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Monitoring the Evolution of Household Economic Systems over Time in Farming Systems Research

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INTRODUCTION

In the 1970s the term Farming Systems or Farming Systems Research (FSR) was applied to several different activities being developed around the world. These activities had as their primary goal the design of research programmes which are holistic, interdisciplinary and cost effective in generating agricultural technology which is appropriate to the production and consumption goals of rural households in specific micro-environments.

It is this attention to the opportunities and constraints of particular groups of households that distinguishes FSR as a research and extension model. In more conventional research models, the new technology is introduced from the research station to a farming population that is assumed to be homogeneous. In contrast, the premise of the FSR approach is that farming households are endowed with different characteristics in terms of social structure, access to land, physical, biological and socio-economic constraints, choices of production activities, management practices and goals that influence both the profitability and acceptability of new technology (Shaner et al., 1982).

One of the first activities in FSR is to identify the groups of households within a target region that are 'relatively homogeneous' in their characteristics, on the assumption that they will respond to new technology in a similar way (Collinson, 1982; Shaner et al., 1982; Gilbert et al., 1980). It is only after an interdisciplinary team has identified and ranked the problems and opportunities of the different groups, known as 'recommendation domains', gathered preliminary data and set out hypotheses, that the team plans on-farm research activities based on an assessment of how much change is possible.¹

As part of this process, it is customary to include a formal definition of *households*, the social groups that are the primary units of description, analysis and, ultimately, extension. For Shaner et al., (1982:16) it is the 'social organization in which members live in the same place and share their meals'; for Norman et al., (1982) and Hansen (1981), 'those who cook together as members of a pot'. The household is considered to be the locus of economic activities and the primary determinant of the cultural and material welfare of the individual. Consequently, many FSR documents refer to the farming household or family rather than the farmer or they use the terms interchangeably (Shaner et al., 1982; Norman et al., 1982; Gilbert et al., 1980).

Recently, more research has focused on the need to consider both *intra*-household production and consumption patterns, in particular the fact that women usually have command over resources and make decisions on their own initiative, as well as the nonmarket flows of labour and commodities between households.

Despite some progress on this issue, there continues to be a tendency for the major methodological discussions of FSR to consider household and *intra*-household opportunities, constraints and goals as if they exist frozen in time. This is in spite of evidence from long-term studies of farming systems projects (Norman et al., 1982), and in a large literature in sociology, anthropology and history, that one can anticipate important changes in household patterns of decision making, leadership, access to resources, production, investment and consumption over the life cycle of individual family members (Hammond, 1966; Bender, 1967; Tiffen, 1973; Broekhuysse, 1974; Haugerud, 1982; Hill, 1972; Dorjahn, 1977; Yanagisako, 1979; Guyer, 1981, 1984; Berry, 1975; Vaughan, 1983; Schmink, 1984; Spring, 1984; Stone et al., 1984). Moreover, studies show that the adoption of technological and market innovations associated with many types of development planning may require the modification of household economic and social systems (Fleuret and Fleuret, 1980; Carloni, 1984; Jiggins, 1984). To the extent that certain members of the household are adversely affected by innovations, either through an increase in work-load or a less than proportionate share of the benefits, so may the willingness and ability of households to adopt other parts of a development programme decrease.

Several reasons for this overly static view of household and

transfer, before major changes in household patterns of production and consumption have occurred. Other reasons include the difficulty of quantifying and verifying the reliability of information on *intra*-household labour and commodity flows, and the need to simplify interview forms to facilitate data collection and comparative analysis. How then can one incorporate into FSR the capacity to address changes over time in the opportunities and constraints of target household and sub-household groups?

This article proposes that one method for accomplishing this is through the incorporation of case-studies, intensive micro-level studies that focus on a small number of households, within a more broadly based farm monitoring survey. The utility of this approach is demonstrated with reference to a study of the Volta Valley Authority (AVV) of Burkina Faso.

Since 1974, the AVV has co-ordinated a capital-intensive programme of planned settlement and agricultural extension for settlers moving into the country's river basins as the result of a disease control programme. As a resettlement project, the AVV is very different from the predominant type of FSR, which emphasizes close collaboration with settled farmers to improve yields on already cleared land. However, the AVV planned settlement, research and extension programmes also possess characteristics sufficiently similar to the conventional FSR, as well as to its more 'top-down' approach that is typical of FSR in many francophone areas (Byerlee et al., 1980; Eicher and Baker, 1982: 161-3; Fresco, 1984), to justify comparing monitoring techniques. Both FSR and the AVV project stress the adoption of a new technology package and encourage the extension of new practices beyond the original target group. Moreover, they both have some nominal commitment to a process of monitoring and feedback, with the intention of incorporating suggestions for improvement.

The present study focuses on a two-year period between July 1977 and December 1979 during which the activities of the AVV's farm monitoring unit were co-ordinated with a four-country survey of Sahelian farming systems by the Department of Agricultural Economics at Purdue University.² One of the unusual aspects of this co-operative agreement was the decision to fund two intensive case-studies to complement the unit's survey research.³ The case-study presented here focuses on the economic and social consequences of

1983, 1984). A comparison of the results of the two research programmes shows that the case-study was able to gather information on the evolution of patterns of household and intra-household production and consumption that was not collected by the farm monitoring survey. Moreover, the incorporation of this information substantially altered the interpretation of survey results and greatly increased the overall quality of the monitoring programme and the utility of the monitoring results for a broader assessment of the project's effects.

After describing the organization and design of the AVV and the role of the project's farm monitoring unit, I present a comparison of the research methods and results of the farm monitoring programme and those of the case-study. The final section discusses some of the implications of the AVV study for the design of monitoring systems for FSR.

RESEARCH SITE AND METHODS

In 1974, the AVV was established as an independent development authority by the national government of Burkina Faso, with responsibilities to co-ordinate the settlement and development of the areas affected by a seven-country programme to control river blindness.⁴ This represents an area of some 30,000 square kilometres, about one-tenth of the total land area of the country. More specifically, the project's goals are:

1. To organize the settlement and installation of basic infrastructure for voluntary settlers moving into the decontaminated areas;
2. To promote the design and extension of improved farming techniques in order to increase production and minimize the long-term ecological effects of higher population densities;
3. To increase Burkina's production of cotton and the basic food grains;
4. To enable the settlers to enjoy a higher standard of living than they could attain in their home areas; and
5. To promote regional economic growth in the areas of planned settlement.

responsible for the selection of village, field and house sites, installation of basic infrastructure and co-ordination of rudimentary social and economic services. Settlers are recruited from the more densely settled parts of the country and assisted with their move. Each settler household is entitled to one or, in the case of an extremely large labour force, two 10-hectare farms that consist of six 1.5-hectare bush fields and a 1-hectare plot on which to construct a house. The project is also responsible for the design, testing, extension and evaluation of a new intensive dry-land crop package.⁵ Basic elements of the package include: cultivation with animal traction, the use of high levels of fertilizer and pesticides on certain crops, a new system of land allocation, new production techniques, cultivation of the cash crop cotton and a system of mandatory (i.e. extension-supervised) crop rotation. Under the crop rotation system, each of the six bush fields to which a household has access is planted in a cycle of crops and two years of fallow that is supposed to preserve soil fertility when used in combination with the recommended levels of fertilizer and cultivation methods. Since two of the six fields must always lie fallow, no household should ever have more than four fields under cultivation in a given year.

The farm monitoring programme provides research and extension staff with information on the success or failure of specific technical innovations, as well as information on the more general effects of the agricultural programme on settler income and welfare. The primary mechanism for the collection of data is an economic survey of a random sample of households in all of the major AVV village clusters. The unit of research is the household, defined as the residential unit that cultivates one of the 10- or 20-hectare AVV farms. The household, or ménage, receives access to a registered landholding, and the official household head represents the ménage in contractual dealings with the AVV for insurance, equipment purchases, credit and sales. Moreover, it was assumed that crops planted on the landholding would be cultivated co-operatively under the supervision of the adult male who is recognized as the official household head.

The farm monitoring survey included 132 households in 1978 and 313 in 1979, which represented about 11 per cent and 18 per cent respectively of the settlers living in AVV villages. During the same time period each of the sample households was visited once a week by

inputs (fertilizer, manure, pesticides) on the bush fields that the household was authorized to farm under the crop rotation system. Other questions in the interview focused on the cash income, expense and loss associated with noncrop production activities (trade, crafts, livestock) and the sale and nonmarket distribution of food and cash crops (Murphy and Sprey, 1980). The enumerators were also required to measure the total area planted and the harvests for each of the cultivated bush and house fields.⁶ The enumerators received the same initial training as extension agents and were supervised by the central office of the AVV Statistical Service, which was also responsible for the collection and analysis of the questionnaires.

The case-study of the Mossi settlers was designed to complement the farm monitoring survey through an intensive examination of the economic and social consequences of the project for settlers from one of the main recruitment zones. The study compared a single group of settlers from the same home village, who are living in the same AVV project village, with related households who had remained in the settlers' home village. The home village is located in the area outside the regional capital of Kaya, while the project village is in the AVV village cluster of Mogtedo. The two sites are separated by 120 kilometres (200 kilometres by the main roads).

The baseline research for the case-study was conducted over two agricultural seasons from April 1978 to April 1980. In the first year the principal investigator (the author) lived in the settlers' home village, and in the second year in one of the AVV planned settlements at Mogtedo. She supervised trained enumerators who gathered information on crop and noncrop production activities and income in the two villages. A short re-study was conducted during the summer of 1983 (McMillan, 1984).

One important finding was that, in contrast to the AVV project plan, there was no clearly defined and terminologically distinct unit in the settlers' home village that corresponded to the AVV household. If the definition of household as 'the social unit that works together and eats together' is used, then most of the home village 'households' would be equivalent to the members of kin-based residential groups that work certain fields collectively and/or rely on the harvest of these co-operatively worked fields for basic food needs. The co-operative fields are worked by the entire household, with the produce of the fields used for the basic food and cash needs of the group. The

activities. However, other fields are cultivated by individual members of these 'household' units, either before or after the completion of tasks on the co-operatively worked fields. The produce of these fields is under the control of the individual cultivator and is stored apart. Several cases were documented of women relying on grain from their private fields once food stores from the co-operatively worked fields were exhausted. In other households, women used their private grain to provide an extra meal for themselves and their children. Some individuals sold part of their private harvest and used the cash for personal needs, or, in the case of women, for the needs of their children. Some cash was usually used to purchase livestock and goods for commerce and petty manufactures. In 1979 the jointly worked household fields accounted on average for 60 per cent of the total area planted and 60 per cent of the recorded labour hours; the remainder represented privately-worked fields. Women's private fields accounted for an average of 24 per cent of the total area planted and 19 per cent of the area planted in sorghum and millet.

The amount of time an individual allocates to the cultivation of the household's co-operatively worked fields versus their own privately worked fields varies enormously over their life cycle, in response to a variety of factors including the total size of the household and the individual's relationship to the group. For example, other things (technology, the crop package, off-farm wage labour) being equal, the amount of time a married woman can devote to her private production activities is related to her childbearing responsibilities, age and health, as well as to the number, sex and age of her older children working with the group. Her position is also affected by the presence and relative status of any co-wives.

The ideal for most Mossi men is to accumulate as large a household as possible, although any household must adapt to the changing opportunities and constraints of individual family members. For example, when a man dies, his sons may cease to farm the same co-operative fields, although they usually continue to live in the same residential compound and often help one another out during peak labour periods and lend equipment. Just as households can divide (as at the death of a father), so they may also combine in response to the death of a family member, a new crop package, immigration, illness or other factors that affect the ability of households to meet their needs and goals. For the purposes of the case-study, it was the residential

Recognition of this complex overlapping of production and consumption units in the settlers' home area led to the design of a questionnaire and interview format that would allow the enumerator to record information on private production as well as interview the man or woman in charge of the group's co-operative endeavours. A similar format was used for the case-study research on settlers in the project.

RESULTS

An analysis of the results of the farm monitoring survey for the 1978 and 1979 cropping years indicated that the AVV had failed in its major objective to encourage the settlers' adoption of intensive cultivation methods. Specifically (Murphy and Sprey, 1980): (1) settlers who had been at the project for shorter periods of time tended to follow the extension package more closely than those who had been there longer; and (2) cotton was the only crop on which the recommended package of intensive cultivation techniques was consistently applied. This included monocropping, chemical protection, planting in rows, use of recommended quantities of fertilizer, thinning and timely weeding with animal traction.

This differential acceptance of agricultural innovations on particular crops and according to length of residence in the scheme was attributed to: (1) the higher level of supervision by the extension service in the early years; and (2) the extension service's emphasis on cotton which was used to reimburse settler credits.

The project was more successful in its attempts to increase crop yields and raise settler income. Although the farm monitoring survey showed that the average yields for sorghum were below those projected, they were two to three times higher than those the case-study recorded for the home village farmers (700–900 kilograms per hectare [kg/ha] versus 200–350 kg/ha). The survey shows, however, that the increased income of the settlers is primarily due to the expansion of the total area cultivated and the natural fertility of the new soils — *not* to the successful introduction of the recommended package of technical innovations.

Where the case-study distinguished itself was in its ability to gather information on areas outside the proposed agricultural innovations

levels of household income as well as changes in intra-household patterns of production and distribution between the project model and the settlers' actual activities in the fifth to eighth year after the study village was created (1979 and 1983 respectively). During the early years at the project, the settlers were involved in the heavy work of clearing fields; families were small; and there was little time or money for noncrop activities like livestock and trade. By the fifth year, the Kaya settlers had accumulated stores of reserve grain and had paid off all or most of their initial debts to the project. Moreover, most households had substantially increased in size due to the immigration of additional family members. This increase in household size on a fixed 10- or 20-hectare land base was an incentive for settlers to move away from the recommended programme by investing in noncrop activities like livestock and trade and by expanding cultivation into areas outside the project hectareage. A second very powerful incentive for the settlers to increase the time spent on noncrop production activities was the desire to move away from a singular dependence on agriculture in the face of a high level of uncertainty about rainfall and the project's future. There were also, by the fifth year in the AVV village, more opportunities for commercial endeavours and specialized trades such as masonry and mechanics.⁷

Although the farm monitoring survey included questions on the settlers' unofficial crop and noncrop production activities, the enumerators were unable to gather very accurate information on these topics. One of the main reasons for this was the settlers' reticence in discussing with project personnel their activities outside the recommended agricultural programme. Another reason is the fact that the enumerators for the farm monitoring survey talked only with the male household heads, thus ignoring a large section of adult men and all the women who were engaged in these activities. Even if an enumerator was highly motivated and did collect information outside the designated questionnaires — and some of them did — he was constrained by his inability to note the information on a standard form.

The case-study was able to avoid many of these problems by concentrating on a small number of households, using a questionnaire design that was at once more flexible and less precoded, and employing enumerators who were not part of the extension pro-

to shed new light on the project's results included: the sources and level of household income; the sufficiency of food produced and creation of a regional grain surplus; and the project's effect on women.

Income

One of the main goals of the AVV programme was to raise settler income and living standards. It was anticipated that by following the prescribed cultivation package, the settlers could achieve average yields and a level of income that would be substantially higher than in other parts of the country. Moreover, it was anticipated that the settlers' per capita income and production of food crops would increase over time. During the first five years, these increases would derive from the annual addition of a new field; after this time, they would come from the application of more intensive cultivation techniques to the four fields they were supposed to farm under the AVV crop rotation system.

To evaluate this aspect of the project's impact, the Statistical Service used two calculated figures of 'net' and 'gross' farm results (Murphy and Sprey, 1980). Since the farm monitoring survey did not show the settlers having a substantial income from trade, handicrafts or private production, none of the recorded income from these sources was included in the calculations. The 'gross result' for each sample household was considered to be the cash value of the recorded kilogram production of each crop at local market prices; minus the cash costs of seed, fertilizer and insecticide; plus the cash value of the recorded kilogram production of the house garden. In the next stage of analysis the cost of tool purchases, depreciation on the animal traction equipment and credit were subtracted to obtain the 'net result'. The analysis of these calculated income figures was broken down by village cluster and length of residence in the scheme. On the basis of this, it was possible to conclude that the project's expectations for a steady increase in total farm income were unrealistic (Murphy and Sprey, 1980). The reason was that as the settlers increased the number of official fields they were authorized to farm from two to four during the first three years, they also increased the size of their families.

This analysis did not, however, include any information on income

When the case-study included the cash value of production and earnings from these activities outside the proposed agricultural programme, the average household showed a substantial increase in the 'net farm results' per worker (using the AVV system for consumption and labour equivalents)⁸ that was between 8 and 23 per cent higher.⁹ This is 40 per cent higher than the average net results for fifth-year settler households in the same village cluster for the same year based on the farm monitoring survey. Although the case-study sample size is too small to draw any statistically significant conclusions about the nature and incidence of this type of economic diversification for the project as a whole, the results do indicate that an assessment of the settlers' income based only on the recommended crop package overlooks other areas of positive change. These include new areas of income growth through noncrop production, commerce and livestock.

Grain Production

A second area for re-interpretation relates to the relative sufficiency of grain production and the achievement of the project's goal to create a regional grain surplus. The results of the farm monitoring survey, which includes production only on the official bush fields, led to the conclusion that there was little 'surplus' grain production in the years from 1977 to 1979 and that, based on these trends, the situation would be unlikely to improve (Murphy and Sprey, 1980).

In contrast, the case-study showed that in the same year the average production per worker of the Kaya settlers was twice the recorded figure for the AVV survey and three times the average quantity produced in the settlers' home area; this represents an average of 515 kilograms per family above the minimum food standards established by the FAO.¹⁰ The substantial differences in results can be attributed to the fact that in 1979, the Kaya settlers of the case-study were in their third to fifth year of the project, whereas the AVV farm monitoring survey included all settlers — those who had been there only one year as well as those who had been there for five. Moreover, the case-study measured production on all fields, while the survey focused only on the official fields in the extension programme.

Although the case study showed a slight increase in the sale of

between 1979 and 1983, the increase in sales did not appear to reflect the overall increase in area planted or the fact that the settlers now had large cumulative stores. The primary factor affecting this appeared to be a substantial increase in the quantity of grain that was given as gifts or in exchange for livestock and hired labour.

The largest category of gift exchange in terms of actual quantities involved was the food given to new settlers. This typically involved an established settler giving several gifts of 100-kilogram sacks of grain to supplement the food rations the new settlers were receiving from the project. In most cases the new settlers could claim some sort of pre-existing lineage or affinal tie with their sponsor. By 1983, a growing number of families was involved in the direct sponsorship of new settlers. It was estimated that the latter type of food aid was the equivalent of 30 to 50 per cent of the recorded harvest for 1982 in many households, sometimes doubling a household's food needs. By far the major motivation that the settlers had for this type of sponsorship was the desire to affirm, strengthen and in many cases create ties between old and new settlers. Given the geographical isolation of the AVV villages and the resentment shown towards the project by the existing inhabitants of the valleys, the AVV settlers considered these ties important for ensuring their long-term survival in the region.

Other grain was exchanged for livestock. The case-study showed that the majority of the fifth-year Kaya settlers sold the original oxen they had purchased from the AVV during the year before the re-study (1982) and used the money to pay off their remaining debts to the project. In most cases the replacement oxen were purchased from the local Fulani in exchange for grain. The cost of the animals did not appear in any of the data on marketing but was discovered during the research on purchase and resale of livestock.

The farm monitoring survey was unable to gather very detailed information on either gift or bartered grain. Although the data from the case-study were imperfect, in that the case-study — like the farm monitoring survey — was primarily concerned with production and market sales, they do suggest that lack of information on nonmarket exchange and the settlers' production in areas outside the official fields tended to camouflage the increase in sorghum production that was associated with the project.

Women

A third area where the case-study suggests a reinterpretation is the effects of the AVV on women and the internal organization of households. In the settlers' home village, as we have seen, a household's land is divided into fields that are jointly cultivated and those that are privately worked. Women have traditionally farmed from 20 to 25 per cent of the total area planted as private fields from which they alone control the harvest. These fields were usually positioned alongside the edge of the co-operatively worked fields in order to reduce travelling time between sites. Women have also had an active role in animal husbandry and trade. No consideration was given to these personal activities in the original design of the AVV fields or extension services. Moreover, the AVV villages were generally farther from major markets than the settlers' home villages, which prevented the women from reinstating many of their former trade activities. Hence, this lack of consideration of women in the project design, and the women's loss of many of their semi-autonomous income-producing activities, indicate very negative project effects on women.

The case-study showed that during the early years of the project, there was little time for private production. By the fifth year, however, most of the wives of the Kaya settlers had reinstated a small area of private fields without recognition from the AVV extension staff. In return for the loss of income caused by a reduction of their private income-producing activities and the much higher labour demands of the new technical package, the male household heads began to make cash gifts to wives and younger adult men after the sale of the co-operatively produced cotton. The settlers also reinstated a system of harvest gifts whereby the male household head gave gifts of twenty to thirty dried ears of corn to the wives of close friends and allies in the village. Over the course of the harvest, a woman could receive 100–200 kilograms of 'gift' corn in this manner.

The re-study in 1983 showed the widespread introduction of private grain fields for women. In contrast to the settlers' home area, almost all the women's grain was sold rather than used for family consumption, and the male household head was responsible for purchases of sauce condiments (i.e. the accompaniments to the staple cereal), school materials and clothing. The income that the AVV

travel, clothes, gifts, trade goods and livestock. In 1979, very few of the Kaya settlers' wives had animals; by 1983, several of the older wives had large herds of twenty to thirty goats, and two of the senior wives owned cattle. These and other changes in the internal distribution of income within the Kaya settlers' households suggest that the actual impact of the AVV on women was less negative and more complex than could be deduced from an analysis based on a point-in-time survey limited to the agricultural project itself.

CONCLUSION

In sum, the case-study provided information on a small intensive sample that was an invaluable complement to the AVV's farm monitoring programme. The case-study did not replace the need for survey research on a more broadly based representative sample in order to monitor the proposed agricultural programme. But its findings challenged the premises of the survey design and led to both a reinterpretation of the survey conclusions and a revision of the inappropriate premises.

The co-ordinators of the AVV farm monitoring survey recognized that an exclusive focus on the acceptance or rejection of the proposed technological package would not be very useful in and of itself. 'It is this interplay between a static technical package and the behaviour flexibility of the farmer which is brought to light in a good monitoring system' (Murphy and Sprey 1980: 24). The main advantage of the case-study was that it was able to gather information on a variety of topics related to this 'behavioural flexibility' that the farm monitoring project did not and, for a variety of reasons, probably could not explore. This includes information on: (1) the settlers' economic activities outside the proposed and heavily supervised agricultural programme; (2) the market as well as nonmarket and 'gift' flows of food and goods between and within households; (3) the economic activities of the wives, children and siblings of the male who is recognized as the official household head; (4) patterns and levels of production and consumption in one of the main areas of settler recruitment. The disadvantages of the case-study relate to its small sample size and the limitations on statistical significance.

The data from the farm monitoring survey were based on a large

simplify the categories of data requested and to exercise fairly rigorous control of enumerator research techniques. Some of the costs associated with this expanded sample size, simplified questionnaire form and centralized supervision were to decrease the flexibility of the monitoring programme to deal with the evolving patterns of household organization, opportunities and constraints. Although the case-study sample size is insufficient to disprove or prove major policy issues about the AVV, it did provide the basis for the redesign of some of the farm monitoring unit's interview forms as well as for informing donors, notably the United States Agency for International Development (USAID), on the growing economic diversification of the project villages and the need to encourage this diversification rather than to see it as evidence for the complete failure of the AVV development programme.

A comparison of the two levels of analysis shows that both the case-study and the farm monitoring survey had positive attributes as well as liabilities. When taken together, they provided information on different levels of project participation and the direct and indirect consequences of this participation for target households. The study shows that a failure to incorporate these different levels of project analysis would lead to the design of project policies that are inappropriate to the evolving needs, constraints and opportunities of target households.

A major conclusion is that a good research methodology and a research-cum-extension/action strategy such as FSR depends on a combination of case-study and survey methods. Therefore, the design of local-level case-studies that examine micro-level processes of intra-household change and diversification away from a proposed technology package, should not be viewed as a research luxury but as an essential element of project design. Secondly, the present argument for the integration of case-studies with survey research should not be used to justify the exclusion of information on women's production roles or economic diversification over time from broader surveys. Instead, there is a need for case-study results to fuel an ongoing and iterative process in which information on intra-household production, consumption and distribution patterns is integrated into the design of research and extension programmes.

Specific points for inclusion in this sort of multi-pronged evaluation methodology involving both survey and case-study research tech-

One of the main insights from this study is the need to have a complete and current understanding of the organization and activities of local production units before they are used for the purposes of policy analysis or for the evaluation of project results.

2. *Delineation of evaluation goals.* More careful attention needs to be paid to the delineation of evaluation goals. A central point in the case-study was that by the fifth year in the project, the AVV administration's emphasis on the cultivation of the four bush fields in the crop rotation system and the attainment of higher yields per hectare through the use of intensive cultivation practices was not necessarily the goal of the participating settlers.

3. *Need for longitudinal perspective.* Whenever possible, a case-study such as the one described here should be longitudinal — that is, it should re-examine the same group of households at different periods of the project cycle. This is especially true in the case of FSR projects in situations of planned settlement, where the demands for labour and investment during the early years of a project are very high and where the stress related to adjusting to new social and production environments is significant (Scudder, 1984). If longitudinal research is not possible, careful attention should be paid to the need to distinguish between households at different stages of adopting a new technical package. This approach allows researchers and policy makers to distinguish between the long- and short-term effects of a technical innovation. It can also increase appreciation of the fact that the achievement of long-term development goals does not emerge from the successful introduction of a single agricultural innovation, but from a series of mutually reinforcing smaller changes and adjustments.

4. *Design of grain marketing research.* The use of recorded grain sales to assess change may exclude large areas of exchange such as 'gift' flows of goods and barter. The challenge is to devise means of monitoring these flows.

5. *Integrating women's concerns into FSR.* There is a crucial need to pay more attention to the factors which influence the ability and willingness of women to take advantage of new income-earning opportunities, extension programmes and improved technology.

NOTES

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1. This process is usually described in four overlapping and interactive stages: Stage One — Description; Stage Two — Hypothesis Testing; Stage Three — On-farm Trials; Stage Four — Extension.

2. The baseline research was funded through a grant from the United States Agency for International Development (USAID) to the Department of Agricultural Economics, Purdue University (AFR-C-1247 and AFR-C-1258) that was referred to as the Purdue West Africa Project. Between 1976 and 1980 the West Africa Project funded research at more than ten separate sites in Mali, Niger, Senegal and Burkina Faso. These studies provided detailed descriptions of the social and economic context of farming in different technical and ecological settings. A strong emphasis was placed in production and the study of the family farm in all its activities. A Technical Assistance Grant from South-East Consortium for International Development (SECID), Center for Women in Development, supported the re-study in 1983.

3. The second case-study, conducted by anthropologist Mahir Saul (1980, 1983), looked at the effects of the AVV's planned settlement on an indigenous village near Kaibo.

4. River blindness (onchocerciasis) is a disease transmitted to humans by the female fly, *Simulium damnosum*. The fly carries the larvae of a parasitic worm, *Onchocerca volvulus*, which spreads into the epidermic tissues of the skin, eventually reaching the anterior chamber of the eye. Clinical indication of the disease appears only after repeated bites from infected flies. The Volta Basin of West Africa is one of the most endemic onchocerciasis areas in the world. A United Nations survey in the early 1970s estimated that nearly 700,000 square kilometres with an estimated one million people were infected. The Onchocerciasis Control Program covers a seven-country area including parts of Togo, Ghana, Benin, Ivory Coast, Niger, Mali and Burkina Faso. At the regional level, the programme includes spraying the infected river basins with a biodegradable organophosphate (abate) in order to bring the population density of the disease below a critical level.

5. The recommended crop and technical package was based on several years of experimental research and trial farms in the major ecological zones of planned settlement and adapted to the more specific conditions of a village cluster by an interdisciplinary planning team.

6. Labour activities and the use of nonlabour inputs (fertilizer, pesticides, seed) were not recorded for crops cultivated on the house site. In contrast to the bush fields, the fields planted around the settlers' homes were not supervised by the AVV extension agents.

7. By 1979 two of the sample farmers were earning an annual income — from their activities as a moped mechanic and parts merchant, and as a Muslim spiritual counsellor — that surpassed their cotton sales.

8. The AVV uses a system of labour equivalents to determine the amount of land a household receives and a similar system to determine the distribution of supplementary

considered to have the work capacity most readily transferred to a variety of tasks, this is the standard unit and is assigned a value of one. Women and children are assigned lesser values (0.75 for adult women, 0.50 for teenage boys, 0.25 for a female over fifty-five). The use of labour and consumption equivalents to standardize the units of comparative analysis (so that one does not calculate the 'average' household income based on units that may range from three to thirty-five residents and one to twelve workers in size) is a standard and hotly debated topic in farm management research. For purposes of comparison with projected income and production figures of the AVV, I have used the AVV system.

9. This depends on whether the calculation includes the actual cash payments of the farmer for the animal traction equipment (the lower figure) or the installment payment they were supposed to make in a given year (the higher figure). In 1979, most of the Kaya settlers paid more than their regular instalment payment in order to clear themselves of debt.

10. These figures are based on the 1975 Project Identification Report of the Netherlands government for the AVV, which estimated a minimum food requirement of 2,230 calories per person per day. This is the equivalent of 140 kilograms of cereals and 30 kilograms of legumes per person per year, including losses during storage (Murphy and Sprey, 1980: 22) The figures represent the difference between the recorded grain per resident and the recommended 240-kilogram minimum of cereals.

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Innovation Adoption among Female-headed Households: The Case of Malawi

G.H.R. Chipande

INTRODUCTION

It is widely recognized that women, especially in Africa, predominate in agricultural production, either as the main growers of food crops in their own right, or as providers of family and/or hired labour to the male-dominated production of cash crops as well as to estate agriculture. However, studies of rural development efforts over the past decade or so in most African countries have tended to suggest that women have not been fully integrated into development efforts (see e.g. Buvinic et al., 1983; Dixon, 1978; Loutfi, 1980). One major reason is a policy bias in directing increased production efforts towards cash crops (especially export crops) in order to earn foreign exchange. Men tended to benefit from this bias, while women's pressing commitments to food production have often prevented them from being more than minimally involved in such efforts on their own account.

Studies in most LDCs also suggest that a substantial proportion of households in rural areas are headed by women (Kossoudji and Mueller, 1983), and that female-headed households tend to have few extra resources (land, labour and finances) to engage in cash-crop production. This is often reinforced by institutional barriers, such as tenurial regulations, that limit or even deny women access to land, credit, extension services, technology and other forms of institutional support which are intended to increase productivity. In these ways, female-headed households tend to be excluded from development efforts, with the consequence that their productivity remains very low and such households usually remain at the bottom end of the income scale.

This study attempts to assess, on the basis of data from studies undertaken by the author and others (see Chipande, 1983a; Kydd,