FOOD SECURITY AND WOMEN : IMPLICATIONS FOR AGRICULTURAL RESEARCH

Louise FRESCO

Since the beginning of the UN Decade for Women, many studies have highlighted the vital roles women play in food production, processing, storage, preparation, and marketing (e.g. FAO - 1983). While guidelines have been formulated with respect to women in rural development projects, institutional support to women and the collection of statistical data on women - to name but a few essential areas - the implications for agricultural research have hardly been discussed (FRESCO - 1983).

Studies on the effects of agricultural innovations on women have pointed to the increasing work loads, the loss of access to income and resources and other negative effects that many women face (AGARWAL - 1981). Too often, modern agricultural technology is viewed as detrimental to women, and the necessity of increasing yields has been relatively neglected by "women-in-development (w.i.d.)" students.

This paper aims to link a discussion of the response of agricultural research to the need to increase food production with an assessment of the impact of agricultural technology on women. In this light, some priorities for future agricultural research will be outlined.

1. FOOD SECURITY AND WOMEN

Today, the world food problem is usually stated in terms of food security : food security is attained when a country's entire population has access (in the physical as well as the economic sense) to sufficient food. Although sufficient food is produced on a world-wide scale to feed everybody, this is not evenly distributed resulting in great discrepancies between regions. Food security is not only a matter of food supply,

or production, but also of effective demand. Poverty is therefore the main constraint to food security. About 90 % of the absolute poor live in rural areas of developing countries (World Bank - 1982), and about half of them are (part time) farmers. Increasing agricultural production thus serves a double purpose : to increase food availability and to generate income with which food may be bought.

A few figures on cereal production may illustrate the current trends in food availability. Cereals supply nearly half of the total calories and proteins consumed and cover about 70 % of the total recorded harvested area. While average cereal yields have been steadily rising to over 1700 kg/ha in Asia and Latin-America, yields in Africa have stagnated at around 800 kg/ha since 1965. Per capital cereal production in the world increased slightly (index 106 in 1978-80) (annual averages of 1969-1971) but in Africa the production per head has actually declined throughout the last decade (index : 90) (FAO - 1981). At the same time, cereal imports into Africa have increased to 8 million tons (1980) (EICHER - 1983). The case of Africa deserves special mention here, because 22 of the poorest 36 countries are African. Cereal production constitutes an adequate indicator of domestic food production because the majority of countries supply at least 80 % of their cereal needs : only 14 % of world cereal production enters international trade. Root and tuber crops are nearly entirely produced domestically. In other words, any improvement in food availability per head will depend on increased production in developing countries themselves. It has been stated that, in order to meet effective demand, agricultural output will have to be doubled by the year 2000 and at least quadrupled by the end of the next century (BUNTING - 1981). Even if we assume that arable land can be increased by 30 %, feeding the world's population will mean a threefold increase of average yields per unit of area within the next 100 years ! Virtually all of these increases will have to be produced where they are to be consumed, e.i. in developing countries.

Women's participation in this staggering increase will be absolutely vital. Women's complex roles in food production are being increasingly documented. In the context of this paper, it may be necessary to underline that women's roles should not only be placed in the realm of subsistence production : they provide an essential part of the household income and often produce a marketable surplus, or assist other family members in surplus production.

In short, future food security requires a drastic increase of the output per unit of area in the rural areas of developing countries. Such an output increase will necessitate action in many fields : price policies, marketing, infrastructure, supply of agricultural inputs, land tenure, etc.

It will also require further agricultural research to provide farmers with the adequate technology, i.e. varieties of crops and breeds of animals, land and crop management techniques that change physical input-output relations. While acknowledging the limited impact on food security of agricultural research per se, the role of agricultural technology must not be underestimated, as witnessed by the considerable increase in irrigated wheat and rice production in many parts of the world.

2. THE RESPONSES OF AGRICULTURAL RESEARCH TO THE NEED TO INCREASE FOOD PRODUCTION

2.1. The Green Revolution

Since the late 1940s, a major effort to develop high-yielding food crop varieties has been launched. In 1971, the Consultative Group for International Agricultural Research (CGIAR) was formed to provide a mechanism to mobilize long term support for a global network of 13 centres. Until recently, the main emphasis has been placed on the development of improved genotypes requiring high input levels to achieve their potential. Although some of the innovations now commonly referred to as the Green Revolution, were already known in the 1940s (e.g. hybrid maize and chlorinated hydrocarbons), the major innovation was the package approach, or prescribed combination of inputs to achieve maximum output of a single crop produced in monocropping. The Green Revolution was based on "high-yielding varieties" (HYVs) capable of increased nutrient uptake and efficient utilization of sunlight, requiring the extensive use of bio-chemicals to supply plant nutrients, and control pests, diseases and weeds. Mechanization can play an important role but has not been associated with the Green Revolution everywhere. Obtaining high yields also necessitated the strict control of the production environment though the exact timing and execution of cultivation techniques (PEARSE - 1980). As a result, the Green Revolution package placed increased demands on the labour input and accuracy of the farm house-

hold, in addition to the increased labour requirements for post-harvest handling induced by the higher yields. Considerable increase in cereal output, in particular in Asia, have followed the diffusion of the package developed by CIMMYT and IRRI and other institutes. However, the largest gains in volume and value terms come from the relatively favorable areas, where agronomic potential is higher, irrigation and infrastructural facilities exist and technical inputs such as fertilizers and peticides are available.

The Green Revolution's results and unintended effects have been severely criticized, in particular the fact that the technology package is not appropriate to resource-poor farmers in rain-fed areas. Moreover, increasing competition for good quality land and a concentration of wealth in the hands of a minority of large landowners, have led in some areas to the displacement of people and an increasing number of landless who depend on purchased food. Also, the Green Revolution has not provided a solution for the most critical area in terms of food production : Africa. The two main crops of the Green Revolution - wheat and rice - that account for about half of the yield increases in Asia, are not widely grown in Africa. Other hybrids such as sorghum have not been successful in Africa,mainly because of rainfall variability, low soil fertility and disease problems (EICHER - 1983). African production systems are extremely complex and varied, and require technology which is adapted to their specific environment.

The debate on the effects of the Green Revolution package and high-yielding varieties in particular has triggered a wider discussion on the assumptions often implicity involved in agricultural research. Often agricultural research assumes, more or less implicity, that

- farming is undertaken by family farms with a single production function headed by individual males who command the resources of individual household members ;
- farmers aim at maximizing gross returns from agricultural production ;
- agricultural technology and the economics of production are gender-neutral, i.e. relevant to any farmer whether male or female ;
- farm-level production constraints are only technological and not social or cultural ;
- farmers are passive receptacles for innovations, and indigenous knowledge systems are mostly irrelevant.

Jiggins e.a. (1981) have pointed out that production increase does not necessarily imply the application of high technology and high investment strategies. Institutional factors make it unlikely that advanced technology will be applied everywhere, for example because foreign exchange is lacking to import biochemicals, and because present farm management practices and input delivery mechanisms limit their application.

2.2. Farming Systems Research

The growing concern over the gap between research station and actual farmer's yields, the unintended negative side-effects to the large scale diffusion of technology, as well as the low rates of adoption of new technology by farmers, has led to a new research focus. Farming Systems Research (FSR) has emerged as an approach to agricultural research, relevant to both on-station and off-station work, that focuses on farmers' circumstances and explicit needs (SIMMONDS - 1984). Its starting point is the whole farm, including livestock and off-farm employment (i.e. the farming system).

Ideally, FSR is interdisciplinary and intercommodity action-oriented research with a high degree of location-specifity (see e.g. SHANER e.a. 1982). FSR aims to take into account that farms (and rural households) operate as systems, i.e. farmers do not seek technical optima or even optimal economic returns from a single enterprise. It is also assumed that farmers behave rationally within the environment and resource constraints that they face. For example, inefficiency in production or poor management may reflect poverty rather than ignorance. Typically, FSR activities involve systems (e.g. the introduction of new germ plasm), systems revision (e.g. increased cropping intensity) and the replacement of traditional farming systems by new ones (DILLON and ANDERSON, undated).

FSR has shown a new appreciation of traditional farming techniques such as mixed cropping or combinations of upland and valley plots, and of traditional drought-resistant (but usually low-yielding) cereals such as bullrush and finger millet. It has also paid attention to the need to reduce variations in total farm output and to ensure household level food security.

Potentially, therefore, FSR may overcome some of the inadequacies of past agricultural research, in particular with respect to women. There is no doubt that the utilization of research results will always affect women, either directly as agricultural producers, or indirectly through the impact of the division of labour and the allocation of resources and income within and between households. Thusfar, however, within FSR, there has been little systematic thinking on the identification of intrahousehold resource allocation or on methods to take into account women's production patterns and knowledge of agriculture, and to screen technology on negative effects for women.

3. THE IMPACT OF AGRICULTURAL TECHNOLOGY ON WOMEN

The (side-)effects of Green Revolution and other technological packages on women have been extensively documented, if not always quantitatively. Agarwal (1981) points to the need to differentiate between Asia and Africa. In Asia where a high labour/land ratio prevails and a high percentage of the households is landless, marriages tend to be monogamous and women usually assist their husband on the family farm. In Africa, however, with its low labour/land ratio and frequent polygyny, women and men cultivate different plots and sometimes different crops. Low external inputs characterise African agriculture in contrast to Asia. There is no doubt that agricultural technology affects women in the two continents in different ways. Moreover, socio-economic class will further determine the impact of technology.

Without belittling the crucial differences between women throughout the thrid world, there appears to be a number of common traits that should be highlighted here. With very few exceptions, in the agricultural production process of small farmers, women's labour is essential at two stages :

1/ weeding (and transplanting in the case of irrigated rice), and
2/ post-harvest handling of produce (small-scale processing, storing, drying etc) and in many cases during harvesting too.

Furthermore, women are universally faced with time constraints because of conflicting demands on their time resulting from their roles as domestic reproducers, agricultural producers and, in some cases, off-farm employees. The care of small (farm-yard) animals is also frequently entrusted to women.

The impact of new agricultural technology on women depends on many factors including :

1/ the role and position of women in specific agricultural systems, including their access to resources and the intrahousehold patterns of resource and income distribution.

2/ external factors influencing agricultural production, such as the prices of agricultural products and inputs, environmental constraints and government regulations,

3/ the nature of the technology, in particular the following characteristics :

- technology that is land-saving and labour demanding (AGARWAL - 1981) such as biochemical inputs, tubewell irrigation, HYVs.
- post-production and post-harvest labour-saving technology such as threshers, driers, mills.
- technology that allows an area increase : tractors, animal traction.
- changes in cultivation techniques such as changes in type of crops and cropping patterns (supplementary crops, early maturing varieties etc...).

The impact of technology on women must be evaluated for its direct and indirect as well as its short and long term effects. A distinction may also be made between the effects of the agricultural technology per se and the synergistic effects of technology in combination with other measures such as occur in resettlement schemes, where title to land and credit are only allocated to men.

Evidence from several studies (e.g. STAUDT - 1979) points to a widening gap between male and female labour productivity because women do not have access to technology and have different management objectives from men. An assessment of the impact of technology should not isolate women from their household context. As a matter of fact, the incorrect perception of the nuclear family as a universal structure has prevented researchers from understanding the distinct sets of female and male (obligations and interests as well as the influence of intra-household dynamics on farmer productivity. (see e.g. JONES - 1983). Technology which does not take into account women's independent income sources, e.g. by assuming that female labour will be available to alleviate production bottlenecks, may have detrimental effects on women's health

and on their ability to assure a stable food supply for other household members.

A case study may further illustrate the impact of technology on women. Dey (1983) documents the changes in the sexual division of labour in the Gambia, when swamp rice cultivation, traditionally a female crop, is replaced by irrigated rice production. While men have taken over the control of the technical equipment and the irrigation system, woman's labour has become essential in transplanting, weeding ans winnowing. Because irrigated rice is a cash crop, whose proceeds go to men, women must continue to produce a rainy season swamp rice crop for home consumption instead of following the intended double cropping scheme. Thus, women's work load increases as they have to assist on irrigated rice fields while receiving little or no remuneration, since men cannot afford to pay realistic wages or hire labour. Moreover, the research program developing the new technology has neglected women's traditional knowledge of soil types, toxicity and salinity problems, and water management.

4. IMPLICATIONS FOR AGRICULTURAL RESEARCH STRATEGIES

There is no doubt that food production must be intensified in order to achieve food security for all categories of the world population. A considerable proportion of food will have to be produced in less favourable areas with little opportunity for irrigation, a weak infrastructure and marketing network, and few and often inadequate delivery services. Women will play a vital role in this production increase. The farming systems approach to agricultural research advocates the development of agricultural technology which is based on farmer's needs and constraints. In general, however, agricultural research has not taken adequate account of the specific problems of female producers, often resulting in technology which, directly or indirectly, has had negative consequences for women.

How then, may agricultural technology be developped or adapted to overcome these problems ?

Three subjects will be discussed here : the assumptions about farmers used by researchers, the technical priorities for research, the research methods.

4.1. Research Assumptions

There is an urgent need to replace the (implicit) assumptions about farmers and farming by an understanding that more adequately reflects women's reality. This implies that the diversity in women's productive and reproductive roles is acknowledged. It also implies that the farm can no longer be seen as a single enterprise under male management but that the multiple productive and reproductive objectives of household members - and their variation according to the household's life cycle - are taken into account. Moreover, it must be acknowledged that transfer of technology and innovations between household members (the so-called "trickle across" diffusion between husband and wife) is not automatic. Special attention must be given to the intricate gender-based patterns of allocation of resources, information, and benefits between household members. The importance of non-agricultural work, undertaken by women and men, cannot be underestimated. All diagnostic studies should make explicit mention of the food production constraints faced by female headed households. Very careful assessments must be made of the seasonal availability, value and output of female agricultural labour and of productivity gaps according to gender.

Changing the assumptions on which most agricultural research is based requires first and foremost a change in attitudes of (male) researches. But this will only come about if the relevance of women's roles, and the costs if these are ignored, are clearly demonstrated, It also means that there is a need for social scientists on agricultural research teams - a fact which is widely recognized by FSR (HORTON - 1984), although most social scientists attached to FSR teams have not paid very much attention to women.

The increasing number of studies on women's roles in food production, undertaken by social scientists, women's bureaux, universities and private foundations are rarely available to agricultural researches. It is recommanded to create data banks at regional and country level with a view to collecting and coordinating existing information (and unpublished reports !) on women's roles in agriculture that are potentially relevant to agricultural research. A list of available studies could be published annually. Although these studies may need to be elaborated upon, they could provide a starting point for the formulation of assumptions that reflect the reality of small farmer households in a more

adequate way. It will be necessary to develop methods to translate the results of such studies into statements that are relevant to agricultural research. Furthemore, specific research is required to document the impact of new agricultural technology on women, in particular with respect to health, revenue, employment, work burden and household food security. The impact of agricultural policy (prices, commodities) need also be assessed.

4.2. Research Priorities

With respect to research priorities, a number of issues may be mentioned that are of particular, but not exclusive, relevance to women.

Firstly, there is a general need to shift the research focus from single crop production increase to a larger array of crops and technologies.

Secondly, labour-saving technology, or technology that allows the reallocation of labour to alleviate bottlenecks during the production and post-harvest processes, deserves special attention. Consequently, breeding and general agronomy programs should give attention to improved crop varieties that do not increase or may actually decrease labour requirements, e.g. varieties that are suitable for dry seeding or late seeding, or minimum tillage conditions. Given input supply problems and fluctuating prices, farmers are likely to prefer technology that does not require high input levels. There is need to maintain genetic diversity and acknowledge the fact that food crops are frequently grown in a multivarietal mix. Minor (traditional) crops such as vegetables, beans, and sometimes coarse grains, roots and tubers, that are usually a woman's responsibility and essential to the household diet, must not be ignored. It must also be acknowledge that many crops serve manifold purposes besides the provision of food, often according to season. They may be used as feed or fodder, fuel, shade, thatch, vegetable, wrapping or building material.

Research should focus on long term yield stability, reducing variations in total farm output throughout each year and over time rather than on maximum commodity yields. First of all this implies that the farmers' natural resource base must be protected to minimize wind and water erosion and to prevent deterioration of soil structure and the loss of soil fertility. Secondly, stability will require technology in the field of crop diversification, mixed (relay and double) cropping,

agro-forestry systems, including perennial grasses and shrubs), the integration of livestock-large cattle and small ruminants - with agriculture in order to develop balanced farming systems. The development of technology (e.g. early maturing drought resistant varieties) for rain-fed farming in the humid and semi-arid tropics of Africa requires special efforts. More attention should also be directed towards the improvement of typical female tasks such as weeding and food processing. As women are more likely to farm marginal lands than men, the development of agricultural technology for low-fertility soils is of particular relevance to them. Although in many crops there is a trade-off between protein content and yield level, increasing protein content while stabilizing yield fluctuations may be beneficial to household food security.

These types of research will have several implications for agricultural research methods. Firstly, it requires a long-term involvement in a given area, because the development and testing of stable systems including perennials can only take place over many seasons. The active participation of farmers through the research process will be essential. The "farmer-back-to-farmer" model as developed in Peru (HORTON - 1984) or specifically for women (FRESCO - 1982) provides an example of how this participation may take place. Women's traditional knowledge and skills, e.g. in the field of soil types, weeds, crop varieties, should be studied and utilized in particular during the diagnostic, design, and testing stages. Women's criteria to assess technology should be given special attention : e.g. the cooking, storage and cleaning food qualities, as well as the firewood and water requirements for cooking, of any new variety, the (seasonal) labour requirement, the share of the benefits they expect to receive, etc. Sources of variability between farming systems and households should be taken into account. Communication with female farmers will not occur as a matter of course, but will often require the involvement of female research and/or extension staff. Training for the research team as a whole may be useful to create awareness of the particular roles and constraints of women in agriculture. As female agricultural researchers are few and far between, one of the further reaching consequences will be the need to increase pre-and in-service training opportunities for women in agronomy and related fields with a view to developing expertise in the study of farming systems.

In short, the magnitude of the food security issue will require an open-minded and innovative approach, which leaves no room for the standard image of women as low quality workers and passive consumers. Any attempt to develop agricultural technology aimed at increasing food production in third world countries will need to involve women farmers as participants and partners.

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ABSTRACT

The intensification of agricultural production per unit of land area will be impossible without the involvement of women. Agricultural research has thus far focussed on the development of crop-centered technology, mostly improved genotypes such as high-yielding varieties of the Green Revolution, assuming that farming is under taken by (male) farmers aiming at maximizing returns with all family resources at their disposal. Moreover, technology has hitherto been considered as gender-neutral. Farming Systems Research, an approach resulting from the awareness of the gap between station and farmers' yields, might overcome some of the inadequacies of past agricultural research.

RÉSUMÉ

L'intensification de la production agricole par unité de superficie cultivable ne sera possible qu'avec la participation des femmes. La recherche agronomique s'est concentrée jusqu'à présent sur la mise au point de technologies centrées sur une culture par l'amélioration des génotypes, tels que les variétés à haut rendement utilisées par la Révolution Verte, tout ceci sur l'hypothèse que l'agriculture est l'affaire des exploitants mâles qui recherchent un profit maximal et ont à leur disposition toutes les ressources familiales. De plus, on a considéré que la technologie avait des effets neutres quel que soit le sexe des utilisateurs. La Recherche sur les systèmes de production née de la perception des écarts entre les rendements des stations de recherche et ceux des exploitants peut aider à surmonter certaines des insuffisances de la recherche agronomique passée.