SUSTAINABLE INTENSIFICATION OF AGRICULTURE IN ETHIOPIA

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Agricultural Economics Society of Ethiopia

The Agricultural Economics Society of Ethiopia (AESE) is a nonprofit making professional society established in 1995. Its objective is to contribute to the development of Ethiopian agriculture by promoting research in agricultural economics and by disseminating such research findings. In addition, the society provides the fora for the discussion of issues on agricultural development.

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The second conference of the Agricultural Economics Society of Ethiopia (AESE) was convened on 3–4 October 1996, under the theme *Sustainable Intensification of Agriculture*.

Agriculture is still the dominant sector in the Ethiopian economy accounting for about 45% of the GDP. It is estimated that about 85% of the population earn their livelihood from subsistence farming and livestock raising. Owing to environmental and socio-economic factors, the country has been suffering from chronic food shortages in recent years. The degradation of the agricultural resource-base, particularly the deforestation and soil erosion in the highlands, has reached alarming proportions at present. Thus, the focus of the second conference on agricultural development incorporated sustainability (long-term) and intensification (short-term) dimensions, which are found to be critical issues of major concern to the discipline and to the country’s policymakers.

The theme of the conference is related to the overall concept of ‘sustainable development’, an approach which has gained worldwide attention and concern because of the awareness of the accelerated deterioration of the environment and continued degradation of both renewable and non-renewable resource-bases. As an approach, the concept of sustainable agricultural development implies the integration of hierarchal systems (economic, socio-cultural and ecological) through time and space. Moreover, the concept involves a continuous process of change of systems and sub-systems with regard to time and spatial dimensions, particularly with reference to intra-generational and inter-generational equities.

The conference was organized to address specific questions, i.e., what is meant by sustainable intensification of agriculture? what are the main characteristics
of sustainable agriculture? what are the main problems facing intensification and what are the driving forces influencing sustainable intensification of agriculture? what are the necessary technological and institutional changes required to accompany the sustainable intensification process? However, the major issues addressed during the deliberations of the conference could be grouped into:

- Concepts and strategies and cases on sustainable intensification of agriculture;
- Economic and environmental impact of renewable and non-renewable resource use (land use, human capital, other agricultural inputs) on sustainable intensification of agriculture;
- Education, extension and development policy issues and strategies related to the intensification of agriculture.

With the strenuous efforts of the president of AESE and the Editorial Committee, the Society feel honored to publish the proceedings of this second conference in quite a short time. It is our hope that the contents of the Proceedings will be of benefit to members of the Society and to those who are actively engaged in the task of promoting agricultural development in the country.

Editors
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This work would not have reached this stage, had it not been for the sustained and highly creative endeavors of Wizo Assegedech Habte and Ato Metasebia Merid. The Society is most grateful for their contribution.

The Society would also like to thank the authors who worked with the editors through several drafts of the articles in order to produce what the editors feel is a coherent body of work.
I. INTRODUCTION

Sustainable intensification of agriculture implies a multi-dimensional world view—the complex relationship among society's socio-economic, environmental, socio-cultural and technological components. The interrelationships are further compounded with the consideration of their impact on the livelihood of the present as well as the future generations. The difficulties in discerning the concept of sustainability can be observed from the wide range of views reflected in the literature.

The objectives of development have undergone various transformations in the past. Since the Industrial Revolution up to the middle of the twentieth century the primary objective of development was focused on economic progress, i.e., rising aggregate consumption and/or output based on the concept of economic efficiency. The concern for development shifted to the satisfaction of human needs and aspirations with emphasis on social objectives of intra—generational distribution of income. At present, development objectives focusing on the protection of the environment have gained prominence. Thus, achieving the greatest improvement in living standards subject to constraints of sustainability is considered as an appropriate development objective.

Much of the interrelationships can be generalized if the three approaches, i.e., the economic, environmental, and socio-cultural, are
considered with focus on one of them without completely overlooking the other approaches (Munasinghe, 1993). Thus, in brief, the economic approach to sustainability is based on the concept of maximization of benefits that could be generated, while at least maintaining the stock of assets, in line with the neoclassical concepts of economic efficiency applied to the use of scarce resources.

The environmental/ecological approach focuses on the stability of the biological and physical systems, on the protection of the biological diversity of the ecosystem, and on the resiliency and dynamic ability of these systems to adapt to change. The socio-cultural approach to sustainability focuses mainly on the maintenance and stability of social and cultural systems with special emphasis on reducing the conflict arising within intra-generational distribution of income as well as inter-generational equity.

This paper attempts to clarify the concept of sustainable intensification of agriculture, while considering and dealing with the question: "what are the forces driving sustainable intensification of agriculture? what are the required technological and institutional changes that should accompany intensification of agriculture? what examples can be derived locally on sustainable intensification of agriculture? and finally what are the identified future research agenda for sustainable intensification of agriculture?"

II. WHAT IS SUSTAINABLE INTENSIFICATION OF AGRICULTURE?

Throughout human history, societies had organized themselves to adapt to the environment in which they live in. This long-term adaptation had led to the development of sustainable agricultural systems that have been
disturbed by stresses and shocks that occurred from time to time. The example of forest and bush fallow system in the tropical farming systems, the sustainable production of the East Asian wet rice that recycled human and animal waste, the grain and crop by-products to increase and maintain yield levels, and the system of integrated crop/animal husbandry in Western Europe in the Middle Ages can be cited as significant human efforts in the practical application of sustainable agriculture (Ruttan, 1994).

At present there is no agreed-upon operational definition of sustainable development, although a number of rules or policy issues of socio-economic, ecological and socio-cultural perspectives are considered essential if sustainable development is to be achieved. The most quoted definition of sustainable development is found in Brundtland Commission Report (WCED, 1987).

Sustainable development is a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development and institutional changes are all in harmony, and enhance both current and future potential to meet human needs and aspirations.

Implicit in this definition is the major objective of growth and development—the satisfaction of human needs and aspirations for long-term sustainability. Thus, sustainable development requires that society meets human needs (a) by increasing productivity potential and (b) by ensuring equitable opportunities for all at present without compromising the needs of the future generations. Thus, sustainability as a dynamic concept involves intertemporal trade-off with primary focus on improving the productive performance of a system without depleting the natural resource-base upon which the performance depends (Pandey and Handaker, 1995).
A number of working rules and policies are proposed that are considered essential for the achievement of sustainable development. The major ones include: (1) equity considerations, (2) resilience of the ecosystem, and (3) the notion of efficiency in the use of resources. Equity considerations arise with the proposition that a declining and degraded natural resource-base is more likely to result, if the interests and needs of the poorest section of poor societies are not satisfied. Resilience refers to changes in the physical ecosystem, i.e., the capacity of a system to maintain its structure and patterns of behavior in the face of external disturbance; in agriculture, it refers to the ability to maintain its productivity in the face of stress or shock. The third working rule implies that whatever the objective(s) of growth and development, sustainable development will require that efficient uses of existing natural resources are pursued and various allocation mechanisms such as prices, taxes and other fiscal control measures have to be used to achieve the objective of greatest value from a given input (Markandya, 1994).

In sustainable systems of agricultural production, a number of rhetorical ideas were considered in the 1980s to reflect the operationalization of sustainable agriculture. The more notable were: bio-dynamic agriculture, organic agriculture, farming systems, appropriate technology, and more recently, regenerative or low-input agriculture. In a recent article on *Constraints on the design of sustainable system of agricultural production*, Ruttan (1994) considers the Brundtland Commission definition on sustainable development as almost devoid of operational significance and presents the visualization of sustainability as an integrative concept that can facilitate the synthesis of the research and policy agenda of the environmental, agricultural, and development communities.
The different approaches mentioned above could be considered as subsystems in the overall framework of sustainable development. Consequently, four sustainability subsystems could be identified: ecological, socio-economic, community (socio-cultural), and institutional. The ecological sustainability subsystem involves the maintenance of individual stock of resources at levels that do not become detrimental to future progress as well as the maintenance and enhancement of the capacity and the quality of the ecosystem. The socio-economic sustainability subsystem, measured at both individual and aggregate levels across the resource systems, involves generating sustainable net benefits by blending economic criteria with social criteria for aggregate welfare. Community sustainability is focused on group level with a clear recognition of its participatory role in decision-making in all phases of planning and implementation. Institutional sustainability refers to the maintenance of the financial, administrative and organizational capabilities in the long run (Charles, 1994). The subsystems (components) are presented in Figure 1.

![Ecological Sustainability Diagram]

Source: Charles (1994)
Figure 1. Subsystems in the overall framework of sustainable development
II. A METHODOLOGY FOR SUSTAINABLE INTENSIFICATION OF AGRICULTURE

In the context defined and the terms used above, sustainable intensification implies the existence of areas of complementarity and trade-offs between the environment and growth. Figure 2 illustrates the relationship between the environment and growth, using some measure of standard of living index on the vertical axis (SOL) and an aggregate measure of environmental stock on the horizontal axis (Ko). The line CD shows the points of complementarity between the SOL and Ko as positive relationship. The line such as AB and A'B' indicate the trade-off between SOL and Ko. Lines such as EL and EM indicate paths of increased SOL with constant Ko or increased Ko with constant SOL respectively. The areas such as LEM (dashed) indicate the area of potential sustainable development (Young and Borton, 1992).

In the case of agricultural systems, the measure of livelihood security is indicated on the vertical axis and quality of the land resource-base on the horizontal axis. The livelihood security (LS) may be defined as availability of adequate stocks and flows of food and cash to meet basic needs through ownership or access to resources or income-earning activities. Land of various categories such as areas of significant potential for increased yield, areas at risk from existing agricultural practices, and areas destroyed or degraded by past practices are aggregated as the measures of the quality of the land resource-base (LRB).

Considering Figure 2 to be adapted to the agricultural systems, the area under LEM shows the potential area for sustainable intensification of agriculture.
Livelihood security may be achieved by various means among which the primary ones are securing ownership of land, livestock and trees; ensuring rights to grazing, fishing, hunting, and gathering; providing stable employment with adequate remuneration; and being engaged in various economic activities. The qualitative improvement of the potential land resources-base (LRB) is ascertained, and the sustainability subsequently enhanced, through the implementation of appropriate agricultural techniques such as intercropping, crop rotation, agroforestry, silviculture, green manure, conservation tillage, biological control, and integrated pest management (Young and Borton, 1992).

Factors and methods outlined above that influence both the LS and the LRB ensure that the agricultural systems operate in the LEM area over the long-term on a sustainable basis.
IV. FORCES DRIVING THE INTENSIFICATION OF AGRICULTURE

The primary objective for the agricultural sector in Ethiopia, as well as in many countries of sub-Saharan Africa (SSA), is to meet the ever-increasing demand for food and acquire food reserves through increased production over the past two decades, despite the adequacy of the potential agricultural resource-base, the sector has failed to meet the food requirements of the population in Ethiopia and in countries of SSA. The major causes for the decline in per capita food production are indicated to be the rising population growth rate of above 3%, widespread poverty, inappropriate allocation of property rights, and inappropriate prices and government policy. These factors are also considered as the major causes for unstable resources management in agriculture, which has a negative impact on increasing productivity.

Furthermore, intensification of agriculture implies both continuous rise in productivity at a given point in time and over time through efficient allocation of resources. Various allocative mechanisms, such as prices, taxes, and other fiscal controls, should be considered to achieve the intensification objective and to tackle the root causes of the problem. Intensification of agriculture, expressed by incremental yield and production to adequately meet the demand required, is driven by such forces as the capacity for generating science-based practices and techniques to users and farmers, training the farming community to increase the adaptive/absorptive capacity for the technology, devising and creating a conducive environment for community participation and decision-making in areas that affect their livelihood (Pearce, 1988).

The need for technological changes originate in the minds of men who are not satisfied with the status quo and who strive for better alternatives to existing situation. These changes maybe developed in an organized
setup or through informal structures that involve trial and error approaches.

The formal and informal approaches to the generation of technological changes are complementary to each other. Diagnostic surveys conducted in woredas of North Omo, Southern Administrative Region, indicated that development workers, nongovernmental organizations (NGOs), missionaries, local chiefs, farmers’ informal networks at markets served as the major sources of information for new technologies such as improved varieties of maize, fruit trees, vegetables, and farm implements. Farmers travelling to neighboring areas imported various species of enset, root crops, sweet potato, sugarcane, and livestock species (FARM AFRICA, 1993). On the other hand, the more formal science-based agro-ecosystem research is initiated with a primary aim of identifying systems that maintain or improve productivity without losing sustainability. Such systems include multiple cropping, crop/livestock polyculture, integrated pest control system, communal resource use, etc. (Young and Borton, 1992).

Thus technological changes, which are formally or informally initiated, that have high potential sustainability include: (a) intensification of cropping system through intercropping, relay or alley cropping, agroforestry, and green manuring; (b) silviculture and intensive livestock management; (c) conservation tillage; and (d) biological control and integrated pest management. In addition, further advances in technological changes of the agricultural systems require the transfer of large quantities of energy, minerals and chemicals (e.g. improved animal-drawn implements, two-wheel and four-wheel-powered tractors, stationary and mobile threshers and harvesters, inorganic fertilizers, herbicides and insecticides and other chemicals, veterinary drugs, and biological, etc.).
Institutional changes should accompany the intensification of agriculture with particular focus on access to resources, appropriate and innovative land reform schemes, human resources development, the introduction and adoption of new practices by the local community, and on sharing the benefits from the restoration of degraded lands. In addition, the management of residuals from the technological changes, produced and accumulated beyond the capacity of the environment to assimilate, requires special consideration. Thus it is imperative that orientation of the technological and institutional changes be harmonized along with the utilization of resources to foster a sustainable intensification of agriculture.

V. POLICY RECOMMENDATIONS AND FUTURE RESEARCH AGENDA FOR SUSTAINABLE INTENSIFICATION OF AGRICULTURE

The dominance of the public goods nature in the interaction between agricultural development and the environment calls for intensive government involvement. Government intervention is expected in setting up rules and procedures to direct and positively influence the technological and institutional changes required for sustainable intensification of agriculture.

The strategic areas for technological changes in which the public sector can play leading roles include: (1) reviving the process of growth; (2) changing the quality of economic growth; (3) devising systems that meet the basic needs for jobs, energy, water, and health infrastructures, etc.; and (4) reorienting the technological packages to the objectives of growth, while maintaining the resource-base and reducing associated risks. Institutional changes that specifically address the issues of population growth and of special groups such as women, youth; create advocate groups for incorporating environmental considerations in
econpic development at the grassroots levels; and promote the development of communication skills for conservation and the resource-base.

With further advances in the commercialization and market liberalization of the economy, institutionalizing the private sectors’ research capacity in certain areas to complement the public sector’ research and technology generation activities should be considered. Improving the performance of plant and animal species so as to facilitate the substitution of biological technologies with chemical technologies should be focused on as a strategic research agenda for further development in sustainable intensification of agriculture.

REFERENCES


I. INTRODUCTION

Ethiopian agriculture has been facing numerous agronomic problems including soil fertility losses, increased weed problems, widespread infestation of pests, accelerated erosion, recurrent and widespread drought periods. Population pressure has been singled out as one of the major factors that gave rise to these problems. It has remained a common belief, since Schultz (1964), that these problems could be overcome only through massive use of new technologies. This argument has grossly neglected the complementary roles that traditional inputs (such as organic materials, household labor, indigenous technical knowledge of the rural people, indigenous institutions, etc.) can play in raising agricultural output or in maintaining acceptable consumption levels per head.

One of the underlying problems of Ethiopian agriculture is whether it is possible, at least in the short term, to raise or maintain per capita
consumption with limited reliance on purchased inputs, under conditions of a rising man: land. In an attempt to address this issue, this paper reviews the outstanding literature on the relationships between population growth, intensification, and technical progress and provides some illustrations from Ethiopia. By doing so, this argument will be forwarded: a scope exists for maintaining or improving the sustainability of agriculture and per capita consumption levels of the rural people through increased intensification of agricultural production.

The relevance of existing literature to current concerns with agricultural sustainability in Ethiopia has been limited by the following factors: (1) the literature has been fragmented in the sense that cultivation system studies (e.g., Ruthenberg, 1971) are separately treated from demographic changes (Boserup, 1965) and from mechanization (Pingali et al., 1985; Pingali and Binswanger, 1987); (2) another response mechanism, i.e., institutional changes accompanying population growth, has been largely neglected in the literature; and (3) Ethiopian agriculture has virtually been neglected in the discussion of intensification, even though it has attained a high level of "traditional" technology quite a long ago.

The purpose of this paper is to show the dynamism of peasant agriculture with particular references to the following specific objectives: (1) to present a synthesis of the literature by bringing together the works of Boserup (1965), Ruthenberg (1971), Pingali et al. (1985), and Pingali and Binswanger (1987); (2) to incorporate institutional changes as another response mechanism to population pressure on land; and (3) to provide illustrations from Ethiopia, wherever possible.

The rest of this paper is organized as follows. Section II reviews Boserup’s theory of population growth, Sections III to V present the evolution of cultivation systems, intensification, and technical progress right from the time of the hunting and gathering societies (foraging
societies) to the permanent cultivation system of the type we find today in most parts of Ethiopian highlands. Section VI presents selected case studies of intensification of agriculture in parts of Ethiopia. The final section provides conclusions.

II. BOSERUP’S THEORY OF POPULATION GROWTH AND AGRICULTURAL DEVELOPMENT

An optimistic view of population growth was originally formulated by Boserup (1965), who among other things, contended that "in many cases the output from a given area of land responds far more generously to an additional input of labor than assumed by neo-Malthusian authors." Boserup, who ended by "standing Malthus on his heads", argues that although in the short run there may be diminishing return to agricultural labor, the aggregate agricultural production function will in the long run always shift upwards in response to population pressure, at a rate required to maintain output per capita. The shift variable is agricultural technology, as expressed by the system of land use, the method of cultivation and the choice of tools. Her optimistic view stresses that "most rural societies have an unrealized potential for further technological adaptation, if and when population pressure does begin to build up" (Robinson and Schutjer, 1984).

Current concern with sustainability of peasant agriculture has prompted a fresh look at Boserup’s model. In her later work, Boserup proposed that sustainable agriculture can be realized not in a single way (i.e., massive use of modern inputs) but rather in three different ways:

There are three different ways to deal with the problems of soil fertility, weeds, water control, and erosion: (1) fallowing, as in sparsely populated countries; (2) industrial inputs, as in high technology countries; and (3) labor-intensive practices, as in densely
According to Boserup (1981:24), chemical inputs may not be the only substitute for fallowing. Proliferation of weeds (which results from continuous cultivation of a given land area without fallowing) can be prevented or reduced by repeated weeding and plowing of the field. Soil fertility can be preserved by applying manure and night soil as well as vegetable matter, as can be substantiated by the case of some densely populated countries. For example, in China non-chemical fertilizers made a larger share (87%) of the total fertilizer consumption in 1965. Even in Japan, chemical fertilizers accounted for only 53% of the total fertilizer consumption in 1958 (Boserup, 1981:24).

As far as Ethiopian agriculture is concerned, fallowing remains an option only for certain regions in the southwest (e.g. the Metekel area), where the human to land ratio is quite small. The second option (use of chemical inputs) has been constrained, among other things, by high costs of inputs and of transportation as well as by myriads of other factors. Therefore, it is important to investigate whether the third approach, i.e., the use of labor-intensive practices could complement science-based technologies in the densely populated parts of Ethiopia.

It is this point that Spencer and Ousmane (1995) underlined at the 22nd International Conference of Agricultural Economists. Based on rather discouraging scenario for African countries, they laid out, among other things, two essential characteristics that crop production technologies must have, if they are to serve the needs of humid and subhumid tropics of Africa (HST):

- **Intensive production systems are needed.** Such systems, however, must also result in significant increases in seasonal labor productivity, since there is evidence that this is the principal scarce
factor of production in the HST, even though it will become less so as population densities increase. The systems must be profitable, given constrained resources of the small farmers, including the riskiness of the technologies.

- New technologies must rely minimally on purchased inputs that are heavily dependent on rural transport infrastructure. Cropping systems need to rely heavily on internal sources of inputs for soil fertility maintenance and enhancement, such as nitrogen-fixing and mycorrhiza associations, and crop residue use. Low doses of chemical fertilizers will be much more profitable under such conditions. Of course, where adequate rural transportation infrastructure is in place, technology based on a high level of purchased inputs can be used. However, there is considerable doubt that such a technology will pass the profitability considerations mentioned above, except in the case of high-value export crops. Furthermore, exploitation of such pockets of adequate infrastructure, the so-called 'high-potential zones', is not likely to yield the aggregate agricultural growth rates required, let alone satisfy income distribution, social welfare and poverty alleviation needs. [emphasis added].

Boserup (1965) did admit that intensification may not lead to economic growth in the generally accepted sense of this term, since the population pressure also results in a decline in output per man-hour (not necessarily per person). But she argued that sustained growth of total population and of total output in a given territory has secondary effects which, at least in some cases, can set off a genuine process of economic growth with rising output per man-hour, first in non-agricultural activities and later in agriculture. And such secondary effects come about through two different mechanisms. On the one hand, the intensification of agriculture may compel cultivators and agricultural
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laborers to work harder and more regularly. This can produce changes in work habits that help raise overall productivity. On the other hand, the increasing population density facilitates the division of labor and the spread of communications and education. However, Boserup (1965:118) noted that these linkage effects may not be realized if population densities are already exceedingly high.

Boserup’s thesis has been corroborated by subsequent studies, of which the works of Ruthenberg (1971), Pingali et al. (1985), and Pingali and Binswanger (1987) on agricultural mechanization and the evolution of farming systems in sub-Saharan Africa are the outstanding ones. Further support to Boserup (1965) has been provided by specific case studies by Clarke (1966), Gleave and White (1969), Basehart (1973), Brown and Podoleisky (1976), and Bilsborrow (1987).

Pingali and Binswanger (1987), in particular, showed how societies have been able to achieve agricultural growth resulting from farmer-generated innovations rather than science-based inputs, although it has been shown (Binswanger and Ruttan, 1978; Hayami and Ruttan, 1985) that farmers’ own methods of technology discovery and land investment have not been sufficient to accommodate modern rates of growth in demand in developed countries where land frontiers are exhausted.

Boserup considered only one type of response, i.e., intensification, the subject of this paper, to the increases in population pressure on agricultural land. However, in practice, people respond in different ways depending upon local circumstances and external situations. Accordingly, Bilsborrow (1987) has identified the following factors to explain multiple responses: (1) the existing standards of living; (2) the availability of untapped, potentially cultivable land; (3) the availability of off-farm employment opportunities; (4) the existing cropping structure and its capacity for change; (5) institutional factors (e.g.
existing land tenure system); and (6) the extent and effectiveness of state intervention. Market expansion is another important factor that determines patterns of response at a given time.

### III. FORAGING SOCIETIES

The review and discussion in this section helps to put the rest of the paper in perspective by providing insights into a system of food supplies where land resource is abundant and labor input is extremely low. This brief review draws heavily from Sahlins’ (1972) celebrated book. Sahlins (1972) rejects the stereotype that primitive societies toil the whole day round in search of food and that they are undernourished. He rather characterizes these societies as the "original affluent society". But the source of this "affluence" is not abundance of material wealth of the type we find in industrial societies. This is "affluence" that arises from limited wants relative to goods available; Sahlins says: "want not, lack not". In foraging societies goods are plentiful not in absolute terms but relative to limited wants of the hunter and the gatherer. "His wants are scarce and his means (in relation) plentiful". Sahlins (1972 directly opposed Tax (1953) by arguing that "unlimited wants" are bourgeois categories that are non-existent in societies who have direct access to resources and who use simple technologies to meet basic human needs. He noted that "economic man is a bourgeois construction". "Why are wants limited? Is it because restrictions are imposed on the wants of the individual by institutions?" Sahlins’ answer is clear: "it is not that hunters and gatherers have curbed their materialistic impulses; they never made an institution of them. It is only with the emergence of settled agriculture that society imposes restrictions on the choices of the individual through institutional factors such as cultural norms, taboos, etc. Hunters and gatherers could satisfy their material wants with little effort because resource is abundant relative to their wants. Surprisingly
enough, they worked few hours per week and enjoyed quite long hours of free time. "The average length of time per person per day put into the appropriation and preparation of food was four or five hours" (p.17). According to Sahlins, hunters and gatherers spend most of their leisure time in the form of long sleep: "The main alternative to work, changing off with it in a complementary way, was sleep" (p.19). He also observed that "If men lack leisure, it is then in the enlightenment sense rather than the literal" (p.35). Here is how Sahlins (1972) described work patterns in this type of society:

A good case be made that hunters and gatherers work less than we do; and, rather than a continuous travail the food quest is intermittent, leisure is abundant, and there is a greater amount of sleep in the day time per capita per year than in any other condition of society (Sahlins, 1972:14).

Although the characterization of foraging societies as "original affluent society" can be "an overstatement, it remains that, among many hunter-gatherers, subsistence work is intermittent, leisure time is abundant and nutritional status is excellent" (Cashdan, 1989: 22-23). Hunters and gatherers, even those living in seemingly harsh environments such as the Kalahari and Australian deserts, are able to live very well indeed by devoting only some 20 to 30 hours per week to the food quest. Subsistence work (hunting and gathering) among the adult population of the !Kung San (or Bushmen) was found to be 2.4 days per week, on the average.

IV. THE EVOLUTION OF CULTIVATION SYSTEMS

1 Shifting Cultivation System

Shifting cultivation also known as swidden, slash-and-burn (Carlstein 1982:328-30), has certain important characteristics that make it radically
different from higher forms of agricultural systems. First, "shifting cultivators are in the habit of regarding the soil as a free gift of nature not as a capital that has to be maintained" (Ruthenberg 1971: 45). That is, shifting cultivators make little effort to invest labor in soil conservation and are inclined to mine land until falling yields force them to look for virgin lands elsewhere. The abandoned land is allowed to regenerate its fertility during the long fallow period. This process is cost-free and effortless to the extent that human labor is not required. Owing to the low population density, the cultivator has a wide range of choices with respect to land quality and location. It is in this way that the cultivator makes the maximum use of land and saves his labor time. Mobility in time and space is a major characteristic of shifting cultivators.

Second, shifting cultivators of the rain forest have few domestic animals (Ruthenberg, 1971:36). In place of draft power, the stick is used for planting. The household’s nutritional requirements are supplemented not by livestock products but by food obtained from hunting and gathering. No animal manure is required to enrich the soil.

Third, labor (besides seeds) is practically the only input required for cultivation and almost no capital is used. The labor input per unit of land or per person (per year) is perhaps the lowest as compared to all farming systems. The only major labor-demanding activities are land clearing and harvesting. Weeding is not a problem since weeds are suppressed as the land is kept fallow for many years. In addition, the slash-and-burn system itself suppresses weeds. In this type of farming system women play more active roles in cultivation than men (Boserup 1970). They undertake both planting and harvesting activities while men take care of land clearing. One reason why women’s labor is sufficiently available for field work is that house work is simple and least demanding.
Fourth, productivity is likely very high resulting from the high quality of land cultivated. Ruthenberg (1971:40) observed that "The productivity of labor is by no means lower than in more intensive forms of traditional land use". Similarly, Carlstein (1982:147) noted that shifting cultivation is a "system with a greater food production and carrying capacity of land than either hunting-gathering or pastoral nomadism". But, gross underutilization of resources is evident in shifting cultivation. The shifting cultivator underutilizes not only labor but also land itself. Ruthenberg (1971) mentioned a case where area cultivated (with rice) per farmer averaged only 2.2 hectares where both land and labor were adequate enough to cultivate more. Perhaps this could be explained by such factors as limited wants (owing to limited demonstration effects or narrow markets or limited demand for cash income), low level of surplus appropriation, and low level of technology. The introduction of plow cultivation is hampered, according to Ruthenberg (1971: 45), by stumping problems, animal diseases (such as in Metekel area of Ethiopia), and by the lack of permanent housing. He further noted that "the lack of stationary housing and the long distances between fields create difficulties in storing food, collecting surplus produce, and division of labor between farming and non-agricultural pursuits."

In short, the defining characteristics of shifting cultivation can be summarized as follows (Pelzer, 1945):

- rotation of fields rather than crops,
- clearing the land by means of fires,
- absence of draft animals and of manuring,
- use of human labor only,
- employment of the digging-stick or hoe, and
- shorter period of soil occupancy, and changing of residence and field with long fallow periods.
Shifting cultivation, a system in which "productivity per person-hour and day is generally high" (Carlstein, 1982:148), becomes increasingly inefficient and superfluous as land becomes scarce and less productive as a result of growing population pressure (Boserup, 1965). Market expansion is also another factor that tends to induce cultivators to replace shifting cultivation by higher forms of agricultural systems (Ruthenberg, 1971; Pingali and Binswanger, 1987). Moreover, institutional changes (e.g. the need to pay taxes in cash) may induce a transition from shifting cultivation systems to higher forms.

The transition from shifting cultivation to a higher form, according to Boserup (1965), is characterized by a process of increased intensification involving the shortening of the fallow period, changes in methods of cultivation and improvements in farm tools. However, this transition can be complicated and Boserup’s thesis need qualifications (Grigg, 1976; Carlstein, 1982:328-30).

Moreover, it can be proposed that intensification is accompanied also by institutional changes unheard of in foraging societies and in shifting cultivation. Some of the reasons why institutional changes are required are the need: (1) to regulate the use of scarce resources and to define common property rights; (2) to determine the mode of utilization of the economic surplus; (3) to reconcile collective action with individual choice; and (4) to suppress the growing wants of individuals to align demand with the productive capacity of the economy.

Some of the major institutional changes are: (1) increased complexity of indigenous technical knowledge; (2) reduced spatial mobility of people and growing importance of permanent houses (3) increased complexity in housework, causing increased demand for women’s labor, (4) increased social stratification and increased subordination of the peasantry to the social hierarchy; (5) growing importance of state machinery (centralized political authority); and (6) increased relative poverty.
The last point deserves some explanation. Intensification makes possible increases in surplus generated per person and creates conditions for the appropriation and use of this surplus on permanent basis. The emergence and growth of permanent economic surplus makes possible division of labor, social differentiation, and growth of relative poverty. According to Sahlins (1972: 37):

The evolution of economy has known, then, two contradictory movements: enriching but at the same time impoverishing, appropriating in relation to nature but expropriating in relation to man. The progressive aspect is, of course, technological.

For Sahlins, growth of civilization or culture is at the center of the paradox of poverty in the midst of abundance. He underlined that "the amount of hunger increases relatively and absolutely with the evolution of culture". With civilization, some people lose direct access and, eventually, direct entitlement to food. Poverty is thus a relation between people, i.e., property relations, and not as such relation between men and things:

The World’s most primitive people have few possessions, but they are not poor. Poverty is not a certain small amount of goods, nor is it just a relation between means and ends; above all, it is a relation between people. Poverty is a social status. As such it is the invention of civilization. It has grown with civilization, at once as an invidious distinction between classes and more importantly as a tributary relation that can render agrarian peasants more susceptible to natural catastrophes than any winter camp of Alaskan Eskimo (emphasis original).

2. SEMI-PERMANENT CULTIVATION

Shifting cultivation evolves into the next higher stage, semi-permanent cultivation, in response to growing population pressure and market expansion (Boserup, 1965: Ruthenberg, 1971). This evolution is
evidenced by successive shortening of the fallow period and growing cropping index, as noted by Ruthenberg (1971: 37):

Expanding cash production (market) and the growing subsistence needs of an increasing population led to a gradual extension of arable farming at the expense of the fallow and short-fallow systems replaces long fallow systems.

The intensity ratio \( (R) \), as indicated by the number of years of cultivation multiplied by 100 and divided by the length of the cycle of land utilization, increases from about 5 to 25% in shifting cultivation to about 30 to 70% in semi-permanent cultivation. Suppose six years of fallow succeeded four years of cultivation, then \( R \) will be 40%.

Under the semi-permanent cultivation, cropping index (area cultivated as a percent of total holding) increases. Ruthenberg gave cropping index for seven different case studies and noted that the indexes for four of the cases were below 100 (ranged between 33% and 76%) and for the rest they were above 100 (107% in two of the cases and 137% in one case), suggesting multiple cropping practices in the last cases.

Under the semi-permanent cultivation the labor demand-supply conditions significantly change and labor is organized in a markedly different way from that in shifting cultivation. Supply of male labor increases as hunting becomes less important than in the past as a result of increased depletion of the games. Similarly, supply of female labor increases as gathering of roots and tubers becomes less important owing to the same reason as above. However, for several reasons increases in demand for labor overwhelmingly outweighs increases in supply. First, area cultivated per household increases under semi-permanent cultivation; second, weeding becomes increasingly problematic as land is repeatedly cultivated; third, additional labor is required to look after animals and to process animal products; fourth, housework tends to be
more complex and more labor-intensive; fifth, social and cultural obligations become more complex and more time-intensive; sixth, the emerging chiefdom or the state impose tribute on the cultivator in the form of labor service (corvee). But, perhaps, the primary factor underlying excess demand for the peasant labor is the need for intensification of labor—primarily in field work and, secondarily, in housework.

The increased demand for field work is met in different ways including: (1) working more hours per day; (2) mobilizing auxiliary family labor, such as child labor, which is used mainly for light work, such as herding of animals; (3) increasing the work efficiency of farming tools through quality improvements and diversification; (4) adopting plow cultivation, where possible; (5) resorting to work party or labor exchange arrangements to deal with seasonal bottlenecks; (6) using slave labor when war captives or other outsiders are available for this type of work; and (7) using migrant labor.

These hypotheses are largely supported or implied by other works on intensification in peasant agriculture (Boserup, 1965; Ruthenberg 1971; Carlstein, 1982; Wilkinson, 1973; Elliot, 1969). "Intensification", a term often confusingly used (Carlstein, 1982:348-49), means land-saving or yield-increasing (or maintaining) technique of production through increased labor input per unit of land. This definition excludes the application of modern land-augmenting technologies (e.g. chemical fertilizers), but includes all traditional techniques including increased uses of manures, intercropping, multiple cropping, diversification of crop varieties, increased labor input per animal, improved soil conservation techniques, etc.

Ruthenberg observed that semi-permanent peasants "usually cultivate a larger area than shifting cultivators in the same environment" and
concluded that "most semi-permanent farmers practice hoe cultivation", a technology advanced as compared to digging sticks, mostly used by shifting cultivators. The area cultivated in Africa ranged from 2 to 8 ha per household. Under semi-permanent cultivation, the working hours are long; this is because of agronomic reasons and market expansion:

It is almost always the case that people work for more hours each day, firstly because semi-permanent cultivation system is, more often than not, more time-demanding per unit of output than shifting cultivation, and secondly because cash cropping requires additional working time (Ruthenberg, 1971: 69).

Many theoreticians on cultural evolution and intensification agree with Ruthenberg concerning the hypothesis that the workload of farmers tends to increase as society moves from hunting-gathering (foraging) forms of technology to shifting cultivation and on towards to more intensive forms of agriculture (Boserup, 1965, Sahlins, 1971; Harris, 1977; Wilkinson 1973; Carlstein, 1982). Here is, for example, how Boserup (1965) describes this process:

When the growth of population in a given area of pre-industrial subsistence farming results in lower average output per man-hour in agriculture the reaction to be expected would be an increase of the average number of hours worked per year (and per person) so as to offset the decline in returns per man-hour.

Ruthenberg also suggested that important institutional changes take place as a shifting cultivation system evolves into semi-permanent cultivation. One such important development is the permanency of the house which follows reduced mobility. A related institutional development is the emergence of private holding and clearly defined fields (except communal holdings). In the words of Ruthenberg (1971: 55):

Semi-permanent farming is usually characterized by clearly defined holdings with largely permanent field divisions. Quasi-stationary
housing predominates, since the changing of hut sites is a matter of moving short distances only.

It is because of the predominance of quasi-stationary housing that Ruthenberg uses the term "semi-permanent" to describe a system that combines permanent settlement with periodic movement of the house a few hundred meters.

The institution of private holding and permanent housing are closely linked and they tend to emerge concurrently. The emergence of permanent housing has very important implications for economic and social development of a society. Permanent residence makes increased investment in land possible (e.g. planting tree crops and manuring) and at the same time contributes to overexploitation of natural resources in defined geographic areas. It also facilitates tribute and tax collection as well as political control by the state. No doubt, in Ethiopia, people in the nomadic areas have remained among the least subjugated ones. Also, permanent residence contributes to the accumulation of wealth and social differentiation, imposes more pressure on women’s time (as food preparation, food storing and household maintenance activities become more complex), and raises household demand for consumer goods.

The permanency of residence has remained a neglected aspect of agricultural development and deserves some discussion. Sahlins (1972:11), referring to the antithesis of permanent dwelling (i.e., constant mobility in foraging societies), remarked that: "of the hunter it is truly said that his wealth is a burden". He added that "mobility and property are in contradiction". That is why in nomadic societies simple, portable goods are preferred to complex ones. It is not surprising that people in some of the nomadic areas of Ethiopia pull down their shelter within a short time, load it on a camel and carry with them over a long distance.
Intensification is also accompanied by growth in indigenous technical knowledge of the rural people, a situation that has almost entirely been neglected by researchers. This is an extremely important area that requires an in-depth research (see Moock and Rhoades, 1992). Improvement in the human capital may compensate for the decline in land quality and for consequent decline in yields. Given the fact that agricultural activities involve human interference with a biological process (Dejene, 1995), it is vital for the farmer to identify the optimal time for farm operations, select the most suitable soil for different crops, conserve soil as demanded by the physical environment and by cropping patterns, select and propagate the best of the local seed varieties and of animal breeds, determine optimal product mix, and protect the environment.

Indigenous technical knowledge of the rural people is not only a national resource that has tremendous potentials for increasing the productivity of land and labor, but also contributes to productivity gaps among farmers, as implicitly suggested by Ruthenberg (1971:73):

Wide fluctuations in the input of work per hectare and returns per hour of work within the range of production possibility, particularly within the range of cash cropping, is one of the major factors differentiating progressive producers from others. The explanation is an obvious one: semi-permanent cultivator differ widely, much more than shifting cultivators, as to their physical effort, their drive, and their knowledge.

In Ethiopia semi-permanent cultivation system is widespread in relatively land-abundant regions such as the southwest. However, this system has been rapidly evolving into permanent cultivation because of several reasons. The growth of cash crop production in the south-west area since the 1950s has created a tendency towards permanency of residences. As noted by Ruthenberg (1971:197), "perennial crops give rise to stationary living and investment in permanent improvements like
houses", and the like. In particular, growing coffee as a garden crop renders movement of the homestead impractical and inefficient.

### 3. Permanent Cultivation System

Permanent cultivation system is normally characterized by: (1) a permanent division between arable land and grassland, which is seldom or never cultivated; (2) clearly demarcated fields; and (3) the predominance of annual and bi-annual crops (Ruthenberg, 1971:99). The fallow period is so short that the value of $R$ often exceeds 70.

Ruthenberg, who restricted his seminal work to tropical areas, dismissed permanent cultivation system as an unimportant system in Africa. In fact, it seems that he has equated this system with a "siege method"; a method which came into existence because tribes were surrounded by hostile neighbors that prevented extension of farming into fallow areas (Ruthenberg, 1971:115). If this were the case, the people of Gojam of northwest Ethiopia would have been practicing permanent cultivation system for centuries because they were besieged by the Gumuz people!

According to Ruthenberg (1971:100), permanent cultivation system emerges when the following conditions are met:

1. The population density is very high and irrigation farming is either not possible or has not yet been adopted. There are numerous areas where a Malthusian process of impoverishment has compelled intensification. (2) The soils allow permanent rain-fed cropping without a drastic decline in yields. Cases of this kind are usually found where the climate has an extended dry period, during which leaching is not taking place. (3) An intensive fertilizer economy is practiced.

Ethiopia, with its highland climate, dense population, extended dry period, and with its rain-fed husbandry but well-developed soil
conservation techniques perfectly meets the conditions required for a successful emergence of permanent cultivation system long before many sub-Saharan African countries. Ruthenberg, based on his rudimentary knowledge of Ethiopian agriculture, noted that "In parts of Ethiopia, ley systems have been replaced by permanent cropping with wheat, tef, millet, and numerous other crops" (p.100). None of his numerous case studies came from Ethiopia. He mentioned Ethiopian agriculture only in passing; e.g." Konso and Tigre" were mentioned as areas practicing some sort of permanent cultivation. In his study, he cited Ethiopia only 10 times as compared to Kenya (38 times) and Tanzania (36 times). It is not clear why he neglected an ancient plow-based cultivation system unparalleled elsewhere in sub-Saharan Africa.

Ruthenberg further explains the main features of a permanent cultivation system in the following way. Spatial organization of cropping radically changes under permanent cultivation. The cultivator can no longer select a plot that is suited to the particular crop; instead, he must decide which crop will grow best on a given plot. This has very important implications for decision-making and for the development of traditional wisdom or indigenous technical knowledge of the rural people. The farmer's degree of freedom or range of choices are reduced in terms of plot choices. The alternative options available are to improve land quality, determine optimum crop-mix, and select the best seeds among from local varieties. Obviously, this type of farming strategy requires, among other things, knowledge of the physical environment and of the attributes of different crops. Also, permanent cropping practices require permanent housing and settlement patterns, unlike shifting cultivation or semi-permanent cultivation systems.

Labor input per hectare is higher than any other of the preceding systems. This is because, with permanent cultivation system, the farmer is left with only one major variable input (i.e., labor) required to
produce food for the family. All of the land-augmenting techniques he (she) employs, whether it is manuring or terracing or seedbed preparation, require increased labor input per person or per farm household. Exceedingly, high labor input per hectare is required to enrich the soil with organic materials:

A general feature of traditional forms of intensive fertilization is the high labor input; this is the case both in the preparation of compost and in collection of animal manure, and lies especially in the difficulties of transport that are part and parcel of most forms of organic farming [Ruthenberg 1971:109].

The transportation of manure to fields becomes difficult because cowdung, which is collected within a permanent homestead, has to be transported to the field. Farmers attempt to overcome this problem by making use of work parties or labor exchange arrangements (such as the debo and wenfel in Ethiopia). Manure is often heavily applied where it is produced, i.e., fields near the house get most of the manure. The saying goes: "those fields are most fertile which can hear the cock crowing." Backyard farms or home gardens, in particular, become highly productive as they get adequate manure and household refuse on regular bases. It is from such types of plots that sample farmers in a village in North Shewa produced 27% of the total crop production in one crop year (Dejene 1993).

The size of herds is drastically reduced owing to shortages of grazing land. Hoarding of animals is no more a status symbol. The type and number of animals kept is determined essentially on utilitarian basis. Draft oxen and cows constitute the most essential animals to be kept and reared. But overgrazing becomes a chronic problem as the density of livestock population rises over time. Does not this description hermetically fit the Ethiopian case?
On the other hand, animal husbandry and crop cultivation simultaneously develop and complement each other. The highly developed mixed farming system of highland Ethiopia provides a good example of interdependence between the two subsectors—livestock production and crop cultivation. But this interdependence also implies crisis in the household economy because shortage of an input from one subsector may mean output decline in the other. This is evident in the case of complementary inputs such as draft oxen and human labor. Ruthenberg (1971: 114) noted that, "Lack of draught power is one important reason for late and inefficient cultivation of fields."

Yields per hectare rise above any other rainfed systems as a result of time and knowledge-intensive techniques of production. But output per hour of work or per time declines as discussed earlier. Ruthenberg (1971: 117) commented that:

The African peasants.... are apparently quite aware of the fact that under their system of permanent cultivation they produce yields that are higher per hectare than those obtained in more extensive systems, but are lower per man-hour.

Table 1 shows that increased population density is closely associated with successive decline in the fallow period, increases in farming intensity, and with improvement in farm tools. Most part of highland Ethiopia fit into the last row of the table. A study undertaken in two woredas (i.e. Shashamene and Dale) in southern Ethiopia generated the following results: cropping intensity for Shashamene was 126% and 114% for Dale, fallow land was only 3 and 2%, respectively (Yibeltal, 1995).
Table 1. Population Densities, Cultivation Systems, and Intensification

<table>
<thead>
<tr>
<th>Population Density</th>
<th>Type of Cultivation</th>
<th>Fallow Period*</th>
<th>Farming Intensity (R-value)**</th>
<th>Tools used</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Foraging</td>
<td></td>
<td>0</td>
<td>Rudimentary hunting and gathering tools</td>
</tr>
<tr>
<td>0-4</td>
<td>Shifting</td>
<td>Forest fallow</td>
<td>0-10</td>
<td>Axe, matchet, and digging stick</td>
</tr>
<tr>
<td>4-64</td>
<td>Semi-permanent</td>
<td>Bush fallow</td>
<td>10-40</td>
<td>Axe, matchet, digging stick, and hoe</td>
</tr>
<tr>
<td>16-64</td>
<td>Permanent</td>
<td>Short fallow</td>
<td>40-80</td>
<td>Hoes and animal traction</td>
</tr>
<tr>
<td>64-256</td>
<td>Permanent</td>
<td>Annual and multiple cropping</td>
<td>80-120</td>
<td>Animal traction and tractors</td>
</tr>
</tbody>
</table>

Source: Adopted from Pingali andBinswanger (1987:29)

Notes: The food supply systems are not mutually exclusion. It is quite possible for two or more of the systems to exist concurrently. The population density figures are only approximations; the exact figures depend on location-specific soil fertility and agroclimatic conditions.

* Fallow periods are described as follows: (1) Forest fallow: one or two crops followed by 15-20 years of fallow; (2) Bush fallow: 2 or more crops followed by 8-10 years of fallow; (3) short fallow: 2 or more crops followed by 1 or 2 years of fallow; (4) annual cropping: one crop each year; (5) multiple cropping: two or more crops in the same field each year.

** R equals number of years of cultivation times 100 divided by number of years cultivation plus number of years of fallow.

V. INTENSIFICATION AND PLOW CULTIVATION

The switch from one set of tools to the next occurs when the resulting labor-saving benefits exceed costs of switching to new tools. And, the transition from digging sticks and hand-hoes to the plow is closely correlated with the intensity of farming. A switch to the plow during grass fallow results in a substantial reduction in the amount of labor input required for land preparation. However, the net benefits of switching from the hoe to the plow are conditional on soil types and topography. The overhead labor costs in the transition from hand to animal power include the cost of training the animals, the cost of
destumping and leveling the fields, and the cost of feeding and maintaining the animals on a year-round basis (Pingali and Binswanger, 1987). In addition, grazing land should be set aside for the animals and a certain number of cows and off-springs should be maintained to replace old oxen.

Plow cultivation is indispensable in Ethiopia mainly because of the short wet season. The necessary and sufficient conditions for the emergence and permanency of plow cultivation in rain-fed agriculture includes: growing population pressure over land, predominance of cereals (as opposed to tree crops and roots or tubers, which do not require plow cultivation), a reasonable size of holding, suitable terrain, availability of draft oxen and complementary technology, reduced problems of destumping, enough grazing land, limited threat posed by fatal animal diseases, and considerable shortage of labor required for land preparation, planting and weeding. A higher degree of intensification, in particular, is an important necessary condition for the emergence of a plow cultivation system.

In Ethiopia, plow cultivation has not only remained ubiquitous, but also has ancient origins. Moreover, Ethiopia at least until recent times, remained the only country in sub-Saharan Africa where plow cultivation is used on a large scale.

A lack or inadequacy of one or more of the preconditions given above may retard the adoption of plow cultivation or may even cause a retrogression from plow cultivation to inferior techniques as can be illustrated with reference from the Ethiopian experience. The Konso people heavily rely on the hoe to cultivate their extremely rugged and mountainous terrain. The Gumuz of Metekel still practice shifting cultivation using digging sticks and the hoe, although the neighboring highland farmers use the plow extensively. They are unable to make use
of the already available technology owing to the prevalence of fatal animal disease in the area.

The two major farm-level benefits of the transition to the animal-drawn plow are: area expansion and income growth. Plow cultivation makes possible increases in area cultivated per person or per household through improvements in the productive capacity of human labor power. According to Pingali and Binswanger (1987:47), "a switch from hand cultivation to animal traction increases yield per man-hour by 78%.

In some parts of Ethiopia, however, the size of holding has dwindled to the point where it has become almost inefficient to use the plow. In the areas where land is available (e.g. the southwest) most farmers are unable to attain the optimum size of farm, mainly, because of shortage of draft oxen. In the lowlands, where there is a huge concentration of cattle, the need for the adoption of plow cultivation has not been felt; here people practice nomadic or semi-nomadic pastoralism. One issue in Ethiopia is, therefore, how to align pattern of spatial distribution of resources with demand patterns for these resources in different regions. For example the Development Bank of Ethiopia launched an oxen-credit loan scheme in the 1980s to induce the flows of oxen from oxen-surplus areas to deficit areas through market purchases. But, its results have remained largely unsatisfactory.

Plow cultivation in Ethiopia has expanded and has been sustained over a long period, mainly at the expense of the fallow period, the reduction of which meant mining of the land under cultivation. The system has also expanded at the expense of grazing land be it at the initial stage, when pastoralist switched to cultivation (e.g. as in Arsi), or at a later stage when the basis of mixed farming system is threatened because of shortage of animal feeds.
Plow cultivation tends to increase available income per household, in spite of the possible decline in income per hour of work. In addition, plow cultivation tends to accentuate income concentration in the hands of some people and contributes to the process of social stratification. Perhaps, it was partly because of this reason that pre-1974 Ethiopia attained a highly intricate social hierarchy and pronounced concentration of wealth in the hands of the few.

With the emergence of plow cultivation, a section of society tends to lose direct access to productive resources in several ways. In the first place, the early adopters of this technology are the already better-off farmers—those having larger holding and larger household size (more labor power) as well as larger herd size than the others. Second, draft power is generated by a reproducible asset (or capital) and not directly by nature. Capital is accessible normally to some people while nature (land under extensive cultivation of the type found in shifting cultivation) is accessible to all, irrespective of their productive capacity or social position. Third, given scarcity of land, area cultivated by a household could be expanded partly at the expense of another household.

What are the sources of growth in income per household? Area expansion is, perhaps, the major way for raising output per household under plow cultivation system. The second way is, at least theoretically, through yield increases resulting from the following possibilities: (1) timely cultivation of fields; (2) increased weed control through deep plowing and through increases in the frequency of plowing a plot of land; (3) the cultivation of deep soils (that have a high clay content and greater capacity to hold water and nutrients) resulting from the use of the plow and from increased labor supply; and (4) skill development (indigenous technical knowledge) resulting from division of labor and specialization, as plowing falls with the domain of males only. These
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Factors strongly suggest yield increases under plow cultivation, although some authors argue that there is no difference in yields between the hand-hoe and animal traction (see Pingali and Binswanger 1987). However, Sandford (1988), a close observant of the animal traction technology in Ethiopia, lucidly argues that draft power should lead to higher yields of crops per unit of area cultivated:

An increased use of animal traction can affect the extent of the area cultivated, balances in the cropping pattern, and crop yields. There are good theoretical reasons why animal traction should lead to higher yields of crops per unit area than occurs with hand cultivation technology. There are technical possibilities for increased yield through better moisture infiltration and less soil erosion as a consequence of ridging, banding, mulching and more timely, more thorough, and generally better tillage. These in turn lead to more timely planting, lower soil bulk density, incorporation of organic matter, weed control, and better pre and post-harvest moisture conservation. In short, even in the absence of a greatly increased supply of outside inputs such as fertilizers, we know enough to be able to quickly increase yields through improved management practices such as those listed above.

A large-scale adoption of plow cultivation system brings about radical transformation of the rural economy and society in several ways. First, labor is reorganized so as to meet the needs of plow cultivation. The gender division of labor radically changes as plowing becomes, at least as the Ethiopian experience suggests, the exclusive domain of males. Women tend to be preoccupied with housework as home production (Z-goods production according to the New Home Economics) becomes more complex and more time-intensive. Planting labor is used in fixed proportion with capital (always one man combined with a pair of oxen), suggesting strict complementarity between draft power and human power. Additional labor is often required to assist the tiller with sowing seeds, removing stumps, hoeing areas not reached by the plow, etc.
Second, plow cultivation establishes lasting and viable links between the two major sub-sectors of the agricultural industry: livestock production and crop cultivation. These two sectors depend on each other, among other things, through the input-output relations (e.g. as when cowdung is used as manure and crop residue as animal feed).

Third, cropping patterns tend to change following the introduction of plow cultivation. Cereals become increasingly important as possibilities are created to cultivate more land per head as compared to hoe-based cultivation. In Ethiopia both cereal production and plow cultivation flourished concurrently. For example at the turn of the century tef and plow culture were adopted simultaneously by the southern people of Ethiopia.

Fourth, plow cultivation technology is, perhaps, almost always associated with changes in food consumption habits. The development of culture, which follows the introduction of plow cultivation, demands improvement in food preparation and cooking technologies (i.e. Z-goods production technology) and sophistication in types and quality of food and drinks consumed by the household.

Fifth, social division of labor tends to expand following large-scale adoption of plow cultivation techniques. The handicraft sector, in particular, expands as the demand for farm tools (e.g. the plow-share, the yoke) increases. Markets grow in importance as output per household increases.

Sixth, important institutional changes take place following the introduction of plow cultivation. For example, tributes will tend to be paid in cereals rather than in labor as witnessed in southern Ethiopia during the last decades of the gabbar system (Guluma, 1995). Asset exchange arrangements, such as the mekenajo system in Ethiopia, will evolve to address problems faced by farmers who lack draft power.
VI. CASE STUDIES FROM ETHIOPIA

The following village-level studies provide further illustration of intensification of agriculture in some of the densely populated parts of Ethiopia, especially the southern part. Further details are provided in Dejene (1996).

CASE 1: The Village of Aze-Debo’a (Kambata)

The village of Aze Debo’a (Kambata) has a population of 300 persons per km², which is more than eight times the national average. According to peasant association (PA) leaders, about 230 households (27 % of the total number of households in the village) are landless. Other sources reported that a much smaller number of households are absolutely landless. The female to male ratio in this village is very high (1.6:1) because of a high rate of out-migration of adult males. This village adopted land-saving crops such as enset, coffee, and sweet potatoes in the 1920s. Today there are indications that permanent crops are increasingly replacing cereals. Cereals accounted for only 56% of the total land under crops as compared to 71% at the national level. Of cereals, it is only tef that gained prominence (24% of the area), while crops such as sorghum, maize and barley lost importance. On the other hand, permanent or perennial crops (of which enset alone accounted for 82%) were grown on 36% of the total area under crops as compared to 8.6% at the national level. Pulses and oil seeds, and vegetables were grown on 4 and 5% of the total area respectively (Data et al., 1995).

CASE 2: The Village of Adele-Keke (Harerge)

Farmers in the village of Adele-Keke (Harerge) have increasingly switched to the cultivation of chat, an extremely high value crop, and to the cultural practice of intercropping in order to save land. Today,
chat covers as much as 75% of the cropped land in Adele-Keke and farmers have predicted that, within five years, the village will practice monoculture because net returns from chat are five times higher than that obtained from food grains. Farmers have successfully resisted the past government’s policies that have attempted to discourage the production of chat on the ground that it causes health hazards and contributes to the expansion of cross-border trade. Chat is intercropped with maize, sugarbeets, fieldpeas, etc. In Adele-keke, as much as 90% of the cropped land is inter-cropped (Mulugeta and Menelik, 1995).

CASE 3: The Village of Gersale in the Konso Area

The Konso area of southern Ethiopia is well known for highly sophisticated "traditional" techniques of soil conservation, water control, and crop husbandry. Table 2 illustrates the following points: (1) the practice of crop diversification and variety selection; (2) possibilities of dynamism of pre-industrial agriculture (i.e., successive adoption of new varieties); (3) the importance of farmer-based technologies and farmer-to-farmer dissemination techniques; (4) the importance of other informal channels of technology dissemination (e.g. traders); and (5) farmers attempt to maintain a certain level of nutritional standard through careful choices of crop varieties.

CASE 4. The Village of Dache-Gofara in Boloso-Sorie Wereda, North Omo

This case study, which draws from Simon (1993a) illustrates the evolution of cropping patterns in the once sparsely populated village but food secure village of the enset-growing areas of the south.

The first settlers of the area raised livestock as a major occupation. In the earlier days, grazing land used to be abundant and was covered with
**Table 2:** Diffusion of crop varieties in a village in the Konso Woreda of Southern Ethiopia (based on interview with farmers)

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Seed color</th>
<th>Time of introduction</th>
<th>Place of origin</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum</td>
<td>White</td>
<td>10 years ago</td>
<td>From the direction of Hamer through trade</td>
<td>*</td>
</tr>
<tr>
<td>Sorghum</td>
<td>White</td>
<td>10 years ago</td>
<td>Through Hamer by trade route</td>
<td>*</td>
</tr>
<tr>
<td>Sorghum</td>
<td>White</td>
<td>recent</td>
<td>From Jarso through trade route</td>
<td>*</td>
</tr>
<tr>
<td>Sorghum</td>
<td>White</td>
<td>Recent (20 years)</td>
<td>From Bekawle, Hamer and Omo through trade route</td>
<td>*</td>
</tr>
<tr>
<td>Maize</td>
<td>Red</td>
<td>During Menelik’s invasion (100 years)</td>
<td>From Amhara land (central Ethiopia)</td>
<td>**</td>
</tr>
<tr>
<td>Maize</td>
<td>White</td>
<td>Recent (4 years)</td>
<td>Introduced through markets</td>
<td>**</td>
</tr>
<tr>
<td>Pigeon pea</td>
<td>Yellow</td>
<td>about 100 years</td>
<td>Introduced by white men</td>
<td>Food (nefro)</td>
</tr>
<tr>
<td>Haricot beans</td>
<td>White</td>
<td>about 50 years</td>
<td>From the direction of Gamo Gofa, through traders</td>
<td>Food (nefro)</td>
</tr>
<tr>
<td>Cotton</td>
<td>Black or White</td>
<td>100 years</td>
<td>Came from the direction of Zeisi and Welem through markets</td>
<td>Used for making clothes, also sold for cash</td>
</tr>
<tr>
<td>Sunflower</td>
<td>Black</td>
<td>100 years</td>
<td>From Amhara land, with Amhara invaders</td>
<td>Roasted &amp; eaten, ground &amp; drunk as coffee</td>
</tr>
<tr>
<td>Cassava</td>
<td>(new)</td>
<td>Recently introduce</td>
<td>Cooked &amp; eaten</td>
<td></td>
</tr>
</tbody>
</table>

Source: Simon (1993)

*Used for food (*kukurta*, *nefro*), *chaka*, marketed stalk, used as cattle feed, and used for making tied ridges.

**Used as food, stalks sold and used as animal feed, also used for making tied ridges.
"nutritive grass" species. Open grazing system was widely practice and there was no need to control the free movement of animals. It was only with the decline in the carrying capacity of the land that animal mobility was restricted as it happened to the geographical mobility of human residence (i.e. shifting cultivation). In the earlier days, herd size was large and the animals themselves were big in size and were highly productive. There were "physically strong bulls and high milk-producing cows with large udders." Draft oxen were engaged "for day-long traction without fatigue." Land cultivated per household "was small in size but produced high yields." In those days, the cropping pattern was dominated by cereals (maize, sorghum, barley and local tef varieties) and by *enset* and *taro*. Enset plants were said to be "robust and were sufficient for human and livestock feed." A large area of the land was covered with natural vegetation and eucalyptus trees were unknown. Human settlement was scattered over wide areas and holding per household was large. However, today all these have changed significantly. Some of the major reasons behind these changes are: (1) increased population growth resulting from natural growth and immigration; (2) increased prevalence of animal, human, and plant diseases of pests; (3) increasingly erratic rainfall patterns and increased moisture stress, occurrences of drought; and, perhaps (4) market expansion.

How do farmers respond to these factors? One major response mechanism, which is the subject of this section, is continuous changes in cropping patterns and intensification. Most farmers have adopted the following mechanisms to maintain their food security positions:

- Adopting land-saving and drought- and disease-resistant crops. Practicing a multiple cropping system, adopting intercropping system, and planting tree crops such as bananas, avocado, oranges, etc. Intercropping took the form of multiple story planting system
in which tree crops are planted along with cereals and seasonal root crops. Fruit trees with expanded branches can spread in the air while occupying a relatively limited land, although they possibly hinder sunlight from reaching the crops planted underneath. Multiple cropping practice has been facilitated by the fact that underground tubers such as taro, sweet potato, etc., can be harvested several time per year per plant.

- Expanded growth of eucalyptus trees for use as timber, fuelwood and as a source of cash income, although eucalyptus trees remove moisture from the soil through their long roots.

- Increased participation in petty trade.

- Engagement in wage labor mainly as migrant workers.

- In addition, farmers adopt increasingly knowledge-intensive farming strategies such as the sophisticated practice of seed selection. For example, the stem of sweet potato is planted around the homesteads, using manure in order to develop longer stems full with leaves for the next planting season. Regarding potato, better tubers are stored for about a month in cool dry places for next planting. Best coffee seeds are selected by picking berries from well-shaped and high-yielding mother trees. Farmers get best seeds in three ways: (1) select seeds from their own harvest and preserve with care; (2) get better seeds from neighbors and relatives; and (3) buy better seeds from markets.

VII. CONCLUSIONS

The above review falls in line with the conclusions of Pingali and Binswanger (1987:50) that:
Far from being immobile and technologically stagnant, "traditional" societies have responded to changes in population densities and external markets with changes in farming systems and land use patterns, as well as technological change, in systematic and predictable patterns.

These changes are generally associated with increased labor requirements per hectare of cultivated land. Additional demand for farm labor arises because of: (1) increased farm operations (e.g. increased weeding problems that follow a rise in the human to land ratio); and (2) increased overhead labor costs (e.g. increased investment in land in the form of irrigation schemes drainage terraces, etc.). Thus it can be argued that peasant agriculture has the capacity to absorb a substantial proportion of additional labor supplies. In other words, it can be hypothesized that peasant agriculture sustains itself, among other things, by generating additional employment opportunities given conducive physical, economic and social environment. In fact, it is possible that agricultural production be constrained by seasonal labor shortages as can be witnessed by the Ethiopian case.

Increased labor input per hectare of cultivated land may imply increased yields but declining output per hour of work time. In other words, peasant farmers attempt to increase or maintain the productivity of the more scarce resource (land) through intensive use of the less scarce resource (labor).

However, declines in labor productivity cannot be assumed to be uniform across different agro-ecological regions. They would not be dramatic in regions such as the southwestern parts of Ethiopia, which are well endowed with land and where yields respond well to land investments and intensification inputs (e.g. manures). In the largely desertified and marginal regions labor could be effectively mobilized for investment in erosion control, water works, and forestry as it is the case in the Tigray region of northern Ethiopia.
One can also argue that rapid population growth per se may not be a problem by itself; what matters is a country’s institutional and organizational capacity to make effective use of farmer-based research and science-generated research as was the case in Japan during its take-off period (see Dejene 1992). If the level of population density had been the main culprit, China, and not Ethiopia, would have depended heavily on food aid. There is no wonder that Pingali and Binswanger (1987:151) observed that: "The potential problems of declining labor productivity and environmental degradation are not problems of levels of population densities." However, certain qualifications are in order. Boserup herself has pointed out that her model works only under certain conditions. Once population growth rate exceeds an acceptable level, it would be difficult to prevent per capita consumption from falling. Current population growth rate in Ethiopia substantially exceeds historical rate in developed countries. Moreover, Ethiopia has limited institutional capacity to mobilize both types of technologies, i.e., farmer-based and science-based research.

REFERENCES

Dejene


I. INTRODUCTION

Enset (*Ensete ventricosum*) is a large perennial herbaceous monocot plant that belongs to the Order Scitaminae, Family Musaceae, and Genus Ensete. It is cultivated as a food and fiber crop in Ethiopia, predominantly in the southern and western parts. Bizuayehu (1995) estimated that 10–12 million people depend on it as a staple and co-staple food; CSA (1994) estimated the area coverage to be 140,201 ha.

Enset provides a widespread vegetative cover to the soil against rain and hence reduces erosion. At the same time, it meets the farmers’ productivity and security objectives. Responding to the food demand of the rapidly increasing population, even under risky and variable ecological and socio-economic conditions, enset has proved useful to a sustainable intensification of agriculture. In addition to its conservation-based development role, it plays an important role in ensuring food security, even during adverse environmental conditions. Pankhurst (1986) noted that the population dependent on enset have never suffered from famine, even during the 1970s and 1980s, Ethiopia’s tragic drought and famine decades.
The other core point that makes enset appropriate for sustainable intensification of agriculture is its high productivity. The productivity of enset is so high that the enset-planting culture can support a denser population than seed farming. Given the limited and degraded land and the rapidly growing population, it can have an important role in intensification of agriculture. However, to be sustainable, the three important criteria of sustainability, defined as ecological soundness, economic viability, and adaptability, should be met. There are both natural and socio-economic factors that influence the ecological, adaptability and economic roles of enset. The objective of this paper is therefore to provide information on these factors.

II. METHODOLOGY

The necessary data for this study were collected from three sources: review of secondary data, informal discussion with farmers, and implementation of verification survey. A set of checklist was developed to serve as a guide in the informal dialogue with farmers.

Following the informal survey, a standard questionnaire was developed. A sample of 85 farmers were selected using a stratified sampling technique from three ecological zones (highland, mid-altitude and low altitude). The sample size of the highland and mid altitude area farmers was 30 each while that of the low-altitude was 25.

The survey area is Marka Woreda, located in North Omo Zone of Southern Peoples Region. According to the Woreda Ministry of Agriculture (MOA) office, the Woreda consists of 32 peasant associations (PAs) with a total population of 73,000 and covers an area of 46,753 ha. Its elevation ranges from 500 to 2500 m. The highland, mid-altitude and low-altitude areas account for 51%, 34% and 16% of the total area respectively.
The topography is characterized by rugged, undulating to rolling, and hilly features. The soil types of the lowland areas are predominantly reddish brown to brown and shallow in depth, while that of the mid-altitude area is mainly reddish and less shallow in depth. In the upper mid-altitude and high plateaus, a soil with dark brownish surface and red brownish color is predominant. The study area is connected to Wolaita Sodo town by a poorly constructed road.

III. ECOLOGICAL AND ECONOMIC IMPORTANCE OF ENSET

1 Ecological Role

One contribution of enset in the context of sustainability is its role in conservation, which is related not only to reducing the intensity of soil losses but also to preserving and, if possible, increasing the capacity of the soil to sustain agricultural production. Given its good morphological nature suited to intercept heavy rainfall showers, enset prevents erosion by providing widespread cover to the soil against rain.

Besides being a perennial mulching crop, which renders possible reinvestment of a good deal of biomass (leaves, leftovers of harvesting and processing), and given the traditional management of enset cultivation by intensive application of manure, enset is likely to improve the structural conditions of the soil and maintain the fertility and biotic stability of the system. Enset leaves enrich plant nutrients because of the foliage incorporated into the soil.

In enset farming system, there is no specific time during which the enset field is open to the negative impact of high temperature and heavy rainfall. Because the time of planting and harvesting often overlaps, the quality of the productive horizon of the soil is maintained; the effect of
rainfall erosivity and soil erodibility is also diminished. It is therefore possible to meet both the conservation role of enset in maintaining the land’s capacity to support production and the development end of growth in production.

Another merit of enset rests upon its capacity to reduce degradation of resource from overgrazing in that it provides cattle with enset leaves through cut-and-carry system. Enset leaves are important for cattle feed especially in dry seasons when grasses are scarce. Dereje (1996) concluded that enset has a good potential as feed for ruminants. The stall feeding also helps avoid wastage of manure and thus renders efficient use of resources.

2. Economic Importance

The farmers’ objective of productivity and security correspond to the criterion for sustainable agriculture, defined as economic viability. Enset is considered to meet this criterion, for it is highly productive and can ensure food security. Its productivity can reach as high as 10 tonnes/ha per year. When this is compared with that of other crops having a similar moisture content (sweet potato, 4.0 tonnes/ha per year; and Irish potato, 5.2 tonnes/ha per year), it has a good performance even with the assumption that the annual crops are produced twice a year.

Another way in which the economic viability is measured is its capacity to produce enough yield for self-sufficiency or earn income and gains sufficient enough to cover the costs incurred. In line with this, various authors noted that enset cultivation is economically viable (Smeds, 1955; Taye and Asrat, 1966; Shack, 1966; and Westphal, 1975). Farmers in Imdibir and Sidamo agree that 50–60 plants and in Kembata 30–40 plants are sufficient for a family of 4–5 persons for one year, yet the number of enset plants eligible for harvest in one’s farm on a yearly
Role of Enset in Sustainable Intensification of Agriculture

basis is in excess of the number required for annual consumption (IAR, 1983).

A farmer in the survey area possesses an average farm size of 2.65 ha, of which 0.31 ha is allocated to enset production. Enset fields are of three types: nursery, transplant and permanent fields. The permanent enset field accounts for three-fourth of the total enset field, which is 0.23 ha. On the basis of one plant per an area of 4 m², there are about 575 plants of 4–9 years old. Farmers harvest 40–50 enset plants on average (Table 1). This is enough to meet the annual consumption of a family size of six persons.

Apart from serving as source of food, enset is also useful in producing economically important industrial raw materials, fiber, whose strength is equivalent to the fiber crop abaca (known throughout the world) (Huffnagel, 1961); enset’s average fiber yield is 543 kg/ha (Endale and Mulugeta, 1993).

In enset production the demand for labor is very high, particularly for processing and land preparation. However, the problem is not very serious as enset allows extended period of harvesting and labor exchange arrangement is widely employed. Enset cultivation is traditionally practiced in areas where the population density is high.

Table 1. Mean area and harvest values of enset in the survey area, 1995

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm area (ha)</td>
<td>2.65</td>
</tr>
<tr>
<td>Enset area (ha)</td>
<td>0.31</td>
</tr>
<tr>
<td>Permanent enset farm (ha)</td>
<td>0.23</td>
</tr>
<tr>
<td>Total no. of harvestable enset plant</td>
<td>575.00</td>
</tr>
<tr>
<td>Actual yearly harvest</td>
<td>40.50</td>
</tr>
<tr>
<td>Family size</td>
<td>6.00</td>
</tr>
</tbody>
</table>
3 Adaptability

Enset has the capacity to adapt itself to changing conditions (e.g. population growth, market demand, drought incidence) thus ensures a continual supply of food in a sustainable manner. Owing to the longer storability of kotcho (the edible product of enset prepared from the pseudostem and the corm), its high productivity, its extended period of harvesting, and tolerance to drought, a stable supply of food can be obtained from enset; the kotcho can be stored for 8–10 years without spoilage. This quality enables the people to sustain their life even under adverse situations when there is no other source of food. As to its tolerance to drought, Pankhrust (1984) indicated that adaptation zone of enset ranges from 1500 to 3100 m, although it does best in the intermediate altitude of 1800–2450 m. Endale (1993) also observed that it could be grown at 1370 m altitude under rainfed conditions, while Kefale and Sandford (1991) noted that enset could be cultivated at 1200 m altitude under irrigation with good performance in terms of high growth rate and plant size. In the survey area, following the villagization program of settling the highlanders in the low-altitude areas (1500 m), some farmers were able to establish enset in the lowland settlement areas.

IV. CONSTRAINTS

1. Natural

1.1. Bacterial Wilt

Enset bacterial wilt is the most important biological constraint that has been affecting enset production in all the ecological zones of the survey
area. According to the study, 88% of the farmers have been affected by the problem (Table 2); about 94% of them reported that it is highly severe (Table 3). Since the disease is easily transmitted, the problem worsens from one year to the next. Even under normal conditions, harvest is often undertaken prior to maturity for fear of the disease. This has a negative impact on yield and quality of the edible material and fiber.

1.2 Wild Animals

Attack to enset plant by wild animals is reported by 97% of the farmers. This is an important problem next to disease(s) (Table 2). About 92%, 80% and 41% of the farmers reported that porcupines, pigs and moles are problematic in their areas respectively (Table 4). These animals usually attack those enset clones whose corm is sweet, which are also important in meeting farmers’ immediate needs for consumption or sale. The attack poses a threat to expand enset farms away from homesteads.

1.3. Lodging

Sixty-one percent of the farmers reported that lodging is a problem, which is attributed to wind because of corm rot, poor development of roots, sloppy nature of the topography, and poor land preparation and maintenance practices (Table 2). Lodging is serious in some months of the year when there is a strong wind. The problem is usually observed in the highland areas.

1.4 Low Soil Fertility

Farmers maintain the fertility of their enset land by applying cowdung, crop residues and household waste in the survey area. However, because of diseases and lack of cash, the number of livestock has gone down,
and farmers have not been able to apply adequate amount of manure. Almost all farmers mentioned that low soil fertility is a serious problem. Neither compost nor chemical fertilizers are used for enset production in the area.

1.5 Traditional Agronomic Practices

The agronomic practices used in enset production are so traditional that it is unlikely that its full biological potential is exploited. Such practices, which include spacing, propagation, frequency of transplanting, rate and time of manure application, have yet to be improved.

1.6 Traditional Processing and Storage Methods and Devices

Enset processing, which is the major activity that demands intensive labor, is the responsibility of women. The women in the study area pointed out that enset processing is the most laborious household activity. This is because it has to pass through various labor-intensive stages—decortication, pulverization, shredding, fermentation and squeezing. Besides, there is an apparent wastage and inefficiency of both the edible and non-edible parts, fiber. The improvement of these techniques and devices can contribute to releasing labor for other activities and rendering efficiency.

1.7 Livestock Diseases

Fifty-six percent of the farmers reported that livestock disease is a problem (Table 2). Apart from weakening the draft power and finally reducing the overall production through improper and untimely farm operations, it affects the amount of manure applied on enset farm. Shortage or lack of animal products also results in unbalanced diet hence creating a cumulative physical weakness for labor. Enset alone in
the diet supplies more carbohydrate and less protein. The amount protein found per kilogram of kotcho is only 9 g (Pijils et al. 1994).

Table 2. Constraint of enset growers in Maraka Woreda (proportion of farmers)

<table>
<thead>
<tr>
<th>Constraints</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enset bacterial wilt</td>
<td>88</td>
</tr>
<tr>
<td>Wildlife</td>
<td>97</td>
</tr>
<tr>
<td>Lodging</td>
<td>61</td>
</tr>
<tr>
<td>Low soil fertility</td>
<td>100</td>
</tr>
<tr>
<td>Traditional agronomic practices</td>
<td>100</td>
</tr>
<tr>
<td>Traditional processing and storage techniques and devices</td>
<td>100</td>
</tr>
<tr>
<td>Livestock disease (shortage of manure)</td>
<td>56</td>
</tr>
</tbody>
</table>

Table 3. Severity of enset bacterial wilt disease by ecological zones (proportion of farmers)

<table>
<thead>
<tr>
<th></th>
<th>H.A</th>
<th>M.A.</th>
<th>L.A.</th>
<th>Mean (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>100</td>
<td>90</td>
<td>93</td>
<td>94</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>10</td>
<td>7</td>
<td>6</td>
</tr>
</tbody>
</table>

H.A = high altitude; M.A. = mid altitude; L.A. = low altitude

Table 4. Types of wildlife affecting enset growers in Maraka Woreda (proportion of farmers)

<table>
<thead>
<tr>
<th>Wildlife</th>
<th>Proportion of Farmers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porcupines</td>
<td>92</td>
</tr>
<tr>
<td>Pigs</td>
<td>80</td>
</tr>
<tr>
<td>Moles</td>
<td>41</td>
</tr>
</tbody>
</table>
2 Technological and Institutional Constraints

As far as enset research is concerned, there are no adequate technologies eligible to be promoted to address the problems of enset. This is actually attributed to inadequate amount of research conducted and poor facility. The extension of the few available technologies (processing and protection technologies) has not been adequate and effective. Farmers are not aware that it is possible to prevent the devastating disease, bacterial wilt, by improving the sanitation of their enset fields, burning and burying an infected enset plant, and avoiding contamination through cutting and farming tools. Even if there are enset processing technologies, they are not adequately popularized for use by the farmers.

In the survey area, especially in the highland and upper mid-altitude areas, enset is also used to earn cash income. Because the marketing of enset products is confined to the local market, the farmers do not receive satisfactory prices. This is partly attributed to the poor road network.

The farmers in the study area reported that the availability of inputs is a problem. This has an indirect impact in that there will be excessive reliance on enset, for the other crops will not do good without the use of inputs, mainly fertilizer. Despite problems like soil fertility, low genetic yield potential of the local cultivars, and pests, farmers have limited access to fertilizers and improved varieties. This has exerted pressure upon the consumption of enset products.

CONCLUSION

Enset has not only productive and food security functions, explicitly perceived by the farmers, but also ecological functions, such as producing organic matter, creating a nutrient reservoir in the soil,
controlling erosion, thus contributing to the stability and continuity of farming. Being a potential crop to bring about a conservation-based development, it needs to be integrated into the development strategy. Since it is ecologically sound, economically viable and adaptable to changing natural and socio-economic processes, enset has the potential for expansion to other areas where it has not been practiced so far.

No external input is required for enset cultivation. It can be practiced under poorly developed rural transportation and input distribution systems. There is high potential to expand its cultivation to diverse and risk-prone areas. However, enset is threatened by a disease (bacterial wilt). Therefore researchers, policymakers, development planners and workers, and non-governmental organizations have to attempt to address this and other constraints.

Given the poor economic situation of our farmers, the attempt to reverse the degradation of natural resources will fail unless the conservation role of enset as a vegetative cover is appreciated. The maintenance of the enset field through intensive application of organic matter and recycling of the vegetative part obtained from it have also important implications for conservation. The role of enset in sustainable development can be effective if conservation-based development policies and technologies are given serious attention.

REFERENCES


I. INTRODUCTION

"Sustainable development" stems from the concern that many activities undertaken in the name of development have actually devastated the resources upon which development is based. In the industrialized countries, the rapid consumption of finite materials, such as fossil fuels and metals, is the major concern; while in the least-developed countries overexploitation of natural biological resources is often the major threat to sustainability.

Sustainable development is improving peoples' material well-being through utilizing the earth's resources at a rate that can be sustained indefinitely. The World Commission on Environment and Development (WCED) defined it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). WCED (1987) particularly stressed the importance of meeting the essential needs of the world's poor. According to Fresco and Kroonenberg (1992), the term sustainability is generally used to indicate the limits placed on the use of ecosystems by humans, or more specifically, to the way in which resources can be used to meet changing future needs without undermining the natural
resource-base. In this definition they have emphasized the dynamic equilibrium between natural inputs and outputs. Whatever the exact definition of sustainability, the term must take account of the society, the economy, and the environment.

Despite the lack of reliable data on production and maximum sustainable yield (MSY) of Ethiopian fisheries, there is an enormous potential to increase production. However, looking at individual water bodies, there is a sign of biological overfishing on some of the lakes that contribute substantial amounts to the annual fish production. On the other hand, fisheries management is needed for water bodies that are “overexploited”, while development is appropriate for water bodies that are “underexploited”. The impression that fishery management is needed only when a fishery resource becomes overexploited may be a misconception. Thus attempts should be made to curb overfishing by taking management measures along with development efforts.

It is, therefore, imperative, to issue proper management regulations for fishery in Ethiopia. The objective of this paper is, therefore, to review general issues related to open access and fishery management in Ethiopia and to propose management strategies towards a responsible exploitation of the fish resources.

II. RESOURCE POTENTIAL AND CONSTRAINTS

Ethiopia is blessed with substantial aquatic resources consisting of 7,500 km² of lakes and 7,000 km rivers (Shibru, 1973). In addition, minor water bodies such as crater lakes make up about 4,000 km². These lakes and rivers are stocked with various fish species. Shibru (1973) has listed 14 families, 31 genera, and 93 species of fish.
There are no comprehensive data related to the size or composition of the present fish stock in Ethiopia. There is no consistency in the estimates of fish stocks in Ethiopia by various sources. According to Getachew (1993), fish production potential is in the range of 33,000–82,900 tonnes per year. The annual nominal domestic production is approximately in the range of 3500–4500 tonnes (Vanden Bossche and Bernacsek, 1991), which makes the utilization rate to be below 15% per caput consumption of the country, has never exceeded 100 g per year. Compared to other African countries, which is around 8.4 kg per year, and 13.4 kg per year for western countries of the world, fish consumption in Ethiopia is far too small. The major constraints to this low level of fishery development in Ethiopia are the following.

a) **Technological**: The primitive fishing-preservation-transportation methods and marketing facilities have curtailed the development of fishery.

b) **Research and Training**: Lack of research and inadequate training in fisheries has resulted in mismanagement of the fishery resource and, in some cases, over-fishing.

c) **Economic and Policy Aspects**: Market prices are relatively low; fishery is not a priority for the government, i.e., emphasis is on projects with immediate economic returns. Moreover, feasibility study of fishing has not been conducted by government bodies to motivate banks and other financial institutions to extend credit facilities to prospective fishers.

d) **Infrastructure**: Lack of adequate extension services and information dissemination programs have contributed to low production.

e) **Social Aspects**: Traditional food habits (e.g. consuming fish only
during fasting periods among Orthodox Christians) have adversely affected fish consumption.

f) **Assistance Programs**: Ethiopian fishery development projects try to support and encourage the expansion of the fishing effort without adequate knowledge of the potential of the resource. Provision of credit and modernization of the fishery industry are the objectives of most projects. But, in the long run, it is bound to fail as a result of open access. Most fishery assistance programs in Ethiopia have assumed that Ethiopian fishery is underexploited and, therefore, efforts should be directed towards development rather than towards managing the exploitation of the lakes. The tendency that fishery management is needed only when the resource becomes overexploited might result in overfishing.

### III. HISTORICAL DEVELOPMENT OF THE ETHIOPIAN FISHERY

Ethiopia has a long history of fishing. Fishing was often performed, according to an 18th century chronicle, by throwing the crushed seeds of a plant called *birbira* into a river where upon the fish become temporarily stupefied and easily caught (Pankhurst, 1961). Lake fisheries using hand-made nets and traditional reed boats or *tanquas* was started on Lake Tana by the Weito people since the early 18th century. On the other hand, with the exception of the islanders on Lake Ziway, fishing is a relatively recent practice in the Rift Valley lakes. It started as late as the mid 1950s when the demand for fish grew among the foreign communities and upper class Ethiopians in Addis Ababa. Regarding river fishery, the Agnuuaks in Gambella have been living entirely on fishing since their settlement in the area. Commercial fishery in Ethiopian lakes hardly developed over the years until the EEC-assisted
Rift Valley Lakes Fisheries Development Project commenced in 1981. The Lake Tana Fishery remained to be almost entirely subsistence until a project assisted by Dutch NGOs was launched in 1986.

Many of the world’s most valuable fisheries have been overexploited, reducing catches to well below their previous levels. The Ethiopian fishery shows a different level of exploitation, especially the lakes included in the second phase of the EEC-assisted Fisheries Development Project (Rift Valley lakes and Lake Tana). The major objectives of this project are to increase the annual fish production from the lakes and to improve the marketing infrastructure. Such development programs have increased the fishing effort (Table 1). The increased fishing effort in Ethiopia is also the result of poor performance of the economy and high population growth.

While this expansion in fisheries is one of the positive achievements of the underexploited fishery, it is destructive in the long run unless controlled. For example, lakes Ziway and Awasa have already indicated some biological overfishing.

Table 1. Basic Indicators of the different lakes in Ethiopia

<table>
<thead>
<tr>
<th>Lake</th>
<th>Area (km²)</th>
<th>MSY (tonnes)</th>
<th>Prodn. 1987%</th>
<th>Change (%)</th>
<th>MSY 1985–1987%</th>
<th>FM (No.)</th>
<th>FG (No.)</th>
<th>Catch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tana</td>
<td>3,500</td>
<td>13,000</td>
<td>7.5</td>
<td>+ 28</td>
<td>+ 49</td>
<td>+ 148</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Koka</td>
<td>255</td>
<td>1,200</td>
<td>34.25</td>
<td>+ 29</td>
<td>+ 7</td>
<td>+ 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ziway</td>
<td>434</td>
<td>1,850</td>
<td>118.78</td>
<td>+ 55</td>
<td>+ 105</td>
<td>+ 150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Langano</td>
<td>230</td>
<td>1,500</td>
<td>13.33</td>
<td>+ 96</td>
<td>+ 200</td>
<td>+ 60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awasa</td>
<td>91</td>
<td>950</td>
<td>49.05</td>
<td>+ 25</td>
<td>- 12</td>
<td>- 84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abaya</td>
<td>1,070</td>
<td>1,150</td>
<td>23.48</td>
<td>- 34</td>
<td>+ 473</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chamo</td>
<td>350</td>
<td>2,400</td>
<td>75.58</td>
<td>- 42</td>
<td>+ 100</td>
<td>+ 430</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Ethiopian calendar
FM = fishermen; FG = fishing gears
MSY = maximum sustainable yield
In general, there is a danger that without fishing regulations and means to supervise, the uncontrolled exploitation will lead to overexploitation of the resource. Hence, introducing and implementing fisheries management and fisheries regulations, along with intensifying fishing, is imperative.

IV. OPEN ACCESS AND EASY ENTRY

An extremely important element in the conservation of resources is controlling the ownership of these resources. The importance of land tenure system with respect to agricultural societies has been discussed by numerous authors. However, until recently, sea tenure was rarely considered. Many of the most vulnerable natural resources of Ethiopia are subject to open access, among which the fisheries resource can be cited as a good example.

Open access means that no one owns the resource and access is open to all. There is no limit that curbs new entrants. Open access implies that the use of the resources is unpriced, as anybody who wishes can exploit the resource without paying. This was not a problem in the past since resources were abundant compared to the available exploitation technologies and the demand for the resources. However, population growth and technological progress have dramatically changed this situation. The consequence is that there is widespread misuse and degradation of these open access resources.

Open access is neither economically nor biologically desirable. Biologically, Pearce and Turner (1990) graphically illustrated the relationship between effort and growth of stock (Figure 1). According to the Figure 1, the choice of effort level determines the harvest and stock level, i.e., where EX is just equal to the rate of growth of the
resource. This effort gives the Harvest $H^*$ and the Stock $X^*$, i.e., harvest is greater than the sustainable yield $X$ and the stock will fall. A harvest level along the line $E'X$ to the left of $X^*$ is less than the yield through natural regeneration, and the stock will grow. In this case, Effort ($E$) becomes the instrument of management and the harvest rate is set equal to $E'X$. But to know the desirable level of exploitation, some concepts of costs and revenue are required.

Economically, open access fishery makes little or no long-term contributions to the country's economic development, since any economic surplus created is consumed by the additional entry it attracts. In addition, favorable changes in economic conditions or attempts to further develop the fishery or assist the fishermen can result in further entry. Panayotou (1982) mentioned that as long as there are excess profits to be made, new entrants would be attracted and effort would expand until a zero-profit or open access equilibrium (OAE) is reached at $E_{OAE}$ level of effort (Figure 2).

V. MANAGEMENT OPTIONS AND IMPLEMENTATION

Traditionally, a number of practices exist for the control of fishery resources. These usually involve direct or indirect control on the fishermen, by limiting access to the fishery, or on the practice of fishing through the control of season, location or type of gear. The choice of regulation mechanisms is often based on the following criteria: (a) acceptance by the majority; (b) costs of enforcement and regulation; and (c) availability technical information. For the selection of proper management measures appropriate to Ethiopian fishery a 'menu approach' is suggested, considering all the possible measures, their biological effects, their technical backgrounds, and implementation problems. For details refer to Christy, (1982), Troadee (1983), and Panayotou (1982).
Figure 1. Effort-growth equilibria

Source: Pearce et al. (1990)

Figure 2. The maximum economic yield (MEY) cannot prevail as a long-term equilibrium in an open access fishery. As long as there are (excess) profits to be made, new entrants would be attracted and effort would expand until a zero-profit or open-access equilibrium (OAE) is reached at $E_{OAE}$ level of effort.
a. Measures based on setting minimum mesh size, though useful in resource productivity, are difficult to apply in Ethiopian fishery. Fishermen usually use nets that are made by themselves and they reduce the mesh size according to their needs. It is also expensive to implement because of the many different types of gears and also that fishermen are dispersed and inaccessible.

b. Gear limitation in terms of numbers, type, size etc., might increase yield. A technically active gear, like trawls, is easier to control than a passive gear, like gillnets and traps. Most fishing gears in Ethiopia are, however, passive.

c. Seasonal and area closures are most easy to control but breeding areas and seasons have first to be determined with certainty. The knowledge on different fish stock is almost absent. In addition, this imposes a heavy burden on the mobility of the fishermen and their fishing capital can be underutilized for longer periods.

d. Economic controls such as taxes on effort or catch, royalties, and license fees aimed at the controlling effort may be more effective. However, the temporary increase in costs makes this unacceptable by the fishermen. Furthermore, tax collection systems are ineffective and, for scattered communities that barely earn subsistence incomes, taxes become politically and practically difficult to impose and collect.

As mentioned above, Ethiopian fishery is diverse in terms of fishing gears, socio-economic characteristics of fishermen, level of development, etc. The fishery is currently at different levels of development in various parts of the country. It is, therefore, imperative that a management policy of fishing should be drafted both at national and regional levels. The management measures recommended in this paper are intended to
serve the national-level strategy. Hence, two management tools can be used for fishermen and one management tool for traders (Figure 3). This management scheme has a general structure of sequential steps for setting objectives, information gathering. The proposed fishery management tools in Ethiopia are discussed below.

1. Licensing of Fishing Units

Licensing is a simple restriction on the number of fishermen operating in a certain area. The difficult thing in fisheries management is to reduce the fishing effort. Fortunately, the number of fishermen operating on Ethiopian lakes is not very large. However, the current open access policy should be reversed to avoid the inevitable difficulty at a later stage, when the fishing size goes beyond the optimum level. Fishing units, cooperatives, and individual traditional fishermen should be registered and made to obtain proper fishing licenses.

2. Community-based Management

Attempts to a direct control through legislation may result in costly and sometimes oppressive enforcement programs, while less involvement by the government in regulating the fishery may be more effective. Community management aims at creating an appropriate environment for self-management through private or community ownership. In this case, the community should be vested with the exclusive right to the resource and be in a position to deny access to others. They must also clearly perceive that their actions have a direct effect on their future. Community management has the advantage of minimum administrative cost and is also sustainable since it is based on the good will of the community.
Figure 3. The Proposed management scheme. Texts outside the box indicate implementing agent.
3. MARKETING REGULATIONS

This would target traders by (a) penalizing them for dealing in undersized fish, and (b) giving them licenses for a certain volume of catch. These would require effective cooperation among the various parties involved.

VI. CONCLUSION

Despite the lack of reliable data on production and maximum sustainable yield (MSY) of Ethiopian fishery, it is estimated that there is an enormous potential for increased production. Reasons for the current low level of production are cited, so that any development project of the subsector can consider them during project preparation. Among the major problems, open access to the fishery is considered dangerous to the aquatic resource of the country and needs immediate action. Open access entails a high risk of resource draining.

Fisheries management in an open access resource use situation is essential because of the increasing fishing effort in view of MSY of the water bodies. It is well established that ecosystems are sustainable, if human interference is absent or at least minimal like in the early 1960s. Moreover, there is population growth that leads to increased natural resource use. A central issue of sustainability is, therefore, to ensure that no net qualitative or quantitative loss of natural resources occurs under the existing human pressure and environmental conditions. This implies that we accept some inevitable changes, but avoid irreversible damage.

On the basis of available information, a management framework is formulated. Within this framework, management structures and responsibilities are identified and a coordinating mechanism, among the
Institutions involved, fishermen organizations, or community management bodies, are identified.

In view of the novelty of fishery regulation in Ethiopia and the technical, economic and political complexities, careful consideration has to be given to opinions of professionals with different backgrounds, the community, fishermen and others before its implementation.

REFERENCES


LAND TENURE AND FARMING PRACTICES:  
THE CASE OF TIYO WOREDA,  
ARSI, ETHIOPIA

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International Livestock Research Institute  
P.O.Box 5689, Addis Ababa, Ethiopia

I. INTRODUCTION

Ever since the agrarian reform of 1974, rural farmlands in Ethiopia have belonged to the "people" but controlled by the government. The only formal way of obtaining access to land was through the peasant associations (PAs), the lowest administrative unit. In order for newly formed households to obtain crop or pasturelands, the PAs periodically redistributed existing lands between households based on family size and land quality. Land transactions between individuals, such as selling, sharecropping, and renting were outlawed.

In 1991, the government suspended the system of land distributions but left most other elements of the former land tenure system in place. When the new constitution of Ethiopia was drawn in November 1994 it reaffirmed state ownership of rural lands and prohibited land sales. The issue of land redistribution has yet to be clarified.

Critics of this system cite its drawbacks in terms of constraints on agricultural productivity, natural resources management, and household well being. Some argue that, because of past redistributions and the
threat of future redistributions, land is insecure, causing farmers to underinvest in agricultural inputs and mine the soil. Land insecurity is also believed to be a source of disincentive to tree planting.

Another potential problem with this system springs not from land redistributions, but from the recently imposed failure to redistribute land. There is a burgeoning landless class of rural dwellers, unable to obtain land from the peasant associations. With little opportunity for off-farm employment, these people are forced to farm by borrowing, renting or sharing land from their family and neighbors. With rapid population growth, the availability of such land is very limited and thus costly.

The purpose of this paper is to evaluate these potential problems in the context of the mixed crop-livestock system of the Ethiopian highlands. Survey data from the Arsi region are used to describe the prevalence and nature of landlessness. The impact of the current land situation on selected parameters of crop agriculture, field management and inter-household equity is analyzed.

II. BACKGROUND OF THE STUDY

The study area is located in one of the most productive regions of the country, Arsi Zone of Oromia Region. Tiyo Woreda was selected as the study site for a year-long survey on the effects of land tenure on agricultural productivity, conducted by the International Livestock Research Institute (ILRI) in 1994. In consultation with the local representatives of the Ministry of Agriculture, four Peasant Associations (PAs)—Abichu, Bilalo, Ketar Genet and Mekro Chebote—were selected for their varying altitudes and thus mix of crop and livestock activities.

A census was conducted in the four PAs in March 1994 to quantify the
key agricultural dimensions of the area and to provide a sampling frame. Farm households were grouped according to their membership in the PAs, which corresponds to their official access to state lands. Accordingly, "landless" or non-PA (NPA) households have not acquired either crop or pastureland from the PA; "landed" or PA households have received at least one crop or pasturefield through PA distributions. NPA farmers can obtain land through various contracts, but as long as they do not possess PA land, they are treated as landless farmers in this study. The census indicated that of the total farming population of 1671 households, 83% were landed PA members and the rest 17% were landless NPA members.¹

To adequately describe the activities of these tenure groups, the smaller NPA category was slightly over-represented in the sample. Using a stratified random sample by tenure class, the final number breakdown of the sample is 115 PA households (71%) and 46 NPA households (29%). Within the PA class, two different types of households were identified based on the tenure portfolio of crop fields they farm. These are: pure-PA households (PPA) who farm only crop fields allocated by the PA, and mixed-PA households (MPA) who supplement their PA land allocation with at least one additional crop field farmed under a farmer-farmer contract. Where relevant, data for these two landed groups, PPA and MPA, are presented separately.

The data collected on each of the 161 sample households covered all areas of households' demographic characteristics, field inventories, input use, crop yield, credit, farming problems, cropping strategies,

¹ In an international sense this definition of landlessness is perhaps overly restricted. In other contexts landlessness may involve a host of social, economic and historic factors beyond simple land ownership (Sinha, 1984; Esman, 1978). Landlessness is often associated with poverty but because of the complicated relation between access to land and access to other resources, some approaches to the study of landlessness see it as a cause of poverty, while others see it as the effect. In this study, landlessness is the result of a government decision not to distribute land.
livestock inventories and management approaches. Farmers were asked their opinions on land tenure and fragmentation, as well as their strategies for managing their fields.

III. HOUSEHOLD CHARACTERISTICS

There are clear demographic and economic differences between the three household tenure categories: NPA, MPA and PPA (Table I). The NPA households came of age too late to receive a land distribution and are markedly younger, with smaller families and fewer able-bodied workers than either of the landed groups (MPA and PPA). Although they receive no land from the government, NPA households manage to obtain an average of 0.8 ha of land, which is only 23% and 38% of the average for MPA and PPA households respectively. NPA households are not land-scarce in relative terms; however, owing to their small family sizes, they use an average of 0.6 ha per family member, not significantly different from their landed neighbors.

All households, regardless of tenure class, put their primary emphasis on farming as a primary occupation. The difference between NPA and PA households emerges in the secondary activities. NPA households, on the whole, have a narrower economic base: over a third have only one source of income. With higher rates of literacy, they tend to devote themselves to trading and education, whereas their landed neighbors put a large effort into livestock management. With small herds, NPA households do not require much pastureland. They devote a much smaller share of their total land area to pasture land than MPA and PPA households (12% against 37% and 24%), and have fewer oxen per cropped area. Although they maintain roughly the same number of oxen, NPA households are, in subjective assessments of wealth, considered poorer than their landed neighbors.
Table 1. Demographic and economic characteristics of household by tenure class

<table>
<thead>
<tr>
<th>Household characteristics</th>
<th>NPA Members</th>
<th>MPA</th>
<th>PPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of household heads</td>
<td>* 23</td>
<td>** 37</td>
<td>±45</td>
</tr>
<tr>
<td>Literacy of household head (%)</td>
<td>* 87</td>
<td>** 69</td>
<td>49</td>
</tr>
<tr>
<td>Family size (no. of people)</td>
<td>*1.7</td>
<td>** 5.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Agricultural labor (no. of people)</td>
<td>* 1.1</td>
<td>** 2.4</td>
<td>2.6</td>
</tr>
<tr>
<td>HHs citing farming as primary</td>
<td>98</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Other important occupations (%) Studying</td>
<td>*13</td>
<td>** 1</td>
<td>0</td>
</tr>
<tr>
<td>Animal owning and management</td>
<td>*17</td>
<td>** 36</td>
<td>38</td>
</tr>
<tr>
<td>Trading or crafts</td>
<td>22</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td>HHs with only one source of</td>
<td>39</td>
<td>** 15</td>
<td>22</td>
</tr>
<tr>
<td>Total farm size (used) (ha)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per household</td>
<td>*0.8</td>
<td>** 3.5</td>
<td>±2.1</td>
</tr>
<tr>
<td>Per family member</td>
<td>0.6</td>
<td>0.7</td>
<td>±0.4</td>
</tr>
<tr>
<td>Crop area used (ha)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per household</td>
<td>*0.7</td>
<td>** 2.0</td>
<td>±1.6</td>
</tr>
<tr>
<td>Per family member</td>
<td>*0.5</td>
<td>0.4</td>
<td>10.3</td>
</tr>
<tr>
<td>Pasture area used (ha)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per household</td>
<td>*0.1</td>
<td>** 3.5</td>
<td>±0.5</td>
</tr>
<tr>
<td>Per family member</td>
<td>0.0</td>
<td>** 0.3</td>
<td>±0.1</td>
</tr>
<tr>
<td>Herd size (TLU)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per household</td>
<td>*1.2</td>
<td>** 5.0</td>
<td>±3.2</td>
</tr>
<tr>
<td>Per family member</td>
<td>0.8</td>
<td>1.0</td>
<td>±0.6</td>
</tr>
<tr>
<td>Per ha. of cropland</td>
<td>1.7</td>
<td>** 2.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Number of oxen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per household</td>
<td>*0.6</td>
<td>** 2.4</td>
<td>±1.5</td>
</tr>
<tr>
<td>Per family member</td>
<td>0.4</td>
<td>0.5</td>
<td>±0.3</td>
</tr>
<tr>
<td>Per ha. of cropland</td>
<td>0.7</td>
<td>** 1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Wealth ranking (% HHs/class)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorest class</td>
<td>*52</td>
<td>** 20</td>
<td>22</td>
</tr>
<tr>
<td>Middle class</td>
<td>48</td>
<td>57</td>
<td>68</td>
</tr>
<tr>
<td>Richest class</td>
<td>* 0</td>
<td>** 23</td>
<td>10</td>
</tr>
<tr>
<td>Number of households</td>
<td>46</td>
<td>75</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: ILRI Household Surveys I & II.

Notes: Test of significance (prob. < 0.05)
* = between NPA and PPA households.
** = between NPA and MPA households.
† = between MPA and PPA households.

To compare herds with different mixes of animals, herd size is calculated in tropical livestock units (TLUs) based on stylized weights for each species. The conversions used here follow Jahnke (1982): camels=1.0, horses=0.8, cattle=0.7, donkeys=0.5 and small ruminants=0.1 animals per capita.
Not only is the landless class of households (NPA) different from landed households, but also there are striking differences within that latter group are striking. Demographically, MPA households fall between NPA and PPA in terms of age, literacy, family size, labor, and occupational preferences. Their desire to increase their farm size above their government allocation reflects relatively abundant oxen holdings. Before contracting in additional land, MPA households had an average of 1.7 oxen per hectare of cropland, significantly higher than the 1.0 and 0.7 oxen per hectare maintained by PPA and NPA households respectively (not shown in Table 1). Afterward increasing their farm size, this ratio falls to 1.4, insignificantly different from PPA households. Likewise, their land to labor ratios, already high relative to their PPA counterparts, are even higher after these MPA households increase their farm size. It appears that their larger oxen herds permit them to use their surplus labor. The MPA focus on livestock is also evident in the relative importance of livestock as an occupation, the size of their pastures and their absolute as well as relative herd size in tropical livestock units (TLUs).

In sum, absolute endowments of land, labor and animals are considerably different between tenure classes, but farmers are using land markets as a means of maintaining the land-man-animal balance critical to efficient farming in the Ethiopian highlands.

IV. ACCESS TO LAND

There are two basic ways that smallholder farmers can acquire crop and pasturelands throughout most of Ethiopia at this time. If they are members of the PA, they receive an official allotment of crop and pasture fields based on family size and, in some cases, herd size. If they are not PA members (i.e., are landless, having qualified for PA
membership after the moratorium on land distributions) or if they are PA members who want more land, they can increase their farm size by making an informal contract with PA households for the use of their surplus lands.

In a situation where 98% of the PA members surveyed claimed that they wanted to increase their holdings by an average of 2.5 ha, no one really has surplus land. However, households headed by elderly men or widows often lack the physical force to exploit their holdings and tend to contract out their land to other users. Over one-fifth of the PA households contracted out one of their fields and about the same proportion contracted in at least one field. A very small proportion (2%) both imported and exported land, perhaps to lessen the distances they had to walk to their fields. Over half of the PA households farmed only the lands they had been allocated by the PA.

Although patterns of land transactions vary greatly between regions of the country, results of the ILRI census indicated that in 1994 in Tiyo Woreda, 76% of all fields were PA-allocated (Table 2). The remaining 24% were farmed under some sort of informal contract between farmers. The absolute number of contracted fields is small, but likely to increase in the absence of a land redistribution and presence of rapid population growth.

1. Types of Contracts for CropLands

What are the contracts under which farmers access croplands? As stated above, the only official contract is with the government. This can either come directly from the PA or, with the PA’s permission, in exchange for another piece of PA-allocated land. Except for a small land tax, these lands are essentially free of charge.
There are several unofficial contracts—two of them, renting and sharecropping, are fairly business-like with a clearly set duration and fee. Rented fields are associated with a cash sum paid in advance by the tenant to the landholder. The renter-tenant pays for all inputs and reaps all the benefits (or losses) of his cropping activities. The average cost for renting a field in the survey area was ETB 352 per hectare in 1994 (USD 56). Rented fields made up about 8% of all cropped lands in Tiyo Woreda in 1994 and 33% of the area’s contracted fields (Table 2).

Sharecropped fields involve a commitment by both partners to share the costs of the inputs and the benefits of the outputs, based on specific sharing arrangements. After deducting from the landholder’s share of all labor and inputs from his share of the outputs, the average cost of a sharecropped contract was ETB 935 per hectare (USD 148). Sharecropped fields made up 4% of all cropped lands in Tiyo Woreda in 1994 and 17% of the area’s contracted fields (Table 2).

There are also two less formal, unofficial land contracts—gift fields are given free of charge for an indefinite period or until the PA re-allocates land; borrowed fields are also given free of charge but for a defined period of time. Both gift and borrowed fields are almost always given by relatives, usually by parents who give part of their holdings to their newly married family members. As offsprings or relatives of the landholder, many of these farmers contribute labor and, in some cases, grain to the landholders. These contributions have been valued at ETB 333 per hectare based on the assessment of labor and cereal

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2 *Equi* and *siso* are local names of the two most common share contracts, meaning equal sharing and one-third share, respectively. Under either contract, most labor is provided by the share-tenant. In spite of these simplified names, there are numerous permutations of these arrangements, based on the specific endowments of the two contracting partners.

3 Note that 1994 was a good crop year in the Arsi Region and, therefore, the cost of the average share contract was higher than usual.
contributions to the landholder. Because the basic attributes of gift and borrowed fields are very similar, they have been combined under the same rubric in this analysis (borrowed/gift). Together, they made up 12% of all cropped lands and half of all contracted fields in 1994 (Table 2).

2. **Nature of Land Contracts: Security and Rights**

There are many ways the nature of a contract may influence the user. A very short contract (i.e., one growing season) that would discourage a farmer from making long-term investments. A long-term contract that was unenforceable would have a similar effect, as would one that clearly prohibited the user from undertaking certain activities.

PA-allocated fields are more secure and have a greater range of rights than contracted fields. The average PA-allocated field being used by the current farmer is four times for longer period than the average contracted field (8 versus 2 years). Furthermore, the duration of the

<table>
<thead>
<tr>
<th>Source of fields, by tenure</th>
<th>All</th>
<th>NPA</th>
<th>MPA</th>
<th>PPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA-allocated</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Rented</td>
<td>76</td>
<td>0</td>
<td>64</td>
<td>100</td>
</tr>
<tr>
<td>Borrowed/gift</td>
<td>12</td>
<td>26</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Shared</td>
<td>4</td>
<td>26</td>
<td>19</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Share of contracted fields by</th>
<th>All</th>
<th>NPA</th>
<th>MPA</th>
<th>PPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rented</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Borrowed/gift</td>
<td>33</td>
<td>26</td>
<td>53</td>
<td>0</td>
</tr>
<tr>
<td>Shared</td>
<td>50</td>
<td>63</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Shared</td>
<td>17</td>
<td>11</td>
<td>33</td>
<td>0</td>
</tr>
</tbody>
</table>

current contract on PA-allocated fields is indefinite, whereas most contracted fields have one-year contracts (Table 3). Shared and rented have usually one-year contracts whereas borrowed/gift contracts are often lent indefinitely, until the next official land allocation.

In Ethiopia, no farmer has a permanent, legally defensible claim to land and thus even PA-allocated fields are somewhat insecure. Although the frequency differs by region, redistributions have been fairly often in Tiyo Woreda, involving 82% of the PA households interviewed. There has been an average of 3.5 redistributions per household, but fully 17% of all PA members have experienced five or more redistributions since their first allocation.

In terms of rights, most farmers on PA-allocated fields felt able to exercise most of the usufruct rights shown in Table 3. About four-fifth felt they could build wells, stone bunds or permanent fences of metal or stone but these responses may reflect more their desires rather than their rights. The distinction is difficult to make to farmers, the concept of rights being rather abstract. Farmers who contracted fields feel significantly more restricted in all activities except the right to choose the crop they plant. Structural changes, fallowing and subcontracting out the land were usually not possible for these farmers.

In sum, although PA-allocated lands are not "secure" in a truly long-term sense, the security offered by the government is necessarily greater than what farmers can offer each other. Furthermore, most farmers on PA-allocated lands claimed the right to undertake important investments or transfers. Farmers on contracted fields, on the other hand, felt both insecure and unable to undertake major improvements to the fields.
Table 3. Nature of contracts for croplands

<table>
<thead>
<tr>
<th>Nature of contract</th>
<th>PA-allocated</th>
<th>Contracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of years farmer has used this field</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Duration of current contract (% fields)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>One year</td>
<td>0</td>
<td>59</td>
</tr>
<tr>
<td>Two years</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Three or more years</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Indefinitely *</td>
<td>100</td>
<td>35</td>
</tr>
<tr>
<td>Share of fields for which user holds the following right(s):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant whatever crop he wishes</td>
<td>100</td>
<td>99</td>
</tr>
<tr>
<td>Fallow for 1 year</td>
<td>96</td>
<td>48</td>
</tr>
<tr>
<td>Fallow for more than 1 year</td>
<td>95</td>
<td>30</td>
</tr>
<tr>
<td>Plant trees</td>
<td>92</td>
<td>37</td>
</tr>
<tr>
<td>Install a well or pump</td>
<td>77</td>
<td>37</td>
</tr>
<tr>
<td>Build stone bunds</td>
<td>79</td>
<td>54</td>
</tr>
<tr>
<td>Build fence from natural materials</td>
<td>93</td>
<td>59</td>
</tr>
<tr>
<td>Build fence from stone/metal</td>
<td>79</td>
<td>38</td>
</tr>
<tr>
<td>Share out</td>
<td>98</td>
<td>48</td>
</tr>
<tr>
<td>Rent out</td>
<td>97</td>
<td>43</td>
</tr>
<tr>
<td>Lend out</td>
<td>96</td>
<td>43</td>
</tr>
<tr>
<td>Bequeath</td>
<td>99</td>
<td>42</td>
</tr>
</tbody>
</table>

n = 166                                      | 151          |

* Indefinitely here means until next redistribution of land, if any.

Source: ILRI Field Management Survey; Rights Survey.experienced five or more redistributions since their first allocation.

V. CROP PRODUCTION

Given the expense and short-term nature of land contracts used by NPA and MPA members, the question arises as to whether the tenure class of farmers influences the way they manage their crop fields, and if so, how?
1. Input Use

There are few important differences in the use of purchased inputs on the wheat and barley fields between the three tenure classes (Table 4). All households apply the same amount of both human and oxen labor per hectare. The source of this labor varies substantially, however. NPA households, with their relatively smaller workforce and fewer oxen per household (Table 1), substitute gift and exchange labor for scarce household resources. The only notable difference in the application of inputs between tenure classes is the use of fertilizers on wheat fields, where MPA households apply 23% more than the PPA households.

Overall, therefore, there are negligible differences in input use by land tenure class. The total quantities of purchased inputs, human and oxen labor are about the same. The composition of both human and animal labor reflect the relative scarcity of these inputs for NPA households and likewise shows their resourcefulness in coming up with solutions.

2. Crop Yields

Land-contracting households (NPA, MPA) receive substantially lower yields for the key crops—wheat and barley—than the households with only government-allocated lands (PPA). Overall, the general pattern is that NPA households harvest lower yields for the major crops than PPA households, and that MPA households bounce around very erratically. For the major crops, wheat and barley, as the proportion of PA-allocated land increases at the household level, so too do yields per hectare.

---

4 This analysis has been restricted to wheat and barley fields only, which constitute 70% of all plots planted.
Table 4. Input use on wheat and barley fields by tenure class

<table>
<thead>
<tr>
<th>Intensity of input use</th>
<th>Wheat</th>
<th></th>
<th>Barley</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NPA</td>
<td>MPA</td>
<td>PPA</td>
<td>NPA</td>
</tr>
<tr>
<td><strong>Purchased inputs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seed (kg/ha)</td>
<td>233</td>
<td>219</td>
<td>214</td>
<td>232</td>
</tr>
<tr>
<td>DAP Fertilizer (kg/ha)</td>
<td>88</td>
<td>95</td>
<td>77</td>
<td>94</td>
</tr>
<tr>
<td>Herbicides (liters/ha)</td>
<td>0.2</td>
<td><strong>0.1</strong></td>
<td>0.2</td>
<td>0</td>
</tr>
<tr>
<td>Tractor (hr/ha)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Human Labor (days/ha)</td>
<td>56</td>
<td>56</td>
<td>55</td>
<td>52</td>
</tr>
<tr>
<td>HH labor</td>
<td>26</td>
<td><strong>33</strong></td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Hired labor</td>
<td>5</td>
<td>7</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Gift labor</td>
<td>*10</td>
<td><strong>4</strong></td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Exchange labor</td>
<td>15</td>
<td>11</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td><strong>Animal Labor (days/ha)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own animals</td>
<td>*14</td>
<td><strong>40</strong></td>
<td>35</td>
<td><em>13</em>*</td>
</tr>
<tr>
<td>Exchange animals</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Gift animals</td>
<td>35</td>
<td><strong>6</strong></td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>Other animals</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td><strong>Number of households</strong></td>
<td>46</td>
<td>75</td>
<td>40</td>
<td>46</td>
</tr>
</tbody>
</table>

Source: ILRI Production Survey.

Notes: Test of significance
1. between NPA and PPA households: * = prob. < .05.
2. between NPA and MPA households: ** = prob. < .05.
3. between MPA and PPA households: † = prob. < .05.

Given the equal or somewhat higher application of purchased inputs to fields controlled by NPA and MPA households, their tendency towards lower yield implies either poor quality land or poor agricultural practices. The survey data provided mild evidence on the effect of land quality: borrowed fields are less likely to have the rich black soils that characterize much of Ethiopian agriculture. In addition, the problems of sticky soil and waterlogging that decrease yields are somewhat higher on the informally contracted fields used by NPA and MPA households. It is therefore likely that some contracted fields are worse than PA-allocated fields for crop production. Even though NPA and MPA farmers try to compensate with extra inputs, their yields are still
somewhat lower. Furthermore, NPA farmers tend to be younger, with fewer labor and oxen resources per hectare. They are therefore, likely, to be less efficient farmers because of their relative inexperience, their reliance on other people’s labor and oxen, and their obligation to help their parents with plowing and threshing at the same time with when their labor is needed on their own fields. Furthermore, lower fertilizer application rates by PPA households may indicate better land quality. PPA households are cultivating lands which they have come to know over many years and which are likely to help them gain superior yields than the other tenure groups.

3. CROP PROFITABILITY

The patterns of gross returns by crop mirror those for yields. Total costs per hectare, however, vary considerably, with costs for NPA always greater than for MPA and PPA households respectively (Table 6). Most of this difference comes from the higher cost of land used by the land-contracting households (NPA and MPA).

At the household level, there is a distinct increase in net returns as one moves from NPA to MPA to PPA categories reflecting the underlying differences in land area cultivated between these tenure groups (Table 5). However, PPA households have done disproportionately well; for example, PPA returns per household are roughly 3.6 times higher than NPA returns, though they have only 2.3 times more cropped area. Conversely, MPA households have performed relatively poorly, with the greatest cropped area but only intermediate net returns at the household level.

The poor performance of MPA households becomes even more pronounced when net returns are adjusted by farm size or family size. MPA returns per hectare and per person are surprisingly low; although
most of their lands are allocated by the government, their returns are roughly equal to the NPA households, for they entirely rely on imported lands. Even though they started out with greater resources, the gap in net returns between MPA and PPA households is 72% per hectare and 35% per family member, and is statistically significant in both cases. NPA households fall in between these poles and are statistically indistinguishable from MPA households.

What explains the high returns of PPA households and low returns of MPA households, relative to their endowments? In addition to the factors listed above—poorer quality fields, and poorer quality labor and animal inputs (especially for NPA)—the fact that the gap in net returns is greater than the gap in yields indicates that the high cost of land eats away the profits of both NPA and MPA.

Another reason for relatively low returns for MPA households is their particular choice of crops (Table 7). All households allot their largest area shares to wheat. In the case of NPA and PPA households, this was their most profitable crop; whereas, in the case of MPA households, it
was only the third most profitable crop (behind "Other" crops and Horse beans). Similarly, NPA and PPA households had a relatively smaller share of area devoted to the low-earning barley than the MPA households. The reasons why the MPA households selected these particular crops is unclear from the survey data, but the impact of the aggregate returns is distinct.

Table 6. Gross returns, total costs, and net returns by crop and household tenure

<table>
<thead>
<tr>
<th>Crop</th>
<th>NPA</th>
<th>MPA</th>
<th>PPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross returns (ETB/ha)</td>
<td>2633</td>
<td>**2130</td>
<td>±3034</td>
</tr>
<tr>
<td>Wheat</td>
<td>*2830</td>
<td>**2373</td>
<td>±3472</td>
</tr>
<tr>
<td>Barley</td>
<td>1496</td>
<td>1704</td>
<td>2276</td>
</tr>
<tr>
<td>Horse beans</td>
<td>2314</td>
<td>2701</td>
<td>2541</td>
</tr>
<tr>
<td>Fieldpeas</td>
<td>1344</td>
<td>1067</td>
<td>1449</td>
</tr>
<tr>
<td>Other crops</td>
<td>2968</td>
<td>5420</td>
<td>4148</td>
</tr>
<tr>
<td>Total costs (ETB/ha)</td>
<td>*1428</td>
<td>**963</td>
<td>960</td>
</tr>
<tr>
<td>Wheat</td>
<td>*1441</td>
<td>**1101</td>
<td>990</td>
</tr>
<tr>
<td>Barley</td>
<td>1013</td>
<td>933</td>
<td>888</td>
</tr>
<tr>
<td>Horse beans</td>
<td>1257</td>
<td>1085</td>
<td>1010</td>
</tr>
<tr>
<td>Fieldpeas</td>
<td>1388</td>
<td>624</td>
<td>552</td>
</tr>
<tr>
<td>Other crops</td>
<td>1518</td>
<td>**831</td>
<td>778</td>
</tr>
<tr>
<td>Net returns (ETB/ha)</td>
<td>*1184</td>
<td>1107</td>
<td>±2035</td>
</tr>
<tr>
<td>Wheat</td>
<td>*1388</td>
<td>1272</td>
<td>±2482</td>
</tr>
<tr>
<td>Barley</td>
<td>483</td>
<td>770</td>
<td>±1388</td>
</tr>
<tr>
<td>Horse beans</td>
<td>1057</td>
<td>1615</td>
<td>1532</td>
</tr>
<tr>
<td>Fieldpeas</td>
<td>(44)</td>
<td>443</td>
<td>897</td>
</tr>
<tr>
<td>Other crops</td>
<td>575</td>
<td>1740</td>
<td>2082</td>
</tr>
<tr>
<td>Net returns (ETB)</td>
<td>Per household</td>
<td>*801</td>
<td>**2104</td>
</tr>
<tr>
<td></td>
<td>Per family member</td>
<td>640</td>
<td>588</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>46</td>
<td>75</td>
</tr>
</tbody>
</table>

Source: ILRI Production Survey.

Notes: Test of significance
1. between NPA and PPA households: * = prob. < .05.
2. between NPA and MPA households: ** = prob. < .05.
3. between MPA and PPA households: ± = prob. < .05.

Family size = no. of adult males + (0.75 x no. of adult females) + (0.5 x no. of children)
Gross revenues include the value of crops and residues.
Figures in parentheses are negative values.
VI. LAND MANAGEMENT

There are distinct differences in the security and rights of the arrangements by which the different tenure classes obtain. Such differences have also resulted in mild differences in crop choice, yields and net returns. Since few of the major inputs are long term in nature; however, the short-term nature of land contracts can have an influence on the longer term actions farmers take to protect their fields, such as solving long-standing crop problems, preventing erosion, and planting trees.

1. Farming Problems

Table 8 lists the most serious farming problems, cited by the farmers, for each fields surveyed; rented, shared and borrowed fields have been grouped together under the ‘Contracted’ column for comparison with the PA-allocated fields. In general, the nature of a farmer’s access to a field has little relation to the type of problem he faces.

Damage by wild animals, soil infertility, waterlogging and pests are the most serious problems faced on both informally contracted and PA-allocated fields.

Secondary problems cited were water erosion, distance from home, and lack of inputs. Statistically, there is no significant difference in any of these problems between the informally contracted and PA-allocated fields.

Regarding the nature of the constraints they faced in solving their most pressing field problems, farmers gave three kinds of responses.

1. Personal factors that pertain to the specific circumstances of that particular farmer, such as lack of resources like time or money;
Table 7. Crop choice by household tenure class

<table>
<thead>
<tr>
<th></th>
<th>NPA</th>
<th>MPA</th>
<th>PPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of planted area (%)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Wheat</td>
<td>66</td>
<td>**45</td>
<td>185</td>
</tr>
<tr>
<td>Barley</td>
<td>16</td>
<td>**35</td>
<td>121</td>
</tr>
<tr>
<td>Horse beans</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Fieldpeas</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Other crops</td>
<td>11</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Number of households</td>
<td>46</td>
<td>75</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: ILRI Production Survey.

Notes: Test of significance
1. between NPA and PPA households: * = prob. < .05.
2. between NPA and MPA households: ** = prob. < .05.
3. between MPA and PPA households: † = prob. < .05.

Table 8. Farming problems and constraints by contract type

<table>
<thead>
<tr>
<th>Field problems and management</th>
<th>PA-Allocated fields</th>
<th>Contracted fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most serious problem on field</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Wild animals</td>
<td>24</td>
<td>19</td>
</tr>
<tr>
<td>Soil infertility</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Waterlogging</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Pests/rats/ants</td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>Weeds</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Water erosion</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Distance from home</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Sticky soil</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Lack of inputs</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Other problems</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Fields for which farmers felt constrained at solving problem (%)</td>
<td>28</td>
<td>33</td>
</tr>
</tbody>
</table>

Nature of constraint
- Personal factors: 72, 42
- Social factors: 24, 10
- Land insecurity: 3, 48

Problems constrained by insecurity
- Soil infertility: 100, 53
- Wild animals: 0, 27
- Waterlogging and sticky soil: 0, 14
- Distance: 0, 7

Note: Contracted fields includes borrowed, gift, shared and rented fields.
2. Social factors that generally affect many people in the community simultaneously, such as poorly functioning input markets; and
3. Land tenure insecurity, which specifically relates to the short-term nature of a farmer’s hold on the field in question.

Although the mode of access to land did not influence the share of farmers’ feelings but somehow constrained in solving their problem(s) (33% for contracted fields and a slightly lower 28% for PA-allocated fields), it greatly influenced the way they described that constraint. Although the security of lands allocated by the PAs is somewhat uncertain because the government might redistribute at any time, farmers of such lands only cited land insecurity as a problem on 3% of their fields, feeling rather more constrained by personal and social factors. On the informally contracted fields, land insecurity was much more of a problem. On nearly half of these fields land insecurity was the major factor preventing them from solving their most serious problem. Land insecurity seemed particularly to hinder efforts to improve soil fertility, although some farmers linked it to problems of distance, waterlogging, and difficulties in controlling wild animals. Thus, facing roughly the same problems, farmers feel different constraints, depending on the of lands they hold. To the extent these constraints translate into long-run land management strategies, PA farmers may take better care of PA-allocated lands than lands under short-term informal contracts.

2. Land Improvement Practices

Tiyo Woreda has very good cropping conditions with good soils and a far more even terrain than most of the Ethiopian highlands. The topographical positions of the fields is most suitable for crop farming, since 72% of the fields were found on flat or gentle slope lands, with no significant difference between the PA and contracted fields. However, black soil, which is said to be fertile, is the dominant soil on
PA-allocated fields (61%) than on contracted fields (43%), and this in part could be the reason for the relatively higher yields of PA lands, or the higher cost of production on contracted fields.

There are relatively low rates of erosion in the area, with only 24% of the fields surveyed showing signs of gully or sheet erosion. In general, there was no difference in rates of erosion between PA-allocated and contracted fields. Of the various sub-categories of contracted fields, shared and borrowed fields were somewhat more likely to show signs of gully or sheet erosion than the rented ones, as they were particularly more likely to be found on slopping lands. Although it was not possible to conclude from the data whether the farming practices of sharecroppers or borrowers caused this erosion, it is rather likely that landholders lend out or give as a gift relatively inferior fields, rather than use it themselves.

3. TREE PLANTING

In terms of trees, there was no difference in the probability of having a tree on a PA-allocated or a contracted field. The average number of trees, regardless of species, was higher on PA-allocated fields. By far the most common tree was eucalyptus; 14% of all fields had at least one eucalyptus tree. The average number of eucalyptus trees per hectare on the PA-allocated fields was 191 versus 13 for contracted fields. Restricting the analysis to only those fields that had such trees, the average number was 613 for PA-allocated fields versus 54 for contracted ones. There were only four trees of other species per hectare.

For the most part, eucalyptus trees were planted by the current (45%) or past (35%) owners. However, in 18% of the cases, they were planted by the farmer contracting in the field, primarily by borrowers with longer term contracts and family ties to the landholders. Farmers
overwhelmingly prefer to plant eucalyptus on their homesteads (77%). Only 11% reported planting trees on their fields, another 8% planted in both places, and the rest planted trees elsewhere altogether. When asked why they preferred homesteads, most cited reasons such as avoiding animal damage, ease of watering, and the desire for shade or windbreak. Only one-fifth said they avoided planting on fields for fear of losing the land.

When eucalyptus trees are planted on fields, they are usually planted on the border, perhaps to delineate the boundary but more likely to decrease competition with crops and for ease of farming (eucalyptus is known for its thirsty nature). In general, there is a very low rate of tree planting on fields by all farmers and almost none on informally contracted fields.

VII. SUMMARY AND CONCLUSION

This study has shown that in Ethiopia a stagnant land distribution system in the absence of a sanctioned land market has given rise to a landless class of rural dwellers and to an informal market of farmer-to-farmer land contracts. Because all farmers can obtain land through these informal markets, it is possible to identify three land tenure classes in relation to the amount of PA-allocated land they hold: NPA, MPA and PPA households. NPA farmers rely primarily on borrowed lands from their parents, whereas MPA farmers are more likely to depend on the more expensive renting or sharecropping arrangements.

Certain patterns arise in crop farming depending on a household’s tenure status. PA members who farm only PA-allocated lands (PPA) receive higher yields, face zero land cost, spend many years getting to know the attributes of their fields, and consequently receive higher returns per
household, per hectare and per family member than the other two tenure classes. Conversely, farmers who have not yet become members of the PA, and cultivate only those lands they can informally contract from their neighbors have low yields, high land costs, short-term horizons, and low returns per household and hectare. These NPA households are not particularly disadvantaged, however. In spite of the lack of land and oxen, they manage to devise contracts that help them attain roughly the same returns per family as the other tenure classes.

In terms of crop farming, the enigmatic class is those of farmers who are PA-members and decide to expand their farming operations by informally contracting at least one additional field. Oxen rich, they embark on the crop season with slightly lower workforce in relation to their farm size. They apply roughly the same levels of inputs per hectare as the other groups, but harvest relatively less. Facing moderate land costs (not as high as NPA households because much of the MPA portfolio is made up of free PA-allocated land), the MPA households have poor net returns, particularly per hectare and per family member. Nevertheless, adding extra fields adds extra output. Possibly these households have unemployed labor to employ (such as grown up sons who do not possess land) and are willing to permit that labor to farm less efficiently. The less profitable crop choice expressed by these households may reflect other criteria, such as producing residues for animal feed.

Using these kinds of descriptive analyses, it is difficult to ascertain to what extent these differences in yields and profitability between tenure classes are due to land insecurity, land quality, or other household attributes associated with land tenure status, such as age and experience. Furthermore, not all farmers depend on cropping to the same extent. NPA households may be distracted by their studies, whereas MPA households may divert their efforts to livestock raising.
In terms of agricultural sustainability, the results from this study are more ambiguous. The evidence on crop choice suggests that nitrogen-fixing crops are seldom planted by any farmer, regardless of field or household tenure status; again, tree planting is rare, regardless of farmer's tenure class. Despite the feelings of insecurity, actual practices do not show significant differences among tenure classes in their land improvement practices. To the extent that perceived constraints translate into long-term land management strategies, however, farmers may take better care of land allocated by the government than lands under short-term informal contracts.

Ultimately, all rural holdings in Ethiopia are insecure. Government-allocated lands are somewhat more secure, but can be redistributed at any time. Lands transacted between farmers are under short-term informal contracts with no legal standing. Given the general insecurity, it is therefore not surprising that there are only slight differences in how farmers of different tenure classes farm those lands. As is evident from the cropping patterns, farmers focus on short-term return maximization, rather than crop rotations that may be more profitable in the long-run. If the government wants to avoid privatizing of rural lands, the land policy for smallholders could be designed to assure a basic level of security. For example, there could be fixed periods between distributions and a formal legal standing granted to farmer-to-farmer contracts made within that period. All efforts should be made to keep land transactions dynamic—to improve efficiency and make redistributions fair—to equalize land costs.

These analyses are only descriptive and cannot be extrapolated beyond the boundaries of the study region. Furthermore, this study cannot be used to evaluate the efficiency or sustainability of the overall land tenure system in Ethiopia. It can only be used to evaluate the players and relative productivity of land contracts within that system. On the whole,
however, this analysis suggests that farmers do find creative and productive ways to arrange their limited agricultural inputs, including land.

REFERENCES


I. INTRODUCTION

Many agricultural policy decisions in sub-Saharan Africa (SSA) are affected by the belief that land must be privatized or that people should have exclusive and secure rights over their landholdings (e.g., titled lands). An important argument in favor of land reforms is that farmlands held under exclusive and secure land rights are more efficient than under other forms of rights. If true, then reforms to title lands or individualize land rights should improve efficiency. The hypothesized greater efficiency of privatized lands, however, may be an illusion if other public policies such as provision of rural infrastructure, promotion of market efficiency, dissemination of new information technologies, and access to credit are not in place (Atwood, 1990). From a public policy viewpoint, better information on the relative efficiency of farmlands under different tenure contracts would provide a better indication of how land tenure systems affect resource use and thereby the overall productivity of farming operations. If one can measure the relative efficiency of alternative land tenure systems, then it is possible to determine the productivity gains possible through land reforms. If land
Relative Efficiency of Alternative Land Tenure Contracts

tenure arrangements are the major sources of differences in productivity, then efforts to develop technologies will be secondary to land reform policies.

Although the question of relative production efficiency of indigenous land rights is central to a discussion of land reform in SSA, there is little empirical research owing to lack of adequate disaggregated data. With the exception of few studies (e.g., Place and Hazell, 1993; Besley, 1994; Gavian and Fafchamps, forthcoming), the subject has not benefitted from rigorous empirical analysis. Furthermore, most studies have covered only areas of rain-fed agriculture. Questions remain about the suitability of indigenous land rights for irrigated farming, extensive pastoral and livestock-based systems, and communal forestry areas (Place and Hazell, 1993).

The objective of this paper is to examine the relative efficiency of alternative land tenure arrangements using a single region in Ethiopia as a case study. In 1974 the country nationalized rural lands, i.e., redistributing land use rights "to-the-tillers" but maintaining land ownership in the hands of the state—land sales were outlawed. Tenancy relations, such as sharecropping and renting were prohibited. In recent years, the restrictions on informal land transactions have been lifted and there are currently an array of formal and informal means by which farmers can obtain land. The varying degrees of security and rights associated with these arrangements make Ethiopia appropriate for a case study of differences in efficiency with land tenure.

The current study differs in several ways from similar studies by Place and Hazell (1993), Gavian and Fafchamps (forthcoming) and Besley (1994). First, it focuses on a farming system in which livestock contribute 40% of the country’s agricultural gross domestic product and provide most of the power for plowing and threshing. Second, the data
used for the analysis were highly detailed, based on short-term (3-day) recall and measured yields, rather than end-of-season recall and qualitative measures. Unlike most other studies, labor hours per plot were collected. Finally, where most studies have attempted to gauge efficiency from econometric estimation of reduced-form production functions, this analysis relies on the concept of interspatial total factor productivity (TFP) as defined by Denny and Fuss (1980 and 1983). The TFP methodology is well-suited to the complexity and diversity of smallholder farming because it summarizes across fields with varying inputs and outputs. The use of indexing methods permits comparisons across systems with multiple outputs. Thus, while controlling differences in input levels, we can examine differences in the output of land under different arrangements.

Contrary to what is popularly predicted in the land tenure literature in Sub-Saharan Africa (SSA), there can be found no evidence of major differences in efficiency between informal contractual tenure arrangements and the more formal government-allocated lands. The difference in land productivity levels among the various land tenure contracts is attributed to differences in factor intensities. For this reason, no empirical basis could be found to support the hypothesis that land tenure is a constraint to productivity. This suggest that informal tenure arrangements should be given a stronger legal basis in order to increase their security and rights and facilitate overall factor mobility.

II. LAND TENURE ISSUES IN SUB-SAHARAN AFRICA

Despite the large body of literature, the degree to which the prevailing land tenure contracts constrain agricultural productivity in SSA is unresolved. Some authors argue that informal contractual tenure arrangements (e.g., tenancy or sharecropping) and other forms of
indigenous land tenure rights result in an inefficient allocation of resources as well as reduced incentives to improve agricultural lands (Hayami and Otsuka, 1993). The argument is that land tenure arrangements that assign land rights either to the community or to a landlord rather than to the principal land user discourage long-term investment in land improvements. Individual farmers, not having secure private rights to the land, thus may not be able to claim fully the returns on their investment. To the extent that investments are required for conservation purposes, informal contractual tenure arrangements may also promote land degradation. According to this school of thought, reforms such as privatization or individualized land rights, the abolition of sharecropping and land redistributions are viewed as policy instruments that can improve agricultural productivity (Ip and Stahl, 1978; Dorner, 1977; Harrison, 1987).

Other authors, however, argue that the form of land tenure has little bearing upon allocative efficiency, and attribute the poverty of the agricultural sector in SSA to agricultural factor endowments and public policies rather than to the prevailing tenure arrangements. This second school of thought cites evidence that indigenous tenure arrangements are dynamic and evolve in response to population pressure and factor price changes. They argue that privatization of land rights, whereby farm households acquire a complete set of transfer and exclusive rights over land, occurs with increases in population pressures and agricultural commercialization (Cohen, 1980; Boserup, 1981; Noronha 1985; Platteau 1996). Place and Hazell (1993) found that land rights were not significantly related to yields in Ghana, Kenya and Rwanda, thus undermining the conventional view that land rights constrain agricultural productivity. Gavian and Fafchamps (1996) tested whether traditional land tenure systems in Niger allocate land efficiently and whether insecurity affects the manner in which households allocate manure (a short-to-medium run land improvement strategy) among fields. They
found evidence that tenure insecurity incites farmers to divert soil-enhancing resources to more secure fields whenever possible. The ability to sell land, however, does not effect the allocation of these resources.

III. THE CONCEPTUAL FRAMEWORK

Most productivity analyses are based on partial productivity measures such as yield per hectare (land productivity) or output per person (labor productivity). Such productivity measures can be misleading if considerable input substitution occurs. Although partial productivity measures provide insights into the efficiency of a single input in the production process, they mask many of the factors accounting for observed productivity differentials.

A conceptually superior way to estimate productivity as well as efficiency is to measure TFP. TFP is defined as the ratio of aggregate outputs to aggregate inputs used in the process of agricultural production. There are two basic approaches to the measurement of productivity: the growth accounting approach, which is based on index numbers, and the parametric approach, which is based on an econometric estimation of production, cost or profit functions. In this paper the index number approach is used for three reasons. First, with the index number approach, detailed data with many input and output categories can be used, regardless of the number of observations over time. There are therefore no problems of degrees of freedom or statistical reliability in working with small samples. Second, there is no need to aggregate outputs into a single index, thus avoiding input-output separability assumptions. Finally, under certain technical and market conditions, the econometric and index number approaches are equivalent. Recent advances in growth accounting theory have shown

The major difficulty with the index number approach is to derive aggregate output and input measures that represent the numerous outputs and inputs involved in most production processes. Earlier approaches to TFP used a Laspeyres or Paasch weighting system where base period prices were used as aggregation weights. However, the Laspeyres or Paasch indexing procedure is inexact except when the production function is linear and all inputs are perfect substitutes (Christensen, 1975; Diewert, 1976). The most popular indexing procedure is the Divisia index, which is exact for the case of homogenous translog functions (Capalbo and Antle, 1988). The translog function does not require inputs to be perfect substitutes, but rather permits all marginal productivities to adjust proportionally to changing prices. Hence the prices from both production systems being compared enter the Divisia index to represent the differing marginal productivities. There have been relatively few applications of this approach in the context of farming systems. Ehui and Spencer (1993) have used the Divisia approach to TFP to measure the sustainability and economic viability of alternative farming systems in Nigeria.

1. **Interspatial and Intertemporal Total Factor Productivity Measures**

Assume that the agricultural process in land held under tenure system \( i \) at time \( t \) can be represented by the production function:
\[ Q_{it} = F(X_{it}, T_{it}, D_i) \] (1)

where \( Q_{it} \) is the output level, \( X_{it} \) is a vector of factor inputs, \( T_{it} \) is an index of technology, and \( D_i \) a vector of dummy variables for every tenure system other than the reference base system.\(^1\) \( T_{it} \) and \( D_i \) denote also intertemporal and interspatial efficiency difference indicators. Equation 1 assumes that the production function in each tenure system has common elements as well as differences resulting from the tenure arrangement, which are maintained by the additional argument \( D \).

Suppose that we wanted to know the difference between the level of output on land held under tenure system \( i \) at time \( s \), and land held under tenure system \( o \) at time \( t \). Application of Diewert’s (1976) quadratic lemma\(^2\) to a logarithmic approximation of 1 gives:

\[ \Delta \ln Q = \ln Q_{is} - \ln Q_{ot} = \frac{1}{2} \sum_k \left[ \frac{\partial \ln F}{\partial \ln X_k} \bigg|_{x_k = x_{wir}} + \frac{\partial \ln F}{\partial \ln X_k} \bigg|_{x_k = x_{wor}} \right] \\
+ \frac{1}{2} \left[ \frac{\partial \ln F}{\partial D_i} \bigg|_{i} + \frac{\partial \ln F}{\partial D_o} \bigg|_{o} \right] [D_i - D_o] \\
+ \frac{1}{2} \left[ \frac{\partial \ln F}{\partial \ln T} \bigg|_{T=T_{is}} + \frac{\partial \ln F}{\partial \ln T} \bigg|_{T=T_{ot}} \right] [\ln T_{is} - \ln T_{ot}] \] (2)

Let us define the interspatial effect as:
and the intertemporal effect as:
Constant returns to scale and perfect competition in input and output

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\(^1\) This section is based on Denny and Fuss (1980, 1983).

\(^2\) Diewert’s (1976) quadratic lemma basically states that if a function is quadratic, the difference between the function’s values evaluated at two points is equal to the average of the gradient evaluated at both points multiplied by the difference between the points:

\[ F(Z^1) - F(Z^0) = \frac{1}{2} [F(Z^1) + F(Z^0)]^T (Z^1 - Z^0) \]

where \( F(Z) \) is the gradient vector of \( F \) evaluated at \( Z^r \), \( r = 0,1 \).
markets imply that

\( (\partial \ln F / \partial \ln X_k) = s_k \), where the term \( s_k \) represents the cost share for the \( k^{th} \) input. Using these assumptions, we can rewrite Equation 2 as:

\[
\Delta \ln Q = \frac{1}{2} \sum_k \left[ s_{kis} + s_{kot} \right] [\ln X_{kis} - \ln X_{kot}] + \theta_{i0} + \mu_{st} \tag{5}
\]

From Equation 5 it can be observed that the output differential across tenure systems and time periods may be broken down into an input effect, a tenure system effect and an intertemporal effect.

Let \( A \) denote the land input. Equation 5 can be rewritten as:

\[
\Delta \ln \left( \frac{Q}{A} \right) = \frac{1}{2} \sum_{k \neq A} \left[ s_{kis} + s_{kot} \right] \left[ \ln \left( \frac{X_{kis}}{A_{is}} \right) - \ln \left( \frac{X_{kot}}{A_{ot}} \right) \right] + \theta_{i0} + \mu_{st} \tag{6}
\]

where \( \Delta \ln (Q/A) \) denotes the change in land productivity levels.\(^3\) The first expression on the right hand side of Equation 6 denotes the weighted sum of differences in factor intensities. Let us define this expression as:

\(^3\) Dividing by \( A \) is the equivalent of presenting agricultural data on a per unit area basis (e.g., per hectare or acre). The final TFP figures are the same whether or not land is used as a numeraire, but the interpretation of the components does not correspond to those described in Equation 8.
The difference in land productivity can therefore be decomposed into three effects: (i) a factor intensity effect $\rho_{io}$; (ii) a tenure system effect $(\theta_{io})$, and (iii) an intertemporal effect $(\mu_a)$. If we want to measure the efficiency levels across tenure systems at a given point in time (where $t=s$), we rearrange the terms to isolate the tenure effect:

$$
\theta_{io} = [\ln(\frac{Q_i}{A_i}) - \ln(\frac{Q_o}{A_o})] - \frac{1}{2} \sum_k [S_{ki} + S_{ko}] [\ln(\frac{X_{ki}}{A_i}) - \ln(\frac{X_{ko}}{A_o})]
$$

The expression $\theta_{io}$ is the Tornqvist-Theil approximation (Tornqvist, 1936; Capalbo and Antle, 1988) to the change in productivity levels as a result of the type of tenure contract at a particular point in time. The difference in the TFP of two systems is a function of the differences in land productivity differential and factor intensities.

In the case of multiple outputs, the Tornqvist-Theil quantity index can also be used to aggregate the various outputs into a single index:

$$
\left[\ln(\frac{Q_i}{A_i}) - \ln(\frac{Q_o}{A_o})\right] = \frac{1}{2} \sum_j [r_{ji} + r_{jo}] \left[\ln(\frac{Q_i}{A_i}) - \ln(\frac{Q_j}{A_j})\right]
$$

where $r_{ij}$ and $r_{jo}$ denote the $j^{th}$ output revenue share in systems $i$ and $o$ respectively. $Q_j$ denotes the $j^{th}$ output level.

Equation 8 indicates that there are two components that contribute to any observed differences in TFP—differences in the level of land productivity and differences in factor intensities. TFP is therefore the residual or the portion of change in output levels not explicitly explained by changes in input levels; however, increases in factor intensities may occur without any increases in TFP. Changes in TFP levels and factor
intensities are not independent but they are of different significance. Increases in TFP will occur if land productivity increases comparatively more than increases in factor intensities.

But increases in land productivity that are due to increases in factor intensities are qualitatively (although not quantitatively) less significant than changes in TFP. Indeed land productivity will increase if a farmer applies more purchased inputs. Unless there are improvements in the use of these inputs, this will be a change in factor intensity and not TFP. It is clear that with TFP changes, in contrast with factor intensity differentials, the farmer’s capability to produce more with the same resources has improved.

Although this study focuses on only one time period, the general expression shown in Equation 6 can be specialized to provide a comparison of the rate of growth of productivity as a result of technical change for a particular system over time ($D_i = D_0$ and $s=t+1$):

$$\mu_{t+1,t} = [\ln(Q_{t+1}/Q_t) - \ln(A_{t+1}/A_t)] - \frac{1}{2} \sum_{k=1}^{N} \left[ s_k, t+1 + s_k, t \right] \left[ \ln \left( \frac{X_{k,t+1}}{A_{t+1}} \right) - \ln \left( \frac{X_{k,t}}{A_t} \right) \right].$$

(10)

$\mu_{t+1,t}$ measures the intertemporal TFP of a production system over two periods. It is the Tornqvist-Theil approximation to the change in productivity levels due to technical change.

IV. THE STUDY AREA AND DATA COLLECTION

For the last two decades in Ethiopia, all rural lands have been owned by the government in the name of the people. Lands were nationalized in a country-wide campaign in 1975, expropriated from both large
landlords and small peasant farmers alike. Control over this resource was given to the representatives of lowest level of government, the Peasant Associations (PAs). PA officials periodically redistributed land between households based primarily on family size. To be eligible for land at the time of the next distribution, a farmer was required to register with the PA at age 18 or when he gets married. When the Transitional Government of Ethiopia took power in 1991, it imposed a moratorium on land distributions until such time as a new land policy was formulated. Although the Constitution of 1994 reiterated the inability of private citizens to own or sell land, the question of land distribution remained vague. To this day, this policy has yet to be clarified, although some regions of the country have undertaken or are planning rural land redistributions. The International Livestock Research Institute (ILRI) conducted a study in 1994 to present evidence on ways farmers in the Ethiopian highlands gain access to land and the production and management strategies they use to cultivate and maintain that resource.

1. The Study Area

The study area was selected from one of the most productive regions of the country, the Arsi Zone of Oromia Region. Four peasant associations in the Tiyo woreda—Abichu, Bilalo, Ketar Genet and Mekro Chebote—were selected for their varying altitudes and thus mix of crop and livestock activities. A census conducted in March 1994 provided a sampling frame for classifying households based on their official access to state lands. Households classified as peasant association members

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4 The original law does not distinguish between men and women. In practice, however, women are usually registered as independent PA members and allocated land in their names when, for some reason, they cannot depend on their spouse for land, as with widows, divorcees and wives in polygamous marriages.

5 For a more thorough description of the recent evolution of land tenure legislation in Ethiopia, see Girma and Zegeye (1995).
(PA) were those who had received at least one crop or pasture field from the government. The second tenure class was made up of households who had not yet acquired either crop or pastureland from the government (NPA) but were farming land acquired from their PA neighbors through various informal contracts. The census indicated that in the total farming population of 1671 households, 83% were PA members and the other 17% were not. To determine the appropriate sample size for both the PA and NPA samples, the Weyman procedure (Cochrane 1963) was applied to gauge the variability of the key agricultural variables in the census data by tenure class. Based on these results, a random sample of 161 households was selected from the census list, composed of 115 PA and 46 NPA households.

These households controlled 510 crop fields from which a final sample of 317 crop fields was selected. Each of the sampled crop fields were subdivided where necessary, into plots, where a plot was defined as a distinct management unit because of the farmer’s choice to plant a unique crop or intercrop there. Not only were crops such as barley, wheat, tef (*Eragrostis tef*), etc., distinguished from one another, but so too were the subvarieties within these categories. Some fields were made up of only one plot, while others had as many as 10 plots. The sampled crop fields contained 477 separate plots for which the following data were collected:

*Input data* on all inputs used on each plot during the 1994 main growing season (from April to December 1994). These were collected twice weekly by asking the farmer to recall his activities on that particular plot during the past three days. Data included labor time (by source, gender, age, and field operation), as well as the quantities of traction (oxen and tractors), seed, fertilizers, pesticides, and herbicides employed. The prices of all purchased inputs were likewise recorded at this time.
Output data on all the quantity of all cereals, pulses, and residues harvested from each plot on the field. The full amount of offtake was weighed by enumerators after threshing and winnowing operations.

Plot Areas, measured in hectares.

In a separate survey, the prices of all crops and residues were collected in each of the two major rural markets frequented by farmers from these PAs: Asela and Ketar Genet markets. Twice monthly, enumerators recorded prices from three samples of each crop species and subvarieties found on the sampled plots.

2. Description of Land Contracts in the Survey Region

There are many arrangements under which farmers gain access to croplands in Ethiopia. As stated above, the only official contract is with the government, through the PA. There are also numerous informal contracts, made unofficially between farmers without involving the PA. Whereas patterns of land transactions vary greatly between regions of the country, the census results indicated that in 1994, in Tiyo woreda, 76% of all fields were allocated directly by the PA to the current farmer. The remaining 24%, originally allocated to PA members, had been informally subcontracted to other farmers.

NPA farmers rely solely on informal contracts whereas PA farmers rely on both formal contracts with the government and informal contracts among themselves. The census indicated that over one-fifth of the PA households exported, or contracted out, one of their fields and about the same proportion imported, or contracted in, at least one field. A very small proportion (2%) of them both imported and exported land, perhaps
Relative Efficiency of Alternative Land Tenure Contracts

to lessen the distances they had to walk to their fields. Over half of the PA households farmed uniquely the lands they had been allocated by the PA. Based on differences in the nature of these contracts—in terms of duration, rights and costs—all the fields were grouped into one of four categories: PA-allocated, rented, sharecropped, and borrowed.

PA fields are those allocated directly to the farmer by PA officials. Because no farmer has a permanent, legally defensible claim to land, even the duration of PA contracts are fairly short term. However, PA-allocated fields are held longer and have a greater range of rights than the informally contracted fields. The average PA-allocated field had been used by the current farmer two and a half to four times longer than the average contracted field. Furthermore, the duration of the current contract on PA-allocated fields is indefinite, whereas most contracted fields have only one year contracts (Table 1).

Most farmers on PA-allocated fields felt able to exercise most of the usufruct rights shown in Table 1. About one-fifth felt they could not build wells, stone bunds or permanent fences of metal or stone, but these responses may reflect more their desire rather than their right (the distinction is difficult to make to farmers, the concept of rights being rather abstract). In contrast, farmers on the informally contracted fields feel substantially more restricted in all activities except the right to choose the crop they plant. Structural changes, fallowing and subcontracting out the land were usually not possible for farmers with informal land contracts.

Although PA members are required to pay taxes, that tax is unrelated to the amount of crop or pasture land they receive. In 1994, PA members were taxed ETB (Ethiopian Birr) 22 per household, which, at an average holding of about 2.9 ha, equals about ETB 7.5 (or USD 1.20) per hectare. Essentially, therefore, PA-allocated lands are free.
Rented fields are those for which a fixed cash sum is paid usually in advance by the tenant to the landholder. The renter-tenant pays for all the inputs and reaps all the benefits (or losses) of his cropping activities. Of the informally contracted fields, rented fields have the shortest leases. The average renter operated under a one-year agreement that was less often extended than agreements established by borrowers or sharecroppers, as indicated by the number of years the field had actually been used in Table 1. As on all informally contracted fields, the range of use and modification rights is more restricted on rented fields than it is on PA-allocated fields. As compared with the other contracted fields, however, renters have the broadest range of rights (Table 1). They also are the most likely to have a written contract. The average cost for renting a field in the survey area was ETB 352 per hectare in 1994 (USD 56). Rented fields made up about 8% of all cropped lands in Tiyo Woreda in 1994 and 33% of the area’s contracted fields.

Sharecropped fields involve a commitment by both partners to share the costs of the inputs and the benefits of the outputs. Sharecropped fields are held somewhat longer than rented fields, with 23% under long-term agreements and an average holding time of three years. The reverse is true in terms of rights; the considerably more restricted range of rights on sharecropped than rented fields reflects the lack of autonomy for the share-tenant in this partnership. In the survey year, the cost of the sharecropped contract was two and a half times greater than that of rented fields (Table 1). After deducting the landholder’s share of all labor and inputs from his share of the outputs, the average cost of a

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6 Equi and Siso are local names of the two most common contracts, meaning equal sharing and one-third share, respectively. Under either contract, most labor is provided by the share-tenant. In spite of these simplified names, there are numerous permutations on these arrangements, based on the specific endowments of the two contracting partners.
sharecropped contract was ETB 935 (USD 148) per hectare\(^7\). Sharecropped fields made up 4% of all cropped lands in Tiyo Woreda in 1994 and 17% of the area’s contracted fields.

Borrowed and Gift fields are those given by the landholder to the user free of charge. Borrowed fields are given for a defined period, whereas gift fields are usually given for a longer, but indefinite period (i.e., until the next land distribution). Both types of fields are almost always given by relatives, usually by parents who give out part of their holdings to their newly married family members. As offsprings or relatives of the landholder, many of these farmers contributed labor to the landholder’s fields. These contributions were difficult to monitor and have not been valued here. Because the basic attributes of gift and borrowed fields are very similar, they have been combined under the same rubric in this analysis (borrowed/gift). The duration of the average borrowed/gift contract comes closest of all the three informal contracts to the PA-allocated fields, with the 81% of the users fully operating under a long-term arrangement (Table 1). Borrowed/gift fields had an average holding time of three years and, as relatives, the two parties rarely require a written document. The range of rights, however, is quite restricted—roughly the same as sharecropped fields, more restricted than rented fields, and much more restricted than PA-allocated fields. As with shared fields, these restrictions represent the partnership underlying the borrowing arrangement, in this case between family members. Borrowed/gift arrangements are fairly common, making up 12% of all cropped lands and half of all contracted fields in 1994.

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\(^7\) Note that 1994 was a good crop year in the Arsi Region and, therefore, the cost of the average share contract was higher than usual.
Table 1. Frequency and nature of land contracts

<table>
<thead>
<tr>
<th></th>
<th>PA-Allocated</th>
<th>Informally-Contracted</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Rented</td>
<td>Shared</td>
</tr>
<tr>
<td>No. years field used by current</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Duration of current contract (%)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>One year</td>
<td>0</td>
<td>91</td>
</tr>
<tr>
<td>Two years</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Three or more years</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Permanent/Indefinite</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>Proof of contract (% fields)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>None required</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Witnesses required</td>
<td>100</td>
<td>8</td>
</tr>
<tr>
<td>Written contract</td>
<td>0</td>
<td>65</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Share of fields for which user holds the following right (%):</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Plant whatever crop he</td>
<td>100</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>Fallow for 1 year</td>
<td>96</td>
<td>87</td>
<td>16</td>
</tr>
<tr>
<td>Fallow for more than 1 year</td>
<td>95</td>
<td>64</td>
<td>13</td>
</tr>
<tr>
<td>Plant trees</td>
<td>92</td>
<td>75</td>
<td>19</td>
</tr>
<tr>
<td>Install a well or pump</td>
<td>77</td>
<td>75</td>
<td>19</td>
</tr>
<tr>
<td>Build stone bunds</td>
<td>79</td>
<td>82</td>
<td>35</td>
</tr>
<tr>
<td>Build fence from natural</td>
<td>93</td>
<td>89</td>
<td>55</td>
</tr>
<tr>
<td>Build fence from stone/metal</td>
<td>79</td>
<td>68</td>
<td>32</td>
</tr>
<tr>
<td>Share out</td>
<td>98</td>
<td>64</td>
<td>6</td>
</tr>
<tr>
<td>Rent out</td>
<td>97</td>
<td>62</td>
<td>6</td>
</tr>
<tr>
<td>Lend out</td>
<td>96</td>
<td>61</td>
<td>6</td>
</tr>
<tr>
<td>Bequeath</td>
<td>99</td>
<td>68</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: ILRI Field Management Survey; Rights Survey.
Notes: 'Permanent', in the case of contract duration, means that the two parties will honor the agreement until the government intervenes with another distribution.

3. Defining Security

Theory suggests that farmers will be reluctant to invest in insecure fields. But the concept of security is complex and elusive, depending largely on a farmer’s subjective assessment of the political and legal
climate. Bruce et al. (1994) describe security in terms of the formal duration of rights, the protection of rights and the robustness of rights. The analysis by Place and Hazell (1993) employs qualitative variables to represent tenure security in terms of bundles of transfer rights—limited, cannot be permanently transferred; preferential, can be bequeathed or given; and complete, can be sold. Besley (1994) measures land tenure security in terms of two variables—the number of transfer rights the farmer can exercise without approval from the family members and the number of transfer rights for which such approval is needed.

In this study, land tenure security is defined as a combination of the expected longevity of the contract and the breadth of rights to exercise a range of field-related activities. Because none of the tenure contracts is long term or alienable, and nearly all farmlands are under exclusive control only for the duration of the growing season (becoming open to grazing animals in the dry season), the definition of security is necessarily relative. The four tenure arrangements described above have been ranked from 1 to 4 based on the information presented in Table 2 in terms of; (a) duration, a combination of past holding and current contract length, (b) use rights (planting, fallowing); (c) modification rights, trees, wells, fences, bunds; and (d) transfer rights, share, rent, lend, bequeath. A ranking of 4 indicates the given tenure arrangement was superior to all the other arrangements on the particular measure; conversely a ranking of 1 indicates that tenure arrangement ranked lowest. Where there was no notable difference between two categories, an equal score is given (Table 2).

This ranking procedure permits to order the land tenure arrangements in terms of declining security: PA, rented, shared and borrowed. Although PA-allocated lands are not "secure" in a truly long-term sense, the security offered by the government is necessarily greater than what
farmers can offer each other under renting, sharecropping and borrowing contracts.

Furthermore, most farmers on PA-allocated lands claim to the right to undertake important investments (modifications to the field) or transfers, whereas farmers on informally contracted fields feel unable to undertake major improvements to fields. Generally, renters have less security but a wider range of rights than either sharecroppers or borrowers. What distinguishes the latter two groups is the stiff price tag paid by sharecroppers in kind to the landholder.

4. Transforming the Production Data

For the purposes of this analysis, the different types of land contracts are hypothesized to have different effects on the structure of production in the region. Pair-wise comparisons are made between those lands allocated by the government (i.e., PA-allocated) and each type of land received under an informal farmer-to-farmer arrangement (i.e., rented, sharecropped, or borrowed lands).

Table 2. Relative ranking of the security of land tenure arrangements

<table>
<thead>
<tr>
<th></th>
<th>PA-Allocated</th>
<th>Rented</th>
<th>Shared</th>
<th>Borrowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Use Rights</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Modification Rights</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Transfer Rights</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>10</td>
<td>7</td>
<td>6</td>
</tr>
</tbody>
</table>

Based on the data on contract duration and rights displayed in Table 1, the land contracts have been order from 1 (least) to 4 (most). The sum of these rankings is given in the row entitled “Total”, and represents a qualitative measure of tenure security.
To have an adequate number of observations in each field tenure class, the analysis has been restricted to wheat, barley and legume plots which constituted 82% of the plots, surveyed.

Within each generic crop category (i.e., wheat, barley and legume) farmers distinguished numerous subvarieties. Because not all subvarieties were found in each tenure system, grains were aggregated into three categories—wheat, barley and legumes—and all residues were grouped together. Likewise, because not all inputs were used in each of the four tenure systems, more generic input categories have been formed: human labor, power (oxen and tractor), chemicals (fertilizer and herbicides), and seed.

Given that the different tenure arrangements had multiple and dissimilar crop outputs and inputs, it was necessary to aggregate the varying input and outputs into meaningful categories to permit application of the Tornqvist-Theil indexing procedure, as shown in Equations 8 and 9. Implicit output indices of wheat, barley and legumes were calculated by dividing the total value of all output by the price index obtained by weighing the individual outputs prices by the revenue share of each crop. A corresponding input quantity index for labor, power, chemicals and seed was computed as the ratio of total expenditures in each input category to the weighted price index of that input. The latter was measured as an index of all prices of individual input prices weighed by the cost share of each input.

All inputs and outputs enter the calculations on a per hectare basis; land enters the model with a quantity value of one along with the associated per hectare price for each tenure category. This method of including land as a numeraire permits the output and input components to be

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8 Because these distinctions were not made by trained agronomists, we refrain from calling these cultivars.
interpreted as land productivity and factor intensity respectively, as shown in Equation 8.

The prices used for these models were derived from several sources. Output and seed prices were drawn from the twice-monthly survey of retail prices in the two major markets in the area. Based on the observation that most farmers market their crops in the three months following harvest, the December through February price average was used to represent output prices; based on the similar observation that seeding is performed in May and June, the average of the market prices for these months was used to represent the value of seed, whether purchased or reserved from last year's stock. Prices for purchased inputs such as fertilizers, herbicides, pesticides, and tractor power were derived from averages cited by farmers in the course of the production survey. Pricing unpurchased inputs such as human and animal labor was more difficult. Although there is a labor market, hired labor made up only 7% of the total labor time. For the purposes of computing the TFP, all labor was valued at the market rate, disaggregated by activity where there were significant differences in daily wages by activity. Assuming the opportunity cost of most household labor is not as high throughout the growing season as the wage rate for labor hired at peak periods, this method most likely overstates the labor component of total input costs (Analyses to test the sensitivity of the results to this method indicated that using the hired labor rate did not distort the final results). As the market for animal labor is even thinner than that for human labor⁹, it was impossible to gather good data for this input. The final prices used were derived from key informant interviews.

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⁹ When farmers need additional animal power, they tend to swap between themselves.
V. PRODUCTIVITY ESTIMATES

Table 3 shows the average TFP levels for each of the three informal contracts (rented, shared and borrowed lands) relative to the PA-allocated land tenure. Land and TFP levels are lower for these contracts relative to the PA-allocated arrangement. Borrowed lands have the lowest TFP levels, producing 16% less output than the PA-allocated lands using the same input bundle. The shared lands are 11% less efficient than the PA-allocated lands, whereas rented lands are only 7% less efficient.

The overall land productivity levels for informally contracted fields are also lower than for PA-allocated fields. However, the gap is smaller than the gap in TFP levels owing to the relatively high levels of factor intensity on informally contracted fields. The higher level of total

Table 3. Comparison of TFP, land productivity and factor intensities by tenure arrangement

<table>
<thead>
<tr>
<th>Informally-contracted fields</th>
<th>PA-Allocated</th>
<th>Rented</th>
<th>Shared</th>
<th>Borrowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total factor productivity</td>
<td>1.00</td>
<td>.93</td>
<td>.89</td>
<td>.84</td>
</tr>
<tr>
<td>Land Productivity</td>
<td>1.00</td>
<td>.99</td>
<td>.93</td>
<td>.92</td>
</tr>
<tr>
<td>Wheat</td>
<td>1.00</td>
<td>1.15</td>
<td>1.24</td>
<td>.95</td>
</tr>
<tr>
<td>Barley</td>
<td>1.00</td>
<td>.88</td>
<td>.78</td>
<td>.95</td>
</tr>
<tr>
<td>Legumes</td>
<td>1.00</td>
<td>.96</td>
<td>.98</td>
<td>1.03</td>
</tr>
<tr>
<td>Residues</td>
<td>1.00</td>
<td>1.01</td>
<td>.99</td>
<td>.99</td>
</tr>
<tr>
<td>Factor Intensity</td>
<td>1.00</td>
<td>1.06</td>
<td>1.04</td>
<td>1.10</td>
</tr>
<tr>
<td>Labor</td>
<td>1.00</td>
<td>1.00</td>
<td>.99</td>
<td>.98</td>
</tr>
<tr>
<td>Power</td>
<td>1.00</td>
<td>1.01</td>
<td>.98</td>
<td>1.01</td>
</tr>
<tr>
<td>Chemicals</td>
<td>1.00</td>
<td>1.04</td>
<td>1.06</td>
<td>1.10</td>
</tr>
<tr>
<td>Seed</td>
<td>1.00</td>
<td>1.01</td>
<td>1.01</td>
<td>1.01</td>
</tr>
</tbody>
</table>
inputs applied to informally contracted fields increases the level of land productivity but not the level of TFP. For example, the factor intensity level on borrowed lands is 10% higher than the PA-allocated lands but the TFP level is 16% lower.

Although Equation 8 provides an excellent framework for decomposing the change in TFP into its various components, we can also express the changes in the levels of inputs as a percentage of the change in land productivity. Table 4 indicates that differences in most input levels between the informally contracted lands and PA lands were positive, whereas differences in land productivity were negative thus resulting in a negative change in TFP levels for all lands under informal contracts. Chemical inputs (fertilizers and herbicides) were the major contributors to higher levels of inputs for all the informal contracts, whereas the

<table>
<thead>
<tr>
<th>Table 4. Sources of productivity differences: informally contracted fields relative to PA-allocated fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rented</td>
</tr>
<tr>
<td>Differences in TFP (percentage points)</td>
</tr>
<tr>
<td>Land productivity (output)</td>
</tr>
<tr>
<td>Total factor intensity</td>
</tr>
<tr>
<td>Labor</td>
</tr>
<tr>
<td>Power</td>
</tr>
<tr>
<td>Chemicals</td>
</tr>
<tr>
<td>Seed</td>
</tr>
<tr>
<td>Differences in TFP as share of difference in land productivity</td>
</tr>
<tr>
<td>Total factor intensity</td>
</tr>
<tr>
<td>Labor</td>
</tr>
<tr>
<td>Power</td>
</tr>
<tr>
<td>Chemicals</td>
</tr>
<tr>
<td>Seed</td>
</tr>
</tbody>
</table>
contribution of animal power, human and seed remain roughly the same. The increase in the level of chemicals was inversely proportional to the degree of land tenure security as defined above. The more insecure the land, the more farmers applied chemical inputs. The largest increase (10%) was for borrowed lands.

The high input intensities, combined with low land productivity ratios and thus low TFP, indicate that the capacity of rented, shared and borrowed lands to produce more output is not hampered by underinvestment caused by land insecurity. Rather than applying less inputs, as theory would suggest, farmers on informally contracted fields applied more inputs, particularly more chemical fertilizers.

There are several reasons for this high input/low output combination on informally contracted fields. First, informally contracted fields may have poor soil quality. This would be true if farmers decide to keep the best of their PA-allocated fields to themselves, offering only inferior fields to other farmers under informal contracts. Although data on the physical description of these fields failed to show a significant difference in slope or erosion on the informally contracted fields, there was some evidence of differences in soil type. Borrowed fields in particular were less likely to be found on the rich black soils that characterize much of the Ethiopian highlands. (More precise assessments of soil quality were not done). Furthermore, borrowers almost always receive the land from their fathers who share a piece of their limited PA-allocated holdings. Dependent on their fathers’ generosity for this free land, borrowers are thus stuck with what they are given, as compared with renters and sharecroppers who have somewhat more bargaining power to search for better land. Many reported not finding land until well into the plowing season. To the extent that landholders may continually contract out the same plot year after year (to different farmers), the inherent quality of those plots may be low. It is thus possible that the quality of all
informally contracted fields, and especially borrowed fields, is lower than PA fields.

Second, land-importing farmers may use labor inefficiently. As young adults, borrowers usually have strong obligations to contribute labor to the family farm in addition, they tend not to own the oxen needed to plow their borrowed fields. Although they use the same amount of total human and animal days per hectare as PA farmers, they do so by relying on labor and oxen exchanges, after tending to family fields. This would imply that borrowers were not planting and harvesting at the optimal time. Thus it appears likely that the TFP efficiency gap is because of youth, poor soil quality and timing rather than tenure insecurity.

VI. CONCLUSIONS

The reform of land policies in sub-Saharan Africa has received much attention in recent years. Many authors believe that farmlands held under indigenous or informal land contracts in sub-Saharan Africa are less productive than those held under title or individualized land rights (e.g. owner cultivation). Others argue that the indigenous tenure arrangements have little bearing on crop productivity because they are dynamic and evolve in response to changes in land values. This debate will continue so long as there is insufficient evidence to support the arguments. Using plot-level data and the concept of interspatial TFP, this analysis determined the relative efficiency of four alternative land tenure arrangements prevailing in one region of Ethiopia. Lands allocated by the government are the most secure because farmers have relatively greater duration and a greater range of rights on them compared to the informal tenure arrangements. There are no privately owned lands in Ethiopia to use as a standard, thus we focused on lands formally allocated by the government (PA-allocated lands), as well as those
informally exchanged between farmers (rented, shared and borrowed lands).

The results of this study show that although the efficiency of farming differs by tenure contract, the differences were relatively small and not attributable to the use of fewer variable inputs as a result of insecurity. Informally contracted lands were relatively less efficient than the PA-allocated lands. Borrowed lands were the least efficient, followed by shared and rented lands. As shown in the conceptual framework (Section II), TFP is a function of both land productivity and factor intensities. The land productivity levels for informally contracted lands were lower than unity, but the factor intensity levels were greater than unity, indicating that primary source of differences in overall TFP were increases in quantities of factor inputs without a corresponding increase in land productivity. Further decomposition of the factor intensity levels identified chemical inputs as the major source of differences. Because of the fairly minor differences among the alternative tenure arrangements, we suggest that other more important factors contribute to the low productivity levels of farming operations than tenure, such as soil quality, farmer endowments and farmer experience. It is perhaps more likely that land productivity determines the tenure arrangement under which that land is farmed, rather than vice versa. Thus there seems to be little evidence to say that changing tenure arrangements per se will change productivity, unless it can also change soil quality and farmer experience.

Although this study uses a different methodology than appears in most analyses of agricultural productivity and property rights, it supports the conclusions of those who argue that land tenure does not constrain productivity at the current level of development in Sub-Saharan Africa. The results of our study suggest that the informal tenure contracts should be formalized. Given the Ethiopian government's hesitation about
privatizing land, providing a formal legal standing to what are now informal land transactions could help to solidify rights, and lengthen contract periods. Furthermore, encouraging the use of such contracts should allow farmers to charge the market value for land, ultimately improving resource allocation and efficiency.

REFERENCES


AGROFORESTRY FOR INTENSIVE AND SUSTAINABLE AGRICULTURE: PROBLEM OF FARM SIZE AND OWNERSHIP
THE CASE OF YEJU, NORTH WELO

Beyene Tadesse
Bako Research Center
P.O.Box 3, Bako, Ethiopia

I. INTRODUCTION

A number of research reports of the International Centre for Research in Agroforestry (ICRAF) recommend the implementation of agroforestry technologies for areas devoid of trees. With continuous and intensive monocropping of annual crops, it is difficult to maintain the productivity of the land because of climatic, topographic and socioeconomic conditions that have led the area(s) to overuse and eventual degradation. Sustaining these farms with expensive chemical inputs is not feasible because of the meager financial resource of farmers. The most viable alternative is applying the low-cost agroforestry land use system that allows simultaneous and continuous cropping.

To succeed in motivating farmers to practice agroforestry depends, to a large extent, on convincing farmers about the economic returns from such practices, which is greatly influenced by the nature of their tenure on land and vegetation (Vergara, 1987). The size of landholding and the level of fragmentation is also an important factor, as the primary objective of farmers is to meet their immediate subsistence (Raintree, 1991; Bruce et al., 1991). Another study by Fortmann (1985) also
underlined that agroforestry depends on people’s right to plant and use trees—rights that in turn depend on the prevailing system of land tenure. The poor definition of tenure rights in a community woodlot provides little incentive for planting and growing trees. Peasants are reluctant to invest time, labor and material inputs (Bruce et al., 1993), emphasizing that insecure land tenure is a serious constraint of investments that would otherwise raise productivity and protect the environment.

Currently, Ethiopia does not have a clearly defined land tenure policy. Land has remained under the control of the state and no fundamental change has been made to date. The land policy of the former military government (the Derg) is still working in the country as a whole, and in the study area in particular. The prevalent fear of periodic land redistribution has created a net effect of fragmentation and loss of incentives to improve land, for example, in Welo, land distribution was carried out prior to the end of the war between the Ethiopian Peoples Revolutionary Democratic Front (EPRDF) and the Derg in 1990.

A macro-level biophysical study by the Technical Committee of Agroforestry for Ethiopia in 1990 and a micro-level study by Beyene (1995) were conducted in Yeju area, North Welo. Both studies identified North Welo as a potential area for the improvement of productivity and sustainability through agroforestry interventions. Based on these studies, Sirinka Research Center, which is located in the study area, has been conducting agroforestry research projects since then. Nevertheless, both studies overlooked the impact of landholding circumstances on the prospects of adopting agroforestry technologies. The major objectives of this study are therefore the following.

a. To assess whether or not size and ownership of land influence farmers’ interests towards growing trees and adopting agroforestry technologies
b. To identify some policy interventions to improve the performance of the system

c. To define the kind of technologies that would be capable of affecting the desired practicality of the interventions in a manner most appropriate to the land use system

II. METHODOLOGY OF THE STUDY

Two levels of surveys—informal and formal—were conducted. The informal survey involved detailed discussions between researchers and farmers; the formal survey used a questionnaire to administer to a random sample of 77 households and verify impressions and test the hypotheses developed during the informal surveys. In both surveys farmers’ fields were closely observed.

III. THE STUDY AREA

1 Physical Features

Yeju is characterized by its most broken and mountainous physical features. Much of the area (approximately more than 90%) consists of steep slopes and rugged terrain, which is not suitable for crop production. The ratio of cultivable to uncultivable land is only 0.07 (Table 1). The altitude of the area ranges from 1300 m to 3500 m. There are two rainy seasons, the long rains from July to September (596 mm), and the short ones from April to May (128 mm), with a mean annual total rainfall of 964 mm that is erratic and highly variable from year to year. The mean maximum and minimum temperatures are 26.6 °C and 13.4 °C respectively. The soils are widely of heavy texture,
varying from fairly fertile black cracking clay in the valley bottoms to red clay loams on the valley sides (FAO, 1984). Yeju area includes Sirinka Agricultural Research Center (SARC), which is nationally mandated to conduct research in agroforestry.

The landscape of the study area has lost its natural vegetation almost completely. Today, very few trees, dominated by eucalyptus trees in home gardens and only some acacia species on hillsides, exist.

2 THE FARMING SYSTEMS

The main objectives of farmers are to ensure food security and to increase farm income. The major crops grown are sorghum and tef, which together constitute more than 75% of the annual crops. Sorghum, the primary food crop, is grown by almost all farmers and accounts for more than half of the total cultivated land of the households. It is consumed primarily in the form of injera and is an important ingredient of the local beer tella. Tef is mainly a cash crop.
Farmers grow trees mainly to satisfy the need for construction material to build houses (64%), for firewood (57%), and the prospect of getting some cash through marketing (49%). They dominantly grow eucalyptus trees (*Eucalyptus camaldulensis*) that is preferred for its good coppicing ability, its good quality for construction and fuelwood, and its quick growth that helps farmers generate cash within a relatively short time. In fact, the compatibility of eucalyptus with the existing cropping system is questionable. In the study area, fruit trees such as papaya, orange, banana, lemon, and sometimes, sugar cane are commonly grown in combination on a small piece of land in or around home gardens, where water for irrigation is available. Apart from such practices, trees are rarely seen in the farm fields or croplands.

### 3.3 Farmers' Farm Resources

Landholding is broadly classified as communal land (belongs to the community), which accounts for more than 90% of the total land; and farmers' land (temporarily and specifically used by individual farmers) that includes home gardens and croplands. As mentioned earlier, cultivable land is proportionally very small as compared to the total land. As a result, the sample households own an average of only 0.70 ha, with the standard deviation of 0.53 ha, and a maximum of 3 ha and minimum of 0.19 ha. The farmers cultivate all the land they have regardless of its suitability. More than half of the sample households (54.5%) have a maximum of 0.5 ha of land, and 85.7% a maximum of 1 ha (Table 1), scattered and fragmented into 4 to 5 different plots. Family size averages 5 persons and ranges from 2 to 10 persons. Nearly half of the family members are fully involved in farming. Therefore, the current human population seem to exceed the carrying capacity of the physical resource-base under the existing level of technology.
Livestock are kept for draft power. Out of the total sample farmers 42% have two oxen, 35% one ox, 22% no oxen, and only 1% more than two oxen.

Analysis of farmers’ resource shows that average area cultivated by two oxen owners and non-oxen owners are not statistically different. Nor does area of cultivated land is associated with family farm labor.

4 MAJOR PROBLEMS

The major constraints and problems of the area are shortage of land, erratic rainfall, erosion and depletion of soil nutrients, shortage of animal feeds, lack of construction materials, and firewood in order of importance. Owing to land shortage, fallowing is not practiced and crop rotation is limited to few crops, or not practiced at all. The majority of the farmers absolutely depend on crop residues for feed (83%) and fuelwood (70%), which, indeed, resulted in complete depletion of the organic matters from croplands. Consequently, about 71% of the farmers experience food shortage from June to October, while nearly 10% throughout the year.

Table 2. Size distribution of total cultivated land

<table>
<thead>
<tr>
<th>Cultivated land (ha)</th>
<th>Farmers’ cultivating the area (n=77)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
</tr>
<tr>
<td>≤ 0.5</td>
<td>42</td>
</tr>
<tr>
<td>&gt; 0.5 ≤ 1.0</td>
<td>24</td>
</tr>
<tr>
<td>&gt; 1.0 ≤ 1.5</td>
<td>6</td>
</tr>
<tr>
<td>&gt; 1.5 ≤ 2.0</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 2.0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>77</td>
</tr>
</tbody>
</table>
Sustainability has increasingly been recognized by ICRAF as the central organizing principle for the continued progress of human development. The need for broader food base that satisfy human nutritional requirements justifies the need for conserving the biological diversity. Thus, efforts to improve the condition of the area should focus on food security by ensuring appropriate and sustainable balance between self-sufficiency and self-reliance; employment and income generation in the rural areas to eradicate poverty; and natural resources conservation and environmental protection. Agroforestry is the latest approach for this purpose. It improves the system in a substantial and enduring way in terms of the underlying productivity of natural resources and cropping patterns, so that farmers can meet their increasing levels of demand, in concert with population and economic growth as well as environmental necessities.

Agroforestry is the name given for land use systems and technologies in which perennial trees are deliberately combined with crops and/or livestock under the same land management unit (Raintree, 1987). It has gained considerable popularity as an effective land use system in recent years. This is because of its potential for addressing a wide range of household needs, with low-level additional inputs, on a sustainable basis. Agroforestry improves land productivity by increasing the output of tree products, improving yield of associated crops, reducing cropping system inputs, increasing labor efficiency, diversifying production, satisfying basic needs and other measures of economic efficiency, and helping utilize biological potentials. It has also the potential functions to satisfy human needs in that it contributes to human food and animal feed, energy, shelter, raw materials, and even has the potential to put marginal lands into cultivation and lessen the problem of land shortage.
Moreover, agroforestry could help reduce soil erosion, improve organic content of soil and restore the ecological balance as well as provide some additional income for farmers through the sale of products such as timber, fruits and fuelwood. Hence it is believed to mightily serve resource-poor farmers in a sustainable way.

SARC has been conducting some research projects on agroforestry to come up with the best alternative strategies. However, this enthusiasm should be accompanied by a critical study of the real landholding circumstances of farmers in order to be able to predict the prospective adoptability of specific agroforestry technologies. Adoption of any new production technique depends on how such a technology is conveyed to the users and how the prospective users perceive the benefits of adopting it (Vergara, 1987).

Whatever agroforestry technologies generated, it primarily involves growing trees in the community. Thus, it might be appropriate to consider the socioeconomic circumstances under which agroforestry is most likely to be successful. Therefore, the essential issue is "do farmers really have interest to grow trees, given the landholding circumstances they have"? Answer to this question would justify the potential adoption of agroforestry technologies by farmers.

V. RESULTS AND DISCUSSION

1. LANDHOLDING AND FARMERS' INTEREST TO GROW TREE

1.1. Farmers' Current Practices
1.1.1. Land Size and Impact of Tree Growing

Presently, 46.8% of the surveyed sample households grow trees on their land, all in their home compounds, but only 36% (i.e., 17% of the
sample size) grow in their croplands, which is usually not more than two or three self-propagated trees in each parcels or plots. The remaining 53.2% of the respondents have less or no interest to grow trees neither on their croplands nor home compounds, not because of their ignorance but because of the critical problem of land shortage (97.4% reported). For this reason, they expect or imagine that trees in croplands have a negative impact on crops in that they compete for land and nutrients (45%), create shade effects (42%), and attract pests, usually birds and rats (37.5%).

Tests of independence showed that farmers’ interests to grow trees, whatever the niche may be, are greatly dependent upon the land size they own (Chi square = 6.52, significant at 5% level). Further analysis of farmers’ interests to grow trees, specifically on croplands, also showed high dependence on size of landholding, chi square = 23.16, significant at 1% level (Table 3).

1.1.2 Land Tenure and Its Influence on Growing Trees

Land tenure is the second most important factor that limits growing trees. [Trees have long-term benefit, but land is collectively owned and repeatedly distributed or divided to community members as the need arises until this study was made (1994)]. One has no permanent right

<table>
<thead>
<tr>
<th>Land size (ha)</th>
<th>Growing trees</th>
<th>Not growing trees</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0.5</td>
<td>16 (1)</td>
<td>26</td>
<td>42</td>
</tr>
<tr>
<td>&gt;0.5 ≤ 1.0</td>
<td>11 (5)</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>&gt; 1.0</td>
<td>9 (7)</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>36 (13)</td>
<td>41</td>
<td>77</td>
</tr>
</tbody>
</table>

Figures in parentheses are number of farmers in response to growing trees in their croplands as well.
to using the land and its products. Farmers are more or less guaranteed to their home gardens only. This area is usually not affected by frequent redistribution. It can be justified by the above data that all the 36 tree growers grew trees in their home gardens, usually as a livefence of their homesteads. This could be either tenure insecurity which does not seem to be preventing farmers from tree growing on this niche, or maybe to strengthen their holdings over the land as Bruce et al. (1991) reported. But few trees are seen on households’ outlying fields, which farmers think they are most likely to lose in possible future redistribution(s).

1.2 Farmers’ Future Plan of Tree Growing: Priority Needs vis-a-vis Appropriate Areas to Grow Trees

Empirically, 84.4% of the sample farmers have interest to grow trees in the future, though the degree of involvement is affected by the problems mentioned above. The rest 15.6% have no plan to plant trees mainly because of shortage of land and tenure problems; 76% of this group currently have less than one hectare of land. Assessment of appropriate areas for tree planting vis-a-vis farmers’ primary interest areas was made. Three niches namely, communal land, homegarden and cropland were considered for comparison.

1.2.1 Communal Land

About 67.7% of the respondents suggested that the marginal land and hillsides of the communal land are the best areas to grow trees. These have been denuded all of their natural covers and are totally vulnerable for erosion. The run-off from such areas has aggravated the problem of erosion by creating gullies on the bottom arable lands (58.4% reported).
This niche could be planted with trees that can supply the community with many wood products. Although attempts have been made to reforest and protect such areas from external damage of the ecology, the efforts were futile and even destruction has become worse by careless management and theft problems. About 85% of the sample farmers reported that afforestation of communal land and post-planting protection is usually neglected. Hence, in spite of its emphasized importance, only 15.4% of the respondents selected this area as conducive to grow trees. Thus, as far as community work and protection are concerned, certain lack of interest can be noticed within the population. Thus lack of interest on collective ownership of land calls for complete privatization of land. In line with this, a 45-years-old farmer explained his interest as "if the communal land is divided among us and I know my own share, I will develop a big forest in five years time given some nursery support from the Ministry of Agriculture".

1.2.2 Farmers’ Home Compound and Cropland

Cropland is the second best area recommended, although the proportion is far less than the communal one (26.2%). However, 72.3% of interested tree-growing respondents selected home compound as the priority niche to plant trees, simply because of tenure reliability on home gardens, despite its smallest area usually not more than 0.05 ha. But cropland and/or farm boundaries are the least preferred, mainly because of land shortage and unreliable tenure problem (Table 4).

In both cases, areas recommended as best (chi square = 36.4) and farmers’ first priority area (chi square = 48.8) are highly significant (1%). Therefore, it strongly suggests two important things.
The first and the most important one is that shortage of land resource restricts farmers’ participation in growing trees on their croplands to a range of options (for cash income or subsistence) because direct production to meet subsistence needs is their major economic strategy. Secondly, land tenure and the right to use trees (tree tenure) has a big impact on farmers interest to plant and grow trees.

VI. POLICY IMPLICATIONS

So far, the landholding circumstances (size and tenure) of Yeju, North Welo, and the way this affects the interests of farmers to grow trees which, in turn, affects the potential adoptability of agroforestry technologies have been discussed. Therefore, proper incentives and development strategies should be devised to improve the vast areas of the region that are under severe degradation. Therefore, the following policy implications should be considered.

a. Motivating farmers to plant trees and making these available promotes intensive and sustainable agricultural practices through agroforestry (least cost and stability of the environment) that may solve multiple problems, even if landholding is quite small.
b. Relatively longer time is required to grow trees and gain the benefits by farmers and this, coupled with short-term land reallocation practices, means that farmers are deprived of secure access to the most reliable and multiple benefits of trees. A land tenure system giving farmers more permanent and individual rights would improve farmers' living conditions and protect the environment from further degradation.

c. Dividing the communal land among the community members and a simultaneous planting of trees and environmental protection would at large encourage farmers to grow trees, from which they could gain direct benefit and at the same time improve the ecosystem of the area.

VII. CONCLUSION AND RECOMMENDATIONS

Trees in North Welo are under severe pressure, and the threat of soil degradation is among the most serious in the country. In this region, where the ratio of cultivable land to the uncultivable is so small, resources from trees and pasture are essential to agriculture and provide additional income to farmers. Tree products are considered important by both urban and rural population since they help in meeting consumption needs, supporting agriculture and animal husbandry, and providing employment opportunities for a large proportion of the rural population.

In spite of this, the majority of the households are marginal farmers (i.e., their landholding is insufficient to meet the subsistence needs) and, in fact, some do not even own land. It may be hard to find agroforestry options to support such groups, despite the unlimited efforts and logistic expenditure by SARC. Hence, unless secured land can be available and/or tree tenure rights are given, the tree planting/growing process may be less viable for such landless resource-poor farmers. Thus the
allocation of long-term tenure rights lands to the landless and marginal farmers over communal lands is necessary to secure the benefits for them, thereby protect the ecology from further degradation. But otherwise, the state has to make a special arrangement in such a way that farmers would be convinced about the importance of collective works. They should be encouraged to grow trees on the communal land and be direct beneficiaries of the land.

The following important niches and potential agroforestry alternatives are suggested, despite the limitations in landholding discussed in earlier sections, as immediate solutions for the prevailing problem of land degradation in the system. This could be possible if joint management is employed whereby local communities enter into partnerships with the state to develop a wide variety of resources, and/or if the local people are actively involved in the overall land use management plans.

a. Integrating multipurpose tree species together with forage grasses on contour lines of the cropland to reduce erosion, add organic nutrients, produce fodder for livestock.

b. Planting trees in upland catchments and fragile ecosystems, non-agricultural lands, provide important environmental services by checking wind and water erosion, preserving and enriching soil nutrients, and mitigating the vagaries of climate, especially the periodic floods and drought. Moreover, trees contain a wealth of biological diversity of both known and unknown economic, social and ecological values.

c. Stabilizing hillside farming with trees as terraces, contour hedge rows, alley farming or strip cropping. These practices will help increase or expand farming onto marginal lands of steeply slopping and improve cultivation on locations in the landscape. In this way, the problem of land shortage can be minimized.
d. Encouraging the planting and better management of citrus trees in irrigable lands.

REFERENCES


I. INTRODUCTION

Ethiopia has an ancient tradition of agriculture. Agriculture currently accounts for about 55% of the country’s GDP, 60% of the merchandise exports, and 80% of the employment (World Bank, 1995).

Ethiopia has an attractive resource-base suitable for agriculture. The country possesses vast areas of agricultural land, plenty of rivers and lakes, good climate, and a large number of livestock.

Currently, about 8.68 million hectares of land is cultivated by smallholders. Some 8.11 and 0.57 million hectares are covered by temporary and permanent crops respectively (CSA, 1996). The country has more livestock population than any other African country with 31.76 million cattle, 12.80 million sheep, 9.97 million goats, 4.4 million equine, and 33.35 million poultry birds (CSA, 1996).

Some 0.6% of the country’s land area is occupied by lakes and rivers that could provide ideal opportunities for irrigation and fishery. Of the estimated 3 million hectares of irrigable land area, only 100 thousand hectares is now under irrigation. According to the CSA (1996), a total
of 84.64 thousand hectares was irrigated by the small-scale farmers during the 1995/96 production year. The area under major lakes is more than 7000 km² and maximum sustainable annual yield of fish is estimated to be about 35,300 tonnes, although the present average annual production is only about 4000 tonnes (MOA, 1996).

The country has got also rich resources for the production of honey and beeswax. Peasant households involved in apiary activities owned a total of 3.56 million bee hives and harvested about 22.75 million kg of honey in 1995/96 production year (CSA, 1996).

About 95% of the presently cropped land of the country is cultivated by the private peasant holders. They still practice centuries-old traditional methods of production with an annual average crop yield of 10 q per hectare. The private peasant holders employ little or no improved farm inputs such as improved seeds and more efficient farm tools and equipment.

The productivity of the peasant farmers must be increased considerably, if self sufficiency in food has to be achieved. Unless the productivity of farmers increases to the level where they could achieve self-sufficiency and have surpluses for sale, it is unlikely for the country to attain improvements in rural welfare.

This paper attempts to examine the existing status of agricultural production in Ethiopia as performed by the private peasant holders with emphasis on problems of intensifying agricultural production. It also tries to assess the role of rural human resource, development in increasing the agricultural productivity. Policy and institutional requirements necessary to achieve sustainable intensive agriculture are also discussed.
II. RURAL POPULATION AND LAND UTILIZATION

The agricultural households of the country are estimated at about 8.68 million and the total rural population is about 50 million. The average farm-family size ranges between 4.63 and 7.02 with a national average of 5.17 (Table 1).

According to the estimations made by CSA, 60.88% of the peasant households own less than 1.01 ha of land while 24.68% and 13.35% own 1.01-2.00 and 2.01-5.00 ha respectively (Table 2). These figures, together with the yield of only about 10 q/ha, indicate that the majority of Ethiopian peasants are subsistence farmers, barely producing as much food as their families' needs.

The national average of agricultural household size of 5.17 and that of 1.09 ha of land holding per household indicates a high human to land ratio of 4.74. Higher human to land ratio usually results in short fallow period. Without improved methods of cultivation this could lead to soil degradation and lower productivity.

Table 1. Number of agricultural households, holders, household members, and average household size by region 1994/95 (1987 EC)

<table>
<thead>
<tr>
<th>Region</th>
<th>Number (‘000)</th>
<th>Average household size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Households</td>
<td>Holders</td>
</tr>
<tr>
<td>Tigray</td>
<td>593.85</td>
<td>602.85</td>
</tr>
<tr>
<td>Afar</td>
<td>27.23</td>
<td>27.23</td>
</tr>
<tr>
<td>Amhara</td>
<td>2664.79</td>
<td>2710.75</td>
</tr>
<tr>
<td>Oromia</td>
<td>3314.95</td>
<td>3427.95</td>
</tr>
<tr>
<td>Benishangul</td>
<td>62.46</td>
<td>65.04</td>
</tr>
<tr>
<td>SNNPR</td>
<td>1971.23</td>
<td>2008.23</td>
</tr>
<tr>
<td>Gambella</td>
<td>20.06</td>
<td>20.95</td>
</tr>
<tr>
<td>Harari</td>
<td>11.22</td>
<td>11.44</td>
</tr>
<tr>
<td>Addis Abeba</td>
<td>4.29</td>
<td>4.38</td>
</tr>
<tr>
<td>Dire Dawa</td>
<td>14.59</td>
<td>14.59</td>
</tr>
<tr>
<td>Total</td>
<td>8684.67</td>
<td>8893.41</td>
</tr>
</tbody>
</table>


SNNPR = Southern Nations and Nationalities People's Region
### Table 2. Distribution of total number of agricultural households total land use and land per household by size of holding national 1994/95 (1987 EC)

<table>
<thead>
<tr>
<th>Items</th>
<th>Size of holding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under</td>
</tr>
<tr>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Number of house holds (000)</td>
<td>502.6</td>
</tr>
<tr>
<td>Cum. % of Households</td>
<td>5.79</td>
</tr>
<tr>
<td>Total Land (000 Ha )</td>
<td>24.71</td>
</tr>
<tr>
<td>Cum. % of Total Land</td>
<td>0.26</td>
</tr>
<tr>
<td>Average Landholding / Household (Ha)</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Excluding Somali Region and other Nomadic Areas.

III. THE PRIVATE PEASANT HOLDERS AND AGRICULTURAL PRODUCTION

Since the 1979/80 production year, the land area under major crops has increased on the average by 2.66% per annum (Table 3). During the last 17 years, the yield per hectare for all crops was between 8.14 and 13.11 quintals. Several factors contributed to this low level of crop yields. The fertility status of the soil is deteriorating as a result of improper land use practices. Moreover, poor seedbed preparation, weeds, crop pests and very little use of improved farm inputs, such as chemical fertilizers and improved seeds, are also responsible for the low crop yields.

As shown in Table 4, only a small fraction (less than 1%) of the total cropped area is planted with improved seeds and/or irrigation. Fertilizer and pesticides are applied on 32.69 and 9.45% of the total cultivated area. The total quantity of commercial fertilizer applied amounted to 2.56 million quintals in 1995/96 or 29 kg per hectare. The rate of fertilizer application is very much below the recommended rate (150-200 kg/ha).

The new extension program launched by the government in the 1994/95 crop year increased its coverage both in terms of area and participation of peasant farmers in 1995/96. The program has given emphasis to technological packages of major crops grown in high-rainfall areas of the country.

Crop and livestock enterprises are closely integrated production activities practiced by the majority of the peasant farmers in rural Ethiopia. Of the total smallholders in the country, about 78% practice mixed crop and livestock production, 20% are engaged in crop production, and the remaining 2% practice livestock husbandry (Table 5).
Table 3. National estimates of area and production of major crops for private peasant holdings 1979/80–1995/96 both seasons

<table>
<thead>
<tr>
<th>Year</th>
<th>Area of Land Cultivated ('000 Ha)</th>
<th>Crop Production ('000 Qt.)</th>
<th>Yield per Hectare (Qt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Cereals Pulses Oil Crops</td>
<td>Total Cereals Pulses Oil Crops</td>
<td>Total Cereals Pulses Oil Crops</td>
</tr>
<tr>
<td>1979/80</td>
<td>4810.70  4814.69  825.86  31.31  72123.38  61308.68  9983.39  165.15  14.99  12.73  12.09  5.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980/81</td>
<td>5409.42  4503.92  724.94  180.56  62368.45  53029.34  8406.82  932.29  11.53  11.77  11.60  5.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1981/82</td>
<td>5341.21  4862.31  767.00  211.90  59321.10  50454.12  8093.59  773.39  11.11  11.57  10.55  3.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1982/83</td>
<td>5801.82  4775.99  780.06  245.77  74559.44  63866.44  9506.89  1186.11  12.85  13.37  12.19  4.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1983/84</td>
<td>5308.81  4422.00  736.15  231.66  60095.48  52174.85  6974.94  945.69  11.15  11.80  9.46  4.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1984/85</td>
<td>5557.16  4553.81  338.98  264.37  45237.26  39234.90  5016.76  985.69  8.14  8.62  14.80  3.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985/86</td>
<td>5612.23  4666.63  670.24  275.36  49631.83  44009.34  4672.75  949.74  8.84  9.43  8.97  3.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1986/87</td>
<td>5220.31  4459.84  565.41  195.06  56978.12  51074.30  5146.30  757.52  10.91  11.45  9.10  3.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1987/88</td>
<td>5491.36  4646.02  679.68  165.66  61460.89  55565.10  5208.63  687.16  11.19  11.96  7.66  4.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988/89</td>
<td>5195.54  4465.67  558.29  171.58  57648.69  51760.75  5255.02  632.92  11.11  11.59  9.14  3.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1989/90</td>
<td>5407.96  4619.31  587.38  201.27  63197.07  56242.74  6124.61  829.72  11.69  12.18  10.43  4.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990/91</td>
<td>5286.08  4340.04  701.57  244.47  69323.67  56418.32  9769.78  3135.57  13.11  13.00  13.93  12.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991/92</td>
<td>5241.22  4303.52  728.38  209.32  56941.01  48691.81  6376.22  872.98  10.86  11.55  8.75  4.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992/93</td>
<td>5890.22  3974.43  704.38  211.41  58399.67  51850.29  5778.53  770.85  11.94  13.05  8.20  3.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993/94</td>
<td>7198.97  5321.18  1840.27 237.55  57327.54  51419.21  5181.98  824.91  7.96  9.66  3.16  3.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994/95</td>
<td>7710.17  6448.57  919.37  342.01  75381.11  65890.91  7920.14  1172.06  9.78  10.22  8.16  3.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995/96</td>
<td>9073.62  7670.46  1008.80 393.75  103279.02  92653.96  8662.09  1962.59  11.38  12.08  8.59  4.98</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: CSA Annual Agricultural Sample Survey Results
### Human Resource and Intensive Agriculture in Ethiopia

Table 4. Some indicators of farming practices of smallholders

<table>
<thead>
<tr>
<th>Type of crops</th>
<th>Total crop</th>
<th>Improved</th>
<th>Irrigated</th>
<th>Pesticide</th>
<th>Fertilizer</th>
<th>Total Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area</td>
<td>%</td>
<td>Area</td>
<td>%</td>
<td>Area</td>
<td>%</td>
</tr>
<tr>
<td>Cereals</td>
<td>8652.55</td>
<td>76.58</td>
<td>49.69</td>
<td>0.75</td>
<td>55.05</td>
<td>0.83</td>
</tr>
<tr>
<td>Pulses</td>
<td>904.39</td>
<td>10.41</td>
<td>**</td>
<td>**</td>
<td>5.30</td>
<td>0.59</td>
</tr>
<tr>
<td>Oil seeds</td>
<td>377.70</td>
<td>4.35</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Other</td>
<td>179.42</td>
<td>2.07</td>
<td>**</td>
<td>**</td>
<td>4.89</td>
<td>2.73</td>
</tr>
<tr>
<td>All temporary</td>
<td>8114.06</td>
<td>93.40</td>
<td>52.27</td>
<td>0.64</td>
<td>65.31</td>
<td>0.81</td>
</tr>
<tr>
<td>Total permanent</td>
<td>573.07</td>
<td>6.60</td>
<td>9.57</td>
<td>1.67</td>
<td>19.33</td>
<td>3.37</td>
</tr>
<tr>
<td>All crops</td>
<td>8687.13</td>
<td>100.00</td>
<td>61.84</td>
<td>0.71</td>
<td>84.64</td>
<td>0.97</td>
</tr>
</tbody>
</table>

147
Table 5. Number of holders by sex and type of holding for private peasant holdings national 1994/95 (1987 EC)*

<table>
<thead>
<tr>
<th>Sex of Holder</th>
<th>Type of Holding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crop only</td>
<td>%</td>
</tr>
<tr>
<td>Male</td>
<td>1283.21</td>
<td>17.58</td>
</tr>
<tr>
<td>Female</td>
<td>449.97</td>
<td>28.83</td>
</tr>
<tr>
<td>Total</td>
<td>1733.18</td>
<td>19.57</td>
</tr>
</tbody>
</table>

*Excluding Somali Region and other Nomadic Areas.

Number in thousands


N.B. There are some holders estimated at 34.40 who did not report their holding type.
Studies made by Gryseels and Anderson, (1983) in the central highlands of Ethiopia have indicated that the following major benefits would be obtained by the peasant farmers from the integration of crop and livestock enterprises.

- Livestock provide draft and transportation power for the crop farming. A pair of zebu oxen of the indigenous breeds provide about 720 ox-pair hours of work per annum for plowing and threshing.

- The peasant holders’ crop enterprises could supply the livestock enterprises with crop aftermath for grazing and crop straws to be used as an important animal feed, mainly during the dry season.

- Livestock enterprises produce manure that can be used as fertilizer on cropland and as supplement to farm-families’ fuel supply.

- The peasant farmers’ livestock could serve as valuables to hoard money/ assets and provide the farm families with security in times of crop failure and serve as a convertible reserve for cash when needed.

No significant efforts are currently under way to increase the livestock productivity of the peasant holders. The indigenous zebu-breed local cows calve first at an approximately four years of age and thereafter calve at about two years interval. A national estimate made by the CSA (1995) indicated that an average local cow under farmers’ management produced around 222 liter of milk per lactation.
period of 6.33 months, which is low by any standards. CSA also reported that there are about 8.93 million milk cows under the peasant holders' management with an estimated total yield of about 1982.46 million liters during the 1994/95 production year.

With regard to sheep and goats husbandry, the reproductive rate per ewe is about one lamb or one kid per year with peasant farmers' management, which is again very low. The private peasant holders who are involved in apiary activities reported to own a total of about 3.56 million beehives, of which 99.72% and 0.28% are traditional and modern beehives respectively. The estimated annual total honey production from traditional bee-hives was 22.57 million kg while that of the modern beehives was 0.18 million kg in 1995/96 production year (CSA, 1996). From the available figures, honey yield per annum per traditional beehive is estimated to be 6.35 kg while that of a modern beehive is 18 kg per year. It was also reported (CSA, 1996) that the average rate of honey harvest from traditional beehives is 1.2 times per year and, on the average, honey is harvested from the modern beehives 2.02 times per annum.

IV. SEASONALITY OF PRODUCTION, LABOR UTILIZATION AND MIGRATION

Crop production in some parts of the Ethiopian highlands is undertaken in two seasons, locally known as meher and belg. The meher is the main rainy season from June to September. About 90% of the total annual crop production is produced during the meher
season. The *belg* season occurs between February and May. Since the short rains are not reliable, *belg* crops are successful mostly once in three years.

A case study made in the central highlands of Ethiopia (Gryseels and Anderson, 1983) indicated that the annual labor requirement per hectare of different crops grown by the farm-families was estimated at 250–650 hours of adult equivalent labor under an average peasant household condition. Surveys conducted by ILCA's Highland Program, from 1980 to 1984, identified that the adult-equivalent labor hours per hectare required was estimated to be 550 for tef, 450 for wheat, 395 for barley, 350 for maize and sorghum, 250 for pulses, and 650 for vegetables, mainly onion. The estimated labor hour requirement includes all the tasks from seedbed preparation to storage of the harvested crops.

Based on the estimated hours of labor required per hectare of various crops grown by a typical farm household in the central highlands of Ethiopia, the annual total hours required for the mix of crops was calculated to be 1349 hours of adult-equivalent labor. Taking a family of 7 members, it was estimated that about four of these members will be involved in farm production activities. Assuming an average of 0.6 adult-equivalent and working some 7 hours of field work per person per day, the four productive members of the farm-family will supply a total of about 3679 hours of adult-equivalent labor during some 219 available working days each year (Woubshet, 1989). Comparing the labor supply and demand of a typical farm-family, there will be a total surplus family labor of approximately 2330 hours of adult-equivalent labor per annum over and above required by crop
enterprises. To some extent, this surplus family labor can be absorbed by the various noncrop production activities practiced by the farm household members. More importantly, the livestock production activities that involve herding, feeding, and barn cleaning are of considerable importance in absorbing the surplus family labor. Hay-making is seldom done by male members of the working age group. Milking and barn cleaning are the tasks of female family members usually above 10 years of age. Women in the rural areas work very hard and spend an estimated total time of 14 hours per day on various activities (UNICEF, 1987). Temporary employment in off-farm activities and sending working-age children to school are some of the other activities that occupy the seasonally surplus labor of the farm households.

Despite the existence of the above-mentioned noncrop production activities, which are likely to absorb the surplus family labor, underemployment of the peasant workforce is a common occurrence, especially during the dry season. In particular, as the family size gets larger, there is a tendency to have greater underemployment of the family labor.

The underemployment of the farm-families labor in rural Ethiopia is one of the driving forces to rural-urban migration. The extent and importance of all other factors that resulted in the outflow of Ethiopia’s rural population has not been adequately studied.

A constant migration from rural areas has contributed to high rate of population increase in the urban centers. For instance, Addis Ababa was reported to grow at annual average of 3.8% during the last 10
years (CSA, 1995). The high migration rate from the agricultural sector persists even when urban unemployment is considerably large. Moreover, the rural population tend to resort to migration as a response to demographic pressure on land.

V. RURAL HUMAN RESOURCES DEVELOPMENT FOR INTENSIVE AGRICULTURE

Ethiopia is endowed with rich natural resource-base that is necessary for agricultural development. The most valuable asset for any country is its people, although the endowment of natural resources is also essential for economic growth. The development strategy should give priority to improve the productivity of the peasant holders and the livelihood of the overwhelming majority of its rural population to exploit the existing potential. Increased production of agricultural commodities could obviously be practical if the skills of the farming population is developed.

The contemporary strategy in Ethiopia focuses on increasing agricultural production with a major objective of making the country self-sufficient in food production. It is obvious that increase in total farm output of the country can be attained either by intensification and/or expanding the cropped area. However, the available data confirm that the prospect of expanding cropped area is limited.

By intensification of agricultural production it is meant that a more efficient use of available farm resources such as land, labor, capital (livestock and money), and other inputs (e.g. energy, water and
nutrients) increases output per unit of input. Improved farm inputs such as chemical nutrients, irrigation facilities, improved seeds and breeds of livestock, pesticides and better agronomic practices are of paramount importance in raising the productivity of land and labor and thereby increasing total farm output. With packages of improved technologies, it will be possible to introduce market-oriented farming practices that would satisfy the needs of the non-farming population.

It is true that an agricultural practice is said to be sustainable when it makes optimum use of locally available natural and human resources, economically feasible, ecologically sound, culturally adoptable and socially acceptable. The use of industrial inputs is not excluded but seen as complimentary to the use of local resources and has to meet the stated criteria (Reijntjes, et al. 1992). In addition to considering the economic and ecological feasibility, industrial farm inputs should be used to supplement other resources that enhance technologies such as soil conservation, green manuring, and pest and disease control practices.

To help the peasant holders adopt farming practices that are more productive and sustainable, concerned rural development institutions and agents need to have relevant strategies and methods of working with the farmers. The actual introduction of sustainable intensive agriculture need to be based on farmers’ capacity to develop, adopt and manage the new technology.

Since about 78% of the Ethiopian peasants are practicing mixed farming systems, involving both crop and livestock production, improved integration of crop and animal enterprises can increase
productivity. In context of the Ethiopian smallholder, who have acute shortage of capital, it is appropriate to increase the productivity of the animals as a means of generating cash income. In turn, this income could be used to purchase improved crop varieties, chemical fertilizers and other known and easily available crop production technologies.

The development of animal husbandry practices is very important for a better market-oriented animal production and for the supply of draft power. Improvement in livestock feed base and raising the genetic capabilities of animals are of primary importance to increase livestock outputs. There is a need to develop and adopt improved but appropriate methods of forage crop production including crop residue storage, haymaking techniques and utilization for sustainable livestock production of small farmers.

The extension package currently practiced to intensify crop production in Ethiopia involves innovations of several improved inputs and agronomic practices. Improved practices involving new varieties, seed rate, seedbed preparations, methods of sowing, weed control, fertilizer application, crop rotation, intercropping, tillage practices, insect pests control, and improved farm implements are among the major package components (Dejne, 1996).

Raising the productivity of the human resources directly or indirectly involved in agriculture, through both short-and medium-term training, should be given prime importance. It would therefore be necessary to update the knowledge and skills of extension agents for technology dissemination through a series of intensive in-service training
programme. Both short and medium term specific training or technical orientation on appropriate research-based improved technologies in crop and livestock production should be given to the extension workers who in turn provide training to farmers. With objective of updating the qualification of extension agents, training and orientation should be organized in the areas of mixed farm management, livestock husbandry, environmental protection, appropriate use of rural technology, extension methods, cooperatives, population education, and gender issues in relation to agriculture.

Training of farmers on certain innovative farm practices should be launched in series using demonstration fields and mass media. Such intensive training should continue until the majority of the farmers are trained and become familiar with improved technique of production. Training Participants of such training programs should include contact farmers, model farmers and enlightened promoters of changes. The training modality is determined by the recipients' capacity. It should however be open system involving discussions, demonstrations, lectures, experience sharing, watching audio-visual aids and brainstorming.

VI. INSTITUTIONAL AND POLICY REQUIREMENTS FOR INTENSIVE AGRICULTURE

The government, farmers and their organizations, and nongovernment organizations are all important institutions that should play a vital role in developing the country's agriculture. The government in particular should play a key role in providing both institutional and
policy frameworks that will enable the productive use of resources in the agricultural sector. It should, however, be noted that the functions of the government institutions should be limited in areas where the private sectors cannot perform well. In principle, state enterprises should not directly be involved in agricultural production and marketing activities.

Investing on construction of rural infrastructures necessary for agricultural development (e.g. feeder roads, and major irrigation facilities) will be the task of the government. Developing a network of rural roads will significantly reduce the cost of delivery of inputs to the farmers and marketing of farm produce. Government investment on major irrigation structures like construction of dams and canals is necessary to intensify agricultural production and increase cropped areas in the arid areas. The participation of the local farm community in the overall development of the rural infrastructure, particularly their involvement in the process of planning, construction and maintenance is very important.

Agricultural support services mainly agricultural education, research, extension and credit facilities should also be provided by government institutions. The use of improved technologies can only be successful if farm credit is made available at favorable terms. The government may also need to subsidize the cost of improved farm inputs at least in the short-run. Ensuring that farmers obtain farm-gate prices close to import parity prices will help the peasant holders increase their income and make their farm activities economically feasible.
Adequate legislative provision should be made by federal and local governments that farmers be granted land use rights, freedom to migrate, settle and undertake agricultural production in any part of the country. It is absolutely essential to ensure honest and accountable public administration with the aim of reducing risk of investments in agriculture.

Farmers who are grouping themselves in voluntary associations mainly in the form of service cooperatives and local peasant associations, facilitate the diffusion of improved technologies. By organizing themselves, farmers will improve their bargaining power so as to increase their share in the final farm outputs prices and reduce the cost of input delivery. The concerned government institution (MOA) should help the formation and successful operations of the farmers associations. Both government and nongovernment organizations (NGOs) can assist in training the leadership and members.

The government should continue to encourage the participation of both local and international NGOs who are interested in community development activities, particularly those who are able to provide technical and economic assistance aimed at raising productivity. The government should seek partnership with these and mobilize resources for rural development programs. Beneficiaries obtain the lion’s share of the development funds.

Finally it is recommended that detailed socio-economic surveys on farm enterprises, including the nomads, their way of life and other farm resources endowments be conducted. So far, it was only through
sample surveys that the database for the agricultural sector of Ethiopia was established giving priority to grain crops production and livestock population. A detailed data, through conducting agricultural census is important for effective agricultural and rural development planning and program formulation. A comprehensive data collected through census can provide with the benchmark information. The annual agricultural sample surveys could update the census results in the subsequent years.

REFERENCES


I. INTRODUCTION

Population growth in Africa has accelerated from 2.2% during 1950–1970 to 3% per annum in the 1980s (Zaman, 1993). Africa’s capacity to feed itself dropped from 98% in the 1960s to around 84% by 1980; whereas the total population growth from 1975 to 1990 was on average 3.1% per annum (ECA, 1990). In 1991 the agricultural output of Africa increased by 2.5%, while population grew by 3%. Agricultural output has thus could not keep pace with population growth, and performance over the past years has been dismal: average annual growth in 1980–1990 being 2.8%, which means negative growth of product per head of 0.2% (ECA, 1993). This has resulted in widespread malnutrition and hunger in the 1970s and 1980s, forcing countries to increased food imports. Africa’s net import of cereals has consequently risen from nearly 20 million tonnes in 1979/81 to nearly 25 million in 1987; the import in 1987 amounted to 47 kg per capita (ECA, 1990).

The same trend holds true for Ethiopia, where the agricultural sector grew at an average of 1.2% per annum, while population increased at a rate of 2.7% per annum between 1965 and 1980 (Franzel and Van
Houten, 1992). The gap between food production and population growth has further expanded in the 1980s. As a result, cereal imports have increased from 397,000 tonnes to 1,045,000 in 1992 (World Bank, 1994). Consequently, Ethiopia has become one of the largest food aid recipients in the continent. Ethiopia faces this reality despite its rich endowment of agricultural land, working population, and untapped water and energy resources.

Agriculture is the mainstay of Ethiopian economy accounting for 43% of the GDP, 90% of the total export earnings, and 85% of the employment (CSA, 1990). Ethiopia’s agriculture is dominated by subsistence farming which accounts for more than 90% of the agricultural output. Although subsistence agriculture has undeniably been important the available information indicates that the productivity of this sector is very low. For instance, average yields of major crops at farmers’ holdings are about ten times less (IAR, 1987). Livestock productivity is even low, about twenty times less than that can be obtained from research stations (Jahnke, 1982; Gryseels and Anderson, 1983; Habtemariam, 1986). This clearly shows that the contribution of agricultural research, education and extension in promoting productivity of small-scale resource-poor farmers has been very low. As noted by Amare (1977), no progress can be made in Ethiopia unless this subsistence agriculture develops. Cognizant of the vital role that could be played by an effective agricultural education, research and extension system in bringing about agricultural development in Ethiopia, it is essential that their historical development and current status be assessed, and their linkage be looked into.

II. AGRICULTURAL EDUCATION

Agricultural education is essential for the generation and adoption of improved techniques and also helps to assure the planning and
implementation of polices and programs that are basic to make progress in agriculture. In Ethiopia, university-level agricultural education started in 1952 with the establishment of the Agricultural College at Alemaya, which is now known as the Alemaya University of Agriculture since 1986. Since then, only half a dozen agricultural colleges and institutions have been opened in the country over the years. At present, one university, five colleges, one institute and one veterinary faculty train agriculturalists at degree (DVM, MSc, BSc) and diploma levels in various disciplines including veterinary medicine, water technology, agricultural economics, agricultural engineering, animal and range sciences, plant sciences, forestry, soil and water conservation, dryland agriculture, general agriculture and home economics. However, until recently, no institution offered university-level training in agricultural extension nor does any institution of higher education sufficiently incorporated methodologies and approaches of agricultural extension in its curriculum.

A few thousands of students graduate each year from higher education institutions, compared to the few hundreds in the late 1950s. In 1987/88, for example, 3146 students currently graduated from agricultural institutions, and this figure was less than 20% of the total graduates in various fields (CSA, 1990). In 1990/91, 22% of the students enrolled in institutions of higher learning and 25% of the total graduates during the same year were agricultural students (CSA, 1994).

Although the number of graduates in agriculture is increasing, the course content has become increasingly detached from practical teaching in fields and laboratories. As a result, from the point of view of practical learning and student to facility ratio, the educational standard appears to be on the decline. The problem is aggravated by the limited capacity of the institutions. For example, the Alemaya University of Agriculture, which was originally planned to accommodate 200 students (FAO,
1973), currently hosts over 1200 students using roughly the same facilities. In this single most important agricultural university of the country, training in research and extension hardly takes place. Students rarely go to experimental sites and laboratories either as practical classes and laboratory sessions are becoming more and more limited for reasons of logistic and personnel problems and the like. This has made the courses offered almost entirely dependent on lectures and few laboratory sessions. Moreover, the academic wing is being affected by the high turnover of staff. As a result, the current agricultural education system produces graduates with only theoretical background.

Given the change in economic policy and also the need for well-trained workforce, the education system needs to be re-adjusted so that university-level agricultural education could produce graduates that can serve Ethiopian agriculture better through assisting in improving productivity and efficient utilization of resources by the traditional subsistence farmers. To this end, the following points are worth considering.

i. The curricula, adopted with some modifications from universities in developed countries, mainly focus on high-input commercial agriculture. Thus it is imperative that major revisions be made to include low-input and risk-averting or responsive agriculture, if agricultural education is to play an important role in promoting the production and productivity of subsistence farmers. Still more, the courses offered should also be modified in such a way that the focus is on more practical training. Probably, strengthening relations with research and extension organizations as well as with all others involved in agricultural development would facilitate in the practical training scheme of students. This will in turn also help teaching institutions to constantly assess and address the training needs of student-recipient organizations.
ii. A mechanism has to be developed that better coordinates and leads the academic programs and development of higher learning institutions in a rational and complementary manner. For instance, the opening of a given program or department is often decided by a given college or university per se provided that funds are available with little or no consultation of sister institutions.

iii. There is a need for creating attractive working conditions within each institution to curb the high turnover of qualified staff.

To summarize, the agricultural education system deserves special attention, if it has to effectively produce qualified and appropriate personnel that fit Ethiopian conditions.

III. AGRICULTURAL RESEARCH

Agricultural research is a purposeful, controlled, often formal, systematic, critical and intensive activity, whose objective is to generate or adapt technically and financially feasible, economically viable, socio-culturally acceptable, ecologically sound, and, hence, easily adoptable technologies that are among the major critical components in the process of developing the traditional agriculture. It is therefore an important input in the national development of any country. Nevertheless, agricultural research is location-specific, both spatially and socio-economically.

The problem of generating new technologies in Ethiopia is compounded by the large number of basic commodities produced and the diverse agro-ecological conditions prevailing in the country. Agricultural research in Ethiopia is, therefore, challenging and costly (Nair, 1984). In fact, in Ethiopia, as is the case with many other less-developed
countries, the resources allocated to research are often insufficient to cope with this challenge; for instance, in 1989/90 the share of agricultural research from the total capital expenditure of the central treasury was only about 0.6% (CSA, 1994).

Besides the obvious low investment, constraints of agricultural research in Ethiopia include lack of adequate skilled workforce; poor infrastructure; low institutional capacity in libraries, laboratories and equipment; and, possibly, suboptimal utilization of resources. The first agricultural research facilities were set up in the early 1950s with the establishment of the Alemaya College of Agriculture. However, agricultural research was not institutionalized until 1966 when the Institute of Agricultural Research (IAR) was established. IAR has since then been the prime body vested with the responsibility of initiating, coordinating, and funding, etc. of agricultural research in Ethiopia, even though recently the Ethiopian Science and Technology Commission seems to have taken the national responsibility to do so.

In addition to IAR, the colleges and universities do some agricultural research. The Ethiopian Seed Corporation, the Ministry of Agriculture (MOA), and the Disaster Prevention and Preparedness Commission (formerly the Relief and Rehabilitation Commission) also conduct some adaptive research (Tesfaye, 1990). The undertakings of these institutions are less integrated. The number of research stations so far established is minimal as compared to the size and agro-ecological diversity of the country. The research programs also have been concentrating mainly on some selected crops. Moreover, the adoption rate of the generated research findings is not that encouraging, as can be seen from the age-old traditional agriculture being still practiced by farmers, just adjacent to the research stations. The inherent weakness of the classical top-down research approach and the chronic failure of researchers to efficiently communicate their findings in easy-to-understand and usable forms have...
certainly contributed to this same state of affairs. Dixon (n.d.) pointed out that in IAR, over the years, the research programs of the different disciplines have grown apart, and though despite significant accomplishments by particular disciplines, there has been little success in integrating the results. To fill the gap, a Farming Systems Project (proposed in the mid 1970s) is currently contributing a lot in developing an integrated approach towards solving farmers’ problems and in narrowing down the gap between research and farmers’ circumstances. A similar measure has been taken also in the Alemaya University of Agriculture in the early 1980s.

To summarize, like the agricultural education, agricultural research in Ethiopia has concentrated mainly on high-input agriculture and cash crops. It is still much more sectorial since the western style of highly specialized, discipline-oriented research methodologies are the dominant strategy. It is also being undertaken quite independently by different organizations, resulting in the absence of leadership and coordination. Goshu (1991) noted that the national research environment in Ethiopia is characterized by the absence of a clear national research policy that imply lack of governance and coordination on the one hand, and conflict among institutions and between regional and national levels on the other. Thus, there is a need to come up with a comprehensive research strategy that better coordinates all the efforts and clearly indicates areas of priority at different levels. This in turn should be based primarily on the characterization of agricultural systems prevailing in the country, and the identification of the respective constraints and development potentials in line with national and regional development objectives. Identifying rural mutual support systems and indigenous techniques and conducting on-farm researches in the different agroecological zones and watersheds are necessary to make agricultural research endeavors more effective to the resource-poor farming community. The government of Ethiopia has now given due emphasis to promote the effectiveness of agricultural research.
As research is often expensive, and its payoff is worthwhile for a sustained development, there is a need for greater commitment from all those concerned with the policy, planning and actual allocation of resources for research. Likewise, researchers have to strengthen their efforts to come up with significant results that can effectively help in developing the agricultural sector so that the profitability of the capital invested in research can duly be justified.

IV. AGRICULTURAL EXTENSION

Agricultural extension is a process whereby new ideas, techniques or materials are communicated or introduced in a variety of ways to the farming community, and the problems, experiences and needs of the latter are communicated back to the sources (research and/or education institutions) and even to policymakers. Thus the capability to transfer appropriate technology to the users is the other critical factor in the development of agriculture. In Ethiopia, the MOA is vested with the responsibility of agricultural extension. Although established at the beginning of this century (Kebede, 1969), it was in the early 1950s that the Ministry attempted to transform the traditional agriculture. Until the late 1960s, the community development program was a strategy to identify and tackle problems of a given community through self-help projects that emphasized the development of agriculture, the rural artisan, its infrastructure and social welfare. In 1967, fertilizer trials commenced, complemented with a small supervised credit schemes. Then, the Comprehensive Packages Program (CPP) was introduced with the idea of removing selected barriers of production, in addition to introducing some agricultural innovations. The basic aim of the package program approach was to promote agricultural development by concentrating inputs and activities in geographically delimited areas. Seven comprehensive package projects of different degrees of intensity
were established (Gryseels and Anderson, 1983; Nair, 1984). Though empirical studies on the impact of package programs on Ethiopian agriculture are unavailable, they seem to have had noticeable influences on improving productivity and encouraging agricultural intensification and specialization in their immediate vicinities.

However, it was realized later that implementing such projects throughout the country is not feasible because of the large number of workforce required and the high costs involved. As a result, the Minimum Packages Program (MPPs) were initiated and in 1971 the Extension and Project Implementation Department (EPID) was established, under the MOA, with the aim of increasing peasant production by implementing these MPPs. The idea of MPPs is that the farmer requires integrated supporting services, viz., extension advice, fertilizers, improved seeds, farm credits, better tools and implements, and improved storage conditions. The MPPs largely focused on wheat, maize, tef, barley and sorghum. The program, funded by the World Bank, had emphasized on the impact of fertilizers on yield. Assistance with the marketing of produce were, however, very limited (Gryseels and Anderson, 1983). The first MPP (MPP I), envisaged to extend its services only to habitations within 3 to 5 km on either side of a motor road, covered only one-fifth of the productive land. EPID attempted to implement this program by setting up organizational cells called MPP areas. Each MPP unit stretches about 75 km along the road and was expected to cover up to 10,000 families on both sides of the road. The optimal area allocated for an extension agent was 150 km² and had to cover approximately 2000 families. The extension agent selects a model farmer who is expected to be an active person with good reputation in his community and who is supposed to extend what he learned to around 100 farm-families (Nair, 1984). The MPP I had two shortcomings—the first is farmers far from the all-weather roads were not beneficiaries; and the second is that MPP I focused on only crop
improvement, paying little attention to the livestock component, despite its tremendous importance in Ethiopian agriculture. Furthermore, it was discontinued following the decentralization of the extension program of EPID in 1976 in favor of the implementation of the Land Reform Proclamation of 1975. Later, the Agricultural Extension Department of MOA took over some of EPID’s responsibilities. But there existed confusion regarding the management, coordination and supervision of extension programs at field level (MOA, 1989).

In 1981, MPP II was initiated and the model farmer extension approach was replaced by the Producers’ Cooperative approach; this was constrained by institutional changes and lack of support facilities and appropriate technologies. The MPPs were not given enough time to be widely implemented, nor were there studies conducted to draw lessons from their weaknesses and strengths.

The Peasant Agricultural Development and Extension Project (PADEP) came as a followup to the MPP II, to be implemented in surplus-producing subdistricts (Wube, 1995). In 1983 a team of experts, based on the Indian experience, recommended the testing in some selected subdistricts of the Training and Visit (T&V) system as an extension management strategy. In 1987 it was decided, by the then government, that surplus-producing subdistricts be given prior attention in acquiring extension staff, agricultural inputs, and credits as part of the campaign for food self-sufficiency. As a result, 148 subdistricts were identified and the Agricultural Extension Department popularized its modified T&V system in these subdistricts. The modifications included the ratio of extension worker to farmer which was 1:1,300–2,300; and the frequency of training that was fixed to be monthly for extension workers and quarterly for district and regional subject matter specialists. By 1989 the modified T&V system had already been established in nearly all districts (awrajas). In each district an extension coordinator supervises
the extension activities of extension workers. Each extension worker, called development agent (DA), selects and works with 48 contact farmers. The DAs do regular visits of 4 days per week, and on each day 6 contact farmers are visited for a duration of half an hour each. A contact farmer is hence visited twice a month for a total duration of one hour. As each contact farmer have had some 26 follower farmers, a total of some two million farmers were said to have been reached by this program (MOA, 1989).

Considering the number of farmers to be served by a DA, and also the duration of each visit, coupled with lack of transport facilities, the effectiveness of the system is questionable. Yet it was a good start. Even this system was highly affected, when MOA was reorganized in line with the new administrative structure introduced in the late 1980s. Again, the reorganization of the MOA, following the current administrative setup was expected to affect, at least in the short run, the already weak extension system. Nevertheless, the fact that more DAs, who are natives of the areas, are trained, employed and made to work and live with farmers was a positive measure towards improving extension services at the grassroots level.

It needs to be recognized that agricultural extension in Ethiopia is likely to have a higher unit cost because of (i) the small size of land holdings (over 4 million farm households have an average size of 1.5 ha of cultivated land) and (ii) the extensive dispersal of habitation (Nair, 1984). In addition, the number of extension personnel is too small. For instance, in the late 1970s the total number of supervisors and extension agents were less than 3000 (CSA, 1980), while in neighboring Kenya, with half the population of Ethiopia, there were over 5000 extension agents in the mid 1950s (MOA, 1989). In the early 1980s the MOA has only one extension agent to serve over 8000 peasant holdings in a 2400 km² of area (Nair, 1984), even though currently it is anticipated that a
DA will serve about 2300 families. It is to be noted that the extension program in effect, as of the 1995 cropping season, is the National Extension Intervention Program which provides model farmers with a 25% down-payment credit to cover the cost of improved seeds of the major food crops and fertilizers, along with effective technical assistance in adopting better cultural practices.

In addition to their limited number, the professional competencies of the extension agents in general is perceived to be low. This is mainly because, that the time allocated for the training of DAs and other extension personnel was often short, the training was too general with too many subjects, and with little or no practical training on how-to approach and work with farmers.

Moreover, the then government used extension personnel for its forced establishment of cooperatives and villagization programs. In some areas they were even observed to have been involved in local administrative issues. Such activities could possibly have triggered the feeling of the farmers to consider the extension workers to be administrative and political weapons, rather than DA trying to help them develop their production and productivity. These might have contributed for the deficiency in the professional efficiency of the extension workers to select appropriate technologies, from what is available, and disseminate them to the region in which they are working and to glean feedback, on the same, to researchers.

To reduce this extension gap and make efforts more effective, the following suggestions are given, largely based on the shortcomings discussed above and from the experiences of other countries:

i. Group approach in extension should be promoted. Organizing large number of short-duration training programs, with the assistance of governmental and nongovernmental organizations, for farmers in
their own localities. Such experiences as annual agricultural fairs and better use of the available mass media will certainly contribute a lot in technology dissemination and making farmers more quality-oriented. Moreover, using markets and religious or cultural gathering sites as additional points of information dissemination, deserves attention; for instance, in market places people assemble weekly or so to exchange not only commodities, but also information.

ii. Launching diploma and certificate-level programs in agricultural extension to recruit and train large number of extension agents helps to reduce the current high DA to farmer ratio gap.

iii. Extension workers should receive relevant and periodic in-service training so as to enable them to listen to and work alongside with farmers by encouraging them to be partners of the development process rather than mere listeners of their advice. Also it is essential to start separate long-term training programs for mid-career extension personnel to improve their professional competence and to promote their dedication to their job.

iv. Publishing, at least annually, in different languages, recommendations, packages of technologies or information, in close collaboration with research and higher learning institutions is of paramount importance. This will alleviate the shortage, in the hands of extension workers, of extension messages.

V. LINKAGE BETWEEN AGRICULTURAL EDUCATION, RESEARCH AND EXTENSION

The Alemaya College of Agriculture served as a national center for coordinating agricultural education, research and extension ever since its
establishment in the early 1950s and until the early 1960s. In 1963, when its administration was transferred from MOA to Addis Ababa University, the extension wing of the college was transferred to the MOA. The establishment of IAR in 1966 with the official responsibility of sponsoring and coordinating of all agricultural research contributed to the separation of agricultural research, extension, and education in Ethiopia, because each became under three different and independent institutions. This independence persisted until the mid 1980s during which there had been no clear linkage between MOA, IAR and higher learning institutions.

In 1986, IAR and MOA formed the national and zonal Research Extension Liaison Committees (RELC) whose major functions include making a periodic review of the research-extension linkage mechanism, devising research priorities, and so forth (MOA, 1989). But soon RELC found itself on a wavering stand, as it was left pending among different institutions. Had it been strengthened, the impact of RELC on bridging the research-extension gap, at least in the short term, could have been significant. The impact of agricultural research, extension and education could have also been more pronounced, had efforts been more coordinated and institutions been mandate-specific, i.e., higher education institutions focussing mainly on teaching, IAR mainly on research, and MOA mainly on extension. This situation is a major feature of the classical top-down approach to agricultural research and extension, where researchers are very often physically isolated from the farmers’ real environment, even from extension workers. As a result, researchers commonly choose and work on problems that are in line with their own research priorities. Consequently, at present, research activities are largely featured by pieces of individual experiments of disciplinary scientists instead of small farmer-targeted and production system-based research undertakings of interdisciplinary teams.
To summarize, even though quantitative empirical studies are unavailable, the impact of the classical top-down approach of agricultural research and extension in promoting agricultural development in Ethiopia has been apparently minimal. The major reasons for this appear to be:

i. the research activities were not often based on the real problems of farmers and thus rarely took into account farmers’ circumstances in terms of objectives, resources (capital, land, labor, management, input, etc.) and limitations;

ii. the research undertakings were conducted in an environment totally different from that of small farmers, the outcomes were very often shelved, and whatever little transmitted, is directly given to extension workers without prior on-farm verifications, i.e., under farmers’ circumstances for their acceptability;

iii. there is little or no feedback from farmers to research about the disseminated packages because of incompetent extension agents and/or the physical isolation of researchers from farmers; and

iv. farmers may not be aware of the existence of appropriate technologies that will, at least partially, alleviate their problems, though many of them would require favorable policy and support systems.

As has been discussed so far, the classical top-down approach to agricultural research and extension created gaps in the technology transfer triangle: farmer–extension worker–researcher. These gaps forced researchers to work largely on the would-be problems of farmers. Consequently, research results are often unsuited to the real situation of subsistence farming. These gaps are underscored as the major reasons
for the lesser contribution of agricultural research and extension in promoting agricultural development in developing countries. These gaps will also persist as long as the farmers and their centuries-old indigenous knowledge about their physical and biological environments are ignored by the existing agricultural research endeavors facilities; and little emphasis is put on the relationship between research and extension (Amare, 1977; Sileshi, 1980; Langlais et al. 1984). Hence it is necessary to develop research and extension strategies wherein farmers and their organizations will be the driving force as well as active participants in promoting the efficiency of agricultural research and extension in Ethiopia. The reason behind bringing farmers into the center of research and extension activities is the conviction that efforts should be properly geared towards helping them improve their farm production and productivity in a sustainable manner.

To this end, the prevailing agricultural systems in the country must be characterized, their development potential and limiting constraints assessed, and those which should be tackled through research and extension should be properly spelled out. This enables to determine the strategies and priorities of agricultural research and extension which, in turn, facilitates to coordinate the efforts of agricultural education, research and extension organizations to attain one major objective—improving the production and productivity of subsistence farming. This also helps to address the problems of inadequate strategy, governance and coordination of agricultural education, research and extension activities. Organizing periodic workshops at regional and national levels to promote linkages among agricultural research, extension and education will also help improve the prevailing situation.
VI. CONCLUSION

Since Ethiopia is an agricultural country, it is by improving the agricultural sector that can be arrived at increasing export, improving the GDP, expanding the internal markets and also the industrial sector, and thereby developing overall economy. It is generally believed that measures to promote agricultural development include, among others, well-defined and integrated efforts in agricultural education, research and extension.

Even though agricultural research, extension and education institutions in Ethiopia have a relatively short history, their contributions in promoting the agricultural sector of the economy could have been more pronounced had their activities been better coordinated and their efforts been targeted to the development of smallholder agriculture.

Many of the higher learning institutions appear to be suffering from lack of qualified workforce and inadequate facilities, hence the academic standard seem to be on the decline. Thus, improving the facilities and creating more favorable working conditions to attract high-caliber staff should be given due attention. Besides, the education system needs revision both in content and course offering mechanism, if self-reliant and job-creating graduates have to be produced.

Until recently, agricultural research in Ethiopia is characterized by the absence of a clear national policy and lack of governance and coordination. It is highly discipline-oriented; the approach followed is still the out-dated top-down approach; and the research activity focuses mainly on high-input agriculture. Moreover, it is being conducted by different institutions that operate independently. This resulted in less-coordinated and sectorial efforts. In countries like Ethiopia, agricultural research needs to be built upon the knowledge that farmers already
have; it should also be geared mainly towards the generation/adoption and on-farm verification of technologies appropriate to small-scale resource-poor farmers to have appreciable impact on Ethiopian agriculture.

To develop governance and coordination at the national and regional levels, there is a need for developing a research strategy document that clearly indicates areas of priority. To this end, characterization of the prevailing agricultural systems in Ethiopia and identification of their respective development potentials and constraints as well as clear division of responsibilities among the institutions involved in agricultural research are the prerequisites.

Regarding agricultural extension, initially the focus was on community development followed by the effort for the development of commercial farming. Later, the package program approach and then the training and visit (T&V) system were exercised. Thus, in addition to substantive changes in approach, lack of well-qualified workforce/personnel, inadequate logistics and misuse of extension personnel. Therefore, special attention should be given to upgrade the quality and, especially, the quality of extension personnel working in this agro-ecologically and socio-culturally diverse country.

The linkage among agricultural education, research and extension, is undeveloped and weak with wide gaps amongst the rural development actors. Consequently, the contribution of education, research and extension in promoting agricultural development is unsatisfactory, although there are also inherent problems that pertain to the Ethiopian condition (diversity of commodities produced, diverse agro-ecological zones, rugged terrain, dispersed habitations, etc.). There is, thus, an urgent need for pooling all efforts together in a more organized, collaborative and complementary manner. It is, therefore, high time to
devise a mechanism whereby agricultural education, research and extension could work in a complementary and coordinated way to a common goal. With this regard further coordination at higher level of institutions may help, as is the experience in some countries like Zimbabwe and France.

Developing Ethiopia’s agriculture also calls for more investment in agricultural education, research and extension, besides developing the support system and coming up with encouraging agricultural policies. From 1989/90 to 1991/92 the expenditure on the agricultural sector rose from 3% to 5% of the total government expenditure; whereas on education and culture it rose from 12% to 17% (CSA, 1994). At present, the tendency of the government is to spend even more on the agricultural and educational sector. This is a trend that should be encouraged.

Finally, it should be emphasized that farmers and their organizations should be empowered to have a say on agricultural research and extension activities. The agricultural systems of the country should be thoroughly studied and characterized and the development paths identified. A research strategy document should be worked out to direct research undertakings towards alleviating the actual problems of the various agricultural systems, and all agricultural education, research and extension efforts should be efficiently coordinated so that agricultural development in Ethiopia will be fully achieved.

REFERENCES

Amare Getahun. 1977. Raising the productivity of peasant farmers in Ethiopia, association for the advancement of agricultural science in Africa journal. IV (1) 27-40

Habtemariam Kassa. 1986. Study on the management, utility and role of livestock in the agrarian system of the Tula peasants association, Kombolcha, Hararghe. Farming systems research unit, department of agricultural economics, Alemaya University of Agriculture, Dire Dawa, Ethiopia.


I. INTRODUCTION

The SG 2000 projects in sub-Saharan Africa were established by two humanitarian, non-profit organizations—the Sasakawa Africa Association (SAA), and Global 2000 of the Carter Center. Both organizations have the mandate to work towards enhancing food security in this part of Africa. The president of the Sasakawa Africa Association is the agricultural scientist and Nobel Peace Prize Laureate Dr. Norman Borlaug. Global 2000 is chaired by Jimmy Carter, former president of the USA. Funding for the SG 2000 projects comes primarily from the Nippon Foundation of Japan whose chairman was the late Ryoichi Sasakawa. The primary goal of the SG 2000 projects, currently operating in a number of African countries, is to develop programs for technology demonstration in cooperation with national extension services.

This paper attempts to present highlights of the role being played by the Sasakawa-Global 2000 (SG 2000) Project in the intensification of small-scale agriculture in Ethiopia, a country known for its poverty, food insecurity, and rapidly growing population.
This paper also gives an overview of the genesis and philosophy of SG 2000 Projects. A summary of the modalities of its operations and highlights of what the project considers its major achievements are also presented, along with recommendations, on policy level, if Ethiopia is to become self-sufficient and food-secure in a sustainable manner.

II. SG 2000 PROJECTS IN SUB-SAHARAN AFRICA

Since 1986 the SG 2000 projects have been involved in the technology transfer plane of food crops production. In fact, the origin of the SG 2000 project dates back to 1984. As to be recalled, this was the period when famine ravaged some 20 African countries south of the Sahara. The sad memory of the searing drought of 1984 in Ethiopia has caused a sizeable devastation and is an example. When the 1984 famine was spot-lighted for the world, the international philanthropist Mr. Ryoichi Sasakawa responded by flying-in emergency food supplies and by personally visiting the worst hit areas in Ethiopia. Recognizing that this solution was only temporary, Mr. Sasakawa wanted to go a step further in searching for ways to address the fundamental causes of the African food crisis. As a result, he turned to Dr. Norman Borlaug, who is one of the architects of India’s "Green Revolution", with a proposal to fund a similar process in sub-Saharan Africa. Dr. Borlaug believed that the essence of the problem was to transfer existing technologies on increasing food crops from research facilities to village-level plots and agreed to provide the technical leadership. Meanwhile, the former U.S. President Jimmy Carter offered to work personally with sub-Saharan Africa leaders to enact more effective agricultural policies.

In 1985, some 30 specialists from various disciplines and representatives from the public and international organizations who were familiar with the problems of African agriculture gathered in Geneva to examine how
sub-Saharan Africa could be assisted to achieve greater food security. That first meeting led to the establishment of pilot projects in several African countries. Ethiopia was included some eight years later in 1993. The general consensus reached in the Geneva meeting was: first, that in Africa, as a whole, the national agricultural research systems have already produced improved technologies that could double or triple yields on most farms; second, that there were reasonably well-established public extension systems; and third, that small-scale farmers in these environments were willing to adopt those improved technologies, if the technologies made sense to them and could result in higher yields.

As a result, the SG 2000 projects were launched in Africa to play a catalytic role in strengthening the agricultural extension services of the ministries of agriculture in countries where the projects operate. At the outset, it became important to underline the fact that the mission of the SG 2000 projects, by and large, is educational. Its major role is to provide a supporting arm to the extension services whose primary responsibilities are to provide advice to small-scale farmers on the use of improved agricultural technologies. Working along with national agricultural extension services since 1986, SG 2000 projects have supported initiatives to increase cereal production in sub-Saharan Africa through distributing the best available agricultural technologies to small-scale, resource-poor farmers.

The scientific and managerial leadership of the SG 2000 projects believe that farmers in Africa’s best lands should use modern scientific information to produce more food. They reject the contention of some agriculturalists that small-scale food crops producers can increase their productivity and be lifted out of poverty by traditional agricultural systems, without the judicious use of appropriate purchased inputs such as improved seeds, fertilizers, and crop protection chemicals.
Over the last decades, mounting population pressures have curbed the traditional system of shifting cultivation to restore soil fertility. As a result, crop yields remained inadequately low, soil resources became rapidly degraded, and croplands became infested with the invasion of noxious weeds. To help overcome these alarming environmental and food production problems, it is essential that agriculture be intensified on lands that can stand more intensive cultivation and be decreased in the more fragile ecologies. Unless African agriculture can be transformed to offer more attractive economic opportunities, the number of rural youth that abandon the land and migrate to the urban areas continue to increase. They will leave behind them the low-yielding food production systems that continually become short of labor and incapable of feeding the growing populations.

In order for the Ethiopian small-scale farmer to adopt improved food crop production packages, the extension services of the Ministry of Agriculture (MOA) must vigorously embark on an on-farm demonstration campaign. Even more important is that such demonstrations must be simple enough to be readily taken up; large enough for participating farmers to clearly assess the labor and input requirements; and effective enough to enable participating farmers receive immediate and clearly measurable benefits. Moreover, the required production inputs must be physically accessible and affordable.

The SG 2000 projects usually operate for a 10-year cycle with two distinct phases in program activities and staffing. The first phase lasts 5–6 years and includes the period of major activities and budget outlays. In Ethiopia the program is managed by an expatriate scientist, supported by few locally hired technical and administrative personnel. Most of the workforce is contributed by MOA, with SG 2000 providing the finance for the purchase of transportation facilities, inputs required for the establishment of 0.5 ha on-farm demonstration plots, and to cover
operational costs, as well as to support the organization and delivery of field-level training programs for extension workers. The second phase lasts 4–5 years. During this period the project sponsors would continue to support selected phase one activities, but at a lower degree. These operations would be managed by locally hired professional and technical staff. Phase two concentrates on exploring ways to alleviate second-generation problems such as those of postharvest activities, alternative uses of surplus grain, food processing, soil fertility recapitulation, input delivery systems, etc. Many of these interventions may commence during phase one, though will be invigorated during phase two.

III. OVERVIEW OF THE SG 2000 PROJECT IN ETHIOPIA

Ethiopia is the largest food cereals importer in sub-Saharan Africa; in 1991–92 the country imported more than 1 million tonnes of food. More importantly, 963,000 tonnes of this import came not as purchased food, but as food aid. Moreover, a 1995 FAO estimate predicted that the need for food import will grow at 6% per year, reaching 2.5 million tonnes by 2010 (Quinones and Takele, 1995).

Although 66% of Ethiopia’s land is believed to be potentially arable, only about 7 million hectares of land is currently cultivated. Until Ethiopia becomes in possession of the resources to put more land under cultivation, much can be done to increase the productivity of the contemporary small-scale agriculture, which accounts for 95% of the cultivated land, by demonstrating to the small-scale farmers the blessings of science-based agriculture.

Currently, Ethiopian farmers consume, on average, only 18 kg of fertilizers per hectare of arable land, and only 2% of the farmers use improved seeds, which is one of the lowest rates in Africa (Mohammed,
As a result of low and stagnating agricultural production, farming in Ethiopia has remained subsistence for several generations. Traditional farming systems are not only low yielding, but also result in the mining of the main plant nutrients from the soil. Practices such as collecting and burning dungs, and crop residues further deplete the soil organic matter content. In addition, rapid population growth has forced land-poor farmers to expand cultivation to more fragile lands. Cultivating highly erodible or hillside soils aggravates water runoff that increases soil erosion. In fact, fragile soils, inappropriate soil fertility management, and poor crop productivity are the three major constraints that impede adequate food crop production in Ethiopia (Quinones and Takele, 1995).

Obviously, there is a need for a rapid expansion in food grains production in this country. In the short-term, this can be attained by using moderate amounts of inorganic fertilizers such as N, P₂O₅ and K₂O, as required, and some judicious use of pesticides, herbicides and insecticides. In the long run, the use of phosphoric fertilizers and potash, when needed, has more to do with recapitulation of soil fertility as long-term crop production strategies; while the use of N will boost yields, once the other nutrients are restored in the totally depleted soils.

The SG 2000 Project in Ethiopia was initiated in 1993 with the overall objective of assisting the country to rapidly increase its food grain production. Some of the major specific objectives of the project are:

- To assist Ethiopia’s efforts to increase food crop production through aggressive agricultural extension campaign programs
- To strengthen the capacity of the extension services of the Ministry of Agriculture
- To assist in the creation of a functional linkage between the agricultural research and extension systems in the country
• To assist the national extension system initiate a strong extension program in post-harvest and food grain processing technologies

• To offer to the government of Ethiopia the capacity of the Carter Center in fostering sound agricultural policies that can help embark upon and sustain agricultural development programs

Working in close collaboration with the extension services of the MOA at all levels, the SG 2000 project has developed a simple, and yet effective, approach to transfer agricultural production technologies. The centerpiece of this approach is the farmer-managed Extension Management Training Plot (EMTP). This is an on-farm demonstration plot that usually is half a hectare in size so that participating farmers can clearly assess the labor and input requirements of the recommended technology. The focus of the extension work is on production environments that generally receive more than 700 mm of annual rainfall or that have irrigation.

The MOA/SG 2000 EMTPs introduce improved technologies for two or three of the most important food crops, for which proven and markedly superior technologies are available. Currently, improved technologies are being demonstrated for maize, wheat, tef, and sorghum. These recommended technology packages include:

• planting improved varieties at optimum densities;
• moderate and appropriate use of fertilizers; and
• improved cultural practices that better control weeds, insects and diseases.

Almost all of the improved varieties popularized to farmers and the crop management recommendations are taken from the Institute of Agricultural Research (IAR) and Alemaya University of Agriculture (AUA).
SG 2000 also devotes almost a quarter of its project resources to training in related activities. Although most farmers in Ethiopia are aware of fertilizers and improved seeds, they often lack the detailed information they need to take full advantage of these purchased inputs. In-service training is offered to development agents who, in turn, provide training to participating farmers. The participating farmers, as well as their neighbors, receive this training using the plots in the vicinity as the teaching sites.

Farmers who participate in establishing these EMTPs are assured that they will receive timely technical training for at least two years, and also the necessary inputs for one year to put into practice the entire recommended technology package. To add economic reality to the demonstration, the EMTP inputs, which cost ETB 500–800/ha, depending on the crop, are given on loan 50–75% to farmers who agree to repay the debt after harvest. Recovering outstanding loans of the 1993, 1994 and 1995 crop seasons has been encouraging, average of the three years being not less than 94%.

SG 2000 is also working with the MOA to help train farmers and development agents (DAs) in postharvest, particularly grain storage technologies, that include the construction of improved storage structures and the control of diseases, insects and other pests in stored grains. There are also plans to make small grants to participating farmers, who cooperate with extension workers in applying the improved postharvest technologies, so that they would continue to serve as demonstration sites for the neighborhood.

SG 2000 believes that viable governmental and nongovernmental agricultural development organizations that are staffed by well-trained and experienced personnel are essential for the agricultural transformation endeavors in the country. It has already been indicated
earlier in this paper that SG 2000 emphasizes the training of national technical staff because the project believes that this is a very important and lasting contribution that an NGO such as SG 2000 can and should make to the food self-sufficiency and food security drive of a nation.

In addition, the Sasakawa African Fellowship and Extension Education Enhancement Program (SAFE), a new program of the Sasakawa African Association that provides fellowships for extension supervisory and frontline technical staff to pursue formal training to a university degree, at BSc and MSc levels, is also in the process of organizing fellowships to strengthen the skills of agricultural extension workers in Ethiopia. These fellowships are directed towards field-level agriculture extension workers of the MOA, so that promising extension staff will pursue formal training at AUA for the BSc level and Sokoine University in Tanzania for the MSc degree level.

SAFE is also currently working with AUA, which is about to establish a new BSc program for mid-career extension staff of MOA with diploma credentials. SAFE will in due time assist AUA to upgrade its curricula and update its library collections on technology transfer materials. Beginning from the end of 1996 SAFE will commence sponsoring some mid-career extension staff with BSc credentials for further training at MSc level in other African universities.

IV. MAJOR ACHIEVEMENTS

Working in collaboration with the extension services of MOA and national agricultural research systems, SG 2000 has played a significant role in illuminating the way to sustainable food crop production in Ethiopia. The Project’s decision to adopt a realistic and practical size of on-farm demonstration plots emanated from farmers' real conditions.
These "commercial-size" plots not only lead to a realistic test of the new technology packages under demonstration, but also remunerate participating farmers with an immediate economic benefit for their labor. More importantly, because of their size, the SG 2000 demonstration plots attract the attention of all farmers in the community, thereby realizing the most important goal of an extension intervention, which is educational.

In the last three cropping seasons (1993–1995) SG 2000 has assisted in establishing some 5000 half-hectare on-farm demonstration plots of maize (both OPV and HB), wheat, sorghum, and tef to prove to farmers, extension workers, and policymakers that it is possible to at least double the production of these cereals provided that extension services are supported properly, inputs and credit services are made available, and the locally available research information is properly packaged.

The SG 2000 recommendation packages address to farmers the most pressing problems that constrain farm productivity, among which stand out:

- poor plant nutrients in the soil;
- lack of use of improved high-yielding seed varieties;
- inadequate plant population per unit of farmland; and
- poor weed and pest control.

Average maize yields from EMTPs have consistently outperformed farmers traditional plots by more than 200%. Partial budget analysis, using the 1994 average yield, has shown the high profitability of the technology. Marginal rates of return (MRR) to additional investment were 565%. A profitability assessment of maize production under three different scenarios: (1) assuming a 20% yield reduction from the current improved practice of an average of 55 q/ha; (2) 20% yield reduction and
no input subsidy; and (3) a 20% yield reduction, no input subsidy; and a 10% fall in farm-gate price; have indicated that maize production is profitable even under the third scenario.

SG 2000 demonstrates improved wheat production technologies on both Vertisols and non-Vertisols. On Vertisols wheat production is marginally more profitable under the traditional practice (MRR=100%) but can be quite profitable under improved management (MRR= 285%). The already-available technology has the potential to still increase productivity above the 30 q/ha average, if properly implemented. The highest yield SG 2000 participating farmers attained on Vertisols is 45 q/ha.

Wheat production in Ethiopia is mainly practiced on Nitosols and loam and sandy loam soils. Average yield is 12.9 q/ha. During 1994 some 451 wheat EMTPs, sponsored by SG 2000, were planted on non-Vertisols soils in most of the most important wheat-growing regions of the country. The overall average yield of the EMTP farmers was 115% above the traditional average. A partial budget analysis for wheat production has shown that, with improved management and use of inputs such as improved seeds, moderate amounts of fertilizers, and herbicides for both broad-leaved weeds and grasses, wheat production was quite profitable (MRR=315%).

SG 2000 has not yet analyzed the data from the more than 3000 EMTPs it sponsored in 1995. However, the raw data on maize and wheat indicate the same trend as in 1994, with large yield increments compared to the traditional yield. Even tef EMTPs, from northern and northwestern parts of the country, seem to show very spectacular results, some exceeded the 30 q/ha level.
V. THE QUESTION OF SUSTAINABILITY

Would Ethiopian small-scale farmers, who have themselves tried the new crop production techniques and those who have seen the benefits and would like to adopt this practice, continue to use the package when the current extension campaign phases out, which it would eventually? With results such as mentioned above, SG 2000 has shown beyond doubt that science-based agricultural production is both possible to realize and also economically attractive to small-scale producers. In other words, the new technology package has been accepted readily by Ethiopian farmers because the technology works. Therefore, the food cereal production package being popularized to farmers is technically sustainable. This is because the technology package is simple to understand, easy to apply and increases yield by two-fold or even higher, if implemented correctly. Moreover, new research findings can easily be incorporated into the package so that the package becomes more profitable.

However, there is a ground to argue that although the technology may be technically sustainable, the country’s economic capacity to use purchased inputs, particularly fertilizers and agro-chemicals, would be beyond its financial resources; as this may require allocating hard currencies. It could also be argued that the provision of credit services and the timely distribution of inputs are daunting tasks whose efficient performance would not be easily realized in the foreseeable future. These are issues that would affect the overall sustainability of the current technology promotion campaign. However, "what alternatives does the Ethiopian government has in order to ensure continued food supply to the ever-growing population?". Since the current traditional food crop production system is already in crisis the government is left with three choices:
• To continue seeking the international community’s food aid;
• To obtain the money necessary to buy food from the world market; or
• To produce the food locally, no matter what it may require.

The first of these is not sustainable because food aid is already declining because of the shift in emphasis to other more needy areas, and receiving continued food aid is not only a disincentive to agricultural production, but also affects the psychological makeup of the people. The third option, is not only much cheaper as compared to the second option but also is the most feasible measure because it has been technically proven that it can be done; therefore, the government must find ways to secure the money just as it does for other essential commodities, such as petroleum.

One of the most striking achievements the SG 2000/Ethiopia believes it has attained, in its brief age of only 3 years, is that it has been successful to win the will of the Ethiopian Government to adopting the SG 2000 method of improved agricultural technology popularization. In 1995, only two years after the initiation of the SG 2000 project in Ethiopia, the Government established close to 36,000 half-hectare on-farm demonstrations with the purpose of popularizing the use of improved technologies to small-scale farmers.

Average production figures show that yields from the 0.5 ha of tef, sorghum, wheat and maize demonstration plots, sponsored by the Government have increased by 240, 250, 300 and 300% respectively. The average yield per hectare for tef, sorghum, wheat and maize demonstrations have gone up to 12.9, 26.7, 29.0 and 42.5 q respectively. As a result, Government-sponsored demonstrations are expected to grow about 10-fold in the 1996/97 cropping season to about 360,000. While SG 2000 is very pleased to see that the Government of Ethiopia is
highly committed to the popularization of improved agricultural technologies, experiences elsewhere in Africa clearly indicate that there is a need to be cautious. We should never lose sight of the fact that the purpose of any agricultural extension campaign is essentially educational. For various reasons, it is important to note that there is a danger in overstretching the extension services because this would eventually entail inefficiencies in performance. In fact, it is not advisable to try to establish demonstration at every farmer’s plot.

What is important is reaching the critical mass within a given village where the technology is being popularized. It has been repeatedly proven that a technology that worked during demonstration will be readily adopted by other farmers as well. On the other hand, currently there is a trend to overburden DAs of MOA to assist several farmers in establishing demonstration plots. When DAs are required to oversee the establishment of several large-scale demonstration plots—particularly without properly training them and providing them with the necessary support, such as transport facilities—the efficiency of the demonstration plots may be less and yield levels might fall. If yields from demonstration plots fail to be dramatic or large enough to influence participating farmers to continue using the new technology and to attract neighboring farmers to adopt the new practice, the whole exercise would become self-defeating. It is very important that DAs ensure success right from the beginning. However, it is hardly possible to ensure dramatic yield increases from demonstration plots that are poorly managed. Therefore, SG 2000 strongly believes that the extension services of the MOA should plan for a manageable number of half-hectare demonstration plots.

There are a number of other important reasons for limiting the number of demonstration plots. For example, the SG 2000 improved technology package includes the provision of credit services for the purchase inputs.
The government-sponsored extension campaign has adopted the same approach. The logistics involved in delivering purchased inputs for 360,000 half-hectare on-farm demonstration plots is quite demanding, especially when this is done through the established government bureaucracy. Inefficiency in the timely procurement and distribution of inputs is bound to result in poor performance, which eventually would result in poor adoption by farmers.

Again, because of the very large number of on-farm demonstrations planned for the 1996/97 season, local government administrators seem to be heavily involved in the planning and implementation of the extension campaign. In terms of facilitating the delivery of inputs and credit services, now and also following the termination of the extension campaign, the current involvement of local government administrators in the process of the extension campaign has indubitably a positive impact. Unfortunately, however, local administrators, who are not often trained as educators, tend to coerce and impose when it comes to the selection of farmers to involve them in the establishment of demonstration plots and collection of down-payments and repayments. They also tend to put unnecessary pressure on the DAs and require them to engage in activities other than their official duties. Such conditions will overshadow the educational aspect of the extension campaign and can make farmers lose interest in the support the DAs attempt to provide them. This would eventually pose a detrimental effect on the overall campaign.

The SG 2000 project is often associated with the Green Revolution model which according to many critics is "dependent on seeds with a high response to big doses of inorganic fertilizers, use of irrigation and chemical pesticides". It is claimed that these seed varieties have displaced a wide range of traditional seeds, thus eroding crop biodiversity. It is also claimed that high-yielding systems of agricultural
production poison consumers out of existence and therefore agricultural production should revert to "lower-yielding sustainable technologies". Some professionals contend that small-scale food producers can be lifted out of poverty without the use of modern agricultural inputs, like improved seeds, fertilizers, and agro-chemicals. They often envision crop production systems based on organic fertilizers, farmer-bred-and-maintained indigenous varieties rather than those improved through science, and only biological and mechanical control of weeds, diseases and pests. The Green Revolution is also criticized for not being able to correct the inequalities of income distribution. What these critics did not observe is that the Green Revolution technologies in Asia (including China) have lowered the real cost of food, which benefitted the poor relatively more; made agriculture an engine of economic growth for the industrial and service sectors, leading to increased employment opportunities; allowed India and China to become largely self-sufficient in grain production despite their huge numbers of population and equipped farmers with increased income so as to be able to invest in soil and water conservation activities. Surprisingly, the critics have not considered the monstrous population explosion (Borlaug and Dowswell, 1995)!

What the SG 2000 project advocates is that the only way for agriculture to produce sufficient food and cope with the population explosion and to alleviate the chronic deficit in food crops production in this country is to intensify production in those ecosystems that lend themselves to sustainable intensification, while avoiding or decreasing the intensity of production in the more fragile ecologies.

Most of the increases in food production must be achieved through yield increases on lands currently under cultivation. Moreover, these yield increases must be achieved through the application of already-available technologies. Adoption of available agricultural technologies on the
more suitable lands will not only lead to economic development, but also will solve the serious environmental problems that come as a consequence of trying to cultivate unsuitable lands (Dowswell, 1994).

If Ethiopia is to feed its people, the use of chemical fertilizers must be expanded two- to three-fold over the next two decades. It is estimated that Ethiopia faces the horrifying prospect of producing only 75% of its food requirements by the year 2000, unless the use of fertilizers is tripled from its present low level, combined with higher yielding varieties and improved crop management practices. Surely, raising the average use of plant nutrients in Ethiopia from 7 kg/ha of arable land to something like 25 kg/ha cannot be an environmental problem.

VI. LESSONS LEARNED AND CONCLUDING REMARKS

The SG 2000 agricultural project in Ethiopia has demonstrated a number of crucial points to farmers, agricultural professionals, and policymakers:

- For areas with high to medium moisture, improved technology is presently available that can double and triple yields of food grains on most small-scale farms.
- Small-scale farmers in these agroecologies are ready, eager and able to adopt improved technologies, provided that inputs and credit services are available on time; a market exists for the increased production and thus there are economic incentives to increase production.
- The extension services of the MOA, when provided with adequate material and financial support to establish farmer-oriented economic-size demonstration plots, can be an effective agent for technological change.
- For Ethiopian small-scale farmers to be able to increase their productivity, the returns they would receive or expect should be
high enough to enable them to make a profit. Moreover, input and output prices need to be relatively stable and predictable.

- Nongovernmental, bilateral and international organizations who work in Ethiopia to assist in the country’s agricultural development endeavors would become more useful to the country, operate more efficiently and gain better acceptance by the government when they establish very close working relationship with the appropriate government bodies.
- In the long term, raising yield levels on very small farms is probably not enough to bring about significant agricultural development. Hence, small-scale farmers must find ways to cultivate larger areas.

To maintain the current inadequate dietary standards in Ethiopia, food production must be doubled over the next 2–2½ decades. The battle to keep food supplies expanding faster than population growth in Ethiopia will continue to be a demanding task. To feed the ever-growing population, small-scale farmers should be equipped with science-based modern agricultural technologies. There are formidable obstacles in the way of developing adequate systems for delivering improved seeds, fertilizers and crop protection chemicals; and for providing vital services such as credit, storage and marketing. Agricultural production in Ethiopia will only increase, if all the necessary basic components for development are properly packaged.

The combination of biotic and abiotic factors that constrain yields must be overcome in an efficient and orchestrated manner. Restoring and managing soil fertility; developing and using improved varieties, which combine high genetic yield potential with improved disease and insect resistance and tolerance to environmental stresses; and improving crop management practices, including integrated pest management, are among the principal factors to consider (Johnston, 1994).
Over the last three years, SG 2000 has been transferring technology to small-scale farm-families who have grown to nearly 5000 EMTPs, while the government has established close to 40,000 EMTPs in 1995. Almost all of these farmers have shown that they are willing, able and eager to adopt the high-yielding, fertilizer-responsive improved seed technologies that are being recommended for maize, wheat, tef, and sorghum.

What has been done so far, both by SG 2000 and the extension services of the MOA, is to demonstrate to farmers that it is possible to significantly increase food crop production. This is an educational intervention. What remains to be done is to ensure the uninterrupted supply of inputs. Ultimately, the private sector should play an important role in supplying inputs. In the mean time, the Ethiopian Government must make sure that public sector organizations that supply inputs and market grain are working more effectively. By the same token, without some subsidy fertilizers, at least in the short term, the present small demand for commercial fertilizers will not grow rapidly enough to make investments in fertilizer delivery systems that are attractive to entrepreneurs.

As is the case with externally funded development assistance projects, SG 2000 does surely terminate its intervention in Ethiopia. The inevitable question asked about projects like SG 2000 is: "will Ethiopia continue promoting the extension approach that it has now adopted"?.
For the first time in 10 years, and after experiences in several African countries, SG 2000 is tempted to believe that in Ethiopia, the government is very determined and has the will to wholeheartedly support small-scale agriculture through strengthened extension services. Nevertheless, the SG 2000 project believes that continued external support will be needed, from both governmental and non-governmental organizations, if this dynamic technology transfer program is to be sustained; because the government may not wholly overcome its budget
limitations in the foreseeable future.

Meanwhile, the Ethiopian Government needs to increase, as much as possible, its support to agricultural research and extension. The timely procurement and supply of agricultural inputs, the strengthening of credit and marketing services, and the enhanced establishment of farmers’ organizations to take care of the provisions of these services, along with private entrepreneurs, are but few of the most important undertakings that the government needs to give priority attention. These are among the most important components of the agricultural development process that must immediately follow an agricultural extension campaign.

REFERENCES


I. INTRODUCTION

Pondering on the possibility of economic transformation is a typical characteristic of the economy of less developed countries (LDCs) in which agriculture plays the crucial role in employment, output, foreign exchange earning, means of livelihood, etc., and yet where this sector is fragile, some of the immediate general questions are (a) the nature and pattern of growth and economic transformation, i.e., what is its nature, how does it occur, etc., (b) what happens to agriculture, and (c) what happens to the peasantry, particularly the rural poor. In this regard some characterization of a given structure, the stimuli that acts on the structure, and the outcome (response) would be instrumental to understand the processes. This, however, has to be seen in relation to the development strategies adopted by LDCs in general over the past decades and their outcomes. It would be helpful to look at four issues.

a. It has been a common practice to regard agrarian way of life in general and agricultural predominance of economies in particular as
the misfit to the archetypes of so-called ‘development’. The latter was often equated with the structural transformation of an economy, i.e., with the decline in agriculture’s relative share of the national product and the labor force.

b. Agricultural development for its own sake has been found to be too extraneous a deed to yearn. It was assigned a relatively passive role. But its instrumentality for bringing about the desired industrialization was underscored

c. The euphoria that ‘development’ would take place through accelerated industrialization-led strategy dissipated when it generally failed to transform the socio-economic structures of the LDCs along desired directions. Fast and sustainable growth did simply not happen, and dependence on the capitalist system has worsened instead of showing any sign of decline. The great deal of industrial protection, apart from its difficulty to sustain, proved to have undermined its competence in the international market, while domestic markets were too narrow to absorb the intended industrial development pattern. Its ability in terms of both earning and saving foreign exchange has suffered and weakened. The prospect for its growth was throttled by external factors as it was totally dependent on foreign capital. Its potential to create employment has been too limited to keep pace with the natural increase in urban workforce, let alone absorbing the rural surplus labor. The rural poor remained untouched by the industrial process thus the trickle-down parable did not work.

d. Because the majority of the poor in most LDCs live in rural areas and because food prices are a major determinant of the real income of both the rural and the urban poor, the low productivity of agriculture was seen as a major cause of poverty. A substantial body
of knowledge now rejects the subordination model of agriculture in economic development as conceptually incorrect as well as observably harmful to the economic fortunes of countries that have pursued such a model (Ellis, 1992:69).

This suggested for a formulation of an alternative that could rectify past failures that LDCs should first develop their agricultural sector. It was pronounced that these countries have their comparative advantage in agriculture and, unlike previous arguments, agriculture is presumed to exhibit the potential for fast growth.

It is contended that past strategies discriminated against agriculture through various mechanisms. Therefore it was argued that industrialization must have been preceded by a prior agricultural growth. Demand-side constraints to industrialization motivated the formulation of agricultural demand-led industrialization (ADLI), which later was modified as agricultural development-led industrialization (Adelman, et al., 1989). The general arguments for ADLI include: that outward looking industrialization must be re-examined in the face of a fall in the international demand for LDCs products, adverse terms of trade, and mounting debt repayments; and that intersectoral interdependence rather than agricultural instrumentality should be focused. Then the foremost task becomes raising agricultural production and incomes and tune the industrial production pattern along the demand pattern. How this is going to lead to increased agricultural output (supply response) in terms of magnitude, social base and sustainability—except the exhortation that individual producer’s decisions in response to market signals are what matter—is not made adequately clear when it is applied under differing agrarian structure.
II. DEVELOPMENT STRATEGIES AND PERFORMANCE:
A HISTORICAL AND MACRO PERSPECTIVE

If growth regressed and poverty advanced for LDCs over the last few decades, the situation in Ethiopia has been worse. Food production per capita declined by an average of 1% per annum during 1979-1992. From being an exporter of grain in the 1940s, the country moved to a rough balance between supply and consumption in the 1950s, and became a net importer during the 1960s. Since nearly two decades Ethiopia has become chronologically dependent on food aid, regardless of the weather condition that prevailed (Clapham, 1988:187-189). The volume of cereal imports skyrocketed between 1980 and 1992. Over the same period per capita GNP declined annually by 2% on the average (Table 1).

Why is that poor agricultural performance has been lingering for such a long period of time despite frequent changes in development strategies, state ideology, and even governments? A historical overview of how development policies and strategies were adopted, and how they affected agricultural performance would be helpful for several reasons: (i) to examine and establish the importance of policy as an explanatory variable of the present crisis; (ii) to understand policy as a process and

Table 1. Some indicators of growth performance

<table>
<thead>
<tr>
<th>Indicators (average figures in %)</th>
<th>1965-73</th>
<th>1974-80</th>
<th>1980-90/91</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP growth rate</td>
<td>4.1</td>
<td>2.2</td>
<td>1.6</td>
</tr>
<tr>
<td>Agricultural GDP growth rate</td>
<td>2.1</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>GDP per capita growth rate</td>
<td>1.5</td>
<td>-0.5</td>
<td>-1.6</td>
</tr>
</tbody>
</table>

the contexts behind adopting this or that strategy; (iii) to examine the rationale for the present policy choice.

It will be attempted to provide a brief account of the most salient features of the development strategies and polices pursued and the nature of the attendant processes in the past covering two distinct regimes; namely, the ‘modernization’ project of the pre-1974 autocratic regime, and the period of ‘socialist transition’ under military dictatorship. Then, on the basis of arguments developed through discussing these two regimes, some contemplation on the features of the third regime which is the post-1990 period of ‘transition to market economy’ under the present government will be made.

These three sub-periods are distinct in several fundamental ways: in initial conditions, agrarian structures, polity and ideology of governments, development strategies, and the international environment they faced. Therefore, the periodization follows such essential differences in regime structures. But also there are some characteristics that they share in common. Among others, all had to transform the same poor agrarian economy.

2.1. The Modernization Project of the Feudo-Capitalist Regime

2.1.1. The Agrarian Structure

Based on access to land as a means of production, three social strata could be identified: (a) the owner-operated small-sized but large number of peasantry, (b) the landless tenants, who are estimated to be at least 50% of all farmers (Warren, et al. 1986:332); and (c) the landlords. This makes it possible to speak of two major social classes: the peasants who
were engaged in the production of output on the one hand and the class of landlords who desperately depended on the peasant surplus which it could manage to voraciously appropriate for its reproduction on the other hand.

Agricultural production, as performed by the peasantry, was characterized by low yields, family-based, small-scale, and predominantly subsistence system. The diminution of the land size cultivated and its excessive fragmentation, the primitive types and trivial value of farm tools and implements, the extreme dependence on and vulnerability to changes in natural climate, the scant, volume and diverse composition of products reflecting the household consumption-bundle, the limited degree of dependence on markets for both production and consumption processes, all reveal the degree of subsistence of this peasant agriculture.

The pattern of surplus appropriation took various forms depending on the nature of land tenure systems. Although rent as a main form of surplus appropriation through variable sharecropping arrangements, constituted the payment to the landlord for the land use by the tenants, the latter had remained victims of several methods of surplus squeeze.

Capitalist penetration into agriculture is a recent phenomenon in Ethiopia. As of the late 1950s, however, the regime had already embarked upon a capitalist development project, including the development of commercial modern farms. With capitalist penetration, the state had to resort to the creation of a modern civilian and military bureaucracy for its maintenance of power. This development on the one hand had significantly reduced the dependence of the state on traditional elites and at the same time facilitated the intensification of centralization and power concentration. But on the other hand, the new and expensive bureaucracy could not be fully financed through similar means i.e., with
the peasant surplus only, that sustained its predecessors for long.

In addition to refining the mode of surplus extraction of the peasant surplus, the regime resorted to external assistance as a principal financial source, which in turn shaped the nature of the country's articulation within the external world. Penetration of capitalism implied restructuring of the economic base and structure that was essentially agrarian in form and content into a new one.

2.1.2. The Development Strategy: the 'Modernization Project'

Between 1957 and 1974 three successive five-year development plans were launched with main emphasis on infrastructural, industrial, and commercial agricultural development respectively. At face value, it was intended to transform the predominantly agrarian economy in accordance with the conditions set by capitalist development rhetoric. The development strategy (modernization) had three dimensions: (a) the regime's lust to build a modern state, (b) its pine for industrialization, and (c) its desire to make the primary export sector the engine of growth. These constituted the modern sector.

The role of external factors (development theories, the international market, experiences of other countries, and conditionalities for securing financial and material assistance) were also supportive of the same trend. Domestic saving ratio was paltry, hence the regime remained obstinately committed to foreign capital. According to Gilkes (1975), in 1967, 75% of the paid-up private capital was foreign and the percentage has not fallen ever since. Of the foreign loans, about 35% came from the USA and 40% from multilateral agencies; the World Bank has been there since 1950s. Modernization with its components of urbanization, industrialization, modern civilian and military bureaucracy, etc., called for additional agricultural produces to be procured. More food for the
growing urban population, raw materials for the nascent industries, and export crops for foreign exchange earning were desperately needed.

2.1.3 Forms of State Intervention

As far as the agrarian sector is concerned, an element of this ‘modern’ sector relates to the formation and expansion of commercial farming. State intervention thus took several forms. At least three forms of state interventions could be identified: (i) the regime’s interest in maintaining the type of land tenure system prevailed and its incessant reluctance towards undertaking any land reform measures; (ii) the macro-policy framework promulgated including the fiscal, monetary and investment policies; (iii) state investment in agriculture with its two variants: (a) in commercial farms, (b) state investment in the agricultural sector through several mechanisms (for example, some infrastructural development, modernization of peasant agriculture, agricultural education and research, etc.).

Side by side to the development of purely capitalist commercial agriculture, an alternative approach to modernize peasant agriculture was designed by selecting strategic geographically delimited regions in which ‘good results could soon be seen’. This approach was what was known as the ‘package programme’ which in effect meant a policy of concentrating development efforts in selected small geographical areas in the form of providing the peasants of the area with modern farm inputs to raise their labor productivities and marketed surpluses, and promoting the establishment of cooperatives for marketing the increased production. Consequently, two major production units emerged in the agricultural sector: (a) the commercial farms that are grouped under the modern sector, and (b) the peasant agriculture in its pre-capitalist backward uniform.
2.1.4. Agricultural Performance

The share of agriculture in GDP, which was about 65% in the early 1960s, has been reduced to about 50% in 1974. Though the share of the manufacturing sector increased over the same period, it did not match with the rate of decline in agricultural share, as the service sector grew much faster. Aggregately, this structural transformation seem to have been accompanied by a positive growth record. For example, according to Mulatu and Yohannes (1988), the average annual growth rate of GDP between 1960 and 1970 was estimated at 4.4%. Agricultural output registered an annual growth rate of over 2%; Berhanu (1994) has also corroborated the same trend.

Such aggregate figures should be broken down into their social groupings before passing any judgement on them. Labor productivities in the commercial farms were quite high. Thus, it could be said that the ‘modern’ agricultural sub-sector had exhibited a supply response that contributed significantly to the growth of agricultural output, particularly its marketed surplus component. Labor productivities and marketed surplus in the ‘package project’ areas were also reported to have risen, despite the fact that a further classification of peasants in the same area would give a different picture.

Those who benefitted from the projects were the resourceful ones rather than the initial target groups, which implies that the project would have caused a relative deterioration of the position of the poor. Peasant labor productivity remained low and the living conditions of the peasants by the end of the planning period (1974) was no better than it used to be at the beginning. Available food supply per head that was 175 kg in 1960 declined to 172 kg in 1973 (Picket, 1991:188). In fact, it could be said that for the majority of the near-landless and the poor it became worse. Between 1957 and 1974 three successive famines were recorded.
that claimed the lives of hundreds of thousands of peasants and their families. This obviously manifests the fact that aggregate growth by itself would mean very little, as far as the rural poor is concerned, unless there is a visible mechanism to re-distribute its benefits.

Some of the reasons why the period between 1957 and 1974, despite the planning efforts, had not successfully transformed the economy include (Mulatu and Yohannes, 1988:80): (a) that the exercise was actually symbolic, primarily designed to give a reforming face to the regime to effectuate socio-economic changes; and that (b) basically, development policies were designed to achieve the interests of the ruling class and foreign capital and therefore lack the political commitment necessary to effectuate substantive structural changes.

It is the nature rather than the pace of growth that really matters to bring any meaningful results in improving the condition of the poor. The nature or the model of growth adopted by the feudo-capitalist regime was exclusionary. It served the interests of the upper class, and thus could not bring about any improvement for the peasantry as it was not designed for that purpose in the first place.

2.1.5. The Exclusionary Model of Growth

The agents of the ‘modernization’ project were the state, domestic private capital (its constituencies), and foreign capital (its ally). This project demanded mobilization of huge resources to be generated and extracted from the agrarian sector. Given the prevalent agrarian structure, an immediate materialization of this objective necessarily involved active organizational and institutional interventions. Peasant agriculture, which dominated the economy, was subsistent and far from being monetized. Even if there were little surpluses, it could not have been captured through passive pricing or marketing policies. On the
other hand, the landlord class was engaged in prodigal consumption of the agricultural surplus it could appropriate from the tenants.

As such, the move towards agricultural ‘modernization’ through its commercialization process and the accompanied aiding policies, were meant to intensify that process of resource generation and extraction. The production of export and industrial crops in commercial estates enabled the generation and capturing of foreign exchange and industrial raw materials. The development of ‘modern’ farms and the commercialization of agriculture made the generation of marketed surplus of food possible. Thus, from the agrarian sector point of view, the model was one that combined the elements of generating agricultural surplus and its extraction through developing of a narrow base of modern commercial agricultural subsector. This in turn required massive investment resources that had to be made available via several mechanisms such as allocation of a disproportionately high amount of investment resources at subsidized terms. For example, out of the ETB 19 million loan disbursed to the agricultural sector in 1970–1971, only ETB 4 million went to what was called small farmers through loans to cooperative societies. The remaining ETB 15 million was devoured by a handful of large commercial farms, of which ETB 6 million went to three large farms and ETB 9 million went to 107 commercial farms (Gilkes, 1975). The formation and expansion of a ‘modern’ subsector within agriculture had several implications for the peasant agriculture. Resource allocation pattern was disproportionately concentrated in favor of the former. In many cases, it involved peasants displacement and eviction.

Not paradoxically, the model had a partial integrative (as a means of social control) component. Through destabilization and eviction of the peasantry, it practically alienated the producer from ownership of the means of production, thus creating the necessary precondition for
subjecting them to proletarian conditions. Thus, not surprisingly, the commercial farms had the principal source of labor force by recounting impoverished and destabilized former peasant farmers.

It must also be mentioned that while the degree of tenure insecurity exacerbated for the tenants, the landlords (who were the regime’s constituencies) were the beneficiaries of the ‘modernization’ project through high price of land, and they also reaped the benefits of improved agriculture through share-tenancy. Peasants outside the selected project areas were completely neglected, and those within were effectively excluded from the growth process in that they could not have access to resources.

2.1.6 Structural Weaknesses

The ‘modernization project’ was an attempt to superimpose capitalist production relations onto a backward and non-monetized agrarian economy. It could not be financed through domestic savings because the material basis was not developed in the first place. As was initially induced by the development and expansion of capitalism, it had to heavily rely upon foreign capital. This situation conditioned its growth pattern and orientation, such that the domestic inter-sectoral linkages and interdependence were subordinated to that of the external one.

The ‘modern sector’ was virtually linked with foreign capital from both supply and demand. Industry was dependent on imported inputs to such an extent that its value-added was negligible. Modern agriculture which was geared towards primarily surplus generation and extraction was also excessively dependent on foreign capital. And, the state machinery, whose chief function was social control, had been virtually dependent on foreign capital and the surplus it could muster from within.
Modernization exacerbated land concentration, tenant evictions, discontent with excessive power centralization, marginalization of the disadvantaged regions and groups, etc. Its reproduction was determined to a certain degree by changes in international political and economic environment with which it forged a relatively strong ties. This narrow-based growth model, which was too heavily dependent on and extremely susceptible to foreign capital, by excluding the peasant agriculture suffered a setback in terms of weak agriculture industry linkages which in turn contributed to further lack of growth in both sectors. Therefore, it failed to be a sustainable model of growth.

2.2. THE SOCIALIST PROJECT (1975–1990) OF THE DERG

The feudo-capitalist regime was immersed in deep structural crises that lay at the heart of its failure to resolve the agrarian crisis, to develop productive forces in such a way that to improve the population’s living standards and even in some cases to maintain previous subsistence levels. Maxims reflecting the deepening of agrarian problems have, since the 1960s, been at the forefront as instruments of struggle against the feudo-capitalist regime.

2.2.1. The Agrarian Structure

One of the factors that profoundly altered the agrarian structure was the radical ‘Public Ownership of Rural Lands Proclamation No. 31’ issued on 4 March 1975 to nationalize rural lands and distribute it to the tillers. Private ownership of land had been abolished and land distributed as promised meant that the classes of landlords and that of landless tenants were virtually abolished. With widespread nationalization, not only of commercial farms but also of the strategic secondary and tertiary sectors’ establishments, so abolished was also the class of private capitalists.
This situation led to the development of two dominant agrarian subsectors. The first is the overwhelming peasantry—in a modified form with the freeing of former tenants and landless from servitude. With ownership of rural land and nationalization of commercial farms and their subsequent conversion into state farms (which rapidly expanded through direct state investment), the state came out as a second dominant subsector. In 1979 a guideline for the formation of agricultural producers’ cooperatives (PCs) was issued that gave rise to the development of the PCs as separate agrarian structure. Post-revolutionary Ethiopia’s agrarian structure was characterized by the co-existence of three distinct forms of agricultural production: the peasantry, the PCs, and the state farms; the latter two as socialist forms and the former with its pre- or non-socialist attributes.

2.2.2. The Development Strategy: The State-Centered Accumulation

The state emerged as a dominant economic agent within the economy\(^1\). It had achieved this through removing the upper classes but also replacing them on the one hand, and through its further expansion on the other. The rationale behind this state hegemony was that socialization of the production process would in the first place involve the conversion of the means of production into the public hands. This, it was alleged, could be achieved only when the state as the representative of the people and in the interest of the Ethiopian workers and peasants, directly owns and controls the natural resources and the key industries, commercial and financial sectors of the economy.

The fact that the ‘socialist project’ was embarked upon within a context of a backward agrarian, feudo-capitalist socio-economic structure

\(^1\) That the entire economy shall be in the hands of the state was clearly spelled out since December 1974 when the Derg first attempted to formulate a policy in its Ten-Point Program.
suggested that the responsibility for preparing the material foundation for socialist development, which was tantamount to a grand-scale socio-economic transformation, had to lie on the shoulders of the state. Rapid development of the productive forces accorded an industrialization-led growth strategy for several reasons (see for example: Saith, 1985; 1990). The imperatives for provision of services to the entire population, which required heavy investment resources that could not be met otherwise, called for an active role of the state.

Therefore, the emerging state sector, by default, had transformed itself into a ‘socialist sector’ where the socialist development process implied the expansion of the role and dimension of the state sector, with the pre-socialist sectors unavoidably yielding to such a growth process. Both theory and experiences of other socialist countries revealed that agriculture must finance ‘socialist industrialization’; and the socialist agrarian transformation agendum involved, as stated above, the burgeoning of the state sector (state farms) and the conversion of the peasantry into PCs. Thus according to the Ten-Year Perspective Plan (1984/85–1993/94), the share of agriculture in the GDP that was 48.3 in 1983/84 was planned to decline to 39.1 in 1993/94; while that of industry to rise from the 1983/84 figure of 16% to 23.9% in 1993/94. Similarly, the importance of peasantry, as a pre-socialist form, had to decline in favor of the socialist form of production: state-farms and PCs (Table 2).

As is the case with any regime in Africa, or elsewhere, the question of survival on power was one of the prime agenda for the state. As stated by Clapham (1991:244):

“This Ethiopian state has shared the interests of states everywhere. As a hierarchy of control, manned by officials who maintain themselves by extracting a surplus from the directly productive areas of the economy, it has an interest in
Table 2. Percentage share of forms of agricultural production in the projected socialist agrarian development

<table>
<thead>
<tr>
<th>Form of Production</th>
<th>1983/84 (base-year)</th>
<th>1993/94 (planned)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cultivated Area</td>
<td>Production</td>
</tr>
<tr>
<td>Peasantry</td>
<td>95.16</td>
<td>95.38</td>
</tr>
<tr>
<td>Producers'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperatives</td>
<td>1.34</td>
<td>1.40</td>
</tr>
<tr>
<td>State Farms</td>
<td>3.20</td>
<td>3.05</td>
</tr>
<tr>
<td>Settlement</td>
<td>0.30</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Source: PMGSE (1984)

...in extending its degree of effective control over the people within its frontiers; and in maintaining the external political and economic linkages which are essential both to surplus extraction (which in Ethiopia, as in other parts of Africa, depends to a large extent on state control of external trade), and to importing the manufactured goods which are needed for central control and elite satisfaction.

Such circumstances unequivocally led to an unprecedented growth of the state apparatus of 'public administration and defense,' which also made the burden on the agricultural sector much more intractable in terms of financing its growth and maintenance.

Viewed thus, the agrarian question, as Saith (1985) argued, bifurcated into two dichotomous (and at times incompatible) sets of issues: its instrumentality in assisting industrialization through the provision of investible resources, also in financing such a relatively overexpanded state apparatus on the one hand, and the imperative to make the rural sector a subject of socialist development on the other (in terms of
raising the standard of living as well as effecting an institutional
transformation favoring socialist production relations and organizational
forms), since the bulk of the poor and the oppressed reside here. There
are obvious trade-offs inherent in such simultaneous transformation
(socialist transformation and industrial transformation) processes which,
in the absence of judicious interventions, would put the whole process
in jeopardy.

2.2.3. Forms of State Intervention in Agriculture

The development strategy, as elucidated above, was one of creation,
extension, and strengthening of socialist sectors with the state taking the
lead in the accumulation process. For agriculture, it had some clear
implications. First, with primacy accorded to socialist industrialization,
agriculture must be the provider of investible surpluses. Second, socialist
institutional reorganization of agricultural production implied that the
peasantry (in pre-socialist uniform) must yield to the socialist forms.
The forms in which the state intervention had taken should be seen from
such a framework. Two general forms, but not mutually independent, of
state interventions in agriculture could be identified: institutional
building, and surplus extraction through several mechanisms. These are
adopted in combination in such a way that the former was implemented
to effect the latter.

One of the options available to the state was to generate agricultural
surplus through direct captive mechanisms, i.e., through establishing the
state farms. This served two simultaneous purposes: it constituted a
grand exemplar of socialist agricultural production process based on
public ownership of the means of production at higher level of
production forces and, in the meantime, ensured the generation of the
necessary agricultural surpluses (however at high opportunity costs). The
other route the state followed was to mobilize peasants to form PCs.
This was a form of state intervention in which elements of incorporation
of peasants within socialist development and, at the same time, their integration into the state-led accumulation process were superimposed. Its organizational and economic superiority as a socialist form of production, over the peasantry that operated on fragmented and scattered holdings, was justified by its potentials to overcome the limits to modernize agriculture and raise labor productivity in which surplus could be generated. Besides, it promotes socialist production relations.

The fact that the state enjoyed also a monopolistic right, over not only foreign trade but also in the control of input supply, made the disproportionate allocation of such farm inputs as chemical fertilizers, herbicides, credits, etc., in favor of the socialist agricultural subsector. This was paralleled by the extension of the Minimum Package Projects (MPPs) in the so-called potentially productive areas where the state felt it feasible to raise incremental agricultural outputs relatively easily.

Once the necessary surplus has been generated, the next step was to mop up and extract it for fuelling the state-led accumulation process. The most overt instrument of surplus extraction of the regime, as elsewhere, was through its pricing and marketing policies and through fiscal instruments. Two versions of control were exercised: restriction of free inter-regional grain flows\(^2\) (exchange suppression) and price suppression. The peasantry had to surrender some proportion of its produce to the Agricultural Marketing Corporation (AMC) at a price that could go down as low as that the SFs used to receive\(^3\).

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\(^2\) Internal customs posts (a feature of Ethiopia's political economy before 1935) have been reintroduced to control trade in coffee, grain, and contraband imported goods, and in the process to demonstrate the level of physical control which the government needs to police the economy (see, Clapham, 1991)

\(^3\) For example, while SFs could receive ETB 47, 55 and 31 per 100 kg of wheat, barley and maize respectively, the corresponding figures for the peasantry were 34, 28, and 20 ETB (Abebe, 1989:60). Of course, even the prices received by SFs were by far lower than that obtaining in the open markets.
2.2.4. Agricultural Performance

Aggregate performances of the economy and that of the agricultural sector deteriorated as compared to the figures recorded during the previous regime. In terms of agricultural growth record, this period witnessed a plunge over the pre-1974 figures\(^4\). Annual per capita GDP declined at the rate of 0.8% per annum in the past two decades. Agricultural stagnation is largely responsible for this record (Berhanu, 1994:12). Rated even by its own objectives, the state-led ‘socialist project’ was doomed to failure. The share of agriculture in GDP declined from about 50% in 1974 to just over 40% in 1990. However, this decline was not accompanied with a proportionate increase in the share of manufacturing sector, which just increased from nearly 10% of its 1974 level to about 12% in 1990. On the other hand, the service sector witnessed a significant rise in its share from 32% in 1974 to over 40% in 1990. Agricultural labor productivity remained generally low. Despite the all-round support, in terms of resource allocations, enjoyed by the socialist agricultural subsectors, their performances were disappointing\(^5\).

The state somehow managed to grab agricultural surplus through generation and extraction mechanisms. Even though the SFs served this short-term purpose, it could not generate a surplus sufficient enough to meet the demand of the state sector, which had grown out of proportions. On the other hand, its disincentive effects on long-term and broad-based production capacity of the peasantry and PCs had been

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\(^4\) According to the World Bank (1986 in Mesfin Mirotche, 1994:87), the post-1974 annual agricultural growth rate was 50 percent lower than the agricultural growth rate during the 1965-73 period.

\(^5\) I have shown elsewhere (Abebe, 1989) that, in economic terms, there was an enormous opportunity cost involved in tying productive resources in state farms. Costs of production (at shadow prices) in state farms per 100 kg of wheat, barley, and maize were in excess of 200%, 190%, and 300%, respectively, of that obtaining in peasantry.
quite substantial. Therefore agricultural growth did not occur. The concentration of resources in selected sectors and regions for purposes of surplus extraction, in addition to its insignificant impact on aggregate growth, further exacerbated regional inequalities and aggravated problems of the neglected areas. Food production per capita deteriorated, and the country became desperately dependent on foreign food aid.

2.2.5. The Logic of the Model

The ‘socialist project’ involved a state-led accumulation process whereby the state assumed ownership of the means of production and took the lead to launch socialist development. This led to an enormous growth of the public sector which could be achieved through destabilization of the elites (the upper class) of the preceding regime and replacing itself instead.

By carving out a narrow-based ‘socialist-sector’, the state not only was concerned with its maintenance, but also undermined all the pre- and or non-socialist agrarian structures since the expansion of the socialist sector demanded the generation and extraction of huge agricultural surpluses. From the peasantry point of view, the model comprised some elements of institutional incorporation, since it was initially based upon an egalitarian basis of land access on the one hand, and that of functional [partial] integration since it focused on marketed surplus through plugging the peasantry into the system of surplus-extraction on the other. Therefore, the system was necessarily a surplus extractive model of exclusion. This model, which encompassed surplus generation alongside its extraction, was a renewal of the old order of exclusionary model even at a higher level propelled by the drive to socialist industrialization and socialist socio-economic transformation simultaneously.
Agricultural surplus could be generated through direct state investment in captive production processes (SFs), which thwarted proper and rational resource allocation patterns, and extracted through monetary, fiscal, pricing, trade and marketing, etc., policy instruments. Rural institutions served more as instruments of social control than as instruments of social liberation and empowerment of the poor. Measures such as forming cooperatives and villagization, which have been encouraged by the government ostensibly to promote a more efficient structure of agricultural production, to use Clapham’s (1991:262) words, in practice have as their main effect the concentration of production into a smaller number of large units that are much easier to control than the scattered rural homesteads. In the process, the peasant subsector did not only suffer from resource starvation, but also had to surrender part of its meager produce to the state at extremely harmful terms of trade. This obsession with short-run surplus generation and its extraction definitely had an impact on the long-run and broad-based agricultural supply response. Among others, it led to the neglect of agriculture in general and the peasantry in particular.

The socialist subsectors (the state farms and PCs) were only fuelling the state-led accumulation process; and agriculture’s importance was conceived in terms of its functionality only. Consequently, agriculture could not develop; industry could make no headway either, and squeezing agriculture through various mechanisms continued to haunt the minds of policymakers. As a result, food production per capita enormously declined. The social basis of reproduction was eroded through the high vulnerability of the peasantry to natural and policy factors. As its focus was on myopic narrow-based marketed surplus, the strategy was not a sustainable one; on the contrary, it was self-destructive. The ‘socialist project’ collapsed because of its inherent structural weaknesses.
2.2.6. Structural Weaknesses

The Derg inherited a poverty-ridden but at the same time exploitative socio-economic structure and attempted to transform it along ‘socialist’ lines. This attempt was more of hasty superimposition than gradual transformation of the socio-economic system which was far removed from the traditional socialist development requisites. Such precipitate actions proved to be part of the problem rather than the solution. Long before the collapse of the Derg, Saith (1985:3) wrote:

"...under certain conditions - which generally typify the circumstances of the socialist aspirant countries at their historical revolutionary ‘moment’ - accelerated industrial growth generates inter-sectoral imbalances which are resolved through the adoption of expeditious institutional policies, especially in the rural sector, which can all too easily divert the trajectory of societal transition away from its socialist direction".

Except that accelerated industrial growth did not materialize, the rest was what had actually happened in Ethiopia with the result that both socialist industrialization and socialist agrarian transformation were put in jeopardy.

But the Derg itself had been the subject of the socialist transformation process—the gap in psychological and ideological preparedness entailed in making a leap from the imperial military officialdom all along to the vanguard of the ‘Workers Party of Ethiopia’ was too wide to veil every hollow within it. The inherent contradiction within it and its manner to resolve not only challenges from its adversaries but also its internal contradiction reflected the Derg’s political immaturity and lack of confidence, which forced it to resort to maintenance of its power at any cost.
The public sector (notably, bureaucracy and military) has grown out of proportions for the purpose of social control beyond the sustainable capacity of the fragile economic base. Neither could it be fully financed by its narrow reproductive base created for the purpose. With the withdrawal of foreign assistance the system could not but disintegrate. After more than a decade and a half of experimentation with a ‘socialist project’, what was obtaining by 1990 was an overnight demise of the rural socialist institutions (particularly the service and producers’ cooperatives) which were considered as key elements of socialist development process. This clearly demonstrates a fundamental attribute of institutions which are imposed from above for the primary purposes of social control involving no popular participation in their making and functioning: that they evaporate and crumble instantly. But most importantly, their features and fates also reveal the mirror image of the very system that make them.

As is well known, the country’s economy throughout this period had been a ‘war-economy’, and the protracted war had serious impacts on development efforts in addition to directly ravaging the human and material resources. But, it also helps explain to a significant extent why the regime had to collapse. The Derg practically alienated itself from the society, but particularly so from the peasantry whose daily lives had been severely intruded through expeditious policies of collectivization, villagization, conscription, contribution, etc., all of which involved overt and/or covert coercion.

The post-1974 period was distinct from the previous one in quite substantial ways. In the first place, the 1975 land proclamation turned rural land into a state property and gave its tillers, the peasants, a usufructuary right. Second, the attempt to develop rural institutions, though ideological motives prevailed and later jeopardized the process, was a move in a right direction in empowering peasants. The 1974
revolution had opened up eminent windows of opportunities which could have brought meaningful results for the rural poor. Unfortunately, it proved to be a missed opportunity.

2.3. The 'Market Populism' of the 1990s

Post-1989 developments in international political environment, in addition to domestic processes, marked the turning point in Derg's ideology and policy. In 1990 the Derg declared that it has abandoned the 'socialist matto', and instead suggested a mixed-economic policy as appropriate to the Ethiopian condition. But, this was too cheap a move to sell at that moment to enable the Derg buy any support, internal or external, to save its face and stay in power.

Thus, unable either to bring any major socio-economic transformation or maintain its power, the Derg regime simply crumbled. It was overthrown by the Ethiopian Peoples Revolutionary Democratic Front (EPRDF), which formed a Transitional Government in 1991 and won the 1995 election to lead the country for the subsequent five years.

The emerging agrarian structure, the development strategy adopted, and the issues of government agenda for agricultural development will be briefly discussed below.

2.3.1. The Agrarian Structure

As mentioned above, the pattern of agrarian structure that had developed during the course of the 'socialist project' has changed a lot towards the downfall of the regime. Particularly, the PCs were completely dismantled following the change in government development policy from a 'command' to 'mixed' economic system, with the peasantry and the state farms remaining.
Peasant Associations (PAs), with limited cultivated land coupled with an ever-expanding rural population, found it increasingly difficult to accommodate the additional land claims of their members. Through successive rounds of redistributions, size of landholdings were turned into fragmented diminutive plots. Over 65% of the households are estimated to be surviving with holdings of below a hectare. On the one hand, the evolution of mini-plots that are too small to meet the household needs made households land deficit. These are households that are no more in a position to secure their livelihoods by operating these subeconimic holdings. Some studies (Berhanu, 1991) revealed the severity of land shortage to be so serious that the majority are far below the minimum required to support households even under very poor living conditions, given the current level of technology and land use intensity. In some areas, land is available only when someone dies without leaving an heir. Partly as a response to such processes, land redistribution has been officially frozen since 1989. On the other hand, landlessness has re-emerged with the young, particularly, being its unwitting victims (Dessalegn, 1994).

So when the new regime came to power this agrarian structure constituted the legacy of the past. The problem was further compounded with the collapse of the Derg when the destabilized people saw their sanctuary in the rural sector.

The Transitional Government of Ethiopia (TGE) made it clear, in its economic policy of 1991, that there would be no major changes in the policy of public ownership of land until the land question has been settled by a referendum after the transition period (TGE, 1991:21). It did promise, however, to correct previous discriminatory land allocation patterns through land re-allocation to the landless without discrimination, and barred further fragmentation of the current holdings.
The 1994 constitution states that land shall remain the property of the state and of all Ethiopian people. In its form, the land policy may be perceived in its continuity rather than a break with the immediate past. Substantively, however, its provisions make a formal land market (short of sale) to operate in rural areas. Given the prevalent intra-rural inequalities in access to land and other farm resources, peasant differentiation and the attendant socio-economic processes are only to be expected with the poor being further marginalized.

Therefore, when raising the issue of agrarian structure in today’s rural Ethiopia, we have to bear in mind the following: (a) there is the peasantry with differential access to basic agricultural resources, including land; (b) there is the state farm subsector that would be retained for some strategic purposes; (c) there is an emergent nascent capitalist production in commercial farming as a result of re-organization of some of the state farms and/or direct investment in new farms; and (d) there is a group of landless.

2.3.2. The Development Strategy: Agricultural Development-led Industrialization

The TGE identified several ‘major causes of economic crises’ and formulated a development strategy. Before looking into the specific features of the adopted strategy, a brief discussion of the justifications for the government’s choice of a market-oriented economic policy would be necessary. Some of the explanations are to be found within the causes of the failure of the regime it replaced. Command economy, as was practiced by the *Derg*, was strongly criticized on various fronts. Apart from its expansion, pervasive state intervention in economic activities is presumed to have resulted in distortion of economic incentive structure, thus it was the major cause of growth failure. Redefining and changing the role of the state in the economy suggested that rectification of such government failure implied its contraction and
replacement by market forces. Therefore, there was the lesson to be drawn from economic theory (the efficiency argument) and the empirical evidence of the experience from the presently ‘developed’ nations, most of which somehow claim the market as an institution that led to efficient resource allocation and growth.

Since the absence of producers’ initiatives to increased production was assumed to have resulted in agricultural stagnation and decline, the need to stimulate peasant production through market incentives was deemed essential so that marketed surplus can relatively easily be generated, captured and extracted.

Second, the economic policy adopted by the current regime cannot be seen in isolation from its overall state ideology, which is to an important extent conditioned by external factors. Its coming to power coincided with (in fact was expedited by) the end of the ‘cold war’ period, with capitalism and ‘free marketeers’ regaining momentum of command and influence over the entire world. There is the scarcity of domestic investible resources to reverse the undesirable situation on the one hand, and the necessity to fill in the resource gap from external sources, thus fulfilling the criterion (‘keeping the house in order’) to attract the resources on the other hand. This was attended by the collapse of the other alternative (i.e., the ‘socialist’ bloc), which rendered fitting in the preconditions for soliciting political and economic support from the world capitalist system inevitable; which is not only a question of choice but also of lack of alternatives. The ideological budge and the economic policies emanating thereof would then assume formalization of the conditionalities. In this case, the role of international organizations (notably the World Bank and the International Monetary Fund) and donor countries has been significant in shaping the economic policy⁶.

⁶ Rau (1991:99) argues that “The Bank commands a powerful place in the development establishment with its views, programmes and financial resources. And behind the Bank itself, its membership (and voting authority) is dominated by the United States, Japan and the Western
Not surprisingly, structural adjustment programs (SAPs) were introduced and the initial necessary monetary and fiscal policy reforms have been made as part of the stabilization program. Reforms in exchange and interest rates, tariff, price structures, etc., were introduced. Restructuring of state enterprises and trade liberalization is under way. An agricultural development-led industrialization (ADLI) has been adopted as fit to correcting the inherent structural deficiencies of the past and the present, as well as propelling growth dynamism for the future. Literally, ADLI refers to development strategy based on domestic resources and markets. Given the predominance of agriculture in the economy in terms of output, employment, etc., the utilization of such capacities for economic development would necessitate its realization in the first place, thus agriculture is to lead and industry to follow.

Some of the reasoning for pursuing the strategy include:

(i) There is the alleged failure of previous development strategies\(^7\) in terms of transforming the economy as well as eradicating poverty, thus the need to search for an alternative. In the past there was a tendency to underestimate the social returns to investment in agricultural growth that is related to faulting agricultural development strategy as antithetical to raising accumulation. If greater self-sufficiency was desired, ADLS may well prove to be the best and quickest route towards this direction because it was considered to be more efficient than available alternatives. The rate of return to investment in agriculture is considered to be high, equal to, or exceeds that of investment in industry (World Bank,

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\(^7\) It can be argued that industrialization-led strategies in LDCs have been throttled by external politico-economic forces. For example Streeten (1982, in Rao & Caballero, op. cit.) suggests for both a cool look at outward-looking industrialization strategy as well as a search for a better one (e.g., investing in agriculture).
1982, cited by Adelman, et al., 1989:321). Comparative efficiency of agriculture can be evinced by its lower incremental capital to output ratios and its capacity to generate internal growth dynamism through creating demand not only for non-agricultural sectors but also for its own products. Also, input requirements and investments in agriculture are much less import-intensive than investment in the non-agricultural sectors. Moreover, the wider base over which income gains can be distributed will limit import-intensive consumption demand patterns. In general, it corresponds with domestic resource endowments and minimizes external dependence.

(ii) The concentration of poverty in rural areas suggests that poor countries should in the first place, improve the living conditions of rural people. If previous development strategies did in fact neglect the rural poor, ADLS would constitute a preferable way of correcting it in terms of narrowing down rural-urban income inequality through improving rural incomes. It would also help improve the intra-rural income distribution, since its growth linkages with rural non-farm activities [commonly referred to as poor’s provinces] are strong.

(iii) Agricultural and economic growth have been found to be complementary, such that investing in agriculture is believed to pay off in terms of both additional agricultural output and additional non-agricultural growth. Strategic resources for the development of the (weak) non-agricultural sectors are located in rural areas, suggesting that their release will be contingent upon the growth in agricultural productivity. The generation of internal growth dynamism through farm-nonfarm linkages, inter alia, calls for an improvement in farm income.

One of the reasons for the failure of industrialization-led development strategies (IDLS) has been its weakness in domestic
supply and demand linkages. Specifically, domestic markets have been too narrow to absorb industrial growth. Then there was an important lesson to be drawn that even for a successful industrialization to take place, a prior agricultural development was a prerequisite.

The experiences of the industrialized regions would suggest that without a prior agricultural development, the industrialization process would only be stalled. Compared to the industrialized regions, the now LDCs are at a disadvantage in that opportunities that prevailed then for the former are not only missing but also the international economic situations in which LDCs find themselves today are only perpetuative of the resource-transfer mechanisms which at balance, are harmful to them.

(iv) There is the imperative to improve the balance of payment of these countries through foreign exchange generation and/or saving, basically through enhanced agricultural production, to meet import demands, repay previous loans and secure additional ones. This latter issue is the one that is ceremoniously advanced by most LDCs governments with blessings from the leading international financial institutions (prominently, the IMF and the WB) and western governments in the form of SAPs.

The argument for ADLS is perceived as a process encompassing the attainment of several objectives simultaneously: a growth objective, an employment objective, food security objective, an income distribution objective, a foreign exchange earning and/or saving objective, a risk-reducing objective, and an industrialization objective (Adelman, 1984). Nevertheless, demand-side constraints to ILDS have dominated the current reasoning for inducing agricultural development (Adelman, 1984; Adelman & Lane, 1989; Singh & Tabatabai, 1993). Hence, most of the
policy prescriptions revolve around the instruments of incentive (mainly price) provision that tend to facilitate surplus extraction through ‘free markets’ rather than focusing on the structural factors constraining agrarian development.

As Adelman, et al. suggested, in African low-income countries, since the creation of an adequate agricultural surplus cannot be financed internally the policy requires financing through international assistance (Adelman, et al., 1989:337). This heavy reliance on foreign aid would condition the pattern that ADLS would assume which, in theory, can vary from the narrow-based development of commercial farms (capitalist or state farms producing export or any strategic outputs) to the broader development of peasant agriculture. Thus, for example, ADLS designed primarily for surplus extraction from agriculture, in the context of backward peasant agriculture, tends to favor the former.

2.3.3. ADLS vis-à-vis Markets

In addressing problems of agricultural growth and entitlement, both inter- and intra-sectoral resource allocation at a point of [and over] time figure out as central elements of the discussion; and, a conceptualization of the mechanisms by which this or that ‘development strategy’ is to be best implemented is fundamental. In this case, the issue occupying the center of the debate is around the choice between the two institutions, namely, markets or states, as to which addresses best the problems of agrarian development. The central issues deserving deliberation are: (a) the theoretical justifications and analytical concepts underlying the argument; and (b) the way agrarian development has been treated in such a conceptualization.

The pro-market view is based on an idealized model of perfectly competitive market, which tends toward full employment equilibrium for
the economy as a whole (the macroeconomy), and efficient use of resources by the firm & the individual (the microeconomy). The way in which the problems faced by LDCs has been conceptualized, by such an approach, serves as an entry point.

For the pro-marketeers, the picture of LDCs’ economies is mainly portrayed as a characteristic of an internal and external ‘deformity’ whose symptoms are expressed in terms of dual deficits: an internal fiscal budget deficit and an external balance of payment deficit. The cause for this ‘deformation’ and its perpetuity is explained by the presence of an excessive state intervention in economic activities which led to series of inefficiencies. The state, in trying to finance such deficits, would only do harm to the economy by introducing and reproducing distortions through various regulations.

The first suggestion of such an accounting system, in order to put the economy in a good shape, would be to avoid state intervention. In other words, the ‘invisible hand of the free-market’ as an efficient resource allocator comes as a basic antidote. Of course, this ‘general remedy’ contains within it specific types of prescriptions.

Related to the first, but more specific to agriculture, is that due to inappropriate policies and strategies, state intervention discriminated against agriculture, through mainly price controls, thus depressed agricultural market incentives. The terms of trade between the agricultural and non-agricultural sectors, and the supply response of agriculture constituted the analytical point of interest. Increased elasticity of supply, as a proxy to growth, forms the pillar of the argument, and it is defined as a function of efficiency in production, and an avenue for efficient trading, which in turn, is conceived as constrained by lack of stimuli (economic incentives) at the level of production units.
Price distortions are to be held responsible for low output levels. Logically, if such distortions are to be removed, the response would come as an enormous outward supply-shift. Since output growth entails a further expansion of investment and opportunities, the benefits would reach the poor in different forms (employment, services, etc.).

The first concern is that there seems to be lack of a systematic addressing of the more deeply embedded constraints on growth (Commander, 1988), mixing-up of causes with symptoms of poverty, and in the process, skipping of entitlement issues. Agrarian problems in LDCs are mainly structural; therefore, they require structural solutions. For example, not only have lack of technical & economic opportunities to which peasants could respond hampered progress, but also the skew distribution and concentration of power and wealth blocked the access of the poor to such limited opportunities. Supply and demand side restrictions imposed by structure have limited the speed and spread of agricultural growth. If this continues unabated, it will lead to economic and social marginalization which exacerbates the conditions of the disadvantaged groups.

The second set of discontent is related to the extent to which assumptions regarding the behavior of the analytical unit, the way production is organized, and functioning of markets, are in conformity to the reality in LDCs. There exists a proposition that the interaction of consumption and production within the rural household causes a unique form of decision making which sets peasants apart from any other kind of production unit under capitalism. Given the trade-offs between goals in household decision making, policy outcomes are unpredictable at household level. Moreover, let alone perfection, factor and product markets are usually missing in many rural areas of the LDCs. Even if the idealized model is to be accepted, the pursuit of individual objectives led by market forces would not necessarily lead to optimization of societal objectives.
There is a tendency to underestimate the social and political relations within which rural production takes place. Some of the reasons why subsistence production, and peasants within it, differ from other production units is that non-market interactions figure prominently in their access to resources, in the farming systems they adopt, and in the social principles to which they conform (Ellis, op cit.). Moreover, from a macroeconomic perspective, most of the prescriptions of such a model are renewals of the old order (theory of comparative advantage, etc.,) and maintenance of status quo which advances dependence of the poor on the rich within the economy, and of LDCs on the dominant capitalist system in general. Development strategies need to be evaluated against some taxonomy of the nature and interest of inter-related actors (for example, the rural poor, national elites, and foreign capital). Hence, the political dimension, which is quite critical, is deliberately left out of the analysis or, at best put at the background.

There are clear evidences that agriculture is price inelastic in the short-run\(^8\). Then the question should no longer be the size of the price response. Instead, analysis should focus on how to make agriculture grow (Binswanger, 1989; Singh and Tabatabai, 1993). For example, it is found that the elasticity of supply response to price incentives is made lower by market failures. The low growth multipliers found for sub-Saharan Africa (Haggblade, Hammer, and Hazell, 1991; in Platteau, 1994) might well have their source in an inelastic domestic supply of food which plays such a strategic role in the growth process of African countries because income levels are low (so that people spend a significant part of their incomes on food, and particularly on starchy staples) and the infrastructure is largely underdeveloped. Given the small size of many rural communities in SSA, market segmentation originating in infrastructural deficiencies gives rise to serious market failures which

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\(^8\) See, for example, Binswanger (1989:230-242); Chibber, in Commander (1989:55).
can possibly take the extreme form of nonexisting or missing markets (Platteau, ibid:30-31). Rural poverty is not properly addressed if the majority of the (less than) subsistence producers are left out of the domain. It should also be noted that a sizable portion of this group is food-deficit peasantry.

Most argue that the central issue should not be a question of choice between state or markets, given the short-comings of each on the one hand and their complementarity on the other. Rather it should be that of achieving the right mix between the two. The characteristics of ‘perfect’ market do depart significantly from those prevailing in actual markets which does not warrant the outcomes resulting from those markets to be efficient. As Timmer observed:

"...In LDCs, the scale and pervasiveness of market imperfections and sometimes even the apparent absence of functioning markets is often addressed as a rationale for government dominance & control in the economy. Getting the ‘mix’ right, not just ‘getting prices right,’ is the key to success, and the mix varies from country to country, from time to time, and from circumstance to circumstance. No single ideological approach provides the right answers any more than does a single technical model...We have learned, for better and for worse, that government matters” (Timmer, 1991:ix).

A question remains: how would ADLI be effective in achieving the stated objectives of sustainable growth, equity, and self reliance, and how would it affect the lives of the peasantry in general and the rural poor in particular?

III. EXPLORATION OF SOME ISSUES

It is a widely held view that agriculture has an important potential in economic development given appropriate structures and policies; that
whatever objective to achieve i.e., faster growth, reduced poverty, increased employment, reduced inequality, etc., agricultural transformation is a strategic instrument. Empirically, agricultural growth and economic growth rates are positively correlated because of both the relative importance in terms of size of the sector and its linkages with other sectors of the economy. It is also widely accepted that the past was characterized by missed agricultural opportunities. We have seen that surplus extraction and squeeze has been a definitive characteristics of past regimes and their development strategies.

History would testify that such tendency was not limited to a recent phenomenon. This obsessions with short-run and narrow-based surplus extractive model had limited the speed and spread of agricultural growth and, as a result, marginalized and pauperized the peasantry, which, in turn became an important barrier to economic transformation through its supply and demand-side multiplier effects. Huge reliance on foreign capital, which could be obtained at relatively easy terms, to finance the enormous government expenditures, not only in the ‘development projects’ but also of the state apparatus of each regime, has served two interrelated purposes: apathy towards genuine development of peasant agriculture (particularly the food sector) on the one hand, and subservience and susceptibility of government policy to the dictates of foreign capital on the other. Then, one has to ask a question that for a full realization of agricultural potential, what would constitute the appropriate structural and policy packages? What is the exclusionary model ascribed to?

Ethiopian agriculture is basically peasant agriculture; and peasant agriculture is overwhelmed by food production. About 80% of the cultivated area and more than 85% of the total agricultural production is under cereal crops. It can be argued that it is precisely because of this production pattern that peasant agriculture failed to attract the attention of the regimes.
Some Reflections on Sustainable Intensification of Peasant Agriculture.

Sustainable intensification cannot be perceived in isolation from the sustainability of the macro-policy and the development strategies themselves adopted by governments. When a given model of development strategy itself fails to be sustainable, but proves exclusionary to the peasantry, it will not be readily obvious as to how it can bring about or assist in sustainable intensification of peasant agriculture. The latter has to be linked with the current low agricultural productivity levels, the prevalent agrarian structure, and the capacity and limitations of the peasants to muster critical resources to reverse the situation on their own bootstraps, as well as the degree to which the government can and will design appropriate policies.

Enhancing peasant productivity through sustainable intensification implies, among other things, that government should design a clear agricultural (including land) policy, assist in rural capacity and institutional building, and facilitate the delivery of the necessary farm resources to the peasantry. Specifically, the agricultural policy should reflect the prevalent agrarian structure and address the needs of the majority of peasants who operate on subeconomic plots and with low level technology. As far as agrarian structure, specifically peasant production, is characterized by excessive land fragmentation, diminution and even in some cases landlessness, low level of technological use, and high degree of subsistence, the very subsistence level of the peasants itself would be put in jeopardy let alone talking about agricultural surplus and dynamic intersectoral linkages. Policy should therefore be directed to avert these processes for something better. An integrated aspect of this endeavor would be to initiate and convince peasants to build their capacities through some sort of cooperation. Of course, the effects of their bad experience with respect to PCs obviously set a limit on future cooperativization endeavors. But, somehow it has to be faced.
This would enable both the government and the peasants to effect desirable changes, such as tackling land fragmentation and diminution and possibly landlessness through several mechanisms which the poor cannot handle individually. It would also become instrumental for provision of services as well as marketing and procuring of products and inputs. This, however, requires a change in philosophy that could break from past trends and practices.

Does this imply getting rid of state as a key element of surplus extraction? Does the contraction of the state and its replacement by market forces preempt surplus extraction? If the past growth models had been exclusionary, could it be avoided under the present structural and policy context? Does market liberalization automatize a broad-based ‘agricultural-development’ strategy or will it be limited to certain accumulation centers? Will it induce growth (a supply response), given the structural basis, and through which mechanisms? If so, what will be the nature of growth and how wide will be its social base? Are the structural weaknesses of the past regimes and models tackled now? What are its potentials and constraints? These are some of the leading questions whose answers should be explored in the future.

REFERENCES


Lewis, W. A. 1954. Economic development with unlimited supplies of labor. The Manchester School of Economic and Social Studies. 22(2).


Pickett, J. 1991. Economic development in Ethiopia: agriculture, the market and the state. OECD.


CONSTRAINTS TO EFFICIENT AND SUSTAINABLE USE OF FERTILIZERS IN ETHIOPIA

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I. INTRODUCTION

Agricultural production increased by less than 1% between 1980 and 1990. In the mean time, the rate of population growth averaged 2.9% resulting in a widening gap between the supply and demand of food. The rate of food self-sufficiency declined to 58% in 1991/92 (Table 1). Per capita availability of food declined well below the recommended intake of 2100 calories per day. In recent years, agricultural production has increased owing to a more favorable policy environment, increased use of fertilizers, and good weather.¹ But past experiences show that good harvest for one or two years can be accompanied by bad years.² The threat to agricultural production emanating from drought is still considerable.

¹ The level of food grain production in 1995/96, for instance, is regarded as one of the highest ever. An estimated 10% increase in area planted to food crops, a 15% to 20% increase in fertilizer use and favorable rains are reported to be the major reasons (MEDC, 1996).

² For instance, the bumper harvest in 1982/83 was followed (2 years later) by one of the worst famines in the history of the country (1984/85). See also Table 1.
### Table 1. Domestic food production and rate of self-sufficiency for cereals and pulses (1979/80-1991/92)

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>Post-harvest losses</th>
<th>Seed requirement</th>
<th>Animal feed</th>
<th>Net production</th>
<th>Required production</th>
<th>Rate of self-sufficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979/80</td>
<td>7406.47</td>
<td>481.42</td>
<td>148.13</td>
<td>23.31</td>
<td>6420.32</td>
<td>5669.42</td>
<td>113.24</td>
</tr>
<tr>
<td>1980/81</td>
<td>6458.46</td>
<td>419.80</td>
<td>129.17</td>
<td>21.23</td>
<td>5888.26</td>
<td>5822.50</td>
<td>101.13</td>
</tr>
<tr>
<td>1981/82</td>
<td>6213.83</td>
<td>403.90</td>
<td>124.28</td>
<td>20.28</td>
<td>5665.39</td>
<td>5981.44</td>
<td>94.72</td>
</tr>
<tr>
<td>1982/83</td>
<td>7683.70</td>
<td>499.44</td>
<td>153.67</td>
<td>24.77</td>
<td>7005.82</td>
<td>6146.53</td>
<td>113.98</td>
</tr>
<tr>
<td>1983/84</td>
<td>6238.07</td>
<td>405.47</td>
<td>124.76</td>
<td>20.52</td>
<td>5687.32</td>
<td>7698.75</td>
<td>73.87</td>
</tr>
<tr>
<td>1984/85</td>
<td>4751.79</td>
<td>308.87</td>
<td>95.04</td>
<td>17.82</td>
<td>4330.06</td>
<td>7911.36</td>
<td>54.73</td>
</tr>
<tr>
<td>1985/86</td>
<td>5302.25</td>
<td>344.65</td>
<td>106.05</td>
<td>19.15</td>
<td>4832.40</td>
<td>8149.50</td>
<td>59.30</td>
</tr>
<tr>
<td>1986/87</td>
<td>6451.21</td>
<td>419.33</td>
<td>129.02</td>
<td>21.89</td>
<td>5880.97</td>
<td>8523.14</td>
<td>69.00</td>
</tr>
<tr>
<td>1987/88</td>
<td>6842.99</td>
<td>444.79</td>
<td>136.86</td>
<td>25.20</td>
<td>6236.14</td>
<td>8779.14</td>
<td>71.03</td>
</tr>
<tr>
<td>1988/89</td>
<td>6798.83</td>
<td>441.92</td>
<td>135.98</td>
<td>23.63</td>
<td>6197.30</td>
<td>9036.66</td>
<td>68.86</td>
</tr>
<tr>
<td>1989/90</td>
<td>7027.17</td>
<td>456.77</td>
<td>140.54</td>
<td>23.96</td>
<td>6405.90</td>
<td>9302.75</td>
<td>68.86</td>
</tr>
<tr>
<td>1990/91</td>
<td>7368.29</td>
<td>478.94</td>
<td>147.37</td>
<td>25.35</td>
<td>6716.63</td>
<td>9578.77</td>
<td>70.12</td>
</tr>
<tr>
<td>1991/92</td>
<td>6292.21</td>
<td>408.99</td>
<td>125.84</td>
<td>22.46</td>
<td>5734.92</td>
<td>9863.34</td>
<td>58.14</td>
</tr>
</tbody>
</table>

Source: World Food Program, Cereal, Pulses and Oilseed Balance Sheet Analysis for Ethiopia, 1993
Measures to increase agricultural production in Ethiopia maybe based on expanding cultivated area and/or agricultural intensification. Much of the highlands suitable for cropping with the present techniques and cropping patterns have already been used. The opening up of new land should help reduce population pressure in the highlands and pave the way for gainful employment in agriculture. However, the prospect of expanding cropped area is mostly confined to the sparsely populated and fragile areas of the western and southeastern highlands and their associated valleys. The cost of resettlement in these areas, as demonstrated by the experience of the previous (the Derg) government, is very high. Resettlement schemes led to large-scale clearing of forestland and exposed the fragile soil to erosion and posed a threat to the indigenous people by alienating resources vital to their livelihood (Alula, 1989; Dessalegn, 1989).

Increasing crop yields is the only realistic option of improving food availability in Ethiopia. At present, cereal yields are one of the lowest in the world. The average yield of tef, barley, wheat, maize and sorghum is 0.8, 1.1, 1.2, 1.6, and 1.2 t/ha, respectively. The results of research experiments and demonstration plots have shown yields can be increased by two- to-three folds (MOA, 1995).

There are several ways of achieving enhanced agricultural productivity. These include widespread use of improved cultural practices, greater and more efficient use of organic fertilizers, expanded use of irrigation, minimization of post-harvest losses, more efficient pest management techniques, and widespread use of chemical fertilizers and improved seeds. These methods are mutually reinforcing and all may need to be introduced for better results. However, it is not possible to expect significant contributions from many of these options at least in the next few years. For instance, more research and extension effort, time, and investment are required to significantly increase productivity by way of irrigation, improved cultural practices, and organic fertilizers.
A more plausible alternative to bridge the wide food gap, at least in the immediate future, in Ethiopia would be to effectively promote efficient and sustainable use of chemical fertilizers. Compared to organic wastes or manure, the availability of commercial fertilizers is not a serious problem. They are relatively more concentrated (contain more nutrient per unit), making them cheaper to transport and store. Again, unlike animal manure, most chemical fertilizers are immediately available to the plant.  

The role of inorganic fertilizers in increasing yield has been well documented. No country in the world has probably managed to achieve respectable agricultural growth without inorganic fertilizers. Commercial fertilizers play an important role in increasing yield, even when applied without improved seeds. Research results on productivity indices of fertilizers show that each kilogram of plant nutrient applied can yield an additional output of more than 5 kg of grain (Table 2).

The amount of fertilizer used in Ethiopia is currently too low to be any cause for ecological degradation. There may not be serious problems associated with either high groundwater nitrates or phosphate-induced fresh water eutrophication at present. On the contrary, increased use of fertilizers will reduce the pressure to expand cultivation onto environmentally fragile lands (IFDC, 1995). 

Efficient and sustainable use of fertilizers in Ethiopia is, however, constrained by a number of problems. A number of marketing and technical problems have reduced the return and efficient use of fertilizers.

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3 See, for instance, Ahn (1993)

4 This however does not mean that fertilizer application should not be accompanied by soil conservation practices and strategies in order to minimize adverse environmental effects. See also IFDC (1993).
The objective of this paper is to identify the major factors constraining sustainable use of commercial fertilizer in Ethiopia. In particular, the study looks into the underlying causes for the high cost of the input, distribution problems, and low yield response.

The paper is organized as follows: Section II describes the distribution and marketing problems; Section III looks into the reasons for low-
output response; and Section IV provides the Summary and Conclusions of the study.

II. DISTRIBUTION AND MARKETING PROBLEMS

During the former government, the parastatal Agricultural Inputs and Supply Corporation (AISCO) was the monopoly importer, wholesaler and retailer of fertilizers. The system lacked flexibility and failed to meet the demand of farmers. In response to shortages and delays, rationing was introduced. The bureaucratic input distribution system, combined with the fixed food grain prices and delivery quota system (imposed on farmers), made the use of fertilizers unattractive.

Market liberalization involves a move away from government-regulated market structure. An open, competitive market is believed to provide an incentive to profit-maximizing participants to use their entrepreneurial and technical skills in developing new markets and new methods of exploiting them. Intense competition would force distributors into remote areas to increase sales. Buyers would also benefit from narrower marketing margins.

The Transitional Government of Ethiopia (TGE) introduced a new marketing system for fertilizers in 1992, with the main objective of liberalizing the fertilizer market and creating a multichannel distribution system. The liberalization permitted the private sector to engage in the importation and distribution of fertilizers, hence ending the monopoly power of AISCO. Nonetheless, the government has continued to regulate fertilizer prices and remain pan-territorial—the maximum retail prices

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5 This section is drawn from a recent study by Mulat Demeke, et al., Improving the performance of Fertilizer Acquisition and Distribution in Ethiopia, August 1996 (unpublished)
are set by the Prime Minister Office (PMO) each year. Each importer (mainly AISCO and the Ethiopian Amalgamated Pirate Limited Company, or the EAL) submits its cost buildup for consideration by the PMO. After making the necessary assessment, the PMO sets the maximum retail price, the rate of subsidy, and the margins for wholesalers and retailers.

The maximum retail prices have sharply increased after the 1992 liberalization policy, particularly, the 140% devaluation of the Ethiopian Birr (ETB) in October 1992 resulted in 64.5% increase in the price of DAP (from ETB 107.10 to ETB 176.20 per quintal) and 63.9% in the price of urea (from ETB 95.3 to ETB 156.1) in 1993. The current (1996) price of DAP and urea is ETB 256.87 and ETB 246.87/q respectively (see Annex 1).

A subsidy of 15% was introduced in 1993, reducing the price of DAP to ETB 149.70 per quintal. But the price was still about 40% higher than the price in 1993. A total of 50 million ETB was allocated annually by the government in the form of subsidy to cushion the effect of the price increase during the period of 1994 to 1996.

Fertilizer distribution and marketing in Ethiopia is characterized by delays or supply shortages and high prices. A recent survey by KUAWAB/DSA 1995 indicated that high prices and supply shortages are the two major reasons for not using fertilizers. The same problems were also cited as the reasons for purchasing less than the farmers had planned to buy. Imperfections in the structure and conduct of the fertilizer market are the causes for the observed shortages, delays and high prices.

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8 The price of urea came down from ETB 156.1 to 132.4.

7 The actual amount paid by the Ministry of Finance in 1994 was ETB 49.1 million. There are claims for more payment by importers in 1995 and 1996.
1. Import Operations and Costs

Private sector involvement in the procurement of fertilizers began with the importation of 25,000 tonnes of DAP by the Ethiopian Amalgamated Pvt. Limited Company (EAL) in 1993. This amounted to 18.5% of the total import. The balance (81.5%) was imported by AISCO. EAL imported 35,000 tonnes in 1994, 60,000 tonnes in 1995, and 94,669 tonnes in 1996. Three years after the first private company moved into the business, a second private firm, Ambassel Trading Enterprise, entered the market and imported 24,337 tonnes in 1996. By 30 June 1996, the share of the private sector increased to 35% in the total arrival. Ethio-Automotive, a private company, canceled its plan of importing 25,000 tonnes in 1996 because of undue delays in processing the procurement (to meet the restrictive requirements of the donor) and the low price fixed by the government.

It appears that the interest of the private sector in importing fertilizers is limited. The market is shared mainly between two firms—the parastatal AISCO and EAL. These two firms have yet to offer a competitive CIF price to their customers.

Average CIF (cost, insurance, and freight) prices (ETB per quintal) have tended to rise since 1993. The rise reflects partly the general increase in world prices and the depreciation of the ETB against the USD (United States Dollar). But the high CIF price can also be attributed to the absence of competitive procurement. There are a number of indications that suggest that the existing practice has resulted in high import costs. First, the procurement is not planned to coincide with seasons of low prices. Fertilizer is imported as and when the foreign exchange is made available. Importers have no entrepreneurial opportunity of choosing their time of purchase. For instance, importers started procurement orders in December 1995 for the current season. But
December–February is the period during which prices are at their highest (based on the average monthly prices over the period 1992–95). Lowest prices are obtained in June–July. The difference between the average price of January (high) and July (low) was USD 22 for DAP-Morocco bulk, USD 11 for DAP-Jordan bulk, USD 17 for urea-eastern Europe, and USD 17 per tonne for urea-Middle East (Table 3)\(^8\). Obviously, the savings from advance purchase should be balanced against the higher interest payment and storage costs. But it is argued that the gain from a well-planned procurement can be substantial. Under the existing practice, importers buy fertilizers when world prices are high, resulting in higher prices for farmers.

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\(^8\) The fluctuation in world price is partly related to the entry and exit of the big importers such as China and India.
Second, the current practice of importing in lots equal to a shipload of about 25,000 tonnes or less has significantly increased the cost of procurement and shipment. According to AISCO, the number of bidders participating in any tender is small and two suppliers are often the winners: Norsk Hydro and Jordan Phosphate Mining Corporation (JPMC). Many suppliers have not been attracted perhaps because of the smaller quantity carried by each tender (maximum of 25,000 tonnes).

Third, the purchase of bagged fertilizer has resulted in high CIF prices. Significant savings in ocean freight and minimal losses in handling can be achieved by importing in bulk and bagging it locally. Currently, AISCO imports fertilizers mainly in bags. Manufacturers are not in the business of bagging and it is only natural to charge higher prices when asked to provide the service (bagging). AISCO bought bagging machines but had a problem of installing it at Asab Port. A separate tender can be issued for bags and less expensive types (than the ones currently in use) can be used.

Fourth, the use of liner terms for shipment has resulted in higher CIF prices than free-out or charter terms because demurrage costs are borne by the suppliers or shipping agency. Liner terms have no cost advantage when the Asab Port is less congested nowadays (since the number of relief cargoes arriving at Asab has declined sharply). A report by the World Bank has also indicated that a significant saving in ocean freight can be achieved by change over to CIF charter terms (World Bank, 1995).

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8 It was estimated that the saving in local mechanical bagging can be in the range of USD 7-11 per tonne for urea and USD 9-17 per tonne for DAP (World Bank, 1994; Alemayehu, 1992).

10 The authorities Asab insisted that their own machines should be used on rental basis. Settling the dispute in favor of AISCO can save costs and reduce fertilizer prices for the producers.
Finally, costs can be reduced by switching over to bigger vessels and inducing competition between the two ports—Asab and Djibouti. Instead of 25,000-tonnes ships, bigger ships of 40,000 tonnes or more can be used to reduce freight costs.\textsuperscript{11} This arrangement is particularly useful to cope with the rapidly growth in fertilizer consumption in the country.

Most of the costly practices mentioned above reflect the absence of competitive procurement.\textsuperscript{12} CIF prices would have been much lower, had more number of firms participated in the trade. Several factors have hindered the transition to open fertilizer procurement in Ethiopia.

The most serious barrier is uncertainty; there is uncertainty regarding the true commitment of the government to accept market outcomes. The government considers fertilizers as the most important commodity in its drive to achieve food self-sufficiency. Unregulated markets may result in too high prices, reducing the consumption of fertilizer and thereby negatively affecting production. The policymakers are also reluctant to leave the domestic fertilizer sector to the volatility of the market forces. Indeed, despite the radical reforms conducted in other markets, the government has yet to abandon its policy of setting the maximum price and subsidizing the fertilizer industry.

The second barrier to entry is the inherent risk associated with fertilizer marketing. Fertilizer sales are largely limited to two or three months of the year. Once the planting season is over the trader has to wait until the next season (a year later). This makes the cost of storage and interest on working capital prohibitive. Fertilizer is also a special product in that its

\textsuperscript{11} USAID was able to dock 46,000 tonnes at Asab for its food aid shipment recently. It is also possible to use the method of mid-stream discharge if the existing docks are unable to handle bigger ships. Such vessels are unloaded onto smaller ships (with a capacity of 3000 tonnes) for discharge at the shore.

\textsuperscript{12} Only the first (timely availability of FOREX) can be attributed to other factors.
quality can deteriorate too rapidly even with properly designed storage facilities.

The third barrier to entry is reliance on donors for foreign exchange and bureaucratic process of foreign exchange allocation. The foreign exchange funds are mainly provided by different international donors and the disbursement of the fund is tied to various conditions. Donors often apply rigid regulations on how and by whom their fund can be used to import fertilizers. The procurement regulations extend the period required to procure and import fertilizers well beyond what would be necessary under normal circumstances. As demonstrated by the experience of Ethio-Automotive, the problem of securing foreign exchange at the right time hinders private sector participation.

The fourth barrier to entry is financial. Economies of scale dictate that fertilizer should be imported in large quantities to gain from cost savings in procurement and shipping. Importing even a single shipload of 25,000 tonnes (not large enough to gain from economies of scale) may call for a cash outlay of ETB 62.5 million (at current prices) to import and transport fertilizers to retail points. Mobilizing such amount is a real challenge for the fledgling private firms. Under the existing arrangement, borrowers are required to pledge tangible collateral agreements in the form of fixed assets (sometimes up to 30% of the loan amount). There are no financial incentives or low-cost credit provisions to participants.

Finally, there is information barrier. The international fertilizer market is characterized by a limited number of large buyers and sellers. Suppliers have an oligopolistic position in the phosphate and potash industry. On the demand side, a small number of countries, including China and India, have a significant effect on international market, and their imports are often influenced by noneconomic considerations.
International demand is also volatile as it is influenced by a number of factors, including weather and balance of payment positions (Ahmed, et al., 1989). Under such circumstances, success in the industry depends on detailed market intelligence. The absence of such services must also have clearly deterred the participation of the private sector.

2. **Wholesale and Retail Activities**

The wholesale and retail operations are carried out mainly by the networks of AISCO and EAL. Like the procurement, the wholesale and retail operations are not as efficient as one would expect. These two dominant firms in the market have chosen to lodge allegations and counter-allegations of misconduct against each other, rather than compete freely in the market. For instance, AISCO alleges that EAL bribed local authorities in high-potential areas to facilitate the sale of its fertilizer; on the other hand, EAL maintains that local authorities intervene in the market in favor of AISCO and its agents. The conduct observed in the fertilizer market exhibits anomaly in the whole system. No one of them has attempted promotional activities or other means to draw customers from its competitor. Moreover, there is no indication that the two enterprises offer price discounts or undertake nonprice competition strategies to increase the volume of their sales.

A number of obstacles have impeded the development of a free, competitive distribution network in Ethiopia. One of the most serious constraints is the credit delivery system. The existing arrangement has undermined the influence of the farmer in the distribution system, reinforced undesirable intervention in the market, and discouraged private retailing. The vast majority of farmers buy fertilizers on credit, which is made available through service cooperatives (SCs) or temporarily formed farmer groups (where SCs are not operational). The system entails that the leaders of the SCs or farmer groups not only
process the loan (on behalf of their members), but also undertake the operations of purchasing and retailing to members. As a result, decisions that relate to purchase are made by the leaders who are not directly elected (in the case of SCs) and are seldom accountable to their members. Because of the uncertainties surrounding SCs, the leadership has more interest in personal gains (e.g., bribes or smooth relations with local authorities) rather than securing favorable terms for the farmers. Under the circumstances, suppliers have no incentives or reasons to offer price discounts or other favorable terms.

Since the beginning of 1996, a new credit delivery system involving the regional councils has been introduced. A loan agreement was signed between the banks and the regional councils, which in turn advanced the money to the SCs and farmer groups. The banks extended the credit to the regional governments at 12.5% and the regions advanced at 15% to the SCs. The margin 2.5% goes to the regional councils, for the administrative service renders and bears the risk of default. As the name of the supplier needs to be specified in the loan agreement signed

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13 SCs and PAs lack the organizational capacity, autonomy and legal bases to operate according to cooperative principles as understood in other countries. They were also part of the repressive administrative system of the former government and are expected to be reorganized (into smaller groups) under the new proclamation of agricultural cooperatives issued in 1994. However, reorganization has been too slow and the old cooperatives have continued to operate despite their weaknesses. This has created uncertainty, leading to accountability and commitment problems on the part of the leaders. The involvement of these SCs in fertilizer distribution in the post-Derg period was largely because of lack of alternatives for delivering credit.

14 Prior to 1996, a loan agreement was signed between the banks and the SCs. The banks advised the wholesaler to deliver the stated amount of fertilizer upon concluding the agreement. After the delivery, the seller sent the signed receipts of the cooperatives to the bank and requested repayment. The bank either credited the distributor’s account or pays in cheques. After the harvest, the cooperative settled the loan as per its loan-contract. Followup of collection was handled by the bank with assistance from the local administration. AISCO also assisted loan collection by refusing to sell fertilizers to SCs which failed to settle their debt with DBE. But the system failed to sustain itself. Following the collapse of the former government many SCs were looted and the consequent massive default destroyed their credibility.

16 A margin of ETB 7 per quintal is provided to the SCs for their transport and retail services.
between the authorities and the SCs, the new arrangement allows local government officials to interfere in the distribution system. A supplier may need to establish prior contacts with the authorities to have its name specified in the agreement.

The interlocking of the group lending scheme with fertilizer retailing has also made private retailing redundant. Private retailers may enter the market only when farmers buy in cash. That is, the proportion of farmers buying in cash, when credit is made available, is very small. Further, most wholesalers prefer to undertake retailing on their own and reap the ETB 7 margin. The evidence does not support the view that there is a competitive and efficient fertilizer retail service.

The system of credit could also imply that small local markets cannot host two or more suppliers. The credit arrangement often requires that a given SC (covering the demand of 4 to 6 peasant associations) buys only from one supplier. This has discouraged entry into a market where a supplier has already started operating.

The second problem in the wholesale and retail activities is the pan-territorial pricing policy. As a result, the pressure to sell in the central and high-consuming areas is obviously high, because the transportation cost is low and hence the profit margin is high. Suppliers operating only in these areas will make a huge profit, while those selling in only low-potential and remote areas lose money.

A third problem is the principal-agent relationship between importers and wholesalers. Distributors, wholesalers and retailers are not in a position to call on several suppliers and obtain the best possible deal. They operate as commission agents of the importers and are therefore unable to establish fully independent and competing operations.
III. LOW OUTPUT RESPONSE AND INADEQUATE FINANCIAL RETURN

Apart from procurement and distribution problems discussed in Section II above, efficient and sustainable fertilizer use in Ethiopia is constrained by low-output response and insufficient financial returns. Yield responses have been low because of inappropriate cultural practices, suboptimal use of nutrients and lack of complementary inputs. The profitability of fertilizers is low because of the inefficient output market, in addition to the low-output response.

1. MANAGEMENT PRACTICES IN APPLICATION OF FERTILIZERS

Farm management practices are among the important determinants of the output response to fertilizer application. The rate and time of fertilizer application; the control of weeds, diseases and pests; the level of organic matter in the soil; drainage conditions (in waterlogged areas); and moisture conservation (in moisture-stress areas) have significant influence on the returns from using fertilizers. The use of complementary inputs and cultural practices are indispensable components of the package necessary to improve the efficiency of fertilizers.

The recent recommended practice is the application of about 200 kg of fertilizer per hectare. This is obviously a very broad recommendation, which requires refinement for different agro-ecological zones. The great diversity of the soil and weather conditions, and the numerous crops grown, require soil- and crop-specific recommendations. For a reliable and successful promotion of fertilizers, soil test-based recommendation services have to be rendered at farm levels. But the required techniques for such services are not yet developed for the country.
The actual rate of fertilizer application is significantly lower than the recommended rates. According to fertilizer market surveys (conducted in Tigray, Amhara, Oromiya and Southern Peoples regions), the average application rate (all types of fertilizer) was 37.43 kg/ha in 1994. The application rate also varied markedly across regions: 75.77 in the Southern Peoples, 35.23 in Oromia, 29.51 in Amhara and 10.75 kg/ha in Tigray (KUAWAB/DSA, 1995).

Moreover, the low rate of nutrient application is one of the causes for the low yield levels. Unbalanced use of nutrients is another serious constraint in the efficient utilization of fertilizers. While the recent recommendation states that DAP and urea should be applied in equal proportion (100 kg DAP and 100 kg urea), the farmers' practice is heavily biased towards DAP application. The average DAP application rate in 1994 was 33.16 kg/ha, compared to a mere 4.27 kg/ha of urea. The majority of the surveyed farmers, 83.7%, used only DAP; only 11% applied both DAP and urea; and the remaining 5.3% used only urea (KUAWAB/DSA, 1995). The loss of output owing to nutrient imbalance is quite significant (Mulat, 1995).

Correct timing of fertilizer application is of great practical importance in achieving adequate yield response. However, the distribution problem (cited in section II above) has meant that farmers often cannot apply fertilizer at the right time. For instance, though the delivery in 1994 was considered to be better compared to the previous years, 67% of the surveyed farmers still reported that delivery was not on time (KUAWAB/DSA, 1995). Not recognizing the different planting calendar of the various regions, fertilizers are mostly scheduled to be delivered in June and July. The distribution practice does not consider the planting time of maize, sorghum and belg crops, which is 2–3 months earlier than June.
Although adapted to various agroclimatic conditions, local crop landraces are of low genetic potential, and because of their weak straws they have lodging (toppling over) problems, particularly at high rates of fertilizer. Thus the marginal productivity of incremental fertilizer declines at higher application levels, necessitating the use of improved seeds to generate higher yields. On the other hand, some of the released crop varieties are resistant to lodging and are highly responsive to added nutrients. Nonetheless, the use of improved crop varieties is limited, less than 1% during the 1995/96 cropping season.\textsuperscript{16} Most of the released varieties have lost their resistance to diseases, especially wheat. A study in Arsi Negele indicated that the average yield of improved wheat variety is not significantly different from the average yield of local variety (Legesse, 1992). Improved sorghum varieties are susceptible to damage by birds and have short stalks; these are undesirable characteristics because the stalks are needed for fuel and construction purposes.\textsuperscript{17}

The reduction in the amount of soil humus or organic matter may lead to spectacular declines in soil productivity. Inorganic fertilizers also yield lower output on such soils. Adequate returns from commercial fertilizers can be obtained only when used in combination with organic fertilizers. Natural fertilizers help to avoid nutrient leaching and improve soil conditions, hence improve the performance of commercial fertilizers (Asnakew et al., 1991; cited in Sahlemedhin et al., 1993). Organic fertilizers in the form of green-manure crops, farmyard manure, and compost and organic waste supply the soil and crops with nutrients as well as improve soil physical conditions. Farmers can grow green-manure crops in fallow areas or short-season leguminous crops during the short rains to improve soil fertility through nitrogen fixation and to

\textsuperscript{16} See for instance CSA (1996).

\textsuperscript{17} See for instance Gordon et al. (1995).
conserv e the soil against erosion (by acting as a cover crop). Nonetheless, green-manuring has yet to be introduced in Ethiopia. Although the importance of farmyard manure in improving soil fertility is well known among small farmers, it is becoming scarce because of its use as fuel. The introduction of small biogas plants for cooking and lighting can solve the fuel problem and allow a full recovery of animal dung for use as manure. But the high cost of installation has hampered the diffusion of the technology.

The efficiency of nitrogen use is generally low in Ethiopia because of poor land preparation. Most of the nitrogen applied to soils is lost by leaching, denitrification, volatilization, etc. A study (Ali, 1992, cited in Sahlemedhin et al., 1993) showed that the nitrogen use efficiency of durum wheat improved from 39% to 70% by employing improved drainage only. Poor drainage systems have reduced the efficiency of fertilizer use in many waterlogged and/or Vertisol areas. Improved drainage implements such as the broadbed-maker, BBM (developed by the International Livestock Centre for Africa) is still unknown to most farmers.

Moisture stress is also a major limiting factor to the efficient use of fertilizers in many drier parts of the country. Although cultural practices such as mulching and tie-ridging can significantly improve nutrient uptake (N and P), very few farmers have adopted these methods. The attention given to popularize the practice is inadequate.

Efficient use of fertilizers is also reduced because of weed and disease infestations (pre-harvest loss of output). It has often been stated that pests and diseases at the pre- and post-harvest stages can cause up to 15–20% crop losses in Ethiopia. Climatic conditions during the rainy

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18 Of the 12.61 million hectare of Vertisols in the country, about 2 million is presently cultivated.
season and overlapping farm activities during weeding deter the timely removal of weeds. Various pests cause losses in the field and in storage. However, the current level of using pesticides and herbicides is minimal. The market for these inputs is poorly developed and needs to be encouraged for increased agricultural production; due consideration should also be given to the possible implications for the environment. Lack of quality control has also created a serious problem.

The traditional plow is inefficient in terms of plowing depth, width of operation and pulverization of the soil. It is of very little use in inverting and cutting the soil, and is ineffective against weeds as it does not bury the stubbles. Developing a suitable moldboard plow to replace the traditional plow has so far become difficult, with the major obstacles being cost, weight, and maintenance (Abiye and Friew, 1993).

2. Grain Markets

Grain prices are of critical importance in the decision to adopt or how much input to use. Crop prices must be reasonably stable and should result in net revenues sufficient enough to make the use of inputs profitable. Low and fluctuating prices could adversely affect sustainable consumption of fertilizers and other commercial inputs.

Liberalization of the grain market is one of the most important components of the economic reform program initiated in 1991. The restrictions on private sector participation, inter-regional movement of grains, and the delivery quota imposed on farmers and traders have been removed. The Agricultural Marketing Corporation (AMC) was restructured to create the Ethiopian Grain Trade Enterprise (EGTE). The enterprise is expected to function and survive, with a free competition, in the grain market. It is also expected to intervene in the market with the objective of stabilizing grain prices for producers as well as consumers.
After the reform, private sector involvement in agricultural marketing has increased dramatically. Producer prices have increased and inter-regional price differentials have become narrowed. Nonetheless, the limited number of large inter-regional traders and their limited access to working capital and storage and the poor road conditions\(^\text{19}\) have resulted in inefficient markets. The small traders have little or no capacity to hold large quantities for a longer time (time utility). In the absence of sufficient stock, the volume of grain marketed falls sharply in years of poor harvest and consequently prices tend to increase significantly. For example, the small-scale drought conditions in 1993, which reduced maize production by 32%, entailed rapid price increases of over 100% in early 1994 (USAID-Ethiopia, 1995). Good harvest in 1995/96, on the other hand, triggered a fall in maize price to levels well below the five-year average. The decline was especially severe in surplus-producing areas such as Wolega and Gojam. Prices declined by a much smaller margin in traditional grain-deficit areas, hence price differences between deficit and surplus areas remained high. Wheat price declined in major production areas, but remained higher than the five-year average in deficit areas (e.g. Dire Dawa and Mekele). The EGTE responded with the aim of ensuring a minimum price of ETB 70 per quintal for maize and ETB 116 per quintal for wheat.

However, the intervention lasted only a few weeks and the attempt to stabilize prices was met with limited success. The firm faced serious problems in obtaining adequate finance to purchase substantial volumes of grain (MEDC, 1996).

The fall in the price of grain has come at a time when fertilizer prices have continued to rise (Annex 1). The actual impact of this on the

\(^\text{19}\) The road density in Ethiopia is among the lowest in Africa, with an estimated 21 km of road per 1000 km\(^2\). Moreover, only 11% of the paved roads and 19% of the gravel roads are in good condition. See ERA, (1996)
demand for fertilizers is not yet known, but the fall in profitability is likely to dampen farmers' enthusiasm for the input. A more efficient marketing system can help pull the grains quickly out of the surplus-producing areas, so as to relieve the localized gluts that depress farm prices and deliver grains more quickly to the deficit areas. Measures that are likely to improve the efficiency of the grain market include investing on timely and widely disseminated market information, improving storage facilities, improving road infrastructure, and promoting cooperative marketing (to enhance the bargaining power of farmers). There is also a need for strengthening EGTE in order to make the price support program effective. More importantly, financial incentives or low-cost credit provisions aimed at increasing traders' capacity have important positive implications for the grain market.

IV. SUMMARY AND CONCLUSIONS

The profitability of fertilizer use is affected by three interrelated factors: input price, yield response, and output price. This study has tried to indicate that there is a high degree of inefficiency on all accounts.

Fertilizer distribution and marketing is characterized by delays, shortages and high prices. The procurement, wholesale and retail operations do not suggest that there is a competitive environment. Institutional problems in the form of distortions in the credit market, the pan-territorial pricing policy, weak private sector, administrative intervention, absence of free and independent SCs, and shortage of FOREX are among the major constraints to a sustainable and efficient distribution of fertilizers.

The response of yield to fertilizer application is low because of inappropriate cultural practices, suboptimal and unbalanced use of nutrients, incorrect timing of application, and lack of complementary inputs. Most farmers use only one type of fertilizer and employ

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* The amount for the year represents total arrival as of June 30, 1996 (see also Table 3).
# LIST OF PARTICIPANTS

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