Report of a Seminar

Women and Agricultural Technology: Relevance for Research

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Women in Agriculture in Sub-Saharan Africa: Implications for Agricultural Research and Technology

by

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1. INTRODUCTION

The purpose of this paper is to examine the role of women in agriculture and the rural household in Africa in order to draw possible implications for development programs, in general, and agricultural technology, in particular, that would facilitate their fuller integration and contribution in the development of African agriculture. As far as technologies per se are concerned, in all the voluminous literature there is practically no example of a technology that women as such are incapable of using. The only exception may have been the case of the rotary weeder, too heavy for use by women. In all of the cited cases where women either could not use the technology or were adversely affected by it, the factors responsible were primarily derived from the underlying social, cultural, and economic conditions which were often compounded by insensitivity in program implementation. Therefore, insofar as the CG system is concerned with not just the development of new technologies but their effective application as well, the user concern at the household and intra-household level would be relevant. A concern for the participation of rural women in the use of and benefits from technological improvements needs to start with examining the experiences and underlying factors in this process.

A great deal has been written on this subject, and analysis reveals three major sets of interrelated concerns. First, development programs have the capacity to radically change the distribution of resources by allowing those already favored in traditional and evolving structures to capitalize disproportionately on the benefits of growth. In the past this has largely been addressed as a between-households problem. It is, however, becoming increasingly evident that similar processes of change may also operate for within-household distribution of resources. Second, if it leads to a marginal ratio of women in production control and decision-making, it may result in both welfare and efficiency losses in the system. Third, stemming from the above and from the higher labor intensity usually accompanying technological change for small farmers, are increasing labor demands on already overburdened rural women.

In traditional African societies, women have had a significant and acknowledged role in contributing to the wealth of their families. Because women's contribution was considered so central both in the agricultural division of labor and for reproduction, traditional structures of resource allocation have provided them access to the basic factors of production in agriculture. Thus, despite the fact that women remained socially subordinate to men, there were mechanisms for their resource access and control, decision-making, and productive contribution. However, this finely balanced system is basically derived from (a) the perceived value of women's contribution, and (b) the traditional structures of authority and resource allocation. Development programs can produce drastic changes within the households by altering both these conditions.

Within the general context of development, two opposing effects have been observed for the change in women's role - one with capital growth in the

non-agricultural sector (or large-scale commercial farm sector) and the other with technological change in the agricultural sector. While the first process is seen as capitalizing on women's subsistence production role by allowing industry to obtain a work force at reduced expense, the second expects little more of them than a source of labor, both for the short-run and through child-rearing activities for the long-run.[1] The consequences of both these processes for agriculture and rural households have been discussed in the literature, and raise important questions for appropriate agricultural strategies and the precise role of international and national agricultural research systems in facilitating this.

In order to examine the available information, three sets of issues are explored in this paper. First, what are the consequences for production and welfare of an inadequate consideration of women's decision-making roles in the generation and use of new agricultural technologies? Second, what are the characteristics of women's role in agriculture in Sub-Saharan African countries, and what, if any, are the generalizations that can be drawn about the nature and consequences of changes in agriculture? And third, what is the experience of efforts that have been made to integrate women's roles or to analyze the needs for successfully achieving that objective?

2. INTRODUCTION OF NEW AGRICULTURAL TECHNOLOGIES: CONSEQUENCES FOR WOMEN

Practically, all of the evidence on the consequences for women of the introduction of new agricultural technologies in Africa stems from two underlying factors - women's traditional obligations towards contributing to food and subsistence needs and their need for a supplemental independent income source. While these underlying factors will be examined in detail later, some of the main consequences of the failure to incorporate women's roles in agriculture that have been cited and are discussed below are : (i) lower production impact due to either nature of technology, their access to it, or their access to returns from adopting it; (ii) an inequitable impact within the household, with possible negative welfare consequences for women; and (iii) failure of agricultural development schemes to recognize women's traditional independent roles in production.

Changes in the organization of production resulting from introduction of new technologies are probably the most frequently cited reason for increasing inequity within and between households. To some extent, these effects appear to parallel those that resulted in the first generation concerns with the "green revolution" during the late 1960s and early 1970s in Asia - for example, displacement of farmers with insecure rights and capitalization of benefits by those with larger and more secure rights. It may be that, just as it was in Asia, a combination of new technology characteristics and, perhaps more importantly, favorable policies for research, extension, input delivery, and output marketing environment will be required for broadening the base for adoption of new agricultural technologies.

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[1] See Achola Pala, "The Role of African Women in Rural Development, Research Priorities", Discussion Paper No. 203 (Nairobi: Institute of Development Studies, 1974), for discussion of these processes.

At the household level, there are numerous observations on the changes in production organization. These changes are most apparent where there had been a relatively clear-cut division of labor between crops in the household. In an extensive review of literature on changes in rice farming, Dey (1983) found that with improvements in rice technology, in every case where women had originally been responsible for the household crop, rice had shifted to being controlled by men even though in two out of five cases the main cultivator remained the woman. What are the household and intra-household level welfare implications of these shifts? On the surface, it would appear that the women's workload would substantially increase in all the cases. Though household incomes would increase, there are some indications that this may not be so for welfare. It is claimed that while the role of women in production may be altered in the short run, the same may not be true for their perceived obligations; reduction in their capacity to fulfill these obligations may have serious consequences for their welfare. Dey concludes that the failure of most of these schemes is due to lack of adequate returns to women who need to provide the labor. The inability to recognize these factors has also contributed to the lack of improvement in those sectors where women have a major role within the household division of labor. Numerous reports of such "blindness on the part of male and urban and foreign planners toward the important role and activities of rural African women" are available.[1]

When there are technologies which could help women to work more efficiently, they are not necessarily able to use them even if they were made available to the household. This may be partly due not only to their lack of knowledge and ability resulting from not being included in training and extension, but also to the relative autonomy of their activities within the household, such that they may be required and unable to pay for the use of the "household" resource.[2] These provide examples of how assumptions made about the structure of households and of women's roles can be translated into a weakening of their relative or absolute economic position.

Resource constraints, in particular a labor constraint, has also been noted for woman-headed households. In conjunction with their low-economic status, this often makes it difficult for them to adopt technological improvements requiring a higher intensity of labor input.[3] As shown in a later section, the resource characteristics of

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[1] Yvette Stevens, "Technologies for Rural Women's Activities - Problems and Prospects in Sierra Leone"; and Eugenia Date-Bah, "Rural Women, Their Activities and Technology in Ghana: An Overview", in Rural Development and Women in Africa (Geneva: ILO, 1984).

[2] Marilyn Carr, "Women and Technology in Rurally Oriented Projects", Notes on Women in Development No. 13 (World Bank, 1981), cites recorded examples from Senegal, Tanzania, Gambia, and Niger of the women's inability to use improved inputs or equipment for one or both of these reasons.

[3] This has been demonstrated in a study in Malawi by G.H.R. Chipande(1984).

female-headed households vary, and it is the characteristics that are necessary to consider and not the fact that they are female-headed in examining their constraints for technology adoption.

In an irrigated rice scheme in Kenya, women were reported to have increased their labor input in agriculture but at the cost of reduced production of the staple food crop. As rice was primarily produced for sale, food security was believed to have deteriorated in the process but at the same time incomes increased.[1] It is not clear to what extent the nature of the rice technology - i.e. taste, storage or processing characteristics - prevented the increase in the diet and to what extent the constraints imposed by the program - i.e. requirement to sell, area-level inadequate market response for supplying the traditional staples, or in staple production - affected the reduced food production and security in the area. Also, it is not clear why the shift of women's labor to rice took place at the cost of staple food production in the first place.

An alternative or, in some cases, a delayed response to the negative consequences of new crops or technologies for household food security has been the rejection of new methods. Three cases have been cited by Migot-Adholla and Pala-Okeyo[2] where the changes introduced in crop production required a reduction in women's labor in food production, but their compensation did not make up for the loss and as a consequence the schemes were not successful.

It may be crucial to emphasize the underlying factors that determine why certain changes take place more than the change itself. One study which attempted to do this was on changes with adoption of irrigated rice production in Cameroon.[3] In this study area, women traditionally contributed to household food needs with the product of their sorghum cultivation. While the man of the household may also have grown sorghum, his output was not primarily used for household food but for exchange purposes. When rice cultivation was introduced, women's labor input was required though its proceeds were controlled by men. As a consequence, there was reduction in sorghum produced by women, but it was more than compensated for by the quantity of paddy retained for home consumption. This was chiefly accounted for by the compensation that women received from their husbands for their labor in rice, which was more than the returns from sorghum cultivation. The difference in this experience from that cited earlier in Kenya with introducing a similar technology

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1 Ingrid Palmer, "Rural Women and the Basic Needs Approach to Development", International Labor Review, Vol. 115, January-February 1977.

2 "On-Farm Grain Storage in Western Kenya", draft, Population Council, 1984.

3 Christine Jones, "Bargaining Processes Among Members of Agricultural Production Units in North Cameroon", paper presented at the Joint Rockefeller Foundation/Ford Foundation Conference on Intra-Household Contractual Arrangements and Farming Systems Research, Bellagio, March 1984.

underlines the need for a better understanding of the factors determining the women's roles in production, the changes in these roles, and the welfare consequences. Without this, the capacity for specific action is severely limited.

Processing of agricultural products is an activity in which women from diverse areas have been found to spend nearly as much time as in production activities. This has been shown to give them an additional right to the crop or its proceeds. Despite that this is an activity almost entirely conducted by women, technological improvements often appear to have either bypassed them or not been suitable. The larger and more centralized the scale of operation, the lower are the benefits likely at the local level. Several success stories reported had two features in common - a design appropriate to the local needs and constraints, and the involvement of women in its adoption and use.[1] On the other hand, a hydraulic palm oil press introduced in Bendel State, Nigeria, was found to be initially popular but in a year's time its use fell drastically. This was because the fiber by-product which was traditionally a good source of fuel was no longer available to the women, and the design of the machine was also claimed too difficult for the women to handle.[2]

Very often, though the technology may be suitable, the assumption of complete "fungibility" of knowledge and resources between household members may tend to exclude women from access to extension training and improved inputs. Efficiency and even direct welfare losses in such circumstances may be expected and have been noted. A study of maize storage in Nyanza district, Kenya, found that though women are largely responsible for grain storage, chemical insecticides were made available for improved storage only to men who also received instructions on its use. As a result, only 4% of women knew how to correctly apply the chemical and there was a high risk of its misapplication.[3]

Labor demand for crop processing should increase with increasing crop production unless labor-saving devices are used (centralized processing can also shift tasks out of household to some extent). However, the lack of effective demand for and availability of small labor-saving crop processing devices, as well as its link with the low resource base of women who are primarily responsible for these tasks, has also been observed.[4] Recognition of these problems clearly has implications for

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1 Irene Tinker, "New Technologies for Food-Related Activities: An Equity Strategy", in R. Danber and M.L. Cain (editors), Women and Technological Change in Developing Countries (American Association for the Advancement of Science (AAAS) Selected Symposia Series, Westview Press, 1981).

2 Jadesola O. Akande, "Participation of Women in Rural Development - Nigeria", in Rural Development and Women in Africa (Geneva: International Labor Organization, 1984).

3 Migot-Adholla and Pala-Okeyo, "On-Farm Grain Storage in Kenya", draft, Population Council, 1984.

4 Carr, 1981, op. cit.

both the choice of suitable technology and the organization of its dissemination and other program components.[1]

3. WOMEN'S ROLES IN THE ORGANIZATION OF AGRICULTURAL PRODUCTION IN AFRICA

It was Ester Boserup, in her classic work on women in agriculture, who first drew attention to the distribution and variations in division of labor in African agriculture and to its implications for development strategies. This early work also makes reference to the gradually changing patterns of labor input that were evident and the underlying factors that were responsible. In particular, the trend appeared to be one in which men were gradually taking on more responsibility for agriculture (especially in the growing cash cropping sectors) at the same time that women's workload and status in general appeared to have deteriorated.[2]

Organization of household production is the result of both socio-cultural norms and practices and the prevailing agro-ecological conditions and needs of the agricultural production systems. Cultural norms are probably central in the organization of household activities, in the patterns of authority, responsibilities, rights, and obligations assigned to the members, and consequently in defining their productive role as individuals. Clearly, this is not a static phenomenon and would be modified by externally induced changes. Several writers have emphasized the need to focus analysis on the dynamics of the organization of production by households and division of labor. This can lead to a better understanding of the underlying factors contributing to it, in particular of the interactive processes in the division of labor whereby role allocation results from negotiation between partners rather than described by sex.[3] It may be argued that shifts in both opportunities and demands imposed externally lead to shifts in the organization of household production, and this is mediated by changes in relative levels of resource access and decision-making capacity of individuals.

The evidence on the variety and intricacy of the individual's community and household links is quite voluminous and any generalizations are risky. It is clear, however, that in order to understand gender relations, one needs to go beyond the economic component of domestic relations between household members. Cultural variables may be crucial in determining the range of permissible variation in roles that may be negotiated by individuals:

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[1] Carr, 1981, op. cit. The pattern of adoption of crop-processing equipment in the more highly stratified Asian countries, e.g. Bangladesh and Indonesia, shows that these are preferentially adopted by households as a cost-saving device (displacement of hired workers) than as a labor-saving device (when unpaid household workers perform the tasks).

[2] Ester Boserup, Women's Role in Economic Development (New York: St. Martin's Press, 1970).

[3] Diane Kayongo-Male, "Dynamics of the Household Division of Labor", paper presented at workshop on Conceptualizing the Household Issues of Theory, Method and Application, Tufts University, November 1984.

> "The critical aspect of women's disability in household production is that they are systematically disadvantaged both in the market, and in the particularistic politico-kinship relations which together form the locus of reproduction of the rural production system.[1]

In this context, a relevant question is posed by Henn:

> "Anthropologists have shown that African women's range of economic choice is drastically curtailed by custom and patriarchal power. Could this be why economists so frequently ignore women's role in food production?" (Henn, 1983)

The question may not be entirely rhetorical and points to the need for a careful analysis of the issue so as to be better able to incorporate it into program and policy analysis.

Another factor central to the organization of household production is the interdependence of members of the household, which is primarily responsible for the existence and form taken by the unit. Apart from any psycho-social benefits, household membership is seen to give access to critical economic resources. Since these are usually significantly different for men and women, this can influence their respective need for self-provisioning.

One consistent observation across various systems is the distribution of responsibility for the tradeables versus non-tradeables in household production. For women, this means first and foremost reproductive and directly survival-related activities such as fetching fuel and water, as well as food processing and preparation. Additional productive activities, whether agricultural or otherwise, can be seen with few exceptions as an extension of women's basic role in subsistence and production.

The predominant role of women in food farming[2] has been noted for a long time. In a survey of 140 ethnic groups in Sub-Saharan Africa, published in 1928, Baumann documented that women carried a major responsibility for food farming in 85% of the communities and did all the work except clearing the land in 40% of them. Several authors have traced this to patterns of traditional obligation of men and women to their household and community. Furthermore, during the decades prior to and since independence in most African nations, two additional factors have been operating that may have accentuated the contribution of women to food farming. Both the colonial policies of drawing men away from the villages and the nearly singular policy emphasis on export/cash crop production in many African states is expected to have further drawn women

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[1] Ann Whitehead, "Beyond the Household: Gender and Kinship based Resource Allocation in a Ghanaian Domestic Economy", paper presented at Workshop on Conceptualizing the Household, Tufts University, November 1984.

[2] This means production for the household food supply, and may be less ambiguous than crop-based dichotomies, such as food/subsistence or cash crop, in discussion of women's role in agricultural production.

into the production of household food supply.[1] An additional contributing factor which is not often mentioned is the continuing need for local production of food in the presence of the fragmentary marketing structure in rural areas, which may also impede their growth potential for producing surplus food.[2]

In Sub-Saharan Africa, women's relatively independent and major role in agricultural production has drawn a lot of attention by anthropologists. Pala (1976), in a review of the evidence on traditional and modern (or pre- and post-colonial) patterns of the organization of production, concludes that in most systems that were based on agriculture or in the transhumant pastoral types, women seem to have been largely responsible for subsistence agricultural production.[3] However, the labor input of men appears essential, even if at a minimum for clearing. It is not clear to what extent women had disposal rights on surplus production beyond the immediate subsistence needs of the family. However, what is clear is that their rights, if any, to the surplus were secondary to men's in all patrilineal systems. In pastoral systems, men controlled cattle and women's rights were largely limited to consumption needs, and they could seldom inherit or dispose of cattle. Small animals, such as goat and sheep, however, could be owned by women in both East and West African pastoral systems.

The most clearly recognized primary rights of women within the households are for agricultural output to meet subsistence needs, whether it is from her own production or from her husband's. In addition, when women retained usufructuary rights in their own kinship, then their need to make transfers to the group were also acknowledged but needed to come out of own production. The precise pattern of the obligations of men and women to the spousal unit and to the kin varies (Guyer 1980, Hemmings-Gapihan 1982, Burbisher and Horenstein 1983, Schildkrout, MacCormack 1982, Kossoudji and Mueller 1983, and Spiro 1980 a,b). Men's primary focus in the exchange economy and surplus accumulation, usually in the form of cattle, it related more to longer-term economic security. This may often be translated partly through the exchange of cattle for additional wives, and consequently the labor force, and partly through sale of cattle in times of crop failure.

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1 Jeanne Koopman Henn, "Feeding the Cities and Feeding the Peasants: What Role for Africa's Women Farmers?" World Development, Vol. II, 1983, pp.1043-1055.

2 Jane Guer, "The Women's Farming System: The Lekie, Southern Cameroon" (Yaounde: National Advanced School of Agriculture, 1977).

3 The only major exceptions being in the so-called male agriculture, predominantly found in West Africa, where women engage in trading as they do not have primary responsibility for agricultural production. However, recent studies have confirmed that women do provide a significant labor input in production in most of these systems (Spiro, 1980a; Guyer, 1980).

Within this general form of organization, there are recognizable common and independent spheres of production activity. The common sphere is represented by one or more household plots which may be farmed predominantly by the man or woman with assistance from other household members, the output from which is collectively owned and goes toward meeting basic household needs. In addition to this, individuals can operate individual plots which are used for fulfilling longer-term goals, individual consumption needs, and often for meeting individual independent obligations to the household. For example, women's obligation to provide relish ingredients in parts of Zambia requires them to have an independent groundnut plot, from which they may also realize some income from sales. Similarly, men frequently are obliged to provide for schooling costs of children. Some estimates of the degree of independent production activity have been made. In an area of Upper Volta which has a relatively high population density, women are reported to have traditionally farmed 15-20% of total area planted as private fields.[1] Similarly, in an area of Northeast Ghana, in addition to the collective farming enterprise for meeting both food and basic cash needs of the household,

> "all adult men and most adult women have land use rights for private farms on which they may grow such crops as they wish. The acreage that women farm is however very small (less than 1 acre), while men's farms range from 3-20 acres in size" (Whitehead, op. cit., 1984).

The author traces this difference in size of private fields to a combination of land access and time constraints for women, as well as their limited access to mobilizing labor. This is a frequent observation in patrilineal communities. Under such circumstances, women sometimes obtain land for farming from their own patrilineage if it is logistically feasible for them to cultivate it.

It is important to note that both the nature of women's obligations to the household and their needs for an independent income source stem from the nature of the conjugal contract which provides the basis for the very existence of the household. Whitehead's analysis links very well the nature of this implicit contract and its implications for women's roles in production. Some generalizable characteristics from this analysis are: (1) marriage recruits women as unfree laborers, (2) husband's rights to wife's labor (and vice versa) are not open and work is often remunerated in some form, (3) agricultural intensification places increased demands on women's unfree labor, and is an area of struggle between the sexes, and (4) division of labor is highly variable and cannot be interpreted "via a naturalistic view of the sexual division of labor."

Furthermore, there is a separation between short and longer term economic concerns which can be traced to characteristics of the household

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[1] Della MacMillan, "The Role of Longitudinal Case Studies in Evaluation of Household Effects of Large-Scale Development Planning", Paper presented at Workshop on Conceptualizing the Households, Tufts University, November 1984.

extremely "variable in their incidence and form." These characteristics include:

> "the flexibility of residence arrangements, with the absence of conjugality as a necessary basis for the domestic group; the existence of polygyny, giving varying degrees of concentration of wives amongst men of different ages and socio-economic or political status; the likelihood and rates of divorce, and the asymmetrical relation of marriage to the kinship status of children (the 'lineality' of the kinship system). All these more structural features emphasize the non-corporate character of the spouses' interests and the potential separation of their life courses" (Whitehead, 1984).

While the geographical variation in patterns of agricultural organization and women's roles has received considerable attention, the question of cross-section variations within communities has been relatively neglected. This probably stems from the assumption of a relatively unstratified homogenous rural society, which may be so only in comparison with parts of Latin America or Asia. This cross-section variation in women's roles, most readily evident in a comparison of female-headed and joint production households, suggests a strong link between socio-economic class and gender roles. At this cross-sectional level of comparison, many specializations of crop or activity by gender tend to break down substantially.

Detailed anthropological studies in areas as diverse as Burundi and the Central African Republic[1], both with origins in feudal patriarchal systems, show a remarkably hierarchical social structure with a concommitant variation in women's roles. Recent literature also makes reference to the increasing inequality between households with increased opportunities for development of agriculture.

One aspect of the cross-section variation in women's role which has received considerable attention is in the difference between female-headed and joint households. These differences may be quite important, as there is evidence that women-headed households are not only widely prevalent in rural areas but also likely to be the most disadvantaged. Even in a Hausa area of Nigeria, where social mores indicate relative seclusion and dependence of women, Polly Hill found that about one-fifth of households were headed by women, "many of whom were the dominant household decision-makers whether or not a married son were living with them; as proportionately more women than men household heads were in charge of large two-generation joint households, nearly a quarter of the whole population actually lived in these women's households".[2]

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[1] Ethel Albert, "Women of Burundi: A Study of Social Values"; and Anne Laurentin, "Nzakara Women", in Women of Tropical Africa (edited by Denise Paulme), University of California, 1963.

[2] Polly Hill, Dry Grain Farming Families (Cambridge University Press, 1982), p. 112.

In contrast to the previous case where there was no apparent evidence of a resource constraint in women-headed households, a study in Malawi found that nearly one-third of rural households on a countrywide basis are headed by women, and these households were at the bottom of the income scale.[1] They were also the most labor-constrained and, as mentioned earlier, were therefore disadvantaged in adoption of the technological package being promoted which required increased intensification in agricultural production.

A study in Western Kenya found that 40 percent of farms were female-managed, many as a result of male out-migration. An examination of the activities performed by women in this group showed that

> "many female managers absorbed men's responsibilities and coped with peak labor periods without the assistance of another resident adult. In the sample, half of the female managers were also responsible for cattle care" (Staudt, 1984).

Here, as in Malawi case, the majority of women farm managers had a low economic status. Significantly, the overall managerial characteristics and economic status of the low-income female and jointly-managed farms were found to be similar.[2]

4. CHANGING PRODUCTION WITH TECHNOLOGICAL CHANGE

There are numerous examples of changes in women's production roles with technological change in agriculture. The reports include many impressions, anecdotes, and some careful studies. In this section, some of the most in-depth work done has been selected in order to illustrate the effects on women's roles and welfare with two of the major types of changes reported:

i) women's loss of crop production role to men with technological improvements;
ii) improvement in crops grown by men (or not previously grown by women) which potentially required additional women's labor input in agriculture.

These and other changes are examined for three types of technological improvements. The improvements examined are introduction of a food-cash crop (irrigated rice), and export/cash crop (cocoa), and mixed dry-land farming. In the first two types, the experiences with different roles of women in production are also examined. It should be noted that, as is invariably the case, irrespective of the type of improvement or existing production organization, all of the improvements were effectively accessible directly only to men. The following table illustrates the types of situations being reported and the general nature of their consequences.

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[1] G.H.R. Chipande, "Innovation Adoption Among Female-Headed Households: The Case of Malawi", paper presented at workshop on Conceptualizing the Household, Tufts University, November 1984.

[2] Kathleen Staudt, "Agricultural Policy Implementation: A Case Study from Western Kenya", draft, Population Council, 1984.

Table 1:

Case studies on possible effects of technological changes on Women

Original Organization of Production[a]	Type of Improvement		
	Irrigated Rice	Cocoa	Mixed Dry Land
Women responsible for food farming	I. Additional requirement for women's labor (Cameroon)	III. Additional requirement for women's labor (Cameroon	
Men responsible for food farming	II. Additional labor requirement conflicts with women's off-season crop (Ivory Coast)	IV. Shift of labor out of food production (W. Nigeria)	V. Loss of women's subsidiary economic activities (Volta Valley)

[a] These categorizations are obviously oversimplified. In both types of cases, the spouse provides some labor for production and a supplementary food or income source.

Case I -- Irrigated Rice Introduction in Cameroon[1]

Traditionally, women spent 95 % of their time growing sorghum on their fields assigned by compound heads and had a minimal obligation to either work on their husband's or the collective field. Grain from the woman's field was the first source of food for her domestic unit (signifying the sub-compound unit of woman, man, and children). When her supply was exhausted the man's supply was used, and access to grain from the collective field was the last resort.

With the introduction of irrigated rice, which is managed by men (even when women are assigned rice plots by the irrigation authorities, the proceeds are controlled by men),[2] the pattern of labor organization in the household changed dramatically. Because of its higher labor requirement, the rice required joint cultivation by members of the domestic unit, in contrast to sorghum which was pretty much grown individually. Since the labor requirement for rice conflicted with sorghum cultivation, a loss in sorghum production was entailed.

The new pattern of crop disposal was as follows:

i) Following the paddy harvest, grain was retained for home consumption. This was intended to compensate for the loss in sorghum by both men and women with the shift in production;
ii) In addition, men gave their wives a lump sum in cash following the sale of paddy.

In appears that the total value of grain retained plus the cash payment to wives roughly equal the returns to women's labor valued at market wage rates. The principle that appears to be enforced here is one which was present traditionally, that it is primarily the women's responsibility to feed the household. However, it is also evident that wage rates for rice are extremely high due to labor shortages, and the returns from any of the alternative uses of women's labor would be less than what they received from rice production. It does not appear that women were free to choose the option of wage labor, and if they were, the wage structure may not have been as favorable anyway.

It would be useful to compare the quantity of grain and cash at women's disposal under the two modes of cultivation and its welfare consequences.

Case II -- Irrigated Rice Introduction in Ivory Coast[3]

The area is the savannah region of Korhogo in Northern Ivory Coast. Men were primarily engaged in production of rainfed maize, yams, and rice,

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[1] Christine Jones, "Bargaining Processes Among Members of Agricultural Production Units in North Cameroon", Joint Rockefeller/Ford Foundation Conference on Intra-Household Contractual Arrangements and Farming Systems Research, March 1984, Bellagio

[2] This is believed to be consistent with tradition.

[3] Jennifer Dey, "Women in African Rice Farming Systems" (Los Banos, Laguna: International Rice Research Institure, 1983).

with labor input from their wives and other household members. Women also planted an independently transplanted rice crop in dambo areas (shallow depressions which retain moisture in the dry season and accumulate water in the rainy season) during the early rains after harvesting the men's dry season crops grown there. The introduction of irrigated rice cultivation was expected to increase double cropping beyond the dambo areas. "However, of a total of 11,000 hectares developed for double-cropped rice in 1982, only 1,466 hectares were cultivated in the dry season (February to June) and 5,164 hectares in the wet season (August-November)." Dey traces this anomaly partly to the reluctance of women to provide the additional unpaid family labor when they did not perceive additional returns from it, and its harvesting also conflicted with the planting of their own rainy season crops.

Case III -- Introduction of Cocoa Cultivation in South Central Cameroon[1]

Traditionally, Beti women performed most of the farm work. In practical terms, however, men controlled the production process since it was their work in the initial clearing that defined the field size and length of fallow. Access to land became a major issue only with the advent of the cocoa economy. Cocoa cultivation became men's work, and "this was not entirely due to the machinations of colonial government." As in all cases, land clearing was by men. In addition, since cocoa cultivation constituted a form of permanent occupation, which as in other patrilineal societies is vested solely in men (as opposed to usufruct rights of women), women's work was extended along the lines of the previous division of labor but involved implicit bargaining about remuneration. A separate food system was retained in which women supplied 84 % total work and which provided 80 % of food consumption by value. The workload of women and also of men was increased. It was noted that the absence of a diversified economy and fragmentary market structure put considerable pressure on women to remain in subsistence production.

Case IV -- Introduction of Cocoa Cultivation in West Nigeria

Most of the farm work here was done by men. In comparison with the previous case of the Beti in Cameroon, the food processing, storage, local trade, and manufacturing (especially cloth) techniques among the Yoruba here were quite elaborate, and it was in these activities that women were engaged. In addition, women helped with planting, harvesting, and transporting the produce. As in the Beti, cocoa cultivation became men's work -- in this case, being an extension of men's role in cultivation. Again, the women's traditional obligation to provide labor was extended to cocoa, which is also accompanied by implicit bargaining and remuneration. However, a much greater reliance was placed on hired labor in cocoa production by men. Again, as in the previous case, a parallel food economy was maintained. Women provided only 17 % of labor in food production, and this appears to be less than was previously the case here. In particular, their labor in planting appeared to have

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[1] Jane I. Guyer, "Food Cocoa and the Division of Labour by Sex in Two West African Societies", Comparative Studies in Studies in Society and History, (22) 1980, p. 355. This comparative paper provides the observations for both Cases III and IV.

declined. Women spent a substantial amount of time in food processing, home industry (cloth), and trade. Self-subsistence in food declined to 32 % (from an earlier 70-80 %), and an active food trade in the cocoa belt developed, suggesting that although food production declined, food security did not. Guyer concludes that "the fact that the food supply was quickly commercialized was made possible by, and reinforced, the existing system of women's processing and marketing".

Case V -- Volta Valley Authority Development Project (AVV)[1]

This project involved the settlement of farmers in a relatively fertile river basin upon control of river blindness. The intent was to promote a package of intensive cultivation methods by the settlers. The project also provided extension, credit, input distribution, and marketing facilities. By 1978, 1,700 families were settled in the project areas. Settlers were drawn from surrounding high population density, plateau areas. In the settler's home villages, land had been cooperatively worked to provide for the household requirements but women had traditionally farmed 15-20 % of the total areas planted as private fields, from which they provided relish ingredients with cowpea and peanut cultivation and were also involved in trading activities.

In the settlement schemes, women lost their traditional rights to land and, therefore, lost the ability to fulfill their household obligations. In a study conducted shortly after the initial settlement, it was found that the new production scheme entailed major changes in household production. One of the early findings indicated that there was a negative effect on women's income. Also, their crops which provided necessary dietary components were not included in the AVV crop rotation. Despite this, however, women were given informal authority by their husbands for cultivating a part of the bush fields, which appears to have been the traditional distribution mechanism.

A follow-up study in 1983 found that family organization and production patterns had changed considerably more since the immediate aftermath of settlement. The initial phase had required relatively more heavy work in the fields, and little time or money was available for private production or trade by either men or women. By the fifth year, settlers had accumulated stores of grain and paid off initial debts, family size had increased with immigration of additional members, settlers' cash income was seven times higher, and grain yields were two to three times higher than in the home villages.

These changes had not been evident in the first few years. Although aggregate grain production was up significantly, sales were only slightly

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[1] Josette Murphy and Leendert H. Sprey, "The Volta Valley Authority: Socio-Economic Evaluation of a Resettlement Project in Upper Volta", Purdue University, Department of Agricultural Economics, 1980; and Della McMillan, "The Role of Longitudinal Case Studies in Evaluation of Household Effects of Large Scale Development Planning", presented at the workshop on Conceptualizing the Household, Tufts University, November 1984.

higher and large retentions were made to protect consumption as well as provide a means for hiring labor. Though time allocation data is not available, many of these changes, especially the increase in hired labor, would suggest that women's common field labor requirements may have decreased. This is confirmed by the widespread expansion of private grain fields for women as well as their greater involvement in trading and livestock activities. Other findings include: male household heads assumed responsibility for many expenses which had traditionally been borne by women; grain produced by women or received by them for working in other fields was sold by them and not kept for family food. "These and other changes in the internal distribution of income within families suggest that the actual impact of the AVV on women was less negative and more complex than originally appeared."[1]

Nearly identical observations have been made for a settlement scheme in West Nigeria, which also demonstrated the need, drive, and initiative of women to re-establish their enterprise despite the fact that development activities may have totally ignored it.[2]

5. ISSUES ARISING FROM CASE STUDIES

Introduction of a similar technology can be seen to have varying effects. In addition to all the household- and area-level factors that we are familiar with, the household organization of production and its interaction with area-level factors also modified the degree of success in technology adoption and its effects. Though limited in number, the in-depth studies attest to the complexity of household analysis given the varying degree of flexibility in its organization, division of labor, and obligation of household members. The research issues to be dealt with are, therefore, also complex, and further examination of these is necessary. Uma Lele[3] has identified some of the broader research issues in this area, which could be taken as a starting point in determining research needs specifically in the realm of the CGIAR mandate.

In many cases a labor constraint, perhaps especially for "women's tasks", may have become an obstacle in the successful adoption of the technological package. The two notable cases where this was overcome was when either wage labor was available (cocoa in West Nigeria) or what appears to be a fuller package of services and the immigration of family labor was available (AVV scheme in Upper Volta). The alternatives available for overcoming these labor bottlenecks is probably a critical issue. The capacity for access and use by women, rather than its physical availability, is of specific relevance to technology.

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1 Della MacMillan, op. cit.

2 Heather M. Spiro, "Agricultural Development Strategies - The Experience at ILORA", Workshop on Women in Agriculture in West Africa, ILCA/IITA, Ibadan, Nigeria, May 1984.

3 Uma Lele, "Women and Structural Transformation", Conference on Population Growth and Labor Force Absorption in the Developing World: 1960-2000, Bellagio, July 1984, reprinted in Part III of this document.

6. EXPERIENCES WITH IMPROVEMENT OF AGRICULTURAL TECHNOLOGY FOR WOMEN

The main observations on the need, availability, and access to improved technologies by women are: (i) women perform a wide range of tasks in agricultural production, processing, and household maintenance and this creates the primary need for technologies to alleviate their time constraints; (ii) their primary roles are in the non-market sector and this is linked to their generally poor access to household resources; (iii) leading from the first two points, the major problems with respect to technologies for women are in the choice of technologies for dissemination and their access by women, rather than in their availability per se. The reviews by Marilyn Carr[1] and the International Center for Research on Women[2] have shown this very clearly. Relevant and related to this is the potential for increased productivity that is lost as a result of the lack of improvements in this area.[3]

These observations point to the need for greater attention to the institutional and organizational needs for a better identification and dissemination of suitable agricultural technologies. In this respect, some of the experiences and lessons of small farmer problems could be brought to bear. For example, it has been shown that it is often organizational inefficiency and bottlenecks for essential inputs that are particularly responsible for the adverse effects of new technologies on agricultural laborers and small farmers.[4]

The two major issues of relevance are therefore: (i) the choice of technology or the technological package that is made available, and (ii) the organization of its dissemination to ensure an adequate access to women who are engaged in a managerial capacity in activities for which the technology is appropriate. Research on and application of the first set of issues can be largely dealt with using the present links between the international and national research centers. The second set of issues, however, requires use of the further link between the national research centers and national agencies, ministries and other organizations implementing agricultural programs and policies.

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1 Marilyn Carr, "Appropriate Technology for African Women", UNECA, 1978; and "Technology and Rural Women in Africa", ILO World Employment Programme Research Working Paper, Geneva 1980.

2 Marguerite Berger, Virginia Delancey, and Amy Mellencamp, "Bridging the Gender Gap in Agricultural Extension" (Washington, D.C.: International Center for Research on Women, 1984).

3 Peter Moock, "The Efficiency of Women as Farm Managers: Kenya", American Journal of Agricultural Economics, 58 (5) December 1976.

4 Grace Goodell, "Bugs, Bunds, Banks and Bottlenecks: Organizational Contradictions in the New Rice Technology", Economic Development and Cultural Change, 1984.

The choice of technology and the technological package requires considering the labor bottlenecks imposed by women's time constraints. This is particularly relevant in Africa, given the high involvement of women in smallholder agriculture. Furthermore, in order to address this effectively, labor-saving technological options for a broad range of activities performed by women may need to be incorporated in a complete technological package. At a minimum this would include post-harvest processing and storage, in addition to the crop production activities.

It is noted in this context that the focus of the IARCs on food crops is especially apropos from the standpoint of the concerns being discussed here.

The dissemination processes for technologies, education, inputs credit, and extension also need to consider the full range of women's activities and constraints, in particular their low resource base.

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