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CCRDA

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INTRODUCTION

Agricultural extension service in Ethiopia has been relatively quiet over the past few decades, primarily because of unconsolidated efforts and often self-styled approaches. Over this time, be it for the absence of a proven and/or standard mode of intervention system or of a forum to critically discuss trends, it bore less fruit than had been expected. No less important was the lack of awareness by parties involved of the sectoral policies and strategies.

Recognizing these facts, CRDA organized a day long sensitization workshop on " Agricultural Extension " on March 19, 1996 that brought together 71 representatives from the MOA and the NGO community. It critically discussed the new government policy and strategy on agricultural extension and future areas of co-operation and collaboration between NGOs, the MOA and relevant regional bureaux.

The forum addressed:

- The government's policy on agricultural development
- The national intervention programme
- The experience of Sasakawa Global-2000
- Experience of NGOs with regard to low inputs and sustainable agriculture (with particular reference to SOS/Sahel)
- Landrace conservation, enhancement and utilization

Held at the Ghion Hotel, the workshop also deliberated delegates' concerns on how to improve the effectiveness of extension service and ultimately boost agricultural productivity in the country. It underlined the need for coordinating efforts in addition to the need to develop regular information sharing fora.

CRDA extends its thanks to all those who presented papers and contributed to a lively discussion.

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Welcoming Address

Dr. Mulatu Baffa
Chairperson, Executive Committee, CRDA

Esteemed Guests!
Dear participants!
Ladies and Gentlemen!

On behalf of the Christian Relief and Development Association and that of myself, I would like to welcome you all to this one day workshop on "The New Government Agricultural Extension System".

One of CRDA's main objectives is to serve as a forum for coordination, collaboration and sharing of information and resources between its member churches and agencies; and pertinent government agencies and organizations. This workshop is a modest move by CRDA to materialize a part of its overall vision. We would, at the outset, like to express our great appreciation to the Ministry of Agriculture and the office of the Sasakawa Global 2000 project for making it possible for us to discuss an issue of major national importance, which I believe, will be of great benefit to all of us.

As we are all aware, despite the significant agricultural potential of the country, Ethiopia has been facing chronic food shortages for the past two decades. Recurrent drought, the growing imbalance of the eco-system and the low usage of improved technological inputs are known to be the major causes of low level agricultural productivity. In addition, the rapidly growing human population and livestock pressure have further exacerbated the problem.

We, members of CRDA, have repeatedly responded to drought and famine with integrated development and relief assistance measures. Such measures have been supported by activities including afforestation, soil and water conservation. Furthermore, NGOs are devoting their efforts and resources towards agricultural rehabilitation and increasing agricultural production through measures such as agricultural inputs including the distribution of improved varieties of seed, and agricultural implements, and draught oxen. In addition, substantial investment has been channelled towards the development of small scale irrigation schemes.

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However, the chronic food shortages or age old land degradation can not be addressed over night. This requires ample time, sustained effort, financial and human resources and above all, the ability to secure the willingness of the farming community. Experience, be it in Ethiopia or elsewhere, has shown that development efforts require an attitudinal change of the beneficiaries, and such a change is hard to bring about. Cognizant of these facts, many NGOs have promoted agricultural extension services that focused on the use of appropriate low level agricultural inputs. These inputs are in principle acceptable, affordable and accessible by the farmer and most importantly, sustainable. In my opinion, such an approach has made a modest contribution towards increased agricultural production and above all conservation of local landraces.

Nevertheless, as I stated earlier, the effort made so far, in light of the magnitude of the food deficit has not been satisfactory. The efforts made to date by government and NGOs have to be tripled and quadrupled in order to bring about significant change in the sphere of agricultural production. Considering this, this forum, in my opinion shall not be limited to one mode of intervention.

It has to be a multi-dimensional approach -- ranging from landrace conservation, its enhancement and utilization to high-tech agricultural inputs or a combination of the two. Here, we should not underestimate the role of farm yard gardening that could significantly contribute to household food security. However, the choice of technology largely depends on the environmental setting of the specific locality, particularly, the socio-economic status of the farming community.

As you might have heard, the government of Ethiopia has issued different policies, strategies and guidelines to increase agricultural productivity so as to enhance the development of the agricultural sector.

In view of the challenges ahead, this workshop is organized with the objectives of creating awareness of government policy and strategies on agricultural extension and mapping out broad areas of cooperation and collaboration between NGOs and Ministry of Agriculture and Regional Bureaux.

As you all know, NGOs are working within the broader framework of the national policy. Hence,the day long sensitization workshop on the "New Government Agricultural Extension System," will help us to gain a clear understanding of government agricultural policies and strategies. Furthermore,it will serve as a forum to explore the possibility of adopting the new extension policy and strategies to our areas of interest. It also aims at fostering collaboration between members and government agencies as well as the office of the Sasakawa Global 2000 project with a view to creating favourable conditions for concerted effort.

We have with us today experts who will explain the new government policy and strategy, working modalities, as well as share their broad knowledge and experience in their respective fields.

I, therefore, believe that this workshop will critically analyse the complex nature of agricultural extension and come up with proposals that will lead to concrete action. To achieve this, it is of utmost importance that this workshop concentrates its efforts on those major aspects of the agricultural extension approach that have the most relevance, the greatest urgency and benefit for the country in general and the agricultural sector in particular.

Finally, hoping that the workshop will form the basis for enhanced collaboration and cooperation between our members and government agencies as well as SG 2000, I would like to take this opportunity to thank all those involved and wish you fruitful deliberation.

Thank you.

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Briefing on Agricultural Policy and New Extension System

Ato Belay Ejigu
Head, Agricultural Extension Division
Agriculture Sector

First of all, allow me to thank CRDA for giving me the opportunity to brief you on the current agricultural development policy of the Government of Ethiopia and the new extension strategy worked out by MoA and endorsed by the Government.

This briefing will have two parts:-

1. Highlighting the current Agricultural Development policy which is part of the Economic Development strategy for Ethiopia (ADLI)- Agricultural Development Led Industrialization.

2. The new extension system, its strategy and content, including its performance.

1. ADLI:-

The strategy in Ethiopia focuses mainly on agricultural development, which it is intended to be attained in two ways: improvement of productivity in small holdings and expansion of large scale farms, particularly in low lands.

The contribution of agriculture to economic development is conceived in two ways: on the one side, it will provide supplies to producers for export and industries, while on the other side, it will expand market opportunities for domestic manufacturers.

At macro level, the agricultural policy recognizes three major issues of agriculture which are long term trends of

- Declining agricultural resource base
- Declining food self sufficiency
- Declining external competitive advantage

The new strategy explains the development of agriculture in three distinct stages. Stage one involves improvement of agricultural practices: including animal husbandry and utilization of better seeds.

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The second stage consists of development of agricultural infrastructure such as small scale irrigation and introduction of modern inputs, including fertilizers.

The third stage relates to increasing farm sizes which takes place along with intensification of the technology level and shifting the populations from the agricultural to non agricultural sector.

The strategy also recognizes that there are two ways in which the productivity of small holders in Ethiopia can be raised: by using existing resources of land and capital in a better way through improved agronomic practices, and by increasing resources, essentially of capital, to introduce improved technology. Both methods compliment each other and the strategic question lies in the sequencing.

The policy further states that for many reasons, the first method will be given priority as against the second which focuses on the introduction of improved technologies.

Factors which attributed to this decision of the government include, among others:

- The manpower input per family is quite low
- Increased utilization of labour within the agricultural sector tends to reduce the migration to towns.
- Effective introduction of modern technologies requires the development of a marketing system, agricultural banking and the formation of farmer organisations.

There are some individuals and organisations who are critical of proceeding in this manner. They believe that the strategy should give priority to the introduction of modern technology as a primary stage of development. However, the reality in Ethiopia shows that increases in food production must be achieved initially through the application of technology already available.

This will not only lead to economic development but will also contribute to resolving the serious environmental problems that result from trying to cultivate unsuitable land for crop production.

2. The New Agricultural Extension System

The new Agricultural Extension system is referred to as Participatory Demonstration, & Training Extension System (PADET). This new system is based on the idea that if farmers actively participate in the development process, it is possible to bring about the desired change within the shortest time possible.

Therefore, the system acknowledges and gives emphasis to the following fundamental issues:

- Farmers are considered to be the focal point of any development programme.

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- The system also takes into consideration all agricultural related activities of the farming communities. This means that it gives equal emphasis to all activities as long as technologies are provided to farming communities in package forms.

- It acknowledges the importance of providing production inputs to farmers on a timely basis.

- It gives priority to research and extension linkages. In this connection, emphasis has also been placed on the utilization of the indigenous technical knowledge of farmers, which is taken into consideration when formulating technology packages suited to different farming systems.

- Provision of credit is one of the development components of the system.

- Both staff and farmer training programmes are considered to be crucial for programme implementation.

- Co-ordination amongst the different development institutions is believed to be the corner stone for any development programme.

- Conducting demonstrations in crop livestock development activities, farm implements, home economics and other activities are the basis for accelerating the trickle down of technologies to many other farmers.

- Logistic support to extension service is also considered as an essential part of the system.

- Extension organization based on function is the pillar for the current restructuring process of the Ministry of Agriculture. In this connection it is suggested that the Ministry should be structured into two main streams: Extension and Regulatory.

Such distinct division of roles coupled with unified extension strategies to be adopted will undoubtedly result in sound intervention.

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Extension Package for moisture stress environments and possible areas of co-operation and collaboration between NGOs and MoA

Ato Dejene Abesha
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Addis Ababa, Ethiopia

Introduction

Compared to several world standards, Ethiopia is well endowed with natural resources with close to 60 percent of its total land mass estimated to be potentially arable. Owing to the extreme variations in its climate, terrain, etc., and comprising of major ecological systems, Ethiopia also possesses one of the largest and most diverse genetic resources in the world. In addition, the country is famed for the high level of endemic species of flora and fauna. This is not to mention its substantive potentials in the areas of water resources.

With over 85 percent of the population living in rural areas, agriculture has always been and remains to be the corner stone of the Ethiopian economy. This is demonstrated by the fact that it accounts for about 45 percent of GDP, 80 percent of total employment and 85 percent of Ethiopia's export earnings.

Despite a series of efforts made in areas of agricultural development, at no time were there any desired and sustainable positive changes to the living standards of the Ethiopian farmer. For much of the period, cultivated area and yield continued to stagnate and even decline with the agricultural output failing to keep up with domestic food demand even during years with normal rainfall.

There are a number of underlying fundamental agricultural problems as well as extenuating circumstances that explain the rather disappointing performance of the agricultural sector over the decades. In general the agricultural land resources are producing below capacity mainly due to climatic conditions and patterns of rainfall, the prevailing low level of agricultural technology, the low level of investment to augment the productivity of the land, and weaknesses of the institutional environment in supporting the small scale farmer.

As part of its overall efforts of rehabilitating and increasing growth and efficiency of the Ethiopian economy, the agricultural development policy, focusing on Agricultural Development Led Industrialization (ADLI) has been developed. This policy focuses primarily on agricultural development, to be attained through improvement of productivity in small holdings and expansion of large scale farms particularly in the low lands.

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On the basis of this, the National Extension Intervention Programme was launched in 1994 with the main objective of attaining self sufficiency in food crop production. When the programme started, the focus was on technology packages suitable for high rainfall areas of the country. This programme enabled many farmers to double or even triple the yields of some of the staple food crops used by the majority of the Ethiopian people.

In addition to the potential to improve yields in relatively high rainfall areas, efforts have been made to formulate extension packages for low moisture areas and preparation is underway to implement the dry land extension package.

2. Characteristic features of moisture stress areas

These areas cover about 71 percent of the total land area of the country. Although they cover about 46 percent of the total potential arable land, they contribute to less than 10 percent of the economy.

The major production constraints of these areas include shortages of rain, poor soil fertility, disease and insect-pest problems, absence of early maturing and drought tolerant crop varieties and shortages of feed for animals.

Despite all these problems, there is a high possibility of increasing crop production in these areas as long as we facilitate an enabling environment for production.

3. Major objective of the dry land extension package

The major objective of promoting the package is to assist small scale-farmers to increase the production of some selected staple food crops.

4. Strategies for promoting the envisaged programme

The programme emphasizes the dissemination of locally available improved production technologies on staple food crops amongst small-scale farmers. Therefore, provision of inputs is envisaged in the programme because of the fact that increased productivity can only be achieved when farmers have access to improved technologies which also include production inputs and information that empower them to optimize all the production resources at their disposal.

Due consideration has also been given to extension staff and farmer training programmes in order to upgrade their knowledge and skills which will in turn speed up the transfer of improved technologies to resource poor farmers.

One of the major strategies is focused on conducting large scale demonstration programmes on farmers' fields in order to disseminate improved production technologies on food grain crops amongst small-scale farmers. The demonstration plots are directly implemented by the

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participating farmers with the assistance of the extension services of the Ministry of Agriculture.

Provision of credit is also made available to participating farmers. The poor level of investment in the rural communities is primarily due to the lack of credit which should have been directed to the agriculture sector in order to energize development opportunities. In order to create a conducive environment for the adoption of productivity enhancing technologies by resourcing poor farmers, credit should be made accessible to this group of society.

The programme also seeks to foster strong linkages amongst all elements facilitating production, namely: research, extension, input distributors, and credit lending systems. Special attention has been given to the linkage between research and extension. The improved technological packages taken to farmers must be assembled after discussion with the national research system.

5. Production technology packages for moisture stress areas

The extension intervention programme mainly focuses on crop technology packages of high socio-economic value. These technology packages are based on the major staple food crops which are widely grown by the vast majority of Ethiopian people. Such staple food crops include sorghum, maize, wheat and teff. In addition, forage crops and pulses are considered for intercropping purposes.

Each crop technology package consists of various production inputs and improved agronomic practices. Such production inputs and improved practices include improved varieties, seed rate, seed bed preparations, method of sowing, weed control, fertilizer application, crop rotation, intercropping, tillage practice, insect-pest control and use of improved farm implements.

6. Services to be rendered for implementing the envisaged programme

Extension and Training Services

In order to upgrade the knowledge and skills of extension personnel for technology dissemination, the provision of both class-room and field level practical training is of paramount importance. Class-room training is basically built around crop management practices, new crop research findings and extension methodologies which will facilitate the interaction of DAs with farmer groups. The hands-on or practical training is routinely provided as part of the on-going activities pertinent to implementation of demonstration plots. With regard to extension, technical assistance and information are provided to farmers to enable them to implement the demonstration programme. These field operations are complemented with field days at various stages of crop development. Field days provide an excellent opportunity to discuss with farmers about the problems constraining rural development activities in their communities.

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Logistic support to extension

In order to facilitate the implementation of the field work as well as co-ordination and supervision activities, support is provided to improve the mobility of extension workers.

Provision of credit

Many poor farmers fail to adopt proven technologies due to lack of access to credit. Realizing this fact, the programme has given special attention to the provision of credit on a revolving fund basis to participating farmers involved in the extension intervention or popularization phase of the programme.

Provision of production inputs

Timely delivery of production inputs is one of the most important components of the production technology packages. To this end, the programme focuses strongly on the delivery of the required production inputs to the beneficiaries.

7. Co-operation and collaboration between NGOs and MoA

One of the agricultural development strategies envisages the consolidation of the extension services being provided by various organizations and, therefore, the extension service is geared towards the requirements of the various agricultural production systems of the country. The programme acknowledges the importance of the co-ordinated efforts between MoA and NGOs which are necessary in order to bring about the desired changes in agricultural development programmes.

Failure to co-ordinate the delivery of services to rural clientele results in resource misuse and confusion, as well as a lowering of service effectiveness. Extension personnel need to co-ordinate their activities closely with extension staff of NGOs and to share information about mutual clientele. Regularly scheduled information- sharing sessions need to be arranged, in addition to the pursuit of information sharing on a more informal basis. Such sharing of information among the providers of services can result in higher staff motivation levels, improved training in the delivery of services, overcoming of bottlenecks and subsequent improvement in the attainment of objectives.

8. Summary and conclusion

- Small-scale farmers are not conservative and reluctant to change. They possess the capacity for understanding, accepting and complementing innovations as long as an enabling environment exists.

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- Training is quite important in order to increase the confidence of front-line Development Agents in the dissemination of improved husbandry practices to the farming communities. By so doing, the morale of extensionists would also be motivated, once the farmers have come to appreciate their skill as agents of change.

- Conducting large scale demonstration is essential in order to enable farmers to harvest crops that can be counted in quintals. In addition, farmers who have already adopted the technologies to half-hectare plot, usually apply the same principle to expand the size of the land to a more commercial size plot.

- The supply of production inputs at village level on a timely basis is crucial in promoting agricultural production. In this connection, much effort is required to supply the inputs on a more sustainable basis.

- Farmers need information from research in order to gain additional advances. To this end, maintaining a strong linkage between research and extension is essential.

- Increased farm productivity entails not only the provision of inputs at field level, but also the conservation of the produce. Otherwise, gains in productivity could be undermined by spoilage due to improper handling of the crop at harvesting, transporting, shelling and storage. Therefore, post harvest technologies should be popularized to enable farmers to increase crop production.

- The Ministry of Agriculture recognizes the values of partnership with non governmental organizations so as to assist needy farmers in their efforts to promote food crop production.

- Finally, the important role of government policies in promoting agricultural development should not be overlooked.

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An Overview of the Sasakawa Global 2000 Projects in Ethiopia

Dr.Marco Quinones
Country Director
SG-2000 Project Ethiopia

Ethiopia, with a land and water mass of 1.1 million square kilometers, is the ninth largest country in Africa. It is also the third most populated and among the poorest nations in the continent (Ministry of Agriculture 1995).

Ethiopia was food secure until the 1960s, but since the drought of 1975, significant volumes of food have been imported (mainly as aid) every year. During the 1980s, domestic food production was on average only 70 percent of the recommended minimum food intake. Including food aid, food availability rose to only 76 percent of the recommended intake. As much as 50 to 60 percent of the population who lived below the poverty line did not have access to adequate food. Not only has food production been low for many years, even more alarming, it continues to decline relative to population growth. FAO (1995) estimates that food import needs will grow at 6 percent per year, reaching 2.5 million tones by 2010.

Table 1 compares the current status of population and other basic indicators in Ethiopia and some other countries of sub-Saharan Africa.

Agricultural profile

Sixty-six percent of Ethiopia's land area is potentially arable, yet only about 7 million hectares are cultivated in any given year (Ministry of Agriculture 1995). Around 95 percent of the cultivated land is under small scale agriculture. The rest is under state and large scale commercial farms.

Ethiopian agriculture is dominated by small-scale, resource poor farmers, most of them holding only 1 to 2 hectares. Until the present, the use of agricultural inputs (such as fertilizers, improved seeds, and agro chemicals) by small-scale farmers has been low for several reasons - inputs are rarely available near the farm gate, they are generally expensive, and credit mechanisms have yet to be put in place in a formal and sustainable manner. Ethiopian farmers consume, on average, only 7 kilograms of fertilizer nutrient per hectare of arable land, and only 2 percent of Ethiopia farmers use improved seed (Stroud and Mulugeta 1992), one of the lowest rates in Africa.

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As the result of low and stagnating agricultural production, in large part due to limited access to inputs and other modern agricultural technologies, farming in Ethiopia has remained at the subsistence level for several generations. Traditional farming systems are not only low yielding, but they also result in the mining of the main plant nutrients from the soil. Shortages of household fuel forces most farm families to collect and burn dung, weeds, and crop residues. Such practices further deplete the soil organic matter content. In addition, land-poor farmers often expand cultivation to more fragile lands. Cultivating highly erodible hillside soils aggravates water runoff that increases soil erosion.

Fragility of the soils and incorrect soil fertility management are two of the main factors constraining agricultural production.

Because of high population growth and reduced food production, the gap between production and consumption continues to increase. In recent years, large volumes of food aid have prevented food shortages comparable to those that occurred during the drought of 1984/85. But reliance on food aid from donors is not sustainable, and commercial food imports required large sums of foreign exchange, which the country cannot afford. Clearly the solution is a rapid expansion in food grain production. Targeted areas should be located where the agricultural potential is high, rainfall is adequate, and farmers have access to national markets. Expansion in food production through productivity improvements would not only help to reduce food deficits, but would also stabilize the price of food for both rural and urban consumers. In low potential areas, the government could carry out investments that would create sources of income to ensure that those who need food can afford to buy it.

The Sasakawa Global 2000 Project in Ethiopia

The Sasakawa Global 2000 (SG 2000) project in Ethiopia is the continuation of an initiative that began thanks to the vision and philanthropic assistance of the late Ryoici Sasakawa. Project activities continue to be supported with the same enthusiasm by his son, Yohei Sasakawa. We are grateful to both of them.

The work of the Nippon Foundation is complemented by the collaboration of the Global 2000 initiative chaired by former U.S. President Jimmy Carter. He works tirelessly alongside African leaders in identifying and forging government policies that are critical for promoting and sustaining economic development, health, education, and particularly, agricultural development.

The SG 2000 projects in the field are led by Norman Borlaug, winner of the 1970 Nobel Peace Prize. Dr. Borlaug has always been a source of inspiration for all of us who work at the grassroots level under his leadership.

In 1993, SG 2000 initiated a collaborative agricultural project with the Transitional Government of Ethiopia which has the following objectives:

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- To assist Ethiopia's effort to increase agricultural production through an aggressive technology transfer program that will disseminate improved production technologies to small-scale farmers through the extension service of the Ministry of Agriculture.

- To strengthen the capacity of the extension services for expedient dissemination of proven, research - led technologies to small-scale production, particularly in food crops.

- To invigorate the linkages between research and extension in order to streamline the process of technology generation and dissemination, and to provide appropriate feedback to research for technological interventions when necessary.

- To extend, through the extension services, improved grain storage and preservation technologies as well as agro-processing techniques suitable for small-scale producers.

- To identify socio-economic and other constraints to agricultural development and to evaluate alternative means of alleviating these constraints through technological and institutional changes.

- To offer the Government of Ethiopia the capacity of the Carter Center in fostering sound agricultural policies that can help sustain agricultural development in the country.

In discharging its mandate, the project has developed a series of interventions designed to strengthen the capacity of the national extension service for technology dissemination to the farming community. Its major elements are described below (Habtemariam 1995).

SG 2000 Management

For its technical field activities, the project makes full use of the extension staff of the Ministry of Agriculture and regional bureaus of agriculture. The project has established a small financial administration unit to avoid bureaucratic government financial administration. The major cost components of the project are:

- *Transport.* The project provides limited logistics assistance to extension activities at the central and regional levels. To a lesser extent, logistics assistance is also provided to researchers who are testing improved technologies in farmers' fields. Usually, the project supplies double-cabin, four -wheel-drive pick-up trucks at central, regional, and zonal levels. In addition, motorcycles are provided to district supervisors, and bicycles are given to front-line extension agents.

- *Input cost for demonstrations.* To empower extension agents with the necessary inputs to implement demonstration plots, the project buys inputs such as seeds, fertilizers, and agro-chemicals and makes them available to farmers at a reasonable cost.

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- *Operating costs.* Important expenditure in the field program include field supervision and field days. The main budget items are per diem and running costs of vehicles, including repair and maintenance.

- *Training.* An important part of the budget goes to seasonal classroom training and hands-on field training, as well as to field tours and workshops. Also, the Sasakawa Africa Association awards scholarships for B.Sc. studies at Alemaya University and for MSc. studies at Sokome University in Tanzania, to extensionists who have distinguished themselves in discharging their duties.

- *Incentives.* A small budget allows the project to offer awards to the best farmers and extension staff. These awards are made in kind rather than in cash. For farmers, production inputs or oxen are the prizes, while for the extensionists, study tours are being considered.

Extension Production Demonstration Plots

Realistic size. Traditionally, the extension services have established field demonstrations relying on what are known as small-plot adoption trials. The harvest obtained from small plots usually cannot be measured in quintals or tonnes and hence extensionists must extrapolate the numbers to make the results are meaningful to the farmer. The size of SG 2000 demonstration plots-Extension Management Training Plots (EMTPs) is approximately one-half hectare, and thus they mimic farmers' real conditions. When small farmers do not have enough land to run an EMTP, they usually join lands with neighboring farmers to attain the half hectare. EMTPs are also implemented in clusters or blocks and, because of their size, they attract the attention of farmers in the community. The commercial-sized plot not only leads to a realistic test of the technological package being demonstrated, it also affords the participating farmers with an immediate economic benefit for their labour.

Availability of production inputs. An extension approach that relies mainly on transfer of messages or information cannot by itself provide enough basis for adoption. The SG 2000 approach makes production inputs physically available to contact farmers. The extension agent, once he has secured the acceptance of the package by the farmer, is further expected to ensure the implementation of the package in the half hectare EMTP. It is on this basis that SG 2000 stresses the importance of integrating information with physical provision of inputs during extension work.

Financial self-reliance. Participating farmers are required to pay 50 percent up front for the inputs they receive. They pay the rest after harvest. In addition to enhancing self-reliance, partial cash payments induce farmers to give more attention to the implementation of the technological package in order to reduce risk.

Participation: Demonstrations are conducted on farmers' own plots, and the management of the plots is their responsibility, although they are supported by the extension agent. Under the

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original farmer extension system in Ethiopia the demonstration plots were very small (usually 10x10m) and were often managed by the extension agent who would invite farmers to learn by observing the results attained.

The idea of the new approach is that by letting farmers conduct the large demonstrations on their own, they will not only evaluate the technologies but will also improve their crop management skills. Under the previous approach, they had a more passive role in technology evaluation.

Hands-on Practical Training. The project is engaged in providing both classroom and hands-on field training to grassroots extension agents, supervisors, and subject matter specialists. The training is conducted on practical field operations, and it is complemented by field days, workshops, and study tours.

Role of Research. Extension recommendations will not be developed without the inputs from researchers. Before each crop season begins, researchers and extension staff meet and discuss technology recommendations. Research-extension linkages are also enhanced because both institutions cooperate in:

- joint definition of recommendations
- joint visits to EMTPs and on-farm research trials
- participation in review meeting
- informal consultations and task sharing

The project plays the role of a catalyst and facilitator by allocating funds for the linkage activities. Improved research-extension linkages are essential for refining current technologies and assisting researchers in the identification and development of practical solutions to farmers' problems.

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Implementation of the Field Program

The EMTP program started in 1993 when 161 demonstration plots were implemented in two regions of the country. The crops involved were maize and wheat. In 1994 the program grew nearly tenfold to 1,474 EMTPs in four regions of the country. In addition to maize and wheat, sorghum and teff (Eragrostis teff) were included in a small number of demonstrations. During 1995, the field demonstration program was expanded to 3,211 EMTPs (table 2).

The growth in EMTPs in each region reflects an increase in the number of zones, districts and villages included within each region, as well as an expansion in the number of participating farmers per village. There are, however, guidelines to limit the number of EMTPs per village to an amount that will trigger a rapid adoption rate within the community, while avoiding an excessive number of plots. Usually 30 to 40 EMTPs per village are implemented during the second and third year. At the end of the second, the first year participants are considered graduates, and after the third year, all the farmers are graduates. In other words, a village has EMTPs for 3 years, but individual farmers take part in them for only 2 years. By the second

year, some neighboring farmers are already buying their own inputs and starting to copy the EMTPs, either by calling on participating farmers for tips or by direct advice from the front-line extension agents. The program moves on to new villages after completion of 3 years. By then the farming community has seen the new technology on participating farmers fields, and after field days and farmer-to-farmer discussions, they can decide whether the new technology makes sense or not.

The EMTP package of recommendations that is advanced to farmers addresses the most pressing problems that constrain farm productivity:

- Restoration of plant nutrients in the soil by adding moderate amounts of chemical fertilizers
- Use of seed of improved high-yielding varieties
- Optimum plant populations
- Timely weeding, pest control, and harvesting

When farmers use such production inputs and good husbandry practices, as recommended by research and extension, their yields can easily be doubled or even tripled when compared with traditional farming practices.

Profitability Assessment

Maize. Average maize yields from EMTPs[1] have consistently outperformed farmers' traditional plots by an average of more than 200 percent in 1993 and 1994. Grain yields from individual farmers varied widely across environments, reflecting both climatic differences (i.e., patterns of rainfall) and differences in management skills. Even at the same location, differing management capabilities of individual farmers resulted in significant variations in yields. Notwithstanding these variations, improved husbandry always resulted in much higher yields than traditional husbandry practices. This was true of even marginal growing conditions (table 3).

Partial budget analysis, using the 1994 average yield data shows the high profitability of the technology (table 4). Marginal rates of return to additional investment were 565 percent.

Table 5 presents the profitability of maize production under three different scenarios: (1) assuming a 20 percent yield reduction from the current improved practice, (2) 20 percent yield reduction, no input subsidy, and (3) adjusted yield, input subsidy and a 10 percent fall of farm-gate grain price. Even under the third scenario, maize production would be considered highly profitable.

[1] During the 1996 crop season, nearly 40 percent of all participating maize growers provided actual grain yield data since their harvests were mechanically shelled.

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Wheat. In 1994, 638 farmers participated in wheat EMTPs. Out of this total, 187 farmers planted the crop on heavy clay vartisols, while the rest farmed under more favourable loamy and sandy loam soils. Since these two agroecologies are very distinct, and offer different opportunities for development, the results are reported separately.

Wheat Production on Vertisols. Ethiopia has about 7.6 million hectares of highland dark clay soils, collectively known as Vertisols. The tendency of these soils to become waterlogged if not properly drained, limits their use.

Vertisols are at present used mainly for grazing and are agriculturally under-utilized because of the waterlogging effect on crop yields. However, if properly managed, they represent the biggest asset of Ethiopian highlands for low risk, high output productivity.

The Ethiopian Government in 1986 established a Joint Vertisol Project (Tekalign et al. 1993) with the aim of improving traditional agricultural production on vertisols. However, unimproved, low yielding technologies continue to be used by farmers.

SG 2000 has promoted the use of a broadbed-maker that was developed and field tested collectively by the International Livestock Research Institute, Ministry of Agriculture, Institute of Agricultural Research, and Alemaya University of Agriculture through the Joint Vertisol Project. With the help of this implement, farmers can make broad, raised beds, which helped to improve internal soil drainage. Although grain yields from vertisols are usually lower than yields from other soil types, improved drainage can boost yield levels several-fold.

Results attained by the 187 farmers who participated in the SG 2000 wheat program are presented in table 6.

There was considerable variation in yields attained by individual farmers. This variation resulted mainly from the different levels of efficiency in promoting internal drainage. Some farmers who crop land at the bottom of a valley, normally suffer excess water logging as rainwater runoffs from upper plots deposit on the lower lying soils. There is an urgent need for a more permanent drainage network encompassing each of the drainage basins of the Ethiopian highlands. This network would minimize soil erosion from water runoff and also would protect the farmer on the low lying areas from receiving excessive water accumulations due to unregulated runoffs.

Table 7 presents the cost of the recommended wheat production package on vertisols. Wheat production is marginally profitable under traditional practice (MRR = 100%) but can be quite profitable under improved management (MRR = 285%). However, close to 70 percent of the production costs under traditional farming and 42 percent under improved management represent gainful employment for the farm family. Considering this, it thus appears that wheat production on vertisols can become quite profitable. Furthermore, available technology has the potential to still increase productivity above the 3 t/ha average, if properly implemented. The highest yield SG 2000 farmers' attained on vertisols was 4.5 t/ha. Under this production scenario, wheat farming would become highly profitable.

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Wheat Production on Non-Vertisols. Wheat production in Ethiopia is mainly practiced on nitosols, and loamy or sandy loam soils. Durum and bread wheat cover around 650,000 to 700,000 hectares each year. Average yield stands at 1.29 t/ha (FAO 1993).

Traditional wheat production is subjected to many constraints resulting in very low productivity. In general, small-scale farmers use little or no fertilizer to restore soil fertility. Most soils in Ethiopia will respond very positively to applications of N and $P_2 O_5$ fertilizer. However, small-scale farmers have been unable to use fertilizer regularly because of their lack of purchasing power and unreliabile supply. Additionally, weed infestations (both broad-leaved and grasses) tend to decrease wheat yields.

In many areas such as Arsi, Bale and Gondar where prolonged wheat monocropping prevails, grasses like wild oats, *Snodonia* sp. and *Lollium* sp. have become widespread weeds that threaten wheat production. Another important constraint is the genetic make-up of the varieties grown by farmers. Some of the varieties are old land races, prone to lodging, late maturing, and susceptible to diseases such as rusts or smuts. Their genetic yield potential is low. Even when modern, high yielding genotypes are grown by farmers, they become contaminated with weed seeds after a few seasons, due to lack of an efficient seed supply system. Also, because Ethiopia is one of the secondary centers of wheat evolution, there is a very wide array of pathogenic micro organisms that renders new resistant cultivars susceptible within a short time. Thus, there is an urgent need for research to continually test and release new genotypes to replace the susceptible ones and for development of a dynamic seed system to get improved varieties into farmers' hands.

During the 1994 crop season, 451 wheat EMTPs were planted on non-vertisols in most of the important wheat-growing regions of the country. Table 8 presents their distribution by regions and zones, yield data, and comparisons to traditional practices. The overall average yield of EMTP farmers was 115 percent above the traditional practices. The considerable variations of the range in yields is perhaps more important. Without exception, the low yielding plots had heavy infestations of grasses that prevented farmers from attaining better results. The SG 2000 program is designing some strategies to cope with this problem. For example, in the 1995 wheat field program, instead of conventional broadcast seeding, row seeding was used in some wheat plots to facilitate hand weeding.

The partial budget analysis of wheat production presented in table 9 shows that wheat production under traditional practice in marginally profitable, unless we see it as an exercise to provide employment to the farm families. On the other hand, with improved management and the use of inputs, such as improved seed, moderate amounts of fertilizers, and herbicides for both broad-leaved weeds and grasses, wheat production is quite profitable (MRR = 315%).

Teff. Based on area show, teff is the most important cereal crop of Ethiopia. It is also one of the preferred staple foods. Unfortunately, it has the lowest productivity among all cereals grown in Ethiopia. The national average yield stands at around 0.78 t/ha. There are many reasons for this low productivity, among which perhaps the most important are the low soil fertility under

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which the crop is grown and the low yielding potential of the varieties. Even when farmers apply moderate levels of fertilizers, the crop may respond by lush growth that leads to pre-harvest lodging and shattering and thus lower yields.

In 1994, SG 2000 sponsored some 20 teff EMTPs in two woredas, Ada and Lume Eastern Shoa, Oromia Region. Although overall results were not spectacular, farmers who participated were able to increase their average yield by 50 percent above the average yield of neighboring farmers. Some modifications in the recommended package have been made for implementation in the 1995 crop season.

Sorghum. Sorghum is the "poor farmers" crop, usually grown under environments where maize and other cereals fail. In many areas where this crop is planted, farmers not only must cope with unreliable rainfall, poor soil fertility, and tall, low yielding varieties, but also with striga (Striga hermonthica), a parasitic weed that often depresses sorghum yields drastically.

SG 2000 planned to implement close to 100 EMTPs during 1994. However, lack of adequate rainfall prevented many farmers from sowing the crop. At the end, only 36 plots were harvested due to insufficient rainfall or infestation by striga. Yields obtained from these plots were little different from yield from other farmers' plots. During 1995 crop season, SG 2000 has continued assessing the possibilities of improving sorghum yields by looking at varieties and management practices that can adapt better to the short season, drought stress, and striga infestation.

Loan recovery

Since it inception, the policy of SG 2000 has been to lend participating farmers 50 percent of the cost of inputs. Therefore, prior to the season, payment of 50 percent of cost of inputs was collected. At the end of the season, during the marketing of the produce, farmers were expected to settle their debts. For the 1994 crop season, loan recovery of 96 percent was achieved. Most farmers who did not settle their outstanding debt had valid reasons, like complete crop failure due to sowing the crop on very acidic soils or losing the crop to bush fire prior to harvesting. In general, however, one can say that as farmers become more productive, the risk of loan defaults diminishes. Of course, there will always be farmers who, in spite of achieving very high yields, are reluctant to pay, because they have been accustomed to free aid from government and international organizations. This dependency syndrome, the result of humanitarian relief work done by scores of international organizations in the past, needs to be eradicated.

Post-harvest program

Grain losses from pests, vermin, and disease-producing microorganisms like fungi can be experienced at harvest, during transportation, drying, shelling, and storage. Depending on the efficiency of the handling, processing and conservation techniques used, post harvest grain losses may be minor or very severe. Because significant gains in crop yields could be nullified if

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inappropriate and unreliable methods are employed to handle and process the grain along the post-harvest pipeline, SG 2000 Ethiopia has included a post-harvest component as part of its field activities.

During the 1994 crop year, SG 2000 investigated post-harvest problems as a baseline for future interventions. Several villages were surveyed and a questionnaire was distributed to collect relevant information.

Data collected during the surveys show that farmers are very much aware of post-harvest losses. Since they can do little to ameliorate this problem, they prefer to sell much of their harvest as soon as possible, thus foregoing the possibility of storing the grain to capitalize on better prices later on. The survey and field observations also show that grain losses from attacks of insects such as weevils often start when the crop is still standing in the field before harvest. Thus, delay in harvesting increases insect infestation. Poor maize shelling methods, such as beating the ears with sticks, produce kernel damage and predispose them to higher levels of insect infestation, moisture uptake, and fungal infection. Shelling on bare soil results in contamination of the grain with dirt, stones, and animal droppings.

Farmers construct storage facilities to hold the produce from an intermediate period of time. However, such structures are often very unreliable, because they stand on the bare soil and have no rodent guards. Also, few farmers use actellic or similar pesticides to protect the grain during storage.

Based on these findings, SG 2000 Ethiopia, is designing a strategy geared towards ameliorating these problems at homestead level.

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Conclusion

The extension service of the Ministry of Agriculture in collaboration with the SG 2000 project has demonstrated both to farmers and concerned decision makers that dramatic increases in the productivity of food grain crops are possible in Ethiopia.

It should be underlined that extension was able to attain this result for two main reasons. First and most important, agricultural inputs were made available for purchase by participating farmers at the place and time needed. Second, participating farmers have been able to receive significant economic returns for the effort they have made in adopting the new technologies.

We believe that by so doing, the extension service has also demonstrated to those responsible for the development of the agricultural sector in this country that timely input procurement, distribution, and supply deserves priority.

The role of extension is to show the way. To sustain what has been so far achieved and to encourage more small-scale farmers to adopt improved technologies, decision makers need to meet this tremendous challenge by doing whatever they can to ensure the timely supply of agricultural inputs and facilitating the provision of credit services. Only by so doing can they hasten the process of attaining food security and economic development in Ethiopia.

Table 1. Some Development Indicators for selected African Countries

Country	Population 1992 (millions)	GNP 1992 ($/capita)	Growth of food production 1979-92	Fertilizer consumption[a] 1991-92 (kg/ha)	Food aid in cereals, 1991-92 (000 t)
Nigeria	101.9	320	2.0	13.3	0
Ethiopia	54.8	110	-1.3	7.1	963
Sudan	26.5	-	-2.2	7.2	481
Tanzania	25.9	110	-1.2	15.3	15
Kenya	25.7	310	0.1	39.1	162
Uganda	17.5	170	0.1	0.2	25
Mozambique	16.5	60	-2.1	1.6	591
Ghana	15.8	450	0.3	2.9	184
Ivory Coast	12.9	670	0.1	10.4	37
Cameroon	12.2	820	-1.7	2.6	8
Zimbabwe	10.4	570	-3.3	52.8	116
Burkina Faso	9.5	300	2.8	7.2	-
Malawi	9.1	210	-5.0	44.7	321
Mali	9.0	310	-0.9	7.1	36

Source: Sasakawa Global 2000 Africa Program country data sheets, 1995.

[a] On arable Land

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Table 2. Distribution of EMTPs by Regions and Crops, 1993 to 1995

Region	Zones(no)	Crop	EMTPs (No.)		
			1993	1994	1995
Oromia	6	Maize	60	461	1126
	6	Wheat	63	462	808
	2	Teff		20	90
	2	Sorghum			40
Southern	4	Maize	38	317	546
	3	Wheat		41	67
	1	Sorghum			
Amhara	1	Maize			60
	2	Wheat		125	221
	2	Teff			5
	1	Sorghum		8	30
Tigray	1	Maize		20	63
	1	Wheat		10	40
	1	Teff			40
	1	Sorghum		10	39
Total			161	1474	3211

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Table 3. EMTP Average maize yield compared with traditional yield

Region	Farmers (no.)		Yield (t/ha)			
			EMTP		Traditional	
	1993	1994	1993	1994	1993	1994
Oromia	60	461	5.1	5.5	1.6	1.6
Southern	38	317	4.9	5.5	1.6	1.6
Tigray		20[a]		3.5		0.9

a/ Yield recorded from nine farmers only

Table 4. Partial budget analysis of maize EMTPs.

Description	Cost (EB/ha)	
	Traditional	Improved
Cultural practices		
Tilling	300	300
Furrowing	-	40
Planting	40	80
First weeding	120	60
Side dressing	-	30
Second weeding	20	20
Harvesting	40	60
Shelling	130	200
Total labour cost	650	790
Inputs		
25 kg of seed	25	58
100 kg DAP		178
100 kg Urea		168
180 g Marshal		70
Input delivery		20
Total Production cost	675	1,284
Average production (t/ha)	1.5	5.5
Gross revenue (grain + straw)	1600	5650
Net revenue (EB)	925	4366
Cost diff. due to technology (EB)		609
Add'l income due to technology (EB)		3441
Marginal rate of return (%)	137	565

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Table 5. Per hectare profitability of maize production under different production scenarios.

Scenario	Estimated cost of prod uction (EB)	Average Product-ion (t/ha)	Gross revenue (EB)	Net revenue (EB)	Cost difference (EB)	Addit-ional income (EB)	Marginal rate of return (%)
Adjusted yield (20%) lower) with current input subsidy	1,284	4.4	4,550	3,266	609	2,341	384
Adjusted yield/no input subsidy	1,384	4.4	4,550	3,166	709	2,241	316
Adjusted yield/no input subsidy/ 10% fall of farm-gate grain price	1,394	4.4	4,110	1,726	709	1,801	254

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Table 6. EMTPs: Average yield on Vertisols, 1994 season

Region	Zone	Farmers	Yield (t/ha)			EMTP increment over traditional (%)
			EMTP		Traditional	
			Average	Range		
Oromia	W.Shoa	82	1.90	3.8-0.8	0.60	216
Amhara	N.Shoa	105	2.60	4.5-0.3	1.40	85
Total			2.30		1.05	120

Table 7 Partial budget analysis of wheat EMTPs on vertisols, 1994 season

	Cost (EB/ha)	
	Traditional	Improved
Cultural Practices		
Tilling	300	300
Broadcasting seed	10	10
Broadcasting fertilizer	-	10
Incorporating with broadbed-maker	-	40
Weed control	150	10
Swathing	40	60
Transporting to threshing area	15	25
Threshing	30	60
Winnowing & bagging	20	40
Total labour cost	565	555
Inputs		
Seed	262	345
100kg DAP		178
100 kg urea		168
Herbicide for broad-leaved weeds		80
Total production costs	827	1326
Average production (t/ha)	1.05	2.30
Gross revenue (grain+straw) (EB)	1675	3600
Net revenue (EB)	848	2274
Cost diff. due to technology (EB)		499
Add'l income due to technology (EB)		1426
Marginal rate of return (%)	100	285

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Table 8. **Wheat EMTP yield compared with traditional yield on non vertisols, 1994 Season.**

Region	Zone	Farmers (no.)	Yield (t/ha)			EMTP increment over traditional (%)
			EMTP		Traditional	
			Average	Range		
Oromia	Arsi	140	3.2	6.0-2.0	1.5	113
	Bale	100	3.4	6.0-1.0	1.2	183
	E. Shoa	80	2.7	4.9-1.2	1.7	59
	E. Wollega	60	2.5	4.8-1.0	1.0	150
Southern	Hadaya	41	2.7	5.5-0.8	1.6	69
Amhara	N. Shoa	20	3.1	4.0-2.6	1.2	158
Tigray	Central	10	1.7	2.3-1.0	0.7	143
Total			3.0		1.4	115

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Table 9. Partial budget analysis of wheat EMTPs on non-vertisol soils, 1994 season.

Description	Cost (EB/ha)	
	Traditional	Improved
Cultural practices	-	-
Tilling	300	300
Broadcasting seed	10	10
Broadcasting fertilizer	-	10
Covering	40	40
Weeding	150[a]	10[b]
Swathing	40	60
Transporting for threshing	15	25
Threshing	30	60
Winnowing & bagging	20	40
Total labor cost	605	555
Inputs	-	-
Seed	262	345
100 kg. DAP	-	178
100 kg. Urea	-	169
Herbicide : Broad-leaved weeds	-	80
Grass Weeds	-	235
Total production cost	867	1562
Average production t/ha	1.2	3.0
Gross revenue (grain + straw) (EB)	1900	4650
Net revenue (EB)	1033	3224
Cost diff. due to technology (EB)	-	695
Add'l income due to technology (EB)	-	2191
Marginal rate of return (%)	120	315

a. Hand Weeding
b. Labour cost only

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Low Agricultural Inputs : Opportunities for Farmer Based Approach to Landrace Conservation, Enhancement and Utilization

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Introduction

Ethiopia, often referred to as a major Vavilovian gene center, is recognized as one of the world's most important centers of crop genetic diversity. Much of this diversity is found in small fields of peasants who, aided by nature, have played and continue to play a central role in the creation, maintenance and use of this valuable resource. The traditional crops and their landraces that are widely grown in the country have been adapted by these farmers over centuries of selection and are used to meet dynamic and changing needs. They were developed on the basis of using locally accessible resources for the management of farming systems. Landraces are crop populations that have not been bred as cultivators but have been adapted through years of natural and artificial selection to the conditions under which they are cultivated (Worede M, 1993b).

Landraces, generally, are low yielding but provide a dependable source of planting material, especially under extremes of environment and low input conditions. It is also a fairly well established fact that under adverse growing conditions, landraces display a greater potential for yield than the modern varieties which are more exacting in their requirements. The development of these materials to improve their competitiveness in this respect is, therefore, crucial to increase productivity for sustainable agricultural development in Ethiopia. In this brief report, an attempt is made to give the salient features of the work that the Seed of Survival/Ethiopia (SoS/E) has been undertaking along this line since its inception in 1988 as a USC/Canada supported programme of the Plant Genetic Resources Center/Ethiopia, (PGRC/E), now the Biodiversity Institute (BDI). The importance of genetic erosion is also highlighted.

Threats of Genetic Erosion

In Ethiopia, traditional farming represents centuries of accumulated experience and skills of peasants who often farmed under adverse conditions using locally available resources that often translated into sustained yields. The basis of this are the traditional crops and their landraces. Wide use of these materials promotes diversity of diet, income source, stability of production, reduced pest and disease incidence and efficient use of labour.

The broad range of genetic diversity existing in Ethiopia, particularly the primitive and wild gene pools, is presently subject to serious genetic erosion and irreversible losses. This threat,

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which involves the interaction of several factors, is progressing at an alarming rate. The most crucial ones include displacement of indigenous landraces by new, generically uniform crop varieties, changes and development in agriculture or land use, destruction of habitats and ecosystems, and drought.

The famine that occurred in the mid eighties was a major event that seriously threatened Ethiopian's biological resources, particularly the crop genetic resources that peasant farmers depend on to produce food. In some cases, food grain coming through relief agencies became the only source of seed for planting as farmers had eaten their own seed, or sold it as a food commodity in order to survive. The poorly adapted high technology, exotic seeds either failed to grow at all or were difficult to deal with, especially under the adverse growing conditions that prevailed on these farms. Disease and pest epidemics also posed a serious threat in areas where such materials were grown in large populations (Worede M, 1991).

Not all crops are, however, affected in the same way and to the same degree. Native barley, for instance, is suffering serious genetic erosion mainly because of gradual replacement of the crop by other crops, particularly by the introduction of wheat varieties. Farmers are growing more bread wheat as a result of increased market demand, and also because of the impact of high yielding varieties that are expanding into the higher elevations where barley is normally grown. Durum wheat is giving way to teff (Eragrostis teff) and new bread wheat varieties in central Highlands of Shewa, where extensive wheat breeding activities have occurred since late 1960, and also to bread wheat varieties in Arsi and Bale regions.

Teff appears to expand because of higher demands and adaptability of the crop to water logged soil. The few uniform selections of teff developed so far, which are vulnerable to disease and pest attack, are not any serious threat to the highly heterogeneous populations or landraces widely grown by farmers. Similarly, in the central highlands, including the Northern Shewa and Gojam, introduced varieties of oats are expanding rapidly, often replacing a wide range of cereals, legumes, and pulses grown in these areas.

With sorghum and millet, exotic varieties do not pose any immediate threat because expansion of such material is at present somewhat restricted. In the case of sorghum, however, genetic erosion is progressive on account of extensive selection based on breeding of the native population. A similar situation exists also with the variety of pulses, legumes, and oil crops grown in the country, where the bulk of the materials utilized in breeding programmes is represented by indigenous landrace population (Worede, M. 1991).

On Farm Conservation

In response to this growing threat of losses of the country's crop/plant genetic resources, the PGRC/E, now emerging as the Biodiversity Institute, has been undertaking a comprehensive Genetic Resources conservation programme comprising of both off-farm (ex-situ) and on-farm (in-situ) maintenance of genetic materials (Worede, M. 1993). The on farm activity represents a dynamic community based genetic resources conservation, selection/enhancement, and

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multiplication of indigenous landraces undertaken in collaboration with farmers, scientists and various grassroots development agents. The programme which was started in 1988 as a Seed of Survival Programme in Ethiopia has been supported by USC/Canada following two major strategies : conservation, selection/enhancement and utilization of native seed stock (landraces); and conservation/production of indigenous landraces developed as elite materials (mainly composites) on peasant farms (Worede, M. 1995b).

The first one relies on protecting the major landrace cultivars from disappearing in areas where landraces are still widely grown and improving their genetic performance through joint evaluation/selection by farmers and SoS/E scientists. Those meeting the requirements of the farmers are selected and multiplied for further distribution to other farmers. This strategy also applies to sorghum landraces and locally adapted maize growing areas of Wollo.

The second type involves re-introduction for restoration of landraces in areas where the diversity has virtually disappeared. It involves the enhanced utilization of elite materials (composites) to meet farmers' production needs beyond the subsistence level. In this strategy, the main objective is to promote productivity while maintaining genetic diversity. This is currently limited to durum wheat landraces in South Eastern and Western Shewa.

Linking Landrace Conservation and Enhancement to Utilization

The value of landraces to farmers in a developing country like Ethiopia lies in their utility as a dependable source of planting material. It is, therefore, important that enhanced seeds are multiplied for distribution to farmers whose requirements have not been adequately met by modern cultivars. It may otherwise make very little sense to conserve landraces (Worede M, 1995a).

Significant progress has been made in this regard, involving the employment of elite durum wheat landrace selections (composites) which, following the above mentioned strategy, SoS/E has been utilizing to enhance, multiply and distribute seed to farming communities, covering some 322 farms. The materials were developed over the past 10 years as elite landraces by the wheat breeding team at the Debre Zeit Agricultural Research Center of the Alemaya University of Agriculture. The performance of these landraces (in yield/ha and farmers preference) has been very high (Tesfaye T. 1993), exceeding the high input varieties by 10-15% and the original farmers' seed (maintained as in-situ) by 20-25% in yield (Ataro and Bayush, 1994); see also Table 1-4. In some instances, the elite durum wheat selections/ composites provided the only reliable planting material in wheat during a drought incidence that occurred in 1993 in some localities in Central Shewa. Similarly, in Wello, many of the sorghum landraces and locally adapted maize jointly selected with farmers have been shown to exceed the original farmers' seeds, all with no additional external inputs. These are now expanding into areas of the region with frequent crop failures due to prevailing droughts, covering 3102 and 2999 farmers for sorghum and maize, respectively (Table 5).

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The yield evaluations shown in Tables 1 to 4 were carried out under low input conditions (i.e, without commercial fertilizer) for the landraces, and for the HYVs, often undetermined rates of fertilizer application were applied by the farmers. In both cases, traditional farming (cultural) practices were employed. The potential of exotic or improved high input varieties in current use has not been fully explored, especially because information on the performance of such materials under improved or optimal cultural practices is lacking. It is, however, a fairly well established fact that, in general, under marginal environments, the landraces show greater potential, are more stable, and will provide a more reliable source of planting material. It is, therefore, essential that further investigation be made, taking all these factors into consideration.

SOS/E is also working towards new strategies and approaches to landrace development and use, adding a new dimension to its yied enhancement efforts which includes the promotion of elite landraces selected/enhanced on the basis of the growing urban consumption needs. This would provide a greater incentive for farmers to produce indigenous food grain beyond the subsistence level. SOS/E scientists and farmers have already identified a few elite seeds (e.g. white and purple seeded durum wheats) with the potential for use in the food industry (resp. for pasta and pastries) which at present largely depends on imported food grain, and are multiplying those for local/urban consumption.

Long term stability of food crop production may be enhanced by maintaining a large repertoire of landrace materials or cultivars which farmers traditionally maintained to adjust to new, changing conditions, including market demand (Worede, M. 1995a). Complementing crop diversity with improved farming practices (e.g. crop rotation, soil and water management, etc) is, however, crucial to sustained crop yields which SoS/E is at present undertaking as a part of a comprehensive programme to improve overall farm productivity.

Promoting the development, distribution and use of indigenous crop cultivars along these lines will provide a mechanism that will enable farmers to benefit from stable, more secured crop harvests. Increased productivity will eventually enable them to sustain their activities independent of the external financial backup that they at present stand in need of.

Rationale for Utilizing Landraces in the Context of Current National Crop Production Strategy [1]

The bulk of the planting materials currently in use on Ethiopian peasant farms is still largely represented by traditional varieties or landraces on which farmers depend for sustained supply of seed. Improved or exotic seeds are generally unpredictable in terms of output, and their yields fluctuate even in areas with near ideal but varied growing conditions. In stress prone areas, the performance of these materials is relatively poor, and is often constrained by disease and pest epidemics. Under these conditions, access to locally adapted seed would provide reliable source of planting material, especially if such material is enhanced to improve its competitiveness in respect of yield and utility (market and non-market). This would also provide the farmer with a wider choice of planting material, under varying climatic conditions and changing circumstances. A case in point : the elite durum wheat landrace that farmers are

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currently multiplying in the Ada area was the only material that survived a drought incidence that occurred in the 1993 cropping season in some localities, thereby enabling the farmers in these areas to continue to grow the crop during that period.

Seen in this context, the landrace development and utilization work that SoS/E is undertaking is complementary to the on-going national crop production strategy, filling significant gaps in the performance of improved high input seeds that are in current use.

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[1] SOS/E Status Report. January 1996

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Table 1. Yield Estimate (kg/ha) of Elite Durum Wheat Selections (composite) at Dirre, 1994/95 Crop Season.

Entry No.	Sample 1	2	3	4	5	6	Average Yield (Kg./ha)	
6	1500	1000	1000	1250	1800	1000	1258.33	(5)
5	1500	1250	1000	1750	1250	1250	1333.33	(3)
7	1500	1000	1000	1250	1750	1000	1250.00	(7)
11	1250	1000	1500	1250	1000	1250	1208.33	(8)
12	1250	1500	1500	1250	1250	1000	1291.67	(4)
13	1250	1000	1250	1500	1250	1250	1250.00	(6)
14	1500	1000	2000	1250	1500	1000	1375.00	(2)
15	1250	1250	1750	1250	1750	1750	1500.00	(1)
IHYV*	750	750	1000	750	750	1000	833.33	(9)
Mean							1255.60	
S.E.							132.50	
LSD (0.05)							237.70	
CV							10.53	

*IHYV = improved, high input variety

** Figures in brackets indicate ranking in terms of yield levels.

Date planted = July 24, 1994
Date harvested = December 9, 1994
Previous Crop = Faba bean

Source : Ataro A. and Bayush T. 1995. Report on Yield and Qualitative Evaluation of Wheat and Sorghum Landraces (1994/95 crop year). Working Paper No. 5/95, Seed of Survival/Ethiopia.

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Table 2. Yield Estimate (kg/ha) of Elite Durum Wheat Landrace Selections (composites) at Deska Bora, 1994/95 Crop Season.

Entry No.	Sample 1	2	3	4	5	6	Average Yield (Kg./ha)	
52	850	1500	750	1000	1250	1250	1100.00	(8)
53	750	1750	1000	1380	1180	1380	1240.00	(6)
54	880	1870	1500	1500	1250	1000	1333.33	(4)
55	750	1120	1250	1120	1750	1000	1165.00	(7)
57	1000	880	1120	1380	880	1120	1063.33	(9)
58	1000	1120	1000	1250	1000	880	1041.67	(10)
59	1250	1120	1750	750	1370	2750	1498.33	(3)
60	1750	1500	1630	2500	1500	3000	1980.00	(1)
61	1870	2120	1370	1750	1250	1370	1621.67	(2)
31	1370	1250	1370	1370	1370	1250	1330.00	(5)
IHYV*	1250	1000	750	1000	490	750	873.33	(11)
Mean							1295.16	
S.E.							207.17	
LSD (0.05)							415.17	
CV							15.91	

*IHYV = improved, high input variety

** Figures in brackets indicate ranking in terms of yield levels.

Date planted = September 1, 1994
Date harvested = March 3, 1994
Previous Crop = Faba bean

Source : Ataro A. and Bayush T. 1995. Report on Yield and Qualitative Evaluation of Wheat and Sorghum Landraces (1994/95 crop year). Working Paper No. 5/95, Seed of Survival/Ethiopia.

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Table 3. Yield Estimate (kg/ha) of Elite Durum Wheat Landrace Selections (composites) at Godino, 1994/95 Crop Season.

Entry No.	Sample 1	2	3	4	5	6	Average Yield (Kg./ha) **	
3	1000	1120	1750	1750	1750	2250	1603.33	(4)
5	1750	1500	1620	2500	1500	3370	2040.00	(1)
7	1820	2120	1320	1750	1250	1370	1605.00	(3)
9	1370	1250	1370	1370	1370	1250	1330.00	(12)
12	1250	1500	1500	1250	1000	1620	1353.33	(11)
16	1100	1100	1250	1500	1250	1620	1303.33	(13)
20	1600	1500	1250	1380	1250	1250	1371.67	(10)
24	2250	1125	1500	1750	1370	1250	1540.83	(6)
30	1060	1350	2120	1870	1620	1370	1565.00	(5)
31	2250	2120	1320	1380	1820	2000	1815.00	(2)
32	1000	1250	1500	1500	1620	2050	1486.67	(8)
33	1000	1250	1620	1500	1620	2250	1540.00	(7)
IHYV*	1500	1500	1600	1250	1750	1120	1453.33	(9)
Mean							1539.04	
S.E.							192.80	
LSD (0.05)							318.17	
CV							12.52	

*IHYV = improved, high input variety

** Figures in brackets indicate ranking in terms of yield levels.

Date planted = July 10-15, 1994
Date harvested = December 21, 1994
Previous Crop = Vetch and Chick peas

Source : Ataro A. and Bayush T. 1995. Report on Yield and Qualitative Evaluation of Wheat and Sorghum Landraces (1994/95 crop year). Working Paper No. 5/95, Seed of Survival/Ethiopia.

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Table 4. Yield Estimate (kg/ha) of Elite Durum Wheat Landrace Selections (composites) at South West Ejere, 1994/95 Crop Season.

Entry No.	Sample 1	2	3	4	5	6	Average Yield (Kg./ha)**	
37	1000	1000	1870	2130	2370	1500	1645.00	(12)
33	1750	2750	2500	2750	2870	3000	2603.33	(2)
32	3250	2500	2750	2370	2500	3170	2756.67	(1)
29	2130	1870	2250	1750	1370	2130	1916.67	(8)
36	2500	1370	2250	1250	2000	2250	1936.67	(7)
30	2630	2370	2250	2370	2130	1250	2166.67	(5)
34	2250	1750	2630	2630	2370	2250	2313.33	(4)
35	2370	1500	1750	1750	2630	1500	1916.67	(8)
50	870	630	1500	1000	1000	1000	1000.00	(15)
51	1000	670	670	385	500	385	601.67	(16)
49	1870	1370	1630	1130	1250	1750	1500.00	(13)
46	1000	1750	1500	2130	2250	2630	1876.67	(10)
47	2000	1750	1500	1750	1630	1750	1730.00	(11)
48	1500	1750	1500	1370	1000	1250	1395.00	(14)
In Situ *1	1250	2750	1870	1630	2000	2630	2021.67	(6)
In Situ *2	2750	2600	1500	2750	2500	2500	2433.33	(3)
Mean							1863.33	
S.E.							181.00	
LSD (0.05)							359.00	
CV							9.90	

* Original landrace population being conserved in situ by SoS/E.
** Figures in brackets indicate ranking in terms of yield levels.

Date planted	=	August 31, 1994
Date harvested	=	March 10, 1995
Previous Crop	=	Vetch and Chick peas

Source : Ataro A. and Bayush T. 1995. Report on Yield and Qualitative Evaluation of Wheat and Sorghum Landraces (1994/95 crop year). Working Paper No. 5/95, Seed of Survival/Ethiopia.

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Table 5. Summary of SOS/E Seed Distribution Activities for year 1993/94, 1994/95 and 1995/96.

Region	Crop Type	Number of recipient Farmer		
		1993/94	1994/95	1995/96
Eastern Shewa	Wheat	76	332	1,709
	Chick pea	32	120	72.6
	Fenugreek	22	114	1,172
	Vetch	33	256	974
Wollo	Sorghum	906	3,102	2076
	Maize	844	2,999	3260

Note : Although a farmer may get more than one crop type, he/she is counted only once as beneficiary.

Source : Ataro A. and Bayush T. 1995. Report on Yield and Qualitative Evaluation of Wheat and Sorghum Landraces (1994/95 crop year). Working Paper No. 5/95, Seed of Survival/Ethiopia.

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SOS Sahel's Approaches to Low-input and Sustainable Agriculture

Ato Dechasa Lemessa,
D/Director, Kosha Rural Dev. Project
SOS/Sahel

Background

SOS Sahel (UK) is a British based NGO working with rural people across the Sahelian Zone of Sub-Saharan Africa. It supports community actions and initiatives that focus on the management and conservation of natural resources and on increasing small scale food production.

The primary focus of its programmes in Ethiopia is to assist communities in areas facing food insecurity and/or environmental degradation to find sustainable ways to improve their livelihoods.

It operates in food insecure and drought prone areas of Kindo Koysha woreda, Wolayta, Southern Region, and Meket woreda, North Wello, Region 3 (both projects are area based IRDP - Integrated Rural Development Programme). Our approaches to addressing food insecurity are as follows:

- Short/medium term: we address seasonal food shortages (transitory and chronic) by creating employment opportunities for food insecure households through an Employment Based Safety Net programme which facilitates our efforts of linking relief with development.

- Long term: we address the underlying causes of food insecurity through area based IRDP.

- One of the IRDP's implemented by SOS Sahel is Koysha Rural Development Project (KRDP). This began in 1989, with an assessment of the existing situation. Implementation began in 1990, and the project is on-going.

The primary aim of KRDP is the sustainable improvement of the food security situation in Kindo Koysha through community based development programmes.

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The components of KRDP are:

- Agronomy
- Livestock and forage development
- Soil and Water Conservation
- Agro-forestry
- Women's programme
- Community development
- Infrastructure (roads and bridges)
- Water Development

Food insecurity must be retained as a primary issue in Kindo Koisha.

Currently, the food situation is as follows:

- Generally, only a few households can produce enough food to support their families.
- Almost every year, there is a seasonal food shortage in Kindo Koysha,
- Research findings suggest that:
  - < 6% of households are classified as food secure
  - > 50% experience transitory food shortages
  - > 40% are chronically food insecure

In a good year, 45% of h/holds face food shortages for 4 months while 34% of h/holds face food shortages for 3 months. In a bad year, 90% of h/holds face food shortage for more than 4 months.

The causes of food insecurity are many and varied:

- Erratic rainfall
- Environmental degradation (decline in soil fertility and deforestation)
- Shortage of draught animals (due to livestock diseases, shortage of forage).
- Land shortage, especially in the highland and midland areas, due to population pressure.
- Human diseases (malaria, TB, elephantiasis)
- Inaccessibility to credit
- Crop pests (wild animals, insects and diseases)
- Generally, poverty

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SOS Sahel's Approach to Sustainable Agricultural Development:

A. Community Participation: Participatory agricultural technology development.

The community is participating in all stages of the project implementation i.e. starting from the need identification, priority setting, design strategies to implementation, monitoring and evaluation.

Technology development

The appropriateness and adoption of technologies depend on farmers' involvement in technology development, their assessment and efficient use of such technologies and the provision of the necessary inputs.

Research and technology development policies have been criticized for being misguided and resulting in technological interventions that have failed to significantly improve low-external input farming systems. This problem arises because introduced technologies are often inappropriate as a means of resourcing poor farmers.

It is within this broader context that KRDP aims to bring improvements in agricultural technology through the greater participation of farmers in research.

The project has been conducting on-farm research activities which mainly focus on screening adaptable and high yielding crop varieties, and the identification of alternative farming techniques. This approach aims at improving the overall productivity of the crop sub-sector.

Farming system diagnostic surveys were carried out by the project in collaboration with farmers in the woreda with the aim of identifying farmers' pressing problems/constraints. This greatly assisted with the identification of researchable topics in accordance with farmers' priorities.

It has also helped to capacitate farmers to screen better performing crop varieties in terms of compatibility to the farming system of the area, meeting farmers production criteria, and adaptability to different local conditions which are limiting factors in crop productivity. To realise this aim a variety of trials on important food and cash crops including cotton, maize, sorghum, soy bean, sesame and cassava have been carried out with the full participation of farmers.

On-farm trials on pest control, fertilizer application rate, crop damage assessment, botanical pesticides and moisture conservation explore alternative crop production practices with the aim of contributing to the improvement of traditional farming practices.

The role of farmers in these activities is well defined in that the farmers are playing a key role in identification of researchable problems, strategy design, implementation, and evaluation of the research activities. Provision of land and labour and contribution of the life-long experiences

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of farmers in the implementation of the programme are crucial and often inestimable elements of the project.

The primary areas of interest are therefore, the opinions, preferences and ideas expressed by farmers. Such evaluations are a useful tool in selecting varieties which are performing well within the farmers' farming systems, and meeting their preferences and criteria. It also helps to develop parameters of interest (for example, seed size, seed colour, taste etc.) for farmers, instead of merely depending on quantifiable parameters which lend themselves to scientific statistical analysis.

Dissemination methods:

These include cross visits, farmer to farmer visits, group discussions, technical papers and training. From the experience of the project, the following points emerged in relation to participatory on-farm research:

- Farmers can play a vital role in technology development and adoption so long as they are involved from the outset. In addition to this, local communities have a lot to offer from their indigenous livelihood systems.

- The participatory technology development process that has been exercised by the project played a significant role in enhancing the capacity of the farmers to undertake their own research. An awareness creation which aimed at exposing non-participant farmers to the participatory research process has created a fertile ground for the potential adoption of the research outcomes. This indicates that successful appropriate techniques tested by self-selected local people are replicating themselves through farmer to farmer interaction and exchange.

- Technology adoption by small holders is dictated by different social, cultural, economic, environmental, and other factors which have a bearing on their livelihoods. Often qualitative parameters of interest to farmers dictate the preference of a given technology to another as opposed to the conventional approach where in most cases, technological adoption is justified on the basis of statistical analysis of quantifiable parameters.

B. Addressing sustainability issues at different levels.

Intervention Level Sustainability

- The project encourages activities which do not depend on external support, and which can be sustained by farmers' resource capacity and know-how.

- Farmers are expected to pay for all inputs they receive from the project at subsidized rates. The project will not provide soft loans, which leads to the creation of a dependency syndrome.

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Institutional Sustainability

The project attempts to ensure the continuity of the technical and management support after the termination of the project by closely working with community and government structures and enhancing their capacities. This includes:

- Working in close collaboration with the Ministry of Agriculture by:
  - Secondment of the Ministry of staff to the project
  - Job sharing arrangements at local level
  - Training of Ministry staff in different disciplines
  - Technical support to the Government Line Departments
- Enhancing the local capacity of Government structures to provide services, instead of trying to substitute the government local services.

An example of this co-operation is the provision of veterinary support packages to the MoA. This enhances its capacity to provide effective veterinary services.

- Working through local structures and enhancing their management and decision making capacity, thus enabling them to gradually take over the management responsibilities of the project.

An example of this is the role of SOS Sahel Committee in managing the Dairy Goat Credit Scheme.

C. Use of locally available resources (Seeking local solutions).

The project focuses on seeking local solutions to the problem. Examples of these are the promotion of compost making to address the problem of declining soil fertility; the use of natural pest control to explore alternative and local means of controlling insect pests. Therefore, as one way of seeking sustainable solutions to farmers' perceived problems, the project encourages and promotes the use of locally available resources (inputs, knowledge) wherever appropriate as an alternative to scarce and expensive, external resources and inputs.

Elements of low-input sustainable agriculture practised

Compost Making:

The problem of poor soil fertility due to erosion, inappropriate soil ameliorating practices (continuous soil mining due to land shortage, lack of manuring due to livestock diseases) is evident in all 35 PAs of the woreda. Therefore, it affects all resource poor households, who are growing crops.

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The project has promoted compost making by giving technical advice and the necessary hand tools (three finger hoe, flat hoe and shovel) required to accomplish the activity, on a subsidized basis. To date, forty six farmers have benefitted from the scheme and have used the compost materials on backyard crops, like maize.

Of the 46 participants all reported that the yield obtained from plots applied with compost to be higher than that from unapplied ones. Currently 96% of the participants are persistently using this technology while the remaining 4% did not use it for different reasons (physical unfitness, for instance).

Feedback from participants indicates that

- it has a residual fertility effect (nutrient supply and moisture content of the soil) and requires less frequency of application on the same plot as compared to chemical fertilizers.

- "Deep green and more vigorous crop leaves than chemical fertilizer".

- Good for small area planted crops.

Its limitations were said to be the following:

- Labour intensive and drudgery
- Shortage of compost materials (during dry season)
- Needs relatively longer time to prepare the material
- Bulk quantity of compost covers only a small area of land

Natural Pest Control

The problem of insect pests (American boll worm, aphids and thrips) on cotton/cash crops is evident in 5 lowland PAs of Kindo Koysha, affecting all cotton growers. This is a primary cash crop in the area, but over the past 20 years, its production has declined as a result of insect pests.

To investigate the possibility of an alternative strategy of controlling cotton pests other than the use of chemical pesticides, the project staff arranged discussions with group of farmers from different PAs and brain storming sessions took place. Based on their life-long experiences, elderly farmers forwarded the practice of using specific plants for killing domestic insect pests and some external parasites of cattle. The preparation/infusions of some locally available plants have already been used by very knowledgeable farmers in the area. The project envisaged this to be a potential area to be tapped in collaboration with creative, keen and volunteer farmers. Participatory on-farm trials of botanical pesticide were carried out on cotton.

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The following locally available candidate plants were selected by the farmers for their natural pesticide features.

Local name (Wolayta)	Scientific name	Part used
1. Neem	Melia azadrick	Leaves
2. Maylua	Datura stramonium	Leaves
3. Chanko	Unkown	Leaves

Currently, the study is an on-going activity on 5 farmers' fields and on the project's multipurpose site, with potentially encouraging results from two of the candidate plants tested against American boll worm.

Its sustainability is indicated by:

- required materials are locally available and easy to get
- easy to apply once found to be effective
- it is based on the life-long experience of farmers.

Its limitations are

- laborious
- requires to be applied in high dose application
- accuracy problem

Concluding Remarks

For a technology to be appropriate, effectively adopted and assimilated by a community, the community should be given a chance of reacting and participating in the development of the technology from day one.

Low-input agriculture could assist a community as an alternative but the complementarily practice of low-input and high technology should be maintained rather than viewing each option as being mutually exclusive.

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DISCUSSION

Following lively presentations supported by slides and transparencies, the participants of the workshop debated technical institutional and policy issues which are of concern to the NGO community and the Ministry of Agriculture.

Evolution of the Agricultural Extension Policy

While agricultural extension has been practiced in Ethiopia for decades, there seems to be no disagreement about the need to revise it to fit to the new demands and changing realities. One of the first strategies employed in formulating the new agricultural extension policy was to learn from the merits and demerits of past extension practices. The new policy exhaustively reviewed the three decades of experience in the area and it also attempted to relate it to existing objective realities and socio-political environment.

Collaboration between Ministry of Agriculture and development agencies.

The participants stressed the importance of devising ways and means of further strengthening cooperation between development agencies, Line Ministries and relevant government departments. Such coordination underlies the whole process of successful development endevours.

Popularization of the new policy.

The new agricultural extension policy needs to be disseminated throughout the government hierarchy as this will be a means of familiarizing people at grass roots with the contents and implications of the new policy. One of the current difficulties is that people at the regional, zonal and woreda levels are not fully aware of the new policy and strategy and are therefore not in a position to actively encourage its promotion. Thus, one of the areas of future focus for the Ministry of Agriculture shall be on popularizing the new package and creating the capacity to implement the policy.

Stability of staff throughout the government hierarchy.

The stability and continuity of regional, zonal, and woreda staff is an ongoing concern . In most cases, the overall attempt of popularizing and implementing the policy is being repeatedly hampered by a high turnover of the actively involved staff. Such turnover continues to adversely affect the effort to maintain the same level of understanding throughout the country. This problem needs to be addressed for the successful implementation of the policy.

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Sustainable development and the use of chemical fertilizers.

Sustainable development was defined as an approach that does not erode the dignity of people at all the centre. While different opinions exist on how to attain sustainability, these should not overshadow the overall common purpose of all agencies involved in development. One means of achieving this is to build the technical capacity of the government in order to sustain existing endevours.

Due to the level of involvement of NGOs in the agricultural sector, they should have a role to play in the formulation of development policies, as such policies impact on the sustainability of programmes.

The danger of overuse of chemical fertilizers adversely affecting sustainability is a concern of many, with the belief that this danger increases with the promotion of such fertilizers through government subsidies. Encouraging the use of organic fertilizers should be regarded as a viable alternative, which in addition to being sustainable input, increases agricultural productivity.

However, the use of chemical fertilizer must be seen in context: Ethiopia imports about one million MT of food per year compared to less than three hundred thousand MT of fertilizers (this year, this will rise to four hundred thousand MT including eighty thousand MT carry over stock). Projections suggest that if the country's food production does not show a significant improvement over the coming years, Ethiopia will be importing 6.5 million MT of food by the year 2000. It can be argued that it is better to import half a million MT of fertilizer and produce the food we need locally, rather than having to import food (particularly commercial food) from abroad.

Chemical fertilizers dissolve into harmless dust particles over a short period of time and therefore, do not cause pollution to water sources or fruit.

Low/intermediate versus high inputs

With regard to the level of inputs appropriate to the Ethiopian situation, participants agreed with the concept of retaining intermediate rather than high-input technologies which reach the majority of Ethiopian farmers by the 'trickle down' effect. High input technology entails the use of machinery, high dosages of fertilizers and chemicals and the development of infrastructure: such inputs are not available in most parts of Ethiopia.

Efforts should be made to maximize the diverse genetic resources of Ethiopia. Unfortunately, the case often arises whereby high breed material is developed and used in certain parts of the country. Considering the highly varied micro environment of Ethiopia, the importation of some varieties for use on a national level, cannot be regarded as being a realistic option.

Further studies need to be undertaken into the value of landraces from the point of view of both plant breeding itself and the rationale of farmers in their use of landraces.

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Using expertise of farmers

The technical know-how, experience and expertise of farmers should be incorporated into all stages of the programme cycle. Such skills have evolved over many generations and are an irreplaceable source of knowledge.

Post harvest losses

Poor post-harvest techniques can result in losses of 20-30% and this is one of the reasons which forces farmers to sell their products immediately after harvesting. In an effort to address this problem, the farming community should be made aware of improved techniques, while they should also be provided with the necessary inputs to implement such techniques.

Deforestation

Deforestation relates to agricultural extension as it is recognized as being a major impediment to crop production. This however, is not included in the activities of SG 2000 because of limited resources, but efforts are made to address this issue through networking with other interested parties. On the part of the MoA, efforts to combat deforestation are acknowledged in the new agricultural extension package. While priority should be given to crop production, this should not be at the expense of forestry extension.

Closing Remarks

In closing the discussion, Ato Wondimagedlehu Gizaw thanked all participants for their contributions, while also thanking CRDA and the Ministry of Agriculture for ensuring a successful and thought provoking workshop.

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RECOMMENDATIONS

- The MoA and concerned development agencies should actively promote the agricultural extension policy.
- Strengthening of cooperation between development agencies and the MoA should be prioritized.
- Efforts should be made to try to ensure the stability of staff employed throughout the government hierarchy.
- NGOs should be given the opportunity of actively participating in the formulation of development policies.
- Improvements in crop production should not be undertaken at the expense of forestry extension.
- Further studies should be undertaken into the value of landraces.
- Farmers should be involved in all stages of the programme.
- The importance of using successful post-harvest techniques should be promoted.

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Annex I

NO.	NAME	ORGANIZATION
1	Ato Berhanu Assefa	EECMY
2	Dr. Demeu Seyoum	MMM
3	Ato Asfaw Belete	EECMY
4	Ato Betru Haile	CISP
5	Mr. Colin Richardson	ADRA
6	Wz.Konjit Fekade	Ethiopian Aid
7	Ato Girma Bezawork	Agri Service Eth.
8	Ato Workau Derekw	PCF
9	Ato Assefa Lalaco	SPCM
10	Ato Daniel Gezahegne	SPCM
11	Ato Firkru Agana	EECMY
12	Ato Nassirou BA	SCF/USA
13	Ato Dabie Qonshie	SEDA
14	Ato Muhammed Damie	SEDA
15	Ato Mulatu Baffa	KHCDP
16	Ato Taye Demissew	AGOS
17	Ato Belay Ejigu	MoA
18	Ato Ayele Habte Michael	SOS EN. Eth.
19	Ato Tadele Mamo	BHCV
20	Ato Wondimagegnew Gizaw	FCIM
21	Ato Miesso Nebi	ADAA
22	Ato Haile Wubneh	Africare
23	Dr. Jangh Bahadur	CIDR
24	Ms.Suzanne J.Barden	Baptist Mission
25	Belayneish Hailu	Baptist Mission
26	Ato H/Selassie Abhate	CISP
27	Ato Habte Gebriel Seife	EOC/DICAC
28	Mr. Mike Wood	CARE
29	Ato Dejene Abesha	MoA
30	Ato Hailu Belale	CARE
31	Ato Ayalew Kassaye	DAY
32	Mr. Roland Hobey	SPCM
33	Ato Girma Tolossa	ASDC
34	Ato Dechassa Lemessa	SOS Sahel
35	Ato Yonis Berkele	CARE-Ethiopia
36	Ato Takele Gebre	SG-2000
37	Ato Negussie Zewdie	KHCDP
38	Ato Almayehu Filas	CHER Ethiopia

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39	Ato Byene Gatena	WVI/E
40	Ato Feyera Abdi	SOS Sahel
41	Mr. Tim Motis	Baptist Mission
42	Ato Alemayehu Mamo	Cheshire Foundation
43	Ato Tesfaye Tesemma	Seed of Survival
44	Ato Kebede Asrat	CRDA
45	Ato Eyasu Mekonnen	AVA
46	Ato Elias Worku	FHI
47	Ato Dawit Asfaw	CONCERN
48	Ato Mengistu Negash	CPAR
49	Ato Samuel Bekalo	ADRA
50	Ato Gashaw Eshete	WDRA
51	Ato Getachew M.	SPCM
52	Ato Tamrat Mekonnen	SCF/UK
53	Ato Kifle Wozdexeso	AVA/OFPEP
54	Ato Solomon Eshete	JVC
55	Dr. Marco Qumores	SG 2000
56	Ato Tessema Adawo	KHCDP
57	Ato Bekele Ararsa	EENGO
58	Ato Assefa Guchie	ADAA
59	Mr. Steve Gill Ette	BME
60	Mr. Bert Lemkes	DHE
61	Ato Girma Abebe	KHC-Kurifte
62	Ato Kassaye Haile	NACID
63	Ato Tadesse Mengus	ARDE
64	Bro. Augustine O'Keeffe	CRDA
65	Wz. Tidenekyalesh Assfaw	"
66	Ato Fekade Tsegaye	"
67	Ato Lulseged Assfaw	"
68	Ms. Catherine Feeney	"
69	Wz. Etsehiwot Wudie	"
70	Wz. Meseret Mulugeta	"
71	Ato Mulugeta Bayeh	"

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Annex II Agenda

08:30 - 09:00	-	Registration
09:00 - 09:15	-	Welcome Address Dr. Mulatu Baffa Chairman, Executive Committee, CRDA

Chairperson : Dr. Mulatu Baffa

09:15 - 10:00	-	Government Agricultural Policy Ato Belay Ejigu Head, Agricultural Extension Division Agriculture Sector
10:00 - 10:30	-	***Coffee Break***
10:30 - 11:15	-	The New Agricultural Extension System Ato Dejene Abesha Senior Expert, MoA
11:15 - 11:45	-	Discussion on the above presentations
11:45 - 12:15	-	Low Agricultural Inputs: Opportunities for farmer based approach to landrace conservation enhancement and utilization Dr. Tesfaye Tessema Senior Breeder, USC/Canada
12:15 - 12:30	-	Discussion
12:30 - 01:30	-	***Lunch***

Chairperson : Ato Wondimagegnehu Gizaw

01:30 - 02:15	-	Experience of Sasakawa Global 2000 Dr. Marco Quinones Country Director SG-2000 Project Ethiopia

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02:15 - 02:45	-	Discussion
02:45 - 03:15	-	***Coffee Break***
03:15 - 03:45	-	SOS/Sahel Experience in Low Level Agri. Input Ato Dechasa Lemessa, D/Director, Kosha Rural Dev. Project
03:45 - 04:30	-	Discussion
04:30 - 04:45	-	General Discussion and Closing

CCRDA