The Southern African Drought and Low Soil Fertility (SADLF) Project: Giving Smallholder Farmers the Maize Seed They Want

CIMMYT
International Maize and Wheat Improvement Center

The Southern African Drought and Low Soil Fertility (SADLF) Project: Giving Smallholder Farmers the Maize Seed They Want

Given a choice, most people would not wish to confront the challenges that govern the lives of small-scale farmers in southern Africa. In this region, which has the most erratic growing conditions on earth, crop failures are a continuous setback to development. In one season they can eradicate several years of investment of scarce resources by farmers, the private sector, and governments alike. The natural resource endowment for farming is generally poor, and there are few alternatives to making a living from agriculture. In these circumstances, crop failures give poverty a firm grip on farming families and deprive them of options to improve their livelihood.

By focusing on how the adverse environment affects maize, the most important crop in southern Africa, the Southern African Drought and Low Soil Fertility Project (SADLF) goes right to the core of the problem. Exciting research achievements, a regional community of dedicated researchers, and innovative partnerships with NGOs, the private sector, and farming communities have catalyzed a revolution in the smallholder maize seed sector in southern Africa. We document the SADLF Project's accomplishments here in the belief that they merit the CGIAR King Baudouin Award. For an overview of impact, see "Restoring the Balance" (insert).

Maize in the Regional Setting

Throughout eastern and southern Africa, about one-quarter of a billion people get their subsistence and income directly from agriculture. Maize is the preferred staple. Per capita consumption surpasses 100 kilograms in several countries in the region (CIMMYT 1999).

Maize was originally a crop for colonial settlers in eastern and southern Africa, but by the 1930s it had become a critical food and cash crop for indigenous smallholders (Byerlee and Heisey 1997). Presently the vast majority of maize producers are smallholders who farm 0.5-3.0 hectares. Only 5% of farmers grow maize commercially on holdings that exceed 50 hectares.

Drought destabilizes crop production and erodes food security across eastern and southern Africa. Highly erratic rainfall leads to tremendous variability in maize production across the region (Figure 1) and even more so at the individual farm level. The socioeconomic impact of this yield variability is more extreme than in any other part of the world, as average yields are so low and agriculture looms so large in the national economies of the region (Heisey and Edmeades 1999). Annual maize production in the region over the past 20 years averaged 20 millions tons, but it varied from 11 million tons to 25 million tons (FAO 2000).

Infertile soils exacerbate the effects of insufficient rainfall. Rising populations have brought on intensified cropping and all but eliminated restorative fallows. It is estimated that 90% of smallholders in Zimbabwe, for example, work sandy, granitic soils that are old and depleted of nutrients. Few farmers can afford chemical fertilizer, which is now rarely subsidized in the region, and few can obtain credit to purchase inputs. Because rainfall is so unreliable, farmers who do manage to obtain fertilizer cannot be sure when to apply it and whether they will get the best benefit for their maize crop.

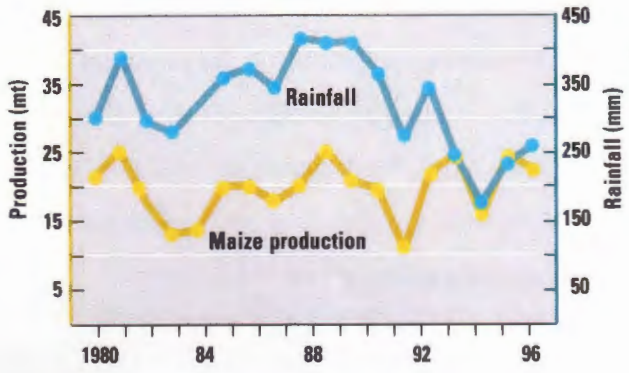


Figure 1. Average seasonal rainfall compared to maize production, eastern and southern Africa, 1980-97.

Many smallholders plant maize varieties and hybrids developed some 30 years ago. About 50-70% of farmers rely on low-yielding seed that they obtain locally or recycle from season to season. These farmers either perceive little advantage in growing improved cultivars, which are not bred to withstand smallholders' low-input systems, or they cannot obtain improved seed. Smallholders who wish to purchase seed usually have little information to help them decide which variety or hybrid they can grow successfully. Private companies rarely view smallholders as an attractive market for maize seed, preferring to focus on developing hybrids for commercial farmers. Non-governmental organizations (NGOs) may distribute seed, but, like the small-scale farmers they wish to serve, they often lack sufficient information to choose suitable cultivars.

The Risks of Agriculture without Choice: A Continuous Setback to Human and National Development

The agroecological and socioeconomic circumstances described earlier have given smallholders no choice but to rely on extremely low-input and therefore low-risk cropping systems. When people live at the edge of extreme poverty, they have no economic safety net if they fail to get a return on the scarce resources they have invested in maize production. Nevertheless, farmers' choice of maize as the staple crop has proven to be economically rational, and substituting other crops for maize is unlikely to increase food security in southern and eastern Africa (see, for example, Anderson, Hazell, and Evans 1987; Mudhara and Low 1990).

Current average maize yields of 1.2 tons per hectare barely enable the region to remain self-sufficient, but it is the years of below-average production that are a continuous setback to development. At the national level, below-average maize production and associated cash constraints of farmers discourage the development of the agricultural input sector, particularly in more remote areas. Crop failure raises the risk of providing credit to farmers, and in the past it has even caused national credit systems to collapse. It necessitates maize imports and food aid, and induces significant maize price fluctuations.

At the farm level, below-average maize production means a reduction in income, with concomitant negative effects on nutrition, education, health care, and investment in the next crop cycle. Women may assume responsibility for the farm household because men must work elsewhere to supplement loss of household income. One unfortunate result of this situation is that even less labor is available for

farming. The urgency of producing enough maize to feed the family, even in drought years, means that scarce land and labor are devoted to maize production first and foremost, with little left over for other crops that could improve human nutrition and soil fertility.

The regional agricultural research body of southern Africa—SACCAR, the Southern African Center for Cooperation in Agricultural and Natural Resources Research and Training—has recognized that drought and low soil fertility are the most important factors limiting maize production and food security in the Southern African Development Community (SADC). SACCAR has placed high priority on addressing these constraints through a regional breeding project. The Southern African Drought and Low Soil Fertility Project (SADLF) was designed to respond to this priority. The project receives supports from the Swiss Agency for Development and Cooperation (SDC) and from the Rockefeller Foundation. Shortly after its initiation, SADLF was followed by a similar project for eastern, central, and western Africa, under the auspices of the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA). Links between the two projects are highly productive.

Figure 2 indicates how SADLF works to ameliorate the combined agroecological and socioeconomic constraints discussed earlier.

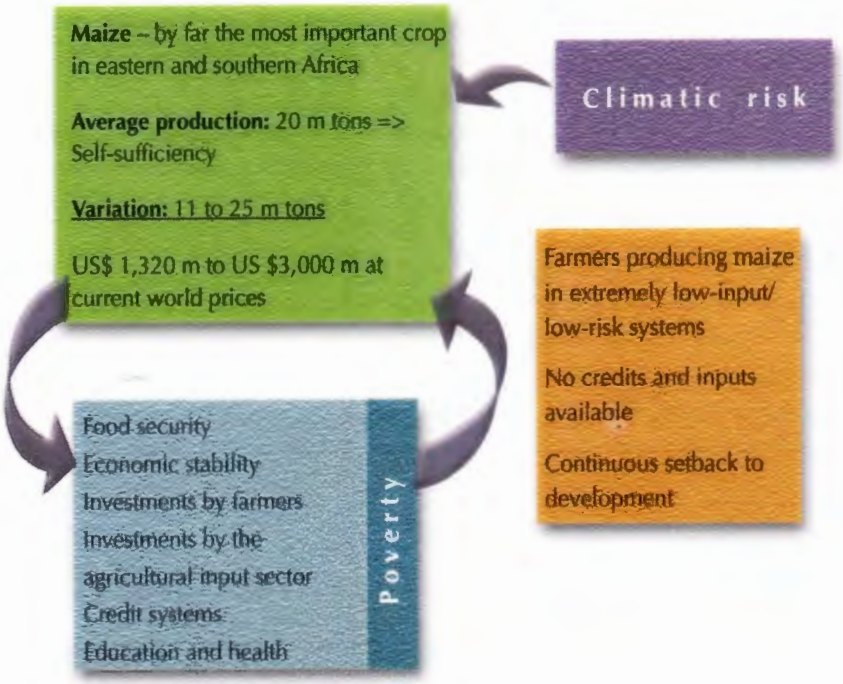


Figure 2. Rationale for the SADLF Project.

Reinventing the Smallholder Maize Seed Sector in Southern Africa: The SADLF Strategy

SADLF follows a simple but ambitious strategy:

1. Develop maize cultivars that deliver higher, more stable yields under the conditions of resource-poor farmers, without further depleting three essential resources: land, nutrients, and water.
2. Foster sustainable change in the way that maize cultivars are developed in southern Africa, and provide transparent information on the relative merit of **every** new maize cultivar for smallholder farmers' needs.
3. Empower farmers to tell the research sector and the seed producers what kind of seed they want.
4. Establish effective links with seed dissemination, as demand for cultivars that perform better under smallholder farmers' conditions becomes transparent and opens new markets.

In summary, the project's implicit goal is nothing less than to reinvent the smallholder maize seed sector, by developing suitable maize cultivars, giving farmers the chance to express their demand for suitable cultivars, and, as new seed markets open up, making the seed available. By combining innovative science with innovative partnerships, the SADLF Project is well on its way to making this goal a reality (see "SADLF: Inclusive Partnerships in Research and Development," insert).

Scaled up over the hundreds of million people who make their living from agriculture, the benefits of the project are evident and powerful. Given the central role of maize in the economies and households of southern African countries, maize cultivars that yield more grain, more reliably, despite drought and infertile soils, can break the vicious cycle described earlier. The poorest members of the farming population, especially women and children, will have more food and income as harvests grow. Because the maize crop will withstand greater climatic variability, the returns to the cash, labor, and land invested in maize production will be more assured. At long last smallholders will have incentives to use fertilizers, other inputs, and practices to improve soil fertility and conserve water (which often require additional labor), or to diversify crop production as labor and land are freed up for planting other crops.

Impacts to Date

Reinventing Breeding Research for Smallholders' Conditions: The SADLF Project has changed the way that new maize cultivars are developed and tested in southern Africa.

The SADLF Project, initiated in 1996, attempts to do what no other maize breeding project has seriously attempted. It seeks to develop maize germplasm with higher, more stable yields under conditions typical for resource-poor farmers (in other words, at the 1.2 ton per hectare yield level), without further depleting water, soil nutrients, and land. Previous breeding attempts by the public and private sector usually focused on raising yields under optimal, agronomically well-managed conditions (i.e., for farming circumstances very different to those faced by the "average," resource-poor smallholder in sub-Saharan Africa). There was insufficient awareness that this breeding system largely ignored the specific maize germplasm needs of most farmers, whose socioeconomic circumstances, combined with the high risk of crop failure, prevented them from purchasing or taking the risk to use the inputs that would create those kind of growing conditions.

The SADLF Project introduced a very different breeding approach in the region. Maize is being improved under carefully managed drought and nitrogen stress. This breeding approach is based on more than 12 years of strategic research at CIMMYT-Mexico that is cited extensively in the scientific literature for its innovative nature. Its principles, derived from the work of many researchers over the years, are summarized in Bänziger et al. (2000).

By training more than 70 scientists and technicians, investing in infrastructure, and contributing to operational costs, SADLF empowered several national research programs in SADC to undertake maize breeding targeted at smallholder farmers' conditions and needs. The project steering committee, consisting of representatives from each SADC country, chose the national maize breeding programs in Angola, Botswana, Malawi, South Africa, Tanzania, Zambia, and Zimbabwe, as well as the CIMMYT-Zimbabwe program, to become the breeding engines for the project. All of these research programs already engage in maize improvement, so the costs of adding stress breeding activities have not been high. Together, these collaborators now annually screen thousands of maize cultivars for drought, nitrogen stress, and, more recently, acid soil tolerance. Through regional collaboration, the other SADC countries gain access to the best of these cultivars. As awareness of their success has spread, three regionally important private seed companies, Seed-Co, Pannar, and SEMOC, have recently started to invest in similar breeding strategies.

The SADLF Project directly assisted its twenty-month-younger sister project in eastern, central, and western Africa to initiate similar stress breeding activities as well. SADLF researchers provided training

material, advised on the establishment of screening sites, organized joint training courses with more than 60 scientists from eastern and central Africa, hosted visiting scientists, and—last but not least—provided stress-tolerant breeding germplasm.

Because SADLF participants felt they required better information on the environments where maize is grown, the project created partnerships to develop new research tools. That is how the *Africa Maize Research Atlas* (Hodson et al. 1999) came into existence. This CD-ROM-based tool makes GIS data readily available to maize (and other) researchers in sub-Saharan Africa. More than 200 African researchers have been trained in using the tool. The impact in terms of research priority setting, research collaboration among countries, and targeting of new technologies is visible far beyond the SADLF Project and the SADC region. Apart from scientists in national research programs, scientists from other CGIAR Centers (e.g., ICRISAT, ICRAF, ILRI), private seed companies, and NGOs have started to use the tool.

The SADLF Project implemented a regional testing network that, for the first time, provides objective information on the relative merits of maize cultivars for smallholder farmers' conditions. The network involves public and private maize research and development agencies in a unified effort to meet smallholders' needs.

By conducting regional trials at several stress screening sites, the countries with stress breeding programs joined forces to demonstrate just how differently maize cultivars perform under the favorable agronomic conditions traditionally used by breeders and under the stress conditions faced by smallholders.

This network was consolidated with other testing initiatives with the result that, today, maize cultivars from the *entire spectrum* of public and private seed organizations in the region are evaluated routinely at the release and prerelease stage for traits that help gauge performance under smallholders' conditions: drought and nitrogen stress tolerance, responsiveness to favorable conditions, resistance to important diseases, and, more recently, tolerance to acid soils and resistance to storage pests. Network collaborators come from international research centers, national research programs, private seed companies, and NGOs.

The testing network thus made two invaluable contributions that transformed maize breeding in southern Africa. First, it provided rapid, essential, and reliable information that breeders previously lacked: the information characterizing maize cultivars for the kind of traits important to the majority of maize farmers in the SADC region. Second, it engaged all agencies involved in maize research, development, and dissemination—public and private—in a unified effort to meet a wide range of maize germplasm needs.

The interest in these regional trials has grown rapidly: 120 trials were conducted in 1996, 207 in 1998, and 395 in 2000. More than 150 elite open-pollinated varieties (OPVs) and hybrids are evaluated annually

through the network, which includes more than 50 collaborators from 30 institutions in southern and eastern Africa. The results are published annually under the umbrella of CIMMYT and the Maize and Wheat Improvement Research Network for SADC (MWIRNET) and distributed to well over 300 institutions and individuals related to the maize seed sector in eastern and southern Africa. The two most recent issues are included with this nomination. Costs of the regional testing effort are partially recovered through paid entries from the private sector.

Several national research programs and NGOs have started to use the regional trial data to decide which cultivars should enter national maize trials and seed dissemination programs. The trial data thus have come to play a decisive role in setting promising cultivars on the road to release or to market.

The SADLF Project has identified and developed maize cultivars that perform under smallholders' conditions far better than any other maize material available. Experimental cultivars have shown yield advantages of 50-75% under stress conditions over commercially available cultivars. Commercial seed production has been initiated for the most promising cultivars.

The network and SADLF breeding activities are delivering results. Among cultivars that had already been released and were available on the market, the project identified several of potential value to smallholders. These cultivars yielded significantly better than others under drought and/or nitrogen stress, although this advantage, because it was unknown, had not been considered when the cultivars were originally promoted to farmers. In addition, researchers identified experimental maize germplasm that yielded 50-75% more grain under drought and nitrogen stress, at a yield level of about 1-2 tons per hectare. The difference between cultivars that tolerate these stresses and those that do not is remarkable (see photograph).

One variety that particularly attracted the attention of breeders, agronomists, extension staff, NGOs, and farmers is ZM521, an OPV developed by the project. In trials throughout eastern and southern Africa—from Ethiopia to South Africa—ZM521 yielded on average 34%

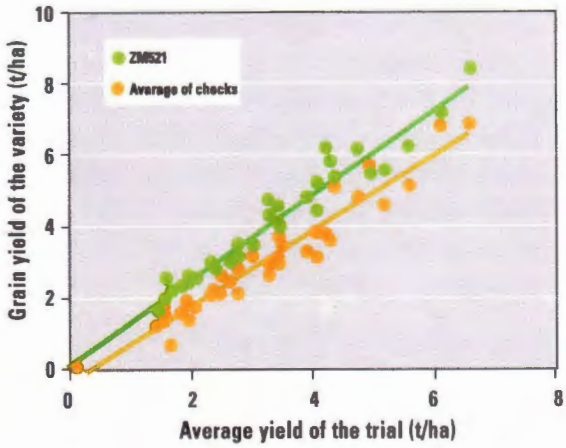


Figure 3. Grain yield of the new open-pollinated maize variety ZM521 compared to the average grain yield of three local check entries across 36 sites in eastern and southern Africa, 1999. Local check entries were the most commonly grown improved varieties at each site and in some instances included hybrids.

Drought-tolerant hybrid | Local, non-tolerant hybrid

better than current releases and showed impressive yield stability (Figure 3). In trials averaging 1-2 tons per hectare, ZM521 yielded 2.2 tons per hectare compared to local check cultivars, which yielded 1.4 tons per hectare on average, surpassing them by 50% at yield levels typical for smallholder farmers. ZM521 is planted in on-farm trials across the SADC region, and commercial seed production has begun.

The project once again demonstrated spillover effects to eastern Africa when a SADLF hybrid was picked up by the sister project in eastern Africa. This hybrid is being released by a national seed company in Kenya.

In summary, in just over four years, SADLF has produced release-ready cultivars with 35-50% higher and much more stable yields under conditions typical for resource-poor farmers in sub-Saharan Africa. These varieties and hybrids do not take up more water or nutrients. They use water and nutrients more efficiently for producing grain because they have a higher grain harvest index under conditions that usually reduce the harvest index to less than 0.2-0.3. For this reason, the new cultivars meet all the requirements for sustainably increasing maize yields and improving food and income security. They give smallholder farmers, for the first time, incentives to use improved management practices and diversify crop production.

Reinventing On-Farm Verification of Maize Cultivars through "Mother/Baby" Trials: Through the mother/baby trials, the SADLF Project has opened an innovative forum for smallholder farmers to communicate with the research sector and convince seed producers that a market for their products can be developed.

Approaching the on-farm verification of stress-tolerant cultivars, SADLF participants knew that they faced a dual challenge. First, the performance and acceptance of new maize cultivars had to be verified systematically and cost-effectively under resource-poor farmers' conditions. Second, those farmers had to gain a voice in determining whether *any* maize cultivar would become available on the market, so as to sustainably meet smallholder farmers' requirements beyond the project's duration.

That is where the "mother/baby" trials came into the picture. Mother/baby trials are sets of experiments grown in and by farming communities. For each researcher-managed "mother" trial, there are as many as 6-12 corresponding, entirely farmer-managed "baby" trials—all within bicycling or walking distance. The mother trial evaluates a set of promising maize cultivars under recommended management conditions *and* under conditions that reproduce farmers' management. This setup demonstrates differences between individual cultivars and shows the effects of improved management practices.

The mother trial is located in the center of a farming community, often at a secondary school, with a progressive farmer, or at a research station. It is managed by a local counterpart, possibly a teacher of agriculture, an extension officer, or a staff member of an NGO. Each baby trial contains a subset of the cultivars included in the mother trial (no more than four) and is planted and managed exclusively by the farmer who hosts it. Because farmers want to use the information from mother/baby trials for purchasing seed of a good cultivar in the following year, only half of the entries are experimental; the other half are recently released cultivars available on the market. Thus, adoption of newly released varieties and hybrids takes place while research is conducted and decisions are made on future releases.

Information on farmers' opinions of the trial cultivars and data on their performance flow back to researchers and seed companies, increasing the chances that seed companies will provide the kind of seed that farmers want.

In 2000, 37 mother trials and more than 280 baby trials were planted in a pilot project throughout Zimbabwe. Collaborating partners were many and varied, including:

- private seed companies;
- NGOs such as CARE International, SALRED (Southern African Unit for Local Resource Development), and ITDG (International Technology Development Group);
- community development associations such as the Horseshoe Farmer Association in northern Zimbabwe, in which commercial farmers link with smallholders to improve agriculture;
- the national extension service (AGRITEX);
- fifteen secondary schools; and
- several national research stations.

The mother/baby trials proved to involve not only the individual farmers who hosted trials, but entire communities. Neighbors came and compared the cultivars in the baby trials, community members attended field days at the mother trial, and school children who managed mother trials interacted with family members about what they were learning.

The successful national pilot of mother/baby trials has become a model for the region. By the 2000/2001 season, under the umbrella of the SADLF project, several SADC countries will have mother/baby trial schemes on the ground. The national research programs will act as the

coordinating units. Through deliberate collaboration with a wide range of partners that have an interest in testing maize cultivars, the trial system is expected to become self-sustaining after an initial start-up phase. When this happens, information on new cultivars will be exchanged routinely with some 1,000 smallholder farmers in SADC—who will be able to send a message to researchers and seed producers that is hard to ignore.

The Next Steps to Impact: The next step is to link with seed markets and policymakers, and make cultivar information transparent to a wider range of farmers.

Success leads to new challenges. As an increasing number of stress-tolerant, robust maize cultivars become available, they are expected to open new markets, because they effectively meet smallholder farmers' requirements. The latest challenge is to characterize present and potential markets and determine which conditions will motivate seed companies to risk entering those new markets. Another challenge is to raise policymakers' awareness of regulations that hinder the rapid release and movement of new cultivars.

In the coming four years, SADLF participants will engage in a range of activities to clarify these issues and develop strategies for action. These activities include:

- Collaborative market surveys by private and public organizations in areas where resource-poor farmers are inadequately supplied with seed.
- Development of cultivar descriptors that convey transparent, accurate, information to farmers in easily accessible ways (e.g., on the seed package). The descriptors will provide information on the relative merit of maize cultivars under farmers' specific environmental conditions and in relation to farmers' preferences.
- Development and dissemination of information on country-specific procedures and regulations that affect the release of new cultivars and the international movement of seed and germplasm.
- Development of more effective mechanisms for private entities to make tenders on rights to produce and sell seed of cultivars developed by public research agencies.

SADLF: Pulling farmers back from the margins of production and survival

The Larger Impacts of SADLF

In just over four years, the SADLF Project has created and sustained a large community of farmers, researchers, and seed producers across southern Africa, focused on changing the nature of the maize seed sector and small-scale maize farming. The tremendously inclusive partnerships fostered by the SADLF Project are a hallmark of its success as international and national organizations, private and public breeding and seed organizations, NGOs, extension, farmers, and community members work together to restore a much-needed balance between human survival and environmental realities.

The achievements of SADLF mean that the region is poised for larger research and development impacts. The first, most immediate, and perhaps most vital impact of the SADLF Project will be greater food and income security, with accompanying improvements in nutrition and health. The need to import food will decline and nations will see more stable and lower maize prices. Women and children, who are often shortchanged when food is scarce, should particularly benefit. As maize production stabilizes, a greater proportion of the population will be able to afford health care and to pay for the education of their children, boys and girls alike. It is extremely likely that cultivars developed through SADLF will benefit maize breeding research elsewhere in Africa as well as Asia and Latin America.

Environmental impacts will be felt in the medium term. When the risk of crop failure is reduced, farmers will be more inclined to invest in their maize crop—taking steps to improve soil fertility (including fertilizer use) and conserve water—or diversify crop production. These actions will lead to more balanced soil nutrient budgets, reduced soil degradation, and less encroachment of agriculture into more fragile ecosystems.

New seed markets will open up as maize cultivars suited to the majority of farmers become available and known. This trend will particularly stimulate the development of smaller seed companies, which can take advantage of the publicly available cultivars generated by the SADLF Project. The demand for other agricultural inputs will increase and become more stable, giving the agricultural input and credit sector incentives to make their products and services more widely available.

References

Anderson, J.R., P.B.R. Hazell, and L.T. Evans. 1987 Variability of cereal yields: Sources of change and implications for policy research. *Food Policy* 12. 199-212.

Bänziger, M., G.O. Edmeades, D. Beck, and M. Bellon. 2000. *Breeding for Drought and Nitrogen Stress Tolerance in Maize: From Theory to Practice.* Mexico, D.F.: CIMMYT.

Byerlee, D., and P.W. Heisey. 1997. Evolution of the African maize economy. In C.K. Eicher and D Byerlee (eds.), *Africa's Emerging Maize Revolution.* Boulder, Colorado: Lynne Rienner. Pp 9-22.

CIMMYT. 1999. *World Maize Facts and Trends 1997/98* Mexico, D.F.: CIMMYT.

FAO (Food and Agriculture Organization of the United Nations). 2000 *FAOSTAT.* Rome, Italy. FAO.

Heisey, P.W., and G.O. Edmeades. 1999. *Maize Production in Drought-Stressed Environments: Technical Options and Research Resource Allocation.* Part 1 of *CIMMYT World Maize Facts and Trends 1997/98.* Mexico, D.F.: CIMMYT.

Hodson, D.P. A. Rodríguez, J.W. White, J.D. Corbett, and R.F. O'Brien 1999. *Africa Maize Research Atlas* Mexico, D.F.: CIMMYT.

Mudhara, M., and A. Low. 1990. Comparative economics of maize production in risky environments in Zimbabwe. *Farming Systems Research Bulletin Eastern and Southern Africa.* No 6

Views of the SADLF Project's Innovation and Achievements

"A Great Impact on Poverty Alleviation in the Region"

...The first phase of this project was a great success. Maize is a staple food for countries of the Kalahari transect and the results of this project will have a great impact on poverty alleviation in the region. ***—K.F. Molapong, Senior Coordinator, SACCAR***

The major part [that convinced donors to fund the project] was your commitment to the idea and the outstanding achievements during phase one. ***—Martin L. Kyomo, Consultant, Rural and Agricultural Development, Tanzania***

SADLF has effectively networked NARS, NGOs, and the private sector. It encourages the use of experimental procedures designed to improve maize drought stress tolerance and harvestable yield under prevailing climate and low fertility environments. This is a project based upon innovative agricultural research but which has its fulfillment in the development of improved cultivars and their adoption by the region's farmers. From my perspective as a maize breeder and manager of a seed company whose principal client base is small farmers, I know of no other project which could have as big an impact on both raising and stabilizing yields among resource-poor farmers in Africa. ***—Barry McCarter, General Manager, Seed-Co Limited, Zimbabwe***

The mother and baby design approach has been both an innovative and an effective way of disseminating the new cultivars. The other significant achievement [of the SADLF Project] is breeding new maize cultivars—open-pollinated varieties that can be maintained by farmers themselves—that yield significantly more under drought stress and low fertility than local cultivars. I am sure that this research will have an immense impact on the livelihoods of poor farmers in southern Africa. ***—John Witcombe, Manager, DFID Plant Sciences Research Programme***

"The Interactive Process That Is Necessary for Poor Farmers to Benefit"

The SADLF Project has propelled maize breeding into the participation revolution in Africa. By achieving broad sharing of germplasm across countries, exposing large numbers of farmers to offerings of improved varieties, and letting farmers take their own decisions, maize varieties can now be developed through the interactive process that is necessary for poor farmers to benefit. Several visits I have made to the project have revealed the right kind of professional energy to make these efforts count. ***—Joseph D. DeVries, Senior Scientist, The Rockefeller Foundation***

In a shop you cannot buy small quantities of maize seed from several varieties, just to try them out. Growing baby trials with several farmers in our own community makes it possible to see how varieties perform under our conditions. ***—Maize farmer, Mushawasha, Masvingo District, Zimbabwe***

These on-farm [mother/baby] trials have served research, observation, adoption, and implementation simultaneously. Extension officers feel highly honored to be involved with these trials, and they are taking it as a part of their core-business—unlike in the past when they were just on-lookers and only got involved when new varieties had been released. I therefore think that such collaboration between researchers, extension. and farmers could accelerate the information flow between research and reality, and accelerate the release and adoption of more suitable varieties. ***—Mr. S. Tapererwa, District Agricultural Extension Officer, AGRITEX***

For me it was the "people" part of our [research] paradigm that will be a lasting memory and a reminder of what our work [in Zimbabwe] is all about. The local school is heavily involved in the research there and young students took leadership in introducing us to the research site.... Two quotes from Chief Chirau perhaps summed up CIMMYT's work: they were "CIMMYT people came to talk to our farmers, but then they came back and have stayed"; secondly he told me, "If I were a rich man I would build a house for Dr. de Meyer [a CIMMYT staff member in the SADLF Project] so he could stay here forever and help my people." These are but glimpses of what is probably one of the largest and most innovative approaches to participatory research in the whole CGIAR. ***—Timothy G. Reeves, Director General, CIMMYT***

The students and the community...had the chance of evaluating cultivars with different fertilizer inputs, but under our own conditions. This is very different to just growing a maize crop and not learning what choices can be taken to influence the performance of a crop. We have seen pupils interacting with their parents on the results of these trials. They are recommending the best varieties to their parents and tell them "If you find this variety in the shops, buy the seed because we have seen it doing very well in the trial at our school." But most importantly, we have experienced as a school and as a community that we can have an active involvement in research and development. This is how it should be happening. ***—Mr. Dodoh, Agricultural Teacher at Mananure Secondary School***

SADLF's unique links to the local and regional private seed industries, promise a long-term impact beyond its mandate through rethinking of the private sector in considering small-scale farmers as a valuable market. Pilot ventures in this respect are expected to result in new networks of retail and collection of services and inputs—so far unavailable especially in remote regions and for small-scale farmers. ***—Peter Bieler, Swiss Agency for Development and Cooperation***

"A Unique Model for Partnership"

SADLF does not only talk about collaboration in research, it implements it in a unique model for partnership in research and development involving farmers, extension actors, national and international research, as well as the private sector. It is a comprehensive programme in this sense, including countries of various scientific strengths and resulting in a critical mass of actors providing southern Africa in with a pretty powerful potential for food security.... SADLF innovates not only in the application of basic research developed elsewhere, thus shortening the duration of a research cycle; it also innovates with new empowerment strategies, not only improving scientific capacity in national agricultural research, but also their management through transfer of responsibility and competitive research. ***—Peter Bieler, Swiss Agency for Development and Cooperation***

A partnership between research, NGOs, and farmers has several benefits. As an NGO, we benefit from results of cutting-edge research, knowledge on new varieties, and very practically the seed of relevant varieties already packed as a trial. Our field officers receive training in field experimentation. The farmers have an immediate benefit because they can make a more informed decision about what varieties to grow next year. In addition, the entire farming community benefits in the medium- to long-term because they can influence breeding priorities and marketing decisions. ***—Mr. V. Zvarevashe, CARE International***

A training manual developed during the first phase of SADLF...was useful for the preparation of lectures delivered during a training program...for scientists from NARS in West and Central Africa. Some of the germplasm developed by SADLF has been incorporated into our adapted breeding materials to develop germplasm tolerant to drought and low N for West and Central Africa. ***—Abebe Menkir, Maize Breeder, International Institute of Tropical Agriculture***

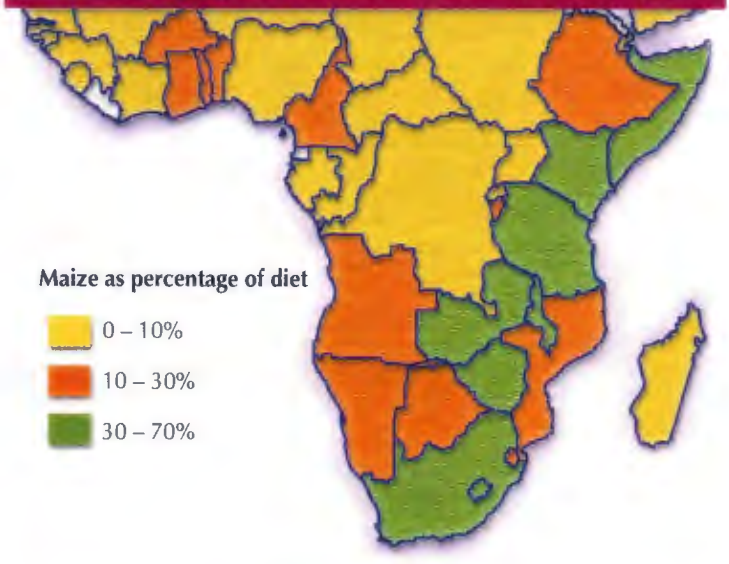
"Sustained Scientific Effort of One of the CGIAR's Stellar Centers"

I have followed the scientific progress that led to CIMMYT's capacity to launch such an activity as SADLF, for nearly 25 years. There were no "breakthroughs"; instead the institute's scientific staff...conducted many years of crop physiological research into the sensitivity of the maize plant to stresses, principally drought. This continuous effort coupled with many years of genetic and plant breeding research finally culminated in the scientific proof and applied technology necessary to transfer the critical screening technology to the SADC region (and eventually I'm certain far beyond). This is not a small achievement in terms of the scientific process and the robustness of the breeding and selection technologies that must successfully operate so environmentally (and geographically) distant from the point of origin—research sites located in Central and South America.

The speed with which the above-mentioned well-researched breeding technology was applied and achieved results is most remarkable. The genetic recombination of the salient drought and nitrogen stress tolerance traits into a suitably adapted, locally preferred, maize line, such as those now being tested at hundreds of locations, in only four years is once again...remarkable!

Therefore, from my perspective it is indeed fortunate that the SADLF Project's rapid success in developing not only new germplasm but bridging the many gaps between the numerous shareholders—farmers, NGOs, public sector extensionists, private seed companies and scientists—is based on the sound principles of science-based agricultural research and technology development applied over 20 years. The innovative techniques applied to the promotion of maize germplasm for small, poor farmers' evaluation and adoption is in itself a unique accomplishment, but let us not forget that the product—maize cultivars adapted to the specific conditions of some of southern Africa's poorest farmers—would not have been evolved without the sustained scientific effort of one of the CGIAR's stellar centers. In this regard, the Rockefeller Foundation is very pleased indeed to join with the Swiss Agency for Development and Cooperation (SDC) in supporting Phase II of the SADLF program. We are assured that this program will provide a landmark in the changing attitudes of all partners, public and private sectors, regarding what is not just desirable, but *possible*, under the very real and challenging conditions of Africa's "resource-poor farmers." ***—Dr. John C. O'Toole, Field Representative and Senior Scientist, The Rockefeller Foundation, Bangkok Regional Office, Thailand***

Maize Facts: Eastern and Southern Africa



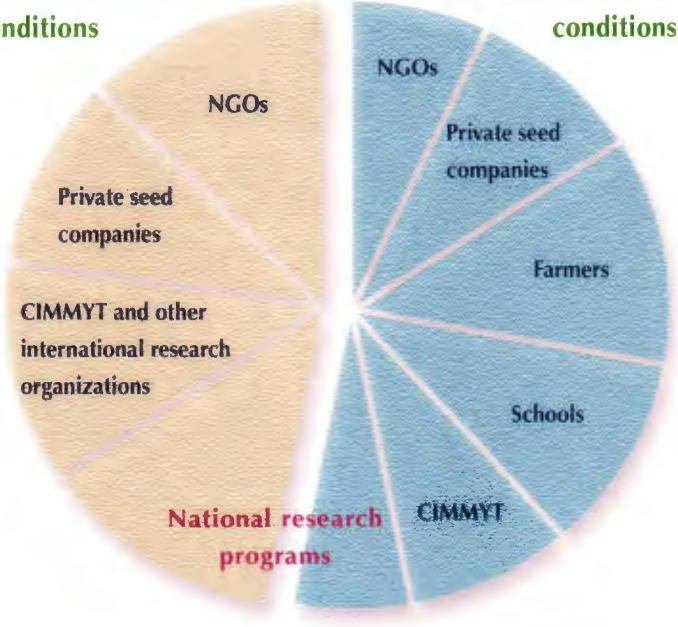
Maize in the Regional Setting

- 340 m people, growing at 2.3% per annum
- >70% rural population
- 38% cereal area planted to maize
- US$ 765 per capita income
- 79 kg per capita maize consumption
- 1.2 t/ha average maize yield
- 50-70% farmers plant low-yielding and/or recycled maize seed
- Only 5% of farmers are commercial farmers (>50 ha)
- Farmers face serious labor/land constraints because of the urgency to produce enough maize to feed the family, even in drought years
- Combination of climatic risk, declining soil fertility, rising population pressure that pushes agriculture into more marginal areas, high input costs, and poor credit systems = extremely low-input, low-risk, low-productivity maize systems for the vast majority of farmers

SADLF: Inclusive Partnerships in Research and Development

Regional testing of experimental and newly released cultivars for characteristics important under smallholders' conditions

Verification of experimental and commercial maize cultivars under smallhholders' conditions



Regional Testing Facts:

- Number of trials on the increase: 120 (1996), 207 (1998), 395 (2000)
- More than 150 varieties and hybrids evaluated yearly
- More than 300 institutions and individuals receive data
- Data recipients include: national research programs, international organizations (including CIMMYT, IITA, and FAO); private companies; NGOs, ministries of agriculture, aid agencies

Verifications Facts:

- "Mother/baby" trials connect smallholders with researchers and seed producers to better communicate needs
- Trials help create markets for seed: producers learn which cultivars farmers value and farmers obtain better information to choose commercial cultivars
- Adoption of newly released cultivars takes place while research is done and decisions made on new releases
- By 2001, trials will be in place throughout the region, giving 1,000 farmers the opportunity to make their voices heard

Restoring the Balance between Human Survival and Environmental Realities:

A Checklist of SADLF Achievements

Achievements:

- SADLF has produced release-ready maize cultivars with 35-50% higher and much more stable yields under conditions typical for resource-poor farmers in sub-Saharan Africa. *No other project has come close to achieving this goal.*
- The new cultivars use water and nutrients more efficiently than commercially available cultivars. They meet all the requirements for sustainably increasing maize yields, food security, and income security.
- The project has established mechanisms for researchers and farmers throughout southern Africa to 1) evaluate maize cultivars for their suitability to smallholders' conditions and 2) exchange germplasm, seed, and information.
- Innovative verification trials involve entire farming communities in the development of new maize cultivars and enable resource-poor farmers to influence which seed becomes available on the market.
- The project has increased the likelihood that private seed producers and seed relief initiatives will market and disseminate appropriate maize seed to smallholders. Seed disseminators have more information about products that smallholders value; in turn, smallholders have more information to choose commercial cultivars suited to their needs.
- The project has made GIS data available in sub-Saharan Africa, with effects on research priority setting, research collaboration and technology targeting far beyond the SADLF Project.
- Project activities are inclusive, involving, public and private breeding and seed organizations, NGOs, extension, farmers, and community members. A steering committee of representatives from each SADC country leads the project.

The achievements of SADLF mean that the region is poised for larger impact:

- As new cultivars from this project become available, and as it becomes transparent to private seed companies which of their cultivars perform better and are valued by smallholder farmers, hundreds of millions of maize producers in southern Africa will benefit from stress-tolerant, appropriate maize seed.
- Household food and income security will increase, with accompanying improvements in nutrition and health, especially for women and children. A greater proportion of the population will be able to pay for education and health care.
- National food security will benefit as the need to import food declines and nations see more stable and lower maize prices.
- Environmental impacts will be felt as the reduced risk of crop failure gives farmers incentives to improve soil fertility (including fertilizer use), conserve water, and diversify crop production, leading to more balanced soil nutrient budgets, reduced soil degradation, and less encroachment of agriculture into more fragile ecosystems.
- Demand for agricultural inputs will increase and become more stable. The agricultural input and credit sectors will gain incentives to make their products and services more widely available.
- In the longer term, national food security will benefit as the need to import food declines and nations see more stable and lower maize prices.
- Cultivars developed through SADLF will be useful elsewhere in Africa as well as in Asia and Latin America.

Maize cultivars that yield more grain, more reliably, despite drought and infertile soils, are breaking a vicious cycle of crop failure and removing the grip of poverty on farm families throughout southern Africa.

International Maize and Wheat Improvement Center
Apdo. Postal 6-641, 06600 México, D.F. MEXICO
http: www.cimmyt.cgiar.org