AGRICULTURAL CHANGE AND ITS IMPACT ON THE NUTRITIONAL STATUS OF SMALL FARM FAMILIES

FINAL REPORT

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This paper is based on the premise that nutrition issues can be and should be explicitly incorporated into agriculture projects and that although many of the issues are unwieldy, farming systems research programs may be the most appropriate framework for their exploration. The hypothesis with which I was given to work is: changes in the agricultural production process which are intended to produce beneficial results may, in fact, be detrimental to the nutritional status of the small farm family. That hypothesis is the antithesis of an assumption that has served as the justification for many agricultural development projects. That assumption can be stated as: increased agricultural production which will increase income will result in improved nutritional status. For quite awhile that assumption has been disputed by nutritionists and there is an increasing volume of literature which substantiates the nutritionists' claims and lends credence to the afore stated hypothesis.

There is no reason to "reinvent the wheel" and undertake another detailed discussion of the pros and cons of either argument as there are various papers which have already been prepared for that purpose. One of the most cogent and concise of these papers has been written by Patrick Fleuret and Anne Fleuret and has been appended to this paper.

Although the basic hypothesis for my work can be supported by various community-level studies which have been done, there are virtually no micro-level studies which address the issues as they relate specifically to small farm families. Therefore it is difficult to try to refine the hypothesis any further at this point. What appears to be the next step would be the arti-

culation of various questions which could be researched under the auspices of farming systems research. Because traditional approaches to economic and agricultural development have often resulted in negligible benefits accruing to those people most at risk, a farming systems approach may provide a better means of reaching a particular segment of the farming population.

Because a farming systems approach purports to take a holistic look at the environment (physical, cultural and social) of the farmer (CGIAR/TAC; Gilbert, Norman and Winch; Norman; Harwood), it would seem reasonable to begin looking at nutritional issues as they affect small, poor farm families within the framework of farming systems research (FSR). However, it may be necessary to first raise some questions about the claims that FSR makes regarding its holistic and innovative approach and the gaps between the theory and practice of FSR. The practice of farming systems research seems to have been primarily oriented toward the technical problems of agricultural production despite the fact that the theory provides room for the treatment of non-technical factors as well. Mechanisms for dealing with those non-technical factors, however, have apparently had limited integration into the design and practice of FSR (Gilbert, Norman and Winch).

That the farmer can identify the goals of the household and the constraints on their achievement is a basic premise of FSR. The way in which these goals are identified, however, is not particularly apparent in much of the farming systems literature. Nor is it apparent how the farmer is able to interact with the researchers to define and solve the constraints on goal achievement. As most farming systems literature in concentrated on discussions of technical problems related to agricultural production, it is possible to get the im-

pression that a farming systems approach views improved agricultural production not only as the means to goal achievement, but as the goal itself. The assumption may be made by the researcher that improved productivity which will be transformed into increased income will improve the well-being of the farm household. Although the researcher wants to improve production to effect improved well-being the orientation of the research toward technical elements of production may not be conducive to evaluating what welfare improvements actually result from production increases: does the family eat more nourishing foods in adequate quantity; do children have more opportunity to attend school; will the general health status of the children improve and the infant mortality rate decline? What seems to be missing from farming systems research is an awareness of and concentration on the effects of agricultural change: the fruits of production, so to speak, measured in social benefits rather than just financial ones. Increased agricultural production itself is not holistic in nature, however, the purpose and results of the increased production may be.

That the development of farming system programs in the agricultural research centers have only marginally incorporated non-technical factors may prove to be a serious problem for the resolution of the theory and practice gap. The solutions to non-technical problem areas (land tenure, credit, markets, price policies) are outside the scope of farming systems research. Within the scope, however, are the impacts that those problems may have on production efforts. The technical expertise to improve agricultural production will have limited value if supporting services and incentives are lacking (Pines; Andrews and Moore; Hernandez et al.)

Apart from these non-technical factors which may limit the capability for improvements in agricultural production to significantly increase income, there are other factors which will probably limit the extent to which production and income increases will improve standards of well-being. These factors are not technical in nature but will influence and be influenced by technical changes made in agricultural production. Some of these factors such as labor considerations and commercialization have been discussed in the Fleuret paper. But, how they may influence well-being, specifically nutritional well-being, can be expanded upon.

Within the farming systems literature there is little in the way of information regarding how household decisions about production and consumption are made. While it has been recognized that the demands of consumption will influence production, it appears that the bulk of farming systems research has centered on production considerations. When Victor E. Smith and several graduate research assistants undertook a survey for Michigan State University on household food consumption in Sierra Leone they started with the hypothesis that

> "...decisions concerning food consumption form part of a unified decision-making process which governs production decisions, decisions as to the extent to which households shall depend upon the market (either as a source of income or as a source of food) and decisions as to the use of household labor in farm, non-farm or off-farm production activities. If food consumption decisions are affected not only by income and the prices of food purchased through the market, but also by the production decisions made in the course of deciding how to use resources for producing income, we shall obtain an adequate understanding of food consumption decisions only as we examine the whole set of decisions made by the household."

Unfortunately very little is known about household decision-making in general and production/consumption decisions in particular. This may be due to the expense of collecting the data and the fact that production surveys and consumption surveys have different purposes and thus use different procedures. Because it is now recognized that consumption affects production but the methodology for determining that influence has not yet been fully developed, farming systems programs might consider incorporating this into their research activities.

In looking at"how resources available to the farm family are used in the generation of income," two major areas present themselves: how labor is utilized and the extent to which the farm is commercialized. Both of these factors may have a significant impact on the quantity and quality of food consumed within the farm household.

The choice of crop varieties that can be cultivated may hinge on the amount of labor available to the farmer. However, there are numerous ways in which a change in the crop varieties will change the labor time available for other household tasks. Harwood compares black mung beans which do not require much weeding with green mung beans which require more weeding and multiple harvests to be optimally productive. In many parts of the world women are primarily responsible for weeding, thus the cultivation of green mung would demand more of their time. Consequently a woman would have less time to devote to her own cultivation of subsistence crops. She would also be left with less time for the preparation of food, requiring the purchase of convenience foods which are generally more expensive and less nutritious than subsistence staples (Chaney and Lewis; Gonzalo; Guyer; Intech, Inc.).

Conversely, of course, the cultivation of crops which require less attention frees up labor potential for other activities, either on- or off-farm. Here again the same income/nutrition trade-off may apply if a woman is able to earn extra income with some sort of wage employment but has less time for the preparation of food. Whether or not the income she generates is sufficient to purchase nutritious foods would depend on market availability and price.

Studies done in sub-Saharan Africa have examined the labor problems resulting from the substantial migration of men from rural to urban areas and how the farming system adjusts to the trend. It is estimated that women's labor now accounts for 60-80 per cent of the agricultural activity in the area (Chaney and Lewis). In her study of the women's farming system in southern Cameroon, Jane Guyer hypothesized that subsistence farming systems are essential for survival and must therefore be flexible to successfully accomodate changes which may occur in the environment both social and natural. As with any farming system there are always ecological, technical and social constraints which will limit the alternatives.

Unlike two of the previously dominant farming systems (esep and groundnut fields) which either demanded some input of male labor or was primarily market oriented, the dominant farming system now (asil fields) is almost the exclusive province of women. This system has evolved (1) to compensate for the lack of available male labor due to migration, (2) because the fallow period is not unduly long, and (3) a balanced diet can be produced by interplanting groundnuts with cassava, maize and green leaves. The esep and groundnut systems are now seen as expansion possibilities depending on

labor availability and market access.

Having observed that more produce was being marketed Guyer wondered whether women were marketing increasing amounts of their normal surplus or whether they were cultivating with a marketable surplus in mind and how the additional income was being spent. She found that as long as the levels of subsistence production are not disrupted and market access is assured, women will invest increased amounts of labor into income generating activities, be they agricultural or not. Steady income is spent on food and household needs while lump sums are used for school fees, house-building, celebrations, and brideprice (Guyer).

This particular farming system has evolved without the help of outside researchers. Several questions arise from this study which may be useful to consider in the design of farming systems research programs. Agriculturalists often voice the assumption that farmers are rational and will do nothing that is not in their best interest. That is apparently not the case, however, as numerous studies indicate that nutrition and consumption levels do not necessarily improve as changes in production occur and income rises. There is not always a positive correlation between the consumption levels and nutrient intake related to increased income (Gonzalo). Increases in production, market activity and income are not necessarily sufficient to improve nutrition. One of the determing factors of nutritional improvement is who within the household receives the additional income and who consumes the output (Pines).

In light of the fact that the women-managed farms in the Cameroon study continued to provide a balanced diet through primary emphasis on subsistence

farming and secondary emphasis on market activity, is it possible to make a distinction between traditional household responsibilities and divisions of labor and their influence on the nutritional levels of the household? The question to be asked is that where women have been responsible for the provision of food through subsistence farming and wage employment and men have been responsible for income generation through cash cropping and wage employment, will an emphasis on agricultural development through increased cash cropping and commercialization make it more difficult for a woman to fulfill her household responsibilities? Does a man expanding his cash crop production by using more of the land allotted to his wife's subsistence farming unwittingly pursue activities which are detrimental to the nutritional status of his family? Are such divisions of labor and responsibility culturally ingrained and thus resistant to redefinition despite the nutritional consequences? Can the agriculturalist's assumption be discarded (at least in areas where the described division of labor exists) and research/extension programs be designed which can equitably accomodate both sets of role responsibilities?

Following closely on the heels of and sometimes overlapping with labor considerations and their nutritional effects are issues related to commercialization. As with labor, some aspects of commercialization may particularly affect women and their ability to provide for family food needs.

Again, as discussed in the preceeding paragraph, concern for women's farming activities and the likelihood, vis-a-vis that of men, that their subsistence crops will be commercialized and concomitant nutritional implications should be considered by agricultural research programs.

Declines in crop diversity have been associated with commercialization and affects household nutritional status in several ways: less variety in the diet and seasonal variations in the availability of staple foods.

Many traditional agricultural systems supply good crop variety which is essential to achieve a balanced diet. The incentive of higher prices for cash crops tends to lead farmers increasingly into crop specialization. The effect is a decline in the amount of land used for the cultivation of domestically consumed staples with shortages and price increases the final result. The Tabasco area of Mexico was the site of a study which, over the course of 13 years and an extensive economic development plan, found that increases in the production of local food items was negligible while the production of bananas and sugar cane for export dominated the economic arena. Despite improvements in the economic circumstances of the area as a whole and changes in the diet of the urban population, the diets of the small rural landholders and landless laborers did not improve (Hernandez et al.; Dewey; Oftedal and Levinson).

In the Ilesha district of Nigeria three different areas were surveyed to determine the influence of environmental, social and economic factors on the cropping systems which have developed. In the first area of Igum, due to the soil being particularly well-suited for the sultivation of cocoa and the profitability of the foreign cocoa trade, the crop has supplanted the cultivation of food crops. The result has been a diminished food supply. The area of Effron Alaiye is not conducive to cocoa growing so the people are left without a cash crop. Consequently they are selling most of their food crops and have little for home consumption. A third area is

better suited to growing food crops which are abundant enough to allow a marketable surplus and limited cultivation of cocoa is possible. This area alone has achieved a balance between the commercialization of food and cash crops (Collins et al). The examples drawn from the Tabasco and Nigeria studies illustrate the fact that commercialization and cash crop cultivation will sometimes have the effect of making the urban population or the wealthy the beneficiaries of cash crops and export items. Very little nutritional benefit accrues to the small producer despite increased income.

Commercialization of cash crop production either for export or non-food items means that increased amounts of food must be imported. The result, of course, will be higher food prices. And if the marketing system is inadequate, the poor particularly in rural areas, will have limited access to the imports.

A final issue on the nutritional hazards of commercialization is related to a monetized economy. In a community where the economy is monetized food consumption will be limited by purchasing power. Within a traditional, usually rural area, food needs may be met through home production and/or barter. Commercial agriculture and the imposition of modernity on a community may hasten the process by which the traditional exchange economy becomes monetized. Facing a new or increased need for cash, the farm family may be forced to: market more of their own subsistence crops; produce cash crops; supplement household income with wage-labor; migrate to urban areas for imployment. Because the family's resources are then limited by land ownership, employment, and prices their food supply is likely to be

insufficient (Oftedal and Levinson).

Although the issues presented here on the nutrition and consumption effects of agricultural development are by no means exhaustive, it is hoped that they can be useful in determing the direction that future research programs may take. Despite some of the current shortcomings in the practice of farming systems research, it should be possible, given the theoretical framework, to incorporate concern for factors such as food needs and nutrition and their influence on the production/consumption process of the small farm household into the design of farming systems programs. While it takes awhile for a new research process to be refined, the incorporation of these issues needs to be instituted before the practice of a farming systems approach gets too far away from the holistic theory.

Because of the paucity of literature which exists on agricultural change among small farm families and its impact on nutritional status, it has been impossible to prove or disprove the hypothesis that I set out to work with. The great vacuum that exists in the area, however, may be useful for pointing out a crucial direction for some research. Whether that hypothesis is correct or the assumption that agriculturalists have often worked on is correct ought to be of some interest to those people who are involved in the design and implementation of agriculture projects and are concerned about the long term effects that those projects may have on the nutritional status of the agricultural producer.

Additionally I would like to recommend an evaluation of AID's goals in agricultural projects. Although most projects are for the ultimate purpose of improving the well-being of the rural poor whether this is the final result remains a question. The criteria by which the success or failure of a project will be measured are production and income figures rather than indicators or improved physical and social well-being. As the literature shows and which I have tried to indicate (although conclusive information remains scarce) output and income increases do not necessarily mean that welfare will have improved. Consequently AID needs to find indicators which would more accurately reflect the kind of impact and the extent of that impact which a project may have.

For the purpose of agriculture projects changes in nutritional status and food consumption patterns may be most reflective of welfare goals. This might be measured in what is consumed and how much is consumed. It might also take account of expenditure patterns so as to find out how the family is affected by changes in the price or availability of items (ie, as fuel costs continue to increase the poor may suffer declines in their food consumption as more income must be used to purchase heating and cooking fuel). The intake and output of energy might be a useful indicator of food need satisfication. Trying to measure nutritional status would not be a particularly useful indicator because there are too many other factors unrelated to food consumption which affect it. The presence of parasites in the body, clean water availability, and the general health status all influence nutritional status but are outside the realm of agricultural projects.

If AID desires to be responsive to the needs of the rural poor it needs to explore ways in which projects can more positively and directly benefit them.

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APPENDIX

Nutrition, Consumption, and Agricultural Change

PATRICK FLEURET and ANNE FLEURET

Introduction

DEVELOPMENT ASSISTANCE IS INTENDED, typically, to ". . . enable the poor . . . in developing countries to meet their basic human needs on a sustainable basis" (USAID 1978). One of the most basic needs of the poor in less developed countries is adequate nutrition (see World Bank 1978). Most programs of agricultural and rural development are intended, directly or indirectly, to improve the nutritional status of disadvantaged populations (see USAID 1977), but the gap between intent and accomplishment is often wide. Although there is some evidence that direct health and nutrition interventions can significantly improve the nutritional status of the poor at minimal cost (Gwatkin et al. 1979), there is growing uncertainty about the impact of indirect means of raising nutritional status. Such indirect approaches—including employment generation, development of infrastructure, land reform, and raising the productivity of smallholder agriculturalists—have, in the past, been thought to have a generally positive effect on nutrition among the poor majority by raising income and improving food consumption. But Berg (1973), Reutlinger and Selowsky (1976), and others have suggested that, because of maldistribution, certain aspects of malnutrition can persist—especially among the poor—in the face of otherwise successful general development programs.

These findings imply that currently there is insufficient awareness of the "malnutrition problem." Too little attention has been directed to the ways in which specific development programs affect community-level social and economic conditions, which, in turn, may affect nutritional status. Thus, there is no general understanding of how specific development programs, apart from direct interventions, may affect consumption patterns and therefore nutritional status. As an initial, perhaps oversimplified illustration, consider the following sets of circumstances under which consumption-related malnutrition may arise:[1] (1) Food production is inadequate, due to lack of land, labor, capital, or any one of these; (2) Food production is adequate, but some people cannot afford enough food, or the right kind(s) of food; (3) Food production is adequate, but cultural factors (e.g., food preferences, intrahousehold distribution) cause unhealthy consumption patterns; (4) Both aggregate food production and overall income levels are adequate, beliefs and values are nutritionally neutral, but certain categories of the population are constrained by other social and economic factors (outlined below) to make consumption decisions that are inconsistent with good nutrition.

Situation (1) has often been amenable to well-planned programs of agricultural technical assistance; situation (3) can be ameliorated through careful programs of nutrition education (provided that income levels are high enough to allow people to act on the new information [Bantje 1977]); income redistribution, food subsidies, price ceilings and the like may improve the nutritional status of communities trapped in situations (2) and (4), but definition of target populations and program implementation have presented many difficulties. This cannot be considered a failure of policy: policymakers have often been unable to give adequate consideration to the nutritional impact of general development programs because little research has been directed at such issues and our fund of knowledge is poor; furthermore, the work that has been done is often poorly publicized.

It has always been difficult to demonstrate the existence of precise relationships between socioeconomic development and nutritional status. This is partly because of the complex "multi-factoral" etiology of nutritional disease itself (Jelliffe 1966); partly because it is hard to identify the effect that a specific development program may have on nutritional status when there are many other coincident and possibly relevant factors (Joy 1973); and partly because the research methodologies used to examine interactions among social, economic, and nutritional variables are often deficient (Ernster et al. 1976; Wilson 1977). Nevertheless, many recent and several older community-based studies of nutrition and society have made important contributions in such directions, and the conclusions reached have much significance for development policy.

Community-level studies of the relationship between society and nutrition may take several directions. Perhaps the most common approach is to identify what Jelliffe (1957) has termed "cultural blocks," that is, local beliefs and practices that influence dietary intake and may thus affect the nutritional status of a population or some portion of it. Wilson's review of food habit research (1973) shows the breadth of work which has been done along these lines. Such materials

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which are often designed to demonstrate the place of traditional cultural patterns in the etiology of nutritional disease, shed little light on an issue of more immediate relevance to development policy: What happens to nutritional status in the course of economic change? This is crucial. There are many studies, from all parts of the world, which show how traditional communities (or specific categories of people within them) are placed at risk nutritionally through cultural patterns of food production, distribution, and consumption. However, there are comparatively few studies which show how modernizing communities (or specific categories of people within these) become malnourished through the introduction of novel methods of food production, distribution, and consumption. In this paper, we review findings of some of this latter category of literature in order to identify some important implications of development policy.

TRADITIONAL FOOD PRODUCTION AND CONSUMPTION SYSTEMS. More often than is generally realized, traditional food production and consumption arrangements constituted rational, well-balanced adaptations to limitations of environment and technology. For example, a diet consisting of maize, beans, and squash, found throughout the New World, is generally conceded to be nutritionally adequate, inasmuch as protein, vitamin, and mineral deficiencies of each individual component are largely overcome by compensatory qualities in the other components (FAO 1953; Haas and Harrison 1977). In addition, indigenous methods of maize preparation (involving the addition of lime or wood ashes) raise the nutritional value of this staple by increasing the biological availability of niacin (Katz et al. 1974; Wilson 1978). Indigenous staple preparation cannot be said to be universally nutritionally appropriate; native milling of grains is sometimes wasteful, for example (Carr 1961), or may lead to phytate imbalance through the inclusion of excess fiber and bran (Reinhold et al. 1973). Nevertheless, there are studies of rice-based food regimes (Hanks 1972; Katsura and Olso 1976), of cassava-based regimes (Berlin and Markell 1977; Houston 1973; Jones 1959), of sorghum-based regimes (Grivetti 1978b), and of banana-based regimes (Bennett et al. 1965; Simmonds 1966), which suggest that when these indigenous food production systems are undisturbed by exogenous forces, they can produce the correct assortment of nutrients in sufficient quantity to meet the requirements of human populations.

Nutritional sufficiency is achieved under traditional circumstances by supplementing staple consumption with small-game hunting, and, perhaps more importantly, through a wide-ranging and sensitive exploitation of available nonstaple food plants. This includes species that are cultivated, species that are foraged in the wild, and other species that are neither cultivated nor foraged but whose germination and maturation are fostered by patterns of land clearance and plot weeding. This latter group includes leafy greens, fruits, roots, and mushrooms.

The most important aspect of this exploitation centers on the harvest of leafy green plants. The most commonly consumed are leaves of *Manihot, Vigna, Ipomoea, Dioscorea,* and *Colocasia* species, which are cultivated plants, but dozens of less well-known wild species are consumed as well. Edible greens, incorporated into the diet as relishes, soups, or in close combination with the staple (Bascom 1951; Calloway et al. 1974; Jelliffe and Maddocks 1964; Oomen 1971), frequently provide significant amounts of nutrients in the form of leaf protein, calcium, iron, and vitamins. This circumstance was recognized by some at an early date (Carr 1956; Fortes and Fortes 1936; Glegg 1945; Orr and Gilks 1931). Many studies have demonstrated the specific nutrient content of commonly consumed green leaves (Hennessey and Lewis 1971; McLaren 1961; McCulloch 1929–30; Platt 1962; Shanley and Lewis 1969) which are often more valuable in this regard than the exogenous vegetables development officials would like to see produced (Latham and Stare 1967). Not until relatively recently, however, have attempts been made to assess the extent to which such foods form a consistent element in the diet. Wild plants are often viewed as important famine reserves (Brokensha and Riley 1978; Brooke 1967; Grivetti 1978b; Hunter 1967), but in fact dozens of different species of green leaves are consumed on a day-to-day basis by people in widely separated parts of the developing world. Work along these lines has been done in East Africa (Brokensha and Riley 1978; A. Fleuret 1979a, b; Scudder 1971), West Africa (Teitelbaum 1977; Woolfe et al. 1977), Southern Africa (Grivetti 1979), Latin America (Berlin and Markell 1977; Messer 1977), and the Philippines (Eder 1978). In all cases, these plant materials supply essential, not supplementary, dietary components.

There are other ways in which traditional diets reflect well-balanced adaptations to nutritional needs. Although the question is somewhat controversial, geophagy (consumption of earth) may be a valuable technique for acquiring iron and mineral supplements; around the world it is associated primarily with the onset of pregnancy and lactation (Grivetti 1978a; Haas and Harrison 1977). Among the Ewe of Ghana, for example, average daily consumption of mineral-laden earths is 13 g for males and 30 g for females (Vermeer 1969, 1971). Elsewhere, indigenous salts are obtained from natural (and heavily mineralized) pans and outcrops (Buchbinder 1977; Orr and Gilks 1931), or by burning and leaching the ashes of swamp grasses which contain many valuable minerals, particularly phosphorus and chlorine (Orr and Gilks 1931). Indigenous methods of food preparation or storage may also contribute positively to the nutritional status of a population. The addition of lime to maize has already been noted, as has the widespread practice of steaming staples in green leaves. In parts of the New World, premastication of coarse grains for infants was nutritionally valuable (Freedman 1977), and this practice is widespread elsewhere. In parts of Africa foods are preserved by soaking in vegetable oil or by mixing with mineral-rich anthill soil (Maletnlema et al. 1974). In many other places, fermentation of staples or beverages derived from staples adds to the value of basic foods and helps to prevent pellagra, scurvy, and beri-beri (Fox and Stone 1938; NAS 1977; Osborn and Noriskin 1937).

On a rather different level, there have been several attempts to associate specific behavioral disorders with aspects of traditional dietary habits. Perhaps the most interesting material comes from the Andes, where researchers have suggested that chewing coca leaves may counter hypoxia-induced hypoglycemia (with attendant aggression), protect against cold stress, and serve as a source of vitamins and minerals (Bolton 1973, 1976; Burchard 1975; Hannah 1974). The consumption of this mildly narcotic leaf, frowned upon by outsiders and local authorities, may thus be a nutritionally and socially valuable

practice. Elsewhere, endemic goiter, cretinism, and other neurological dysfunctions have been seen to emerge when indigenous sources of iodine and/or thiamine are disrupted (Buchbinder 1977; Greene 1973; Latham and Stare 1967).

Most of the foregoing material challenges the assumption that indigenous food production systems in developing countries were largely unable to meet the nutritional needs of the people depending on them. Traditional agricultural systems in many parts of the world were for the most part adequate in terms of overall production; shortcomings were evident in methods of storage and distribution, but even these did not often assume significance until the introduction of Western preventive medicine and consequent high rates of population growth. Although some cultures have evolved low-technology means of storing significant quantities of food (Ogbu 1973; Shack 1971), much of the developing world undergoes a more or less debilitating "hunger season" (annually or less frequently) that can cause widespread morbidity and mortality among young children whose nutritional status may have been marginal at the outset (Knuttson 1972). Throughout much of Africa, Asia, and Latin America, women and young children are placed at a nutritional disadvantage through indigenous food distribution practices. It is particularly noteworthy that these "cultural blocks" to adequate nutrition work against those who are especially in need of superior nutritional intake. It is also necessary to consider that these deleterious practices are balanced by other features of traditional social organization that encourage equitable distribution of food on a more inclusive level. A close relationship between features of social or political organization and nutritionally advantageous redistribution of food among kin groups, villages, or tribes has been specifically described in the Orinoco Delta (Heinen and Ruddle 1974), in the Amazon Basin (Gross 1975), among tribesmen in the New Guinea Highlands (Rappaport 1967), in East Africa (Gerlach 1964), West Africa (Hunter 1967), southern Africa (Grivetti 1978b), and in Latin America (A. Brown 1978; Dewey 1978). Many other studies have mentioned the food distribution aspect of social organization but studied the process less thoroughly.

What these materials tell us is that features of traditional social organization in many parts of the world encouraged equitable distribution of food among communities and families, at the same time that other cultural factors encouraged inequitable distribution within families or households. The implication, most evident in work done by Kolata (1978), Wilmsen (1978), and others (e.g., Haas and Harrison 1977), is that systematic nutritional deprivation of pregnant and lactating women and children under five (especially female children) observed in traditional societies around the world, may be regarded as a cultural mechanism of controlling fertility and population growth.

To summarize: there is reason to believe that traditional systems of agricultural production in the developing world were largely adequate in terms of productive capacity; this adequacy was based on an extensive exploitation of nonstaple food plants, but undermined by technological shortcomings that prevented the development of sufficient food storage capacity. Traditional systems of food distribution, linked closely with political organization, appear to have been oriented toward maintaining the viability of the society as a whole; this was achieved by equitable distribution among separate units of production (e.g., households, kin groups, villages), and inequitable distribution within units of production (particularly households).

NUTRITIONAL IMPLICATIONS OF AGRICULTURAL DEVELOPMENT PROGRAMS. We turn now to a consideration of the steps taken by foreign aid donor organizations to improve the nutritional status of Third World populations. These programs have included, at a minimum, nutrition education, aimed at removing cultural blocks to adequate nutritional intake; food supplement programs, aimed at eliminating critical deficiencies among specific populations; nutrition rehabilitation programs, which combine elements of both of these; and improved agricultural production.

The advantages and disadvantages of nutrition education, food supplement programs, and nutrition rehabilitation programs are important areas of investigations, as are other types of direct interventions, but these will not be considered here. This paper focuses on the nutritional consequences of improved agricultural production schemes.

The relationship between agricultural change and nutritional change is sometimes direct, but more often not. This is because a large number of intermediate or subsidiary changes are set into motion when traditional modes of agricultural production are altered. Regional and international markets, indigenous dependency ratios, systems of land tenure, the organization of agricultural labor, and ecological balances can all be changed by novel agricultural inputs, and may all in turn cause changes in the consumption patterns and nutritional status of subject populations. The discussion of the nutritional consequences of agricultural change which follows, therefore, is likely to be suggestive rather than definitive; qualitative rather than quantitative; and forsakes the rigorous examination of all contingent factors in particular settings for a less detailed, but more comprehensive, review which is meant to show the multiplicity of ways in which consumption and therefore nutritional status may be affected by general development policy. The review will consider these concomitants to agricultural change: changes in crop inventories, changes in agricultural labor requirements, and changes in market relationships.

Change in Crop Inventories

That commercial production often leads to a decline in nutritional status has long been recognized (Culwick and Culwick 1939; Levy et al. 1936; McCulloch 1929–30). Further investigation has led to understanding of some of the agrarian processes involved.

The multiplot and multicrop production strategies typical of subsistence agricultural regimes are aimed at reducing the levels of risk to which producer households are exposed (Brokensha and Riley 1978), and also smooth out irregularities in the food supply (Nietschmann 1973; Rutishauser 1963), so far as this may be possible with limited technology. Commercial production in developing countries, on the other hand, nearly always exaggerates seasonal cycles of plenty and want. The money obtained through crop sales, which ordinarily arrives in one or two lumps during the course of the year, should, in theory, allow food purchases to dampen cycles of scarcity, but is often inadequate to the task. This can happen because the sudden arrival of cash has a tendency to drive up

food prices, or because of inequalities in the structure of agricultural credit and savings facilities (Lappe and Collins 1977), or because the food available for purchase is scarce or of inferior nutritional quality (Adams 1974; King 1971; Picon-Reatagui 1976), or because scarce cash income must be allocated among many competing nonfood needs (Florencio and Smith 1969; Newman 1970).

Another consequence of commercialization of agriculture is a decline in crop diversity. As single households place increased amounts of land into production for the market, the range of possibilities for food production is reduced (Hanks 1972), with rare exceptions (Freed and Freed 1979; Messer 1972). When supplementary nonstaple foods are deleted from crop inventories in favor of commercial cultigens, the peasant household becomes less self-sufficient and, more importantly, less able to withstand seasonal variations in the supply of staple foods. This decline in the variety of available foods is critical in other ways as well, for dietary diversity has been shown to be a close analogue for dietary sufficiency (Dewalt and Pelto 1977; Robson and Wadsworth 1977), and the nutritionally complementary dietary associations common in traditional settings are easily upset by new cultigens, to the detriment of nutritional status among peasant consumers (Messer 1977). Even more deleterious may be the replacement of traditional staples with exogenous staples (e.g., maize, wheat). Pellagra, for example, is more frequently found among populations introduced to the use of maize than among populations where maize is the traditional staple, because the necessary diet complements (chiefly legumes) are usually not introduced simultaneously (Patwardhan and Darby 1972).

Change in Agricultural Labor Requirements

Throughout the developing world, commercial agricultural production has placed increased demands on the labor time of women, who are often overburdened in traditional production systems and who may already be unable to devote sufficient time to nutritionally relevant activities (Ojiambo 1967). Often there are changes in cooking habits, as women substitute quicker but often less nutritious techniques for traditional methods of preparation (Knuttson 1972). When less time is given to food preparation and child feeding, the deleterious nutritional consequences can outweigh those due to either lack of food or lack of cash income (Sharman 1970). In other cases, the labor demands of commercial agriculture can result in the selection of less labor-intensive food crops, and these (often manioc or other tubers) are relatively poor in nutritive content (Idusogie 1969).

More subtle—but equally deleterious—consequences of change in labor relations become evident if we consider the energy costs of food production. Recent calorimetric work from Colombia (Taussig 1978), northeastern Brazil (Gross and Underwood 1971), the Philippines (Eder 1978), New Guinea (Rappaport 1971) and the Amazon Basin (Gross 1975) suggests that the introduction of market agriculture may increase the amount of human energy needed to obtain necessary nutrients (chiefly calories), and may also engender nutritionally damaging patterns of intrafamily food distribution. The populations undergoing these disadvantageous shifts in energy allocation and the efficiency of energy expenditure are least able to withstand the negative nutritional consequences.

Changes in Market Relationships

Commerical agriculture directly influences dietary intake and nutritional status in developing countries by changing cropping patterns and the caloric productivity of labor. More indirect dietary changes follow the incorporation of peasant producers into regional and international markets. Elite urban populations, well rewarded through participation in bureaucracies or trade networks, are able to bid up the price of scarce, highly nutritious foods, thus removing them from the diets of the urban poor and rural populations in general. This may be seen in the flow of animal protein to urban areas from the rural areas in which it was formerly consumed, which can take place continually (Read 1964; Sai 1969) or only in response to temporary rural shortages in staple foods (Hunter 1967). It may also be seen in the development of rural productive enterprises that meet the nutritive needs of wealthy townspeople while neglecting the needs of the producers themselves (Cattle 1978; Williams 1973).

A common contributing factor to all these processes is that the prices offered to growers of commercial crops are marginal, or subject to annual fluctuations (P. Fleuret 1978; Stavenhagen 1978), which makes it difficult for commercial producers to assemble needed cash. When cash-short producers enter a dependency relationship to obtain agricultural inputs (whether public or private), they often begin a downward cycle of diminishing productive resources that is most visible in consumption declines at the household level but which can impoverish whole regions (Brookfield 1973). The deleterious consequences of agricultural dependency may also emerge in the context of food imports; when food imports were restricted in Jamaica, nutritional status in rural areas improved as producers responded to the price incentive of increased demand for domestic food (Marchione 1977).

From this discussion, it emerges that there is no necessary relationship between a shift to commercial agriculture and improved nutritional status in the developing world. On the contrary, there is reason to suspect that unless extraordinary precautions are taken to develop a distributive network and a pricing mechanism that will provide modernizing peasants with both the chance and the incentive to exchange new-found cash for nutritious food, absolute declines in nutritional status among some or all of the population can be expected. It is important to note that the discussion has been of "commercial crops" in general—no distinction has been drawn between crops grown solely for export, such as coffee, fiber, rubber and the like, and commercial crops which may be consumed domestically, such as maize, cassava, or vegetables. This is because the processes which work to the disadvantage of peasant producers are not commodity-dependent. When crop diversity is lower, peasant producers are placed at risk. When regional price mechanisms impinge on allocative decisions that were formerly structured by risk aversion, a steady supply of food to peasant producers is endangered. When additional demands are placed on household labor resources, nutritional status may be undermined. And when changes are made in the array of calorie capture strategies open to peasant producers, the opportunity for inefficient energy expenditure (guided by commodity prices, wages, and taxation) will emerge. The disadvantageous ramifications of agricultural change are many, and the complexity of the issue has led Brown and

Parisier (1975), May (1974), and others to recommend that, in the best interests of Third World producers, Western technology should be applied to improve the productivity of existing crop regimes and staple foods, rather than to introducing exogenous cultigens and methods of production. These cautions may be unrealistic; in any event they have been largely ignored. Further ramifications of these issues emerge below in a detailed discussion of the relationship between income, consumption, and nutritional status in less developed communities.

INCOME AND NUTRITION. In the developing world there is a significant correlation between low income and low nutritional status (Adrianzen et al. 1973; Banik et al. 1970), especially in regard to protein deficiencies (Sai 1969). This relationship has been most evident in urban areas, where low wage rates (Okeahialam 1975), lack of access to well-understood traditional foods (Jelliffe et al. 1963; Keyter 1971), the need to prepare quick, fuel-efficient meals (Idusogie 1973), and nutritionally inefficient cash expenditure (Florencio and Smith 1969) may separately or together undermine the nutritional status of the poor majority. Some of these aspects of urban poverty can also influence nutritional status in rural areas, either directly (Bantje 1977) or indirectly through the effects of long- and short-term labor migration (Freedman 1973; Richards and Widdowson 1936; Robson et al. 1962). The importance of income in determining nutritional status is highlighted by the frequent observation that, even where "cultural blocks" to good dietary practice are most strongly in evidence, it is rare to find malnutrition among the wealthiest segments of a population. This has led to an emphasis on raising income as a necessary prelude to improving nutritional status, and more often than not, "raising income" has meant introducing commercial agriculture. The value of such an approach is open to question, for there is no necessary link between commercialization and growth in real income or improved nutritional status. Indeed, it can be shown that even when rural income rises, nutritional status may not change (Dema 1969). To understand why these very discouraging circumstances exist, and to understand what policymakers may do to counter them, it is necessary to take a closer look at specific processes of agrarian change. Three aspects of the relationship between nutritional status and agricultural change will be examined: declining nutritional status during the transition from subsistence to commercial cropping; variation in landholdings, income, consumption, and nutritional status; and nutritional change in association with overall economic advance.

Declining Nutritional Status during Agrarian Transitions

There is a limited amount of evidence that the worst nutritional declines experienced in rural areas happen when households are changing from subsistence to commercial production. In a cocoa-growing area of West Africa, Collis et al. (1962) observed that:

> [Some] farmers appear to sell enough cocoa to be able to buy reasonable quantities of food for their families, but [other] families have much younger cocoa which has to be cared for with cash from the sale of their food crops. Hence they have a lower food intake . . .

Similar conclusions emerged from a study of coffee farming among the Chakaka Poka of Malawi. Coffee begins to bear only after three years have passed, so those who invest in coffee trees must either have surplus land and labor to produce the necessary staple foods or be prepared to experience food shortages during the interim. When prices were high, established commercial farmers could afford to buy sufficient staples to replace the food they no longer grew (Ogbu 1973). Evidence that the concept of "transitional malnutrition" may have more general significance comes from circumstances observed in the Caribbean, where the transition was not to new cultigens but to new employment strategies (Beaudry-Darisme et al. 1972). Unfortunately, it is rather rare for malnutrition following upon the introduction of new income strategies to be transitory; much more frequently, attendant institutional changes embed malnutrition in the new patterns of production, distribution, and consumption. How this happens is outlined below.

Variations in Landholdings, Income, Consumption, and Nutritional Status

Pelto and Jerome (1978) have recently stressed that to understand variation in nutritional status one must be sensitive to rather small variations in income in rural areas:

> Even among seemingly homogeneous [farmers] there can be significant differences in economic status, based on access to paying jobs [and] differences in agricultural productivity . . . assumptions [regarding dietary intake] about the same social stratum are not warranted when households are examined more closely.

One or two studies have been able to show, by focusing closely on household income strategies, that variations in economic status which are all but invisible to outside observers can have implications for nutritional status. Desai et al. (1970), working in Jamaica, conducted a household survey that took into account number of rooms, construction materials and methods, the ratio of earners to dependents, principal occupation of the household head, and other similar factors. All these are approximate analogues for real household income, which is difficult to measure directly. They conclude that . . . "the relationship between (child) growth and income was quite apparent . . . in spite of the relatively narrow range of socioeconomic status found within the study area."

Similar results were obtained by Dewalt and Pelto (1977) in a Mexican community, where it was found that "The most powerful predictor of nutritional adequacy . . . is material well-being or general economic well-being."

Of the total variance in nutritional status observed in this study, 30% was explained by a household analogue for real income, and 11% was explained by livestock holdings. No significance could be attached to either women's educational level or their beliefs about what constitutes nutritious food.

There is much other evidence that women's education and "modern" attitudes contribute positively to nutrition in rural households (Munoz de Chavez et al. 1974), but it is possible that this is a largely spurious association achieved through a more general coincidence of household wealth and expansion

in the scope of women's opportunities. In those few nutritional studies which have been able to make use of data on landholdings in rural areas, the linkages between inadequate land, constriction of opportunity, and malnutrition become very clear. Rawson and Valverde (1976), working in Costa Rica, found that children from the 45% of all households with less than 1.4 ha of land were significantly more likely to be malnourished than children from families with larger landholdings. The critical causal link had to do with off-farm employment. Adult males from such households often took low-paying casual jobs to supplement their incomes-in-kind with cash. The resultant income would have been insufficient to meet consumption needs even had it been allocated entirely to food, which it was not; and the absence of the traditional farm manager from the household lands meant that staple food production suffered. Adult women from such households were also often constrained to take salaried jobs, which were poorly rewarded, but which demanded a great deal of time. Serious consequences followed as cooking and child care were neglected, and poorly maintained houses multiplied the chances of infection among children.

Equally compelling results were obtained by Valverde et al. (1977) in Guatemala, where they found that among families with 1.5 ha of land or less, 38% of all children were malnourished; among families with more than 1.5 ha but less than 3.5 ha of land, 31% of all children were malnourished; and among families with more than 3.5 ha of land, only 17% of all children were malnourished. The authors conclude; ". . . land availability was significantly associated with nutritional status of young children and may thus be used as an indicator of health and nutritional status of the family."

Similar factors played a role in a study done near Hyderabad (Jyothi et al. 1963), where wealthy households (with much land) were observed to include ". . . pulses in the diet daily or on alternate days while the other sections of the population used pulses twice a week or less frequently."

What conclusions may be drawn from studies such as these? The clearest lesson is that the land allocation effects of economic development programs must be carefully watched to make sure that inequities in landholdings are not encouraged. Unfortunately, this is not often done. Dewey (n.d.) reviewing materials from Latin America and Asia, has observed that "A major effect of agricultural development in many parts of the world has been drastic changes in the distribution of land and in land tenure relations. Very often the result has been less land for small farmers."

Irrigation, mechanization, the introduction of fertilizers and hybrid seeds, and other novel technologies that lead more or less directly to economies of scale, tend to lead simultaneously to inequitable land redistribution. It cannot be assumed that the landless laborers and small farmers created by this process will be able to make up consumption shortfalls by taking up new (adequately remunerative) jobs made available through technological advance.

We are now familiar with the disadvantageous nutritional concomitants of inadequate landholdings in rural areas. Inadequate land implies inadequate income (in kind or in cash), and this has a negative impact on patterns of consumption. One implication is that where overall economic advance has taken place, nutritional status should improve. It is then very disappointing to discover that, even where agricultural development has been successful in terms of traditional measures, such as overall growth in income, there is no necessary improvement in general nutritional status.

Nutritional Change in Association with Overall Economic Advance

The most complete studies of nutrition change in the wake of successful agricultural change have been done in the part of Tabasco, Mexico affected by the Plan Chontalpa (Hernandez et al. 1974). A major rural development project involving some redistribution of land, resettlement, and the introduction of commercial agriculture was initiated in the 1950s. By the early 1970s, the value of agricultural production in the area had increased by a factor of six, but population had only doubled. By this objective measure, then, the material well-being and nutritional status of the affected populations should also have improved; indeed, it was found that total food intake had increased, and, on the average, the composition of the diet had improved as well. Unfortunately, the overall improvement was due to vast changes in the resources available to wealthy households; the poorest 30% of the families showed improvement in neither dietary intake nor nutritional status.

A later, more detailed study in approximately the same area (Dewey 1978) reveals some of the reasons for such discouraging results. During the land reallocation, in which private holdings were collectivized, government and financial institutions directly or indirectly acquired the authority to make productive decisions on all but a fraction of the available land; the decisions which followed, aimed at maximizing crop exports and returns on investment, ultimately stunted growth in food supplies. Furthermore, a close relationship was noted between reduced crop diversity and lowered nutritional status. Some of the new settlements also took shape in a fashion that increased the risk of infestations and infections among children. The most positive aspect of the plan resulted from health clinics; children living near to these were significantly healthier than children living elsewhere.

Rather different but equally disconcerting circumstances have been observed in another Mexican setting (A. Brown 1978). Resettlement following the filling of a large dam affected people from four different types of communities: Indian maize farmers, plantation workers, participants in collective agricultural schemes, and workers on cattle estates. In a comparison of affected and unaffected communities of all four types, it was uniformly observed that overall economic well-being was higher in the affected (i.e., resettled) communities than in the unaffected communities. This was attributed to liberal credit programs, sensitive administrative procedures, and the like. Nevertheless, the absolute variation in nutritional status between well-off households and relatively poor households was much greater among the affected communities than among the unaffected communities—and this happened independently of productive strategy. The disappearance of traditional mechanisms of food redistribution in resettled communities, coupled with the unequal impact of economic opportunity under rapidly changing circumstances, resulted in inequitable nutritional change among low-income segments of the population, even when overall nutritional status was improving and economic development was taking place.

This review of the community-level factors which may influence the nutritional impact of agricultural development allows us to define a number of policy and program issues which should be considered carefully by those who determine and implement agricultural development policy.

(1) A great deal of discussion has taken place in recent years on means of ensuring that "technological packages" for increasing rural productivity are suited to the community-level social and economic situation. The material presented here suggests that another design consideration should be added: analysis of current and projected dietary intake among various segments of the affected population, perhaps along the lines proposed by the FAO Committee on Agriculture (UN 1978, 1979). Agricultural changes will affect the consumption patterns of some or all members of the community, and it cannot be assumed that these changes will be nutritionally advantageous.

(2) Many development technicians and designers assume that all rural producers in the Third World are poor in resources and income. This attitude results in projects aimed at helping the "poor majority" of countries or regions, who are not nearly as homogeneous a group as this term implies. Minute differences in the quality and quantity of productive land, combined with small variations in off-farm income strategies, can have major consequences for levels of household income and nutritional status. Insensitivity to such variations in income on the part of those who design and implement development projects can exacerbate economic differentiation as benefits flow to those with greater investment capacity—and this nearly always has major implications for nutritional status among the poor *minority* who are truly disadvantaged.

(3) Careful consideration should be given to any project which entails a decline in crop diversity among peasant producers. Declining diversity will lead to declining nutritional status unless care is taken to ensure that nutrients formerly grown by rural consumers are made available on the market in a form and at a price that will be acceptable.

(4) The extent to which traditional nonstaple foods can contribute to the nutritional status of rural populations should not be overlooked. It may often be more effective, in terms of nutrition and in terms of cost, to encourage expanded output and consumption of indigenous vegetables and fruits before undertaking a program of agricultural change that introduces new vegetables and new fruits.

(5) Virtually all agricultural development projects, particularly those that entail changes in the technology of production (e.g., irrigation, mechanization, or the replacement of root crops by grain crops), cause major realignments in the allocations of labor responsibilities by sex and age in affected communities, and are likely to lessen the control peasant households have over the process of production. Such changes will seldom be nutritionally neutral, and care must be taken to ensure that the critical activities of subsistence food production, distribution, processing, and child feeding are not unnecessarily disrupted.

(6) Macroeconomic decision making, with respect to relative factor prices, import-export pricing policy, levels and incidence of taxation, and development of agricultural infrastructure, often imposes a penalty on small rural producers who leave off subsistence production to enter the market in agricultural commodities. Sometimes it is possible to express this penalty in terms of declining returns to labor and land; much more frequently the only evidence of such institutionalized disadvantage takes the form of decreasing levels of consumption and malnutrition in rural areas. The future of the Third World lies for the most part in agrarian development, but, despite much controversy, most governments of developing countries and many foreign aid donor organizations continue to have an urban bias embedded deeply in development policy.

(7) Since agricultural change may endanger nutritional status, and since it is often difficult to predict what form the nutritional threat may take, more agricultural projects should incorporate nutrition and health-status monitoring components. If deleterious trends then emerge, appropriate action to change elements of the project or to initiate specific nutrition/health interventions could be taken.

In the long run, there is little doubt that the food needs of the world will have to be addressed through increasing productivity, which will inevitably involve greater specialization and capitalization of agricultural production in the developing world. But development efforts that focus narrowly on production without considering distribution and consumption unfortunately tend to alter access to resources of all kinds in ways that can have a deleterious impact on nutritional status among the rural poor and which reduce the likelihood of meeting long-term goals. These unfortunate consequences are not inevitable. If greater attention is given to refining definitions of the rural poor; if greater respect is given to the value of traditional production and consumption practices; if greater heed is paid to the widely ramifying community-level consequences of change in agricultural production; and if care is taken to upgrade the efficiency of markets in staple and nonstaple foods *before* rural producers are encouraged to begin purchasing nutrients they formerly grew, then it should be possible for effective long-range and long-lasting agricultural development to take place without undermining the health and nutritional status of poor people in rural areas.

NOTE

[1] This paper focuses on the consumption component of malnutrition since this is more directly affected by changing agricultural patterns. Agricultural change can also affect the prevalence of conditioning infections and infestations, but these relationships are not considered here.

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