AGRICULTURE-HEALTH LINKAGES

Michael Lipton       Emanuel de Kadt

The Institute of Development Studies
University of Sussex
Brighton, England

WORLD HEALTH ORGANIZATION
GENEVA
1988
# CONTENTS

## CHAPTER 1. THE ISSUE, THE AIDS AND THE AUDIENCE

1.1 Impact of agriculture on health .......................... 5  
1.2 The aims ........................................... 7  
1.3 Target audience ....................................... 7

## CHAPTER 2. HEALTH GOALS FOR AGRICULTURE

2.1 Nutrition-infection synergism .......................... 10  
2.2 Assessing and monitoring dietary inadequacy .......... 13  
2.3 Indicators of energy inadequacy ......................... 16  
2.4 Expectation of healthy life ........................... 22

## CHAPTER 3. THE AGRICULTURAL PROCESS: IMPACT ON HEALTH

3.1 The process ........................................... 24  
3.2 Agricultural inputs .................................... 25  
   3.2.1 Labour and its associated problems .............. 25  
      3.2.1.1 Low income .................................. 25  
      3.2.1.2 High energy requirements .................. 29  
      3.2.1.3 Health hazards ............................... 30  
      3.2.1.4 Women's work ................................ 30  
      3.2.1.5 Seasonal changes ............................. 31  
   3.2.2 Land use and associated problems .............. 32  
   3.2.3 Water and associated problems .................. 33  
   3.2.4 Tillage methods ................................ 35  
   3.2.5 Agrochemicals ................................... 36  
      3.2.5.1 Fertilizers .................................. 37  
      3.2.5.2 Pesticides .................................. 37  
3.3 The choice of agricultural outputs .................. 40  
   3.3.1 High-value outputs or local-use outputs? ........ 40  
   3.3.2 Food crops or cash crops? ........................ 42  
   3.3.3 Production of dietary energy and important nutrients ........................................... 45  
   3.3.4 Regional balance of output expansion .......... 46  
   3.3.5 High yields versus stability ..................... 48  
   3.3.6 Dangers from farm products ...................... 49
CHAPTER 1

THE ISSUE, THE AIMS AND THE AUDIENCE

1.1 **Impact of agriculture on health**

Agricultural products and processes are linked to the two main causes of death and disease and thus also to the main ways of preventing them. The first main cause is the joint action (synergism) of infection, parasites, and malnutrition which is an important cause of mortality in children aged 0-5 years in the poorest one-fifth of families - mostly rural - in most countries of Africa, Asia, and Latin America. The great majority of families in this situation work mainly in agriculture - mostly as private subsistence farmers in Africa, as communal subsistence farmers in China, as landless rural labourers in Asia, and as market-oriented smallholders in Latin America. Among all these vulnerable groups the family's farm output, income, and energy requirements for work largely determine what the children eat. As we shall see, the conditions of agricultural production also greatly affect risks of infection and parasitism. Farming circumstances are thus the main determinant of health among vulnerable groups in developing countries.

The second main cause of death and disease operates at present mainly in Australasia, Europe, and North America. It is also a synergism between the use of various agricultural products - some beneficial such as fibres, some dangerous such as tobacco - and other elements of the "lifestyle", such as stress, work conditions, and sedentary living. This synergism causes, or accelerates, a variety of severe, often fatal, diseases (chiefly among persons aged over 40 years): cancers, heart failure, stroke.
These effects of agriculture on health are mostly well documented. However, health personnel have so far had very little influence on the public-sector agricultural decisions that could modify these effects, i.e., decisions affecting the level, distribution and use of tobacco or butter in rich countries, and of basic food crops in poor countries. This publication tries to show how the situation could be improved as workers in the health sector interact with agricultural activities.

There are also major feedback effects of health on agriculture: healthier farmers and workers are more productive and careful; if health and nutrition are secure, farm families are better able to risk experiments with new crops or methods; and bad health and inadequate health care are among the reasons why bright young people leave rural areas, depriving farm activities of the needed leaders and innovators. Agricultural ministries, therefore, should strive to obtain greater—or more effective—expenditure on rural health care, just as health ministries can assist by pressing for better-supported and better-chosen farm policies. At present, often neither of these links is effective. However, this publication concentrates mainly on how agricultural policy might have an impact for the better on health.

In addition, this publication concentrates on the effects of agriculture on health in developing countries. It does so for two reasons. First, agricultural failings cause far greater loss of life there than in developed countries, particularly at an early age. Second, the experiences of developing countries tell us a lot about the ways in which health personnel in developed countries might help to improve the impact of farm policy on health.
1.2 The aims

The agriculture-nutrition chain constitutes the main set of links between farming and health. The nature of each link is increasingly well documented. We know how manmade decisions - and indecision - about farming affect health. Yet health considerations play little or no part, in most countries, in decisions either by farmers about production, or by government about agricultural projects and policies. We aim, in this publication, to contribute to a fundamental change in this situation. First, we seek to increase awareness among health personnel - doctors, paramedicals, health-sector civil servants and researchers - of the totality of the effects of agriculture on health. Second, we show how health-nutrition targets can be formulated, and how the effect on them of agricultural projects and policies can be predicted and monitored. Third, we illustrate how agricultural projects and policies affect the health of different groups, and how these effects can be improved, at acceptably low cost to other policy objectives and other groups' interests. Fourth, we explore the institutions and modalities through which health personnel can help to achieve these improvements.

1.3 Target audience

Thus this publication is aimed mainly at people in ministries of health, starting with health planners and those working in statistical or epidemiological divisions who are likely to be concerned with the data collection, analysis, and presentation of issues raised by these links. There is much information on the health effects of specific agricultural policies under particular conditions; most ministries will need to start by evaluating the
impacts of past agricultural policies and projects, in order to assess how the findings from elsewhere relate to specific circumstances in their country.

Apart from these line officials, ministry of health officials in executive positions need to be aware of these matters. Their actions - and ultimately those of their political masters - will determine whether the issues are: (a) pursued effectively with decision makers in the ministries of agriculture, irrigation, finance, planning, etc., and ultimately in the cabinet and (b) taken seriously within the health sector. The latter will involve incorporating relevant data from the agriculture sector into ministry of health procedures, for example by making adjustments to training, support and supervision procedures; by adapting the demands made on health workers at lower levels by the health information system; and by ensuring that at those levels people such as district medical officers of health are able and willing to analyse the impact of local agricultural events and decisions upon health, and are then authorized and encouraged to make inputs into the work of other sectors. Health personnel outside the ministry of health should also adjust their work to allow for the almost overwhelming impact of agriculture on health conditions, especially in developing countries. Persons in health-based research institutes or university departments should analyse agriculture-health links in the country or region where they are based, partly by adapting findings from elsewhere. Health workers in the voluntary sector need to know about the effects on health of agricultural projects and policies and take action on them, especially where these workers provide the main or only organized health care available to the local population. Representatives of health-related United Nations agencies, notably WHO and UNICEF, may have a crucial role in enabling health
personnel to communicate their findings to - and to obtain and monitor responsive action from - decision makers in agriculture ministries and agencies at the highest level.

The facts discussed in Chapters 2-4 are relevant to - and are, we believe, in large part unknown to - decision makers and officials in agriculture, and in national planning offices. While health personnel may have to play the leading role in this area, policy improvements will require active support - based on understanding of the health issues - from those responsible for the public policies on agriculture, irrigation, pesticide management, and much else affecting farming. Planning ministry officials, too, can help by coordinating and integrating the policies of different sectors, by insisting that agricultural policy makers explicitly allow for the impact of their decisions on the nutrition and health of the vulnerable rural and urban poor, and that health personnel give these policy-makers the data to assess that impact.
CHAPTER 2

HEALTH GOALS FOR AGRICULTURE

2.1 Nutrition-infection synergism

In poor countries, the nutrition-infection-parasite synergism is by far the main cause of death and disease. Agricultural projects and policies on agrarian structure, rural technology and farm prices are the main manmade determinants of changes in the amount, timing and distribution of (a) food intakes, (b) food requirements for work, and (c) insect vectors of parasites and infections. Thus these policies and projects are among the most important influences on death and disease in poor countries. Most of the following discussion deals with projects;¹ much more attention has been paid to research into agriculture-health linkages via project effects – and more has been done – than via coordinating or integrating national policies (see p.69). However, the health sector has up to now had minimal involvement in agricultural policies or projects.

The main reason for this is that health personnel have no clear, testable, messages for agricultural policy makers and project managers. Usually, the health information system is almost exclusively geared to generate data on the health care system itself. No use is made of data from other sectors, and no

¹ Projects may be controlled at the national level, covering areas in different parts of the country, or they may be localized when the implementing agency may be sub-national. Different kinds of issues arise with regard to policies, national projects, or localized projects (see p.68). Similarly, there are differences in the ways by which health sector workers might make inputs into agricultural policies and projects.
questions are asked about the impact on health of decisions made outside the health sector. If the impact of an agricultural decision on a relevant health variable is to be monitored, other kinds of information need to be gathered, either collected routinely at national level, or generated specially in a small project area (see p.74).

Without such information:

(a) Health personnel cannot predict or monitor whether overall health is most cost effectively improved by more (or a different kind of) health care, food gifts, or agricultural projects. Some evidence exists that, if the first two share a fixed outlay, death-rates and morbidity fall faster than if one receives it all (Kielmann et al., 1978 and 1981). Almost nothing is known about the impact on nutrition or on overall health of specific outlays on agricultural projects (Pines, 1982, p.49) or on policies, e.g. for research (Ryan, 1984, p.199).

(b) While health personnel can estimate the partial health impacts of an agricultural project, they cannot compare general health with it and without it. Thus they can quantify the impact of the Aswan Low Dam or the Gezira Dam upon schistosomiasis (Lanoix, 1958; Biswas, 1978; Obeng, 1978; Goldsmith and Hildyard, 1984), but cannot compare total death and disease rates with and without the food, income, infections, and parasites that result from the presence of any one dam.

(c) Health personnel have not in practice predicted or tracked the total health impact of alternative ways of spending a given sum of money on a particular agricultural project. Research on health spending shows that the most cost-effective balance of
outlay (e.g., between prevention and cure) varies enormously according to: (i) the target variable (e.g., lower death-rate or lower morbidity) and (ii) the total amount of money available (Prescott and Warford, 1983). That surely applies also to the health impact of options within any agricultural project, but we know much less about this.

Thus, even if agricultural project or programme managers were willing to modify their decisions on health grounds,\(^1\) health personnel cannot advise them about whether the agricultural activity is better or worse for health than: (a) spending some of the same outlay on health care or nutrition interventions instead; (b) not spending it at all; or (c) spending it on agriculture, but in a different way. Qualitative assessments have proved too vague to provide useful priorities (Mason, 1983, p.98). Until some data for the health impact of agricultural projects and policies are available, health ministries will seldom be effective in agricultural decision-making. The demise of ambitious proposals for 'nutrition planning' (Poleman, 1981; Field, 1981; Pellett, 1983, p.115; Lipton, 1983a) is only one instance of this failure. More serious are the attempts by well-meaning agricultural specialists to fill the gap left by the absence of health data with incorrect and misleading measurements of health impact, as criticized by Pinstrup-Andersen (1981, pp.55, 65, 68).

\(^1\) The bureaucratic or political system may not reward agricultural professionals for responding to health messages. However, if those messages are clearly stated, they have popular appeal. This, in turn, creates pressures on officials and politicians.
2.2 Assessing and monitoring dietary inadequacy

Ideally, health personnel should follow, over time, the measured impact of agricultural projects and policies on vulnerable groups. The realities of resource constraints in developing countries, especially on health personnel and budgets, however, dictate the utmost economy in using health information systems, especially to generate unfamiliar data; 'rapid rural appraisal' in the health field is feasible (UNHCR, 1982, pp.115-6; Pacey, 1981). We therefore recommend concentrating on one or two indicators of the proportion of persons in the main vulnerable group (children aged 0-5 years) who are at significant risk of substantially inadequate dietary energy intake, and hence of either functional impairment or substantially reduced capacity for economic activity.

(a) All the possible indicators, i.e., energy intake relative to requirements, anthropometric measures (weight/height, weight/age, weight/height$^2$, height/age), incomes-per-consumer-unit, have advantages and drawbacks. The indicators chosen will depend in each case mainly on personnel and costs. Fortunately, several indicators of likely substantial energy inadequacy (dietary, anthropometric, economic) identify very similar proportions of children at risk in each particular project area or socioeconomic group.

(b) Indicators must be recorded for a fairly large sample of children in each major region, over a significant period, in particular, at the individual level, since: (i) short-term variations in weight/age indicate mainly infections, and (ii) substantial daily or even weekly decreases in energy intake relative to requirements can be perfectly acceptable.
(c) Where data are routinely and reliably collected on mortality rates for infants, and for the age-group 1-2 years (or 1-3 or even 1-4 or 1-5 years), they can serve as a proxy for an energy adequacy indicator.

(d) None of the above indicators should be taken to suggest that it is better or worse, cheaper or costlier, to raise intake rather than to reduce requirements (e.g., energy requirements of infection).

(e) The use of one or two simple indicators of adequate energy intake is not meant to suggest that poverty can induce morbidity, or death, solely by influencing food intake or requirements; only that energy shortfall (relative to requirements), acting jointly with infection/parasites, is the main factor, and thus the priority to be monitored.

(f) In developed countries and in experimental areas well-endowed with personnel in developing countries, a measure of 'expectation of healthy life' should also be used to monitor differences associated with projects, areas or social groups (see also pp.22, 79).

For any chosen measure, baseline data, i.e., before the start of the agricultural project or programme, are needed. Especially for local projects, these should where possible be obtained both for areas (or groups) affected by the project and for otherwise similar controls not so affected. Changes in health or nutrition may otherwise be attributed to a particular project, such as the Maheveli project in Sri Lanka (FAO, 1984, p.114), without checking
whether similar changes are happening even where its impact is much smaller. The control-group approach, however, raises three problems.

(a) In the case of nationwide policies, e.g., on food prices, it may be impossible to find an unaffected control group. Then, it may prove possible: (i) to compare the present situation with an earlier situation when policies were different (e.g., UNICEF's area-wise monitoring of infant mortality before and after the change in Sri Lanka's rice ration system in 1977-78); or (ii) to use regression analysis or other statistical methods to relate 'more, or less, of a given policy' to changes in the nutrition indicator chosen.

(b) For both projects and policies, it is best to measure the impact on adequacy of energy intake by routine, area-by-area recording of the chosen indicators (see p.13), rather than to create (even with proper control groups, etc.) ad hoc project- or policy-specific monitoring. The latter may be inconsistent with (and will certainly drain resources away from) national nutritional or health measurements. However, if this whole-system approach is absent, such ad hoc measurement of the indicators is better than nothing.

(c) Both whole-system measurement and proper baselines and control groups are expensive. Ignorance is even more expensive, and the illusion of knowledge - from uncontrolled single-case data - can be most expensive of all, leading to useless remedies. Costs can be kept down by brief enquiries into a few key variables:

An estimation of the chosen health variables is important early in the project cycle. Two weeks of 'nutritional assessment'
in the field, even if preceded by desk work (FAO, 1984, pp.12-14, 79), cannot obtain the necessary data, and this will cause agricultural professionals to doubt the seriousness of health sector inputs, as has been the case in Machakos, Kenya. Such procedures often lead to quick estimates later contradicted by field studies (cf. FAO, 1984, pp.51 and 55, on the nutritional status of tea-growers' children). However, excessive demands for data (e.g., FAO, 1983) are also pernicious. They have led to the abandonment of attempts to incorporate health considerations into rural projects (Pinstrup-Andersen, 1981, p.30). In Northern Nigeria, the World Bank spent over US$ 4 million in monitoring the Funtua Project (through the Agricultural Projects Monitoring, Evaluation and Planning Unit of the Federal Department of Rural Development), to yield mountains of data hard to process and of dubious quality.

2.3 Indicators of energy inadequacy

What simple indicators can measure — though not necessarily by diet surveys (see p.13) — the main single cause of ill-health, the nutrition-infection-parasitism synergism? It is widely agreed that a measure of adequate energy intake is what is needed. Protein scarcity (or amino acid imbalance) is unlikely to be a significant cause of death, disease, or dysfunction once energy intake is adequate (FAO, 1983, pp.63, 75; Lipton, 1983a, p.8), except in the rare cases in which such energy comes overwhelmingly from roots, tubers or plantains, without significant intake of protein-rich foods such as milk, pulses, or cassava leaves. Vitamin and other micronutrient deficiencies are usually corrected alongside energy inadequacy, but in a few cases (especially for vitamins A and C) remain important for many people with an energy-sufficient diet. But such deficiencies are seldom much affected by the choice of
agricultural projects and policies, except as regards benefits to the poor which should be evaluated even without specific health sector involvement.\(^1\) Therefore, health personnel, seeking to improve an agricultural project or policy, should address themselves to recording adequacy of energy intake. In the case of local projects, data are needed on both persons affected by the project and a control group. In order to assess the impact of broader national policies or trends, however, a national monitoring system for adequacy of energy intake is needed. This would develop routine procedures to test the impact of different factors, such as changes in agricultural policies over time, or the presence or absence of agricultural projects in different areas (see p.79).

The importance of adequate energy intake is recognized in principle by the World Bank's criterion for absolute poverty, i.e., income too low to afford minimal energy needs at normal spending patterns. A standard for adequate energy intake is also proposed by Pinstrup-Andersen (1981, pp.75-7) and by the International Fund for Agricultural Development (Muscat, 1983, p.4). However, answers to five key questions are needed to enable health personnel to track such adequacy in planning or monitoring an agricultural project or policy, and to turn such adequacy into a more global health indicator: (a) 'Adequacy' for which groups of persons? (b) Relative to what requirements? (c) How is it related to environmental health variables? (d) Over what period should it be measured? (e) Exactly what readily available measurement should be recorded?

\(^1\) One exception in some parts of West Africa is that agricultural settlement can sometimes destroy wild foods that were a major, or even the only, source of vitamin A.
Malnutrition is concentrated in mothers and children of low-income families (de Rubinstein, 1984, p.232) and especially among younger siblings of large families. Often, occupational groups may be added: non-boat-owning, fishing households, or inexperienced settlers (FAO, 1984, pp.7, 84, 111). Subtle criteria may often be required to identify who is at risk; for example, as landholding increases from zero (pure labourers) to 3-4 ha. in India, so the risk of energy-intake inadequacy declines in well-watered areas, but not elsewhere (Lipton, 1985a); in north-east Brazil those most at risk of serious malnutrition were found to be young families farming small areas of land (Tanner, 1987). This risk was found in several studies to rise sharply with distance from a town (FAO, 1984, pp.24, 76-78). It is not suggested that the targeting of benefits from agricultural projects and policies to narrowly defined risk groups is always feasible or desirable, but only that the task of measuring and monitoring the impact of the project or policy on nutritional adequacy can be simplified and made cheaper by such narrow definition. A baseline or pilot survey will often show that only children under the age of six years, in certain areas and occupations, are at serious risk; if so, it usually suffices to predict and monitor the impact of a project or policy on nutritional adequacy in such circumstances, bearing in mind the possibility of migrations or the emergence of new at-risk groups.

There is growing recent evidence that: (a) average energy requirements in developed countries have been overstated by 15-20%; (b) formulae and procedures for 'translating' such requirements into the conditions found in developing countries involve further overstatement; (c) an individual with apparently low energy intake may not be malnourished, but may have below-average requirements, low frequency of disease, or perhaps
above average capacity to adapt to temporary falls in intake. There is also evidence that only severe shortfalls, either in energy intake or in anthropometry, are associated with increased mortality, morbidity, or dysfunction (Lipton, 1983a, section II). Such evidence strengthens the case that, in poor countries where hunger is widespread, health personnel need to concentrate on 'first things first' by monitoring principally the impact of an agricultural project or policy on severe energy deprivation relative to need. For example, moderate stunting of growth (especially, but not only, in adolescents) is not likely to be much affected by the choice of project or policy except in the very long run; severe (and perhaps some moderate) wasting, especially among under-fives, is plainly damaging, amenable to short-run improvement in the wake of appropriate agricultural policies or projects, and not so prevalent as to convey a sense of hopelessness (Longhurst, 1983, p.79; FAO, 1984, pp.20, 37, 125). Quite often, as in Machakos, Kenya (FAO, 1984, p.43), concentration on severe wasting indicates different target groups or areas from concentration on milder wasting or stunting (see pp. 20-21, however). Most health care services continue to collect and process data on mild, moderate and severe wasting indiscriminately (e.g., by means of 'road to health' cards, which are usually based on weight/age). There is a need to consider much more carefully what information is important either for individual growth monitoring, or for the analysis of social risk. In this area, as in many others, health information systems collect too much and analyse too little information.

Appropriate indicators of requirements will therefore help health personnel to advise agricultural policy-makers more effectively on those in greatest nutritional need. However, the concept of nutritional adequacy relative to requirements also
requires health personnel to advise how to improve health status via, for example, reductions in energy expenditure in physical activity and in fighting disease. The necessary physical activity of adults (to fetch water, to seek employment, to walk among unconsolidated plots) often leaves under-fives with too little food. As for infection, there is strong evidence that it plays the main role in the damage done by the malnutrition-infection synergism. In Kerala the energy intake per person is the lowest of any Indian state, the anthropometry only slightly better, and yet the levels of infant and adult disease are by far the lowest because recovery from infections is quicker because of the more rapid availability of care (Panikar and Soman, 1984, pp.28-31, 64-67, 70). Infant mortality in Chile fell from 251 to 55 in 1935-75 because of better health care, despite unchanged food intakes (Solimano and Vine, 1982); in the following decade, when poverty and malnutrition both increased, it continued to fall because of targeted health and nutrition interventions (Foxley and Raczynski, 1984). In Palavan, Peru, malaria rather than energy inadequacies caused regional deficiencies in nutrition (FAO, 1984, p.131). Thus, when health personnel assess the contributions of an agricultural project or policy to the adequacy of energy intake relative to requirements, the impact on the disease environment of vulnerable groups — which is substantially affected by drinking-water quality and quantity (FAO, 1984, pp.6, 12, 40-41; Tristan, 1980) — needs as careful attention as its impact on energy intakes.

These impacts need to be compared over the year (especially because wasting — the preferred indicator of severe malnutrition — can otherwise show misleading short-term fluctuations due to infections in children). This need not mean many costly visits to at-risk households, but four to six visits, spread over the year,
are needed, be it in the context of project monitoring, or as part of a national nutritional monitoring scheme based perhaps on sentinel sites (see p.79). Disease risk, food prices, and farm output and work (and hence child care) are often highly seasonal; as therefore is undernutrition (Schofield, 1974, 1979; Chambers, 1982; Longhurst and Payne, 1981). Large agricultural projects or policies often change the seasonal patterns of some or all these variables. Awareness of this is especially important in designing agricultural research for good nutritional impact (Gryseels and Whalen, 1984, p.146). Baseline studies and monitoring are especially misleading if confined to 'good' seasons.

One advantage of "adequacy of energy intake relative to requirements" as a health indicator among vulnerable groups, is that several different variables will serve as proxies for it; data concerning these variables may be collected through special studies in agricultural project areas, or their collection can be incorporated into the routine (national) monitoring system, so that changing circumstances can be related to changing risks of malnutrition for different socioeconomic groups or areas. Subject to their correlation with energy-intake inadequacy being checked from time to time, many of the variables can be measured over time. 24-hour recall is an adequate technique for energy-intake surveys, with known and corrigeable limitations. Anthropometry indicating severe or moderate-to-high wasting, or reductions in growth towards severe stunting, is also feasible. Insufficient income or outlay to meet 80% of the household-level dietary energy requirements defined by FAO/WHO, despite spending over 80% of income or outlay on food, is a further possible criterion. Finally, the World Bank's absolute poverty criterion would lead us to consider, as at risk of undernourishment, all children in households where, with typical national or regional spending
patterns, a basic minimum diet could not be obtained. In practice all these indicators identify roughly similar proportions of the population (not necessarily the same persons), in particular areas or groups, as being at risk of (but not necessarily currently suffering from) severe undernutrition relative to requirements. Moreover, indicators of consumption behaviour when incomes rise slightly show such at-risk groups, but not others, as maintaining the proportions of income\(^1\) (75-85%) used to obtain food and the cheapest staples. Thus only the very poor, with significant risks of 'severe' deprivation on the anthropometric indicators and normally consuming below 80% of the recommended 1973 FAO/WHO minimum dietary energy intakes, behave in ways indicating that extra food is their top priority (Lipton, 1983a; Poleman and Edirisinghe, 1983; Rao, 1981).

2.4 Expectation of healthy life

The energy intake/requirements ratio is the main health-related variable affected by agricultural projects and policies in developing countries. In view of the urgent need to keep information systems simple and manageable, most developing countries should monitor the health effects of such projects or policies mainly via this variable or proxies (see pp.24 and 33), supplemented by simple measures of specific direct risks (e.g., p.38). However, energy-intake adequacy is not the whole health story. In developed countries, expectation of autonomous life probably best defines 'community' total health status. The feasibility of measuring this variable has been proved, not only in Canada and the United States, but also in Ghana and Java (Prescott and Warford, 1983; Grosse et al., 1979; GHAP, 1981).

\(^1\) Including the value of output grown on the family farm for household consumption.
However, the Ghana study showed that mortality reduction very greatly outweighed morbidity reduction in its impact on this variable, so that it is doubtful whether the extra effort required to record it over time - rather than, say, age-specific mortality - is worth while. In developed countries, however, 'expectation of healthy life' is probably more appropriate than the energy requirements/intake ratio, suggested here, for tracking impacts of agricultural projects and policies on health in vulnerable groups. For example, a price policy to stimulate the consumption of butter or tobacco hardly affects the ratio, but certainly reduces expectation of healthy life.
CHAPTER 3

THE AGRICULTURAL PROCESS: IMPACT ON HEALTH

3.1 The process

Agriculture involves transforming (1) inputs - soils (land), sun, rain, irrigation water, labour, draught-power, agrochemicals - via (2) technologies and (3) structures of work and ownership, into (4) foods and other outputs. All four components of this process affect the nutritional requirements, food availability, and health of farmers, farm labourers, and their families. Also all four components - especially the amount, volume and type of food outputs produced - may affect the health and nutrition of non-farm populations, especially the consumers.

In developing countries, these four components of the agricultural process are the main variables affecting human health. Typically most working time is spent in agriculture, and most income on food; for poor and vulnerable groups, the proportions are usually over two-thirds.

In developed countries, although malnutrition based on primary poverty is much rarer, component (4) - the proportion of products provided by agriculture and subsidized by governments - is probably the main policy-related variable affecting human health. This component, together with policies affecting processing, and the demand for farm products, determines whether consumers are offered more (or cheaper) saturated fats, opiates, tobacco, or refined sugar - as against fibrous foods, polyunsaturated fats, or complex carbohydrates. Increasingly, developing countries, even before overcoming the agriculture-linked health problems related to
poverty, are acquiring those of affluence, often without the resources to treat either.

3.2 **Agricultural inputs**

3.2.1 **Labour and its associated problems**

3.2.1.1 **Low income**

In poor countries a large proportion of deaths are among infants and children. The main cause of high infant and child mortality is insufficient or unbalanced diet and/or infection. In most low-income countries, the poorest 20% suffer infant (0-1 year) and child (1-5 years) mortality rates of 150-250 and 20-50 per 1000 respectively - usually well over double the rates suffered by the richest 20% in the same countries (Mitra, 1978). The main reason for this is that the poorest 20% - the only groups whose children are normally exposed to risks of periodic severe malnutrition, and of frequently recurring and untreated infection (Lipton, 1983a, pp.17-19) - lack the income to buy food, a healthy environment, and health care (unless it is free). In most areas, only a very small proportion, if any, of these appalling death-rates can be traced to nutritional errors by, or maldistribution of foods within, poor families (Lipton, 1983a, pp.51-52). However, in conditions of rapid culture change (e.g., emergence of major new staple foods, or of women's factory work and bottle-feeding) such maldistribution may suddenly become important, thus necessitating nutrition education. In countries with increasingly scarce land, these very poor people depend increasingly on labour for income, and above all on rural and agricultural labour. Rural infant and child mortality rates far exceed those of urban areas (Lipton, 1983, pp.41-42, 46-48) and high rates are heavily concentrated among the working
poor. In south and east Asia, and increasingly in many parts of Africa, workers are landless or near-landless rather than small family farmers. Hence, higher and more stable real income for persons dependent on unskilled agricultural labour is the most important contribution that agricultural policies could make to human health in developing countries.

Yet most discussions of agricultural policies and projects from the viewpoint of health and nutrition completely neglect this issue. The standard, and otherwise excellent, analysis of the impact of agricultural research on nutrition (Pistrup-Andersen et al., 1984) concentrates almost entirely on 'resource-poor farmers' (e.g., Tripp, 1984, pp.287, 291, 293) and on consumers, with little mention of the impact of the amount and stability of access to food and health-care on farm labourers, via employment and wage/food-price ratios. Too often, the poorest of labourers and even resource-poor farmers (migrants, often semi-legal shifting cultivators and squatters on the fringes of irrigation schemes) are seen merely as problems and threats to the much better health of settled populations (Marga Institute, 1984, p.90; FAO, 1984, pp.71, and 111). Health personnel should seek to maximize such people's share in the gain from an agricultural project or policy (subject to some outlays to control communicable diseases); this is probably the most cost-effective way for such activities to reduce death-rates.
But it is mainly through higher employment that these health improvements must be achieved. The poorest depend for income mainly and increasingly on farm labour. Their desperate need to concentrate scarce health resources on income-earning workers compels them to neglect child feeding and health-care. Very high, rising population/land ratios push real wage-rates very low. Attempts to raise them artificially (e.g., minimum-wage laws) reduce the demand for labour and increase unemployment in developing countries. Similarly, artificial depression of food prices, while temporarily raising the value of wages in terms of food, soon harms the poor by discouraging both the production of food and the employment of labour to grow it. Until prosperity, diversification, and industrialization are achieved, a low-income country can solve the main health problem of the very poor (that they cannot afford enough food or health-care for their children) by only two effective agricultural strategies:

---

1 Planners and agricultural professionals should be aware that an increase in employment per acre, per hour, etc., does not result in a fall in labour-productivity, i.e., output per unit of labour. Indeed, a switch towards more labour-intensive patterns of farm innovation is in most developing countries highly conducive to raising productivity of labour and of land since modern varieties of crops, and the use of irrigation and fertilizers all need more labour per acre. Hence agricultural efficiency, as well as labour income and hence nutrition and health, are improved because developing countries have more underemployed labour each year, but very little savings with which to afford capital-intensive innovations which often do little to raise farm output directly (combine-harvesters, tractors, modern rice mills).
(a) Finding ways, including new technologies and crop-mixes, to increase the demand by farmers for more unskilled labour, especially migrant and other marginal workers.¹

(b) Redistributing the rights to income from agricultural assets, especially land and draught-power, if possible towards the poorest labourers, otherwise to small farmers whose employment/hectare ratio is relatively high.

We discuss strategy (b) later (see pp.61-62), but at present health personnel can make a less substantial impact on it than on strategy (a). Strategies such as the direct provision of health care, food, work guarantees, or non-farm assets to the poorest are beyond the scope of this discussion, although health personnel may need to compare their cost-effectiveness in improving health with that of agricultural policies or projects. Health personnel have been so little involved in the farm-labour route, although it is clearly the most generally feasible strategy for improving the health of the poor, because the four main problems - energy costs, labour hazards, women's role, seasonality - have been seen too much as insuperable barriers to the adoption of a farm labour strategy as a route to 'health for all'. They are obstacles but can be overcome.

¹ Such dependence on higher employment income, while raising average nutritional status for the working poor, might well also lower status in bad times, as employers lay off farm labourers and withdraw their entitlements to food. Unless the other strategy - asset redistribution - is also feasible, the inevitable reliance of an anti-poverty policy upon employment creation therefore implies food security policies, e.g., subsidized food distribution in bad times.
3.2.1.2 High energy requirements

The first problem is that farm labour has high energy requirements. To the amounts of the energy calories used in work we must also add energy requirements for: (i) travel, (ii) the rise in basal metabolic rate (Miller, 1982, p.195) for up to 15 hours after strenuous work, (iii) 'insurance' for casual labourers against being too fatigued to find or complete available work, and (iv) possible income diversion (associated with some forms of extra or new work) towards costlier foods, alcohol, bottle-feeding of children by working mothers, etc. Research is needed to investigate ways of lowering energy requirements by a reduction in: (i) needless travel, via plot consolidation, nearer sites of drinking-water or fuel, etc.; (ii) energy costs per task - and very heavy work (which raises basal metabolic rate) - via farm innovations that reduce physical effort, but not paid working time; (iii) fruitless job search, via better labour-market information for workers; and (iv) possible wastes and abuses, via different forms of payment, etc. While recognizing the impact of agricultural project and policy options on 'expenditures of human energy' (Pinstrup-Andersen et al., 1984, p.15), experts seldom seek to adjust such options to reduce the energy demands per hour of work. Especially at peak seasons, those households that are the most hungry and in poor health must sell much farm labour and can buy little. They may thus be in an 'energy trap', which impedes their efficient conversion of work into the food (and hence health) that their families need (Longhurst, 1984, pp.38-39, 41, 79-90). This trap would only be made worse by 'labour-saving' innovations that transferred income from the workers to the wealthier owners. It can be broken only by channelling assets or work to the poorest workers, while reducing the energy intensity of each hour of work.
3.2.1.3 Health hazards

The second problem, familiar to many health personnel, is that of farm labour hazards. Growing attention is rightly paid to risks, linked to pesticides (see pp.37-39), machinery, etc. However, there has been little study on how the traditional hazards of tropical farm work - snake and scorpion attack, dehydration or inferior water quality, back injury (particularly in transplanting), etc. - could be reduced, especially in the context of farm intensification, settlement, or other agricultural policies. Yet such hazards account for much of the time spent out of work due to illness for rural casual labour (5% for men, 6% for women, plus 1% in chronic disability) in rural India in 1977-78 (Lipton, 1983b, p.11; data from other developing regions suggest higher incidences).

3.2.1.4 Women's work

The third difficulty with using a change in farm labour as a path to income and health is its effect on participating women and children. Is more work for women good or bad for their nutrition or that of their children? The subject is obscured by rival hypotheses, often no better than anecdotes: that extra female income is offset by reduced attention to child care; or that it is more likely to be spent on extra food for children than is extra male income. There is little firm evidence for such opinions (Pines, 1983, pp.52-54). In Calcutta, Berg showed that extra income from women's work did improve child nutrition, though not in proportion to the increase in the income (Reutlinger and Selowsky, 1976). In eight Bangladesh villages, displacement of female labour by modern methods of rice processing harmed levels of nutrition.
more than they were improved by the extra grain (Lipton, 1982). In Kerala, India, extra female income was associated with better infant birth weights and growth. This finding was reversed only if the income was earned (a) outside the home (or home farm), (b) by the poorest households, and (c) in the slack season (Kumar, 1977; Lipton, 1983b, p.34). In these extremely difficult circumstances, the mother's absence from home damaged child care more than the income she earned helped it. This important finding underlines the importance to nutrition of ensuring that a mother's work is compatible with child care in hungry times. Health personnel need to monitor the localized seasonal impact of women's work options on infant health.

3.2.1.5 Seasonal changes

The seasonal pattern of extra work and income greatly affects vulnerable groups. It is in the slack agricultural seasons that the poorest households, who are most reliant on income from casual female labour, go hungry because demand for labour is usually much below average; the supply of labour also falls slightly as workers are discouraged from job searching, especially if the rainy, 'unhealthy' season coincides with this time. Because labour demand falls much faster than supply, wage-rates usually also fall (Lipton, 1983b, pp.33-34, 56-60, 84-85). Thus, household food stores are depleted and food prices high at a time when infections are prevalent. For all these reasons (many of them documented by Chambers, 1982; Chambers et al., 1981; Schofield, 1974; and Longhurst and Payne, 1981), health personnel should assume that extra labour income for vulnerable groups normally helps nutrition most in the slack season. However, Kumar's work (see above) points to an important possible exception among the poorest working mothers. Also Ryan (1984, pp.215-216) points out that more intense
peaks in the demand for labour can sometimes raise workers' income more than extra slack-season employment by forcing employers to raise wage-rates.

3.2.2 Land use and associated problems

It is the labour-health relationships in agriculture that should preoccupy health personnel. Health aspects of land reform (see pp.60-62) and of the spread of irrigated farming into new areas (see pp.33-34) are reviewed later. Three issues will be mentioned here. First, health personnel should correct the commonly held health and other prejudices against those who practise shifting cultivation, squatters, and those with traditional and uncodified land rights in settlement areas. Such persons are too often seen only as health 'threats', or farming rivals, to a more powerful and articulate group that seeks to make more 'modern' use of their land. Yet they are often the groups at greatest risk. Seasonally migrant farm labourers are least immune to local diseases and are the least organized and articulate in the face of agrochemical or other dangers. Health personnel are often the only officials who know their problems and can speak for them.

Second, urban expansion diverts land to housing uses - often, good farmland previously controlled by poor people. This at once raises the demand for food, reduces its supply, and worsens distribution. This serious threat to peri-urban health is often neglected, even in otherwise excellent 'poverty-oriented' discussions of urban expansion and land acquisition (e.g., Yeh, 1984, pp.41-47). Health personnel could encourage not only agricultural-policy makers but also urban-policy professionals to seek efficient ways to replace the cheap food (and purchasing power) lost by poor people in the process, e.g., by assistance to
individual or group 'home gardens' in site-and-service developments (see p.62) through extension, land reservation, or credit.

Third, special health problems are regularly associated with the plantation organization of land use. This is partly through a legacy of colonization involving continued non-food monoculture and/or dependence on disenfranchised ethnic groups (Beckford, 1972). Also some crops such as tea and coffee, and the hilly terrains and cooler climates of many plantation systems impose heavier energy demands, and the infections of cooler temperatures are added to those of tropical latitudes. Some land uses involve further hazards; a switch to coconuts, for example, involves the risk of death and injury to pickers (Marga Institute, 1984, p.92). The health problems of plantations are tractable; although plantation families in Sri Lanka suffer much higher infant mortality rates than prevail on the island as a whole (79, as against 37, per thousand in 1979) (Gunatilleke, 1985, p.15; compare Meegama, 1980), comparable disparities do not hold between tea—plantation workers and others in Kericho, Kenya (FAO, 1984, pp.51-56). Health personnel can help by providing basic data to compare the nutritional status of plantation and other children; this has stimulated remedial action in Kenya and Sri Lanka, but too often the information is not available.

3.2.3 Water and associated problems

Apart from land and labour, agriculture needs water. Scarce and unreliable rains mean scarce and fluctuating food supplies and income from work in growing food. Therefore, irrigation is vital in poor countries, especially as population growth increasingly requires double-cropping and use of fertilizers. There are three
main types of irrigation: major surface-water systems, minor surface or groundwater systems, and farm-level micro-irrigation. Micro-irrigation, seasonal irrigation, or even large systems in temperate zones cause little controversy. However, large permanent systems involving stationary water in tropical areas have been associated with major health hazards. Schistosomiasis has spread massively in the wake of the Aswan and Gezira Dams and the situation needs to be watched carefully in South America and south and east Asia. Perennial irrigation also increases tropical malaria risks by providing year-round breeding sites for Anopheles mosquitos, unfortunately, especially for the most efficient malaria vector, A. gambiae (Goldsmith and Hildyard, 1984, pp.75-77). This effect is synergistic with that of greatly increased insecticide use in irrigated areas, encouraging selection of species of Anopheles resistant to a wide range of insecticides (see p.37).

However, the health case against major irrigation projects is often grossly overstated (e.g., Goldsmith and Hildyard, 1984, Ch.7). Without regular irrigation, probably many more would have starved than have suffered from irrigation-induced diseases. Also, conventional minor irrigation (especially of paddy fields) creates stagnant water for mosquitos (Panikar and Soman, 1984, p.126), often for longer periods than more modern systems of major canal irrigation management such as Warabandi rotational irrigation in N.W. India. Bad irrigation maintenance that results in seepage is the cause of many of the breeding sites for insect vectors (Marga Institute, 1984, p.97). Well-planned irrigation can complement increased drinking-water quality and quantity, which is a major dry-season health need (FAO, 1984, pp.40-41).
Health planning, before and during irrigation projects, is essential if such advantages are to be realized, and possible disastrous side-effects avoided. It is alarming that major dams continue to be built without consideration of health effects and options (Goldsmith and Hildyard, 1984, pp.89, 91, 231-232), despite clear guidelines about how such effects can be improved by careful choice among design options (McJunkin, 1982; Hunter et al., 1980; World Bank et al., 1985, Annex 3). Indeed, given the vast size of some such effects, they must be taken into consideration or most benefit/cost analyses of such schemes will be invalid. Health personnel can make a major contribution by offering irrigation and agricultural authorities in national governments and donor agencies clear analyses of cost-effective options for improving the health impact of irrigation systems by changes in design, maintenance and management. WHO encourages such analyses and may be able to give advice on carrying them out.

3.2.4 Tillage methods

A fourth major input, needed for almost all farming, is tillage. Often this is provided by human labour alone; in Africa usually hoeing by women. The other two main systems are animal-draught and, increasingly, tractor-power. We know of no analysis of the health effects of these alternatives. The shift in Asia from animals to tractors almost always displaces labour—that is what makes it profitable—and seldom raises output (Binswanger, 1980). Therefore, negative effects on nutrition are likely in places where many poor people are employed as farm labourers. Yet that shift is commonly encouraged by subsidies (on fuel, credit, or tractors) by governments eager to move resources towards larger-scale farmers, who are more likely both to use tractors and to sell surplus food to townspeople. Such socioeconomic effects
and the 'physical' health-nutrition impacts of methods of tillage (accident risks, ergonomics, energy uses, etc.) appear to warrant investigation and guidance from health personnel.

3.2.5 Agrochemicals

Apart from seeds, the other substantial farm inputs with health implications are chemicals: naturally occurring soil chemicals; organic additives (mainly animal and vegetable manures and composts); and inorganic compounds (mainly nitrogen, phosphorus and potassium-based fertilizers, herbicides, insecticides, and fungicides). Insufficient attention has been given to the effects on health of any of these inputs, except for the impassioned controversy about insecticides (see pp.37-39). This means that the health effects of the great mass of natural and artificial agrochemicals are not well known. Yet on the farms of poor and vulnerable groups, especially in Africa, the available nitrogen, phosphorus and potassium comes overwhelmingly from the soil, secondly from organic additives, and least from inorganic compounds; and the use of herbicides and pesticides by such groups is minimal. Only in a few much-visited places in the developing countries, such as north-east Mexico, the Punjab, Taiwan (Province of China) and Central Luzon, are inorganic fertilizers and pesticides intensively used by small farmers. For most poor people, the threats to food production and hence health in this area are the vulnerability of plants (in decreasing order of importance) to: (1) nitrogen and phosphorus deficiency; (2) weeds; (3) insects, fungi and viruses; and (4) shortfalls of output due to inaccurate use of (mostly organic) manures and composts. The health implications of these matters have hardly been investigated.
3.2.5.1 **Fertilizers**

Also uninvestigated are alternative methods of plant nutrient enrichment. New methods of fertilizer placement, such as mudball techniques, developed at the International Rice Research Institute (IRRI) and elsewhere, are promising for small farmers because they substitute labour for purchased fertilizer inputs. By precise placing of nutrient sources in the root zone, farmers can substantially raise yields without needing cash to buy more fertilizers. However, such techniques involve much more handling of toxic substances. Health personnel need to seek inexpensive ways to identify and reduce associated health hazards.

3.2.5.2 **Pesticides**

This is also the best approach to the serious problems associated with insecticides [we rely heavily on the scrupulously balanced account by Bull (1982)]. In any one year, insecticides save tens of millions of tons of staple foodstuffs for human use, and greatly increase the employment income of poor people (and hence nutrition and health) from non-food and food crops alike. But insects develop resistance to an ever broader spectrum of insecticides, so that over the years a wider variety of chemicals and increasing amounts and strengths of insecticide must be used to achieve the same level of plant protection. With some crops, notably cotton and tobacco, pesticides destroy natural pest predators too, ultimately reducing plant protection absolutely (Bull, 1982, passim, and 1983, pp.160-162). This 'pesticide treadmill' steadily increases not only the costs of application but its various health hazards. WHO has extensively researched pesticide effects and made recommendations, but agricultural research is often confined to assessing output benefits against
input costs; a concentration of research finance in companies producing insecticides can reduce the chances of a full review of the health risks and favour new insecticides (and hence 'the treadmill').

Pesticide-related health hazards are of four main types (excluding, of course, such tragedies of industrial pollution as occurred in Bhopal in 1984, which cannot be blamed on the fact that the end-product of the chemicals happened to be pesticides): (a) Via direct poisoning, pesticides cause very few deaths (compared with those they prevent by saving food) - currently perhaps 10 000 per year throughout the developing world. Probably over 7000 of these deaths are due to suicide, not to application risks (Marga Institute 1984, p.94; Bull, 1983, pp.159-160). But the 'treadmill' renders them a growing threat. (b) Cumulative pesticide build-up - both of long-lived (but probably not very harmful) chemicals such as DDT, and of other more harmful organochlorine compounds - occurs throughout the food chain. Finally, it affects individuals who regularly apply pesticides and/or ingest food or water contaminated with them. The extent of long-term risks, especially of cancers, is controversial but probably substantial, especially in developing countries with inadequate safety standards (see below). (c) Protein loss due to fish poisoning, worse with overuse of pesticides (Panikar and Soman, 1984, p.126), presents another major risk (although very poor people, i.e., those at nutritional risk, usually get their proteins largely from vegetable sources). (d) Much the most serious danger from the use of larger amounts of stronger and more varied agro-insecticides is the pressure towards selection of very robust species of insect vectors of human disease, above all of malaria (Goldsmith and Hildyard, 1984, p.77, citing WHO sources). It may be argued that agro-insecticides are the main cause of the
increase in malaria and the abandonment of the elimination strategy (Goldsmith and Hildyard, 1984, pp.77-78; Bull, 1982). This interacts with selective insecticide damage to fish species, and with the introduction of Nile carp (Tilapia), which preys on the small fish that lived off mosquito larvae (Goldsmith and Hildyard, 1984, p.80).

Health personnel cannot decide the right balance between more food from pesticides now (saving human life), and more deaths from treadmill effects later (wasting it). They can, however, estimate the health effects of alternative strategies to control insect pests of crops, and can also help to design overall policies, or strategies specific to (and applied very early in) agricultural projects to reduce health damage inexpensively. Among the more appropriate ways are:

(a) To press all major exporters to agree to all pesticides being clearly labelled, pictorially and in the language of the potential users, with the health hazards, maximum advised dosages, and required safety precautions at the smallest unit-of-use level (e.g., simple face-masks and protective clothing for sprayers; washing after use). This would prevent many abuses (Bull, 1983), even though poorer users in hot and humid climates might, at first, be reluctant to comply with precautions, especially those that demanded expenditure.

(b) To experiment with insurance schemes against pest recurrence; the current tendency of farmers to insure against pests by applying pesticides too often, in too heavy doses, is a major cause of the 'treadmill' and especially of damage to fish (Panikar and Soman, 1984, p.126).
(c) To guide research stations in choosing between crop varieties which are pest-resistant without agrochemicals, or natural predators of the pests that would permit phasing-out of the most risky insecticides (e.g., for potatoes see Valle-Riestra, 1984, p.65), and in general to encourage promotion of environmentally safe alternative approaches.

3.3 The choice of agricultural outputs

Agricultural projects have aspects such as input availability, research, transport, water regimes, etc., which affect in very different ways the prospects of producing different farm outputs. This applies almost as strongly to so-called 'subsistence' farmers, of whom there are strictly few, and to crops grown for domestic consumption, as to commercial farming. Six main issues are of concern with respect to the output-mix sought by agricultural projects. Should it consist of more expensive (high quality) outputs, or a higher proportion of cheaper, locally consumed products, with high weight/value ratios for local use? Should food crops or cash crops be the main goal? Should foods be high in energy, proteins, or micronutrients? Should outputs be mainly for promising regions or poor ones? Should high-yielding or robust products be used? And how should the issue of dangerous products be handled?

3.3.1 High-value outputs or local-use outputs?

For farmers, it seems obvious that expensive crops are better than cheap ones, per unit of scarce resources used up in production. From a health viewpoint, this may not be true: a reliable supply of energy-giving foods is important, even at the expense of (a) on average higher, but less reliable outputs of
energy; (b) outputs of saleable non-food products, usually valuable enough to buy ample food, but sometimes fetching very low prices; (c) food products with high value-per-acre and/or good cooking quality, taste, and protein content (see p.16), but low fat or carbohydrate content and unsure prospects of market exchange for adequate energy-giving foods, especially when these are in short supply at a national level. Thus, even at the farm level, the emphasis on research for protein-rich foods, and even more for cooking and aesthetic quality (Ryan, 1984, pp.199-204), may well be misplaced. Although, for example, high-protein maize has been developed that are as high-yielding and robust as other varieties (which is not the case for other major staples), research skills and land have thereby been diverted from health-promoting foods to proteins for poultry-feed.

The issues are even more stark in questions of commodity choice affecting total communities of vulnerable groups (not just farmers) and of the appropriate price and other policies at a national level. This is illustrated by the undoubted damage to health and nutrition that has resulted from neglect of poor people's staple root crops\(^1\) in African agricultural systems, to the benefit of export crops of high but uncertain value, and more recently of fashionable high-protein crops like soybeans (Lipton, 1985b). Similar research bias against commodities consumed primarily by the poor has to be reversed "to alleviate malnutrition in urban Latin America" (Pacheco, 1984, p.30). Health personnel should also question agricultural policies which advocate dairy

\(^1\) This refers especially to cassava. This has major health advantages as a robust food reserve, as it is self-storing (as a root) until needed in time of sparse rains. Its agricultural drawback — unless mixed or rotated with legumes — is rapid soil depletion, especially if fallows are shortening (e.g., due to population growth).
development on the grounds of 'proteins for the poor'; the poor get their proteins (usually adequately) from affordable cereals and pulses rather than from costly animal products, and often suffer when land and farmworkers are diverted from the former to the latter, although they may on occasion gain (Jul, 1979) as owners of one or two milking animals. General neglect of minor crops, especially local roots, beansprouts, and melons and plantains, reduces their seasonal importance to adequate energy requirements for very poor rural people in pre-harvest seasons\(^1\) (Longhurst and Lipton, 1987) and in the home gardens of very poor urban and plantation workers (FAO, 1984, p.56). An 'international' crop-mix issue for health personnel concerns food aid. For the poor, it is better if such aid comprises grain rather than (as from the European Economic Community) dairy products bound to be much more expensive once marketed.

3.3.2 Food crops or cash crops?

These arguments, however, do not constitute a general case for food crops against cash crops on grounds of health. Very often, e.g., for much of the land devoted to tea, the value and employment-intensity of output are such that the income (and hence ability to buy food) provided to nutritionally vulnerable groups from appropriate cash crops far exceeds what might be provided by any food-crop alternatives. It is sensible not to provide artificial support to cash crops until "household food security is assured through accessible food supply and/or own production", but the former assurance, obtained by market enlargement and development, will often be greater and safer than the latter.

Generally "differences in nutritional status" have little to do with "type of crop grown" (FAO, 1984, p.128), though health personnel should enquire whether pricing policies (and delays in payment for cash crops; FAO, 1984, p.130) may deprive vulnerable farming families of command over necessary food energy. Often, as in Kenya and Zambia, payment is swifter (even if still set at artificially low levels) for export crops than for food crops (FAO, 1984, pp.8, 122); small farmers who grow and sell maize cobs, but must buy processed meal, may in the process be compelled to underfeed their children.

At both local and national levels, the choice of producing food crops for local consumption, food or cash crops for exchange internally, or export crops, has complex implications for health. These include seasonal considerations, dependent on storability and credit markets, and gender considerations, dependent on who in a household controls crop income and how he/she uses it. Such issues are highly specific to crops, regions, societies, etc. They should be studied, but are currently clouded by conflicting and little-tested hypotheses. Health personnel should require of agricultural planners, not a policy for localized food self-sufficiency that would appear to prevent exchange altogether (Twose, 1984), nor a policy for free trade and specialization in advance of any guarantees for food security, but research into the likely local and national health consequences of the choices made, especially with regard to their impact on adequacy of energy intakes of children under five years old from large and poor families. By cooperating in such research, health personnel could help agricultural project designers to end the disgraceful situation in which "few project appraisal reports make mention of potential declines in the production of foods for home consumption", or of effects on seasonal or annual fluctuations in
the command over dietary energy among vulnerable groups, e.g. in
the wake of changes in the crop-mix (Reutlinger, 1983, pp.15, 21).

One particular national-level consequence of strategic shifts
in crop-mix towards cash-cropping is often overlooked yet can have
major health consequences. It is the major shift in consumption,
even among vulnerable groups, from locally grown millet and sorghum
to maize meal processed in cities (Africa) and to imported wheat
flour (some of Africa and much of Asia). This can greatly increase
food insecurity, especially if food stocks are small, remote from
areas of need, reliant on scarce foreign exchange for
replenishment, or unsupported by plans for non-commercial emergency
relief. The impression that self-sufficiency is being approached
because net imports of the traditional main staple diminish
dangerously reduces political awareness of the new nutritional
dangers, since it neglects the fact that they are replaced by a new
import, e.g., rice by wheat in Sri Lanka (Marga Institute, 1984,
p.34).

These dangers are greater where tastes are developed for
imported crops, such as wheat in much of tropical Africa, that for
agroclimatic reasons cannot be grown locally without major
diversion of inputs and research (Ryan, 1984, p.214) from currently
grown foods with more promise and energy values per acre, and
higher consumption by the rural poor. Even where the new crops can
be grown locally, the concentration of research, credit and
especially marketing on the newly popular 'urban' food crop
frequently reduces large parts of the production of much more
drought-resistant local staples; the shift from sorghum to
katumani maize in Machakos, Kenya, greatly increased nutritional
Shifts to finer grains are an irreversible, indeed desirable, part
of development; nor should health personnel seek to 'put the clock back' by advocating local crops for their own sake. However, the development of appropriate flour mixes, e.g., using sorghum, millet, and/or cassava as well as wheat or maize, could do much to soften the harsh side-effects.

3.3.3 Production of dietary energy and important nutrients

Given the changes in agricultural output-mix and consumption-mix, should health personnel stress the possible impact of these changes on the intake by vulnerable groups of dietary energy of total or specific proteins, or of micronutrients? In developing countries, the over-riding fact of shortfall in energy intake, and the need for simply monitored data, both point to adequate energy intake as the goal (see pp.16-17). Major cereals differ little in the energy they supply per kilogram, or their absorbability or suitability as weaning foods, although root crops, except potatoes, are somewhat less favourable in these respects. The problem with imported wheat, or town-processed maize, is not its yield of energy, but (at least for remote and poor people) its possible unavailability and its high price in years or seasons of greatest need.

While health personnel are rightly concerned at land diversion from the production of cheap sources of energy, whether towards animal production or urban development, they seldom need to worry about the effects of the spread of cereals on the availability of pulse proteins. High-yielding wheats and rices have indeed displaced large areas of pulses in Asia, but the health gain from the extra energy produced per acre greatly outweighs the loss from any possible reduction in protein. In addition, in the diets of poor and vulnerable people, cereals are a cheaper, and hence more
important, source of protein (and even of most key amino acids) than pulses. High-yielding wheat often produces, on each hectare, three times more food than the pulses it replaces; yet its protein content per kg is often as high as 35-40% of that of the pulses, so the shift to grain may even increase protein availability. However, it normally remains important to incorporate pulse or leaf protein sources into weaning gruels, as children often cannot obtain enough protein from staples alone because of the sheer bulk they need to consume.

3.3.4 Regional balance of output expansion

The issue of regional balance is perhaps the most difficult question facing agricultural policy makers. It is one on which health advice is desperately needed but rarely sought or offered. To give helpful advice, health personnel need to avoid the comforting simplicities of advocating support for food production in poorer regions, or in regions of high agricultural potential as such. These simplicities offset each other. Food availability at the national level is best advanced by concentrating resources for food production where the returns are highest, but at the local level where the need is greatest. The dilemma weighs heavily on national agricultural research councils of countries such as India (Brass, 1984); for international crop research — notably at the International Rice Research Institute — work has been directed towards some very poor, although not very promising, areas (Lipton and Longhurst, 1985). For nutritional impact, it is overall public policy, not simply research priority, that matters here. If extra output of cheap food staples will anyway replace imports (or build stocks) rather than increase consumption per person — because poor people's average purchasing-power is not increasing, as in India (Lipton and Longhurst, 1985) — then health considerations indicate
that extra food output should go to the poorest areas and farms, even at some cost in efficiency. If a government can ensure that vulnerable groups' incomes per person rise (and hence the ability to buy food), it does best, even on health grounds, to locate resources to grow more food where the returns are highest. Thus health personnel would probably advise the Government of India, on health grounds, to shift some agricultural support from the high-yielding, progressive north-west area towards the neglected poverty belts of north-east India. Conversely, the Indian State Government of Kerala [where the power balance favours equitable distribution of gains, but has failed to achieve rapid growth (Panikar and Soman, 1984)] might well achieve a better impact on health by concentrating resources in the most promising regions and distributing some of the gains to the highlands, where health levels are worse than elsewhere, and where because of higher energy requirements nutrient adequacy is low.

Agricultural project research (e.g., Pachico, 1984, p.39) often assumes that poorer regions contain a higher proportion of poorer and hence more nutritionally vulnerable people. This need not be so, in view of (a) greater internal equality within more remote, less commercialized villages and areas (Dasgupta, 1977), and (b) migration. The problem, rather, may be that remoter, poorer places - especially unirrigated semi-arid areas - are subject to greater downward fluctuations in bad seasons or years, and are less likely to receive timely help from central governments. Even in poor regions, moreover, there are surplus farmers and landless labourers; the latter, who are vulnerable nutritionally, may gain if scarce resources are used to grow much more food in more promising (even in 'prosperous') areas which would thus reduce food prices (Mason, 1983, p.106). Of course,
this depends on whether public policy can ensure that the extra food means an increase in available supplies, not just more stocks or fewer imports. Each set of local facts will need to be examined on its merits. Often the poorest regions have been so long neglected that they are actually more promising users of scarce government support than the 'progressive' areas [e.g., ragi millet and hybrid kharif sorghum in parts of monsoon India (Lipton and Longhurst, 1985)]. If not, vulnerable groups in poor regions may gain more from accessible food stores and employment guarantee schemes (Dandekar and Sathe, 1980) than from outlays on farm projects in their own unresponsive agroclimates. With regard to monitoring, there are advantages in using (or rather generating) separate data for different areas of socioeconomic groups; however, sometimes only indicators for larger regions are available or affordable.

3.3.5 **High yields versus stability**

The major long-term strategy for areas with low agricultural potential has usually been a search for crops and micro-irrigation to reduce downward fluctuations. The relatively good health conditions in Kerala and Sri Lanka owe much to the relative stability of seasonal, and to some extent annual, levels of output of inexpensive sources of food energy (Lipton, 1983, p.62). Breeding robust varieties stabilizes farm incomes, as well as food-levels for consumers (Pachico, 1984, p.38). There need be no conflict between output and stability; irrigation normally improves both, and much research into high-yielding crop varieties achieves improvements largely by selecting for resistance to pests and drought (Jodha, 1984, p.110). However, maximum average yield and maximum stability will normally require quite different policies for research, irrigation, pricing, crop-mix, and much
else. In high-potential areas with surpluses, agricultural policies are influenced both by the yield-orientated research priorities of international science and by the demands of city-dwellers for plentiful cheap food. This tends to make growth, especially of food surpluses, a policy goal rather than the stability of farmers' and rural labourers' command over food. Health personnel need to explain the possible costs to health of that choice and should help devise methods to reduce them. They should work with agricultural and socioeconomic scientists to analyse the case for the opposite policy choice.

3.3.6 Dangers from farm products

The final output-mix issue involving health personnel is that of dangerous products. Dangerous food crops contain elements that endanger life or health to a greater or lesser extent. The food itself may be a direct danger, as with kesari dal, a variety of lentil that causes perhaps a million current cases of lathyrism in India. However, the danger may arise indirectly after storage, processing or preparation, as with (i) the build-up of hydrocyanic acid in cassava, which appears to cause health problems (goitre, and sometimes cretinism) only where storage is prolonged but processing is absent or inappropriate (Pachico, 1984, p.32 and sources cited); or with (ii) the infestation of groundnuts (and, rarely, cereals) with mycotoxins, which is a serious danger if drying is inadequate. In these cases and many others, appropriate breeding priorities (Pachico, 1984, p.32) or post-harvest systems can greatly reduce risks. Although testing, as for example of groundnuts for aflatoxin, usually requires laboratory work, there is an important role here for local-level health workers, who may be able to monitor whether the results of such measures are readily, inexpensively and punctually available to the poorest
growers and consumers. Otherwise these vulnerable, needy groups will continue to grow or eat dangerous products, and formal banning orders will be of little avail.

Unfortunately, many health risks from directly dangerous farm products cannot be dealt with by low-cost varietal or post-harvest innovation. The appalling effects of addictive derivatives of tobacco, opium, and coca are the most striking cases. As health information spreads, and as preventive and disincentive policies, and restrictions on advertising and sales are enforced in the developed world, so the pressures increase on growers, processors and intermediaries to promote these potentially dangerous products in the less safeguarded and less sophisticated markets of developing countries, where populations (being both less educated and younger than in richer countries) provide, at once, more receptive audiences and longer-term incomes (Taylor, 1985, Chs. 14-15).

It is doubtful whether health personnel can successfully attack this problem by way of agricultural supply. The per-acre profitability to their growers of all the narcotics usually so much exceeds that of alternative crops that laws, incentives, or campaigns against cultivation, while being laudable, are unlikely to achieve much, especially in developing countries. In the case of tobacco, even successful control of supply is not a clear case morally; tobacco may kill smokers but it also saves the lives of many Bangladeshi children, for whose parents it constitutes an attractive crop on unrewarding soils.

Dangerous farm products also include foods which contain only low levels of proteins, for example, or which are potentially harmful. If low-protein foods are cheap staples and/or are
energy-dense, the consumption of foods richer in those nutrients is reduced. The replacement of higher-protein cereal staples by root crops is a rather rare example. Much commoner causes of illness are staples low in iron, vitamin A, iodine, or absorbable niacin. Where diets contain few other sources of the nutrient, such deficiencies can cause, respectively: anaemia, especially if there is also frequent blood loss to hookworm and insects (especially in small children); xerophthalmia; goitre or even cretinism; and pellagra (Mayer, 1985, pp.5-9). The main remedies, minor crops and food fortification, were known even before the 1960s' revolution in tropical cereal breeding, let alone the possible 'second revolution' of the 1990s (genetic engineering). Health personnel need to be involved now in helping agricultural professionals to incorporate screening priorities for appropriate micro-nutrients into the breeding of staples for regions with deficiencies.

Other dangerous products are refined sugar, saturated fats (including coconut and palm kernel oil), and low-fibre foods. None of these is dangerous in moderation, especially given a life-style that reduces other synergistic causes of cancer or ischaemic heart disease. Yet these are increasingly important causes of death in many developed and some developing areas. High coconut oil and sugar consumption is almost certainly linked to Sri Lanka's high, near-Western incidence of degenerative diseases. Here too, there is a case for health personnel to be involved in the design of appropriate policies to develop healthier varietal and crop mixes. There are, of course, major problems for very poor farmers and workers — as well as for richer farmers, processors, and lobbyists — with policies aimed at reducing a particular product line sharply on health grounds. Such policies are unlikely to succeed unless health and agricultural professionals can jointly
develop new output-mixes that offer comparable or better incomes, at least to the numerous poorer producers.

A special problem is associated with the consumption of alcohol, which is a refined agricultural product. This is unusual because it is dangerous in two ways, both "positively" (via alcoholism or via adulteration, e.g., with methyl alcohol) and "negatively" (by diverting income of poor people, especially the wives and children of husbands who drink, thus denying them sufficient resources to obtain food); yet it is dangerous only, in most cases, if consumed to excess. Local alcoholic products from agriculture are of two types. Lightly fermented beers, as from millet and sorghum, cause little distress or drunkenness, and are often a major safe energy source for poor people, e.g., when cereals stored underground ferment. Local spirits and toddies are often dirty, adulterated and very dangerous. The sale of non-local beers and spirits, superficially similar to local products but usually stronger, reduces employment, usually of women in brewing safer products from local agriculture, but also reduces consumption of dangerous local spirits. The growing alcohol problem, especially in some parts of southern and eastern Africa, requires careful and sensitive attention jointly from health and agricultural professionals.

3.4 Inputs to outputs: technologies, structures, policies

Farm inputs (soils, sun, rain, seeds, labour, etc.) are transformed into outputs (food) through (a) technologies and (b) socioeconomic structures. Both involve public and private choices which have major effects on health. Choices in farm technology are of five main types: hydraulic, mechanical,
chemical, biological, and post-harvest. (Such choices are expressed as optimizing decisions along technically specified 'production functions' to neo-classical economists; and as 'forces of production' to Marxists.) Alternative structures of law, custom and power express themselves as ownership of, or access to: technologies; land, labour, and capital embodying them; and as claims on their usufruct. (These are 'property relations' to neo-classicals, 'relations of production' to Marxists.) As earlier sections show, health personnel could usefully provide much more help in making public choices on technology, and influencing private ones, if they can supply, publicize and analyse the facts about health effects, including effects on income and hence on access to food and health care. However, both the training and the job descriptions of most health personnel, including social scientists, tend to restrict their influence on 'structural' decisions, such as how a family, a village, or a state might use or redesign land tenure and inheritance systems.

Health effects of hydraulic, mechanical and chemical alternatives in agriculture have been considered above (see pp.33-40). Throughout, the stress has been on the impact of such alternatives on health (a) via vulnerable households' nutritional requirements (e.g., sufficient energy-rich foods to work or to fight disease) as well as via the availabilities of these; (b) via income, and hence (largely) the ability and knowledge to avoid or overcome ill-health, as well as via the health environment, including total food availability, in which such income is used. In this framework, health personnel should seek to improve the impact on health of biological research into new seeds and associated farming systems.
3.4.1 Nutritional effects of new technologies

In a nutritional context, three useful summaries of these effects have been prepared. Pistrup-Andersen (1984, pp.14-15) writes:

"Agricultural production research influences human nutrition [via] (1) incomes acquired by households at [nutritional] risk; (2) the prices they must pay for food commodities; (3) the nature of production systems among semi-subsistence farmers; (4) risk and fluctuations in food production, storage, prices, and incomes; (5) the nutrient composition of household [and] intrahousehold income and budget control, and the allocation of women's time; (6) the demand for labour; (7) expenditure of human energy; (8) infectious diseases".

His priorities are (1), (2) and "insufficient food", but he stresses that "using production expansion as a proxy for nutritional effect is ... misleading". Muscat (1983, p.3) lists seven nutrition-related questions about agricultural projects that could, at least as well, apply to biological research programmes and outputs; these questions cover points (1), (2), (4) and (5) only from Pistrup-Andersen's list, replacing his (3) by a closely related quest for health-linked effects on "production of foods for home consumption", and also specifying seasonal effects and effects on women's food preparation and child care. Reutlinger (1983, pp.12-21) stresses, from this list, three questions [corresponding closely to Pistrup-Andersen's (1), (2) and (3)]: does the activity raise or lower at-risk households' incomes, production for own consumption, and food prices?
We strongly advise that scarce analytical time be concentrated on the three nutritional effects in Reutlinger's list, viz., what happens to vulnerable groups' income, production for home consumption, and prices of purchased foods when analysing projects, but attention should be given in each case to fluctuations in food levels and to food requirements, and a review should be added of the disease impact of changes in water and pest management. For research programmes, especially into biological alternatives, a rather different approach is required (the next five paragraphs draw heavily on Lipton and Longhurst, 1985, Ch.5) although the main components remain as in Reutlinger's list.

3.4.1.1 Improving nutritional impact of biological research

By far the main impact of modern cereal and root-crop varieties on poor people's health is via the effects on cereal availability, consumption and prices. If the extra grain adds to grain available from net food imports, cheaper food greatly benefits consumers, especially the poor and hungry. The poorest household group in Colombia in 1970 was 12.8% less poor because modern rice varieties restrained food prices (Scobie and Posada, 1978). Surplus producers lose, but the poorest growers eat most or all of their product, thereby gaining as consumers (Hayami and Herdt, 1977). A fall of 8% in rice prices in the Philippines would allow even the poorest to afford a sufficient diet (Gonzales and Regaldo, 1983). The poor gain even more when modern crop varieties raise per-person availability of inferior foods, such as cassava meal in Brazil (Centro Internacional de Agricultura Tropical, 1981).

Unfortunately, the rise in output of modern crop varieties does not imply a rise in per-person availability. Most growth in
poor countries has favoured the wealthier people, so the massive extra supply from modern crop variety research - 10-27 million metric tons of wheat and 7-20 mmt of rice alone by 1981-82 (Pinstrup-Andersen and Hazell, 1984) - has not been matched by higher demand per person in vulnerable groups. The extra food output from modern crop varieties in Southern Asia and Latin America has (a) matched population growth, (b) displaced imports (e.g., of wheat to India) or increased exports (e.g., of cassava chips from Brazil), and (c) helped to build stocks. Even where the ratio of food prices to other prices has fallen, which initially helps the nutrition of the poorest - who increasingly are unskilled labourers, rural and (less often) urban, rather than farmers - the increasing over-supply of labour, and hence high wage-elasticity, has enabled employers to respond to slowdowns in food price rises, due to extra output from modern varieties, by correspondingly slowing wage rises.

It is no use for health personnel to blame technology. The African experience confirms that the absence of change is far worse for the poor than are modern varieties of crops. The main way to benefit from modern crop varieties is to provide the Asian and Latin American poor with either land and farming skills and inputs to grow modern varieties of crops for their own consumption, or alternatively to provide them with non-farm assets and skills to earn income to buy these crops. However, health personnel should examine recent developments in agriculture to see if they could do more to improve poor people's health. The emphasis on high-protein or high-lysine varieties has harmed the poor, who mostly need extra energy-giving foods, not extra protein. This harm has occurred not only because increases in protein levels, etc., have often been at the expense of yield and/or stability (e.g., Pachico, 1984, p.34; Jodha, 1984, p.111), but also because, indirectly, the introduction
of high-protein varieties has delayed the development of high-yielding and robust varieties (Lipton and Longhurst, 1985, sec.5). This diversion is even less justifiable if its aims are aesthetic colour and taste qualities, except in the rare cases where the very poor both grow 'luxury' varieties of cereals at prices enhanced by such research, and use the income to buy low-cost energy sources. Nutritional bio-characteristics to be emphasized in research should instead increasingly include energy density (Pinstrup-Andersen, 1984, p.20), and absorbability by pregnant and lactating women, sucklings, and infants, especially if they are more vulnerable due to infection or parasites.

The main issue facing health personnel seeking to improve the health impact of biological research into modern crop varieties, assuming they cannot affect the structure of poor people's command over assets (see p.58), is the balance among commodities and among regions. The regional dilemma has been discussed (see p.47). As for commodities, colonial agricultural research in developing countries favoured export crops, raised the profits of the large farmers and cheapened imports to the metropole, with the health benefits in the colony being confined to fairly small employment effects. This traditional pattern of research has been partly replaced since independence by a shift towards main food staples, but with heavy emphasis on rice and wheat. In most of Africa, and much of Asia and Latin America, however, the poorest, nutritionally vulnerable, groups eat mainly the cheaper, locally available staples such as sorghum, millet, cassava, yams, and to a lesser extent, maize. Maize hybrids have helped the nutrition of the poor somewhat in a few countries, but development since about 1970 has been slow.
The true 'green revolution' for the poor since the mid-1970s has been the development and spread in India of drought-resistant main-season sorghums and eleusine millets (ragi) (Rajpurohit, 1983; Rao, 1982). Success in the 1990s may depend on similar progress in Africa with cassava and yams (Hartmans, 1985). If more research is focused on crops grown and eaten by the poorest people, it will depend, for nutritional success, on developing varieties and practices tested as profitable and safe in production, and appetizing in consumption, in the context of traditional poor households and their farming systems [including intercropping and sometimes shifting cultivation (Maxwell, 1985)]. It is noteworthy that such research (and indeed all research on root crops, sorghum and millet) is less evident in national research systems, especially in Africa, than in international systems. Health personnel need to infiltrate into the former, since success in using international or non-local biological research, where quantified, has proved to be heavily dependent on the scale of national or local research (Evenson and Kislev, 1976), which determines adaptive capacity.

3.4.2 Structural issues

Structural issues have an important influence on how a given agricultural technology affects health. A selected group of poor agriculture-based countries and regions, some capitalist and some socialist, has achieved structures such that the poor — and therefore the population as a whole — attain much better health (lower age-specific mortality and morbidity) than the income-per-person would suggest, although available agricultural and health technologies are similar to those used in other countries (see, for example, Morris, 1979; Sen, 1980). What 'structures' affecting agriculture are relevant here? By far the main reason why poor people often fail to gain nutritionally and
sometimes lose from agricultural projects and policies, is that they do not participate in them (Pines, 1983, p.45; Mason, 1983, p.93), or participate too late, when the large gains have already been seized (Binswanger, 1980, p.180; Lipton and Longhurst, 1985, pp.24-25). The main reason why the poor participate late or not at all, is that structures of assets, laws or customs – especially as they affect land rights – often deny non-participants (be they small farmers, tenants, the remote, the low-caste, women, or just the poor) access to benefits from agricultural projects or policies. Health personnel can seldom change such structures directly, but should (a) describe their effects on health and those of any alternatives, and (b) help agricultural professionals to design and implement ways that allow for the role of the current (or changing) structures in affecting vulnerable groups' participation in, and health benefit from, agricultural projects.

3.4.2.1 Urban-rural power balance

In general, death-rates in all age-sex groups are much higher in rural than in urban areas. Indian urban infant mortality was 70% of the rural rate in the 1960s, but only 55% in 1974-76 (Grawe, 1980, p.130; Mitra, 1978, p.223; Ruzicka, 1982, pp.20-39). In Africa, much more than in southern Asia, the urban-rural power balance (Lipton, 1977, 1984), largely neglected by political scientists of all ideologies (for a notable exception, see Bates, 1981), is mainly responsible for excess rural death and disease, by preventing massive redirection of resources from lower-priority (but more powerful or articulate) urban users to vulnerable rural

---

groups. Under the banner of 'health for all', many health personnel try, with some success, to redirect health resources so as to reduce infections and parasite infestations among vulnerable rural groups and thus to lower nutritional requirements, via preventive measures, primary care, and family planning. However, health personnel are usually involved to a far too small extent in analysing and promoting the health gains that could arise from redirecting productive resources to agriculture and rural industry, thereby raising vulnerable groups' income and hence their command over health and food.

3.4.2.2 Land tenure

The main aspect of societal structure related to the effects of agricultural policies and projects on the health of the poor is that of land tenure. Several studies confirm that the size of a rural family's operational landholding (from zero upwards) is strongly and positively related to its income, consumption, and hence health status and risks (FAO, 1984, pp.43-45, for Machakos, Kenya, and p.87 for the Philippines; Pines, 1983, p.59, for Peru; Vaughan and Flinn, 1983, for El Salvador; Huffman et al., 1983, for Bangladesh; Wijga et al., 1983, and Lipton, 1983, p.38, for Gujarat, India). The Machakos study is especially interesting, since it correctly tests separately the link between landholding per person and (a) stunting and (b) wasting, showing that only (b) - corresponding closely to a risk of severe malnutrition - is strongly correlated with land poverty. A major exception to the 'land shortage, poverty, ill-health' nexus arises in many areas where land is very poor, unreliably irrigated, and/or of adequate size; there, rural nutritional and health status changes very little as the size of a household's
agricultural holding increases from zero to 3-5 ha (Visaria, 1978, 1980; Lipton, 1985). Under these circumstances, such status levels appear to be raised mainly by off-farm income sources, e.g., in northern Nigeria. It is notable that a farmer's tenancy status (i.e., owner or tenant) is related to income and health much more weakly than is holding size (Lipton, 1985), although data from north-east Brazil suggest that the stage in the household development cycle is a further intervening factor: those who are worst hit by malnutrition are young families with small but demanding plots that leave them little time to spare for off-farm work (Tanner, 1987).

If tenants are not really poorer or less well than owner-farmers, then health personnel should not in general expect major health gains from tenancy reform. Without land redistribution this is almost impossible to implement either effectively or without damaging side-effects on vulnerable groups (Herring, 1983; Lipton, 1974). On the other hand, land redistribution, involving the subdivision of large farms into small family-farmed holdings, would not only increase many poor people's access to income and hence food and health, it would also usually raise agricultural output in the medium term (Lipton, 1974; Berry and Cline, 1979). The proportion of this output, by value, comprising food, notably inexpensive foods grown and eaten by vulnerable groups, would probably also be raised. Wherever land redistribution is politically possible, health personnel should coordinate existing evidence on its likely impacts on health. Such evidence should include effects on landless labourers, many of whom, in land-scarce Asian countries, are unlikely to benefit from extra land; to redistribute land from the large-farm sector could reduce their employment income and leave them more vulnerable than before, although most experience
suggests the much higher labour input per hectare on small family farms outweighs their somewhat lower ratio of employees to self-employed, leaving the landless at least at the same level of employment after the reform as before.

3.4.2.3 Non-farm assets

In some cases, land reform is irrelevant to improved health. Sometimes, where land is poor, plentiful, or not a major factor of production, vulnerable groups' income (and hence health and nutrition) depends much more upon their access to other assets, such as ownership of fishing-boats (FAO, 1984, p.84), or draught animals (Government of Botswana, 1975), or small urban capital, often neglected in slum upgrading (Yeh, 1984, p.59; Cook, 1984, p.82). Policies for agricultural structure are relevant to all three routes to income and health for the poor, since agriculture is the main income source for over 10% of urban workers in developing countries, even in cities, and for a much larger proportion of one nutritionally vulnerable group - female casual labourers. In the country (including plantations) and the city alike, most otherwise landless people have a tiny home garden. Together with appropriate inputs, research, and extension (often for under-investigated traditional foodstuffs), home gardens could be enlarged or provided, or at least intensified, for very many of the ultra-poor. They could contribute much more to nutrition, at low cost, even where land is scarce, unequally distributed, and politically not reformable. For example, home garden development, as in World Bank schemes in Papua New Guinea (Berg, 1981, p.50) and Indonesia, can improve the income, employment, and health impact of site-and-service schemes. Conversely, expanding communities can force home gardens out into areas further from the
centre, requiring more energy to walk to them and often making them less productive (Nardi, 1984).

Just as home gardens are more likely than other farmland to be owned by vulnerable groups, so are smallstock - rabbits and backyard poultry, as well as sheep and goats - than are cattle. Smallstock, too, have been relatively neglected in research and extension. They offer urban as well as rural opportunities and could provide substantial extra income, and hence nutrition and health, where most needed. The policy lesson of both home gardens and smallstock is simple. If land is scarce, structurally unreformable, and the main income source of the poorest, other agricultural assets can often be created, intensified, or restructured or otherwise redistributed, by changing the incentives and markets, or by more direct state actions; this could be of great benefit to the nutrition and health of vulnerable groups. Notably, smallstock and home gardens provide work and income directly to mothers while they care for children, whereas in many cultures draught cattle and agricultural land preparation are male-dominated.

3.4.3 Policies

Health personnel should analyse policy options, explain their health advantages and problems, and, where appropriate, help to design them in health-oriented ways. The role of health personnel in policy, notably for research and for project management, has been mentioned; we shall return to certain aspects of this in Chapter 4. So far emphasis has been almost entirely on specific policy: for agricultural projects, research, land structures, etc. There are also two areas of general agricultural policy to consider: on prices and on food strategies. Both raise a key
issue for health personnel: that the health impact of a policy depends on who the vulnerable groups are.

For example, does state action to depress average food prices improve health? If almost all poor households in a typical year are smallish family farmers and net sellers of food, as in much of sub-Saharan Africa, it clearly does not. If the great majority of them are net food buyers, as in heavily urbanized Colombia, lower food prices may benefit health (Scobie and Posada, 1978); although government maintenance of food import levels (while modern varieties boosted rice output) cut prices and thus hurt some very poor hill rice-farmers (who could seldom use the modern varieties), many could be helped to move to other work. If - as increasingly in Bangladesh, Eastern India, and Java - the very poor are dependent, not on urban work or work on their own farms, but on employment by farmers, the impact of agricultural price repression is complex: such people gain temporarily from cheaper food, but lose income in the medium term, as agricultural production (usually labour-intensive) and employment are discouraged relative to other activities. In all cases, any gains (losses) to the poor from cheaper food due to price-repression have to be offset against losses (gains) when food prices go up again, later, because local food production has been discouraged. Clearly, the impact of action to depress food prices upon seasonal and year-to-year stability needs to be carefully reviewed; any instability hits the poor hardest, because they have few reserves and face high borrowing costs or are unable to borrow at all; also, the benefit of any project to help the very poor can be prejudiced by instability in cash-crop prices (FAO, 1984, p.91, for an example in the Philippines).
Health personnel seldom feel called upon to explore such issues when, for example, they plan the allocation of resources within a drugs budget, or health workers' time, whether at the level of a single dispensary or of the nation. Yet when or where a health worker is of most use, or this or that drug most needed, is critically determined (in countries where the nutrition-infection-parasite syndrome is the main cause of death and disease) by the level and variation of food prices. Health personnel should at least take account of the effects of such policy upon the impact of their own actions. Preferably and increasingly, health personnel should make agricultural price policy makers aware of the consequences of their acts on the nutrition and health of vulnerable groups. Even 'no policy' is a price policy for food, with often serious health effects. "Increasing income among the well-nourished may bid up food prices and reduce consumption among malnourished groups" (Pinstrup-Andersen, 1981, p.18). Even quite widely shared growth, missing out (say) one in four people, whether vulnerable or not, will shift first demand and later supply, investment and research (Pachico, 1984, p.30) to superior food crops. The medium-term effect, after an initial price fall as demand falls, is probably greater scarcity and higher prices for the 'inferior' foods of those consumers who remain poor and vulnerable (Lipton, 1975), e.g., as marginal lands are given over to dairy products rather than cereals.

Unlike pricing, 'food strategy' (Heald and Lipton, 1984) appears to imply policies favourable to health and nutrition. The large numbers of discussion papers on food strategy (some excellent, but hardly any with major policy impact) prepared by advisory groups, notably the World Food Council, indeed stress the objective of nutritional improvement, and especially more dietary energy, for vulnerable groups. However, this is only one of four
possible goals for a national food strategy. The four strategies which have obtained cash and technical-assistance support from the European Economic Community (those for Kenya, Mali, Rwanda, and Zambia) stress: (i) above all, self-sufficiency for major food staples (i.e., the deviation of urban demand away from imports towards supplies from domestic rural sources); (ii) higher farm production; (iii) food security (less priority); (iv) reduction or elimination of malnutrition (even less priority). "The expectations of the international agricultural policy institutes, especially the Institute for the Support of National Agricultural Research and the International Food Policy Research Institute, are also negative in [their] present attempt to help strengthen the capabilities of national institutions to deal with the interactions among agriculture, public policy, and nutrition" (de Rubinstein, 1984).

The very low priority given to nutrition and health in the four operational national food strategies supported by the European Economic Community and their total omission by the International Monetary Fund and the World Bank when advising on the scale and direction of stabilization and structural adjustment, respectively, despite the major impact of retrenchment on vulnerable groups, are the world-level counterparts of this national-level pessimism. Yet the massive public support in many rich countries for international assistance to poor countries is heavily focused upon health, food and other humanitarian concerns (as witness the popular response in the West to the African famines of 1983–85). Aid ultimately depends on such public support. National health ministries, international agencies, researchers, and doctors should analyse, for the financing agencies, the effects of agriculture-related and
macro-economic policies on the health of the poor. Armed with such analyses, they can then reasonably suggest or even insist that, in response to Western popular concern, major decisions (including macro-policies) affecting agriculture be vetted for their impact on the health of vulnerable groups.
4.1 Intersectoral institutions and information needs

The preceding discussion has drawn attention to two phenomena. First, some important linkages between agriculture and health have not been either studied or pursued with regard to policy implications. Second, a considerable body of knowledge is not put to good use for health promotion because health personnel either ignore it, or lack information, training, institutions or power to obtain action from agricultural policy makers. What, then, is the institutional context of these linkages between agriculture and health? If agricultural activity strongly affects the two main synergisms determining life or death, disease or health, why is intersectoral action so weak? What institutional innovations might result in better use of existing knowledge?

Throughout the preceding analysis we have emphasized the problems of vulnerable or at-risk groups. Much of the unused knowledge is concerned with the impact of different circumstances or policies on individuals, households, farms or communities. This knowledge gives rise to three sorts of policy issue, with three sorts of institutional implication.

(a) There is the issue of centrally made policies for large projects. We have reported on some such policies where the effects on vulnerable groups are well known and yet largely ignored. A flagrant example is the spread of water-borne diseases as a result of major irrigation works (large dams and artificial lakes); a well-developed methodology now exists for ex ante assessment of
impacts (World Bank et al., 1985). Critics of large dams sometimes take an unbalanced view of benefits and costs (see p. 35). Yet they are right that major policy decisions, known to pose possible major threats to health, should never be taken by sectoral authorities without assessing the seriousness of such risks and without reviewing possible preventive and/or promotive measures to deal with them (Goldsmith and Hildyard, 1984, 7.06). Some institutional mechanisms that might be put to better use for such early involvement are discussed below.

(b) Many of the findings reported in Chapter 3 are not only micro-level, but (although often leading to wider and more general conclusions) are most effectively acted upon by institutional and policy decisions at 'project' level. The project may be a piece of research, or a localized set of interventions aimed at raising agricultural production or promoting rural development.

(c) There has been something of a 'knowledge gap' regarding the health impact of non-project macro-policies affecting agriculture: policy on farm prices, on crop priorities for agricultural research, etc. We have, however, reviewed recent findings on these matters. These findings make a strong case for health/nutrition assay, at top decision-making levels, of such proposed and current policies. We consider the institutional options later in this chapter.

In all three areas, there are several things to explain. What obstacles have prevented the health sector from making health-promoting inputs into the formulation or implementation of agricultural projects and policies? What is the broader institutional context of intersectoral contacts, exchanges of information, and the reciprocal influencing of decisions? What
room for improvement exists at different levels (project or district, regional, national) in intersectoral collaboration? How can health personnel contribute positively, on a secure knowledge base, and with tactful awareness of the interests of other groups?

We focus on agriculture-health linkages, but institutionally these cannot be understood in isolation from wider intersectoral relationships. Such a broad approach does not come easily to the health sector, which has tended to generate its own analyses of, and to propose solutions in health care terms for, the problems it encounters. However, only rarely are the institutional issues in some sense peculiarly health- or even medicine-related.

4.1.1 Intersectoral institutions at national level

The health sector has approached intersectoral action largely through initiatives at the national level. The intersectoral institutions advocated by WHO are of two types: technical and political. Discussions on the latter have centred mainly on the idea of the National Health Council; the former have been promoted by WHO through the idea of the National Health Development Network, whose main function is to give technical support to the political decision-makers, perhaps specifically to the National Health Council. Yet a WHO report on National Health Development Networks in twelve countries (of which ten were developing countries) suggests that they appear to have been predominantly concerned with the health sector proper - especially with working out the implications of implementing the primary health care approach - and only to a limited extent with those areas immediately 'contiguous' to health: water development, sanitation, and nutrition policy (WHO, 1983b). There is no evidence that sustained attention has been paid anywhere to agriculture-health linkages. Although in
some cases the broader socioeconomic issues that influence health, such as agriculture-related policies, were on the agenda, it is not clear that the National Health Development Networks concerned have actually dealt with them. This is not surprising, given that they are organized by the health sector and that their secretariat is often located in the Ministry of Health, and given their preoccupation with problems within the health (care) system.

Even so, National Health Development Networks and National Health Councils can make a contribution to help policy-makers take better account of the health-related costs and benefits of decisions about agricultural development. But this would require that they reorient their priorities, get more professional resources, and draw in institutions from other sectors, or researchers from academic disciplines and departments other than the health sciences. Though none of these is easy to achieve, it is an option that countries may wish to consider. In view of the frequent need to deal with regionally specific agricultural issues, the development of such networks at the subnational level would be desirable in the larger countries.

Another relevant set of institutions has emerged. Over the past fifteen years or so, many countries have established National Food and Nutrition Councils, often placed under the national planning authority (Aranda-Pastor and Saenz, 1981; Caribbean Community). Planning units such as Zaire's Centre de Planification de Nutrition Humaine, Kenya's Food and Nutrition Policy Unit in the Ministry of Finance, and the Philippines' Nutrition Institute have played a similar role, though as yet more through research and 'sensitization' than through tangible policy outcomes. All this has coincided with a move away from the previously dominant concerns in nutrition studies with metabolic and biological issues,
towards a new socioeconomic and planning perspective, emphasizing effects on vulnerable groups (Joy and Payne, 1975; Lipton, 1983a; Pacey and Payne, 1985). Often, after one or two false starts, institutional forms were developed which enabled such programmes to initiate activities that went beyond conventional approaches.

Nevertheless, the impact of National Food and Nutrition Councils has been limited. For Latin America, more was achieved in developing new methodologies and refining diagnostic tools - a whole new technical cadre emerged during the 1970s - than in getting new policies implemented (Daza and Campoamor, 1981; also INCAP, 1983). This applies even to such a well-established national programme as Colombia's National Food and Nutrition Plan, which has firm roots in the top policy-coordinating agency of the country (the National Planning Department). While quite successful at the project level, in the communities, it apparently has been much less able to influence national policies, being "particularly deficient in terms of agricultural sector policy" (Uribe, 1981). Moreover, governmental councils cannot displace National Health Development Networks which are at most semi-governmental and whose value depends substantially on incorporating findings from university, and other, independent research. The National Food and Nutrition Councils, in this context, risk clashing with National Health Development Networks and even National Health Councils: who is to coordinate the coordinators?

Even so, National Food and Nutrition Councils could be broadened into wider networks, where National Health Development Networks have not yet become firmly established. If the Ministry of Health (hitherto often a follower rather than a leader in this field) is willing to press both for a wider analytical role for the National Food and Nutrition Council, and for stronger links with
national decision makers in the field of agriculture and rural development and with research institutions, the Council could provide a sound basis for the incorporation of health concerns into agricultural policies.

Quite a range of institutions can be expected to make inputs into such networks. In addition to planning ministries or other departments charged with overall planning and policy making, there are institutions within each sector which deal with planning and the information gathering and analysis necessary to prepare for it—namely the planning, statistical and budgeting units of the sectoral ministries. But research institutes also play an important role. In agriculture these are supported by a network of International Agricultural Research Centres, which have generated much of the research reported in Chapter 3. Their work—and, even more, research in national agricultural research institutes, local research stations, and the private sector-deals mainly with crop improvement, breeding programmes, fertilizers, pesticides, etc. There are few contacts with nutritional researchers (Tripp, 1984), let alone with other health personnel. In recent years, some International Agricultural Research Centres have placed more explicit emphasis on the nutritional impact of the productive innovations they propose, and they are being urged to do more in this respect (IFPRI, 1984). However, crop-oriented nutritionists are geared mainly towards enriching a crop in specific nutrients, cooking qualities, etc. They require regular, institutionalized contact with health and economic researchers, and different career and publications incentives, if they are to reorient their work to obtain maximum benefits for nutrition and health of vulnerable groups.
Researchers on health work mainly in national institutes or universities. While involved for a long time in medical nutrition work, they have usually been isolated in medical schools, and even more cut off from the socioeconomic aspects of nutrition than agricultural researchers. WHO tried to address that isolation, and the need for a broader interdisciplinary and interdepartmental approach, to match the intersectoral needs of government and administration, at the Technical Discussions of the World Health Assembly in 1984, which considered the role of universities in the strategies for 'Health for All' (WHO, 1984). These efforts do not, as yet, appear to have had much effect.

4.1.2 Collection, analysis and use of information

To achieve an improvement in the health effects of decisions related to agriculture, health personnel will have to make more effective inputs into the analysis that precedes policy formulation. As has been shown, research into these effects, particularly as regards the nutritional impact on vulnerable groups, has produced well-documented findings, often of general applicability. Nevertheless, findings often refer to situations that are only relevant in a particular country or region or at a particular time. So one pre-requisite for health personnel to interact effectively with other sectors is that regionally specific minimum essential information, on the nature and range of the findings sketched in Chapter 3 be available (and taught) to health personnel in a regularly updated, easily communicable form. Before such findings can be applied, a series of steps (sometimes called the 'project cycle') have to be gone through systematically. Table 1 exemplifies such an analysis for one particular problem, that of recording the health-impact of agricultural practices on women farmers.
Some agricultural projects or policies reflect one-time policy choices and/or affect limited areas. For these, special information may have to be collected. Other policies relate to permanent features of economic management and have nation-wide effects even though their parameters change from time to time, i.e., marketing boards and farm price policies; credit mechanisms; incentives or disincentives to labour-intensive production methods. Here the prime need is for disaggregated information covering the entire country which will serve, however approximately, to follow the differential impact of agricultural projects and policies on areas and population groups. We should not overstate the confidence with which those impacts can be demonstrated: epidemiologists know only too well how difficult it is to establish the effect of a particular factor or intervention. Nevertheless, provided the basic data are of reasonable quality, and likely other factors ('confounders', in the language of epidemiology) can be taken into account, plausible conclusions can often be drawn. Policy making can only base itself on the best available information; at the present time usually no information on health impacts is incorporated into the appraisal or monitoring of agricultural decisions, although these are often extremely important determinants of health status.

Apart from information on notifiable infectious diseases (partly internationally required), the data routinely collected by health information systems are largely confined to health care system activities. Monitoring often consists only of a comparison between activities undertaken and numerical targets for those activities; impact is generally assumed rather than demonstrated. This is not the place for a discussion of health information systems in general. However, for most countries it would be unrealistic to call for the incorporation of additional data to
Table 1. Improving farm women's health.

<table>
<thead>
<tr>
<th>Project cycle of actions</th>
<th>Village-level agents</th>
<th>District/block officers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of health problems</td>
<td>Maternal mortality, morbidity</td>
<td>Report on women farm workers &amp; output</td>
</tr>
<tr>
<td>Research</td>
<td>'Felt' needs &amp; farm hazards</td>
<td>Note projects and technologies inappropriate to women</td>
</tr>
<tr>
<td>Identification of projects, policies</td>
<td>Make up a realistic &quot;wish list&quot;</td>
<td>Recall pre-industrial farm methods if easier, and elicit village suggestions</td>
</tr>
<tr>
<td>Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appraisal of costs, etc.</td>
<td></td>
<td>Feedback</td>
</tr>
<tr>
<td>Training</td>
<td>Awareness of farm workers' needs</td>
<td>Awareness of women's needs</td>
</tr>
<tr>
<td>Implementation</td>
<td>Primary health care services, Growth charts, Health cards</td>
<td>Include women farmers in planning implementation</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Report on health status of women farmers and children</td>
<td>Report results of changing technology</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Report local &quot;felt&quot; results and supply data as needed</td>
<td></td>
</tr>
</tbody>
</table>

Based on Project cycle of actions, see Baum, W. The World Bank's project cycle. Finance and development, 15, 4 (1978).
Finding: By emphasizing less effort-intensive farm methods, making provision for child care, searching out old and new methods of farming which are suitable for women, the health of women farmers and that of their children can be substantially improved.

<table>
<thead>
<tr>
<th>Action at national level</th>
<th>Decision makers</th>
<th>International agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Health</strong></td>
<td><strong>Agriculture</strong></td>
<td><strong>Planning/finance</strong></td>
</tr>
<tr>
<td>Compare women farm workers' output with their illness ratios</td>
<td>Intersectoral co-ordination committees, conferences to plan research</td>
<td></td>
</tr>
<tr>
<td>Organize research specific for women farmers</td>
<td>Intensive hunt for appropriate techniques &amp; projects which are suitable for women and improve 'Health for All'</td>
<td></td>
</tr>
<tr>
<td>Identify health hazards</td>
<td>Formal appropriations for technology suitable for women, child care plans. Policy to include women's issues in all policies</td>
<td>Enlist public cooperation, support policies</td>
</tr>
<tr>
<td>Recommend approaches innovations</td>
<td>Establish a 'woman-farmer' department</td>
<td>Arbitrate any difficulties</td>
</tr>
<tr>
<td>Ensure projects will improve women farm workers' health</td>
<td>Submit budget &amp; programmes</td>
<td>Propose plans and budgets</td>
</tr>
<tr>
<td>Design joint retraining</td>
<td>Earmark funds for retraining</td>
<td></td>
</tr>
<tr>
<td>Ensure primary health care &amp; collect data on women farm workers</td>
<td>Supervise/track implementation effect</td>
<td>Support implementing agencies</td>
</tr>
<tr>
<td>Recommendations to DOA as necessary</td>
<td>Trial &amp; error Goodwill</td>
<td>Analyse effects of modifications; collect feedback</td>
</tr>
<tr>
<td>Extensive joint evaluations</td>
<td>Fund and use evaluation research</td>
<td>Use 'birdseye viewpoint' to assess and communicate results</td>
</tr>
</tbody>
</table>
deal with agriculture–health linkages in the absence of a major simplification of these systems. Health personnel often have little or no time for analysis; in most of the least-developed countries the quality of the information is poor to start with and does not improve as it is collected and analysed. Hill's discussion, though dealing with socioeconomic statistics, is also relevant to the health and nutrition fields (Hill, 1984). A strong case exists, at least until capacities improve, for reducing the range of data routinely collected, many of which are neither accurate nor related to high priority issues.

In Chapter 2, we considered indicators used for routine measurement of nutritional status and in Chapter 3 the agricultural determinants of nutritional status (and of health in general). Innovations to improve agriculture–health policy linkages have a much better chance of success if accompanied by appropriate 'reform' of the health information system. In countries with more limited capacities this could involve a reduction in the amount of data routinely processed: WHO's own development of basic indicators to follow the progress of 'Health for All by the Year 2000' is relevant here (WHO, 1981). Use will also have to be made of data collected in special studies. The World Fertility Survey Programme is a good example of such a study, imaginatively used in a number of contexts (WHO, 1983a; Jolly and Cornia, 1984). Mason's work on the minimum data needed to assess the nutritional impact of rural development projects is particularly useful (Mason, 1983). The National Household Survey Capability Programme of the United Nations may provide a framework for data collection that could be used to monitor agriculture–health linkages (Carlson, 1985); however, for many developing countries its statistical demands have proved rather too severe. Attention should be firmly focused on the need for regular collection, supervision, and
processing for policy use of a few essential data sets, such as outputs of main food staples, or height/age for samples of those under five years old.

Also important is the UNICEF-sponsored effort to develop methodologies to produce adequate information on child survival and development, which take account of a country's level of data gathering capacity. These emphasize that concentration should be on a minimum set of globally collected data. The shortest suggested list of variables to monitor child survival and development consists of: the infant (0–1 years) and child (1–4) mortality rates; nutritional status of children under five; percentage of infants with low birth weight; incidence of diarrhoea and fever in children under five; percentage of children fully immunized (DPT III) (Solimano and McNamara, 1984).\(^1\)

Chapter 3 emphasized measurement of adequacy of energy intake relative to requirements for all vulnerable groups. It may, however, be regarded as desirable to advance initially along the lines proposed by UNICEF, thereby concentrating attention on monitoring the effects of agricultural policies on the health of children under five years old. UNICEF has also examined various alternative procedures for improving quality and coverage of monitoring; these include sample studies (especially if part of national household surveys), but also the use of sentinel sites. These involve a representative selection of locations in different regions, where detailed and reliable information is generated for the purposes of comparative monitoring, by means of cluster rather than random sampling methods (de Kadt and Andersson, 1984). The

aim of these and other similar procedures, such as those detailed in Pinstrup-Andersen (1981, p.69), is that a capacity be created whereby relevant data are routinely collected and available for comparative analysis by population groups or areas. (Large samples are much less important than reliable supervision to reduce non-sampling error.) In addition to a nation-wide monitoring capacity, we would suggest that a standard data collection methodology (which aims at collecting a few nutrition and health indicators reliably, for project and control areas, at baseline, appraisal and monitoring stages) should be developed for use in any specially funded project. This would ensure that the data generated in such projects also fit into, and complement, the national monitoring system, as has usually not been the case with large donor-funded projects.

Who is to be responsible for these monitoring procedures? We deal in section 4.3 with "bottom-up" aspects of monitoring. Here, first, we discuss the more conventional "top-down" view. The health information system is normally under the control of the ministry of health, and one focus of attention should therefore be that ministry's planning or statistical division. There are alternatives, however. The national planning authority or the central statistical office may be better placed to take initiatives which involve various sectors. If there is an active national health development network, its secretariat may be able to take these questions further, as may national food and nutrition councils. Pinstrup-Andersen (1981, p.41) describes in this context the tasks of special national nutrition monitoring or planning units that have been established in a number of countries. However, experience (e.g. in the Philippines, Tanzania and Zaire) suggests that such units, however excellent technically, cannot succeed without strong, senior support from either finance or line
ministries. They can seldom mobilize the pressure to obtain that support. It is not possible to determine in the abstract which of these possible avenues is most appropriate in any particular country. However, it might well be possible (with 6-12 months of research) to collate and analyse existing country experiences to suggest, by types of national political and administrative environments, 'what works and what fails' in monitoring the health and nutrition impact of agricultural policies. Whatever route is chosen, it is essential to build up a national capacity for intersectoral data collection and analysis.

4.2 Sub-national policy-making, administration and politics

Yet such a national capacity would provide only one part of the answer; its ability to make an effective contribution would depend on what happens lower down, where analytical weaknesses are usually even greater and intersectoral contacts just as problematic. Two possible exceptions are: (a) small-scale nongovernmental projects which branch out from health care into agriculture and other income-generating activities (Morley et al., 1983; Newell, 1975) and (b) donor-assisted integrated rural development projects, discussed below. Most sub-national agricultural policies and projects are, however, intersectorally weak, even those which are formally the responsibility of the central ministry of agriculture, e.g., large-scale irrigation projects which may operate in a province or region. But agricultural development projects are often situated in much smaller administrative divisions. Their implementation may to a considerable extent depend on arrangements at the 'district' level (a term used here as the lowest unit with a relatively complete range of administrative institutions, both of local government and of national sectoral ministries).
4.2.1 District level activities

The district has the minimum resources necessary for many productive and service activities, including reasonably comprehensive health care (Friedmann, 1981-82). Whatever the form of local government, it is here that national ministries have their furthest 'outposts'. The two officials most directly concerned with any local action on agriculture-health linkages, the district medical officer of health and the district agricultural extension officer, are usually stationed here. Yet in most developing countries their offices are overstretched and understaffed, and even in the medium term they can be expected to undertake few additional tasks. Often, they have neither the time nor the tools to engage in sustained analysis of the activities in their domain. Often they do not know the impact of their decisions, since monitoring and evaluation are rudimentary, at best, and they do not have a budget for research. They are therefore unlikely to contribute much to the identification of groups in the district that are nutritionally vulnerable to the different risks detailed in Chapter 3, unless such information is routinely gathered. Villagers (and village-level workers) can contribute to this if asked regularly for their perceptions of major changes in the health-nutrition situation, and of the causes (see p.93). For the health sector, this is dependent on whether action has been taken to simplify the health information system and make it more relevant to priority concerns, as was discussed above.

In most developing countries, the health and agriculture sectors at the district level cannot be expected to do much more than 'micro-planning', i.e., deciding within the parameters given by the region or the centre what is to be done where, and with what resources. Intersectoral collaboration can best take the form of
defining the complementary tasks that have to be done by the various workers of each sector, specifying the division of labour and eliminating wasteful duplication or conflict of messages — notably between agricultural extension, public health, and nutrition workers, who at present often give contradictory advice.

4.2.2 The relevant experience of integrated rural development projects

This approach is in line with the experience of integrated rural development projects. Their primary aim is to help generate higher incomes through improvements in agriculture, but they also include activities related to other sectors. They are usually relatively well-endowed with resources, both financial and human, often from foreign donors. This has distinguished them from sectoral government structures and made their experiences less susceptible to replication (Morris, 1984). Their relatively well-prepared and well-supported top-level staff come from various disciplines and develop intersectoral analytical approaches and methods for the joint planning of activities (Honadle et al., 1980). Even so, we know of no such development projects which have set out to analyse the impact of agricultural activities on health, and to deal systematically with them. In structural terms the meaning of integration in these projects appears to be quite limited and thus the health element consists in most cases of 'packaged' additions of conventional health activities: curative measures, often specially targeted at mothers and children, and preventive ones, which may include construction of latrines and wells and perhaps the development of immunization programmes (Longhurst, 1983).
In general, integrated rural development projects show that incorporating components from various sectors into the same management structure often overloads administrative capacity and leads to poor implementation (Morris, 1984). Similar experience has been noted with national nutrition planning (Pines, 1982). While the causes of malnutrition lie within the domain of many sectors, and analysis of these should benefit from a multisectoral approach, action may often best be pursued separately by the different sectors. Even when some sectors do not act, interventions by others may still have an impact. Also, intersectoral responses are often ineffectual because of political and administrative difficulties, and sectors are inhibited from pursuing actions which they could have undertaken on their own (Pines, 1982).

4.2.3 **Intersectoral collaboration and the circumstances of decentralization**

How health personnel at lower levels can contribute to a better understanding of the health impacts of agricultural projects and policies will depend on sector and country-specific differences in the extent of administrative and political decentralization. The three most important processes to shift responsibilities away from 'the centre' (Leonard, 1982b; Rondinelli et al., 1983) are:

(a) **deconcentration**, which shifts the workload of central government ministries and agencies to lower levels while functional responsibility remains within the central government structure;

(b) **delegation**, which transfers managerial responsibility for particular functions to an organization outside the regular bureaucracy, only indirectly controlled by central government, e.g., parastatal enterprises or decentralized social security organizations; and (c) **devolution**, which creates or strengthens,
usually as a result of political demands from below, sub-national units of government whose activities are substantially outside the control of central government. How far administration is decentralized or delegated, or government devolved, will largely determine which institutional solutions for intersectoral collaboration are feasible at a sub-national level.

The case of India is of interest. Although the central government maintains a firm grip on the planning process, it has devolved considerable powers upon its constituent states which have constitutional responsibility for matters of health. The Central Planning Commission has a strong influence on the pattern of allocation of resources (i.e., the shift to primary health care) and can restrain states from spending in ways that are not in accordance with the Plan, but it cannot force states into expenditure they do not wish to undertake (Jeffery, 1985). Indian districts are more like regions elsewhere— the order of magnitude of the population is one to three million — and the equivalent in India to a district in most African or Asian countries is the 'block'. Many of the implementation activities relevant to agriculture-health linkages take place at block level; as elsewhere, the success of intersectoral action largely depends on what happens at this level. Of the various experiences in decentralized planning aimed at improving the lot of the poorest, block-level planning has been described as the most promising (Vyas et al., 1983, p.17). It is more than the simple aggregation of local mini-projects expressing local "felt needs" for social services, formulated by the local population. Its main emphasis over the last few years has been on productive efforts, focused especially on the rural poor, although health, education and nutrition programmes have also been incorporated.
Even so, the results have been limited: various studies have revealed little block-level integration and mutual reinforcement of the sectoral programmes. The office of the Block Development Officer contains a number of professional specialists, including officials from agriculture and health, but the lines of responsibility and authority are confused, with each sectoral specialist reporting to his or her ministry. Moreover, the state authorities have not everywhere been truly committed to this form of decentralization. Although decentralization has been taken seriously in a few states (e.g., Maharashtra), elsewhere the higher level sectoralized plans are handed down from state through district to block, and lower levels simply follow the sectoral priorities of higher levels. Plans at lower levels are essentially expenditure programmes; the districts or blocks do not adopt more comprehensive criteria for the overall allocation of funds, which could be 'sectoralized' at that level after local key issues have been addressed. Unless some such procedure is followed, even district (i.e., regional) planners cannot respond to the health sector impacts of agricultural projects and policies. In fact, there appears to have been no institutionalized concern about these effects. The health sector has been fully occupied with planning and implementing conventional (public) health oriented activities. Also, in most states there are very few 'horizontal' working contacts between sectoral officials at block or district level; these operate almost exclusively along hierarchical sectoral lines (Vyas et al., 1983, p.9). This is shown in the strict financial control exercised from above: "Most development funds reaching the district are so rigidly earmarked that officials must shuttle constantly between the district and state secretariats to obtain approvals and sanctions" (Vyas et al., 1983, p.5). The situation is correspondingly worse at the block level.
A comprehensive review of the experience of decentralization in developing countries reveals "a kind of schizophrenia in developing countries about the desirability and feasibility of transferring powers and responsibilities away from the central governments" (Rondinelli et al., 1983, p.46). Even where powers have been transferred, funds and the power of local government to raise its own revenue have often been withheld. Linkages between local and central administrations are usually very weak. Therefore, training, supervision, and support services are defective and many countries lack the capacity to build up nationally a local-level cadre with comparable standards of competence (Rondinelli et al., 1983, p.66). Partly as a result of this, the status of officials at the local level is usually low, especially of those in charge of decentralized programmes. These officials are often persons without tenure, are frequently transferred, and have few if any formal powers vis-à-vis other agencies: in India below the district no official belongs to the elite Indian Administrative Service. So, central organizations still see supervision usually as control. This is particularly marked in Francophone Africa, where the idea of tutelle, as inherited from the colonial system, is still deeply ingrained in administrative and political culture. It is necessary to question any arrangements for intersectoral action on agriculture-health linkages which presume that lower levels will take considerable initiatives: "Field offices of central ministries, provincial planning administrative units, and district and local development committees have been established in most countries in Asia and Africa, yet central government officials have been reluctant to assist them, or use them in other than a 'transmission belt' manner. Local officials have been hesitant to use their discretion, and local officials continue to look to central
government ministries for decisions even in routine matters” (Rondinelli et al., 1983, pp.49-50).

It could be argued that these issues can be resolved through political pressures, but there is much evidence of problems in the relationship between planners and politicians. Vyas et al. (1983) note for India that the links between planners and politicians are weak at most levels, and that below the state there is no real local political sanction for or control over the activities of the officials. There are unresolved conflicts of interest between higher and lower levels. Higher level administrators as well as politicians see the emergence of lower level persons with increased power as a threat to their positions. In some East African cases, decentralizing reforms of public administration have paradoxically strengthened the hands of the central authorities (Apthorpe and Conyers, 1982; Conyers, 1984). One reason is that through their control of information and their knowledge of procedure, officials can dominate local politicians much more easily than they can powerful national figures or senior administrators; also, local decision-makers may be tightly monitored and controlled through a centrally run national party organization.

Constituency politicians are bound to locate and allocate activities, in part, in ways that increase their political influence and support (Vyas et al., 1983, p.72; Jeffery, 1985, p.235). The separation of policy/programme formulation (planning) and implementation suits them; they spend less time on the former than on "manipulating how things are in fact done" (Field, 1977, p.234). They can show their concern for equity and their respect for formal allocative criteria at the time of policy-making, for which they can be held accountable, but then put pressure on the officials to twist the implementation (for which the latter are
accountable) in the direction of the particular interests of their constituents. This is a 'safe' procedure, "as the officials are likely to be held responsible for all irregularities in administration" (Vyas et al., 1983, p.73). Moreover, devolution may merely underpin the entrenched interests at lower levels, without giving a chance for the poor to strengthen their economic - and hence power - base. To counteract this, different political systems may allow for different types of 'pressure from above', in order to ensure that higher administrative or political bodies maintain an active monitoring and correcting role over what happens closer to the grass roots.

Before innovations to improve agriculture-health linkages are designed, the balance of political and administrative power and resources, among ministries and agencies and between districts and the central government, must be clearly established; then, the processes described elsewhere in this section can be turned into precise, country-specific recommendations. Even this is not with the object of discovering the 'right solutions' to these problems (these hardly ever exist), but in order to illuminate and clarify the various more-or-less acceptable compromises. Inevitably, dilemmas arise once choices are viewed from different perspectives, notably local or national, short-term or long-term. For example, however much planning is deconcentrated or government is devolved, certain issues need to be decided at the top, because the necessary cross-regional overview is only found there. This is particularly relevant to general policies or interventions meant to help vulnerable groups - policies intended to make allocative mechanisms more equity-oriented (UNICEF/WHO, 1981) - or to specific interventions aimed at ensuring that agricultural policies and projects have beneficial health effects for those most at risk.
4.3 Participation and pressure from below

There is, therefore, a case for demanding monitoring and control by 'pressure from above'. But such pressure is unlikely to succeed unless the demand to incorporate health and nutrition values into agricultural policies, in the interests of the poor and vulnerable, is articulated through participation and through 'pressure from below'. This has much backing, especially in the health sector; WHO regards participation as essential for primary health care (WHO, 1978). However, much discussion of participation, especially from within the health sector, treats it like a tax, i.e., as the people's necessary contribution to the improvement of health (Daza and Campoamor, 1981, p.168). Popular demand for agricultural policies and projects that improve health, not just popular contributions to health activities, is at issue; only a few governments of developing countries have the will and the power structure to use agriculture for health purposes if such popular demand is not both well-informed and loud.

Here we distinguish two somewhat different aspects of participation: the cognitive and the political. The former deals with the way in which the perceptions and knowledge of the poor and vulnerable present both opportunities for and obstacles to the development and implementation of agricultural policies. The latter concerns the impact which those most affected can have on planning and implementing health-related agricultural activities.

4.3.1 The cognitive aspects of participation

In its cognitive aspect, participation concerns the perceptions, attitudes and habits of the poor, and embodies the view that a better understanding of the findings of science and
social science will enable them to improve their health. Education helps people to understand, improve, and demand changes in their health environment, including agriculture, and to discriminate better among suggested innovations (Dore, 1981). The fundamental importance of education, particularly education of women, for health has been frequently demonstrated; the education of women, specifically four years or more of primary school, constitutes the one variable which has been found universally to correlate closely with a reduction in infant mortality rates (Jolly and Cornia, 1984; Marga Institute, 1984; Panikar and Soman, 1984). This suggests that health education and agricultural extension (a) need to address their new messages about agriculture-health linkages above all to women; and (b) will have more effect if supported by a broader programme of basic education (Cochrane et al., 1980).

However, the conventional approaches to health education used by the health sector, particularly as regards nutrition have been criticized both in terms of scope and content (Gordon, 1984). Too often, poor women are told to obtain food and to adopt cooking methods that are too costly in terms of work, time or money. Instead, the most important findings reported in this chapter need to be incorporated urgently into the syllabus of health education courses given to health workers, in order to develop appropriate means of imparting this knowledge in due course to the people themselves.

Often, however, the findings of modern science are difficult to integrate with the knowledge and attitudes of the rural poor. Chambers (1983) has devoted much attention to the question of indigenous knowledge. In the struggle for survival, rural people have developed over generations responses that are clearly adaptive to their environment. Local people always know much more about
that environment than outsiders, even though their knowledge is often incomplete and not scientifically systematized (Gordon, 1984). For example, they have lived through a lifetime of seasonal variations: they know much more about the local effects of the seasons on labour demand, hunger, food reserves, and disease, than any outsider can ever hope to deduce from generalized findings. This does not mean that poor people's traditional knowledge is superior to modern knowledge. Whatever the importance of recognizing the relevance of indigenous knowledge, the most disadvantaged groups can undoubtedly put much 'expert' knowledge to good use. Yet 'experts' may have particular difficulties in bridging the gap between traditional and modern knowledge. They could be helped by those who work at the grass roots: auxiliary nurses, agricultural extension assistants, and community development workers. Many of such grass roots workers would first have to be retrained, because their earlier training is likely to have made them disdainful of indigenous knowledge. Yet in many places auxiliary workers are the most important potential link between the modern service structures and the people expected to benefit from them.

Local knowledge may be even more solid among community volunteers, who are another potential link with the service structures. Such volunteers are little used in agriculture but very widely used in the health sector. With the switch to primary health care, the part-time (and usually unpaid) village health worker has almost been promoted as the expression of community participation. Like the auxiliaries, they can potentially make a significant contribution to improving the application of knowledge on agriculture-health linkages. For this potential to be realized, auxiliaries and volunteers must be trained in how to engage in
simple analysis and to understand why certain data are important for solving real problems experienced locally.

The introduction of local participation in information gathering and analysis demands a drastic change of perspective. It requires the drawing up of simple forms for use by auxiliaries and village health workers (even illiterate ones, perhaps), and the development of simple analytical methodologies that would involve them at the (sub-)district level. Even established senior health workers such as district medical officers of health rarely have time for - or a clear idea of how to proceed with - an analytical approach to the vast and undifferentiated flow of data that comes across their desk. The development of a perspective from below would inevitably put pressure for technical and methodological change on the higher levels. It might also have another effect: it could become more difficult for the facts to be simply ignored. The 'participatory (action) research' tradition (Swantz, 1984) attempts to promote the idea that people at the grass roots level be brought into data gathering and analysis (and even to some extent into problem definition). If such participation is successful, people are more likely to confront policies and decisions, made in a far-away capital, with local realities, and to generate pressure to ensure that the findings are acted upon. The people stand simultaneously on the last step of the downward, 'technical' ladder of planning, implementation and monitoring, and on the first step of the upward 'political' ladder of promoting change.

4.3.2 Political participation

What, then, of the idea of political participation, through pressure from below, where vulnerable groups demand improvements
and the institutional arrangements to bring them about? By themselves, interventions from the top do not necessarily much benefit vulnerable groups. Social and economic processes at the grass roots level make the better-off the main beneficiaries of programmes developed for the poor (Galjart and Buijs, 1982; Bhaduri and Rahman, 1982). In India, the middle levels of the caste structure, whose position has dramatically improved over the last twenty years or so (Vyas et al., 1983, p.74), have benefited above all from programmes meant for the poor. The very poor have interests different from this increasingly vocal and dominating group in the villages. For the very poor, food, employment, clothing, and shelter are the main worries. Often there is little immediate interest in the health or education programmes actively demanded by the middle groups. The experience of the poor with programmes whose benefits have passed them by makes them suspicious of new initiatives. As 'patients' the vulnerable groups are a transient category, at least in their own perception, and are hence not likely to organize themselves spontaneously for health (health committees often express the interests of health professionals and health workers more than those of the people) (Jeffery, 1985, p.234).

The exclusion of the poor from local decision-making may result from traditional social arrangements, such as caste in India or traditional tribal structures in Africa, or from property and income-based class relations. It is often reinforced by the attitudes of officials, where centralization, authoritarianism and submissiveness within the bureaucracy are mirrored by condescension of even the lowest official towards clients, especially poor clients (Rondinelli et al., 1983, p.57). So it is easy to get caught in a vicious circle about participation; the old attitudes and perceptions should be challenged with new demands, but this
requires much persistence and effort—much time or even money needs to be spent. Yet none of these are easily available to the rural poor.

Whether it is possible to break this vicious circle depends on the wider context of politics and social structure. Where private agriculture dominates, there is little point in promoting cooperatives or communal farms. Where the poor confront locally powerful groups, in an unequal social structure, income-augmenting (and nutrition-improving) activities may be built up from below, around small groups whose members recognize each other as sharing a similar situation (Vyas et al., 1983), perhaps with outside funds (Dore and Mars, 1981). This may be especially useful in communities segmented along caste or ethnic lines. Other places have a tradition of community-wide organization in opposition to outside state or landlord interests; highland areas in the Andean countries of Latin America provide good examples (Muller, 1983). In either case, such activities may increase the overall resources available in a village, rather than leading to their redistribution. Mobilization of the poor in this sense does not harm the interests of other groups, certainly not in any immediate way. And there is ample experience to show that it is possible for very poor people to participate in, to help design, and to defend successfully, programmes in agriculture from which they are the main beneficiaries (Dandekar, 1983, on the Employment Guarantee Scheme; Howes, 1984, on hand-pumps for micro-irrigation; Wood, 1984, on non-farm assets to sell water from landless labour to farmers; Paul and Subramanian, 1983, for self-identification by the very poor—antyodaya—and a general review of Indian anti-poverty experience).
It is important for those working with vulnerable groups to identify and emphasize such situations as 'non-zero-sum', in the sense that the better-off need not lose when the very poor gain. If this is accepted by the better-off, they are less likely to oppose the measures leading to such a gain (de Kadt, 1965; 1985). Yet often the better-off nonetheless perceive any kind of organization of the poor as a threat, and they will use their influence and power to try and thwart such initiatives. They will mobilize even more when 'participation' does indeed pose a challenge to their interests (Bhaduri and Rahman, 1982). If locally powerful groups are able to call upon the state (the local police or judiciary) when the demands of excluded groups imply, for example, a reallocation of the time spent by agricultural extension officers, or of the credit facilities given by local agricultural banks, then 'pressure from below' is not likely to be successful. However, if the state is not over-influenced by the better-off, the outcome may be more helpful to vulnerable groups.

In most circumstances, efforts to 'empower' the poor are unlikely to succeed without outside support (Cohen and Uphoff, 1980). Moreover, community participation does not often arise spontaneously. Mostly it is 'sponsored', i.e., brought about by agents external to the community. Participation sponsored by government is likely to be less far-reaching (more a contribution of communities, less decision-making by communities) than participation sponsored by non-government organizations, although the action radius of the latter is often limited by the personal influence of 'charismatic' leaders (Jeffery, 1985). Nevertheless, there are examples of government-sponsored community involvement in health where grass roots organization and pressure have spread spontaneously, after an initial mobilization and 'conscientization' from above (Irvin and Corostiaga, 1985). So while participation is
not the panacea sometimes suggested by international organizations and assemblies, pressure from below is essential if governments and bureaucracies are to take notice of the evidence reviewed here on agriculture-health linkages, and of their implications for the well-being of those who are most vulnerable.
BIBLIOGRAPHY


CARLSON, B.A. The potential of national household survey programmes for monitoring and evaluating PHC in developing countries. World health statistics quarterly, 38(1), Special Issue on Health Surveys (1985).


COHEN, J.M. & UPHOFF, N.T. Participation's place in rural development: seeking clarity through specificity. World development, 8(3) (1980).


HARTMANS, E. Increasing the pace of development in sub-Saharan Africa: the role of IITA. *Ibadan, 1985*.


JUL, M. Unexpected benefits from a dairy project. Food and nutrition bulletin, 1, 3 (1979).


LIPTON, M. Post-harvest technology and the reduction of hunger. Institute of development studies bulletin, 13, 3 (1982).


TRISTAN, M. Estudios antropologicos de clasificacion funcional. Boletín informativo del sistema de información en nutrición, 6 (1980).


