production.

The results of linear programming studies (Norman, 1970) in Table 2 indicate there is little potential for increasing incomes in this manner. For example, net returns are ₦185.61 in model B as compared with ₦173.36 in model A.¹ Although the validity of such a conclusion is challenged by Lipton (1968) it does support a similar conclusion derived by Hopper (1965) that farmers are efficient under traditional conditions.

(2) The utilisation of more inputs under indigenous technological conditions.

There is a greater potential for increasing incomes using this approach, i.e., compare net returns in model C with model B in Table 2. However, it can be argued that this is only a relevant solution as long as land continues to be a less limiting input than labour.² When land becomes truly limiting,³ increases in income will have to come from the use of improved technology which increases output per acre, e.g., improved seeds, fertiliser, etc. At the present time the type of technology that would be most relevant would be that which increases the output per unit of labour. However, this type of technology is either not well developed for the environment in which the farmers work, e.g., herbicides, or is very expensive, e.g., oxen and tractors, and is therefore not likely

¹One Naira (₦) is equal to \$1.50.

²This can be deduced from the results in Table 2 in which all models have fallow land.

³This is likely to happen because of the high population growth rates and the inability of the non-agricultural sector to absorb much of the increase in population.

Table 2. Results of Linear Programming Models Using Different Levels of Technology
In The Zaria Area of Northern Nigeria

	average farm A	Linear Programming Models			
		Indigenous technology		Improved technology	
		Labour restriction (1) B	Labour restriction (2) C	Labour restriction (1) D	Labour restriction (2) E
Land availability (acres):					
Upland	8.1	8.1	8.1	8.1	8.1
Lowland	1.0	1.0	1.0	1.0	1.0
Results:					
Total labour used (hours)	1753	1543	1822	1588	1996
Months in which no surplus labour is available	-	Apr, June, July Nov, Jan.	May, June July, Nov.	Apr, June, July Nov, Jan.	May, June July, Nov.
Cultivated acres:					
Indigenous technology					
Sole crops (lowland)	0.8	0.5	1.0	0.6	1.0
Sole crops (upland)	1.2	0.9	1.8	0.0	0.0
Mixtures (upland)	5.3	4.7	4.5	4.6	5.5
Improved technology					
Sole crop (upland): Sorghum	-	-	-	0.8	1.8
Total (acres)	7.3	6.1	7.3	6.0	8.3
Net return (N)	173.36	185.61	218.17	187.60	222.67
Percent increase in net return over B	-	-	17.83	1.01	20.00
Are food needs satisfied?	Yes	Yes	Yes	Yes	Yes

1 and 2. The monthly labour distribution reflected the degree of agricultural activity. With labour restriction (1) the labour availability was the same as that actually used on the average farm. With labour restriction (2) labour availability in each month was the non-family labour actually hired in each month on the typical farm, i.e., A, plus the time actually spent by family members on farm A during June, the peak labour month for family labour. In other words it assumes that in any month family members will be prepared to spend as much time on farm work as they do during June. Source: (Norman, 1970)

to be commonly adopted. One interesting point to note from the results in Table 2 is that using more of the traditional resources (land and labour) does require the employment of greater monetary resources, primarily for hiring labour. This implies that even in the absence of improved technology credit may play an important role in facilitating the enlargement of the farm business.¹

(3) Adjustment of prices.

Profits and therefore incomes can be increased under ceteris paribu conditions by raising the prices received by farmers for their products and/or by reducing the costs of the inputs.

(a) Product prices. In Nigeria at the present time food crop marketing is not controlled while export cash crops are marketed through marketing boards. In the case of food crops it would seem price support programmes would only be justified if the present marketing system exploits the farmer and if such a programme would not turn the terms of trade against the urban sector, which benefits greatly from relatively cheap food. Hays (1973) has undertaken a study which indicates that farmers receive 69 percent of the final retail price for their grain. He found the relatively wide margin between the producer and consumer, was however, not due to exploitation, but rather to the length of the marketing chain, i.e., up to seven middlemen. The question is could a government controlled system do any better? The history of the Nigerian Marketing Boards suggests that this is doubtful. Rather the solution as Hays suggests is to allow the free market to operate but to try and increase the farmers' share of the

¹This however, does not necessarily suggest that institutional sources of credit should be advocated for this purpose, in the absence of improved technology.

final retail price by continuing to improve communications, e.g., by building roads and disseminating price information through the news media, introducing standard volume or weight measures and encouraging farmers to organise in groups, e.g., as cooperatives, in order to eliminate some of the links in the marketing chain. Unlike food crops there is a stronger case that can be made for government intervention in the marketing of export cash crops. Initially the Nigerian Marketing Boards were established to help the farmer but slowly developed into taxing institutions by giving farmers low prices for their products and using the resulting trading surpluses for development rather than stabilization purposes (Helleiner, 1966; Olayide, 1971). In the last two or three years, with the apparent stagnation of the agricultural sector, the fallacy of this has been recognised and the producer prices for these cash crops have been raised substantially. Analysis presented elsewhere (Ogunfowora, 1972; Norman, 1970) indicates that substantial increases in the incomes of farmers could be achieved by a 50 percent increase in export cash crop prices, in spite of the fact that sufficient food supplies for the family would still be produced.

(b) Input prices. It is of course not easy to control the prices of certain inputs, e.g., labour, land¹, interest charged by moneylenders, etc. In discussing reducing prices of inputs, one therefore usually thinks of elements of improved technology, e.g., fertiliser, herbicides, etc. It has been suggested (RERU, 1972) that a preferable approach to that

¹That is rent since farmers only hold usufructuary rights to the land.

suggested in (a) above would be not to raise the prices of cash (export) crops too much but to use more of the trading surpluses of the marketing boards in the subsidization of the cost of the new technology, e.g., fertiliser. This strategy would have at least two clear advantages. First, as well as having the advantage of encouraging the adoption of the new technology by reducing the cost per unit, it would provide a more certain way of ensuring that at least some of the increase in incomes that would result, would not be spent on consumption. Secondly, the recent increases in cash (export) crop prices could divert farmers away from food crop production and thus contribute to further increases in food prices which would increase pressure for higher wages in urban areas. The main modern technological input is fertiliser. This is not crop specific in its application and therefore an approach of continuing to heavily subsidise inputs could benefit both food crops and cash crops and also areas where no cash crop, which comes under the jurisdiction of the marketing board, is grown. Governmental subsidies for fertiliser, seed dressing, herbicides, etc., could provide a firm basis for increasing farm incomes and production. Although as yet no analysis has been done on the impact on farmers' incomes of such a policy it has been shown that the demand for fertiliser could greatly increase (Ogunfowora and Norman, 1973).

(4) Adoption of improved technology.

It is of course obvious that relevant improved technology has to be available before it can be adopted. Is there improved technology available? According to the information in Table 1 the answer is definitely yes but the analytical results in Table 2 indicate this conclusion is not so definite. Although model D does indicate some payoff to the improved technology this is not so striking as would be

expected. Model C utilising greater amounts of traditional inputs under indigenous technological conditions indicated potentially a much greater increase in income. However, it is also apparent that the biggest payoff comes with a combination of greater capital, a higher land availability and labour utilisation base, and the improved technology, i.e., model E. Once again as in (2) above the importance of monetary resources is emphasised both for the purchase of the extra labour required and the improved technology. The apparent inconsistency between the relative values of the improved technology as expressed in Tables 1 and 2 can be resolved by an assessment of its relevance to the farms programmed in Table 2. Two and possibly three points which raise doubts about the validity of the improved technology are as follows:

(a) The farms in Table 2 face a labour rather than land constraint.

De Wilde (1967) has bemoaned the failure of people to recognise the potential significance of the seasonal labour constraint¹ while Collinson (1968) has stressed the importance in such situations for the technology to fit in with seasonal labour requirements of other crops grown by the farmer.² Thus land intensive technology will likely only appear in optimal farm plans (based on a profit maximisation goal), if it is very profitable (relatively to other crops), and/or it does not require much higher labour inputs (particularly during the labour bottleneck period) than other

¹This is a difficulty for technical scientists to grasp who are accustomed to thinking in terms of the return per acre.

²After all the farmer is interested in maximising his income, subject to a security constraint, not from one crop but from the farm business as a whole.

crops. The problem of this becomes particularly apparent in the crop enterprises recorded in Table 1. Cotton is a good example of a crop which according to recommendations should be planted earlier than is done traditionally. This immediately brings it into conflict with the weeding bottleneck for food crops in June and July (Norman, Hayward and Hallam, 1973). In spite of its much greater profitability under improved technological conditions it is therefore not competitive with other possible crop enterprises as can be seen by the fact that it does not appear in any of the optimal farm plans, in Table 2.

(b) It is seen from the results in Table 2 that crop mixtures (growing several crops on the same field at the same time) are very significant in all the farm plans. One of the reasons for their popularity is that they permit a great deal of flexibility in the timing of farming operations and therefore can help alleviate the demands of the weeding bottleneck period in June and July (Norman, 1973). As a result they tend to be relatively more remunerative than sole (single) crops under indigenous conditions in terms of labour expended during this period.¹ This means that sole crops under improved technological conditions have also to compete for adoption with a more serious competitor than sole crops under indigenous conditions, i.e., crop mixtures under indigenous conditions. In addition to the problem of seasonal timing of resources, particularly labour, sole crops under improved technological conditions often suffer from the problem of a lack of flexibility in the timing of the operations which can cause

¹And also in fact, in terms of land.

farmers difficulties in their adoption. The relevance of the improved technology could be greatly enhanced by research workers devoting some resources to making the improved technology more competitive and flexible by incorporating it into crop mixtures.¹

(c) Another important factor in determining the relevancy of the improved technology is not only its profitability but the variability in that return. The nature of the programming exercise given in Table 2 has not permitted this to be taken into account but because of the low incomes there is no doubt that this will be an important factor in determining the farmers attitude to its adoption. Here again crop mixtures are in a strong competitive position since the variability in their return in value terms is lower than that of sole crops.²

Therefore, in conclusion, there is no doubt that for small farms relevant improved technology exists, but for the middle sized farms (Table 2), as opposed to the larger farms which can justify oxen, there are some limitations to the improved technology available at present. However, the time is rapidly approaching as population increases when

¹It is of course, a very complicated subject and it is questionable just how much in the way of research resources should be devoted to it in terms of the potential payoff. The Institute for Agricultural Research, Ahmadu Bello University, has never explicitly stated that the recommended practices are only applicable to sole (single) crops. Unfortunately, however, since the recommended practices arose from experiments which of necessity were carried out on sole crops, the interpretation that they are only valid for crops grown under such conditions, has tended to be implicitly assumed. This impression has been further encouraged by the fact that the demonstration plots undertaken by the Ministries of Natural Resources in the northern states are undertaken on sole crops.

²This is mainly because different crop species are not equally affected by variations in weather, insects, diseases and prices.

this technology will become relevant to larger numbers of farmers.¹

The remaining part of the paper discusses in more detail the conditions necessary to ensure that improved technology is adopted and to suggest what levels of improved technology should be offered.

VIII. MEASURES TO INCREASE THE RATE OF ADOPTION OF IMPROVED TECHNOLOGY

Earlier in the paper it was mentioned that, providing the relevant technology is available, government programmes for bringing about agricultural development should concentrate on three factors: programmes designed to convince and encourage farmers to change; programmes to ensure that the farmers will be able to purchase the inputs necessary to bring about the change; and programmes to deliver the inputs in sufficient quantities to the right place at the right time. These programmes may seem obvious but it is very rare that all these operate together in one place.²

(1) Convincing the farmer.

Many factors contribute to convincing the farmers of the desirability and practicality of increasing their well-being. They must of course want to change (Bailey, 1966) and since they are rational individuals (Blair, 1971) there must be good reasons for convincing them to change.³ The myth that traditional farmers have some target level of income and

¹Much of the technology available at present could become much more relevant as soon as suitable herbicides have been recommended.

²For example one northern state did not have any fertiliser to distribute in 1973.

³In French-speaking countries in Africa the "animation rurale" approach has often been used in awakening farmers' receptivity to change and encouraging them to exercise some initiative in bringing about this change (UN, 1971).

have no desire to obtain more has long been exploded. Like anyone else, they will consider the effort (cost) of obtaining extra income in relation to the satisfaction (benefits) that income gives. If the probability that the potential benefits outweigh the costs is high, then they will be interested in making efforts to obtain the extra income. The higher the level of profitability¹ of the innovation and the lower its variability, the greater will be the chance of a relevant innovation being adopted (Wharton, 1968). The extension worker plays a key role in convincing the farmer, by demonstration, of the potential profitability and dependability of the improved technology.² The significance of the extension worker cannot be overemphasised, even after the demonstration phase, since it is he who has to provide the managerial expertise with reference to the improved technology, in order to ensure that farmers obtain the full benefits from its adoption.³

(2) Ability of farmers to purchase the improved technology.

Even if the farmer is convinced of the value of the modern technology he may not adopt it because it is too expensive and he does not have the cash when it is necessary to purchase it. It is likely that

¹This can be helped to some extent by appropriate pricing policies on the output or preferably input side (see page 27).

²Wharton (1968) has stated that it is the farmer's subjective evaluation of profitability and dependability of the improved technology that will influence his decision whether or not to adopt it and not any objective measurements done by someone else. This implies the importance of demonstrating the improved technology on the farmer's own field.

³This discussion has assumed that convincing the farmer to adopt the improved technology is purely a production problem. However, it is appreciated that if farmers do adopt it and production does increase there may well be very soon a reduction in profitability and therefore incentives because of a marketing problem.

it would be easier to convince farmers to adopt it if it is cheaper. This could be done as was suggested earlier by larger input subsidies rather than by raising the prices of the cash crops and thereby reducing the trading surpluses of the marketing boards.

However, although larger input subsidies will make their utilization relatively more profitable as far as the farmer is concerned, it will not eliminate the need for cash. This is obvious from the cost of non-labour inputs given in Table 1. Considering that a farming family's average income is in the region of ₦200 to ₦400, it is not difficult to justify the contention that some form of institutional credit is required. The Nigerian Federal Government has recognised this in the current Development Plan by setting up a National Agricultural Credit Bank specifically for this purpose (Federal Republic of Nigeria, 1970). Although previous government credit programs have suffered from the low rate of repayment, it is hoped that future loans to farmers will be administered in such a way as to reduce the rate of default. Whether or not cooperatives or some other institutional arrangement is desirable has not yet been firmly established.¹

(3) Availability of inputs.

Finally, although the farmers may be convinced of the value of the modern technology, and, with the provision of credit, may be in a position to purchase the inputs, it is essential that the inputs are available in

¹RERU is at the present time undertaking three studies in this area. Unfortunately cooperatives in several of the northern states are located in different ministries from the Ministry of Natural Resources, and there is some opposition to the idea of using them for this purpose. Also the past history of cooperatives in the northern states has not been good.

the area in convenient sized units at the right time. This may seem an obvious statement but because of the dispersed nature of the agricultural sector such a seemingly simple operation can cause enormous logistical problems. Government agencies still are primarily responsible for the input distribution system. However, because of the many other functions that such agencies are expected to perform, it has been suggested that consideration should be given to the possibility that at least part of this should be transferred to private organisations (CSNRD, 1969). There is a great deal to be said in favour of this approach especially since safeguards can be introduced by government agencies to prevent exploitation of farmers by commercial enterprises.

The Need for Dual Recommendations

As was noted in the preceding section it is rare for all the three programmes to be in one place at one time. Indeed it is at the present time beyond the financial and administrative resources of government to undertake this approach everywhere. In view of this the following strategy is suggested.

(a) Top priority should be given to ensuring that improved inputs are available to farmers everywhere.¹

(b) The IAR should provide two levels of recommendations for improved technology (Norman, 1973).

- i. The intermediate level of recommendations would be advocated when there are a large number of farmers per extension worker,

¹Also pricing policy for these inputs should be reviewed in the light of comments on page 27.

i.e., 2,000-3,000:1, as is the case at the present time in most northern states. The recommendations would be based on a level of input at which average value product is at a maximum.¹ Since managerial expertise with reference to the improved technology is not readily available (extension worker concentration is low) the risk of adopting the improved technology is correspondingly high. Therefore the levels of recommended improved inputs are relatively low.² The potential profitability of the improved inputs will therefore not be as high as the advanced level of recommendations, but in the absence of the extension input risks will be reduced.

ii. The advanced level of recommendations would be advocated when there are fewer farmers per extension worker, e.g., less than 500:1 and, in the case of the land intensive technology presently available, where population densities are high and therefore farms are small.³ These recommendations would be based on a level of input at which marginal value product equals marginal factor cost, i.e., the optimum quantity of

¹This is analagous to the highest return per unit of outlay approach suggested by Collinson (1968).

²It is likely that in such a situation farmers will apply the improved inputs in a crop mixture framework, a system they are confident of. This in fact is what often happens now. As a result IAR has issued advice but not recommendations (proved experimentally) on use of improved inputs in crop mixtures.

³The technology at present available is more suited to such farms. Also such farmers, because of a land constraint, will be more open to change, since they need to adopt the improved technology in order to continue to obtain a livelihood from agriculture.

input in terms of profit maximisation. The greater concentration of extension staff will enable them to provide the managerial expertise (concerning the improved technology) to the farmers thereby helping them to reap the full benefits of the technology while at the same time reducing risks and variation in the return.

(c) That credit programmes would only be introduced in areas in which the advanced levels of recommendations are being extended.

APPENDIX A. RESEARCH PROGRAMME OF RERU

A summary of the research programme since the inception of RERU is as follows:

BASIC STUDIES

Village studies

Until recently the main area of emphasis has been in studies carried out in a total of 13 villages in four of the six Northern States, i.e., North West (1967-70), North Central (1966-72), North East (1967-68) and Kwara (1969-70)¹. To assess the impact of urban areas on the factor and product markets, two or three villages were picked in each area differing in ease of communication with the main city in that area. Research in each area has in general followed a similar pattern with the initial population enumeration and field mapping (using aerial photographs) being done cooperatively by all three disciplines. Each discipline has then undertaken responsibility for a specific study. Geography has concentrated on constructing land use maps in each of the study villages in the three far northern states and has investigated the problems of densely populated areas with specific reference to the three villages in the Sokoto area (North West State) and the resulting tendency towards seasonal migration. Research by rural sociologists has emphasized the determination of factors influencing the readiness to change with specific reference to the study villages in the Zaria area (North Central State) in the hope that

¹Work in fact was undertaken in five different areas. At the request of the State Government two different areas were picked in Kwara State.

this will give some idea as to how future changes should be introduced. In one of the Sokoto study villages (North West State) a study has been made of the traditional lines of authority and communication to understand how these could increase the effectiveness of extension programmes. The main thrust of the agricultural economics work has been in undertaking farm management surveys in all the study areas. However, more recently in the Zaria study villages (North Central State) these have been complemented by a consumption study, a grain and legume marketing study and a utilisation of credit study.

Other studies

A number of other basic studies have also been undertaken as a result of specific requests from government, specific interests of research workers, etc. Those undertaken include: in geography an examination of Zaria (North Central State) as an urban centre on the surrounding rural area and a study to determine land utilization in relation to soil and land types in the Hadejia Flood Plain (Kano State); in rural sociology the influence of occupation (farming versus wage earning) of men on the life patterns of women and children; and in agricultural economics a small study of fruit and vegetable marketing in the Sokoto area (North West State), and a study of the marketing of cowpeas in various parts of North West and Benue Plateau States.

CHANGE STUDIES

The research programme with regard to the change studies is at present being concentrated in three broad groups. Much of the field work of projects listed in this part of the summary is still underway.

Evaluation of government programmes

In geography this includes a study of the changes in agricultural land use that are accompanying the development of the Kadawa Pilot Irrigation Scheme (Kano State), in rural sociology these include studies on the effectiveness of the Farm Institutes and reasons why many of the trainees leave agriculture (Kwara State), innovative farmers in North Central State, responsiveness of farmers to rises in cotton prices (North Central State), the functioning of Farmers Advisory Committees (Benue Plateau State) and the introduction and adoption of dry-season tomato production (North Central State). Studies in the area of agricultural economics include the analysis of the yields of crops from the demonstration plots carried by the state Ministries of Natural Resources, studies of the problems of cooperatives (Kwara State) and the impact of credit and marketing cooperatives on farmers incomes (Kano and North Eastern States). Rural sociology and extension have cooperated in a study to determine the factors responsible for the farmers adoption of cotton growing recommendations in the Gombe area (North East State) while extension, agricultural economics and Ministry of Natural Resources North Central State are cooperating on a study of two different farmer credit programmes, high and low levels of improved inputs and extension inputs.

Assessment of recommendations at the farmers' level

All the projects involved in this category have involved more than one discipline. Projects have included the undertaking of observation plots on crop mixtures (rural sociology and agricultural economics), observation plots on sole cropped maize (rural sociology and agricultural economics), assessment of recommendations for cotton growing at the

farmers level (entomology, agricultural economics and North Central State Ministry of Natural Resources), assessment of recommendations for cotton, sorghum and maize growing at the farmers level with a credit component (entomology, extension, agricultural economics and North Central State Ministry of Natural Resources).

Guided introduction of change

This project which is just commencing and is a logical development of RERU's work will last at least five years and will test different combinations of three variables, i.e., different extension methods, credit versus no credit programme, and assurance of availability of improved inputs versus no such assurance will be tested in different villages. The plan is to test only those types of programmes that would be reasonably feasible for governments to adopt within the next 10 years. An inter-disciplinary approach is to be used including technical and social science disciplines and North Central State Government.

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